APPENDIX D
BASELINE GROUNDWATER CHEMISTRY AND WATER LEVEL STUDY MONITORING REPORT
SECOND QUARTER 2002

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EXECUTIVE SUMMARY

The Baseline Groundwater Study has produced sufficient water level and chemistry data to adequately describe the present chemical and hydrological conditions of the sulfate and acid plumes.

Spring and fall water level measurements have documented the effects of production well pumping. Kennecott and West Jordan production wells have resulted in approximately an overall five feet drop in the water table over a one year time period. Drops of up to 28 feet in the local vicinity of the Kennecott acid and drinking water wells have been documented. Recent dry conditions account for 0 to 2 feet of this overall five feet drop.

There are four zones of vertical water movement defined by the water level monitoring of nested wells: upward gradient, downward gradient, little to no vertical gradient (horizontal), and variable gradient. These zones are located as follows:

- Downward gradient: Located to the east and south of the process water wells and extends from 118th South to the Old Bingham Highway.
- Upward gradient: Located in the area of the acid extraction well and extends northeast to the Kennecott production wells.
- No vertical gradient: Located north of the Old Bingham Highway and extends from Highway 111 east approximately 10,000 feet.
- Variable gradient: Located near the intersection of Highway 111 and 118th South and extends 10,000 feet to the east and approximately 3000 feet north.

Water analytical data quality were evaluated and were found to meet data quality objectives for 99.7% of the analyses performed. Only thirteen of the total 4128 separate analyses were flagged and future analyses for these sites will be monitored to confirm data quality.

The present day acid plume is slightly larger in plan view than the 1996 acid plume. The areas of plume expansion are located at the northeast, southeast and south-central edges of the plume. One area on the north-central edge of the plume has contracted, based on a slight rise in the pH of one well.

The present day sulfate plume is smaller in plan view than the 1996 sulfate plume. The leading eastern edge of the 1500 mg/l plume has receded approximately 1000 feet to the west. In addition, sulfate concentrations in the >20,000 mg/l core of the plume have decreased significantly. However, although the leading eastern edge of the 1500 mg/l sulfate contour is receding, wells in this area that are screened below the more concentrated and shallower sulfate zone, are showing an increase in sulfate. This may be due to a downward vertical gradient at this location.

Differences in the expansion/contraction of the sulfate and acid plumes were evaluated and were determined to be driven by independent processes. Shrinkage of the sulfate plume and acid plume expansion should continue. Additional pumping from a strategically placed acid extraction well appears to be the only remedial alternative to prevent further migration of the acid plume.

The existing monitoring program is considered adequate, however if future analytical data shows unexpected results, additional sampling of selected wells may be initiated.

BASELINE GROUNDWATER CHEMISTRY AND WATER LEVEL STUDY MONITORING REPORT SECOND QUARTER 2002

1.0 INTRODUCTION

Kennecott Utah Copper (KUC) has conducted a baseline groundwater chemistry and water level study as part of the Remedial Design for the CERCLA groundwater plume located in the southwest Jordan Valley. The purposes of the study were to create a current representation of the shape and size of the groundwater plume and to monitor water level changes. Future chemistry and water level data will be compared to the baseline data to evaluate the effectiveness of the remediation effort and its effect on water levels. This report presents the Baseline Study data as of the second quarter 2002.

The baseline chemistry data were collected from monitoring wells between January and November 2001. Baseline water-level measurements were taken at three separate times: May 2001, September 2001 and April 2002. These data have been compiled and are presented in this report.

1.1 Purpose

Data gathered in the baseline study will be used for the following purposes:

1. To create a current, pre-remediation representation of the shape and size of the contaminated groundwater plume and to determine the status of water level changes in the valley. This data set will be the "starting point" against which the impacts of remedial extraction and natural attenuation will be measured.

2. To demonstrate compliance with the stipulations of the Record of Decision for Kennecott South Zone Ground Water Plumes (ROD) (EPA and UDEQ, 2000), that groundwater with greater than 1500 mg/L sulfate and/or metals concentrations exceeding state and federal drinking water standards does not migrate off KUCC property.

3. To update the historical data set of water-level and chemical trends. Some wells in the valley currently show falling water levels, reduced head pressure or contaminant migration. Remediation may exacerbate the head loss. It will be necessary to distinguish trends that existed before remediation from those caused by remedial extraction so that KUCC can mitigate as necessary.

4. To update the current groundwater flow and transport models, including use in calibration of a new "subset model" of the Bingham Reservoir plume area as described in Groundwater Modeling Studies Work Plan (KUCC work in progress A). Baseline data will be used to understand where the current model deviates from field

conditions, thereby allowing an initial sensitivity analysis. Areas that are closely simulated by the model can have less frequent monitoring in the long-term monitoring plan, and areas that are poorly predicted should be monitored on a more frequent basis.

2.0 DATA COLLECTION PROCEDURES

2.1 Methods

KUCC's Groundwater Monitoring and Characterization Plan (GCMP) (KUCC 2000) and associated Standard Operating Procedures (SOPs) (KUCC 1999a) were followed for all sampling and water level measurements. The GCMP has been approved by the Division of Water Quality and is updated on an annual basis. Procedures for documentation and sample handling, equipment maintenance and decontamination, quality control sampling, field measurements, and groundwater sampling are detailed in the SOPs.

2.2 Data management

The GCMP specifies how field and laboratory data are managed from the point of collection, through sampling and laboratory handling, to reporting in quarterly and annual reports to the State of Utah Division of Water Quality. In addition to GCMP data management, the Data and Records Management Plan for the Remedial Design (KUCC work in progress B) provides more detail on how data will be managed on the project level and how it will be managed after all GCMP procedures are complete.

All water-level data were collected using GCMP water-level measurement protocol, and these data were entered into a project database instead of the GCMP database; therefore, they will not be included in GCMP quarterly and annual reports. The data have been reviewed by project personnel in a similar manner to the quality control review conducted under the GCMP program. The two data sets have been combined to generate the necessary tables and figures for this Baseline Study report.

2.3 Quality Control/Quality Assurance

Quality-control procedures for the GCMP program were followed for all Baseline Study data collection. These procedures are documented in the Quality Assurance Project Plan for the Groundwater Characterization and Monitoring Plan (QAPP) (KUCC 1999b). In addition to the extensive quality control/quality assurance performed according to laboratory and GCMP protocol, project personnel have reviewed the baseline data by comparison to historical data (Section 5.1)

3.0 MONITORING PLAN

3.1 Water levels

3.1.1 Frequency

For the Baseline Study, three sets of water levels were collected. The first set was collected between May 23, 2001 and May 29, 2001, the second set was collected between September 24, 2001 and October 5, 2001 and the third set was collected between April 4, 2002 and April 11, 2002. The April/May measurements were taken before seasonal pumping of production wells began. The September measurements show water levels at the end of the irrigation season but while large production wells in surrounding communities were still pumping.

3.1.2 Monitoring Locations

Water levels measured during the September 2001 were collected from 318 wells. This includes almost every KUCC monitoring well and some private wells in Zone A. The water level measurements taken in May 2001 and April 2002 were collected from all the wells with shallow (first water) completions (approximately 180 wells) and from 36 wells with deeper screen intervals. Elevations listed have been corrected for density (Section 4.4) Table 1 lists the wells, measurement dates and water elevations in feet above mean sea level and the change in water level from May 2001 to April 2002.

Table 1: Baseline Groundwater Study Water Level Monitoring Data (elevation in feet above mean sea level)

Well ID	April/May 2001	September 2001	April 2002	Difference April/May 2001 to April 2002
ABC01	NM	5249.85	5248.62	NA
ABC02	5157.1	5157.33	5152.70	-4.40
ABC04	NM	5148.93	NM	NA
ABC04A	NM	5155.78	5154.09	NA
ABC05	4713.69	4712.07	4709.72	-3.97
ABC06	5040.08	5000.19	5014.39	-25.69
ABC07	NM	5252.13	5251.51	NA
B1G1120A	4815.72	4815.65	4812.53	-3.19
B1G1120B	NM	4818.19	NM	NA
B1G1120C	NM	4820.10	NM	NA
B1G951	5177.03	5175.98	5175.77	-1.26
B2G1157A	4601.03	4593.52	4595.75	-5.28
B2G1157B	NM	4588.45	NM	NA
B2G1157C	NM	4588.00	NM	NA

Table 1: Baseline Groundwater Study Water Level Monitoring Data (elevation in feet above mean sea level)

Well ID	April/May 2001	September 2001	April 2002	Difference April/May 2001 to April 2002
B2G1176A	NM	4709.71	4707.40	NA
B2G1176B	NM	4710.47	NM	NA
B2G1176C	NM	4711.34	NM	NA
B2G1193	NM	4571.94	NM	NA
B2G1194B	NM	4596.88	NM	NA
B3G1197A	4611.02	4596.12	4605.08	-5.94
B3G1197B	NM	4595.91	NM	NA
B3G1197C	NM	4595.75	NM	NA
BCG1150A	5215.99	5215.22	5214.94	-1.05
BCG1150B	NM	5214.64	NM	NA
BCG1150C	NM	5032.44	NM	NA
BCG1158A	5239.8	5239.70	5239.30	-0.50
BCG1158B	NM	5229.70	NM	NA
BCG1158C	NM	5223.50	NM	NA
BFG1136A	4710.32	4708.44	4706.21	-4.11
BFG1136B	NM	4708.60	NM	NA
BFG1136C	NM	4709.01	NM	NA
BFG1155B	4599.89	4596.97	4595.65	-4.24
BFG1155C	NM	4589.97	NM	NA
BFG1155D	NM	4592.66	NM	NA
BFG1155E	NM	4593.49	NM	NA
BFG1155F	NM	4593.79	NM	NA
BFG1156A	4603.2	4594.99	4597.52	-5.68
BFG1156B	NM	4594.67	NM	NA
BFG1156C	NM	4595.22	NM	NA
BFG1156D	NM	4595.19	NM	NA
BFG1156E	NM	4596.07	NM	NA
BFG1156F	NM	4596.14	NM	NA
BFG1168A	4712.37	4710.62	4708.40	-3.97
BFG1168B	NM	4710.89	NM	NA
BFG1168C	NM	4711.24	NM	NA
BFG1195A	4601.82	4593.40	4596.28	-5.54
BFG1195B	NM	4593.47	NM	NA
BFG1198A	4712.52	4710.47	4708.03	-4.49
BFG1198B	NM	4709.54	NM	NA
BFG1198C	NM	4710.70	NM	NA
BRG286	5576.53	5575.90	5574.29	-2.24
BRG287	5351.82	5350.28	5348.26	-3.56

Table 1: Baseline Groundwater Study Water Level Monitoring Data (elevation in feet above mean sea level)

Well ID	April/May 2001	September 2001	April 2002	Difference April/May 2001 to April 2002
BRG288	5351.54	5349.53	5348.66	-2.88
BRG289	5351.17	5349.16	5348.38	-2.79
BRG290	5323.59	5320.84	5318.61	-4.98
BRG291A	5532.61	5531.61	5530.23	-2.38
BRG919	5601.82	5601.77	5601.25	-0.57
BRG920	5341.12	5335.33	5335.55	-5.57
BRG921	5334.79	5332.88	5330.02	-4.77
BRG999	5333.93	5331.07	5328.62	-5.31
BSG1119A	4631.1	4627.35	4626.40	-4.70
BSG1119B	NM	4630.61	NM	NA
BSG1119C	NM	4728.82	NM	NA
BSG1125A	4716.89	4714.99	4714.21	-2.68
BSG1125B	NM	4714.63	NM	NA
BSG1125C	NM	4714.27	NM	NA
BSG1130A	4617.22	4613.65	4612.21	-5.01
BSG1130B	NM	4610.18	NM	NA
BSG1130C	NM	4607.99	NM	NA
BSG1132A	4609.97	4603.64	4604.47	-5.50
BSG1132B	NM	4602.49	NM	NA
BSG1132C	NM	4598.61	NM	NA
BSG1133A	4615.47	4611.11	4610.51	-4.96
BSG1133B	NM	4611.55	NM	NA
BSG1133C	NM	4599.21	NM	NA
BSG1135A	4618.83	4616.34	4614.08	-4.75
BSG1135B	NM	4613.14	NM	NA
BSG1135C	NM	4606.44	NM	NA
BSG1137A	4610.61	4605.65	4605.87	-4.74
BSG1137B	NM	4603.49	NM	NA
BSG1137C	NM	4602.52	NM	NA
BSG1148A	4716.23	4714.38	4712.72	-3.51
BSG1148B	NM	4714.29	NM	NA
BSG1148C	NM	4713.82	NM	NA
BSG1153A	4772.65	4772.13	4770.99	-1.66
BSG1153B	NM	4731.83	4734.17	NA
BSG1153C	NM	4794.03	4786.56	NA
BSG1177A	4710.98	4709.10	4706.93	-4.05
BSG1177B	NM	4704.50	NM	NA
BSG1177C	NM	4716.01	NM	NA

Table 1: Baseline Groundwater Study Water Level Monitoring Data (elevation in feet above mean sea level)

Well ID	April/May 2001	September 2001	April 2002	Difference April/May 2001 to April 2002
BSG1179A	4715.57	4712.09	4710.10	-5.47
BSG1179B	NM	4709.88	NM	NA
BSG1179C	NM	4705.10	NM	NA
BSG1180A	4712.59	4710.64	4708.30	-4.29
BSG1180B	NM	4704.62	NM	NA
BSG1180C	NM	4711.82	NM	NA
BSG1196A	4712.64	4710.63	4708.27	-4.37
BSG1196B	NM	4710.07	NM	NA
BSG1196C	NM	4711.63	NM	NA
COG1175A	4831.89	4832.58	4829.96	-1.93
COG1175B	NM	4831.32	NM	NA
COG1175C	NM	4832.96	NM	NA
COG1178A	4834.7	4835.16	4832.71	-1.99
COG1178B	NM	4835.54	NM	NA
COG1178C	NM	4835.56	NM	NA
ECG1113A	5176.63	5175.74	5174.42	-2.21
ECG1113B	NM	5145.24	5146.36	NA
ECG1113C	NM	5146.08	5147.50	NA
ECG1114A	5332.81	5331.79	5330.34	-2.47
ECG1114B	NM	4981.46	4981.17	NA
ECG1115A	4975.54	4964.10	4952.51	-23.03
ECG1115B	NM	4978.81	4965.80	NA
ECG1115C	NM	4962.22	4950.47	NA
ECG1115D	NM	4988.19	4975.80	NA
ECG1115E	NM	4932.59	4933.02	NA
ECG1116A	4970.11	4964.13	4951.65	-18.46
ECG1116B	NM	4964.90	4953.10	NA
ECG1116C	NM	5116.23	5110.81	NA
ECG1117A	4972.94	4968.11	4957.19	-15.75
ECG1117B	NM	4981.14	4969.38	NA
ECG1117C	NM	4988.29	4976.64	NA
ECG1118A	4807.6	4805.79	4803.78	-3.82
ECG1118B	NM	4813.90	NM	NA
ECG1118C	NM	4816.01	NM	NA
ECG1121A	4810.16	4810.13	4808.21	-1.95
ECG1121B	NM	4815.09	4812.54	NA
ECG1124A	4976.44	4964.05	4951.80	-24.64
ECG1124B	NM	4970.66	4954.00	NA

