This form has been developed to document changes to the NorthMet Project and/or Project SDEIS Water Modeling resulting from the water modeling process. The forms will be used during the water modeling process. At the end of the process, the Project Description, Data Packages and Management Plans will all be updated to reflect the content of all forms submitted during the process.

Change Type:

Model Refinement

Rationale for Change:

Because the project now includes pumping of water from Colby Lake directly to watersheds and tributaries downstream of the Flotation Tailings Basin (FTB) to offset hydrologic impacts, the MPCA and MDNR requested that probabilistic (rather than deterministic) inputs of Colby Lake water quality be used. This CDF presents probabilistic model inputs of Colby Lake water quality for constituents with sufficient data to develop distributions.

Description:

This proposed change acknowledges the temporal variability of constituent concentrations in Colby Lake and seeks to incorporate that variability in the Plant Site probabilistic water quality model. For many model constituents, monitoring data is too limited to develop a distribution representing temporal variability (see Attachment A). The model input for those constituents will remain deterministic. The following constituents were measured 19 times from samples collected on 7 dates in 2008 and 2010, allowing for the development of a probabilistic distribution:

- Aluminum
- Arsenic
- Calcium
- Iron
- Magnesium
- Manganese
- Sulfate
- Thallium

Measured concentrations taken at different locations within Colby Lake on the same date were averaged to create a daily average concentration. At locations with duplicate samples, measured concentrations were averaged for that location prior to averaging according to date (i.e., each location is equally weighted in the daily average). This procedure resulted in 7 data points for each of the above constituents. A log-normal distribution was developed for each constituent, using the mean and standard deviation of the ln-transformed data points as the defining parameters for each distribution.

The use of log-normal distributions is consistent with the distribution shape used to represent natural runoff water quality and mean background groundwater quality. The two parameters defining each log-normal distribution and the resulting median concentrations are presented in Table 1, along with deterministic average previously used as model inputs. Figure 1 through Figure 8 present cumulative probability plots of the resulting log-normal distributions.

Table 1 Distribution parameters to represent daily water quality in Colby Lake

Constituent	Probabilistic Distribution			Deterministic
	Log-normal True Mean (mg/L)	Log-normal True Standard Deviation (mg/L)	Log-normal Median (mg/L)	Average * (mg/L)
Aluminum	0.086	0.044	0.077	0.078
Arsenic	0.00077	0.00038	0.00069	0.00075
Calcium	21.8	6.7	20.8	19.8
Iron	0.86	0.29	0.82	0.86
Magnesium	9.0	1.8	8.8	8.5
Manganese	0.073	0.046	0.062	0.066
Sulfate	38.1	14.7	35.5	33.8
Thallium	0.000059	0.000064	0.000040	0.0001

* based on Table 1-44 of Plant Site Work Plan Version 8 (October, 2012)

The aluminum distribution shown in Figure 1 underestimates the highest observed data point in the Colby Lake data set (208 ug/L observed on 11/19/2008). This data point was assigned equal weight to the other 6 data points in developing the log-normal distribution. For comparison, the median of the distribution in Figure 1 (~75 ug/L) is similar to the median of observed concentrations in the Partridge River, the primary source of water to Colby Lake (and a much larger dataset). The 87th percentile of observed total aluminum concentrations in the Partridge River is ~130 ug/L, which is less than the 208 ug/L data point from 11/19/2008 (the 87th percentile of the Colby Lake data set) and nearly identical to the 87th percentile of the fitted Colby Lake distribution. The poor fit between the highest data point and the fitted distribution is likely a result of the small data set used.

The thallium distribution shown in Figure 8 provides a poor fit to the highest data point (0.25 ug/L observed on 11/19/2008). This data point was assigned equal weight to the other 6 data points in developing the log-normal distribution. It should be noted that the 0.25 ug/L is an average of a single detection of 0.46 ug/L and four non-detections with a detection limit of 0.4 ug/L, which are included at half the detection limit when computing the daily average concentration. The detection limit was lowered for subsequent monitoring, during which a maximum value of 0.066 ug/L was observed. For comparison, the maximum observed concentration in the Partridge River downstream of the Peter Mitchell Pit discharge is 0.028 ug/L. The poor fit between the highest data point and the fitted distribution is likely a result of using a small data set that may include an outlier in the 11/19/2008 observation.

The concentration of the above constituents in Colby Lake water will be sampled from the associated probabilistic distribution at each monthly model time step, representing temporal variability (versus uncertainty in the long-term average).

The proposed change in this CDF only applies to the Proposed Project Model, as there is no Colby Lake water appropriation in the No Action Model.

