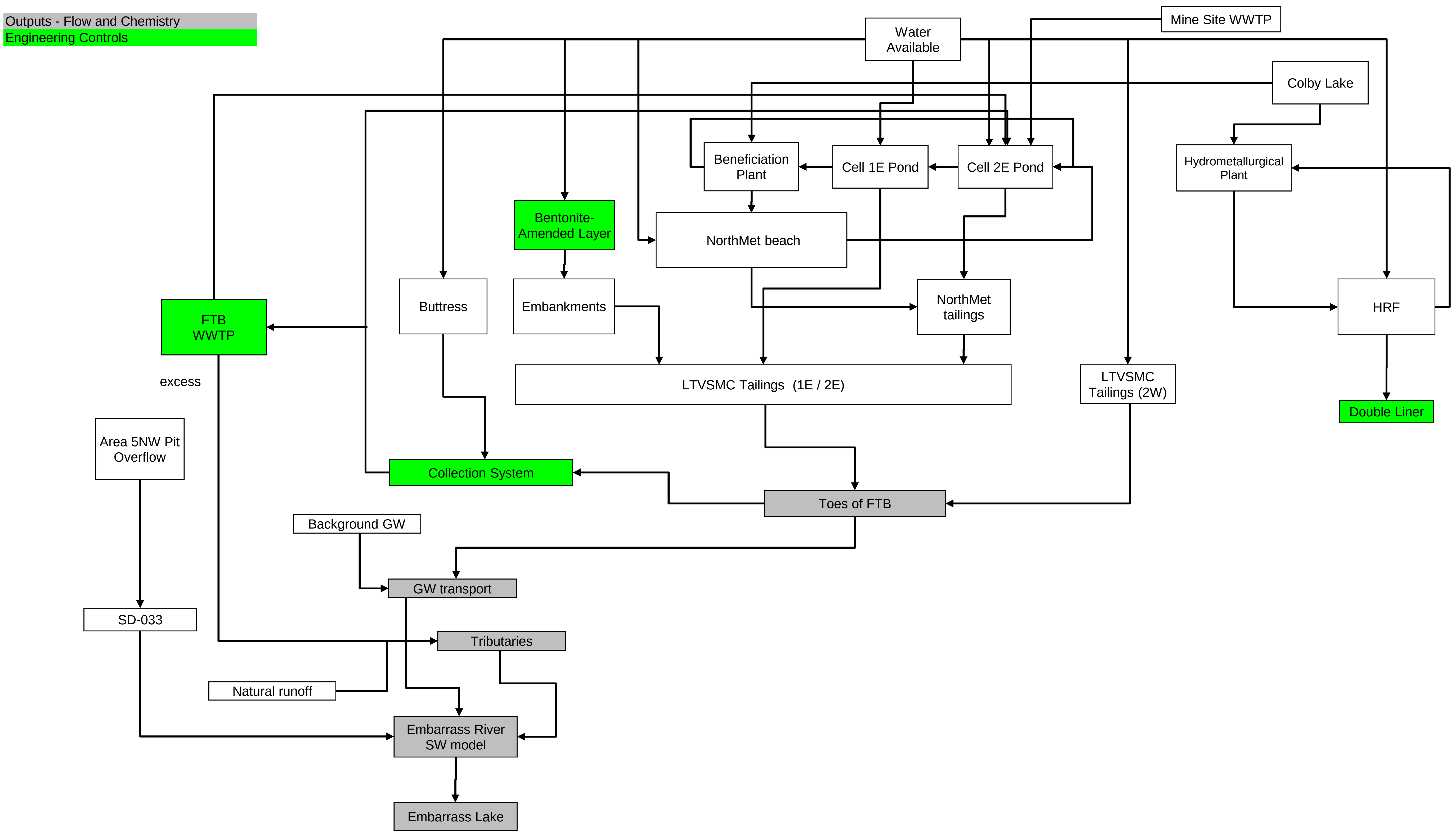
Figure A - Tailings Basin Water Modeling - Operations (early years)



Probabilistic Aspects

Mine Site model output

precipitation, evaporation, watershed runoff

plant and pond flow and chemistry

runoff, evaporation, infiltration

O2 diffusion, sulfate generation rates, scale up, metal release ratios, NM tailings permeability

soluble loading, LTVSMC tailings permeability

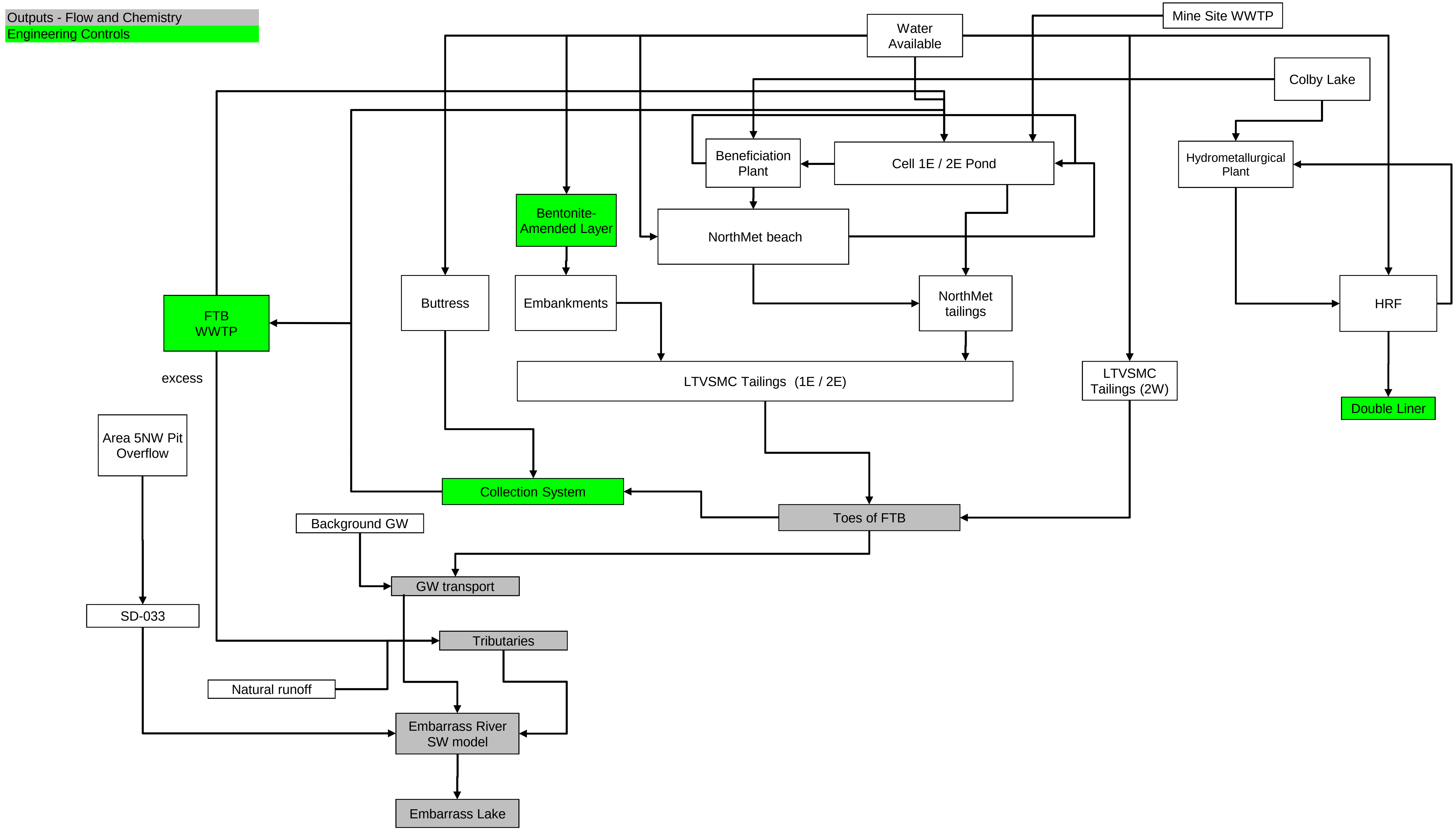
capture efficiency

metals sorption, recharge rate, dilution

SW & GW input flow and chemistry

flow and chemistry

Figure B - Tailings Basin Water Modeling - Operations (later years)



Probabilistic Aspects

Mine Site model output

precipitation, evaporation, watershed runoff

plant and pond flow and chemistry

runoff, evaporation, infiltration

O2 diffusion, sulfate generation rates, scale up, metal release ratios, NM tailings permeability

soluble loading, LTVSMC tailings permeability

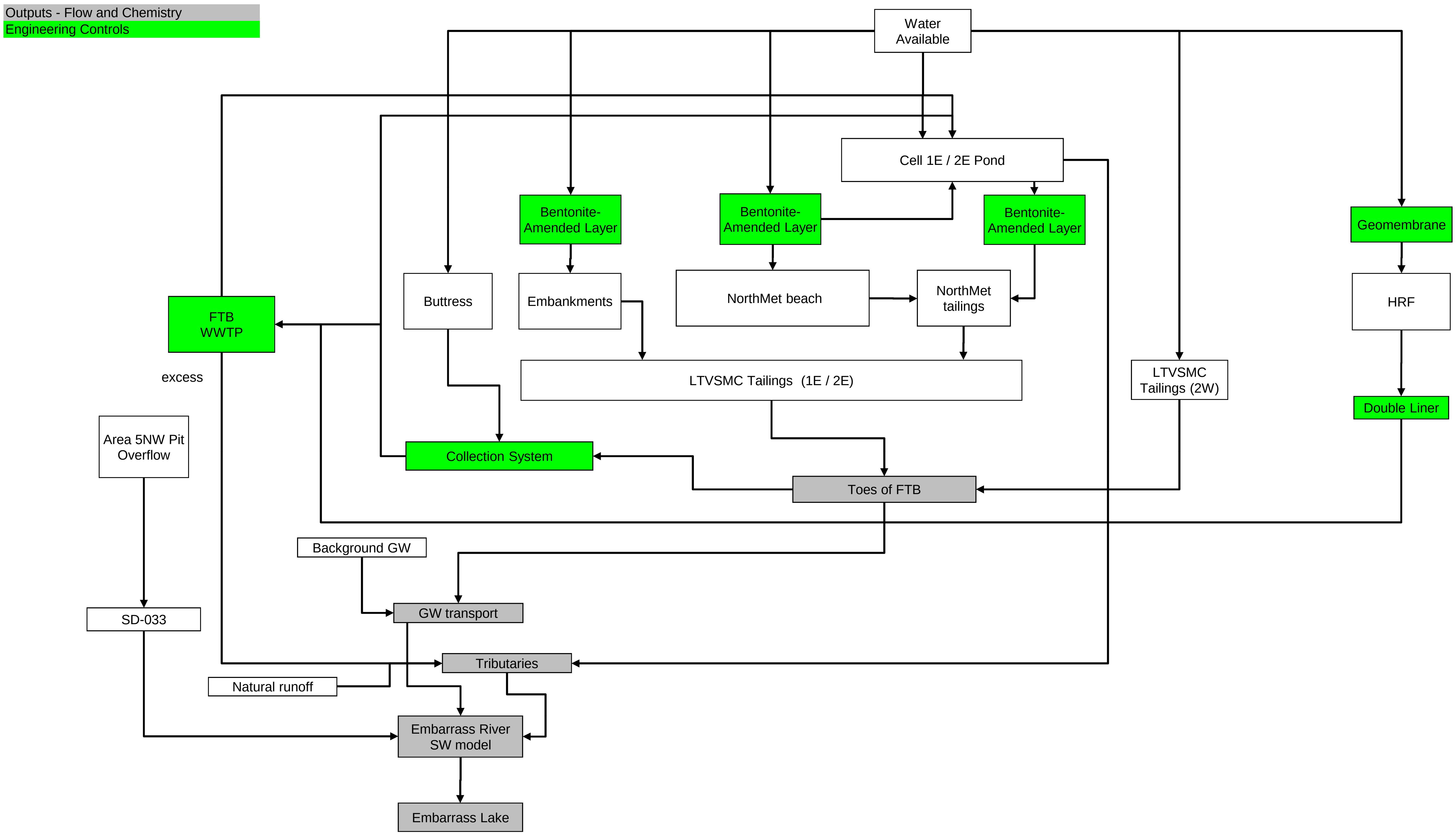
capture efficiency

metals sorption, recharge rate, dilution

SW & GW input flow and chemistry

flow and chemistry

Figure C - Tailings Basin Water Modeling - Long-Term Closure - Model until closure activities complete and pond water chemistry/level stabilize