Table 1: Baseline Groundwater Study Water Level Monitoring Data (elevation in feet above mean sea level)

Well ID	April/May 2001	September 2001	April 2002	Difference April/May 2001 to April 2002
ECG1124C	NM	4985.29	4973.42	NA
ECG1128A	4973.53	4957.99	4944.98	-28.55
ECG1128B	NM	4956.28	4945.48	NA
ECG1128C	NM	4973.53	4959.06	NA
ECG1131A	4915.07	4913.25	4910.13	-4.94
ECG1131B	NM	4929.62	4922.75	NA
ECG1131C	NM	4942.52	4932.99	NA
ECG1142A	4982.95	4976.23	4962.26	-20.69
ECG1142B	NM	4978.34	4976.38	NA
ECG1142C	NM	4965.40	4965.94	NA
ECG1143A	5055.79	5056.66	5050.37	-5.42
ECG1143B	NM	5043.19	NM	NA
ECG1143C	NM	5078.88	NM	NA
ECG1144A	4855.67	4853.82	4851.23	-4.44
ECG1144B	NM	4968.23	4955.75	NA
ECG1144C	NM	4976.46	4964.29	NA
ECG1145A	4975.89	4961.33	4949.23	-26.66
ECG1145B	NM	4961.36	4947.29	NA
ECG1145C	NM	4971.94	4957.61	NA
ECG1146	NM	4949.56	4930.68	NA
ECG1182A	5570.11	5564.89	5569.33	-0.78
ECG1182B	NM	5577.48	5576.35	NA
ECG1183A	5418.86	5418.24	5419.17	0.31
ECG1183B	NM	5428.84	NM	NA
ECG1184	5427.76	5406.26	5411.19	-16.57
ECG1186	5332.29	5333.89	5330.18	-2.11
ECG1187	5336	5334.94	5333.51	-2.49
ECG1188	5330.86	5330.15	5328.81	-2.05
ECG1189	5156.92	5157.06	5157.00	0.08
ECG1190	5283.58	5282.99	5282.05	-1.53
ECG1199A	5332.74	5331.72	5330.30	-2.44
ECG1199B	NM	5316.86	NM	NA
ECG1199C	NM	5331.66	NM	NA
ECG1199D	NM	5331.65	NM	NA
ECG1199E	NM	5331.64	NM	NA
ECG1199F	NM	5331.85	NM	NA
ECG1199G	NM	5331.33	NM	NA
ECG293	5262.33	5261.57	5260.64	-1.69

Table 1: Baseline Groundwater Study Water Level Monitoring Data (elevation in feet above mean sea level)

Well ID	April/May 2001	September 2001	April 2002	Difference April/May 2001 to April 2002
ECG294	5286.12	5283.94	5280.77	-5.35
ECG296	5295.84	5295.14	5294.23	-1.61
ECG297	5309.33	5307.05	5305.30	-4.03
ECG299	5330.95	5329.29	5326.57	-4.38
ECG900	5331.79	5330.04	5327.29	-4.50
ECG901	5331.18	5329.90	5327.16	-4.02
ECG902	NM	5353.13	NM	NA
ECG903	5487.12	5484.83	5480.56	-6.56
ECG904	5357.47	5355.80	5352.79	-4.68
ECG905	5378.71	5377.65	5374.79	-3.92
ECG906	5333.38	5332.55	5331.03	-2.35
ECG907	5334.26	5333.18	5331.54	-2.72
ECG908	5578.93	5578.00	5578.03	-0.90
ECG909	5483.66	5481.66	5479.02	-4.64
ECG916	5566.18	5564.38	5563.69	-2.49
ECG917	5354.49	5352.84	5350.61	-3.88
ECG922	5334.29	5333.49	5331.62	-2.67
ECG923	5425.88	5424.10	5420.32	-5.56
ECG924	5556.75	5556.40	5556.63	-0.12
ECG925	5521.53	5518.25	5520.66	-0.87
ECG926	5512.09	5508.33	5510.71	-1.38
ECG928	5426.2	5423.88	5419.93	-6.27
ECG931	5570.63	5569.30	5569.29	-1.34
ECG932	5633.08	5632.26	5631.56	-1.52
ECG934	5580.59	5578.82	5578.94	-1.65
ECG935	5708.8	5707.75	5707.94	-0.86
ECG936	5843.46	5842.34	5840.86	-2.60
ECG937	5806.53	5804.64	5806.63	0.10
ECG938	5983.93	5982.78	5983.60	-0.33
ECG939	5984.96	5983.30	5984.55	-0.41
ECG940	6078.47	6075.50	6079.59	1.12
ECG952	5145.13	5144.86	5142.49	-2.64
EPG1165A	4615.01	4610.80	4609.60	-5.41
EPG1165B	NM	4609.11	NM	NA
EPG1165C	NM	4606.15	NM	NA
EPG1166	4590.98	4581.78	4589.42	-1.56
EPG1689	4604.73	4605.98	4604.41	-0.32
HMG1122A	4720.22	4718.25	4717.40	-2.82

Table 1: Baseline Groundwater Study Water Level Monitoring Data (elevation in feet above mean sea level)

Well ID	April/May 2001	September 2001	April 2002	Difference April/May 2001 to April 2002
HMG1122B	NM	4716.59	NM	NA
HMG1122C	NM	4716.59	NM	NA
HMG1123A	4717.34	4715.44	4715.19	-2.15
HMG1123B	NM	4715.20	NM	NA
HMG1123C	NM	4714.94	NM	NA
HMG1126A	4739.67	4735.84	4735.15	-4.52
HMG1126B	NM	4735.86	NM	NA
HMG1126C	NM	4730.60	NM	NA
HMG1134A	4622.54	4620.82	4612.40	-10.14
HMG1134B	NM	4614.00	4612.66	NA
HMG1134C	NM	4610.03	4609.56	NA
K105	5112.5	5112.63	5111.79	-0.71
K106	4711.99	4710.80	4708.55	-3.44
K120	5139.89	5139.69	5139.39	-0.50
K201	4621.26	4619.05	4616.34	-4.92
K26	4982.26	4973.98	4965.40	-16.86
K70	5328.44	5327.45	5326.16	-2.28
K84	5175.6	5175.24	5174.97	-0.63
LRG910	5245.72	5245.34	5244.36	-1.36
LRG911	5201.56	5201.99	5203.42	1.86
LRG912	5224.75	5223.95	5223.54	-1.21
LRG914	5259.93	5259.76	5257.61	-2.32
LTG1127A	5177.96	5176.60	5175.11	-2.85
LTG1127B	NM	5183.21	NM	NA
LTG1127C	NM	5184.63	NM	NA
LTG1129A	5032.11	5033.84	5022.08	-10.03
LTG1129B	NM	5021.34	NM	NA
LTG1129C	NM	5018.94	NM	NA
LTG1138A	4707.27	4705.40	4719.50	12.23
LTG1138B	NM	4693.06	NM	NA
LTG1138C	NM	4699.28	NM	NA
LTG1138D	NM	4701.84	NM	NA
LTG1138E	NM	4702.75	NM	NA
LTG1138F	NM	4711.72	NM	NA
LTG1139	NM	4952.29	5013.55	NA
LTG1140A	5039.86	5025.66	5011.49	-28.37
LTG1140B	NM	5014.29	5012.95	NA
LTG1140C	NM	4983.70	5016.16	NA

Table 1: Baseline Groundwater Study Water Level Monitoring Data (elevation in feet above mean sea level)

Well ID	April/May 2001	September 2001	April 2002	Difference April/May 2001 to April 2002
LTG1140D	NM	5068.44	5052.02	NA
LTG1147	NM	4649.36	4718.86	NA
LTG1167A	4919.5	4911.97	4907.39	-12.11
LTG1167B	NM	4911.90	NM	NA
LTG1167C	NM	4913.85	NM	NA
LTG1191	5308.45	5308.12	5308.20	-0.25
LTG929A	5210.13	5210.16	5209.60	-0.53
LTG929B	NM	5207.05	NM	NA
P190A	4614.55	4610.81	4609.46	-5.09
P190B	NM	4609.72	4607.71	NA
P191B	4606.31	4598.63	4600.63	-5.68
P192B	4610.77	4603.99	4605.96	-4.81
P193B	4609.96	4602.75	4605.35	-4.61
P194A	4614.05	4609.84	4608.86	-5.19
P194B	NM	4609.75	4608.85	NA
P197B	4593.53	4584.84	4587.82	-5.71
P208A	4971.42	4960.81	4950.33	-21.09
P208B	NM	4961.85	4949.08	NA
P209B	4714.19	4712.46	4710.11	-4.08
P211A	4897.04	4896.68	4895.23	-1.81
P211B	NM	4897.58	NM	NA
P212A	5038.35	5032.81	5012.93	-25.42
P212B	NM	5014.76	NM	NA
P214A	5420.73	5419.38	5420.23	-0.50
P220	5500.09	5496.21	5492.46	-7.63
P225	5461.13	5459.31	5455.55	-5.58
P228	5762.07	5759.61	5760.78	-1.29
P231	5306.45	5305.59	5306.05	-0.40
P239	5902.87	5897.95	5900.41	-2.46
P241B	4711.85	4708.94	4708.63	-3.22
P241C	NM	4716.61	4715.07	NA
P242	5185.07	5184.82	5184.90	-0.17
P243	NM	5340.53	NM	NA
P244A	5629.31	5629.69	5628.95	-0.36
P244B	NM	5624.83	NM	NA
P244C	NM	5621.42	NM	NA
P248A	5253.14	5252.79	5252.27	-0.87
P248B	NM	5253.69	NM	NA

Table 1: Baseline Groundwater Study Water Level Monitoring Data (elevation in feet above mean sea level)

Well ID	April/May 2001	September 2001	April 2002	Difference April/May 2001 to April 2002
P248C	NM	5258.18	NM	NA
P249A	NM	4838.55	4835.64	NA
P249B	NM	4838.49	NM	NA
P257	4629.62	4631.35	4624.32	-5.30
P260	4599.67	4600.42	4597.69	-1.98
P261	4609.17	4609.57	4609.20	0.03
P263	4592.04	4600.88	4594.09	2.05
P264	4812.53	4812.19	4809.71	-2.82
P267B	4790.67	4783.73	4788.02	-2.65
P268	4906.54	4906.08	4904.73	-1.81
P269	NM	5036.06	5036.87	NA
P270	5396.14	5383.31	5384.74	-11.40
P271	5440.31	5438.76	5439.04	-1.27
P272	5532.14	5529.87	5529.15	-2.99
P273	4918.1	4916.77	4914.37	-3.73
P274	5083.69	5084.61	5083.51	-0.18
P277	4714.93	4712.72	4710.58	-4.35
P279	4977.33	4966.27	4954.15	-23.18
SRG945	5154.1	5153.78	5151.69	-2.41
SRG946	5171.63	5169.60	5169.84	-1.79
W131A	4645.31	4643.06	4640.37	-4.94
W361	NM	4604.33	NM	NA
W403	4809.82	4802.27	4808.16	-1.66
WJG1154A	4598.02	4591.38	4599.21	1.19
WJG1154B	NM	4591.39	NM	NA
WJG1154C	NM	4591.17	NM	NA
WJG1169A	4713.09	4711.44	4709.23	-3.86
WJG1169B	NM	4711.44	NM	NA
WJG1169C	NM	4711.56	NM	NA
WJG1170A	4604.34	4592.69	4598.34	-6.00
WJG1170B	NM	4592.43	NM	NA
WJG1170C	NM	4592.44	NM	NA
WJG1171A	4607.86	4585.18	4601.82	-6.04
WJG1171B	NM	4582.15	NM	NA
WJG1171C	NM	4581.38	NM	NA
WJG1980	4604.38	4589.45	4598.79	-5.59

NM: Not measured
NA: Not applicable

3.2 Water Chemistry

3.2.1 Water Chemistry Analytical Suite

Ninety-six wells were chosen to be sampled for this study because of their three-dimensional relationship to the acid and sulfate plumes. These wells were analyzed for 43 analytes (Table 2). The rationale for selecting these specific parameters is also listed in the Table 2. The suite includes major and minor analytes as well as trace metals. Major analytes are needed for general chemistry and to calculate charge and mass balance to check the quality of the analyses.

Some of the analytes listed in Table 2 were identified as being present in the Bingham Reservoir plume area at concentrations above baseline concentrations in an independent study done as part of the RI (Shepherd Miller, Inc., 1997, page 50). Sulfate, TDS, magnesium, cadmium, nickel and zinc were identified in the Shepherd Miller, Inc. study as indicators of elevated concentration of metals related to mining activities. Several elements are not indicators of the plume, according to the report, and were recommended for removal from the list of chemicals of concern. These were barium, mercury, nitrate, and selenium; however, because each of these elements has a primary drinking water standard, and all but mercury are listed in the final clean-up levels in the ROD, KUCC included these analytes in this baseline study. It is anticipated that concentrations will be low and these elements may be dropped from the list for the long-term monitoring plan. The study also reported that silver was not an indicator of the plume and was not found at elevated concentrations, but was included as an analyte for the same reasons.

Chemistry data from 53 additional wells, sampled as part of the GCMP and Bingham Canyon Mine and Leach Collection System Groundwater Discharge Permit are included in this study. These wells were not analyzed for the full suite of 43 analytes.

Table 2 also identifies the analytical method and target detection limits for each parameter as given in the QAPP. Analytical methods are selected by laboratory personnel to meet the target detection limits where possible. All analyses were conducted according to test procedures specified under Utah Administrative Code R317-6-6.3.L for groundwater. Samples were analyzed by Kennecott Environmental Laboratory, a state-certified lab.

