

# APPENDIX E

## **BINGHAM CANYON MINE AND WATER COLLECTION SYSTEM OPERATIONAL MONITORING PLAN**

### **MONITORING REQUIREMENTS AND PLAN CONTENT**

Operational monitoring includes flow and quality sampling of meteoric and storm-water flow. Kennecott Utah Copper LLC (KUC) has an existing general, operational, and groundwater monitoring plan that is described in the Ground Water Characterization and Monitoring Plan (GCMP) Kennecott, 2011.

This Operational Monitoring Plan for the Bingham Canyon Mine/Water Collection System includes the Water Quality Sampling program.

### **WATER QUALITY MONITORING PROGRAM**

#### **Surface Water Sampling**

*Meteoric and Water Collection System* - As a part of a continuing operational monitoring program, water quality samples from all drainages associated with the water collection system will be collected two times per year. The Water Collection System concrete drainage structures will be sampled once in April or May and again in September or October. The Surface Water Sample Sites Drawing (454-T-0119) shows the locations of the 25 operational surface water sample sites.

*Tunnels and Seeps* - Additionally, quarterly flow and semiannual water quality samples will be taken for each of the flows from mine tunnels that underlie the Bingham Canyon Mine Waste Rock Piles. Surface seeps will also be sampled for semiannual flow and water quality. Refer to Appendix A for additional permit conditions related to surface seeps.

Table E-1 lists all current monitoring sites for the operational monitoring program. Table E-2 lists which of the original cut-off wall sites were replaced by which new cut-off walls.

Flow information for each surface water sample site will be provided in the annual report as part of the operational monitoring discussion.

All sampling will be performed in compliance with the protocols and standard operating practices specified in the current approved version of the GCMP and attachments. The water quality date will be provided in the annual report as part of the operational monitoring discussion.

*Bluewater Repository* - The leachate collection system sumps for the Bluewater Repository shall be examined quarterly and the volume of leachate that has flowed from the respective segments of the repository recorded. A semi-annual water quality sample will be taken of leachate flowing into each collection sump. Results from sampling along with the volume of leachate measured from each sump will be reported in the annual operational monitoring report provided to the Utah Division of

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Water Quality (UDWQ). Refer to Appendix B for additional permit conditions related to the repository.

## **MONITORING TECHNIQUES AND DATA VALIDATION**

All monitoring will be done using the methods for sampling, analyses, and quality control specified in the GCMP and attachments.

If data outliers or quality assurance/quality control problems are identified, the sample will be retested, and the wells will be re-sampled within 30 days. If the results from the retesting or re-sampling show that the data is an outlier, normal monitoring will resume.

## **REPORTING**

Kennecott will submit compliance groundwater monitoring data to the DWQ on a quarterly basis. The reports will include a summary of all monitoring data collected during the quarter. Field measurements (ground water levels, specific conductance, pH) and certificates of analysis will be provided.

Operational monitoring data for operational sites including cut-off walls, seeps, tunnels, Bluewater Repository, informational wells and extraction wells will be submitted to the DWQ in an annual report to be provided by March 31 each year. The annual report will contain results of monitoring in a tabular form with descriptive statistics such as: number of samples, mean, standard deviation, maximum and minimum values for each site. Each site will be described with time series graphs of significant parameters over the period of record for that site; with analytical data reported from the past three years through the current reporting cycle. A narrative description shall be included that describes any significant trends or observations on the data.

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Table E-1

<b>OPERATIONAL SURFACE SITES</b>	<b>NORTHING</b>	<b>EASTING</b>	<b>MONITORING FREQUENCY</b>
<i>WATER COLLECTION SYSTEM</i>			
Bingham Ck. Cut-off wall (ECP2562)	15784	16905	Semiannual water quality and quarterly volumetric flow
Bluewater 1/2 Collection Box (ECP2682)	15145	13910	Semiannual water quality and quarterly volumetric flow
Bluewater 1 Flume (MDP2679)	14467	13613	Semiannual water quality and quarterly volumetric flow
Bluewater 2 Flume (ECP2709)	12271	16656	Semiannual water quality and quarterly volumetric flow
Bluewater 3 Flume (ECP2674)	11022	16182	Semiannual water quality and quarterly volumetric flow
Midas 1 Flume (ECP2670)	9391	15692	Semiannual water quality and quarterly volumetric flow
Midas 2 Flume (ECP2668)	9189	15494	Semiannual water quality and quarterly volumetric flow
Midas Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow
South Congor Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow
Crapo Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow
South Crapo Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow
North Keystone Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow
Keystone and Lost Creek Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow

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<b>OPERATIONAL SURFACE SITES</b>	<b>NORTHING</b>	<b>EASTING</b>	<b>MONITORING FREQUENCY</b>
Lark Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow
Copper 1 Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow
Copper 2 Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow
Copper 3 Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow
Copper 4 Flume (TBD)	TBD	TBD	Semiannual water quality and quarterly volumetric flow
Yosemite Cut-off wall (ECP2616)	-1302	12460	Semiannual water quality and quarterly volumetric flow
Saints Rest Cut-off wall (ECP2614)	-2797	13156	Semiannual water quality and quarterly volumetric flow
S. Saints Rest Cut-off wall (ECP2612)	-4318	13304	Semiannual water quality and quarterly volumetric flow
Castro Flume (ECP2606)	-5637	13598	Semiannual water quality and quarterly volumetric flow
Butterfield 1 Cut-off wall (ECP2605)	-7876	9515	Semiannual water quality and quarterly volumetric flow
Olsen Cut-off wall (ECP2603)	-8670	8481	Semiannual water quality and quarterly volumetric flow
Queens Cut-off wall (ECP2601)	-9483	6350	Semiannual water quality and quarterly volumetric flow
<i>TUNNELS</i>			
Old Bingham Tunnel (ECP2664)	8990	16938	Semiannual water quality and quarterly volumetric flow
Butterfield Tunnel (UPD010)	-10026	10313	Semiannual water quality and quarterly volumetric flow
Utah Metals Tunnel (BMP2712)	-1255	-2563	Semiannual water quality and quarterly volumetric flow

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<b>OPERATIONAL SURFACE SITES</b>	<b>NORTHING</b>	<b>EASTING</b>	<b>MONITORING FREQUENCY</b>
Mascotte Tunnel (ECP2631)	3569	17231	Semiannual water quality and quarterly volumetric flow
5490 Tunnel (ECP2710)	15715	14960	Semiannual water quality and quarterly volumetric flow
Bingham Tunnel (LWP2632)	3736	17773	Semiannual water quality and quarterly volumetric flow
<i>SURFACE SEEPS</i>			
Butterfield 1 Seep (ECS2715)	-7980	10500	Semiannual water quality and semiannual volumetric flow
Upper Keystone Seep (ECS2716)	4220	15520	Semiannual water quality and semiannual volumetric flow
Lower Keystone Seep (LWS2717)	3700	18600	Semiannual water quality and semiannual volumetric flow
Crapo Seep (ECS2718)	6930	16130	Semiannual water quality and semiannual volumetric flow
Upper Queen Seep (ECS2786)	-7263	5097	Semiannual water quality and semiannual volumetric flow
<i>REPOSITORY</i>			
Bluewater 1 North Sump (BRP292)	14146	16561	Semiannual water quality and quarterly volumetric flow
Bluewater 1 Main Sump (BRP1476)	13770	15740	Semiannual water quality and quarterly volumetric flow

*Note: Coordinate system in KUC True North, See Permit Table 5 for Lat/Long Coordinates*

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Table E-2  
Original and New Cut-off Walls

Original Cut-off Wall (historic)	New Cut-off Wall (relocated)
Copper	Copper 4
	Copper 3
	Copper 2
	Copper 1
North Copper	Lark
Lost Creek	Lost Creek
Keystone	Keystone
North Keystone	North Keystone
	South Crapo
Crapo	Crapo
South Congor 2	South Congor
Congor 1	Midas
Congor 2	