Probabilistic Aspects

precipitation, evaporation, watershed runoff

plant and pond flow and chemistry

runoff, evaporation, infiltration

O2 diffusion, sulfate generation rates, scale up, metal release ratios, NM tailings permeability

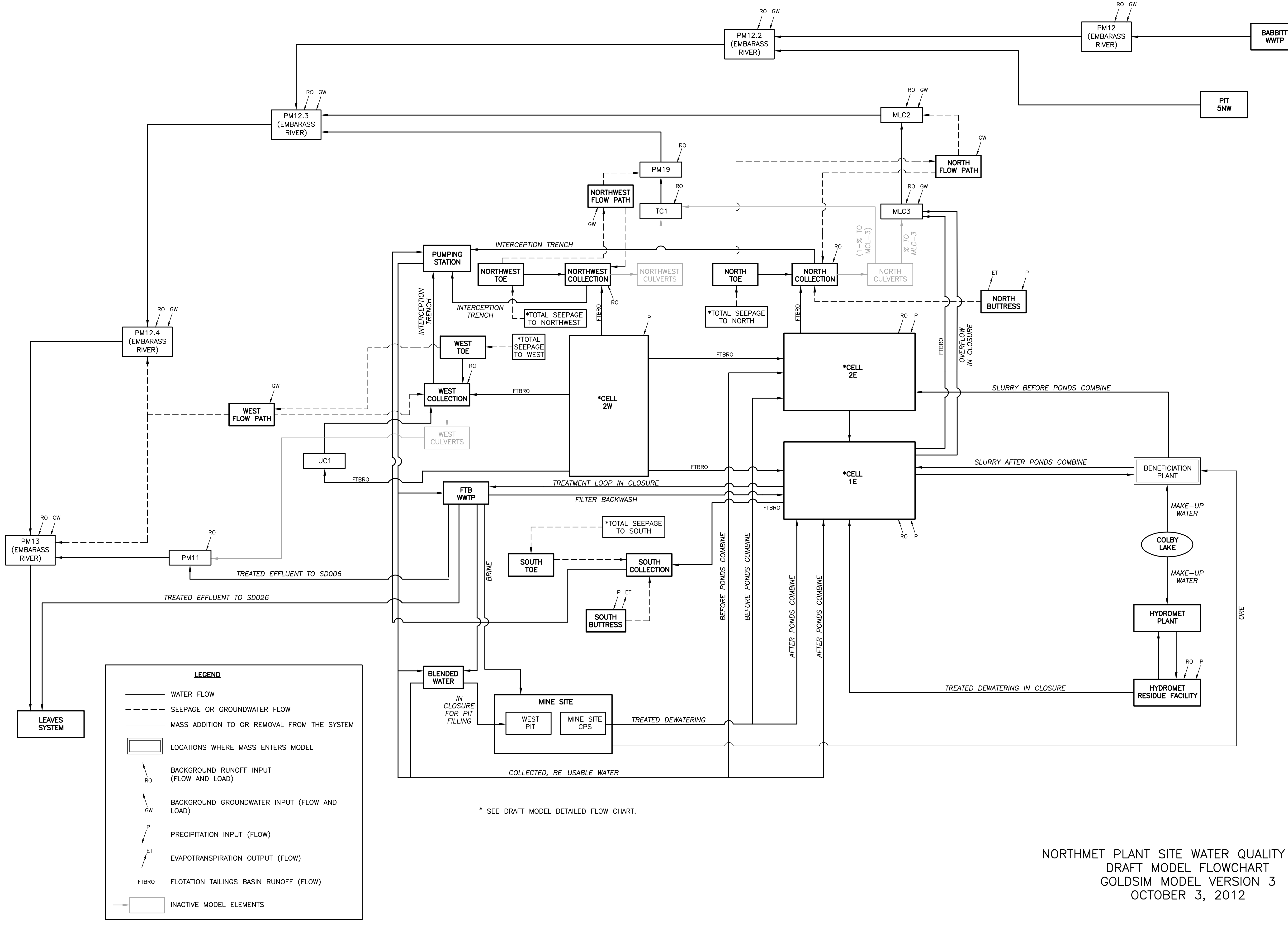
soluble loading, LTVSMC tailings permeability

capture efficiency

metals sorption, recharge rate, dilution

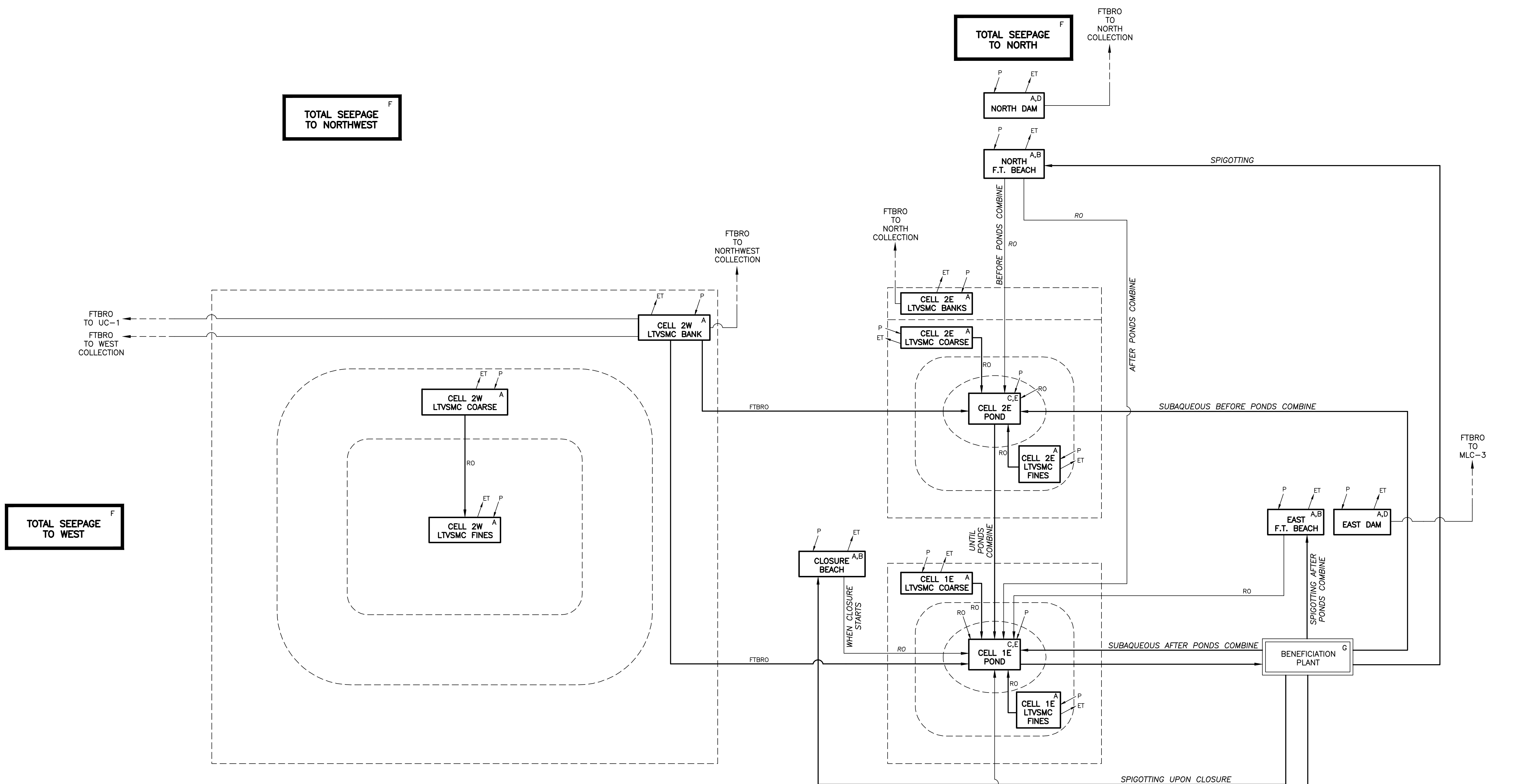
SW & GW input flow and chemistry

flow and chemistry



NORTHMET PLANT SITE WATER QUALITY MODEL
DRAFT MODEL FLOWCHART
GOLDSIM MODEL VERSION 3
OCTOBER 3, 2012

CADD USER: Rick Gustner FILE: M:\ADEPTWORK\RLG\23690862000_NORTHMET PLANT SITE WQ MODEL FLOWCHART.DWG PLOT SCALE: 1:2 PLOT DATE: 10/1/2012 4:23 PM



NOTE:
SOME FRACTION OF SEEPAGE FROM EVERY [thin box] GOES TO EVERY [thick box]

LEGEND

(heavy line)	WATER FLOW
(light line)	MASS ADDITION TO OR REMOVAL FROM THE SYSTEM
(double box)	LOCATIONS WHERE MASS ENTERS MODEL
RO	BACKGROUND RUNOFF INPUT (FLOW AND LOAD)
P	PRECIPITATION INPUT (FLOW)
ET	EVAPOTRANSPIRATION OUTPUT (FLOW)
FTBRO	FLOTATION TAILINGS BASIN RUNOFF (FLOW)

A	UNSATURATED TAILINGS GENERATE CONSTITUENT LOAD WHERE OXYGEN IS PRESENT.
B	RUNOFF FROM THIS ZONE CARRIES WEATHERED LOAD TO THE POND.
C	OXYGENATED SEEPAGE GENERATES CONSTITUENT LOAD IN THE FULLY SATURATED TAILINGS BELOW THE POND.
D	A FLUSHING LOAD IS GENERATED AS THE DAM IS CONSTRUCTED DUE TO DISTURBING LTVSMC TAILINGS.
E	LOAD FROM THE POND IS CARRIED TO THE TOES VIA SEEPAGE.
F	ALL LOADS AND FLOWS TO THIS TOE ARE SUMMED TOGETHER TO CALCULATE THE TOTAL LOADING, TOTAL FLOW, AND SEEPAGE CONCENTRATION AT THIS TOE.
G	LOAD IS ADDED TO THE SYSTEM AS WEATHERED ORE IS PROCESSED IN THE PLANT.