Table 2: Baseline Groundwater Study Water Sample Analytical Suite

PARAMETER	T/D	RATIONAL FOR SAMPLING	ANALYTICAL METHOD	TARGET DETECTION LIMIT
FIELD				
pH	-	general chem., has drinking water std.	E 150.1	N/A
Temperature	-	general chemistry	E 170.1	N/A
Conductance	-	general chemistry	E 120.1, Std 2510B	10 µmho
Depth to Water	-	indicator of hydraulic changes	N/A	0.01 ft
LAB.				
TDS	-	general chemistry, plume indicator	E 160.1	10 mg/l
TSS	-	general chemistry	E 160.2	3 mg/l
Chloride (Cl^-)	T	general chem., indicator of water source	E 325.2	5 mg/l
Fluoride (F^-)	T	has drinking water std., lack of baseline data, may occur at elevated levels	Std 4500F- E C/300.0	0.2 mg/l
Sulfate (SO_4^{2-})	T	plume indicator	E 375.2, 375.3, 9036	5 mg/l
Nitrate (NO_3^--N)	T	has drinking water standard, to document low levels	E 353.2 0.	2 mg/l
Calcium (Ca)	T	general chemistry	E 200.7	1 mg/l
Magnesium (Mg)	T	plume indicator	E 200.7	1 mg/l
Potassium (K)	T	general chemistry	E 200.7	0.1 mg/l
Sodium (Na)	T	general chemistry	E 200.7	1 mg/l
Alkalinity (ALK)	-	general chemistry	Std 2320B, E 310.1	10 mg/l
Acidity (ACD)	-	general chemistry	Std 2310B	10 mg/L
Aluminum (Al)	TD	above background concentration, needed for mineral acidity calculation	E 200.7, 200.8	200 µg/l
Arsenic (As)	TD	above background concentration	E 200.7, 200.8, 200.9, 6010B, 6020	5 µg/l

Table 2: Baseline Groundwater Study Water Sample Analytical Suite

PARAMETER	T/D	RATIONAL FOR SAMPLING	ANALYTICAL METHOD	TARGET DETECTION LIMIT
Barium (Ba)	TD	to document low levels, has drinking water standard	E 200.7, 200.8, 200.9, 6010B, 6020	10 µg/l
Cadmium (Cd)	TD	plume indicator	E 200.7, 200.8, 200.9, 6010B, 6020	2 µg/l
Chromium (Cr)	TD	above background concentration	E 200.7, 200.8, 6010B, 6020	10 µg/l
Copper (Cu)	TD	above background concentration	E 200.7, 200.8, 220.1, 6010B, 6020	20 µg/l
Iron (Fe)	TD	plume indicator, needed for mineral acidity calculation	E 200.7, 236.1, 6010B	300 µg/l
Lead (Pb)	TD	above background concentration	E 239.1, 200.8, 200.9, 200.7, 6010B, 6020	5 µg/l
Manganese (Mn)	TD	plume indicator	E 200.7, 243.1, 243.2, 200.8, 6010B, 6020	10 µg/l
Mercury (Hg)	T	to document low levels, has drinking water standard	E 245.1, 200.8	0.2 µg/l
Nickel (Ni)	TD	plume indicator	E 200.7, 200.8, 200.9, 6010B, 6020	30 µg/l
Selenium (Se)	TD	to document low levels, has drinking water standard	E 200.7, 200.8, 200.9, Mod7742, 6010B, 6020	3 µg/l
Silver (Ag)	TD	to document low levels, has drinking water standard	E 272.1, 272.2, 200.8, 200.9, 200.7, 6010B, 6020	1 µg/l
Zinc (Zn)	TD	plume indicator	E 289.1, 289.2, 200.7, 200.8, 200.9, 6010B, 6020	10 µg/l

NOTES: N/A = Not Applicable; E = EPA Method Number; Std = Standard Methods, 20th edition, method number. T/D = Total or Dissolved concentrations.

3.2.2 Sampling frequency

At least one sample was collected from each well included in the study between January 2001 and November 2001. Many of the wells were sampled more frequently as part of existing monitoring programs. In these cases, the sample results closest in time to the majority of the other Baseline Study samples were included in the Baseline Study data set. The purpose of this was to have as many samples as possible around the same date to provide a true "snapshot" in time.

3.2.3 Monitoring Locations

As discussed in Section 3.2.1 above, ninety-six wells were selected for water quality sampling in the Baseline Study. Wells were selected based on (a) their three-dimensional location in relationship to the acid and sulfate plumes and (b) their historical water-quality trends. The name, location, screen depth and rational for sampling for each site are given Table 3. Monitoring locations are more dense in the acid plume and the sulfate extraction areas because these are the areas that will be critical to monitor for changes during plume extraction. The margin of the sulfate plume between the sulfate extraction area and West Jordan's municipal well field also have been monitored more densely. Other monitored areas include several wells around the Lark clean water production well (well ID LTG1139) where supplemental water for plume treatment may be obtained, and a line of wells along the base of the Oquirrh Mountains, where recharge to the alluvial aquifer occurs.

Table 3: Baseline Groundwater Study monitor wells, sampling rationale, location and screen interval

Well ID	Sampling Rationale	Northing*	Easting*	Screen top (ft)	Screen Bot (ft)
B1G1120A	acid plume core	16141	26693	493	532
B1G951	source area (large reservoir)	16322	21727	92	131
B2G1176A	acid plume margin	16148	30121	555	575
B2G1193	SO4 extraction	15378	33485	451	881
B3G1197A	SO4 extraction, West Jordan well field	17661	38129	340	360
B3G1197B	SO4 extraction, West Jordan well field	17661	38129	460	480
B3G1197C	SO4 extraction, West Jordan well field	17661	38129	610	630
BFG1195A	SO4 extraction	16434	33104	558	578
BFG1195B	SO4 extraction	16434	33104	679	699
BFG1198A	1500 mg/L SO4 contour, property boundary	17580	30793	400	420
BRG286	Leachwater Collection System Operational Well	15036	15181	153	183
BRG287	Leachwater Collection System Operational Well	14559	16105	231	261
BRG288	Leachwater Collection System Operational Well	15418	15821	284	363
BRG289	Leachwater Collection System Operational Well	15461	16261	225	265
BRG290	Leachwater Collection System Operational Well	15045	16208	275	354
BRG291A	Leachwater Collection System Operational Well	14494	15463	183	223
BRG919	Leachwater Collection System Operational Well	14263	14430	116	155
BRG920	Leachwater Collection System Operational Well	13262	15108	159	198
BRG921	Leachwater Collection System Operational Well	13190	16540	303	343
BRG999	Leachwater Collection System Operational Well	14479	17043	250	290
BSG1119B	acid plume, leading edge	13853	32358	538	558
BSG1125A	1500 mg/L SO4 contour, property boundary	8494	32397	280	320
BSG1130A	1500 mg/L SO4 contour	10114	34557	340	380
BSG1133A	1500 mg/L SO4 contour	12400	34000	390	410
BSG1133B	1500 mg/L SO4 contour	12400	34000	600	620

Table 3: Baseline Groundwater Study monitor wells, sampling rationale, location and screen interval

Well ID	Sampling Rationale	Northing*	Easting*	Screen top (ft)	Screen Bot (ft)
BSG1137A	1500 mg/L SO4 contour	15300	38000	377	397
BSG1137B	1500 mg/L SO4 contour	15300	38000	637	657
BSG1148A	acid plume margin	11276	28859	510	530
BSG1148B	acid plume margin	11276	28859	580	600
BSG1177A	acid plume margin	13826	30357	525	545
BSG1177B	acid plume margin	13826	30357	680	700
BSG1179A	acid plume margin	12358	29633	440	460
BSG1179B	acid plume margin	12358	29633	685	705
BSG1179C	acid plume margin	12358	29633	805	825
BSG1180B	acid plume, leading edge	13817	31356	660	680
BSG1180C	acid plume, leading edge	13817	31356	798	818
BSG1196B	acid plume, leading edge	13825	31860	470	490
BSG1196C	acid plume, leading edge	13825	31860	650	670
ECG1113A	clean water source area	8508	21783	138	178
ECG1115A	acid plume core	14603	24663	538	578
ECG1115B	acid plume core, base	14603	24663	838	858
ECG1115C	acid plume core, base	14601	24700	898	938
ECG1117A	acid plume core	15047	25243	438	478
ECG1117B	acid plume core, base	15047	25243	758	798
ECG1118A	acid plume core	13882	27446	598	638
ECG1118B	acid plume core, base	13882	27446	818	858
ECG1121A	acid plume core	14957	26824	600	640
ECG1128A	acid plume margin	12249	25795	418	458
ECG1144A	acid plume core	13855	26003	440	460
ECG1145A	acid plume core	13049	25373	420	440

Table 3: Baseline Groundwater Study monitor wells, sampling rationale, location and screen interval

Well ID	Sampling Rationale	Northing*	Easting*	Screen top (ft)	Screen Bot (ft)
ECG1145B	acid plume core	13049	25373	760	780
ECG1145C	acid plume core, base	13049	25373	810	830
ECG1146	acid plume core	13467	25673	500	750
ECG1183A	alluvial bedrock contact	579	18992	35	65
ECG1183B	Sulfate monitoring	579	18992	280	300
ECG1184	Butterfield Canyon alluvial recharge to Herriman	-1538	17816	60	80
ECG1186	Leachwater Collection System Compliance Well (alluvium near recharge area)	9647	18578	36	136
ECG1187	Leachwater Collection System Compliance Well (alluvium near recharge area)	7540	18458	54	164
ECG1188	Leachwater Collection System Compliance Well (alluvium near recharge area)	10109	18567	38	118
ECG1189	Leachwater Collection System Compliance Well (alluvium near recharge area)	13054	19990	205	265
ECG1190	Leachwater Collection System Compliance Well (alluvium near recharge area)	11715	19026	118	198
ECG294	Bingham Creek	15987	17728	165	205
ECG297	Bingham Creek	15935	17370	97	136
ECG299	Leachwater Collection System Operational Well	13807	17474	161	201
ECG900	Leachwater Collection System Operational Well	13772	17557	276	316
ECG901	Leachwater Collection System Operational Well	13734	17716	178	218
ECG902	Leachwater Collection System Operational Well	12180	17214	226	265
ECG903	Leachwater Collection System Operational Well	11385	15617	158	198
ECG904	Leachwater Collection System Operational Well	10433	17076	206	246
ECG905	Leachwater Collection System Operational Well	10839	16434	254	293

Table 3: Baseline Groundwater Study monitor wells, sampling rationale, location and screen interval

Well ID	Sampling Rationale	Northing*	Easting*	Screen top (ft)	Screen Bot (ft)
ECG906	Leachwater Collection System Operational Well	9121	17481	159	199
ECG907	Leachwater Collection System Operational Well	7087	17875	131	171
ECG908	Leachwater Collection System Operational Well	9457	15187	207	246
ECG909	Leachwater Collection System Operational Well	12745	15271	186	226
ECG915	Leachwater Collection System Operational Well	8804	15135	138	178
ECG916	Leachwater Collection System Operational Well	9692	15269	238	277
ECG917	Leachwater Collection System Compliance Well (alluvium near recharge area)	6289	18385	150	190
ECG922	Leachwater Collection System Operational Well (alluvium near recharge area)	7677	18058	142	181
ECG923	Leachwater Collection System Operational Well	4934	17977	119	158
ECG924	Leachwater Collection System Compliance Well	661	16870	69	109
ECG925	Leachwater Collection System Compliance Well	1343	17470	69	109
ECG926	Leachwater Collection System Operational Well	2549	17698	165	204
ECG928	Leachwater Collection System Operational Well	5126	18358	119	158
ECG931	Leachwater Collection System Operational Well	-708	16395	107	147
ECG932	Leachwater Collection System Compliance Well	-2325	14914	147	187
ECG934	Leachwater Collection System Compliance Well	-4704	14177	187	227
ECG935	Leachwater Collection System Compliance Well	-6210	13555	89	128
ECG936	Leachwater Collection System Operational Well	-6303	12389	82	122
ECG937	Leachwater Collection System Compliance Well	-8174	11378	276	316
ECG938	Leachwater Collection System Compliance Well	-8909	9785	242	282
ECG940	Leachwater Collection System Compliance Well	-10587	7385	198	237
HMG1126A	Herriman water quality	2682	31045	280	320
HMG1126B	Herriman water quality	2682	31045	380	420

Table 3: Baseline Groundwater Study monitor wells, sampling rationale, location and screen interval

Well ID	Sampling Rationale	Northing*	Easting*	Screen top (ft)	Screen Bot (ft)
HMG1134A	Herriman water quality	5503	41670	160	180
HMG1515	Herriman water quality	-4662	27152	104	390
HMG1623	Riverton water quality	5711	48152	134	135
HMG1856	Herriman water quality	657	33611	200	280
HMG2067	Herriman water quality	-5128	27923	140	147
HMG2436	Herriman water quality	-5231	27797	140	155
HMG2727	Herriman water quality	-3198	26981	169	170
K109	SO4 extraction	17611	34847	403	520
K26	source area (large reservoir)	16448	25287	204	224
K72	Leachwater Collection System Operational Well (alluvium near recharge area)	13841	18189	10	240
LRG910	source area (large reservoir)	16038	18754	77	136
LRG911	source area (large reservoir)	15231	18914	77	136
LRG912	source area (large reservoir)	16539	19577	77	136
LTG1139	clean water source area	6989	24166	330	980
LTG1140A	clean water source area	6984	23149	220	240
LTG1140B	clean water source area	6984	23149	330	350
LTG1147	SO4 extraction well	7067	29725	400	590
LTG1167B	Herriman water quality	553	28415	300	320
LTG1191	Leachwater Collection System Compliance Well	3749	20549	20	100
P190A	1500 mg/L SO4 contour, property boundary	12580	37968	286	296
P190B	1500 mg/L SO4 contour, property boundary	12570	37976	529	539
P208B	acid plume margin	12512	25036	401	412
P220	Leachwater Collection System Operational Well	10999	16234	100	120
P225	Leachwater Collection System Operational Well	12000	17200	125	165

Table 3: Baseline Groundwater Study monitor wells, sampling rationale, location and screen interval

Well ID	Sampling Rationale	Northing*	Easting*	Screen top (ft)	Screen Bot (ft)
P228	Leachwater Collection System Operational Well	-1491	13963	?	84
P239	Leachwater Collection System Operational Well	1315	14210	90	100
P241B	acid plume margin	12351	29699	530	570
P241C	1500 mg/L SO4 contour, property boundary	9804	32427	385	405
P244A	alluvium near recharge area	2285	16110	37	47
P244B	bedrock recharge	2278	16123	63	73
P244C	bedrock recharge	2266	16139	107	127
P248A	alluvium near recharge area	15485	17875	80	100
P248B	bedrock recharge	15491	17849	120	140
P248C	bedrock recharge	15496	17828	175	195
P272	Leachwater Collection System Operational Well	3964	16571	85	105
P279	acid plume core	14156	24053	395	415
RVG1164A	Riverton water quality	1840	56073	180	200
RVG1164B	Riverton water quality	1840	56073	340	360
RVG1164C	Riverton water quality	1840	56073	680	710
SRG946	source area (small reservoir)	16988	21598	120	179
W107	property boundary	20440	43285	215	460
W189	property boundary	18943	39481	350	637
W22	Herriman water quality	-1534	23091	80	350
W361	West Jordan well field	25805	37702	225	620
W363	West Jordan well field	23509	37928	380	590
W387	West Jordan well field	23373	35197	379	690
W409	Herriman water quality	-4079	27132	140	505
W412	Herriman water quality	-5469	23323	105	256
W41A	mouth of butterfield creek	-1401	19536	45	73

Table 3: Baseline Groundwater Study monitor wells, sampling rationale, location and screen interval

Well ID	Sampling Rationale	Northing*	Easting*	Screen top (ft)	Screen Bot (ft)
WJG1154A	SO4 extraction, West Jordan well field	20510	36367	310	350
WJG1154B	SO4 extraction, West Jordan well field	20510	36367	400	420
WJG1154C	SO4 extraction, West Jordan well field	20510	36367	730	750
WJG1169A	1500 mg/L SO4 contour, West Jordan well field	19501	30501	400	420
WJG1169B	1500 mg/L SO4 contour, West Jordan well field	19501	30501	470	490
WJG1170A	SO4 extraction, West Jordan well field	19110	35012	375	395
WJG1171A	SO4 extraction, West Jordan well field	20426	37696	430	450

*Kennecott Mine Coordinate System

4.0 WATER-TABLE LEVELS AND WATER-LEVEL CHANGES

Water-table elevation drawings, Figures 1 and 2, have been compiled from the September 2001 and the April 2002 monitoring events. Figure 3 shows the change in water levels between May 2001 and April 2002.