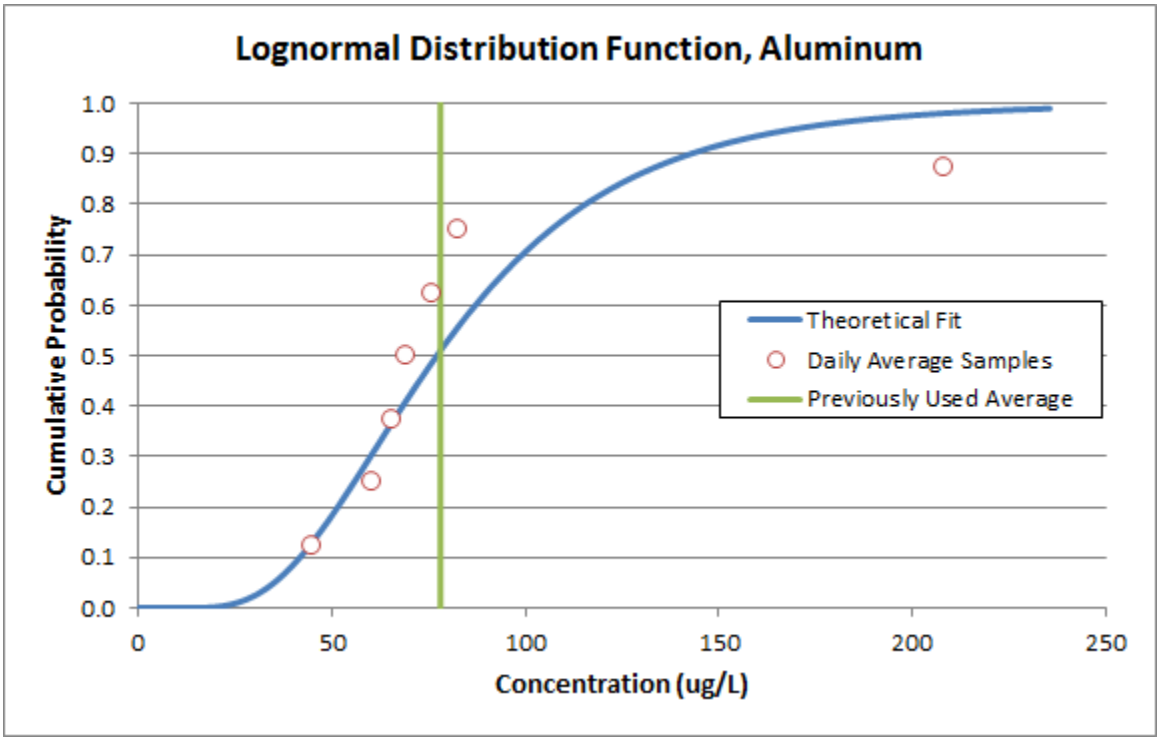

Figure 1 Cumulative Probability Distribution of Aluminum in Colby Lake Water

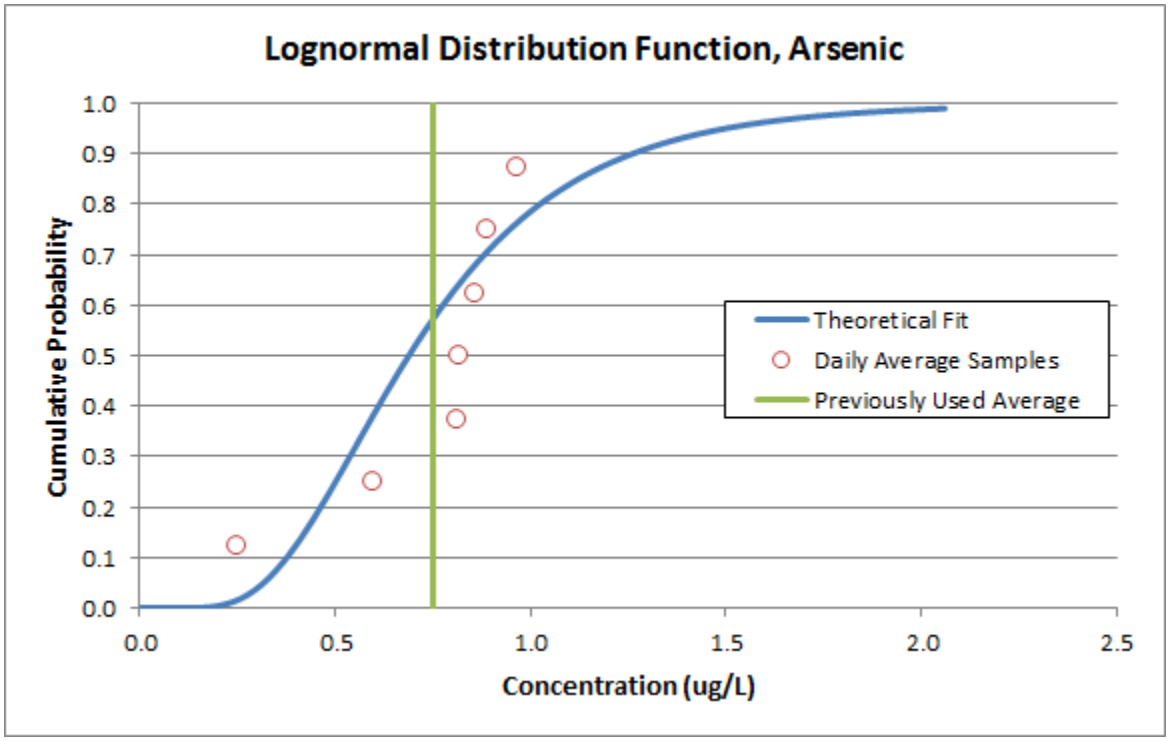

Figure 2 **Cumulative Probability Distribution of Arsenic in Colby Lake Water**

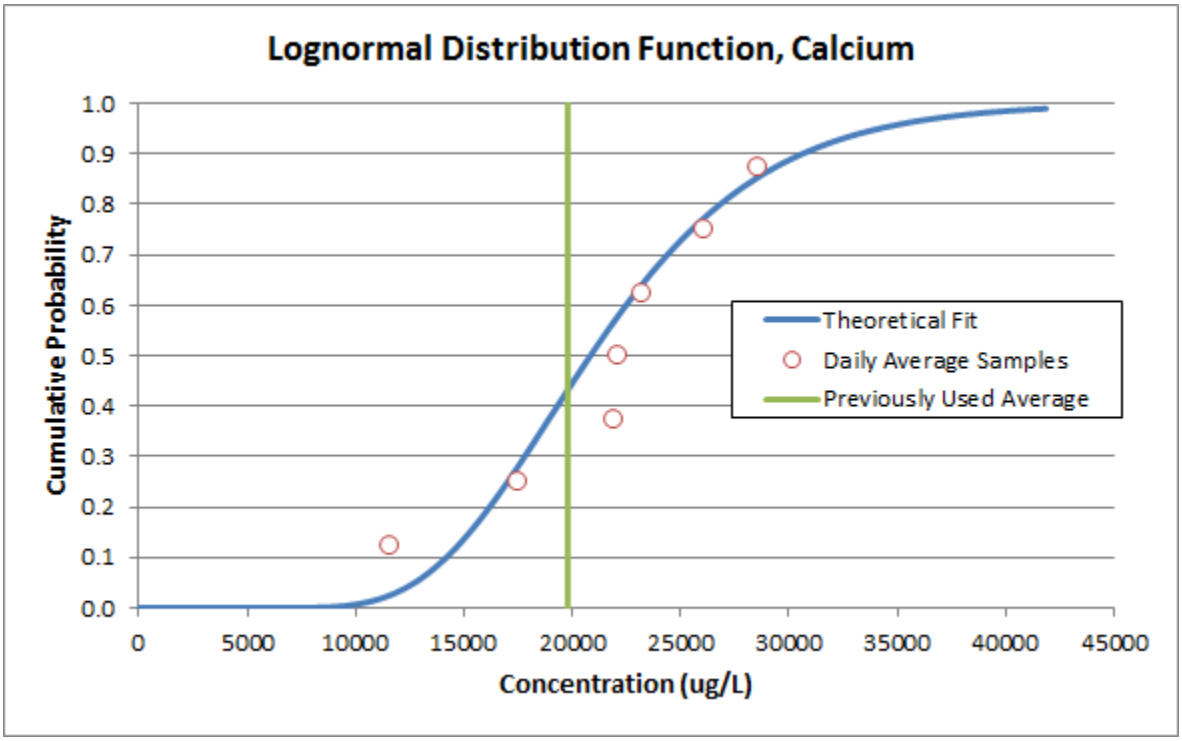

Figure 3 **Cumulative Probability Distribution of Calcium in Colby Lake Water**

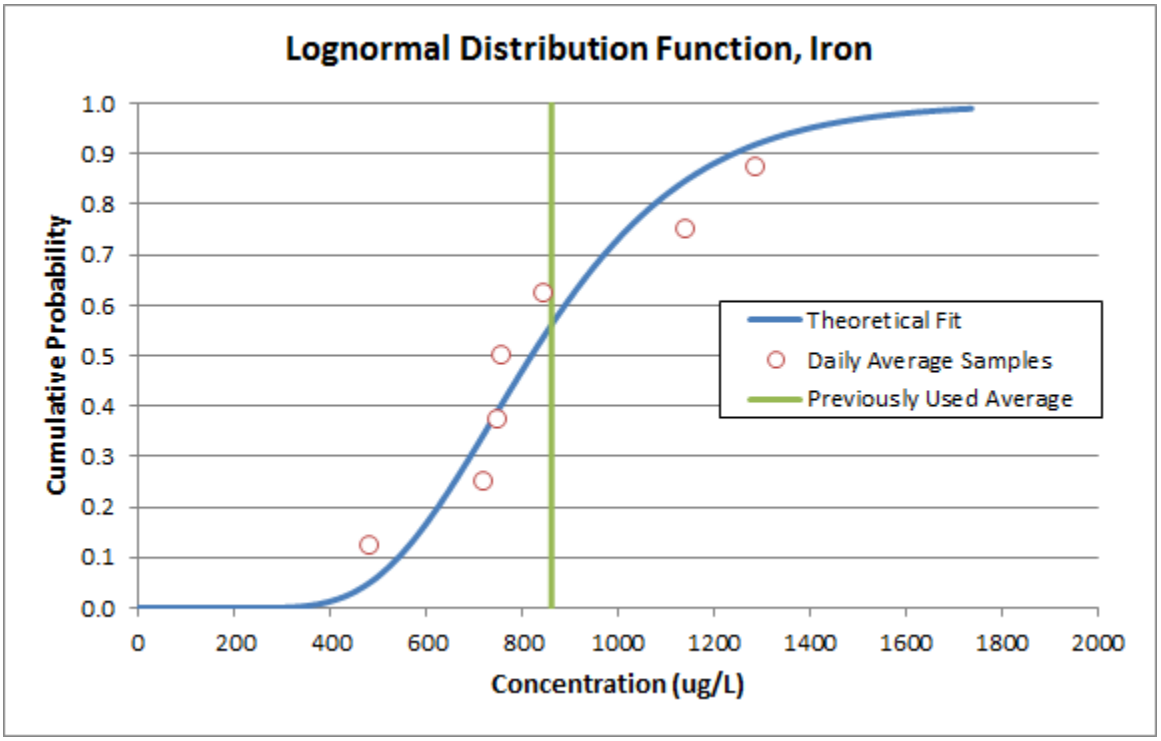

Figure 4 **Cumulative Probability Distribution of Iron in Colby Lake Water**

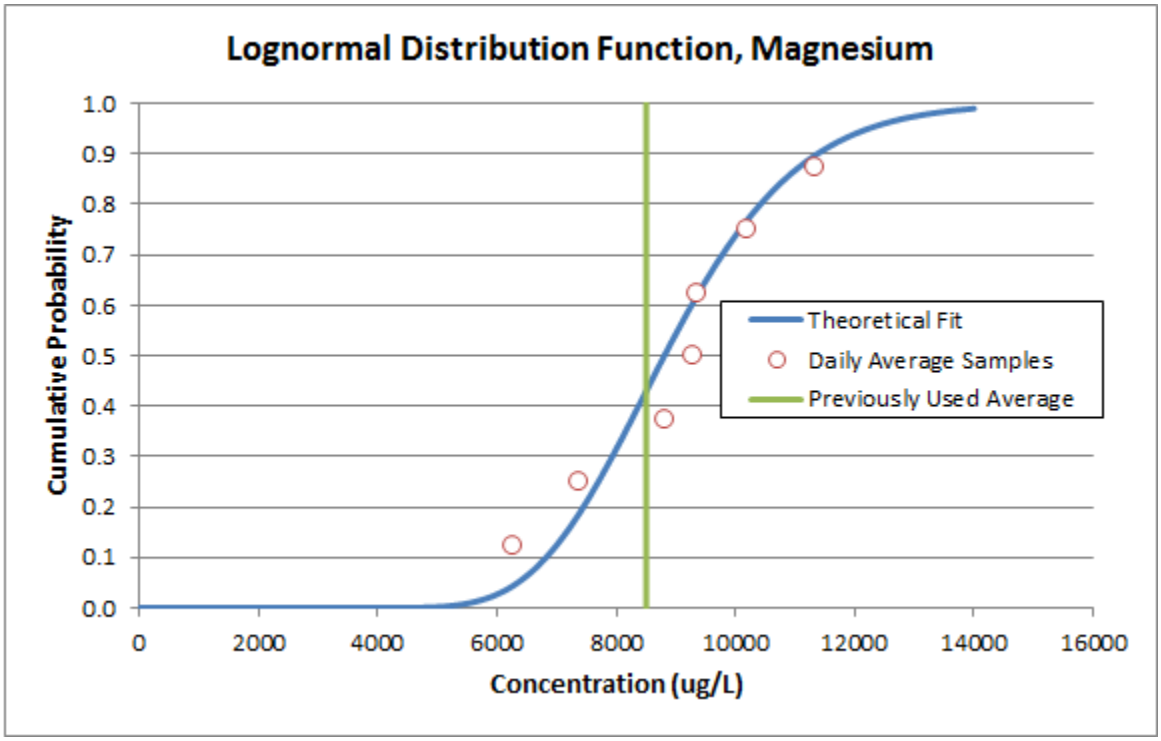

Figure 5 **Cumulative Probability Distribution of Magnesium in Colby Lake Water**