NORTHMET PLANT SITE WATER QUALITY MODEL
DRAFT MODEL DETAILED FLOWCHART
GOLDSIM MODEL VERSION 3
OCTOBER 3, 2012

NorthMet Plant Site Water Quality Model
Model Feature Timeline
GoldSim Model Version 3 (September 28, 2012)

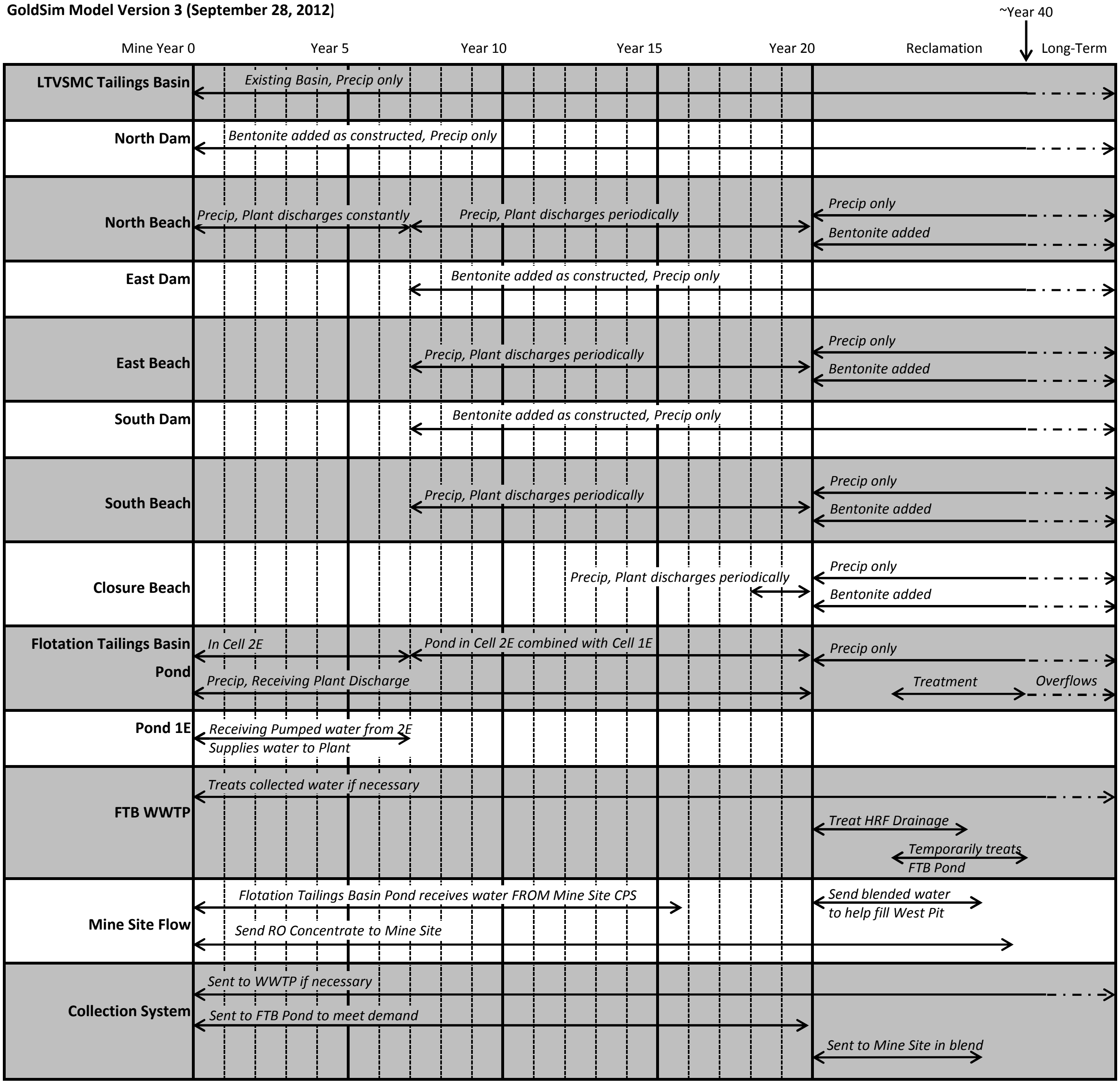


Table 1-1 **Input Variables for the Plant Site Model**

Variable Name	*Units*	*Deterministic/ Uncertain*	*Sampling/ Calculation Frequency*	*Distribution*	*Mean or Mode*	*Standard Deviation*	*Minimum*	*Maximum*	*Description*	*Source of Input Data*	*Modeling Package Section*
Water Quality Standards											
Surface_Constant_Standards	[mg/L]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-2				Constant surface water quality standards applicable to the project	MN Rules 7050 and 7052	Water Section 2.1 - *MN SW Standards*
SW_Hardness_Standard	[mg/L]	Deterministic	N/A	Constant	500	N/A	N/A	N/A	Constant surface water standard for hardness	MN Rule 7050	Water Section 2.1 - *MN SW Standards*
Surface_Hardness_Standards	[--]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-3				Hardness-dependent surface water quality standards applicable to the project	MN Rules 7050 and 7052	Water Section 2.1 - *MN SW Standards*
Ground_Primary_Standards	[mg/L]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-4				Constant Primary groundwater quality standards applicable to the project	MN Rules 7050 and 4717	Water Section 2.3 - MN GW Standards
Prim_GW_Hardness_Stand	[mg/L]	Deterministic	N/A	Constant	999999	N/A	N/A	N/A	Primary groundwater standard for hardness	MN Rules 7050 and 4717	Water Section 2.3 - MN GW Standards
Ground_Secondary_Standards	[mg/L]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-4				Constant Secondary groundwater quality standards presented for reference	MN Rules 7050 and 4717	Water Section 2.3 - *MN GW Standards*
Sec_GW_Hardness_Stand	[mg/L]	Deterministic	N/A	Constant	999999	N/A	N/A	N/A	Secondary groundwater standard for hardness	MN Rules 7050 and 4717	Water Section 2.3 - MN GW Standards
General Engineering Variables											
Closure_Year	[yr]	Deterministic	N/A	Constant	20	N/A	N/A	N/A	Year when operations cease	Project Description	Water Section 5.1.1 - *Flotation Tailings Basin Design*
Water_Depth	[in]	Deterministic	N/A	Constant	0.1	N/A	N/A	N/A	Average depth of water at the bottom of stockpile (for volume calculation)	See Mine Site Work Plan Tables	None
Tiny_Area	[acre]	Deterministic	N/A	Constant	0.001	N/A	N/A	N/A	Tiny area to prevent dividing by zero	See Mine Site Work Plan Tables	None
Tiny_Mass	[kg]	Deterministic	N/A	Constant	0.001	N/A	N/A	N/A	Tiny mass to prevent dividing by zero	See Mine Site Work Plan Tables	None
Tiny_Volume	[m^3]	Deterministic	N/A	Constant	0.001	N/A	N/A	N/A	Tiny volume to prevent dividing by zero	See Mine Site Work Plan Tables	None

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*
Plant Site Hydrology											
Precip_cuberoot	[--]	Uncertain	Annually	Normal	3.03	0.15	N/A	N/A	Cubed root of the annual precipitation in inches	HiDen Climate network for Mine Site (1981-2010 climate normal)	Water Section 5.2.1 - *Precipitation*
Annual_P_Variation	[yr/mon]	Deterministic	N/A	Constant	Vector by month. Reference Table 1-51				Fraction of annual precipitation that falls each month	HiDen Climate network for Mine Site (1981-2010 climate normal)	Water Section 5.2.1 - *Precipitation*
Open_Water_Evap_OPS_Early	[in/yr]	Uncertain	Annually	Normal	32.5	0.56	N/A	N/A	Evaporation rate from open water in Cell 2E only during operations (artificially heated water)	Meyer Model, developed for the DEIS modeling (RS-13B), and updated for the new climate normal	Water Section 6.1.3.1 - *Climate*
Open_Water_Evap_OPS_Late	[in/yr]	Uncertain	Annually	Normal	30.8	0.69	N/A	N/A	Evaporation rate from open water in combined Cell2E and 1E during operations (artificially heated water)	Meyer Model, developed for the DEIS modeling (RS-13B), and updated for the new climate normal	Water Section 6.1.3.1 - *Climate*
Open_Water_Evap_CLSR	[in/yr]	Uncertain	Annually	Normal	17.1	2.16	N/A	N/A	Evaporation rate from open water after operations (normal temperature water)	Meyer Model, developed for the DEIS modeling (RS-13B), and updated for the new climate normal	Water Section 5.2.2 - *Evaporation*
Annual_E_Variation	[yr/mon]	Deterministic	N/A	Constant	Vector by month. Reference Table 1-51				Fraction of annual evaporation that occurs each month	HiDen Climate network for Mine Site (1981-2010 climate normal)	Water Section 5.2.2 - *Evaporation*
Beach_Evap_Frac	[--]	Uncertain	Annually	Normal	0.528	0.046	N/A	N/A	Fraction of precipitation that evaporates from the Flotation Tailings beaches	Meyer Model, developed for the DEIS modeling (RS-13B), and updated for the new climate normal	Water Section 6.1.3.1 - *Climate*
Beach_RO_Frac	[--]	Uncertain	Annually	Normal	0.195	0.043	N/A	N/A	Fraction of precipitation that becomes runoff from the beaches	Meyer Model, developed for the DEIS modeling (RS-13B), and updated for the new climate normal	Water Section 6.1.3.1 - *Climate*
Delta_Evap	[in/yr]	Uncertain	Annually	Normal	46.0	0.69	N/A	N/A	Evaporation rate from the active delta in the Flotation Tailings beach	Meyer Model, developed for the DEIS modeling (RS-13B), and updated for the new climate normal	Water Section 6.1.3.1 - *Climate*
Beach_BNT_Evap_Frac	[--]	Uncertain	Annually	Normal	0.662	0.073	N/A	N/A	Fraction of precipitation that evaporates from the bentonite-amended Flotation Tailings beaches	HELP modeling conducted by Golder	Water Section 6.1.3.1 - *Climate*
Beach_BNT_RO_Frac	[--]	Uncertain	Annually	Trunc. Normal	0.126	0.063	0	N/A	Fraction of precip that runs off the amended beaches	HELP modeling conducted by Golder	Water Section 6.1.3.1 - *Climate*
Rec_Bank_Evap_Frac	[--]	Uncertain	Annually	Normal	0.662	0.073	N/A	N/A	Fraction of precipitation that evaporates from the bentonite-amended dams	HELP modeling conducted by Golder	Water Section 6.1.3.1 - *Climate*
Rec_Bank_RO_Frac	[--]	Uncertain	Annually	Trunc. Normal	0.126	0.063	0	N/A	Fraction of precip that runs off the amended dams	HELP modeling conducted by Golder	Water Section 6.1.3.1 - *Climate*
LTVSMC_Tailings_Evap_Frac	[--]	Uncertain	Annually	Normal	0.449	0.045	N/A	N/A	Fraction of precipitation that evaporates from the LTVSMC tailings in Cells 1E, 2E, & 2W	Coeff. of Var. from updated Meyer Model, calibrated to updated ex. cond. MODFLOW model	Water Section 6.1.3.1 - *Climate*
Cell2W_RO_Frac	[--]	Uncertain	Annually	Normal	0.074	0.011	N/A	N/A	Fraction of precip that runs off the coarse tailings in Cell 2W	Coeff. of Var. from updated Meyer Model, calibrated to updated ex. cond. MODFLOW model	Water Section 6.1.3.1 - *Climate*
Cell1E_Coarse_RO_Frac	[--]	Uncertain	Annually	Normal	0.469	0.072	N/A	N/A	Fraction of precip that runs off the coarse tailings in Cell 1E	Coeff. of Var. from updated Meyer Model, calibrated to updated ex. cond. MODFLOW model	Water Section 6.1.3.1 - *Climate*
Cell1E_Fines_RO_Frac	[--]	Uncertain	Annually	Normal	0.501	0.077	N/A	N/A	Fraction of precip that runs off the fine tailings in Cell 1E	Coeff. of Var. from updated Meyer Model, calibrated to updated ex. cond. MODFLOW model	Water Section 6.1.3.1 - *Climate*
Cell2E_Coarse_RO_Frac	[--]	Uncertain	Annually	Normal	0.373	0.057	N/A	N/A	Fraction of precip that runs off the coarse tailings in Cell 2E	Coeff. of Var. from updated Meyer Model, calibrated to updated ex. cond. MODFLOW model	Water Section 6.1.3.1 - *Climate*
Cell2E_Fines_RO_Frac	[--]	Uncertain	Annually	Normal	0.416	0.064	N/A	N/A	Fraction of precip that runs off the fine tailings in Cell 2E	Coeff. of Var. from updated Meyer Model, calibrated to updated ex. cond. MODFLOW model	Water Section 6.1.3.1 - *Climate*
Cell2E_Bank_Evap_Frac	[--]	Uncertain	Annually	Normal	0.560	0.057	N/A	N/A	Fraction of precip that evaporates from the banks of Cell 2E	Coeff. of Var. from updated Meyer Model, calibrated to updated ex. cond. MODFLOW model	Water Section 6.1.3.1 - *Climate*
Cell2W_Bank_Evap_Frac	[--]	Uncertain	Annually	Normal	0.471	0.048	N/A	N/A	Fraction of precip that evaporates from the banks of Cell 2W	Meyer Model, developed for the DEIS modeling (RS-13B), and updated for the new climate normal	Water Section 6.1.3.1 - *Climate*
Cell2W_Bank_RO_Frac	[--]	Uncertain	Annually	Normal	0.248	0.038	N/A	N/A	Fraction of precipitation that becomes runoff from the embankments of Cell 2W	Meyer Model, developed for the DEIS modeling (RS-13B), and updated for the new climate normal	Water Section 6.1.3.1 - *Climate*