4.1 Water Table

The water-table gradient in the southwestern Jordan Valley drops steeply from the east side mine waste-rock dumps eastwardly, to approximately 2000 feet east of Highway 111 (Figure 7). The water table shows an abrupt flattening from there to approximately 3000 feet to the east, then steepens again to the easting of the Kennecott production wells. The gradient is again flatter from the production wells east to the Kennecott property line. Variations in the water table due to production well pumping are observed locally.

4.2 Water-Table Changes

Almost every well that was monitored has shown a decrease in the water level from May 2001 to April 2002. The majority of the drop in water levels in most wells is due to effects of nearby pumping wells. There are only a few wells that have not been influenced by pumping wells, and these have shown a drop of 0 to 2 feet. However, the zones of influence from the West Jordan well field, Kennecott's process water, acid, sulfate and freshwater wells cover almost the entire study area. Only wells located to the immediate east of the east-side mine waste rock dumps and the area north of the city of Copperton are unaffected by pumping wells.

4.3 Pumping Wells

The acid extraction well area near ECG1146 has experienced a drop in the water table of 28 feet from May 2001 to April 2002. Drops of greater than 5 feet are seen in an area approximately 4000 east to west and 9000 feet north to south of ECG1146.

The drinking water well LTG1139 has dropped the water table up to 28 feet in the immediate vicinity of the well. Drops of greater than 5 feet are seen in the LTG1139 area and cover approximately 4000 feet southwest to northeast and 7000 feet northwest to southeast.

Water levels adjacent to LTG1147 recovered slightly from May 2001 to April 2002. This can be observed in monitoring well LTG1138A and is due to less pumping of LTG1147 during the year.

The West Jordan well field water-level has dropped more than 5 feet in an area covering approximately 6500 feet north to south and 5500 feet east to west. Kennecott's production wells BFG1200 and B2G1193 has created a drop in the water-table of greater than 5 feet in an area covering approximately 8000 feet east to west and 10000 feet north to south. The area of influence of Kennecott's production wells probably overlaps with that of the acid extraction well ECG1146 located 8500 feet to the west.

4.4 Vertical Gradients

Vertical gradients were determined by comparing static water levels where multiple-completion wells are located. Most of the multiple-completion wells are located near the acid extraction, Kennecott process water and Kennecott drinking water wells. Only a few multiple-completion wells are located along the east-side waste-rock dumps. Most of the multiple-completion wells have at least three wells completed at the same location with these exceptions: one location has five completions, one location has six completions and one location has seven completions.

The water elevations were corrected for density differences in areas where plume water with high total dissolved solids (TDS) are found. The density correction is based on an empirical formula for plume waters determined from laboratory measurements. The density correction was calculated by multiplying the TDS by 0.0000008 and adding 1. This number is then multiplied by the column of water (feet) in the well (measured from the screen bottom to the measured depth to water). Density corrections are notable in the deeper wells with high TDS (plume core) water.

Table 1 lists the water level measurements for three separate measuring events. The nested wells were all measured in the September 2001 monitoring event. The vertical gradient data discussed here are based on the September 2001 data. Figure 4 shows the multiple-completion well locations and the vertical gradients as listed in Table 1.

There are four zones of water movement defined by the data: upward gradient, downward gradient, little to no vertical gradient, and variable gradient. The zone where most wells show an upward gradient is located in the area of the acid extraction wells and extends east to the Kennecott process water wells. The zone showing a downward gradient is located east and south of the process water wells and extends from 118th South to the Old Bingham Highway. A smaller zone of wells showing no vertical gradient, is located north of the Old Bingham Highway and extends from Highway 111 east approximately 10,000 feet. There is a zone where the vertical gradient is variable. Generally this area has a downward gradient from the A completion toward the B completion. The C completion is, more often than not, confined and has a higher static water level than the A well and less often higher than the B completion. This variable gradient zone of wells is located near the intersection of Highway 111 and 118th South and extends 10,000 feet to the east and approximately 3000 feet north. These variable gradient well locations are not exclusive to this zone and are found locally in, and around, the upward gradient zone as shown in Figure 4.

It should be noted that the vertical gradients, defined by the September 2001 monitoring event, are likely affected by production well pumping. Water may be preferentially pulled through more conductive zones and, depending on well screen placement, show gradients that may not exists under static conditions. In addition, the alluvial geology, particularly near the acid well, is variable, as is the depth of screen intervals. Variations include quartzitic gravel, volcanic gravel, quartzitic gravel with clay interbeds and volcanic tuffs interbedded with clay. Despite these variables these four zones have been defined by the data.

5.0 WATER CHEMISTRY

5.1 Data Validation

Baseline samples collected in 2001 were compared to the pre-existing data set for each analyte. The purpose was to determine if the baseline data properly represents the analyte concentration at the time the sample was collected. The baseline data point was compared to the most recent 8 to 12 data points for each analyte. The mean and the standard deviation of the baseline data point plus the previous 8 to 12 sample points were calculated. Not all wells have been sampled 8 times but the same calculations were made as long as there were at least two data points for an analyte. If the baseline data point was greater than plus or minus two times the standard deviation, the point was flagged. One hundred three points were flagged from the 4128 separate analyses (2.50 percent).

The analytical data for each flagged point were reviewed. All the flagged data fell into four categories. In 65 percent of the samples, the baseline data point was the first sample in time series collected from a well after a relatively long time (often 2 to 3 years). This data gap, in conjunction with a pre-existing increasing or decreasing trend, resulted in the point being flagged as an outlier when in fact it was on trend (explanation 1 and graph 1 below).

In 13 percent of the samples, the baseline data point was the first sample collected in a relatively long time and was flagged as an outlier but, no pre-existing trend was evidenced by previous data. This could be due to a trend that may have started some time between the baseline sample event and the most recent sample or, the baseline data point may in fact be a non-representative outlier (explanation 2 and graph 2 below). The next analysis for these wells will be checked to confirm if the baseline point is the first data point indicating a trend or, is an outlier that may be a non-representative data point.

Twenty-one percent of the data shows that the concentration of an analyte has historically varied more than two times the standard deviation (see explanation 3). This may be due in part to the location of the well relative to the advancing groundwater plume. For example, some wells have shown changes in concentrations of sulfate from 12,000 to 27,000 mg/l over short periods of time as the plume advances (graph 3). These data are reasonable given the location of the well and the known water chemistry of the plume. Wells with concentrations of an analyte that are at or slightly above the method detection limit can also exceed two times the standard deviation without being unreasonable data (graph 4). Some wells have data sets with more than 25 data points that clearly show that an analyte concentration varies more than two times the standard deviation and that is representative of the water at that location (graph 5). Wells that fall into one of these categories were assigned explanation 3.

Graphs

Graphs 1-5

Graph 1: ECG1117B Ca

[Click on above link - Tab 1]

Graph 2: ECG1115C K

[Click on above link – Tab 2]

Graph 3: P244C Ca

[Click on above link – Tab 3]

Graph 4: ECG1145A As

[Click on above link – Tab 4]

Graph 5: ECG904 SO4

[Click on above link – Tab 5]

Only one baseline data point was determined to be a non-representative outlier (B2G1193 Zn). One sample was collected after the baseline sample, and the Zn concentration of the subsequent sample is similar to concentrations prior to the baseline sampling event. This analysis will be omitted from the data set, and the most recent sample replaced as the baseline data point.

In summary, only one of 4128 separate analyses (0.02 percent) is considered invalid, and that well has been re-sampled so that a valid datum is available for the baseline. Another 13 samples (0.3%) will be confirmed in subsequent sampling rounds. 99.7 percent of the data are confirmed. The baseline analytical data are included in Tables 4 and 5.

Number Code Explanation

1. Long time between sampling events and baseline data point is much lower or higher than the mean concentration but consistent with a pre-existing rising or falling trend. Data are considered valid.

2. Long time between sampling events and baseline data point is much lower or higher than the mean concentration. A rising or falling trend may have begun between sampling events, and baseline data point may be valid. Need to monitor next sampling event to confirm whether there is a trend occurring or point is an outlier.

3. Historically, analytical results have varied enough to exceed two standard deviations. This may be a result of very high or very low analyte concentrations, the location of well relative to advancing groundwater plume or for other reasons the analyte just varies that much. Data are considered valid but future analyses will be monitored.

4. Outliers are non-representative data and should be removed from data set.

5.2 Acid Plume

The acid plume is defined as that section of the plume with the pH less than 4.5 standard pH units. Figure 5 shows the low (<4.5) pH distribution relative to the entire plume. This covers an area of 5500 feet (north to south) by 12,700 feet (east to west) and is located to the immediate east and down-gradient of the source area.

The present day acid plume is slightly larger in plan view than the 1996 acid plume (Figure 8). The areas of plume expansion are located at the northeast, southeast and south-central edges of the plume. The plume has expanded approximately 700 feet to the northeast and 300 feet to the southeast. The south-central edge of the plume has expanded to the southeast approximately 500-100 feet in an irregularly shaped area. One area of the plume, located at the north-central edge has contracted approximately 1000 feet to the southwest, based on a slight rise in the pH of one well.

The pH plume defined by water with pH's between 4.5 and 6.5 has also expanded slightly compared to the 1996 plume. Areas of expansion are located along the southeast, east and northeast leading edge of the plume. The plume has expanded approximately 350 feet to the northeast and east and approximately 300 feet to the southeast.

5.3 Sulfate Plume

The sulfate plume is defined as that section of the plume with sulfate concentrations greater than 1500 mg/l sulfate. Figure 6 shows the sulfate distribution within the plume. Sulfate in excess of 1500 mg/l is found in the main core of the plume, which covers an area of approximately 12,000 feet north to south and 17,000 feet east to west. This core portion is located to the immediate east and down-gradient of the former source area (Large Bingham Creek Reservoir).

The present day sulfate plume is smaller in plan view area than the 1996 sulfate plume (Figure 9). The leading edge of the 1500 mg/l sulfate contour line has receded to the west approximately 1000 feet. There are minor changes at the northeast leading edge of the plume where the 1500 mg/l contour line has receded and expanded locally. The plume core (>5000mg/l) is approximately the same size today as in 1996 with minor variations locally, however sulfate concentrations have dropped significantly in the >20000 mg/l core area.

Although the leading eastern edge of the 1500 mg/l sulfate contour is receding, wells in this area that are screened below the more concentrated shallower sulfate zone are showing an increase in sulfate. This may be due to a downward vertical gradient at this location.

5.4 Acid and Sulfate Plume Migration

As described above, the acid and sulfate plume monitoring has shown some changes in the spatial extent of the plumes since monitoring has begun. The sulfate plume has decreased in size near the eastern leading edge and the acid plume has increased in size along the northeast, east and southeast leading edges. This disparity is addressed below.

The sulfate concentration of the plume is finite and since the source has been cut-off no new sulfate has been added to the system. As the initial mass of sulfate moves downgradient there are only two processes that affect sulfate concentration change. These processes are, precipitation of the sulfate bearing phases and dispersion. Both of these processes tend to decrease SO_4 concentration in the downgradient direction. Precipitation decreases aqueous concentration by moving SO_4 from the aqueous to the solid phase. Dispersion decreases the aqueous concentration by increasing the total volume of solution under consideration.

The effect of dispersion is clearest near the leading edge of the plume. In the area of the 1500 mg/L SO_4 contour, the advancing plume has the maximum potential to release Ca into solution, and in the same zone, the Mg concentration (which had been maintaining

SO_4 in solution as a complex magnesium-sulfate ion) has decreased significantly. These effects maximize the potential for gypsum precipitation.

In contrast to sulfate, which represents a unique and finite mass of specific dissolved molecules, the pH of the acid plume is a response of the chemical system to acid-base reactions that are occurring in solution. Ninety to ninety-five percent of the acidity in the acid plume is derived from the hydrolysis of Al^{3+} and Fe^{3+} ions in solution. The core of the acid plume has dissolved Al concentrations in the range of 1500 – 2000 mg/L. As the groundwater plume migrates down-gradient into zones with near-neutral pH water, the dissolved Al undergoes a hydrolysis reaction that produces hydrogen ions, thereby decreasing the pH. The zone in which this kind of reaction is most likely to occur is at the leading edge of the plume.

The remaining five to ten percent of the acidity is a result of carbon dioxide production from the solution of calcium carbonate encountered as the plume advances through previously unacidified sediments. In deep groundwater, the carbon dioxide cannot leave the system to the atmosphere and so is converted to carbonic acid or bicarbonate by reaction with water. Elevated concentrations of these compounds will depress the pH of the groundwater. This phenomenon may contribute to the depression of pH near the leading edge, especially in zones where the observed pH has fallen from about pH 7 to pH 6.

Dilution of the acid plume, through dispersion, has relatively little effect on pH because of its logarithmic definition (versus the arithmetic definition of concentration).

Additional pumping from a strategically placed acid extraction well appears to be the only remedial alternative to prevent further migration of the acid plume.

6.0 SUMMARY/CONCLUSIONS

The Baseline Groundwater Study has produced sufficient water level and chemistry data to adequately describe the present chemical and hydrological conditions of the sulfate and acid plumes.

Spring and fall water level measurements have documented the effects of production well pumping. Kennecott and West Jordan production wells have resulted in approximately an overall five feet drop in the water table over a one year time period. Drops of up to 28 feet in the local vicinity of the Kennecott acid and drinking water wells have been documented. Recent dry conditions account for 0 to 2 feet of this overall five feet drop.