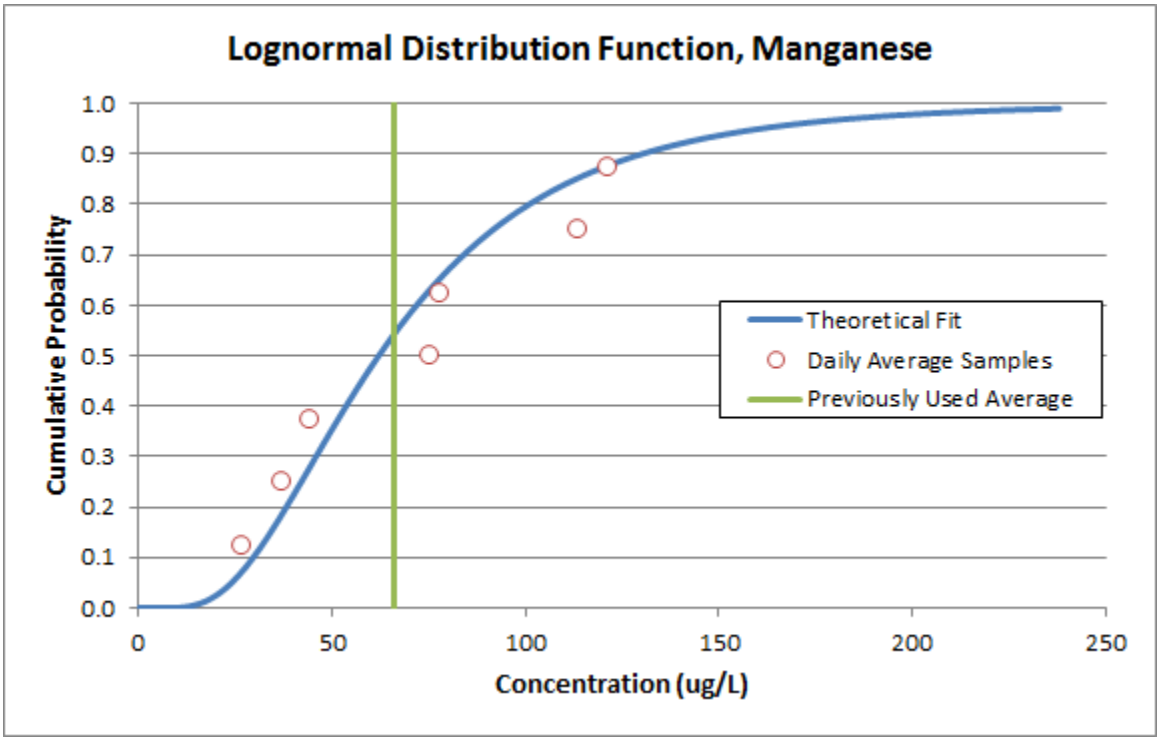

Figure 6 **Cumulative Probability Distribution of Manganese in Colby Lake Water**

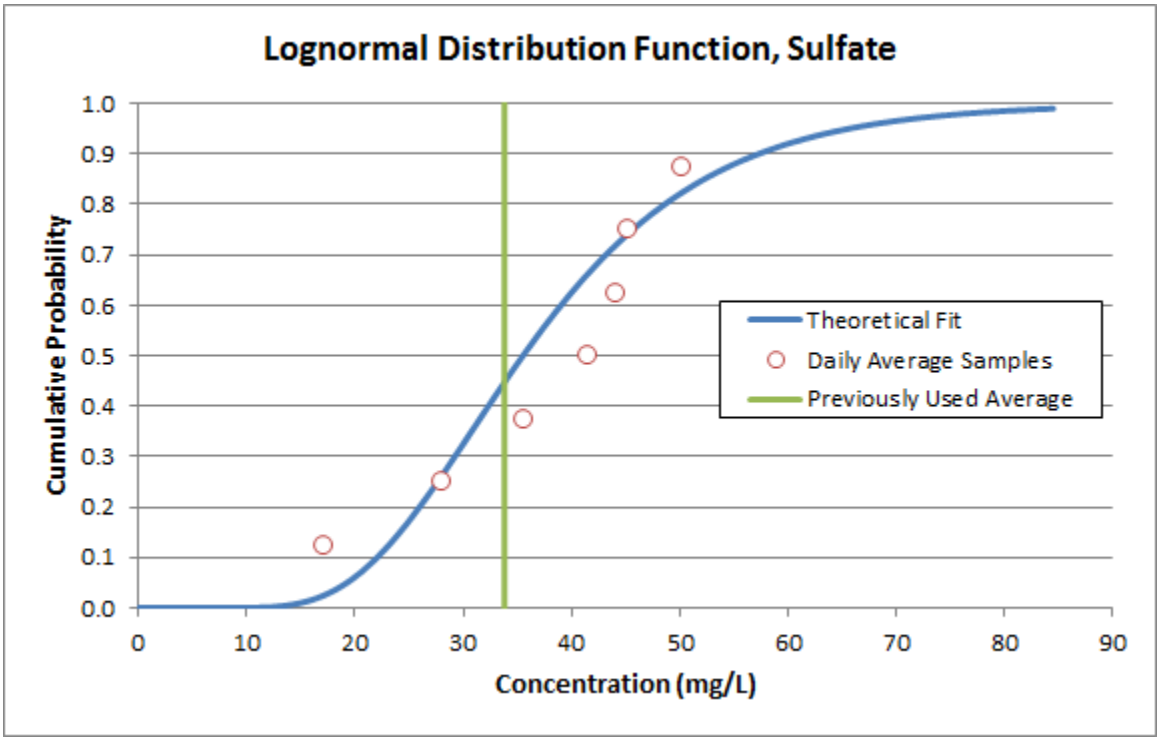

Figure 7 **Cumulative Probability Distribution of Sulfate in Colby Lake Water**

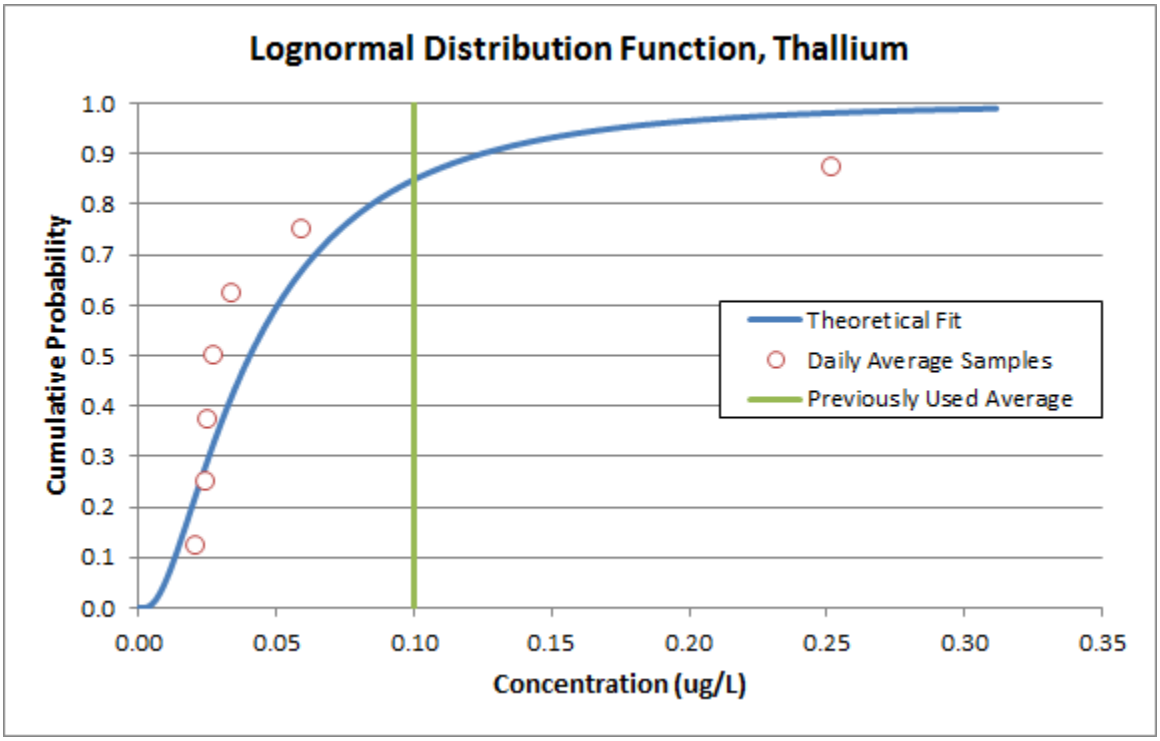

Figure 8 Cumulative Probability Distribution of Thallium in Colby Lake Water

Advantages of this change:

1. Probabilistic inputs of Colby Lake water quality provide a more accurate representation of observed data (i.e., variability).