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 1-1 **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*
NorthMet Tailings Hydraulic Properties											
NM_SG	[--]	Deterministic	N/A	Constant	3.0	N/A	N/A	N/A	Specific gravity of the NorthMet tailings (both coarse and fine fractions)	DBS&A Analysis and Report	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
Beach_Porosity	[cm^3/cm^3]	Uncertain	Annually	Triangular	0.4012	N/A	0.3668	0.4685	Porosity of the tailings in the NorthMet beaches	Interpretation of the SAFL Depositional Study	Waste Section 5.1.3.1 - *Depositional Study*
Pond_Porosity	[cm^3/cm^3]	Uncertain	Annually	Triangular	0.5602	N/A	0.4049	0.5696	Porosity of the tailings under the Flotation Tailings Basin pond	Interpretation of the SAFL Depositional Study	Waste Section 5.1.3.1 - *Depositional Study*
Mean_Perc_Fines	[%]	Deterministic	N/A	Constant	35	N/A	N/A	N/A	Average percentage of the flotation tailings beach that is made up of fine flotation tailings	Interpretation of the SAFL Depositional Study	Waste Section 5.1.3.1 - *Depositional Study*
Perc_Fines_Retained	[%]	Uncertain	Annually	Normal	Mean_Perc_Fines	3.04	N/A	N/A	Percent of the NorthMet tailings in the beaches that are from the fine fraction (by mass)	Interpretation of the SAFL Depositional Study	Waste Section 5.1.3.1 - *Depositional Study*
Perc_Coarse_Feed	[%]	Uncertain	Annually	Normal	38	1.82	N/A	N/A	Percent of the NorthMet tailings feed that is in the coarse fraction (by mass)	Interpretation of the SAFL Depositional Study	Waste Section 5.1.3.1 - *Depositional Study*
Ksat_Coeff	[--]	Deterministic	N/A	Constant	Function coefficients. Reference Table 1-11				Function coefficients to determine the saturated hydraulic conductivty of the NorthMet tailings	DBS&A Analysis and Report	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
ResMoist_Coeff	[--]	Deterministic	N/A	Constant	Function coefficients. Reference Table 1-11				Function coefficients to determine the residual moisture content of the NorthMet tailings	DBS&A Analysis and Report	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
AirSuct_Coeff	[--]	Deterministic	N/A	Constant	Function coefficients. Reference Table 1-11				Function coefficients to determine the air entry suction parameter of the NorthMet tailings	DBS&A Analysis and Report	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
VGBeta_Coeff	[--]	Deterministic	N/A	Constant	Function coefficients. Reference Table 1-11				Function coefficients to determine the Van Genuchten parameter β of the NorthMet tailings	DBS&A Analysis and Report	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
BNT_SG	[--]	Deterministic	N/A	Constant	3.0	N/A	N/A	N/A	Specific gravity of the bentonite amended tailings	The same as the specific gravity of the NorthMet Flotation Tailings	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
BNT_Porosity	[cm^3/cm^3]	Deterministic	N/A	Constant	0.36	N/A	N/A	N/A	Porosity of the bentonite amended tailings	HYDRUS model database for a silty-clay	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
BNT_Ksat	[cm/s]	Deterministic	N/A	Constant	5.56E-06	N/A	N/A	N/A	Saturated hydraulic conductivity of the bentonite amended tailings	HYDRUS model database for a silty-clay	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
BNT_ResMoist	[cm^3/cm^3]	Deterministic	N/A	Constant	0.07	N/A	N/A	N/A	Residual moisture content of the bentonite amended tailings	HYDRUS model database for a silty-clay	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
BNT_AirSuct	[1/cm]	Deterministic	N/A	Constant	0.005	N/A	N/A	N/A	Air entry suction parameter for the bentonite amended tailings	HYDRUS model database for a silty-clay	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
BNT_VGBeta	[--]	Deterministic	N/A	Constant	1.09	N/A	N/A	N/A	Van Genuchten Beta parameter for the bentonite amended tailings	HYDRUS model database for a silty-clay	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
LTVSMC Tailings Hydraulic Properties											
LTVSMC_SG	[--]	Deterministic	N/A	Constant	Vector by tailings type. Reference Table 1-12a				Specific gravity of the different classes of the LTVSMC tailings	Unsaturated geotechnical modeling	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
LTVSMC_Porosity	[cm^3/cm^3]	Deterministic	N/A	Constant	Vector by tailings type. Reference Table 1-12a				Porosity of the different classes of the LTVSMC tailings	Unsaturated geotechnical modeling	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
LTVSMC_Ksat	[cm/s]	Deterministic	N/A	Constant	Matrix by tailings and Cell. Reference Table 1-12a & Table 1-12b				Saturated hydraulic conductivity of the LTVSMC tailings	Unsaturated geotechnical modeling	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
LTVSMC_ResMoist	[cm^3/cm^3]	Deterministic	N/A	Constant	Vector by tailings type. Reference Table 1-12a				Residual moisture content of the LTVSMC tailings	Unsaturated geotechnical modeling	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
LTVSMC_AirSuct	[1/cm]	Deterministic	N/A	Constant	Vector by tailings type. Reference Table 1-12a				Air entry suction parameter for the LTVSMC tailings	Fitted curves to data from the unsaturated geotechnical modeling	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
LTVSMC_VGBeta	[--]	Deterministic	N/A	Constant	Vector by tailings type. Reference Table 1-12a				Van Genuchten Beta parameter for the LTVSMC tailings	Fitted curves to data from the unsaturated geotechnical modeling	Waste Section 10.3 - *Saturation and Oxygen Diffusion*

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*
Saturation-Diffusion Inputs											
O2_Air_Diff	[m^2/s]	Deterministic	N/A	Constant	1.80E-05	N/A	N/A	N/A	Free diffusion coefficient of oxygen in air	Cussler, 1997	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
O2_Water_Diff	[m^2/s]	Deterministic	N/A	Constant	2.20E-09	N/A	N/A	N/A	Free diffusion coefficient of oxygen in water	Cussler, 1997	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
Tortuosity	[--]	Deterministic	N/A	Constant	0.273	N/A	N/A	N/A	Tortuosity factor	Elberling, 1993	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
C	[--]	Deterministic	N/A	Constant	3.28	N/A	N/A	N/A	Empirical coefficient in the Elberling equation	Elberling, 1993	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
KH	[--]	Deterministic	N/A	Constant	33.9	N/A	N/A	N/A	Henry's constant for oxygen	Known value	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
O2_Conc_Air	[mol/m^3]	Deterministic	N/A	Constant	8.89	N/A	N/A	N/A	Concentration of oxygen in the air (boundary condition)	Known value	Waste Section 10.3 - *Saturation and Oxygen Diffusion*
Pond_DO (see Table 1-18)	[mg/L]	Uncertain	Monthly	Normal	Pond_DO_Mean	Pond_DO_SD	N/A	N/A	Oxygen concentration in the tailings basin ponds which seeps into the tailings generating chemical load	DO saturation at expected yet conservative pond water temperatures	Waste Section 10.6.1 - *Oxidation of Saturated Tailings*
NorthMet Tailings Chemical Loading											
NM_Fines_Release	[varies]	Uncertain	Realization	Varies	Vector by constituent. Reference Table 1-13				Distribution parameters for constituent release rates and ratios from the fine fraction of the NorthMet tailings	Analysis of HCT, Aqua Regia, and Microprobe data	Waste Section 10.1.1 - *NorthMet Tailings*
NM_Coarse_Release	[varies]	Uncertain	Realization	Varies	Vector by constituent. Reference Table 1-14				Distribution parameters for constituent release rates and ratios from the coarse fraction of the NorthMet tailings	Analysis of HCT, Aqua Regia, and Microprobe data	Waste Section 10.1.1 - *NorthMet Tailings*
Ratio_or_Conc_NM	[--]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-13 & Table 1-14				Defines whether a release rate is from a release ratio (1) or from a concentration (0)	Release Method	Waste Section 10.1.1 - *NorthMet Tailings*
Atmospheric_pH	[--]	Uncertain	Realization	Uniform	N/A	N/A	7.8	8.1	Estimate of the pH in the areas of the FTB dominated by advection of surface water	See Mine Site Work Plan Tables	Waste Section 10.4 - *Concentration Caps*
Enriched_pH	[--]	Uncertain	Realization	Discrete	7.1	N/A	N/A	N/A	Estimate of the pH in the CO2 enriched areas of the FTB	CDF056	Waste Section 10.4 - *Concentration Caps*
NM_Solubility	[mg/L]	Uncertain	Realization	Varies	Vector by constituent. Reference Table 1-15				Concentration cap distributions for each constituent in the NorthMet Tailings	Category 1 Waste Rock	Waste Section 10.4 - *Solubility Limits*
NM_Content	[mg/kg]	Deterministic	N/A	Constant	Matrix by Constituent and Tailings Class. Reference Table 1-16				Whole tailings content for depletion modeling	Aqua Regia data	Waste Section 10.6.6 - *Depletion*
NM_Tailings_Weathering	[mg/m^2/mon]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-17				Weathering rate by the NorthMet tailings beaches	RS46	Waste Section 10.6.2 - *Tailings Weathering*
LTVSMC Tailings Chemical Loading											
Dist_Params_LTVSMC_Release	[varies]	Uncertain	Realization	Varies	Matrix by constituent and parameter. Reference Table 1-19				Distribution parameters for the release rates from the existing LTVSMC tailings	Analysis of HCT, Aqua Regia, and Microprobe data	Waste Section 10.1.2 - *LTVSMC Tailings*
LTVSMC_Flush	[mg/kg]	Uncertain	Realization	Beta	Matrix by constituent and parameter. Reference Table 1-20				One-time loading from the disturbed LTVSMC tailings as the dams are constructed	Analysis of HCT, Aqua Regia, and Microprobe data	Waste Section 10.1.2 - *LTVSMC Tailings*
Coarse_Calib_Fact	[--]	Deterministic	N/A	Constant	0.185	N/A	N/A	N/A	Calibration factor to modify the SO4 release rate from the coarse LTVSMC tailings	Calibration of the existing conditions / No Action Model	Waste Section 10.2.1 - *Scaling / Calibration of LTVSMC Lab Data to Field Data*
Fine_Calib_Fact	[--]	Deterministic	N/A	Constant	0.360	N/A	N/A	N/A	Calibration factor to modify the SO4 release rate from the fine LTVSMC tailings	Calibration of the existing conditions / No Action Model	Waste Section 10.2.1 - *Scaling / Calibration of LTVSMC Lab Data to Field Data*
LTVSMC_Calib_Fact	[--]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-21				Calibration factor applied to each constituent so that the theoretical loading matches the observed seepage data	Calibration of the existing conditions / No Action Model	Waste Section 10.2.1 - *Scaling / Calibration of LTVSMC Lab Data to Field Data*
Ratio_or_Conc_LTV	[--]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-21				Defines whether a release rate is from a release ratio (1) or from a concentration (0)	Release Method	Waste Section 10.2.1 - *Scaling / Calibration of LTVSMC Lab Data to Field Data*
LTVSMC_Content	[mg/kg]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-22				Whole tailings content for depletion modeling	Aqua Regia data	Waste Section 10.6.6 - *Depletion*