There are four zones of vertical water movement defined by the water level monitoring of nested wells: upward gradient, downward gradient, little to no vertical gradient (horizontal), and variable gradient. These zones are located as follows:

- Downward gradient: Located to the east and south of the process water wells and extends from 118th South to the Old Bingham Highway.
- Upward gradient: Located in the area of the acid extraction well and extends northeast to the Kennecott production wells.
- No vertical gradient: Located north of the Old Bingham Highway and extends from Highway 111 east approximately 10,000 feet.
- Variable gradient: Located near the intersection of Highway 111 and 118th South and extends 10,000 feet to the east and approximately 3000 feet north.

Water analytical data quality were evaluated and were found to meet data quality objectives for 99.7% of the analyses performed. Only thirteen of the total 4128 separate analyses were flagged and future analyses for these sites will be monitored to confirm data quality.

The present day acid plume is slightly larger in plan view than the 1996 acid plume. The areas of plume expansion are located at the northeast, southeast and south-central edges of the plume. One area on the north-central edge of the plume has contracted based on a slight rise in the pH of one well.

The present day sulfate plume is smaller in plan view than the 1996 sulfate plume. The leading eastern edge of the 1500 mg/l plume has receded approximately 1000 feet to the west. In addition, sulfate concentrations in the >20,000 mg/l core of the plume have decreased significantly. However, although the leading eastern edge of the 1500 mg/l sulfate contour is receding, wells in this area that are screened below the more concentrated and shallower sulfate zone are showing an increase in sulfate. This may be due to a downward vertical gradient at this location.

Differences in the expansion/contraction of the sulfate and acid plumes were evaluated and were determined to be driven by independent processes. Shrinkage of the sulfate plume and acid plume expansion should continue. Additional pumping from a strategically placed acid extraction well appears to be the only remedial alternative to prevent further migration of the acid plume.

The existing monitoring program is considered adequate, however if future analytical data shows unexpected results, additional sampling of selected wells may be initiated.

Table 4: Baseline Groundwater Study Total Metal and Field Analytical Data

SITE ID	DATE	DEPTH	COND	PH	TEMP	TDS	TSS	CA	MG	NA	K	SO4	CL	F	ALK	ACD	NO2_N	NO3_N
		feet	*Us/cm*		*degree C*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*
B1G1120A	7/20/01	315.1	10980	3.61	18	15600	4	400	2021	114	12.2	11000	200	0.3	<5.0	3490	<0.05	0.2
B1G951	9/18/01	62.79	14210	3.34	16	25500	4	388	4700	103	5.1	17700	196	0.1	<5.0	7880	<0.05	<0.2
B2G1176A	8/15/01	367.11	6490	3.9	17	7840	<3.0	460	906	120	11	4610	172	6.7	<5.0		<0.05	0.5
B2G1193	9/19/01		2820	6.98	17	2930	<3.0	558	179	84	5.3	1620	168	0.1	206		<0.05	1.3
B3G1197A	9/18/01	313.33	996	7.5	16	744	<3.0	121	43	44	3.2	230	98	0.2	150		<0.05	1
B3G1197B	9/17/01	313.34	748	7.52	16	451	<3.0	82	33	35	3.4	80	110	0.2	151		<0.05	1
B3G1197C	9/17/01	313.35	588	7.57	16	396	<3.0	62	26	31	3.2	44	71		155			
BFG1195A	8/17/01	419.19	2980	7.04	16	2510	<3.0	527	145	92	4.9	1340	188	0.2	220		<0.05	1.6
BFG1195B	8/15/01	418.36	2120	7.22	17	1660	<3.0	282	81	62	3.5	641	135	0.2	187		<0.05	1.9
BFG1198A	2/28/01	366.43	2150	7.16	12	1710	<3.0	312	88	95	3.5	828	272		165			
BRG286	5/17/01	93.17	954	7.42	13	620	700	117	31	49	2.2	48	164		184			
BRG287	5/16/01	274.53	3450	7.11	16	2800	<3.0	510	135	131	9.8	712	671		373			
BRG288	4/5/01	300.05	1078	7.07	12	664	<3.0	147	33	40	4.8	64	195		191			
BRG289	4/5/01	205.94	1046	7.11	11	650	<3.0	136	35	39	4	68	180		188			
BRG290	7/5/01	301.88	1620	7.02	16	1090	<3.0	192	74	30	4	129	346		161			
BRG291A	5/14/01	85.05	5330	6.43	14	4670	<3.0	896	217	333	5.7	1760	596		1050			
BRG919	5/14/01	41.52	3360	7.33	14	2400	25	245	234	129	8.5	265	871		142			
BRG920	5/14/01	91.27	2950	6.73	13	2570	<3.0	451	151	118	4.1	1210	176		608			
BRG921	7/10/01	296.09	2170	6.9	14	1680	<3.0	356	87	107	5.8	656	255		259			
BRG999	7/5/01	230.49	1814	7	16	1390	<3.0	268	67	67	7.3	510	210		208			
BSG1119B	8/8/01	421.91	8250	5.32	16	11000	3	428	1840	116	8.2	7800	190	15.5	62		<0.05	0.6
BSG1125A	8/24/01	285.03	2140	7.05	15	1560	<3.0	336	89	73	5.8	766	215	0.2	179		<0.05	2
BSG1130A	9/12/01	328.79	1778	7.23	17	1420	<3.0	298	80	61	4.4	569	257	0.1	201		<0.05	2.3
BSG1133A	8/22/01	382.65	4530	6.47	16	4530	6	513	533	81	6	2720	219	0.1	137		<0.05	1.8
BSG1133B	8/22/01	381.95	3380	7.11	16	3150	3	612	198	75	5.8	1750	125	0.1	255		<0.05	0.4
BSG1137A	3/8/01	325.85	1556	7.39	14	1050	3	198	57	48	2.9	378	196		179			
BSG1137B	3/8/01	326.44	1155	7.46	14	776	<3.0	126	52	39	3.5	336	117		148			
BSG1148A	8/3/01	397.16	3940	6.88	17	3900	8	832	229	93	6.7	2484	162	0.2	322		<0.05	0.2
BSG1148B	8/7/01	396.98	1444	7.1	17	1020	<3.0	199	59	48	4.3	455	100		194			
BSG1177A	8/17/01	387.68	11660	3.83	17	17700	<3.0	415	2590	73	14.9	12000	135	14.2	<5.0		<0.05	<0.2
BSG1177B	8/22/01	392.36	17710	3.34	16	32800	<3.0	390	4570	70	7.3	21300	155	49.7	<5.0		<0.05	<0.2
BSG1179A	1/4/01	384.9	10480	3.96	13	16000	5	407	2630	94	14.7	11500	147		<5.0			
BSG1179B	1/5/01	387.3	10170	3.74	13.3	14400	<3.0	417	2190	71	18.6	10000	132		<5.0			
BSG1179C	1/9/01	392.3	15760	3.81	14.1	29300	10	435	4040	59	11.5	18600	142		<5.0			
BSG1180B	9/10/01	368.27	16480	3.54	16	32100	16	373	6320	98	17.7	21700	140	225	<5.0	7610	<0.05	<0.2
BSG1180C	9/13/01	361.62	6140	6.25	16	7490	10	502	1170	133	7	4940	129	116	264		<0.05	0.3
BSG1196B	9/7/01	351.48	7490	6.28	15	9440	3	430	1640	117	7.1	6600	140	0.2	215		<0.05	0.9

Table 4: Baseline Groundwater Study Total Metal and Field Analytical Data

SITE ID	DATE	DEPTH	COND	PH	TEMP	TDS	TSS	CA	MG	NA	K	SO4	CL	F	ALK	ACD	NO2_N	NO3_N
		feet	*Us/cm*		*degree C*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*
BSG1196C	9/6/01	349.24	5680	6.64	14	6990	33	759	818	163	6.7	4650	163	6.6	367		<0.05	<0.2
ECG1113A	2/13/01	82.98	2250	7.17	14	2040	<3.0	446	96	64	4.8	1100	172		294			
ECG1115A	7/11/01	316.13	23500	3.56	19	53200	6	366	5810	45	6.8	34400	165	10.8	<5.0		<0.05	<0.2
ECG1115B	8/29/01	305.5	4290	6.9	17	3890	<3.0	588	281	99	7.1	2300	153	0.1	640		<0.05	<0.2
ECG1115C	7/13/01		22700	4.67	19	40000	35	400	7090	130	21.2	28300	138	15	<5.0		<0.05	0.2
ECG1117A	7/19/01		18970	3.39	19	35300	3	395	4294	57	2.5	23900	157	76.1	<5.0		<0.05	<0.2
ECG1117B	7/19/01		3840	7.22	19	3690	<3.0	751	234	73	8.9	2290	127	2.5	291		<0.05	0.3
ECG1118A	8/8/01	378.49	13280	3.49	18	21800	3	436	2590	102	7.8	14949	168	32.4	<5.0	6220	<0.05	<0.2
ECG1118B	7/31/01	370.4	763	7.46	16	516	<3.0	85	27	39	6.5	166	54	0.2	141		<0.05	0.3
ECG1121A	3/20/01	397.31	13490	3.49	15	22100	<3.0	396	3460	100	8	14800	160		<5.0	5800		
ECG1128A	8/15/01	235.54	22400	3.66	17	40500	3	370	6720	96	17.1	28400	144	141	<5.0		<0.05	<0.2
ECG1144A	8/30/01	376.4	13010	3.55	17	21100	3	390	2680	60	7.3	15800	143	44.8	<5.0		<0.05	<0.2
ECG1145A	3/5/01	266.66	18800	3.5	13	33600	8	428	4460	69	13.7	25100	165		<5.0	8070		
ECG1145B	3/5/01	262.39	13680	4.51	14	19400	19	459	4460	117	16.5	14300	151		<5.0	1530		
ECG1145C	3/6/01	252.98	3460	7.12	14	3360	9	686	218	56	8.3	2370	123		315			
ECG1146	9/5/01		19900	3.31	15	43500	6	374	5390	58	10.9	28100	153	76.4	<5.0	13700	<0.05	<0.2
ECG1183A	9/19/01	44.47	3630	6.7	14	2980	22	519	134	221	8.3	846	676	0.3	305		<0.05	5.5
ECG1183B	9/19/01	33.77	2020	7.08	16	1450	19	223	79	100	9.9	130	488		177			
ECG1184	8/15/01	45.5	1509	6.97	17	1170	<3.0	168	90	64	3.1	387	122	0.8	276		<0.05	0.3
ECG1186	7/13/01	36.77	2380	6.88	14	1720	12	317	76	138	4.9	599	380	0.2	203		<0.05	1.4
ECG1187	7/9/01	55.07	1785	7.11	14	980	<3.0	219	55	68	4.5	82	436		155			
ECG1188	7/18/01	38.6	4030	6.86	14	3400	<3.0	700	135	239	6.4	1570	480	0.2	278		<0.05	0.6
ECG1189	8/7/01	225.06	916	7.39	15	615	6	114	34	32	4.7	17	220	0.3	139		<0.05	2
ECG1190	8/7/01	125.23	1108	7.26	15	788	<3.0	155	42	27	3.2	53	250	0.3	166		<0.05	1.4
ECG294	2/26/01	80.03	4390	6.51	15	4590	<3.0	524	460	143	9.8	2740	154		269			
ECG297	9/18/01	64.9	4240	4.08	17	4260	<3.0	519	381	98	10	2790	156		<5.0	590		
ECG299	7/17/01	151.42	2080	6.03	14	1510	<3.0	219	109	108	7.6	687	229		105			
ECG900	7/17/01	148.83	1731	6.84	15	1150	<3.0	219	58	71	4.5	224	304		218			
ECG901	7/18/01	138.28	1938	6.91	14	1330	<3.0	250	62	54	6.9	124	463		168			
ECG902	8/29/01	164.32	1583	6.93	15	1090	<3.0	187	52	75	5.1	258	238		213			
ECG903	7/10/01	116.23	1273	7.08	14	770	25	159	47	57	4	145	208		183			
ECG904	8/29/01	151.31	2380	6.8	15	1880	<3.0	309	85	138	6.5	699	227		209			
ECG905	8/29/01	206.22	2470	6.33	15	2210	<3.0	433	93	84	7.4	1120	130		175			
ECG906	7/13/01	99.11	4370	7.07	14	3950	<3.0	701	173	276	11.5	1980	411		422			
ECG907	8/21/01	98.18	2350	7.07	15	1430	<3.0	322	71	68	6.9	156	554		215			
ECG908	8/21/01	4.95	1167	7.7	15	645	<3.0	46	39	142	6.1	80	223		159			
ECG909	7/10/01	136.28	8920	4.16	21	11200	19	514	1630	315	12.7	7570	290		<5.0			
ECG915	8/14/01		2600	7.28	12	1670	10	117	119	258	8.9	139	638		204			