Disadvantages of this change:

1. None

Other Potential Impacts:

No change in direct wetland impacts is expected.

No change in geotechnical impacts is expected.

No change in air emissions impacts is expected.

No change in project footprint is expected.

Attachments:

Large Table 4 of the Water Modeling Data Package, Volume 1 – Mine Site, Version 10

Table 1-1 of the Plant Site Water Modeling Work Plan – Version 8

Table 1-44 of the Plant Site Water Modeling Work Plan – Version 8

References:

NorthMet Plant Site Water Modeling Work Plan – Version 7 (July 2012)

Project Description Changes:

None

Data Package Changes:

Section 5.3.4 of the Water Modeling Data Package, Volume 2 – Plant Site, Version 7

5.3.4 Colby Lake Quality

Colby Lake is a water body downstream of the Mine Site and the quality of this water body may be affected by Project impacts to the Partridge River. However, mining features at the Mine Site will not have any surface water discharges during operations. Additionally, long travel times in groundwater flow will prevent any seepage from mining features from arriving at the Partridge River during operations. Therefore, because the Plant Site will only be drawing water from Colby Lake during operations and reclamation to meet Beneficiation Plant and Hydrometallurgical Plant demand and stream augmentation demand until long-term closure, the quality of Colby Lake will be ~~considered a constant deterministic value~~ derived from recently collected field data.

Colby Lake water quality will be considered a probabilistic input (sampled at each model time step) for the following constituents: aluminum, arsenic, calcium, iron, magnesium, manganese, sulfate, and thallium. Concentrations of these constituents will be sampled log-normal distributions developed from average daily concentrations observed from 2008 to 2010 (i.e., data collected from multiple lake locations on the same date are averaged to a single data point prior to developing the distribution). Colby Lake water quality for the remaining modeled constituents is considered a constant deterministic equivalent to the average collected data (see Large Table 4 of the Water Modeling Data Package – Volume 1 Mine Site, version X). ~~Table 1-44 of the Plant Site Modeling Work Plan shows the assumed constituent concentrations of Colby Lake.~~

The flow of water from Colby Lake to the FTB will not be a direct input to the model because it will be calculated as the flow necessary to meet the Plant and stream augmentation demands. The calculated flow rate from Colby Lake and the ~~deterministic~~ water quality of Colby Lake will be used together to calculate the loading to the overall system from this model component.

In the GoldSim model, this flow stream will be a direct input into the Beneficiation Plant and the Hydrometallurgical Plant and to each of the four tributaries downstream of the FTB.

Work Plan Changes:

Table 1-1 of the Plant Site Water Modeling Work Plan – Version 8 (see attached)

Table 1-44 of the Plant Site Water Modeling Work Plan – Version 8 (see attached)

Management Plan Changes:

None

Attachments

Attachment A

Large Table 4 (Water Modeling Data Package, Volume 1 – Mine Site, Version 10)