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*
Geochemical Parameters for Scaling											
Activation_energy	[kJ/mol]	Uncertain	Realization	Uniform	N/A	N/A	47	63	Activation energy of pyrrhotite for the Arrhenius equation	Literature-reported range	Waste Section 8.3 - *Lab to Field Scale Up*
Contact_factor	[--]	Uncertain	Realization	Triangular	0.5	N/A	0.1	0.9	Fraction of Ore contacted by water	Professional judgement	Waste Section 8.3 - *Lab to Field Scale Up*
Field_temp	[C]	Uncertain	Annually	Normal	2.004	1.388	N/A	N/A	Average annual site air temperature, assumed the same temperature as the Ore and tailings	HiDen Climate data for 1981-2010	Waste Section 8.3 - *Lab to Field Scale Up*
O2_Mol_Weight	[g/mol]	Deterministic	N/A	Constant	32.00	N/A	N/A	N/A	Molecular weight of oxygen	Known value	Waste Section 10.1.1 - *NorthMet Tailings*
SO4_Mol_Weight	[g/mol]	Deterministic	N/A	Constant	96.07	N/A	N/A	N/A	Molecular weight of sulfate	Known value	Waste Section 10.1.1 - *NorthMet Tailings*
S_Mol_Weight	[g/mol]	Deterministic	N/A	Constant	32.07	N/A	N/A	N/A	Molecular weight of sulfide	Known value	Waste Section 10.1.1 - *NorthMet Tailings*
Lab_temp	[C]	Deterministic	N/A	Constant	20	N/A	N/A	N/A	Laboratory temperature (known)	RS 53/42	Waste Section 8.3 - *Lab to Field Scale Up*
Size_factor	[--]	Uncertain	Realization	Trunc. Normal	0.18	0.061	0	1.00E+10	Scaling factor to adjust to field scale Ore	Analysis of Equity Silver Mine data	Waste Section 8.3 - *Lab to Field Scale Up*
Scale_Factor_LAM	[--]	Uncertain	Annually	Beta	0.128	0.085	0.019	0.687	Scaling factor for buttress material	MDNR Analysis of Dunka Mine Data	Waste Section 10.6.5 - *Buttress Material*
Sulfate_gen_ratio	[mol SO4 / mol O2]	Deterministic	N/A	Constant	0.444	N/A	N/A	N/A	Ratio of the number of moles of sulfate produced for every mole of oxygen consumed	Pyrrhotite reaction stoichiometry	Waste Section 10.3 - *Saturation and Oxygen Diffusion*

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*
Engineered Dam Characteristics											
Dam_Volume	[yard^3]	Deterministic	N/A	Time Series	Time series by dam. Reference Table 1-23				Cumulative volume of bulk LTVSMC tailings used to construct the FTB dams through time	Flotation Tailings Basin design	Water Section 5.1.1 - *Flotation Tailings Basin (FTB) Design*
Dam_Outer_Area	[acre]	Deterministic	N/A	Time Series	Time series by dam. Reference Table 1-23				The surface area of the outer slope of the dams of the FTB	Flotation Tailings Basin design	Water Section 5.1.1 - *Flotation Tailings Basin (FTB) Design*
Crest_Elevation	[ft]	Deterministic	N/A	Time Series	Time series. Reference Table 1-24				The elevation of the top of the dams of the FTB	Flotation Tailings Basin design	Water Section 5.1.1 - *Flotation Tailings Basin (FTB) Design*
Crest_Area	[acre]	Deterministic	N/A	Time Series	Time series. Reference Table 1-24				The plan-view area within the dam crest (helps define the storage volume within the FTB)	Flotation Tailings Basin design	Water Section 5.1.1 - *Flotation Tailings Basin (FTB) Design*
Beach_Elevation	[ft]	Deterministic	N/A	Time Series	Time series. Reference Table 1-24				Elevation of the NorthMet tailings beach where it meets the constructed dams of the FTB	Flotation Tailings Basin design	Water Section 5.1.1 - *Flotation Tailings Basin (FTB) Design*
Beach_Areas	[acres]	Deterministic	N/A	Time Series	Time series by dam. Reference Table 1-24				Areas of the NorthMet tailings beaches that are contributing load to the seepage	Flotation Tailings Basin design	Water Section 5.1.1 - *Flotation Tailings Basin (FTB) Design*
Beach_Slope	[%]	Deterministic	N/A	Constant	1.0	N/A	N/A	N/A	The slope of the beach formed using NorthMet tailings from the dam to the pond's edge	Flotation Tailings Basin design, validated by SAFL Deposition study	Waste Section 5.1.3.1 - *Depositional Study*
Beach_Width	[ft]	Deterministic	N/A	Constant	625	N/A	N/A	N/A	The width of the beach formed using NorthMet tailings from the dam to the pond's edge	Flotation Tailings Basin design	Water Section 6.1.3.2 - *Beneficiation Plant Slurry*
Delta_Angle	[deg]	Deterministic	N/A	Constant	75	N/A	N/A	N/A	The angle at which spigotted water and tailings will spread as they flow down the NorthMet tailings beach	Value carried forward from RS-13B	Water Section 6.1.3.2 - *Beneficiation Plant Slurry*
Delta_Flow_Frac	[%]	Deterministic	N/A	Constant	30	N/A	N/A	N/A	The fraction of the delta area that is receiving active flow	Value carried forward from RS-13B	Water Section 6.1.3.2 - *Beneficiation Plant Slurry*
Dam_Flow_Direction	[%]	Deterministic	N/A	Time Series	Time series by dam and by toe. Reference Table 1-25				Time series of the proportion of water that flows through the dams that will report to each toe of the FTB	MODFLOW model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Dam_Sat_Volume	[acre-ft]	Deterministic	N/A	Time Series	Time series by dam and by toe. Reference Table 1-26				Time series of the proportion of water that flows through the dams that will report to each toe of the FTB	MODFLOW model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Beach_Flow_Direction	[%]	Deterministic	N/A	Time Series	Time series by dam and by toe. Reference Table 1-27				Time series of the proportion of water that flows through the beaches that will report to each toe of the FTB	MODFLOW model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Beach_Sat_Volume	[acre-ft]	Deterministic	N/A	Time Series	Time series by dam and by toe. Reference Table 1-28				Time series of the proportion of water that flows through the beaches that will report to each toe of the FTB	MODFLOW model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Dam_WT_Depth	[ft]	Deterministic	N/A	Time Series	Time series by Dam. Reference Table 1-29				Time series of the depth to the phreatic surface under each Dam (where chemical production would cease)	MODFLOW model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Beach_WT_Depth	[ft]	Deterministic	N/A	Time Series	Time series by Dam. Reference Table 1-29				Time series of the depth to the phreatic surface under each NorthMet tailings beach	MODFLOW model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Buttresses											
N_Buttress_Volume	[yard^3]	Deterministic	N/A	Time Series	Time series by buttress. Reference Table 1-23				Volume of the north buttress	Flotation Tailings Management Plan	Water (Volume 1) Section 6.1.1 - *Stockpile Hydrology Modeling*
N_Buttress_Area	[acres]	Deterministic	N/A	Time Series	Time series by buttress. Reference Table 1-23				Area of the North Buttress	CAD drawing of the proposed Flotation Tailings Basin	Water (Volume 1) Section 6.1.1 - *Stockpile Hydrology Modeling*
S_Buttress_Volume	[yard^3]	Deterministic	N/A	Time Series	Time series by buttress. Reference Table 1-23				Volume of the south buttress	Flotation Tailings Management Plan	Water (Volume 1) Section 6.1.1 - *Stockpile Hydrology Modeling*
S_Buttress_Area	[acres]	Deterministic	N/A	Time Series	Time series by buttress. Reference Table 1-23				Area of the South Buttress	CAD drawing of the proposed Flotation Tailings Basin	Water (Volume 1) Section 6.1.1 - *Stockpile Hydrology Modeling*
Buttress_Sulfur	[%]	Deterministic	N/A	Constant	0.063	N/A	N/A	N/A	Mass-weighted average sulfur content of the buttresses	See Mine Site Work Plan Tables	Waste Section 4.3.2 - *Sulfur Content*
Buttress_Content	[mg/kg]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-16				Content of constituent of concern in waste rock	Analysis of Aqua Regia Data	Waste Section 8.4.1 - *Depletion*
Buttress_Bulk_Density	[lbs/ft^3]	Deterministic	N/A	Constant	140	N/A	N/A	N/A	Bulk density of the material used to form the buttresses	Geotechnical design group	Water Section 6.1.3.8 - *Buttresses*