Table 4: Baseline Groundwater Study Total Metal and Field Analytical Data

SITE ID	DATE	DEPTH	COND	PH	TEMP	TDS	TSS	CA	MG	NA	K	SO4	CL	F	ALK	ACD	NO2_N	NO3_N
		feet	*Us/cm*		*degree C*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*
ECG916	7/23/01	43.04	1171	8.25	24	700	6	53	37	144	6.2	238	139		181			
ECG917	8/24/01	113.7	1800	7	14	1170	<3.0	229	56	88	5.1	123	402	0.2	187		<0.05	1.6
ECG922	7/20/01	101.72	1731	7.18	13	1010	<3.0	206	63	50	3.3	112	392	0.3	206		<0.05	0.9
ECG923	9/11/01	88.59	1620	7.4	14	1050	<3.0	133	19	188	3.8	103	368		179			
ECG924	9/4/01	31.91	5100	6.46	14	4650	5	685	349	256	12.4	2210	474		468			
ECG925	9/4/01	36.52	3840	6.62	14	2960	23	562	125	210	6	1050	562		384			
ECG926	8/16/01	36.55	1569	6.96	17	946	3	184	54	74	4.7	133	291		228			
ECG928	11/15/01	65.25	1119	7.39	13	711	<3.0	104	28	100	3.8	54	259		150			
ECG931	9/4/01	50.27	7180	6.75	14	5120	<3.0	971	210	340	14.4	477	2200		211			
ECG932	8/28/01	81.64	1078	7.31	16	642	27	114	49	32	3.2	126	120		241			
ECG934	7/12/01	116.18	1302	6.93	14	933	<3.0	172	58	57	3.5	343	89		273			
ECG935	8/31/01		3540	6.84	14	3270	<3.0	487	209	209	6.6	1700	215		421			
ECG936	8/28/01	44.75	4060	6.71	13	4060	<3.0	579	312	186	5.4	2190	234		283			
ECG937	8/31/01	237.98	1580	6.9	16	1080	3	211	49	84	2.9	352	166		262			
ECG938	8/29/01	215.22	1241	7.08	15	778	<3.0	135	47	72	2.4	198	127		296			
ECG940	8/30/01	122.13	643	7.13	12	466	<3.0	82	24	25	2	48	35		248			
HMG1126A	9/4/01	274.46	1882	7.14	14	1330	<3.0	260	75	55	3.4	542	184	0.2	216		<0.05	1.3
HMG1126B	8/31/01	274.68	1352	7.17	14	800	3	172	45	47	3	211	158	0.1	239		<0.05	2.1
HMG1134A	9/12/01	166.63	1176	7.16	15	664	13	135	35	46	3.6	122	164	<0.1	194		<0.05	2.5
HMG1515	9/24/01		1750	7.12	16	1330	<3.0	212	54	87	7	109	363		224			
HMG1623	11/14/00	55.96	1120	7.17	13.3	743	<3.0	137	36	64	2.9	171	81	<0.1	349		<0.05	1.4
HMG1856	4/26/01		2150	7.45	13.8	1330	12	206	52	86	6	300	321		298			
HMG2067	5/16/01		1935	7.22	16.4	1240	13	211	52	94	20	110	403		217			
HMG2436	5/16/01		1826	7.32	16.2	1200	<3.0	201	50	90	10.1	124	355		231			
HMG2727	9/12/01		2720	6.97	17.8	1810	<3.0	346	103	76	4.8	355	545	0.2	263		<0.05	2.8
K109	9/19/01		2700	6.48	17	1980	<3.0	390	113	71	4.5	1020	153	0.1	180		<0.05	1.6
K26	3/22/01	191.12	5840	3.76	15	6960	11	432	601	103	2	4780	158		<5.0	1310		
K72	6/5/01	193.86	2030	7.15	13	1200	7	189	64	96	7.3	193	378		179			
LRG910	8/10/01	76.74	1965	6.9	15	1560	<3.0	323	88	85	3.9	819	155	0.1	174		<0.05	1.9
LRG911	7/26/01	127.13	2350	6.43	18	2110	4	418	117	60	9.4	1124	152	0.4	137		<0.05	1.2
LRG912	1/12/01	95.75	5840	3.59	13	6760	<3.0	466	716	195	8.1	4600	238		<5.0	1221		
LTG1139	9/19/01		803	7.54	21	540	<3.0	72	27	61	16	31	148	0.3	156		<0.05	1
LTG1140A	6/12/01	166.13	1973	7.16	14	1460	<3.0	245	79	84	7.3	576	236		219			
LTG1140B	6/12/01	165.82	717	7.45	14	429	16	58	25	38	6.5	32	107		164			
LTG1147	9/10/01		2250	7.54	15	1630	<3.0	313	79	91	5.5	692	216	0.2	225		<0.05	2.5
LTG1167B	9/10/01	195.92	1630	7.14	13	1130	<3.0	204	62	64	3.1	453	122	0.2	269		<0.05	1.2
LTG1191	7/13/01	23.26	4970	6.43	14	4940	8	556	476	252	6.6	2790	359	2.8	303		<0.05	3.3
P190A	9/5/01	295.42	1990	7.16	16	1790	<3.0	330	100	80	<0.5	668	285	0.1	194		<0.05	2.6

Table 4: Baseline Groundwater Study Total Metal and Field Analytical Data

SITE ID	DATE	DEPTH	COND	PH	TEMP	TDS	TSS	CA	MG	NA	K	SO4	CL	F	ALK	ACD	NO2_N	NO3_N
		feet	*Us/cm*		*degree C*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*
P190B	9/5/01	296.63	1626	7.21	15	1170	<3.0	170	65	53	3.4	214	250	0.1	179		<0.05	2.2
P208B	7/25/01		8990	4.86	16	11300	3	414	1910	97	12	8109	149	17	7		<0.05	0.9
P220	8/14/01	48.46	2100	7.1	15	1440	6	147	51	277	6.1	459	214		334			
P225	6/14/01	33.91	1160	6.99	13	755	<3.0	141	38	70	4.8	110	194		201			
P228	8/28/01	24.67	6860	5.94	14	7970	<3.0	432	1210	165	6.2	4910	329		103			
P239	6/12/01	68.92	4170	6.61	13	3530	6	602	208	241	5.2	1870	375		493			
P241B	8/24/01	391.16	8400	3.68	16	11500	<3.0	443	1600	67	9.1	6180	115	26.5	<5.0		<0.05	<0.2
P241C	8/1/01	295.47	1700	7.23	16	1300	<3.0					329	256	0.2	160		<0.05	2
P244A	3/14/01	44.66	8630	3.92	12	10100	44	509	1160	409	7.4	5250	1330		<5.0	492		
P244B	8/15/01	47.94	5230	6.76	16	4630	<3.0	810	190	301	8.3	1370	921	0.2	473		<0.05	0.5
P244C	1/2/01	52.06	2440	7.21	12	2190	<3.0	450	98	136	7.4	418	689		282			
P248A	7/21/01	84.77	2420	3.96	17	2000	<3.0	188	184	61	3.4	1200	182	5	<5.0	289	<0.05	1.4
P248B	7/21/01	84.45	3370	5.93	20	3520	4	471	310	65	9.7	2130	111	0.5	97		<0.05	0.8
P248C	7/21/01	79.51	1331	6.25	14	933	<3.0	165	65	35	3.1	432	117	3.2	120		<0.05	1.1
P272	8/16/01	76.08	3610	6.74	16	3070	3	564	153	190	12.4	1500	215		462			
P279	3/12/01	326.47	17070	3.48	12	28800	22	372	4600	65	6.5	27300	157		<5.0	8680		
RVG1164A	7/20/01		1493	7.31	15.3	906	<3.0	160	42	121	4.1	226	159	0.1	336		<0.05	3.7
RVG1164B	7/20/01		1588	7.41	17.3	974	<3.0	184	54	87	4.1	287	197	0.1	277		<0.05	2.6
RVG1164C	7/24/01		598	7.02	17	336	<3.0	40	15	62	3.2	34	86	0.2	121		<0.05	0.7
SRG946	1/11/01	118.38	15430	3.5	13	28700	69	401	3680	204	3.3	21600	165		<5.0	7390		
W107	8/12/99		992	7.28	15.5	624	72	95	40	58	3.2	64	197		149			
W189	3/5/01		745	7.43	17	482	<3.0	80	31	36	2.7	117	96		163			
W22	7/13/01		1396	7.09	16	970	<3.0	183	53	48	4.6	258	150	0.2	268		<0.05	1.8
W361	8/29/01		1096	7.22	18	690	<3.0	104	37	51	3.2	46	210	0.2	152		<0.05	2.4
W363	9/11/01		1012	7.34	15	635	<3.0	104	37	41	3.1	164	119	0.2	156		<0.05	1.6
W387	8/29/01		1155	7.23	18	750	<3.0	113	37	56	3.2	48	228	0.2	154		<0.05	2.2
W409	9/25/01		1924	7.3	15	1540	3	248	68	78	6.4	183	393	0.2	207		<0.05	1.7
W412	7/13/01		1100	7.1	16	673	<3.0	116	32	77	2.6	105	146	0.4	222		<0.05	1.1
W41A	9/19/01		1224	6.98	20	1110	<3.0	159	61	64	3.3	285	102		282			
WJG1154A	12/7/01	318.14	1490	7.24	14	1140	<3.0	235	74	59	4.2	483	138		159			
WJG1154B	6/13/01	309.25	690	7.48	16	451	11	70	25	40	3	63	88		148			
WJG1154C	7/14/01	312.32	821	7.22	15	538	<3.0	81	32	54	3.3	113	98	0.3	169		<0.05	0.4
WJG1169A	7/24/01	362.34	2390	7.17	15	1970	<3.0	375	92	113	4.1	903	251	3.5	201		<0.05	2.1
WJG1169B	8/16/01	362.4	2330	7.27	17	1710	<3.0	341	95	92	4.5	673	272	0.2	175		<0.05	2
WJG1170A	7/14/01	366.32	1342	7.24	16	976	<3.0	173	57	50	4	348	152	0.2	149		<0.05	1.8
WJG1171A	7/6/01	300.18	691	7.51	16	474	<3.0	75	25	34	2.3	71	80		154			

Table 5: Baseline Groundwater Study Total and Dissolved Metals Analytical Data (mg/L)

SITE ID	DATE	AG T	AG D	AL T	AL D	AS T	AS D	BA T	BA D	CD T	CD D	CR T	CR D	CU T	CU D	FE T	FE D	HG T	MN T	MN D	NI T	NI D	PB T	PB D	SE T	SE D	SEHY D	SEHY D D	ZN T	ZN D
B1G1120A	7/20/01	<0.001	<0.001	486	483	0.024	0.023	<0.01	<0.01	1.06	1.01	0.01	0.01	211	21.1	2.09	2.09	3.1	296	296	9.82	9.82	<0.005	<0.005			<0.002	<0.002	45.5	45.5
B1G951	9/18/01	<0.001	<0.001	1180	1100	0.034	0.031	<0.01	<0.01	0.463	0.463	0.074	0.074	65.2	65.2	259	246	<0.2	177	177	12.6	12.4	0.005	<0.005			0.008	0.005	81.3	80.1
B2G1176A	8/15/01	<0.001	<0.001	65.9	64.5	0.017	0.015	0.013	0.013	0.382	0.382	0.015	0.015	0.214	0.213	<0.3	<0.3	6.8	73.2	71.2	4.92	3.66	0.022	0.022			0.003	0.003	16.4	11.3
B2G1193	9/19/01	<0.001	<0.001	<0.1	<0.1	<0.005	<0.005	0.027	0.026	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.009	0.007			0.109	0.109
B3G1197A	9/18/01	<0.001	<0.001	0.215	0.045	0.006	0.006	0.092	0.092	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	0.013	<0.01	<0.05	<0.05	<0.005	<0.005	0.005	0.003			0.02	0.014
B3G1197B	9/17/01	<0.001	<0.001	<0.1	<0.1	0.009	0.008	0.092	0.091	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	<0.003	<0.003			0.043	<0.02
B3G1197C	9/17/01		<0.001		<0.1		0.009		0.071		<0.001		<0.01		<0.01		<0.3			<0.01		<0.05		<0.005		<0.003				<0.02
BFG1195A	8/17/01	<0.001	<0.001	0.013	<0.1	0.006	0.005	0.023	0.022	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.01	0.006			0.012	<0.02
BFG1195B	8/15/01	<0.001	<0.001	<0.1	<0.1	0.005	<0.005	0.025	0.022	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.009	0.005			0.012	0.012
BFG1198A	2/28/01						<0.005				<0.001				<0.01									<0.005				0.004		<0.02
BRG286	5/17/01		<0.001				0.004		0.068		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
BRG287	5/16/01		<0.001				0.005		0.053		<0.001		<0.01		<0.01									<0.005				0.005		<0.02
BRG288	4/5/01		<0.001				<0.005		0.095		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
BRG289	4/5/01		<0.001				<0.005		0.112		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
BRG290	7/5/01		<0.001				<0.005		0.125		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
BRG291A	5/14/01		<0.001				0.006		0.031		<0.001		<0.01		<0.01									<0.005				0.008		<0.02
BRG919	5/14/01		<0.001				<0.005		0.122		<0.001		<0.01		<0.01			<0.2						<0.005				<0.002		<0.02
BRG920	5/14/01		<0.001				0.005		0.048		<0.001		<0.01		<0.01			<0.2						<0.005				<0.002		<0.02
BRG921	7/10/01		<0.001				0.01		0.049		<0.001		<0.01		<0.01			<0.2						<0.005				0.002		<0.02
BRG999	7/5/01		<0.001				<0.005		0.035		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
BSG1119B	8/8/01	<0.001	<0.001	13	9.37	0.011	0.009	0.025	0.021	0.337	0.296	<0.01	<0.01	0.032	0.029	<0.3	<0.3	0.4	181	134	5.54	4.66	<0.005	<0.005			0.005	0.004	0.223	0.208
BSG1125A	8/24/01	<0.001	<0.001	0.268	0.048	<0.005	<0.005	0.019	0.018	<0.001	<0.001	<0.01	<0.01	0.022	<0.01	<0.3	<0.3	<0.2	0.115	0.016	<0.05	<0.05	<0.005	<0.005					0.045	0.014
BSG1130A	9/12/01	<0.001	<0.001	0.019	0.019	0.006	0.006	0.03	0.03	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	0.012	0.011	0.044	0.044	<0.005	<0.005	0.011	0.008			0.036	0.02
BSG1133A	8/22/01	<0.001	<0.001	0.075	<0.1	0.006	<0.005	0.023	0.021	0.011	0.011	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	3.66	3.61	0.079	0.079	<0.005	<0.005			0.002	<0.002	0.033	0.03
BSG1133B	8/22/01	<0.001	<0.001	<0.1	<0.1	0.006	0.005	0.024	0.022	<0.001	<0.001	0.022	0.022	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	0.042	0.042	<0.005	<0.005			0.002	<0.002	0.017	0.015
BSG1137A	3/8/01						<0.005				<0.001				<0.01									<0.005				0.003		<0.02
BSG1137B	3/8/01						<0.005				<0.001				<0.01									<0.005				<0.002		<0.02
BSG1148A	8/3/01	<0.001	<0.001	0.02	<0.1	<0.005	<0.005	0.026	0.026	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	0.012	0.011	0.042	0.042	<0.005	<0.005			0.005	0.005	<0.02	<0.02
BSG1148B	8/7/01																													
BSG1177A	8/17/01	<0.001	<0.001	337	336	0.051	0.049	0.011	0.01	1.71	1.71	0.016	0.016	0.37	0.363	<0.3	<0.3	0.2	281	272	14.8	14.4	0.075	0.073			0.007	0.002	47.2	46.1
BSG1177B	8/22/01	<0.001	<0.001	1410	1410	0.065	0.057	<0.01	<0.01	1.29	1.28	0.016	0.016	80.7	77.8	107	98.8	2.7	424	407	22	21.6	0.035	0.034			0.104	0.007	109	106
BSG1179A	1/4/01		<0.001				0.047		0.01		1.23		0.011		7.6									0.034		0.089				71.3
BSG1179B	1/5/01		<0.001				0.043		0.012		0.982		0.011		8.029									0.082		0.085				42.32
BSG1179C	1/9/01		<0.001				0.047		<0.01		0.82		<0.01		64.2									0.017		0.055				84.382
BSG1180B	9/10/01	0.002	0.001	1050	1050	0.093	0.079	<0.01	<0.01	2.4	2.39	0.015	0.012	3.76	3.71	0.614	0.42	3.8	577	577	27.2	27.2	0.039	0.038			0.005	0.004	105	105
BSG1180C	9/13/01	<0.001	<0.001	9.64	9.64	0.005	<0.005	0.02	0.017	0.107	0.093	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	27	91.3	91.3	2.93	2.93	<0.005	<0.005			0.007	0.006	0.191	0.154
BSG1196B	9/7/01	0.004	<0.001	0.041	<0.1	0.009	0.007	0.023	0.023	0.014	0.014	0.025	0.025	0.023	0.021	<0.3	<0.3	1.3	3.08	2.89	0.137	0.122	<0.005	<0.005			0.006	0.006	0.056	0.056