Large Table 4

Surface Water Data Summary
Colby Lake and Whitewater Reservoir

		Sys Loc Code	LC-1	LC-2	LC-3	LC-4	LC-5	Lcy-1	Lcy-1	Lcy-1	Lcy-1	Lcy-1	Lcy-1	Lcy-2		Lcy-2
		Sample Date	11/19/2008	11/19/2008	11/19/2008	11/19/2008	11/19/2008	4/21/2010	5/12/2010	6/16/2010	7/27/2010	8/23/2010	9/20/2010	4/21/2010		5/12/2010
		Sample Type Code	N	N	N	N	N	N	N	N	N	N	N	N	FD	N
Chemical Name	Total or Dissolved	Analysis Location														
General Parameters																
Alkalinity, bicarbonate as CaCO3	NA	Lab	**25.7 mg/l**	**25.0 mg/l**	**33.2 mg/l**	**29.4 mg/l**	**25.7 mg/l**	--	--	--	--	--	--	--	--	--
Alkalinity, total	NA	Lab	**33.2 mg/l**	**25.0 mg/l**	**28.9 mg/l**	**29.4 mg/l**	**25.7 mg/l**	--	--	--	--	--	--	--	--	--
Carbon, total organic	NA	Lab	**29.1 mg/l**	**30.6 mg/l**	**31.1 mg/l**	**27.3 mg/l**	**29.4 mg/l**	--	--	--	--	--	--	--	--	--
Chemical Oxygen Demand	NA	Lab	**79.6 mg/l**	**86.6 mg/l**	**87.6 mg/l**	**80.2 mg/l**	**81.5 mg/l**	--	--	--	--	--	--	--	--	--
Chloride	NA	Lab	**2.28 mg/l**	**1.98 mg/l**	**2.17 mg/l**	**2.25 mg/l**	**2.18 mg/l**	--	--	--	--	--	--	--	--	--
Dissolved oxygen	NA	Field	--	--	--	--	--	**10.0 mg/l**	**9.45 mg/l**	**8.11 mg/l**	**7.96 mg/l**	**6.65 mg/l**	**7.94 mg/l**	**9.95 mg/l**	--	**9.63 mg/l**
Fluoride	NA	Lab	**0.1 mg/l**	< 0.1 mg/l	**0.1 mg/l**	**0.14 mg/l**	< 0.1 mg/l	--	--	--	--	--	--	--	--	--
Hardness, total as CaCO3	NA	Lab	**61.7 mg/l**	**44.4 mg/l**	**54.6 mg/l**	**68.5 mg/l**	**45 mg/l**	**109 mg/l**	**101 mg/l**	**81.6 mg/l**	**93 mg/l**	**108 mg/l**	**119 mg/l**	**83.4 mg/l**	**84.2 mg/l**	**85.1 mg/l**
Nitrate + Nitrite	NA	Lab	**0.17 mg/l**	**0.37 mg/l**	**0.25 mg/l**	**0.19 mg/l**	**0.48 mg/l**	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia as N	NA	Lab	< 0.1 mg/l	**0.33 mg/l**	< 0.1 mg/l	< 0.1 mg/l	**0.1 mg/l**	--	--	--	--	--	--	--	--	--
pH	NA	Field	--	--	--	--	--	**7.68 pH units**	**7.96 pH units**	**7.83 pH units**	**7.78 pH units**	**7.81 pH units**	**7.96 pH units**	**7.29 pH units**	--	**7.70 pH units**
Phosphorus, total	NA	Lab	**0.013 mg/l**	**0.012 mg/l**	**0.012 mg/l**	**0.014 mg/l**	**0.01 mg/l**	--	--	--	--	--	--	--	--	--
Solids, total dissolved	NA	Lab	**119 mg/l**	**108 mg/l**	**116 mg/l**	**128 mg/l**	**104 mg/l**	--	--	--	--	--	--	--	--	--
Solids, total suspended	NA	Lab	**1.2 mg/l**	**1.6 mg/l**	**1.2 mg/l**	**10.4 mg/l**	< 1 mg/l	--	--	--	--	--	--	--	--	--
Specific Conductance	NA	Field	--	--	--	--	--	**246.9 umhos/cm**	**226.6 umhos/cm**	**189 umhos/cm**	**191 umhos/cm**	**248.5 umhos/cm**	**273.5 umhos/cm**	**189.6 umhos/cm**	--	**187.6 umhos/cm**
Sulfate	NA	Lab	**18.7 mg/l**	**10.1 mg/l**	**14.4 mg/l**	**31.7 mg/l**	**10.8 mg/l**	**60.7 mg/l**	**54 mg/l**	**36 mg/l**	**37.9 mg/l**	**44.1 mg/l**	**46.4 mg/l**	**39.5 mg/l**	**39.8 mg/l**	**36.5 mg/l**
Temperature	NA	Field	--	--	--	--	--	**14.02 deg C**	**12.20 deg C**	**17.38 deg C**	**25.70 deg C**	**24.10 deg C**	**15.29 deg C**	**11.95 deg C**	--	**10.67 deg C**
Turbidity	NA	Field	--	--	--	--	--	**0 NTU**	**0.2 NTU**	**0.1 NTU**	**0 NTU**	**0 NTU**	**0 NTU**	**0 NTU**	--	**0 NTU**
Metals																
Aluminum	Dissolved	Lab	**135 ug/l**	**171 ug/l**	**160 ug/l**	**154 ug/l**	**166 ug/l**	**58.1 ug/l**	**46.2 ug/l**	**56.6 ug/l**	**58.8 ug/l**	**43.8 ug/l**	< 25 ug/l	**46.4 ug/l**	**46.3 ug/l**	**42.2 ug/l**
Aluminum	Total	Lab	**179 ug/l**	**243 ug/l**	**203 ug/l**	**214 ug/l**	**202 ug/l**	**71.9 ug/l**	**69.3 ug/l**	**68.9 ug/l**	**87 ug/l**	**62.9 ug/l**	**46.7 ug/l**	**57.4 ug/l**	**61 ug/l**	**69 ug/l**
Antimony	Total	Lab	< 0.5 ug/l	< 0.5 ug/l	< 0.5 ug/l	< 0.5 ug/l	< 0.5 ug/l	--	--	--	--	--	--	--	--	--
Arsenic	Total	Lab	**0.89 j ug/l**	**0.81 j ug/l**	**0.74 j ug/l**	**0.81 j ug/l**	**0.83 j ug/l**	**0.63 ug/l**	< 0.5 ug/l	**0.78 ug/l**	**1.1 ug/l**	**0.95 ug/l**	**0.88 ug/l**	**0.53 ug/l**	**0.59 ug/l**	< 0.5 ug/l
Barium	Total	Lab	**7.4 ug/l**	**6.9 ug/l**	**7.0 ug/l**	**7.6 ug/l**	**5.7 ug/l**	--	--	--	--	--	--	--	--	--
Beryllium	Total	Lab	< 0.2 ug/l	< 0.2 ug/l	< 0.2 ug/l	< 0.2 ug/l	< 0.2 ug/l	--	--	--	--	--	--	--	--	--
Boron	Total	Lab	**61.1 ug/l**	< 50 ug/l	< 50 ug/l	**72.1 ug/l**	< 50 ug/l	--	--	--	--	--	--	--	--	--
Cadmium	Total	Lab	< 0.2 ug/l	< 0.2 ug/l	< 0.2 ug/l	< 0.2 ug/l	< 0.2 ug/l	--	--	--	--	--	--	--	--	--
Calcium	Total	Lab	**13200 ug/l**	**8950 ug/l**	**11400 ug/l**	**15400 ug/l**	**9100 ug/l**	**26700 ug/l**	**24300 ug/l**	**19700 ug/l**	**22700 ug/l**	**26600 ug/l**	**29100 ug/l**	**19600 ug/l**	**19800 ug/l**	**19600 ug/l**
Chromium	Total	Lab	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	--	--	--	--	--	--	--	--	--
Cobalt	Dissolved	Lab	< 0.2 ug/l	< 0.2 ug/l	< 0.2 ug/l	**0.4 ug/l**	< 0.2 ug/l	--	--	--	--	--	--	--	--	--
Cobalt	Total	Lab	**0.22 ug/l**	**0.27 ug/l**	**0.21 ug/l**	**0.42 ug/l**	< 0.2 ug/l	--	--	--	--	--	--	--	--	--
Copper	Dissolved	Lab	**2.7 b ug/l**	**1.8 b ug/l**	**2.9 b ug/l**	**4.1 b ug/l**	**2.0 b ug/l**	--	--	--	--	--	--	--	--	--
Copper	Total	Lab	**2.6 ug/l**	**1.8 ug/l**	**2.3 ug/l**	**3.5 ug/l**	**1.6 ug/l**	--	--	--	--	--	--	--	--	--
Iron	Dissolved	Lab	**858 ug/l**	**872 ug/l**	**889 ug/l**	**813 ug/l**	**852 ug/l**	--	--	--	--	--	--	--	--	--
Iron	Total	Lab	**1140 ug/l**	**1250 ug/l**	**1160 ug/l**	**1110 ug/l**	**1050 ug/l**	**733 ug/l**	**678 ug/l**	**715 ug/l**	**1240 ug/l**	**730 ug/l**	**451 ug/l**	**772 ug/l**	**792 ug/l**	**765 ug/l**
Lead	Total	Lab	< 0.5 ug/l	< 0.5 ug/l	< 0.5 ug/l	< 0.5 ug/l	< 0.5 ug/l	--	--	--	--	--	--	--	--	--
Magnesium	Total	Lab	**6970 ug/l**	**5360 ug/l**	**6350 ug/l**	**7290 ug/l**	**5420 ug/l**	**10200 ug/l**	**9900 ug/l**	**7870 ug/l**	**8830 ug/l**	**10100 ug/l**	**11300 ug/l**	**8370 ug/l**	**8440 ug/l**	**8780 ug/l**
Manganese	Total	Lab	**45.6 ug/l**	**64.4 ug/l**	**38.9 ug/l**	**43.7 ug/l**	**28.2 ug/l**	**25.2 ug/l**	**34.5 ug/l**	**68.1 ug/l**	**76.2 ug/l**	**125 ug/l**	**125 ug/l**	**28.6 ug/l**	**27.5 ug/l**	**39.5 ug/l**
Mercury	Total	Lab	**0.0048 ug/l**	**0.0060 ug/l**	**0.0054 ug/l**	**0.0054 ug/l**	**0.0052 ug/l**	--	--	--	--	--	--	--	--	--
Mercury methyl	Total	Lab	**0.00049 ug/l**	**0.00047 ug/l**	**0.00046 ug/l**	< 0.00045 ug/l	**0.00042 ug/l**	--	--	--	--	--	--	--	--	--
Molybdenum	Total	Lab	**0.47 ug/l**	**0.3 ug/l**	**0.3 ug/l**	**0.39 ug/l**	**0.29 ug/l**	--	--	--	--	--	--	--	--	--
Nickel	Dissolved	Lab	**2.1 ug/l**	**1.8 ug/l**	**1.9 ug/l**	**2.9 ug/l**	**1.7 ug/l**	--	--	--	--	--	--	--	--	--
Nickel	Total	Lab	**2.6 ug/l**	**2.3 ug/l**	**2.3 ug/l**	**3.1 ug/l**	**2.0 ug/l**	--	--	--	--	--	--	--	--	--
Potassium	Total	Lab	**1040 ug/l**	**840 ug/l**	**970 ug/l**	**1000 ug/l**	**850 ug/l**	--	--	--	--	--	--	--	--	--
Selenium	Total	Lab	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	--	--	--	--	--	--	--	--	--
Silver	Total	Lab	< 0.2 ug/l	< 0.2 ug/l	< 0.2 ug/l	< 0.2 ug/l	< 0.2 ug/l	--	--	--	--	--	--	--	--	--
Sodium	Total	Lab	**3420 ug/l**	**2900 ug/l**	**3290 ug/l**	**3480 ug/l**	**3140 ug/l**	--	--	--	--	--	--	--	--	--
Strontium	Total	Lab	**90.3 ug/l**	**40 ug/l**	**65.9 ug/l**	**128 ug/l**	**40.6 ug/l**	--	--	--	--	--	--	--	--	--
Thallium	Total	Lab	**0.46 ug/l**	< 0.4 ug/l	< 0.4 ug/l	< 0.4 ug/l	< 0.4 ug/l	**0.031 ug/l**	**0.045 ug/l**	**0.039 ug/l**	**0.032 ug/l**	**0.066 b ug/l**	**0.024 ug/l**	< 0.02 ug/l	< 0.02 ug/l	< 0.02 ug/l
Titanium	Total	Lab	< 10 ug/l	< 10 ug/l	< 10 ug/l	< 10 ug/l	< 10 ug/l	--	--	--	--	--	--	--	--	--
Vanadium	Total	Lab	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	--	--	--	--	--	--	--	--	--
Zinc	Dissolved	Lab	< 6 ug/l	< 6 ug/l	< 6 ug/l	< 6 ug/l	< 6 ug/l	--	--	--	--	--	--	--	--	--
Zinc	Total	Lab	< 6 ug/l	< 6 ug/l	< 6 ug/l	< 6 ug/l	< 6 ug/l	--	--	--	--	--	--	--	--	--