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*
Flotation Tailings Basin Details											
Pond_Bottom_Area	[acre]	Deterministic	N/A	Time Series	Time series. Reference Table 1-30				The plan-view area of the bottom of the FTB pond	Flotation Tailings Basin design	Water Section 5.1.1 - *Flotation Tailings Basin (FTB) Design*
Pond_Top_Area	[acre]	Deterministic	N/A	Time Series	Time series. Reference Table 1-30				The plan-view area of the top of the FTB pond (where optimum depth is reached and the slope breaks)	Flotation Tailings Basin design	Water Section 5.1.1 - *Flotation Tailings Basin (FTB) Design*
Design_Depth	[ft]	Deterministic	N/A	Constant	8	N/A	N/A	N/A	Designed optimum depth of the FTB pond	Flotation Tailings Basin design	Water Section 5.1.1 - *Flotation Tailings Basin (FTB) Design*
Pond_Slope	[%]	Deterministic	N/A	Constant	3	N/A	N/A	N/A	The slope of the NorthMet tailings under the FTB pond water surface	Flotation Tailings Basin design	Water Section 5.1.1 - *Flotation Tailings Basin (FTB) Design*
Pond_Seepage_Rate	[in/yr]	Deterministic	N/A	Time Series	Time series. Reference Table 1-31				Seepage rate of water from the FTB pond into the saturated NorthMet tailings	MODFLOW model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Pond_Seepage_Direction	[%]	Deterministic	N/A	Time Series	Time series by toe. Reference Table 1-31				Time series of the proportion of water that seeps from the pond that will report to each toe of the FTB	MODFLOW model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Pond_Saturated_Volume	[acre-ft]	Deterministic	N/A	Time Series	Time series. Reference Table 1-31				Time series of the volume of saturated tailings below the NorthMet Flotation Tailings pond	MODFLOW model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Initial_Pond_Volume	[acre-ft]	Deterministic	N/A	Constant	1800	N/A	N/A	N/A	Volume of the water that is currently in Cell 2E where the FTB pond will begin	Using the area of the pond from the MODFLOW model and assuming a 3 meter depth	Water Section 5.4.5 - *MODFLOW Model*
Pond_1E_Volume	[acre-ft]	Deterministic	N/A	Constant	3700	N/A	N/A	N/A	Volume of the water that is currently in Cell 1E	Using the area of the pond from the MODFLOW model and assuming a 3 meter depth	Water Section 5.4.5 - *MODFLOW Model*
Cell1E_Pond_Surf_Area	[m^2]	Deterministic	N/A	Constant	1513672	N/A	N/A	N/A	Existing surface area of the pond in Cell 1E	MODFLOW model of the Tailings Basin	
Contr_Embank_Area	[acres]	Deterministic	N/A	Time Series	Time series. Reference Table 1-32				Area contributing runoff to Cells 1E & 2E from the embankments of Cell 2W	Contour data and Flotation Tailings Basin Design	Water Section 6.1.3.1 - *Climate*
Contr_Watershed	[acres]	Deterministic	N/A	Time Series	Time series. Reference Table 1-32				Area contributing runoff to Cells 1E & 2E from the surrounding forested areas	Contour data and Flotation Tailings Basin Design	Water Section 6.1.3.1 - *Climate*
Pond_Transport_Time	[yr]	Deterministic	N/A	Constant	5	N/A	N/A	N/A	Transport time for flow and load from under the ponds in the FTB	Assumed value in RS74B, September 2008, Figure 8-11	Water Section 6.1.3.5 - *Seepage and Seepage Recovery*
Interior_Transport_Time	[yr]	Deterministic	N/A	Constant	7	N/A	N/A	N/A	Transport time for flow and load from the NorthMet beaches and the coarse and fine interior LTVSMC tailings	Assumed value in RS74B, September 2008, Figure 8-10	Water Section 6.1.3.5 - *Seepage and Seepage Recovery*
Dam_Transport_Time	[yr]	Deterministic	N/A	Constant	10	N/A	N/A	N/A	Transport time for flow and load from the dams of the FTB	Assumed value in RS74B, September 2008, Figure 8-9	Water Section 6.1.3.5 - *Seepage and Seepage Recovery*
Erlang_Dispersion	[--]	Deterministic	N/A	Constant	25	N/A	N/A	N/A	A value greater than or equal to 1 representing some amount of dispersion where 1 is the maximum amount of dispersion.	Assumed	Water Section 6.1.3.5 - *Seepage and Seepage Recovery*

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*
Existing LTVSMC Tailings Basin											
Cell_Areas	[m^2]	Deterministic	N/A	Time Series	Time series by Cell and by tailings class. Reference Table 1-33				Reactive areas of the tailings in the existing Tailings Basin	MODFLOW Model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Cell_WT_Depths	[ft]	Deterministic	N/A	Time Series	Time series by Cell and by tailings class. Reference Table 1-34				Depth to the phreatic surface in the existing Tailings Basin	MODFLOW Model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Cell2W_Seepage_Direction	[%]	Deterministic	N/A	Time Series	Time series by Cell and by tailings class. Reference Table 1-35				Percent of seepage within each zone of Cell 2W that reports to each toe of the Tailings Basin	MODFLOW Model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Cell2W_Sat_Volume	[acre-ft]	Deterministic	N/A	Time Series	Time series by tailings class and by toe. Reference Table 1-36				Saturated volume of tailings below each zone in Cell 2W that reports to each toe of the Tailigns Basin	MODFLOW Model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Cell2E_Seepage_Direction	[%]	Deterministic	N/A	Time Series	Time series by tailings class and by toe. Reference Table 1-37				Percent of seepage within each zone of Cell 2E that reports to each toe of the Tailings Basin	MODFLOW Model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Cell2E_Sat_Volume	[acre-ft]	Deterministic	N/A	Time Series	Time series by tailings class and by toe. Reference Table 1-38				Saturated volume of tailings below each zone in Cell 2E that reports to each toe of the Tailigns Basin	MODFLOW Model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Cell1E_Seepage_Direction	[%]	Deterministic	N/A	Time Series	Time series by tailings class and by toe. Reference Table 1-39				Percent of seepage within each zone of Cell 1E that reports to each toe of the Tailings Basin	MODFLOW Model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Cell1E_Sat_Volume	[acre-ft]	Deterministic	N/A	Time Series	Time series by tailings class and by toe. Reference Table 1-40				Saturated volume of tailings below each zone in Cell 1E that reports to each toe of the Tailigns Basin	MODFLOW Model of the FTB through time	Water Section 5.4.5 - *MODFLOW Model*
Initial_Pond_Concs_2E	[mg/L]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-44				Initial concentrations in the pond water in Cell 2E	Samples where available, model calibration of existing conditions at the toes.	Waste Section 10.2.1 - *Scaling / Calibration to LTVSMC Field Data*
Initial_Pond_Concs_1E	[mg/L]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-44				Initial concentrations in the pond water in Cell 1E	Samples where available, model calibration of existing conditions at the toes.	Waste Section 10.2.1 - *Scaling / Calibration to LTVSMC Field Data*
Cell2E_Exist_Seepage	[in/yr]	Deterministic	N/A	Constant	46.0	N/A	N/A	N/A	Seepage rate from the existing pond in Cell 2E	MODFLOW Model of the existing Tailings Basin	Water Section 5.4.5 - *MODFLOW Model*
Cell1E_Exist_Seepage	[in/yr]	Deterministic	N/A	Constant	48.7	N/A	N/A	N/A	Seepage rate from the existing pond in Cell 1E	MODFLOW Model of the existing Tailings Basin	Water Section 5.4.5 - *MODFLOW Model*
Hydrometallurgical Residue Facility											
V_El	[acre-ft]	Deterministic	N/A	Time Series	Lookup Table. Reference Table 1-41				Volume as a function of elevation of the final constructed HRF	CAD design of the facility	Water Section 6.1.5 - *Hydrometallurgical Residue Facility (HRF)*
A_El	[acre]	Deterministic	N/A	Time Series	Lookup Table. Reference Table 1-41				Area as a function of elevation of the final constructed HRF	CAD design of the facility	Water Section 6.1.5 - *Hydrometallurgical Residue Facility (HRF)*
Crest_El	[ft]	Deterministic	N/A	Time Series	Time series. Reference Table 1-42				Crest elevation of the dams constructed to form the HRF	CAD design of the facility	Water Section 6.1.5 - *Hydrometallurgical Residue Facility (HRF)*
Forest_WS_Area	[acre]	Deterministic	N/A	Time Series	Time series. Reference Table 1-42				Area of the forested contributing watershed to the south-west of the HRF	CAD design of the facility	Water Section 6.1.5.1 - *Climate*
Cell2W_WS_Area	[acre]	Deterministic	N/A	Time Series	Time series. Reference Table 1-42				Area of Cell 2W that contributes runoff to the HRF	CAD design of the facility	Water Section 6.1.5.1 - *Climate*
Residue_Porosity	[cm^3/cm^3]	Uncertain	Realization	Triangular	0.57	N/A	0.53	0.61	Porosity of the hydrometallurgical residue	RS13, March 2007	Water Section 6.1.5.3 - *Entrainment*
Residue_Sp_Gr	[--]	Deterministic	N/A	Constant	2.76	N/A	N/A	N/A	Specific gravity of the hydrometallurgical residue	Bateman MetSim model	Water Section 6.1.5.3 - *Entrainment*
Residue_Sat_K	[cm/s]	Deterministic	N/A	Constant	3.40E-05	N/A	N/A	N/A	Saturated hydraulic conductivity of the hydrometallurgical residue	NorthMet Data Package - Geotechnical, Volume 2	Water Section 6.2.3 - *Hydrometallurgical Residue Facility (HRF) in Closure*
Geomembrane_Defect_Size	[cm]	Deterministic	N/A	Constant	1	N/A	N/A	N/A	Assumed diameter of a circular defect in the upper geomembrane liner under the HRF	Values assumed for the same geomembrane liners at the Mine Site used to determine leakage rates	Water Section 6.2.3 - *Hydrometallurgical Residue Facility (HRF) in Closure*
Defects_Per_Acre	[1/acre]	Uncertain	Realization	Lognormal	2	1.82	N/A	N/A	Number of defects per acre in the geomembrane liner	Values assumed for the same geomembrane liners at the Mine Site used to determine leakage rates	Water Section 6.2.3 - *Hydrometallurgical Residue Facility (HRF) in Closure*