Table 5: Baseline Groundwater Study Total and Dissolved Metals Analytical Data (mg/L)

SITE ID	DATE	AG T	AG D	AL T	AL D	AS T	AS D	BA T	BA D	CD T	CD D	CR T	CR D	CU T	CU D	FE T	FE D	HG T	MN T	MN D	NI T	NI D	PB T	PB D	SE T	SE D	SEHY D	SEHY D D	ZN T	ZN D
BSG1196C	9/6/01	0.003	<0.001	4.65	1.46	0.006	<0.005	0.027	0.022	0.104	0.09	<0.01	<0.01	0.02	<0.01	<0.3	<0.3	30	32.3	31.5	1.68	1.47	<0.005	<0.005			0.006	0.004	0.525	0.445
ECG1113A	2/13/01						<0.005				<0.001				<0.01									<0.005				0.002		<0.02
ECG1115A	7/11/01	<0.001	<0.001	3030	2650	<0.005	<0.005	<0.01	<0.01	0.99	0.9	0.28	0.27	160	145	629	629	0.4	368	336	27.9	25.6	<0.005	<0.005			<0.002	<0.002	187	171
ECG1115B	8/29/01	<0.001		<0.1		0.006		0.024		<0.001		<0.01		<0.01		<0.3		42.3	0.024		0.052		<0.005				0.006		0.027	
ECG1115C	7/13/01	<0.001	<0.001	275	275	0.056	0.054	0.015	0.015	1.01	0.975	0.016	0.016	0.668	0.621	0.522	0.497	11.6	975	975	38.8	38.8	0.007	0.007			0.006	0.006	49.2	49.2
ECG1117A	7/19/01	<0.001	<0.001	1720	1690	0.044	0.04	<0.01	<0.01	0.529	0.519	0.143	0.143	77.7	77.7	499	418	0.4	245	240	14.6	14.6	<0.005	<0.005			<0.002	<0.002	117	117
ECG1117B	7/19/01	<0.001	<0.001	<0.1	<0.1	0.006	<0.005	0.027	0.024	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			0.004	0.004	0.026	0.018
ECG1118A	8/8/01	0.004	<0.001	865	823	0.068	0.046	<0.01	<0.01	0.927	0.895	0.032	0.012	50.4	47.5	137	118	1	316	291	14.4	13.6	0.016	<0.005			<0.002	<0.002	77.1	71.2
ECG1118B	7/31/01	0.004	<0.001	0.068	0.065	0.005	<0.005	0.069	0.069	<0.001	<0.001	0.012	0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			0.002	0.002	0.016	<0.02
ECG1121A	3/20/01		<0.001		783		0.036		<0.01		1.198		<0.01		52.323		51.5	7.8		405				<0.005				<0.002		91.452
ECG1128A	8/15/01	<0.001	<0.001	1040	1020	0.122	0.122	<0.01	<0.01	4.71	4.11	0.026	0.026	12.8	11.1	<0.3	<0.3	6.7	1160	1040	43.1	37.6	0.057	0.056			0.006	0.005	206	206
ECG1144A	8/30/01	<0.001	<0.001	855	841	0.034	0.032	<0.01	<0.01	0.57	0.558	0.015	0.013	53.1	52.7	159	<0.3	2.6	213	210	13.3	13.3	<0.005	<0.005	0.073	0.065		0.002	66.7	66.5
ECG1145A	3/5/01		<0.001		1590		0.068		0.01		2.36		0.014		69.5		43.3			526		26.9		0.193				0.004		141
ECG1145B	3/5/01		<0.001		267		0.036		0.012		0.658		<0.01		4.99		1.05			483		17.5		0.006				0.009		25.1
ECG1145C	3/6/01		<0.001		<0.1		0.007		0.031		<0.001		0.011		<0.01		<0.3			<0.01		0.059		<0.005				0.005		0.033
ECG1146	9/5/01	0.001	<0.001	2150	2050	0.085	0.07	<0.01	<0.01	1.08	0.907	0.018	0.011	133	129	549	458	7.5	405	389	24.8	24	<0.005	<0.005			0.006	0.006	134	130
ECG1183A	9/19/01	<0.001	<0.001	0.581	<0.1	0.007	0.006	0.043	0.027	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	0.509	<0.3	<0.2	0.01	0.01	<0.05	<0.05	<0.005	<0.005			0.003	0.003	0.012	<0.02
ECG1183B	9/19/01		<0.001		0.036		<0.005		0.098		<0.001		<0.01		<0.01		<0.3			<0.01		<0.05		<0.005				<0.002		<0.02
ECG1184	8/15/01	<0.001	<0.001	0.039	0.009	<0.005	<0.005	0.021	0.021	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			<0.002	<0.002	<0.02	<0.02
ECG1186	7/13/01	<0.001	<0.001	0.191	0.032	<0.005	<0.005	0.031	0.031	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			<0.002	<0.002	0.014	<0.02
ECG1187	7/9/01		<0.001				<0.005		0.106		<0.001		<0.01		0.004									<0.005				0.002		<0.02
ECG1188	7/18/01	<0.001	<0.001	0.012	<0.1	<0.005	<0.005	0.031	0.028	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			<0.002	<0.002	0.005	<0.02
ECG1189	8/7/01	<0.001	<0.001	0.151	<0.1	<0.005	<0.005	0.363	0.363	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			<0.002	<0.002	<0.02	<0.02
ECG1190	8/7/01	<0.001	<0.001	0.014	<0.1	0.005	<0.005	0.164	0.161	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			<0.002	<0.002	<0.02	<0.02
ECG294	2/26/01						<0.005				<0.001				<0.01									<0.005				0.003		0.178
ECG297	9/18/01						<0.005				0.087				4.01									0.052				0.004		10.2
ECG299	7/17/01		<0.001				<0.005		0.028		0.002		<0.01		0.097									<0.005				<0.002		0.15
ECG900	7/17/01		<0.001				<0.005		0.075		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
ECG901	7/18/01		<0.001				<0.005		0.153		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
ECG902	8/29/01		<0.001				0.006		0.098		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
ECG903	7/10/01		<0.001				0.006		0.161		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
ECG904	8/29/01		<0.001				0.005		0.036		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
ECG905	8/29/01		<0.001				<0.005		0.028		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
ECG906	7/13/01		<0.001				<0.005		0.031		<0.001		<0.01		<0.01									<0.005				<0.002		0.022
ECG907	8/21/01		<0.001				<0.005		0.261		<0.001		<0.01		<0.01									<0.005				0.002		<0.02
ECG908	8/21/01		<0.001				<0.005		0.036		<0.001		<0.01		<0.01									<0.005				<0.002		0.032
ECG909	7/10/01		<0.001				0.031		0.021		0.061		0.044		6.45									0.01				<0.002		8.85
ECG915	8/14/01		<0.001				<0.005		0.065		<0.001		<0.01		<0.01									<0.005				0.002		<0.02
ECG916	7/23/01		<0.001				0.006		0.018		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02

Table 5: Baseline Groundwater Study Total and Dissolved Metals Analytical Data (mg/L)

SITE ID	DATE	AG T	AG D	AL T	AL D	AS T	AS D	BA T	BA D	CD T	CD D	CR T	CR D	CU T	CU D	FE T	FE D	HG T	MN T	MN D	NI T	NI D	PB T	PB D	SE T	SE D	SEHY D	SEHY D D	ZN T	ZN D
ECG917	8/24/01	<0.001	<0.001	0.028	0.017	<0.005	<0.005	0.143	0.136	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			<0.002	<0.002	<0.02	<0.02
ECG922	7/20/01	<0.001	<0.001	0.012	<0.1	0.006	0.005	0.077	0.074	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			<0.002	<0.002	0.025	<0.02
ECG923	9/11/01		<0.001				0.007		0.168		0.001		<0.01		<0.01									<0.005				<0.002		0.064
ECG924	9/4/01		<0.001				0.006		0.027		0.002		0.013		<0.01									<0.005				<0.002		0.075
ECG925	9/4/01		<0.001				0.006		0.03		<0.001		0.018		<0.01									<0.005				0.002		<0.02
ECG926	8/16/01		<0.001				0.008		0.127		<0.001		<0.01		<0.01									<0.005				<0.002		0.028
ECG928	11/15/01		<0.001				0.006		0.137		<0.001		<0.01		<0.01			<0.2						<0.005				<0.002		<0.02
ECG931	9/4/01		<0.001				0.007		0.106		<0.001		<0.01		<0.01									<0.005				0.009		<0.02
ECG932	8/28/01		<0.001				<0.005		0.034		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
ECG934	7/12/01		<0.001				<0.005		0.039		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
ECG935	8/31/01		<0.001				<0.005		0.022		<0.001		<0.01		0.008									<0.005				0.003		<0.02
ECG936	8/28/01		<0.001				0.023		0.012		<0.001		<0.01		<0.01									<0.005				<0.002		0.02
ECG937	8/31/01		<0.001				0.006		0.02		<0.001		<0.01		<0.01									<0.005				<0.002		0.013
ECG938	8/29/01		<0.001				0.01		0.025		<0.001		<0.01		<0.01									<0.005				<0.002		0.01
ECG940	8/30/01		<0.001				<0.005		0.044		<0.001		<0.01		<0.01									<0.005				<0.002		0.012
HMG1126A	9/4/01	<0.001	<0.001	0.017	<0.1	<0.005	<0.005	0.046	0.046	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.005	0.004			<0.02	<0.02
HMG1126B	8/31/01	<0.001	<0.001	0.103	<0.1	0.005	<0.005	0.082	0.063	<0.001	<0.001	0.014	<0.01	<0.01	<0.01	<0.3	<0.3	0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.007	0.004			<0.02	<0.02
HMG1134A	9/12/01	<0.001	<0.001	0.223	0.083	0.007	0.007	0.096	0.084	<0.001	<0.001	0.021	<0.01	<0.01	<0.01	1.8	<0.3	<0.2	0.364	<0.01	<0.05	<0.05	0.008	<0.005	0.006	0.006			0.038	0.038
HMG1515	9/24/01		<0.001				<0.005		0.201		<0.001		<0.01		<0.01									<0.005						0.022
HMG1623	11/14/00	<0.001	<0.001	0.01	<0.1	<0.005	<0.005	0.032	0.031	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	0.98	<0.3	<0.2	0.037	0.013	<0.05	<0.05	<0.005	<0.005	0.003	<0.003			0.07	0.07
HMG1856	4/26/01	<0.001	<0.001	0.008	<0.1	0.006	<0.005	0.05	0.048	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3		<0.01	<0.01	<0.05	<0.05	<0.005	<0.005					0.026	0.022
HMG2067	5/16/01	<0.001	<0.001	0.006	<0.1	0.006	<0.005	0.254	0.254	<0.001	<0.001	0.012	<0.01	0.026	<0.01	1.28	<0.3		0.02	<0.01	<0.05	<0.05	0.006	<0.005					0.038	0.038
HMG2436	5/16/01	<0.001	<0.001	0.008	<0.1	<0.005	<0.005	0.23	0.22	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	0.338	<0.3		0.012	0.012	<0.05	<0.05	<0.005	<0.005					0.058	0.058
HMG2727	9/12/01	<0.001	<0.001	<0.1	<0.1	<0.005	<0.005	0.062	0.058	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	0.029	0.026	0.072	0.041	<0.005	<0.005	0.017	0.011			2.04	1.754
K109	9/19/01	<0.001	<0.001	<0.1	<0.1	0.006	0.006	0.032	0.032	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.007	0.005			0.035	0.035
K26	3/22/01				185		0.011				0.15				67.8		16.8			40.7				0.007				<0.002		17.4
K72	6/5/01		<0.001				<0.005		0.064		<0.001		<0.01		<0.01									<0.005				0.002		<0.02
LRG910	8/10/01	<0.001	<0.001	0.015	<0.1	<0.005	<0.005	0.023	0.022	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			0.003	0.003	<0.02	<0.02
LRG911	7/26/01	<0.001	<0.001	0.244	0.058	<0.005	<0.005	0.024	0.024	0.004	0.004	<0.01	<0.01	0.172	0.166	<0.3	<0.3	<0.2	0.474	0.474	0.074	0.072	<0.005	<0.005			<0.002	<0.002	0.473	0.473
LRG912	1/12/01		<0.001				0.013		<0.01		0.246		<0.01		33.2			<0.2						<0.005				<0.002		20.9
LTG1139	9/19/01	<0.001	<0.001	0.094	<0.1	0.005	<0.005	0.143	0.119	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	0.022	0.014	<0.05	<0.05	<0.005	<0.005	0.003	<0.003			0.019	<0.02
LTG1140A	6/12/01						<0.005				<0.001				<0.01									<0.005				<0.002		0.01
LTG1140B	6/12/01						<0.005				<0.001				<0.01									<0.005				<0.002		<0.02
LTG1147	9/10/01	<0.001	<0.001	0.026	<0.1	0.006	0.006	0.023	0.023	<0.001	<0.001	0.012	0.012	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.011	0.008			0.016	0.011
LTG1167B	9/10/01	0.002	<0.001	4.129	0.173	0.008	0.006	0.074	0.033	<0.001	<0.001	0.011	0.011	<0.01	<0.01	2.7	<0.3	<0.2	0.037	0.011	0.051	<0.05	0.007	<0.005	0.011	0.008			0.021	0.01
LTG1191	7/13/01	<0.001	<0.001	0.03	<0.1	<0.005	<0.005	0.021	0.021	0.068	0.068	<0.01	<0.01	0.026	0.022	<0.3	<0.3	<0.2	0.658	0.658	0.221	0.221	<0.005	<0.005			<0.002	<0.002	20.1	20.1
P190A	9/5/01	0.003	<0.001	0.497	<0.1	0.054	<0.005	0.056	0.017	0.004	<0.001	0.076	<0.01	0.054	<0.01	152	5.14	<0.2	0.112	<0.01	<0.05	<0.05	0.36	<0.005	0.018	0.009			1.57	1.13
P190B	9/5/01	<0.001	<0.001	<0.1	<0.1	0.004	<0.005	0.035	0.024	<0.001	<0.001	0.012	<0.01	<0.01	<0.01	0.869	0.457	<0.2	0.014	<0.01	<0.05	<0.05	<0.005	<0.005	0.014	0.007			1.05	0.566
P208B	7/25/01	<0.001	<0.001	74.7	74	0.021	0.013	0.023	0.018	1.61	1.3	<0.01	<0.01	0.824	0.676	<0.3	<0.3	<0.2	206	204	12.6	12.4	0.031	0.026			0.004	0.003	99.5	99.5