Large Table 4

Surface Water Data Summary
Colby Lake and Whitewater Reservoir

		Sys Loc Code	Lcy-2	Lcy-2		Lcy-2	Lcy-2	LWr-1	LWr-1		LWr-1		LWr-1	LWr-1		LWr-1
		Sample Date	6/16/2010	7/27/2010		8/23/2010	9/20/2010	4/21/2010	5/12/2010		6/16/2010		7/27/2010	8/23/2010		9/20/201
		Sample Type Code	N	N	FD	N	N	N	N	FD	N	FD	N	N	FD	N
Chemical Name	Total or Dissolved	Analysis Location														
General Parameters																
Alkalinity, bicarbonate as CaCO3	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Alkalinity, total	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon, total organic	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chemical Oxygen Demand	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloride	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved oxygen	NA	Field	**8.31 mg/l**	**6.11 mg/l**	--	**6.81 mg/l**	**6.91 mg/l**	**11.13 mg/l**	**9.80 mg/l**	--	**8.41 mg/l**	--	**7.08 mg/l**	**7.17 mg/l**	--	**7.65 mg/l**
Fluoride	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hardness, total as CaCO3	NA	Lab	**66.4 mg/l**	**89.5 mg/l**	**90 mg/l**	**106 mg/l**	**117 mg/l**	**85.7 mg/l**	**89 mg/l**	**91.6 mg/l**	**89.6 mg/l**	**90.2 mg/l**	**90.8 mg/l**	**91.7 mg/l**	**92 mg/l**	**92.3 mg/l**
Nitrate + Nitrite	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia as N	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH	NA	Field	**7.69 pH units**	**7.59 pH units**	--	**7.81 pH units**	**7.79 pH units**	**7.40 pH units**	**7.95 pH units**	--	**7.80 pH units**	--	**8.33 pH units**	**8.02 pH units**	--	**8.18 pH units**
Phosphorus, total	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solids, total dissolved	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solids, total suspended	NA	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific Conductance	NA	Field	**165 umhos/cm**	**201.9 umhos/cm**	--	**246.4 umhos/cm**	**248.5 umhos/cm**	**206.6 umhos/cm**	**208.7 umhos/cm**	--	**181 umhos/cm**	--	**218.7 umhos/cm**	**220.2 umhos/cm**	--	**217.7 umhos/cm**
Sulfate	NA	Lab	**20.2 mg/l**	**33.2 mg/l**	**33.3 mg/l**	**38.9 mg/l**	**41.7 mg/l**	**35.1 mg/l**	**34 mg/l**	**34 mg/l**	**35.3 mg/l**	**35.2 mg/l**	**34.8 mg/l**	**33.8 mg/l**	**33.6 mg/l**	**33.7 mg/l**
Temperature	NA	Field	**16.01 deg C**	**25.08 deg C**	--	**22.85 deg C**	**14.89 deg C**	**9.54 deg C**	**10.16 deg C**	--	**17.18 deg C**	--	**23.89 deg C**	**21.84 deg C**	--	**14.64 deg C**
Turbidity	NA	Field	**0 NTU**	**0 NTU**	--	**0.2 NTU**	**0 NTU**	**0 NTU**	**0.1 NTU**	--	**0 NTU**	--	**0 NTU**	**0 NTU**	--	**0 NTU**
Metals																
Aluminum	Dissolved	Lab	**71.2 ug/l**	**54.1 ug/l**	**55.1 ug/l**	**38.6 ug/l**	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l
Aluminum	Total	Lab	**83.3 ug/l**	**77.8 ug/l**	**79.5 ug/l**	**58 ug/l**	**42.8 ug/l**	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l
Antimony	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	Total	Lab	**0.94 ug/l**	**1.0 ug/l**	< 0.1 ug/l	**0.98 ug/l**	**0.90 ug/l**	< 0.5 ug/l	< 0.5 ug/l	< 0.5 ug/l	**0.53 ug/l**	**0.52 ug/l**	**0.6 ug/l**	**0.59 ug/l**	**0.56 ug/l**	**0.58 ug/l**
Barium	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Boron	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Total	Lab	**15300 ug/l**	**21400 ug/l**	**21500 ug/l**	**25500 ug/l**	**28100 ug/l**	**20100 ug/l**	**20500 ug/l**	**21100 ug/l**	**20800 ug/l**	**20900 ug/l**	**20900 ug/l**	**20900 ug/l**	**21000 ug/l**	**21200 ug/l**
Chromium	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt	Dissolved	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	Dissolved	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Total	Lab	**970 ug/l**	**1320 ug/l**	**1350 ug/l**	**769 ug/l**	**513 ug/l**	**53.3 ug/l**	**50.3 ug/l**	**52.5 ug/l**	**72.6 ug/l**	**76.5 ug/l**	< 50 ug/l	< 50 ug/l	< 50 ug/l	< 50 ug/l
Lead	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Total	Lab	**6860 ug/l**	**8750 ug/l**	**8820 ug/l**	**10300 ug/l**	**11400 ug/l**	**8630 ug/l**	**9170 ug/l**	**9440 ug/l**	**9160 ug/l**	**9220 ug/l**	**9370 ug/l**	**9600 ug/l**	**9600 ug/l**	**9550 ug/l**
Manganese	Total	Lab	**82.6 ug/l**	**80.3 ug/l**	**79.5 ug/l**	**102 ug/l**	**118 ug/l**	**12.8 ug/l**	**12 ug/l**	**12 ug/l**	**8.3 ug/l**	**8.5 ug/l**	**7.31 ug/l**	**11.2 ug/l**	**11.6 ug/l**	**14.4 ug/l**
Mercury	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury methyl	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Molybdenum	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	Dissolved	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sodium	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Strontium	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	Total	Lab	**0.029 ug/l**	**0.030 ug/l**	< 0.005 ug/l	**0.053 b ug/l**	**0.026 ug/l**	< 0.02 ug/l	< 0.02 ug/l	< 0.02 ug/l	**0.023 ug/l**	**0.049 ug/l**	< 0.005 ug/l	**0.020 b ug/l**	**0.020 b ug/l**	< 0.002 ug/l
Titanium	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	Dissolved	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	Total	Lab	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Large Table 4

Surface Water Data Summary
Colby Lake and Whitewater Reservoir

		Sys Loc Code		LWr-2	LWr-2	LWr-2	LWr-2	LWr-2	LWr-2
		Sample Date	0	4/21/2010	5/12/2010	6/16/2010	7/27/2010	8/23/2010	9/20/2010
		Sample Type Code	FD	N	N	N	N	N	N
Chemical Name	Total or Dissolved	Analysis Location							
General Parameters									
Alkalinity, bicarbonate as CaCO3	NA	Lab	--	--	--	--	--	--	--
Alkalinity, total	NA	Lab	--	--	--	--	--	--	--
Carbon, total organic	NA	Lab	--	--	--	--	--	--	--
Chemical Oxygen Demand	NA	Lab	--	--	--	--	--	--	--
Chloride	NA	Lab	--	--	--	--	--	--	--
Dissolved oxygen	NA	Field	--	**11.09 mg/l**	**10.05 mg/l**	**8.11 mg/l**	**7.48 mg/l**	**7.07 mg/l**	**7.61 mg/l**
Fluoride	NA	Lab	--	--	--	--	--	--	--
Hardness, total as CaCO3	NA	Lab	**92.8 mg/l**	**86.3 mg/l**	**90.3 mg/l**	**91.2 mg/l**	**89.3 mg/l**	**92.8 mg/l**	**91.2 mg/l**
Nitrate + Nitrite	NA	Lab	--	--	--	--	--	--	--
Nitrogen, ammonia as N	NA	Lab	--	--	--	--	--	--	--
pH	NA	Field	--	**7.51 pH units**	**8.16 pH units**	**7.90 pH units**	**8.21 pH units**	**8.08 pH units**	**8.07 pH units**
Phosphorus, total	NA	Lab	--	--	--	--	--	--	--
Solids, total dissolved	NA	Lab	--	--	--	--	--	--	--
Solids, total suspended	NA	Lab	--	--	--	--	--	--	--
Specific Conductance	NA	Field	--	**207.1 umhos/cm**	**208.4 umhos/cm**	**198 umhos/cm**	**199 umhos/cm**	**219.7 umhos/cm**	**219.1 umhos/cm**
Sulfate	NA	Lab	**33.8 mg/l**	**35.1 mg/l**	**34.1 mg/l**	**35.2 mg/l**	**34.5 mg/l**	**32.9 mg/l**	**33.8 mg/l**
Temperature	NA	Field	--	**10.62 deg C**	**10.02 deg C**	**17.03 deg C**	**23.88 deg C**	**21.44 deg C**	**14.60 deg C**
Turbidity	NA	Field	--	**0 NTU**	**0.2 NTU**	**0 NTU**	**0 NTU**	**0 NTU**	**0 NTU**
Metals									
Aluminum	Dissolved	Lab	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l	< 25 ug/l
Aluminum	Total	Lab	< 25 ug/l	< 25 ug/l	**25.4 ug/l**	< 25 ug/l	< 25 ug/l	< 25 ug/l	**25.1 ug/l**
Antimony	Total	Lab	--	--	--	--	--	--	--
Arsenic	Total	Lab	**0.62 ug/l**	< 0.5 ug/l	< 0.5 ug/l	**0.51 ug/l**	**0.5 j ug/l**	**0.58 ug/l**	**0.55 ug/l**
Barium	Total	Lab	--	--	--	--	--	--	--
Beryllium	Total	Lab	--	--	--	--	--	--	--
Boron	Total	Lab	--	--	--	--	--	--	--
Cadmium	Total	Lab	--	--	--	--	--	--	--
Calcium	Total	Lab	**21400 ug/l**	**20200 ug/l**	**20800 ug/l**	**21100 ug/l**	**20500 ug/l**	**21200 ug/l**	**21100 ug/l**
Chromium	Total	Lab	--	--	--	--	--	--	--
Cobalt	Dissolved	Lab	--	--	--	--	--	--	--
Cobalt	Total	Lab	--	--	--	--	--	--	--
Copper	Dissolved	Lab	--	--	--	--	--	--	--
Copper	Total	Lab	--	--	--	--	--	--	--
Iron	Dissolved	Lab	--	--	--	--	--	--	--
Iron	Total	Lab	< 50 ug/l	**62.6 ug/l**	**57.5 ug/l**	< 50 ug/l	< 50 ug/l	< 50 ug/l	< 50 ug/l
Lead	Total	Lab	--	--	--	--	--	--	--
Magnesium	Total	Lab	**9550 ug/l**	**8720 ug/l**	**9310 ug/l**	**9350 ug/l**	**9250 ug/l**	**9690 ug/l**	**9350 ug/l**
Manganese	Total	Lab	**13 ug/l**	**12 ug/l**	**8.97 ug/l**	**6.87 ug/l**	**9.97 ug/l**	**14.6 ug/l**	**11.9 ug/l**
Mercury	Total	Lab	--	--	--	--	--	--	--
Mercury methyl	Total	Lab	--	--	--	--	--	--	--
Molybdenum	Total	Lab	--	--	--	--	--	--	--
Nickel	Dissolved	Lab	--	--	--	--	--	--	--
Nickel	Total	Lab	--	--	--	--	--	--	--
Potassium	Total	Lab	--	--	--	--	--	--	--
Selenium	Total	Lab	--	--	--	--	--	--	--
Silver	Total	Lab	--	--	--	--	--	--	--
Sodium	Total	Lab	--	--	--	--	--	--	--
Strontium	Total	Lab	--	--	--	--	--	--	--
Thallium	Total	Lab	< 0.002 ug/l	< 0.02 ug/l	**0.035 ug/l**	**0.021 ug/l**	< 0.005 ug/l	**0.021 b ug/l**	< 0.002 ug/l
Titanium	Total	Lab	--	--	--	--	--	--	--
Vanadium	Total	Lab	--	--	--	--	--	--	--
Zinc	Dissolved	Lab	--	--	--	--	--	--	--
Zinc	Total	Lab	--	--	--	--	--	--	--