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*
Beneficiation Plant											
Clean_H2O_Demand	[gpm]	Deterministic	N/A	Constant	3.29	N/A	N/A	N/A	Clean water demand from the concentrator process	RS13B, Attachment A-7, applying Plant_Uptime	Water Section 6.1.2 - *Beneficiation Plant*
Total_H2O_Demand	[gal/yr]	Deterministic	N/A	Constant	7.5901E+09	N/A	N/A	N/A	Total flow rate of water needed by the concentrator plant	Bateman Water Balance (June 2011)	Water Section 6.1.2 - *Beneficiation Plant*
Process_H2O_Discharge	[gal/yr]	Deterministic	N/A	Constant	7.9217E+09	N/A	N/A	N/A	Flow rate of water discharged from the concentrator process	Bateman Water Balance (June 2011)	Water Section 6.1.2 - *Beneficiation Plant*
Other_H2O_Discharge	[gpm]	Deterministic	N/A	Constant	26.3	N/A	N/A	N/A	Flow rate of water discharged to the FTB from other water uses	RS13B, Attachment A-7, applying Plant_Uptime	Water Section 6.1.2 - *Beneficiation Plant*
Solids_Discharge	[ton/yr]	Deterministic	N/A	Constant	1.235E+07	N/A	N/A	N/A	Flow rate of solids from the concentrator plant to the FTB	Flotation Tailings Management Plan	Water Section 6.1.2 - *Beneficiation Plant*
Reagant_Load	[g/ton]	Deterministic	N/A	Constant	55	N/A	N/A	N/A	Grams CuSO4 per ton of ore processed	RS46, July 2007	Waste Section 10.6.4 - *Process Water Loading to Pond*
Ore_Processing_Rate	[ton/day]	Deterministic	N/A	Constant	30,860	N/A	N/A	N/A	Tons per day of ore processed by the Beneficiation Plant	Mine Plan	Waste Section 10.6.4 - *Process Water Loading to Pond*
SO4_S_Regression	[mg/kg/week/%]	Uncertain	Realization	Normal	13.92	0.581	N/A	N/A	Sulfate release as a function of sulfur content (%S)	See Mine Site Work Plan Table 1-27	Waste Section 8.1.1.1.2 - *Correction for Non-Constant Variance*
OSP_Sulfur	[%]	Deterministic	N/A	Constant	0.608	N/A	N/A	N/A	Mass-weighted average sulfur content of stockpile	See Mine Site Work Plan Tables	Waste Section 4.3.2 - *Sulfur Content*
Ore_Storage_Time	[mon]	Uncertain	Realization	Uniform	N/A	N/A	1	6	Length of time that any unit of ore is stored in in-pit stockpiles	Assumed	Waste Section 10.6.3.1 *Ore Leaching Load*
Plant_Uptime	[%]	Deterministic	N/A	Constant	91.26	N/A	N/A	N/A	Annual average percent of time the plant is running	Bateman Water Balance (June 2011)	Water Section 6.1.2 - *Beneficiation Plant*
Hydrometallurgical Plant											
Clean_H2O_Demand	[gpm]	Deterministic	N/A	Constant	124.9	N/A	N/A	N/A	Clean water demand from the hydrometallurgical process	RS13B, Attachment A-7, applying Plant_Uptime	Water Section 6.1.4 - *Hydrometallurgical Plant*
Total_H2O_Demand	[gal/yr]	Deterministic	N/A	Constant	2.342E+08	N/A	N/A	N/A	Total flow rate of water needed by the hydromet plant	Bateman Water Balance (June 2011)	Water Section 6.1.4 - *Hydrometallurgical Plant*
Process_H2O_Discharge	[gal/yr]	Deterministic	N/A	Constant	1.144E+08	N/A	N/A	N/A	Flow rate of water discharged from the hydromet process	Bateman Water Balance (June 2011)	Water Section 6.1.4 - *Hydrometallurgical Plant*
Other_H2O_Discharge	[gpm]	Deterministic	N/A	Constant	26.3	N/A	N/A	N/A	Flow rate of water discharged to the HRF from other water uses	RS13B, Attachment A-7, applying Plant_Uptime	Water Section 6.1.4 - *Hydrometallurgical Plant*
Solids_Discharge	[ton/yr]	Deterministic	N/A	Constant	3.342E+05	N/A	N/A	N/A	Flow rate of solids from the hydrometallurgical plant to the HRF	Residue Management Plan	Water Section 6.1.4 - *Hydrometallurgical Plant*

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*
Flotation Tailings Basin Waste Water Treatment Plant											
Effluent_Perc_Influent	[%]	Deterministic	N/A	Constant	85	N/A	N/A	N/A	Percent of the influent flow to the FTB WWTP that is discharged to SD026 and SD006	Barr Memo, NorthMet Tailings Basin Water Treatment, August 2011	Water Section 6.1.3.6 - *FTB WWTP*
MaxFlow_SD026	[gpm]	Deterministic	N/A	Constant	500	N/A	N/A	N/A	Maximum flow to existing outfall SD026 from the FTB WWTP	Refined Embarrass Lake Wild Rice Mitigation Memo, June 2011	Water Section 6.1.3.6 - *FTB WWTP*
Backwash_Perc_Influent	[%]	Deterministic	N/A	Constant	5	N/A	N/A	N/A	Percent of the influent flow required for backwashing the greensand filter	Barr Memo, NorthMet Tailings Basin Water Treatment, August 2011	Water Section 6.1.3.6 - *FTB WWTP*
Effluent_Conc	[mg/L]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-43				Quality of the discharge from the Flotation Tailings Basin WWTP	Barr Memo, NorthMet Tailings Basin Water Treatment, August 2011	Water Section 6.1.3.6 - *FTB WWTP*
Fe_Backwash_Conc	[mg/L]	Deterministic	N/A	Constant	4	N/A	N/A	N/A	Iron concentration in the greensand filter backwash	Barr Memo, NorthMet Tailings Basin Water Treatment, August 2011	Water Section 6.1.3.6 - *FTB WWTP*
Mn_Backwash_Conc	[mg/L]	Deterministic	N/A	Constant	30	N/A	N/A	N/A	Manganese concentration in the greensand filter backwash	Barr Memo, NorthMet Tailings Basin Water Treatment, August 2011	Water Section 6.1.3.6 - *FTB WWTP*
K_Backwash_Conc	[mg/L]	Deterministic	N/A	Constant	11	N/A	N/A	N/A	Potassium concentration in the greensand filter backwash	Barr Memo, NorthMet Tailings Basin Water Treatment, August 2011	Water Section 6.1.3.6 - *FTB WWTP*
Babbitt WWTP											
Babbitt_Flow	[cfs]	Deterministic	N/A	Constant	0.33	N/A	N/A	N/A	Flow from the Babbitt WWTP	RS74B	Water Section 4.4.2.2 - *Babbitt WWTP*
Area 5NW											
Area5_Summer	[cfs]	Uncertain	Timestep	Lognormal	2.127	1.798	N/A	N/A	Flow from Area 5NW during summer months	Analysis of measured flow data at SD033	Water Section 5.5.4 - *Pit 5NW (SD033) Discharge*
Area5_Winter	[cfs]	Uncertain	Timestep	Lognormal	1.177	0.888	N/A	N/A	Flow from Area 5NW during winter months	Analysis of measured flow data at SD033	Water Section 5.5.4 - *Pit 5NW (SD033) Discharge*
Area5_Snowmelt	[cfs]	Uncertain	Timestep	Uniform	N/A	N/A	0.774	7.271	Flow from Area 5NW during snowmelt months	Analysis of measured flow data at SD033	Water Section 5.5.4 - *Pit 5NW (SD033) Discharge*
Area5NW_Conc	[mg/L]	Deterministic	N/A	Constant	Vector by constituent. Reference Table 1-44				Concentration of water that discharges from the Area 5NW Pit	RS74B	Water Section 5.3.5 - *Pit 5NW (SD033) Discharge*

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*
Groundwater Flow Path Characteristics											
HD	[m]	Deterministic	N/A	Constant	Vector by flowpath. Reference Table 1-46				Downstream water table elevation	GIS data/calculations	Water Section 5.4.2 - *Modeled Groundwater Flow Paths*
D	[m]	Deterministic	N/A	Constant	7	N/A	N/A	N/A	Aquifer thickness	Average thickness of the saturated material	Water Section 5.4.2 - *Modeled Groundwater Flow Paths*
La	[m]	Deterministic	N/A	Constant	Vector by flowpath. Reference Table 1-46				Total flow path length	GIS data/calculations	Water Section 5.4.2 - *Modeled Groundwater Flow Paths*
w	[m]	Deterministic	N/A	Constant	Vector by flowpath. Reference Table 1-46				Average flow path width	GIS data/calculations	Water Section 5.4.2 - *Modeled Groundwater Flow Paths*
Init_Grad	[--]	Deterministic	N/A	Constant	Vector by flowpath. Reference Table 1-46				Initial hydraulic gradient (determines flow capacity)	GIS data/calculations	Water Section 5.4.1.2 - *Groundwater Flow Paths*
Eval_Loc1	[m]	Deterministic	N/A	Constant	Vector by flowpath. Reference Table 1-46				Length from the upstream end to the first evaluation location on the flow path	GIS data/calculations	Water Section 5.4.2 - *Modeled Groundwater Flow Paths*
Recharge	[in/yr]	Uncertain	Realization	Triangular	0.6	N/A	0.3	1.5	Uniformly distributed recharge rate to the flow path	Most likely based on baseflow estimates, bounds based on using 1/2 the mode and 2.5 times the mode	Water Section 5.4.4.1 - *Recharge*
Perc_Flow_to_PM12_4	[%]	Deterministic	N/A	Constant	7.21	N/A	N/A	N/A	Percent of the groundwater flow path discharge that goes to PM-12.4; 0.44 mi2 / 6.10 mi2	CDF051	
Groundwater Flow Variables											
Surficial_Porosity	[--]	Deterministic	N/A	Constant	0.3	N/A	N/A	N/A	Porosity of the surficial aquifer	Assumed value, e.g. Fetter, 2001	Water Section 4.5.1 - *Water Quantity*
K_Surficial	[m/d]	Uncertain	Realization	Lognormal	4.0	1.6	N/A	N/A	Hydraulic Conductivity of the surficial aquifer	Mean based on aquifer tests, minimum value based on the limits of the recharge distribution	Water Section 4.3.2.2 - *Surficial Aquifer* & Section 5.4.4.1 - *Recharge*
Surficial_Density	[kg/m^3]	Deterministic	N/A	Constant	1,500	N/A	N/A	N/A	Dry (bulk) Density of the surficial deposits	USDA St. Louis County Soil Survey Database	Water Section 5.4.3 - *Sorption*
As_Kd	[L/kg]	Deterministic	N/A	Constant	25	N/A	N/A	N/A	Sorption coefficients for As in the surficial aquifer	EPA screening-level values	Water Section 5.4.3 - *Sorption*
Cu_Kd	[L/kg]	Deterministic	N/A	Constant	22	N/A	N/A	N/A	Sorption coefficients for Cu in the surficial aquifer	EPA screening-level values	Water Section 5.4.3 - *Sorption*
Ni_Kd	[L/kg]	Deterministic	N/A	Constant	16	N/A	N/A	N/A	Sorption coefficients for Ni in the surficial aquifer	EPA screening-level values	Water Section 5.4.3 - *Sorption*
Sb_Kd	[L/kg]	Uncertain	Realization	Triangular	1.6	N/A	1.3	6.1	Sorption coefficients for Sb in the surficial aquifer	EPA screening-level values	Water Section 5.4.3 - *Sorption*