Table 5: Baseline Groundwater Study Total and Dissolved Metals Analytical Data (mg/L)

SITE ID	DATE	AG T	AG D	AL T	AL D	AS T	AS D	BA T	BA D	CD T	CD D	CR T	CR D	CU T	CU D	FE T	FE D	HG T	MN T	MN D	NI T	NI D	PB T	PB D	SE T	SE D	SEHY D	SEHY D D	ZN T	ZN D
P220	8/14/01		<0.001				0.019		0.041		<0.001		0.011		<0.01									<0.005				<0.002		<0.02
P225	6/14/01		<0.001				0.006		0.12		<0.001		<0.01		<0.01			<0.2						0.007				<0.002		<0.02
P228	8/28/01		<0.001				<0.005		0.011		0.037		<0.01		0.248									<0.005				<0.002		3.28
P239	6/12/01		<0.001				<0.005		<0.01		<0.001		<0.01		<0.01			<0.2						<0.005				<0.002		<0.02
P241B	8/24/01	<0.001	<0.001	1650	1600	0.022	0.022	<0.01	<0.01	0.685	0.685	<0.01	<0.01	76.3	74.7	94.4	88.9	<0.2	758	743	37.7	37.2	0.014	0.014			0.002	0.002	189	185
P241C	8/1/01	0.001	<0.001	0.07	0.065	0.005	<0.005	0.034	0.034	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			0.004	0.004	0.012	0.012
P244A	3/14/01		0.004				0.008		0.013		0.192		0.012		5.26									0.036				0.004		7.32
P244B	8/15/01	<0.001	<0.001	0.009	<0.1	0.006	0.006	0.021	0.021	<0.001	<0.001	0.017	0.017	<0.01	<0.01	<0.3	<0.3	<0.2	0.018	0.018	0.055	0.055	<0.005	<0.005			0.004	0.004	0.016	0.016
P244C	1/2/01		<0.001				0.007		0.098		<0.001		<0.01		<0.01									<0.005				0.002		<0.02
P248A	7/21/01	<0.001	<0.001	31.2	31.1	<0.005	<0.005	<0.01	<0.01	0.037	0.036	<0.01	<0.01	11.5	11.5	<0.3	<0.3	<0.2	8.06	7.58	0.519	0.504	0.015	0.014			<0.002	<0.002	4.83	4.83
P248B	7/21/01	<0.001	<0.001	2.24	1.71	<0.005	<0.005	0.015	0.01	0.059	0.059	<0.01	<0.01	3.78	3.78	<0.3	<0.3	<0.2	13.1	12.6	0.443	0.417	<0.005	<0.005			<0.002	<0.002	4.92	4.92
P248C	7/21/01	<0.001	<0.001	0.042	0.025	<0.005	<0.005	0.02	0.016	0.003	0.003	<0.01	<0.01	0.259	0.233	<0.3	<0.3	<0.2	0.16	0.134	0.04	<0.05	<0.005	<0.005			<0.002	<0.002	0.31	0.239
P272	8/16/01		<0.001				0.006		0.026		<0.001		<0.01		<0.01									<0.005				<0.002		<0.02
P279	3/12/01				1440		0.045				1.1				103			2.9		403				<0.005				0.007		128
RVG1164A	7/20/01	<0.001	<0.001	0.01	0.006	0.004	0.004	0.036	0.034	<0.001	<0.001	0.005	0.002	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.007	0.004			0.019	<0.02
RVG1164B	7/20/01	<0.001	<0.001	0.018	<0.1	0.006	0.004	0.106	0.106	<0.001	<0.001	0.013	0.005	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.013	0.008			0.017	<0.02
RVG1164C	7/24/01	<0.001	<0.001	0.011	0.007	0.008	0.007	0.088	0.088	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.005	<0.003			0.017	<0.02
SRG946	1/11/01						0.038				0.611				70.2									<0.005				<0.002		80.6
W107	8/12/99		<0.001				<0.005		0.056		<0.001		<0.01		<0.01									<0.005				<0.002		0.022
W189	3/5/01						0.007				<0.001				<0.01									<0.005				0.002		0.02
W22	7/13/01	<0.001	<0.001	0.028	0.006	<0.005	<0.005	0.058	0.054	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	0.02	<0.01	<0.05	<0.05	<0.005	<0.005	0.006	<0.003			0.023	0.007
W361	8/29/01	<0.001	<0.001	<0.1	<0.1	0.01	0.01	0.176	0.167	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.005	0.005			0.021	0.021
W363	9/11/01	<0.001	<0.001	0.287	<0.1	0.011	0.011	0.092	0.092	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	0.068	<0.01	<0.05	<0.05	<0.005	<0.005	0.006	0.005			0.04	0.015
W387	8/29/01	<0.001	<0.001	<0.1	<0.1	0.009	0.009	0.179	0.179	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.004	0.004			<0.02	<0.02
W409	9/25/01	<0.001	<0.001	0.106	0.015	<0.005	<0.005	0.109	0.109	<0.001	<0.001	0.058	0.011	0.022	<0.01	0.469	<0.3	<0.2	0.027	0.014	<0.05	<0.05	<0.005	<0.005	0.006	0.005			0.015	<0.02
W412	7/13/01	<0.001	<0.001	0.207	0.03	0.006	0.006	0.12	0.12	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	0.664	0.078	<0.05	<0.05	<0.005	<0.005	0.005	<0.003			0.04	0.012
W41A	9/19/01		<0.001				<0.005		0.027		<0.001		<0.01		<0.01									<0.005				<0.002		0.243
WJG1154A	12/7/01						0.01				<0.001				<0.01									<0.005		0.006				<0.02
WJG1154B	6/13/01						<0.005				<0.001				0.024									<0.005				0.005		0.014
WJG1154C	7/14/01	<0.001	<0.001	0.05	<0.1	0.01	0.009	0.042	0.042	<0.001	<0.001	0.011	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005			<0.002	<0.002	0.013	<0.02
WJG1169A	7/24/01	<0.001	<0.001	0.036	<0.1	0.005	0.005	0.026	0.021	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.008	0.005			0.005	<0.02
WJG1169B	8/16/01	<0.001	<0.001	0.016	<0.1	0.008	0.008	0.025	0.025	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.01	0.008			<0.02	<0.02
WJG1170A	7/14/01	<0.001	<0.001	0.014	<0.1	0.008	<0.005	0.068	0.05	<0.001	<0.001	0.007	<0.01	<0.01	<0.01	<0.3	<0.3	<0.2	<0.01	<0.01	<0.05	<0.05	<0.005	<0.005	0.004	<0.003			<0.02	<0.02
WJG1171A	7/6/01						0.007				<0.001				<0.01									<0.005				<0.002		<0.02

7.0 References

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Figure 1: September 2001 Potentiometric Surface

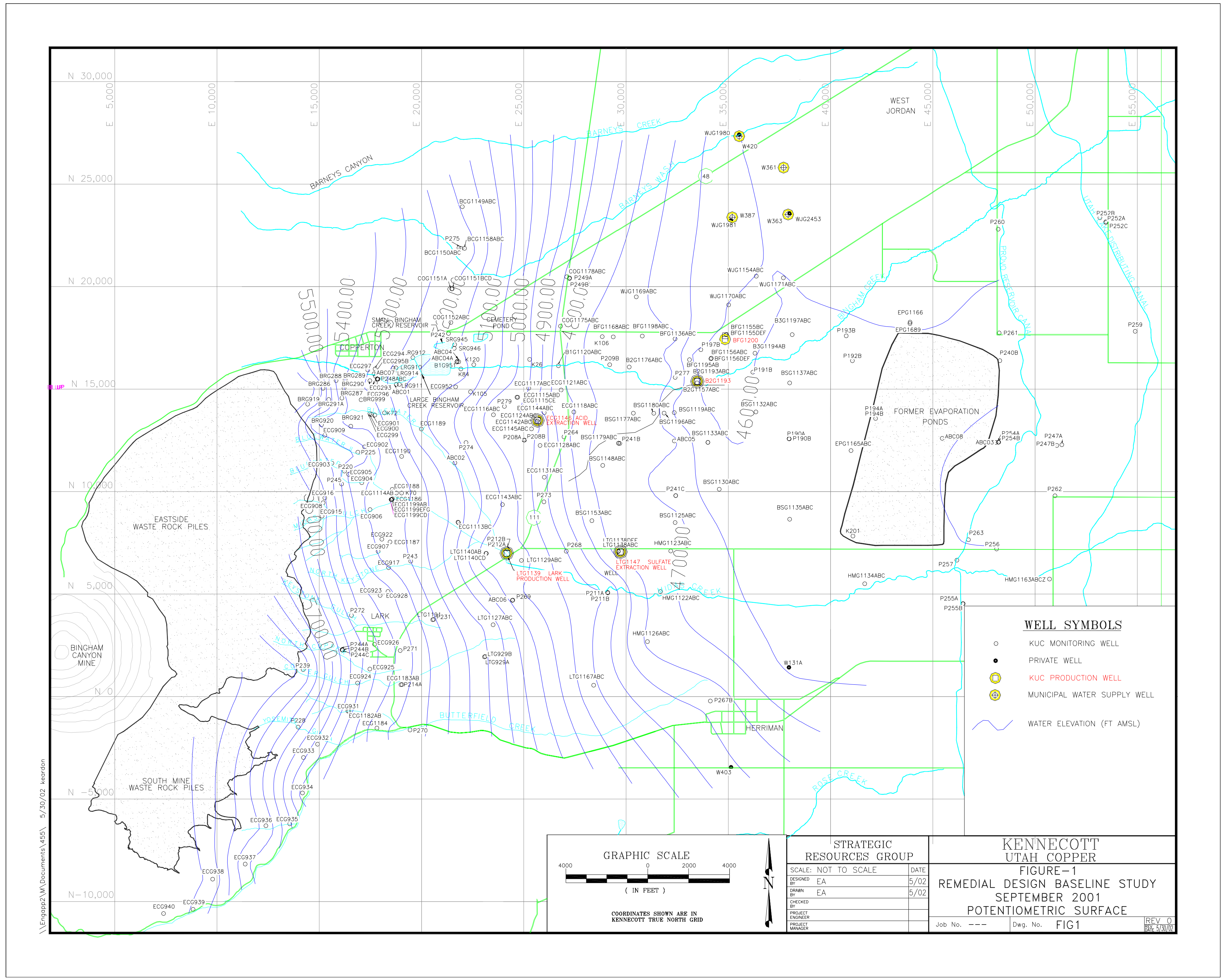

Figure 2: April 2002 Potentiometric Surface

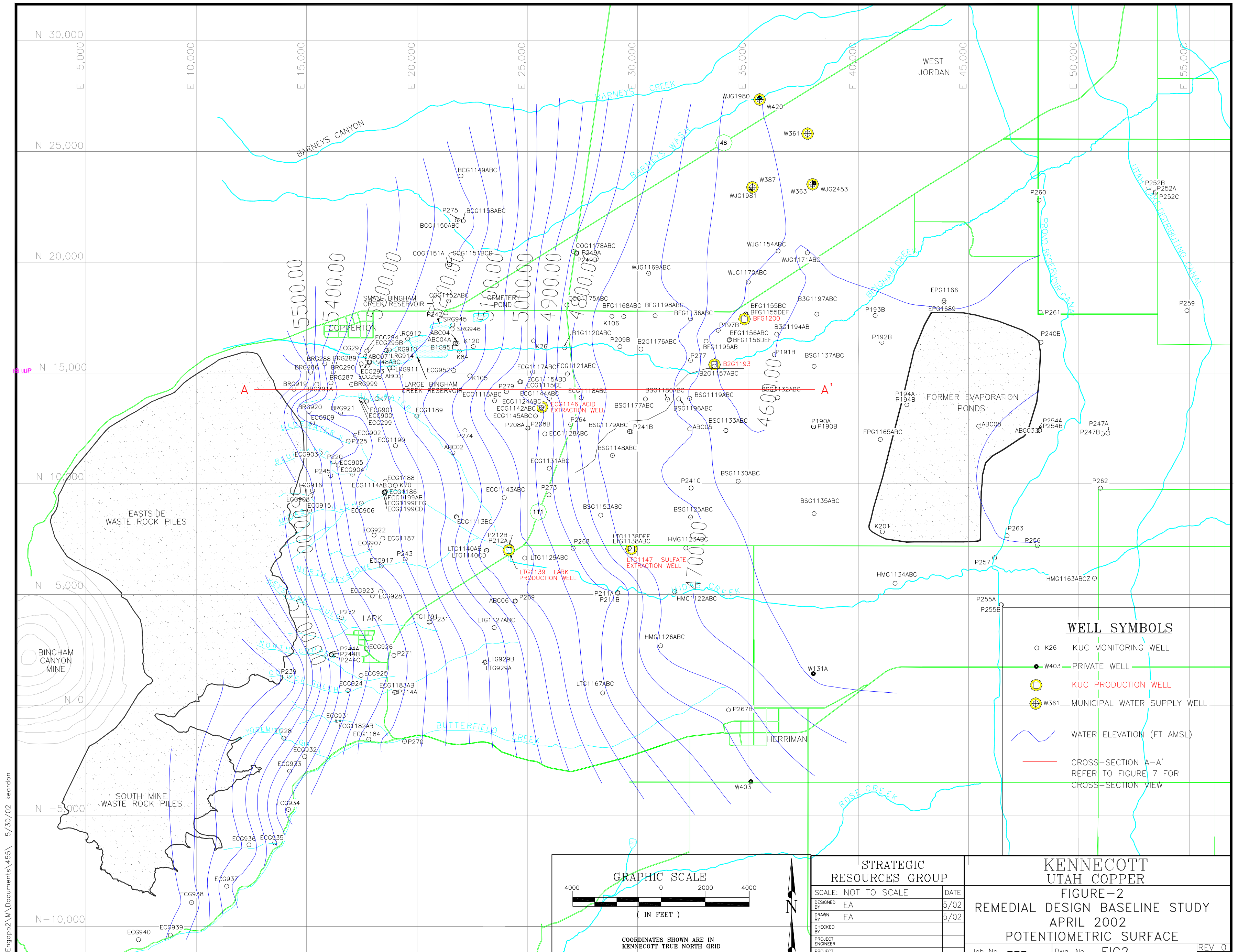

Figure 3: Potentiometric Change Map 5/01 to 4/02