Large Table 4

Surface Water Data Summary
Colby Lake and Whitewater Reservoir

Data Qualifiers/Footnotes	
Qualifier	**Definition**
--	Not analyzed/not available.
a	Estimated value, calculated using some or all values that are estimates.
b	Potential false positive value based on blank data validation procedures.
c	Coeluting compound.
e	Estimated value, exceeded the instrument calibration range.
h	EPA recommended sample preservation, extraction or analysis holding time was exceeded.
I	Indeterminate value based on failure of blind duplicate data to meet quality assurance criteria.
j	Reported value is less than the stated laboratory quantitation limit and is considered an estimated value.
p	Relative percent difference is >40% (25% CLP pesticides) between primary and confirmation GC columns.
pp	Small peak in chromatogram below method detection limit.
r	The presence of the compound is suspect based on the ID criteria of the retention time and relative retention time obtained from the examination of the chromatograms.
s	Potential false positive value based on statistical analysis of blank sample data.
*	Estimated value, QA/QC criteria not met.
**	Unusable value, QA/QC criteria not met.
N	Sample Type: Normal
FD	Sample Type: Field Duplicate
AT	Sample chromatogram is noted to be atypical of a petroleum product.
DLND	Not detected, detection limit not determined.
DF	Did not flash
EMPC	Estimated maximum possible concentration.
NA – (Not applicable)	NA indicates that a fractional portion of the sample is not part of the analytical testing or field collection procedures.
ND	Not detected.
TIC	Tentatively identified compound
BQA	Barr-applied project specific qualifier: extraction and/or analyses conducted using an alternative method and/or procedure.
BQC	Barr-applied project specific qualifier: plant shut down.
BQD	Barr-applied project specific qualifier: equipment malfunction.
BQE	Barr-applied project specific qualifier: equipment adjustment.
BQM	Barr-applied project specific qualifier: manual measurement.
BQN	Barr-applied project specific qualifier: unable to be sampled or measured due to various reasons.
BQP	Barr-applied project specific qualifier: atypical chromatographic pattern.
BQQ	Barr-applied project specific qualifier: some aspect of QA/QC was not met.
BQR	Barr-applied project specific qualifier: location was re-sampled.
BQS	Barr-applied project specific qualifier: data is considered suspect.
BQT	Barr-applied project specific qualifier: summed value not displayed due to insufficient field length.
BQU	Barr-applied project specific qualifier: historical qualifier - definition unknown.
BQV	Barr-applied project specific qualifier: estimated value.
BQX	Barr-applied project specific qualifier: see notes for qualifier definition.
BQZ	Barr-applied project specific qualifier: data is considered unusable.

Original

Relevant Page from Table 1-1 (Plant Site Water Modeling Work Plan)

Table 1-44 (Plant Site Water Modeling Work Plan)

Table 1-1 **Input Variables for the Plant Site Model**

Variable Name	*Units*	*Deterministic/ Uncertain*	*Sampling/ Calculation Frequency*	*Distribution*	*Mean or Mode*	*Standard Deviation*	*Minimum*	*Maximum*	*Description*	*Source of Input Data*	*Modeling Package Section*
Min_Climate_Infiltration	[in/yr]	Deterministic	N/A	Constant	0.1	N/A	N/A	N/A	Minimum infiltration allowed in the tailings beaches and dams for model stability purposes (eliminate divide by zero)	Assumed	Water Section 6.1.3.1 - *Climate*
Bare_ET	[--]	Uncertain	Realization	Normal	0.524	0.020	N/A	N/A	ET from bare waste rock as a fraction of precipitation	See Mine Site Work Plan Tables	Water (Volume 1) Section 6.1.1 - *Stockpile Hydrology Modeling*
Bare_RO	[--]	Deterministic	N/A	Constant	0	N/A	N/A	N/A	Runoff from bare waste rock as a fraction of precipitation	See Mine Site Work Plan Tables	Water (Volume 1) Section 6.1.1 - *Stockpile Hydrology Modeling*
SnowMelt_Start	[--]	Deterministic	N/A	Constant	4	N/A	N/A	N/A	Month of the year when snow melt starts	Analysis of flow record and watershed yield	Water Section 5.5.5 - *Seasons*
SnowMelt_Stop	[--]	Deterministic	N/A	Constant	5	N/A	N/A	N/A	Final snow melt month of the year	Analysis of flow record and watershed yield	Water Section 5.5.5 - *Seasons*
Frozen_Period	[mon]	Uncertain	Annually	Triangular	3.4	N/A	2.4	4.4	Number of months each year that the inactive tailings are frozen and limit oxygen diffusion	Analysis of site specific temperature data	Waste Section 10.2 - Lab to Field Scale Up

Plant Site Chemistry

GW_Alpha_Rand (see Table 1-5)	[--]	Uncertain	Realization	Normal	GW_Alpha_Mean	GW_Alpha_Stdev	N/A	N/A	Vector by constituent, mean of the LN transformed baseline groundwater quality	Analysis of groundwater on-site groundwater wells	Water Section 5.3.1 - *Background Groundwater*
GW_Beta	[--]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-5				Standard Deviation of the LN transformed baseline groundwater quality	Analysis of groundwater on-site groundwater wells	Water Section 5.3.1 - *Background Groundwater*
SW_RO_Concentration (see Table 1-6)	[ug/L]	Uncertain	Timestep	Lognormal	RO_Mean	RO_StDev	N/A	N/A	Concentration of surface runoff in the un-impacted watershed	Calibration to existing water quality in the Embarrass River	Water Section 5.3.2 - *Background Surface Runoff*
INIT_Concs	[mg/L]	Deterministic	N/A	Constant	Matrix by constituent and location. Reference Table 1-7				Initial Concentrations in the surface water evaluation locations	Sampled water quality data	Water Section 4.4.3 - *Embarrass River Watershed Water Quality*

Mine Site Water

Mine_Site_Flow_Rate	[gpm]	Uncertain	Timestep	Trunc. Normal	Reference Table 1-8		0	1E+10	Flow at any point in time from the Mine Site WWTF to the FTB, auto-correlated (0.9) per data package	Mine Site probabilistic water quality model	Water Section 6.1.3.6 - *Mine Site WWTF Flow*
Mine_Site_Conc	[mg/L]	Uncertain	Timestep	Trunc. Normal	Table 1-9	Table 1-10	0	1E+10	Concentration for all constituents at any time in the water from the Mine Site WWTF to the FTB	Mine Site probabilistic water quality model	Water Section 5.3.3 - *Mine Site WWTF*

Colby Lake

CL_Quality	[mg/L]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-44				Mean concentration for all constituents at any time in the water from Colby Lake	Sampled Surface Water Data	Water Section 5.3.4 - *Colby Lake Quality*

Table 1-44 Other Surface Water Quality Inputs

Constituent	*Area5NW_Conc* (mg/L)*	*Initial_Pond_Concs_1E** (mg/L)*	*Initial_Pond_Concs_2E** (mg/L)*	*CL_Quality (mg/L)*
Ag	0.0001	0.0001	0.0001	0.0001
Al	0.0125	0.01	0.01	0.078
Alk (as CaCO3)	96	260	340	27.8
As	0.0013	0.0047	0.0054	0.00075
B	0.16	0.25	0.3	0.042
Ba	0.0036	0.25	0.25	0.007
Be	0.0001	0.0002	0.0002	0.0001
Ca	85.7	26	34	19.8
Cd	0.0001	0.0001	0.0001	0.0001
Cl	4.33	23	23	2.17
Co	0.0004	0.0006	0.0006	0.00016
Cr	0.0005	0.0005	0.0005	0.0005
Cu	0.0018	0.0013	0.001	0.0027
F	0.17	5.9	4.4	0.088
Fe	0.116	0.025	0.03	0.86
K	51.9	8.7	12	0.94
Mg	243	47	66	8.5
Mn	0.804	0.048	0.079	0.066
Na	89.2	78	77	3.25
Ni	0.0036	0.0013	0.001	0.0021
Pb	0.00015	0.0016	0.0016	0.00025
Sb	0.00025	0.00025	0.00025	0.00025
Se	0.00079	0.0005	0.0005	0.0005
SO_4	1042	95	130	33.8
Tl	0.0001	0.00017	0.00017	0.0001
V	0.00541	0.00541	0.00541	0.00541
Zn	0.003	0.013	0.013	0.003

Notes

Source: Surface Water Samples for Area_5NW_Effluent_Conc from SD-033 through 08/23/2011

* Data not available for Alkalinity, F and V; GW values assumed

** Data not available for Ag, Al, Ba, Be, Cd, Cr, Pb, Sb, Se, Tl, V, & Zn; average concentrations at the North Toe (GW001 & GW012) assumed

Revised

Relevant Page from Table 1-1 (Plant Site Water Modeling Work Plan)

Table 1-44 (Plant Site Water Modeling Work Plan)

Table 1-1 **Input Variables for the Plant Site Model**

Variable Name	*Units*	*Deterministic/ Uncertain*	*Sampling/ Calculation Frequency*	*Distribution*	*Mean or Mode*	*Standard Deviation*	*Minimum*	*Maximum*	*Description*	*Source of Input Data*	*Modeling Package Section*
Min_Climate_Infiltration	[in/yr]	Deterministic	N/A	Constant	0.1	N/A	N/A	N/A	Minimum infiltration allowed in the tailings beaches and dams for model stability purposes (eliminate divide by zero)	Assumed	Water Section 6.1.3.1 - *Climate*
Bare_ET	[--]	Uncertain	Realization	Normal	0.524	0.020	N/A	N/A	ET from bare waste rock as a fraction of precipitation	See Mine Site Work Plan Tables	Water (Volume 1) Section 6.1.1 - *Stockpile Hydrology Modeling*
Bare_RO	[--]	Deterministic	N/A	Constant	0	N/A	N/A	N/A	Runoff from bare waste rock as a fraction of precipitation	See Mine Site Work Plan Tables	Water (Volume 1) Section 6.1.1 - *Stockpile Hydrology Modeling*
SnowMelt_Start	[--]	Deterministic	N/A	Constant	4	N/A	N/A	N/A	Month of the year when snow melt starts	Analysis of flow record and watershed yield	Water Section 5.5.5 - *Seasons*
SnowMelt_Stop	[--]	Deterministic	N/A	Constant	5	N/A	N/A	N/A	Final snow melt month of the year	Analysis of flow record and watershed yield	Water Section 5.5.5 - *Seasons*
Frozen_Period	[mon]	Uncertain	Annually	Triangular	3.4	N/A	2.4	4.4	Number of months each year that the inactive tailings are frozen and limit oxygen diffusion	Analysis of site specific temperature data	Waste Section 10.2 - Lab to Field Scale Up
Plant Site Chemistry											
GW_Alpha_Rand (see Table 1-5)	[--]	Uncertain	Realization	Normal	GW_Alpha_Mean	GW_Alpha_Stdev	N/A	N/A	Vector by constituent, mean of the LN transformed baseline groundwater quality	Analysis of groundwater on-site groundwater wells	Water Section 5.3.1 - *Background Groundwater*
GW_Beta	[--]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-5				Standard Deviation of the LN transformed baseline groundwater quality	Analysis of groundwater on-site groundwater wells	Water Section 5.3.1 - *Background Groundwater*
SW_RO_Concentration (see Table 1-6)	[ug/L]	Uncertain	Timestep	Lognormal	RO_Mean	RO_StDev	N/A	N/A	Concentration of surface runoff in the un-impacted watershed	Calibration to existing water quality in the Embarrass River	Water Section 5.3.2 - *Background Surface Runoff*
INIT_Concs	[mg/L]	Deterministic	N/A	Constant	Matrix by constituent and location. Reference Table 1-7				Initial Concentrations in the surface water evaluation locations	Sampled water quality data	Water Section 4.4.3 - *Embarrass River Watershed Water Quality*
Mine Site Water											
Mine_Site_Flow_Rate	[gpm]	Uncertain	Timestep	Trunc. Normal	Reference Table 1-8		0	1E+10	Flow at any point in time from the Mine Site WWTF to the FTB, auto-correlated (0.9) per data package	Mine Site probabilistic water quality model	Water Section 6.1.3.6 - *Mine Site WWTF Flow*
Mine_Site_Conc	[mg/L]	Uncertain	Timestep	Trunc. Normal	Table 1-9	Table 1-10	0	1E+10	Concentration for all constituents at any time in the water from the Mine Site WWTF to the FTB	Mine Site probabilistic water quality model	Water Section 5.3.3 - *Mine Site WWTF*
Colby Lake											
CL_Quality (see Table 1-44)	[mg/L]	Uncertain	Timestep	Lognormal	CL_Mean	CL_SD	N/A	N/A	Concentration for all constituents at any time in the water from Colby Lake	Sampled Surface Water Data	Water Section 5.3.4 - *Colby Lake Quality*

Table 1-44 Other Surface Water Quality Inputs

Constituent	*Area5NW_Conc* (mg/L)*	*Initial_Pond_Concs_1E** (mg/L)*	*Initial_Pond_Concs_2E** (mg/L)*	*CL_Mean (mg/L)*	*CL_SD (mg/L)*
Ag	0.0001	0.0001	0.0001	0.0001	0
Al	0.0125	0.01	0.01	0.086	0.044
Alk (as CaCO3)	96	260	340	27.8	0
As	0.0013	0.0047	0.0054	0.00077	0.00038
B	0.16	0.25	0.3	0.042	0
Ba	0.0036	0.25	0.25	0.007	0
Be	0.0001	0.0002	0.0002	0.0001	0
Ca	85.7	26	34	21.8	6.7
Cd	0.0001	0.0001	0.0001	0.0001	0
Cl	4.33	23	23	2.17	0
Co	0.0004	0.0006	0.0006	0.00016	0
Cr	0.0005	0.0005	0.0005	0.0005	0
Cu	0.0018	0.0013	0.001	0.0027	0
F	0.17	5.9	4.4	0.088	0
Fe	0.116	0.025	0.03	0.86	0.29
K	51.9	8.7	12	0.94	0
Mg	243	47	66	9	1.8
Mn	0.804	0.048	0.079	0.073	0.046
Na	89.2	78	77	3.25	0
Ni	0.0036	0.0013	0.001	0.0021	0
Pb	0.00015	0.0016	0.0016	0.00025	0
Sb	0.00025	0.00025	0.00025	0.00025	0
Se	0.00079	0.0005	0.0005	0.0005	0
SO_4	1042	95	130	38.1	14.7
Tl	0.0001	0.00017	0.00017	0.000059	0.000064
V	0.00541	0.00541	0.00541	0.00541	0
Zn	0.003	0.013	0.013	0.003	0

Notes

Source: Surface Water Samples for Area_5NW_Effluent_Conc from SD-033 through 08/23/2011

* Data not available for Alkalinity, F and V; GW values assumed

** Data not available for Ag, Al, Ba, Be, Cd, Cr, Pb, Sb, Se, Tl, V, & Zn; average concentrations at the North Toe (GW001 & GW012) assumed