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*
Stream Reach Characteristics											
Flow_Control	[--]	Deterministic	N/A	Constant	Matrix, location by location. Reference Table 1-47				Controls which nodes contribute flow to other nodes	Surface water layout and stream order	Water Section 5.5 - *Surface Water Modeling*
XS_Area	[m^2]	Deterministic	N/A	Constant	Vector by location. Reference Table 1-48				Cross sectional area of each river reach	RS26 geomorphic surveys	Water Section 5.5 - *Surface Water Modeling*
Lengths	[m]	Deterministic	N/A	Constant	Vector by location. Reference Table 1-48				Incremental length upstream of each model node	GIS data	Water Section 5.5 - *Surface Water Modeling*
GW_Contr_Areas	[mi^2]	Deterministic	N/A	Constant	Vector by location. Reference Table 1-49				Un-impacted area contributing groundwater to the surface water evaluation nodes	GIS subwatersheds	Water Section 5.5 - *Surface Water Modeling*
Flowpath_Area	[mi^2]	Deterministic	N/A	Constant	Vector by location. Reference Table 1-49				Area of the modeled flow paths	GIS subwatersheds	Water Section 5.5 - *Surface Water Modeling*
SW_Contr_Areas	[mi^2]	Deterministic	N/A	Constant	Vector by location. Reference Table 1-49				Runoff contributing watershed area to each model node	GIS subwatersheds	Water Section 5.5 - *Surface Water Modeling*
FTBRO_Area	[mi^2]	Deterministic	N/A	Constant	Vector by location. Reference Table 1-49				Cell 2W area that runs off to the adjacent tributaries	GIS subwatersheds	Water Section 5.5 - *Surface Water Modeling*
Cell2EFTBRO	[mi^2]	Deterministic	N/A	Constant	Vector by location. Reference Table 1-49				Cell 2E area that runs off to the adjacent tributaries	GIS subwatersheds	Water Section 5.5 - *Surface Water Modeling*
Perc_NToe_MLC3	[%]	Deterministic	N/A	Constant	25	N/A	N/A	N/A	Percentage of the north toe surface seepage that travels to MLC-3 (the remainder goes to TC-1)	CDF051	
Stream Flow Variables											
Watershed_Yield	[cfs/mi^2]	Deterministic	Monthly	User-defined	User-defined Look-up Table by month. Reference Table 1-50				Randomly sampled daily total watershed yield as a function of month	USGS gage data	Water Section 5.5.2 - *Developing Probabilistic Model Inputs (Flow Distributions)*
Embarrass_Baseflow	[cfs/mi^2]	Deterministic	N/A	Constant	0.045	N/A	N/A	N/A	Baseflow added to Embarrass River nodes	Watershed wide average minimum 30-day flow	Water Section 4.4.1.3 - *Estimating Embarrass River Watershed Baseflow*
Model Initiation											
Initial_Mass_LTVSMC_Basin	[tonne]	Deterministic	N/A	Constant	Matrix by constituent and location. Reference Table 1-52				Initial mass of each constituent in each zone of existing Tailings Basin features	Average, steady-state results of the existing conditions GoldSim model	Water Section 5.9.1 - *Tailings Basin Initiation*
Initial_Mass_Rate	[kg/day]	Deterministic	N/A	Constant	Matrix by constituent and location. Reference Table 1-53				Initial rate at which constituent load is leaving areas of the existing Tailings Basin	Average, steady-state results of the existing conditions GoldSim model	Water Section 5.9.1 - *Tailings Basin Initiation*
Expected_Toe_Conc	[ug/L]	Deterministic	N/A	Constant	Matrix by constituent and location. Reference Table 1-54				Expected existing concentrations at the toes of the Tailings Basin to initiate groundwater concentrations	Average, steady-state results of the existing conditions GoldSim model	Water Section 5.9.2 - *Groundwater Flow Path Initiation*
Additional Inputs											
Max_Vol_To_Mine	[acre-ft]	Deterministic	N/A	Constant	50000	N/A	N/A	N/A	Maximum volume that can be sent to the Mine Site, determined by the Mine Site model	AWMP	
HRF_Drainage_Period	[yr]	Deterministic	N/A	Constant	10	N/A	N/A	N/A	Time it takes to drain the HRF	Residue Management Plan	
OPS_Treatment_Capacity	[gpm]	Deterministic	N/A	Constant	2000	N/A	N/A	N/A	Treatment capacity of the FTB WWTP during operations		
CLSR_Treatment_Capacity	[gpm]	Deterministic	N/A	Constant	3500	N/A	N/A	N/A	Flow to the treatment plant during reclamation		
GW_Capture_Eff	[%]	Deterministic	N/A	Constant	90	N/A	N/A	N/A	Efficiency of the groundwater containment system		

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Table 1-2 **Constant Surface Water Quality Standards (modeled constituents only)**

Constituent	*Surface_Constant_Standards (mg/L)*
Ag	0.001
Al	0.125
Alk	*999999*
As*	0.053
B	0.5
Ba	*999999*
Be	*999999*
Ca	*999999*
Cd†	*999999*
Cl	230
Co	0.005
Cr*	0.011
Cu†	*999999*
F	*999999*
Fe	*999999*
K	*999999*
Mg	*999999*
Mn	*999999*
Na	*999999*
Ni†	*999999*
Pb†	*999999*
Sb	0.031
Se*	0.005
SO_4 (non-wild rice areas)	*999999*
Tl	0.00056
V	*999999*
Zn†	*999999*

Notes

* From MN Rules 7052; all others from MN Rules 7050

** A value of 999999 indicates that there is no applicable standard

† See Table 1-4 for hardness-based standards

Table 1-3 **Coefficients for Hardness-Dependent Surface Water Quality Standards (modeled constituents only)**

Constituent	***A***	***B***
Cd*	0.7852	-2.715
Cu*	0.8545	-1.702
Ni*	0.846	0.0584
Pb	1.273	-4.705
Zn*	0.8473	0.884

Notes

Standard [mg/L] = exp(A*ln(total hardness [mg/L])+B)/1000

* From MN Rules 7052; all others from MN Rules 7050

$$Std\left({}^{mg}\!/\!_{L}\right) = \frac{e^{A\cdot\ln\left(Hardness\left({}^{mg}\!/\!_{L}\right)\right)+B}}{1000}$$

Table 1-4 **Groundwater Quality Standards (modeled constituents only)**

Constituent	*Ground_Primary_Standards** (mg/L)*	*Ground_Secondary_Standards** (mg/L)*
Ag*	0.03	0.1
Al†	*999999*	0.2
Alk	*999999*	*999999*
As	0.01	*999999*
B*	1	*999999*
Ba	2	*999999*
Be*	0.00008	*999999*
Ca	*999999*	*999999*
Cd*	0.004	*999999*
Cl	*999999*	250
Co	*999999*	*999999*
Cr	0.1	*999999*
Cu	*999999*	999999
F	4	2
Fe†	*999999*	0.3
K	*999999*	*999999*
Mg	*999999*	*999999*
Mn*†	0.1	0.05
Na	*999999*	*999999*
Ni*	0.1	*999999*
Pb	999999	*999999*
Sb	0.006	*999999*
Se*	0.03	*999999*
SO_4	*999999*	250
Tl*	0.0006	*999999*
V*	0.05	*999999*
Zn*	2	*5*

Notes

* Primary standard from MN Rules 4717 (HRLs); all others from MN Rules 7050 (EPA MCLs)

** A value of 999999 indicates that there is no applicable standard

† Secondary standards presented for reference but not used for impact assessment

Table 1-5 Average Background Groundwater Quality Distributions

Constituent	Source	Surficial Aquifer		
		GW_Alpha_Mean	GW_Beta	GW_Alpha_Stdev
Ag	All	-3.446	1.081	0.127
Al	All	2.859	1.673	0.208
Alk	All	11.170	0.774	0.093
As	Polymet	-0.788	0.485	0.111
B	Polymet	3.358	0.400	0.080
Ba	PolyMet	3.090	1.295	0.374
Be	Polymet	-1.832	0.886	0.177
Ca	All	9.876	0.976	0.116
Cd	Polymet*	-2.179	0.632	0.126
Cl	All	7.141	1.090	0.130
Co	Polymet	-1.952	0.876	0.253
Cr	All	-0.706	1.195	0.140
Cu	Polymet*	0.590	1.067	0.213
F	All	4.838	0.779	0.097
Fe	Polymet	3.682	0.740	0.174
K	All	7.188	0.974	0.116
Mg	All	9.023	0.937	0.111
Mn	Polymet*	4.898	1.581	0.316
Na	All	8.319	0.692	0.082
Ni	All	1.110	1.090	0.127
Pb	Polymet	-1.595	0.646	0.187
Sb	All	-2.878	1.761	0.260
Se	All	-0.344	0.853	0.126
SO_4	Polymet*	8.799	0.597	0.120
Tl	Polymet	-1.995	0.459	0.092
V	All	1.660	0.239	0.046
Zn	All	2.222	1.214	0.142

Notes

* Initially, the distribution (PolyMet Data or All Data) with the highest Mean was chosen. After further review, comparing the distribution to surface water samples and runoff calibrations, the PolyMet groundwater data was chosen IF it provided a better calibration to surface water data. The distribution from All Data was NEVER chosen if the Mean from All data was lower than the Mean from the PolyMet data.

Table 1-6 Existing Surface Runoff Concentrations

Constituent	***RO_Mean (ug/L)***	***RO_StDev (ug/L)***
Ag	1.30E-01	1.3E-03
Al	1.11E+02	4.1E+01
Alk	3.24E+04	3.5E+04
As	1.04E+00	1.0E-02
B	1.56E+01	1.6E-01
Ba	1.77E+00	7.9E-01
Be	5.12E-02	5.1E-04
Ca	6.22E+03	2.2E+03
Cd	6.82E-02	1.6E-02
Cl	5.15E+03	3.3E+03
Co	6.19E-01	2.0E-01
Cr	9.81E-01	9.8E-01
Cu	5.65E-01	7.5E-01
F	7.66E+01	7.4E+01
Fe	2.32E+03	9.6E+02
K	2.86E+02	1.9E+02
Mg	3.34E+03	7.7E+02
Mn	4.22E+01	2.7E+02
Na	2.34E+03	9.5E+01
Ni	2.53E-01	2.5E-03
Pb	2.74E-01	3.8E-01
Sb	2.42E-01	2.4E-03
Se	6.09E-01	4.5E-01
SO_4	3.08E+03	1.6E+04
Tl	1.78E-01	5.0E-02
V	5.41E+00	5.4E-02
Zn	8.92E+00	5.9E+00

Notes

Surface water data not available for V; mean groundwater value assumed

Table 1-7 **Initial Concentrations in the Embarrass River (mg/L)**

	Embarrass River Evaluation Point (including tributaries of concern)										
Constituent	***PM-12***	***PM-12.2***	***PM-12.3***	***PM-12.4***	***PM-13***	***MLC-3***	***MLC-2***	***TC-1***	***PM-19***	***UC-1***	***PM-11***
Ag	**0.0001**	*0.0001*	*0.0001*	*0.0001*	**0.0001**	*0.0001*	**0.0001**	*0.0001*	**0.0001**	*0.0001*	**0.0001**
Al	**0.107**	*0.328*	*0.328*	*0.328*	**0.328**	*0.0125*	**0.0125**	*0.328*	*0.328*	*0.328*	*0.328*
Alk	**50.3**	*57.2*	*57.2*	*57.2*	**57.2**	*246*	**246**	*291*	**291**	*341*	**341**
As	**0.005**	*0.001*	*0.001*	*0.001*	**0.001**	*0.0008*	**0.0008**	*0.0013*	**0.0013**	*0.0005*	**0.0005**
B	**0.025**	*0.0443*	*0.0443*	*0.0443*	**0.0443**	*0.048*	**0.048**	*0.146*	**0.146**	*0.2605*	**0.2605**
Ba	**0.018**	*0.0304*	*0.0304*	*0.0304*	**0.0304**	*0.023*	**0.023**	*0.071*	**0.071**	*0.036*	**0.036**
Be	**0.0001**	*0.0001*	*0.0001*	*0.0001*	**0.0001**	*0.0001*	**0.0001**	*0.0001*	**0.0001**	*0.0001*	**0.0001**
Ca	**13.8**	*14.8*	*14.8*	*14.8*	**14.8**	*36.6*	**36.6**	*42.6*	**42.6**	*46.9*	**46.9**
Cd	**0.00001**	*0.00008*	*0.00008*	*0.00008*	**0.00008**	*0.00002*	**0.00002**	*0.00006*	**0.00006**	*0.00007*	**0.00007**
Cl	**3.84**	**3.28**	**3.8**	**4.07**	**4.57**	*11.3*	**11.3**	*12.56*	**12.56**	*18.2*	**18.2**
Co	**0.0005**	*0.0004*	*0.0004*	*0.0004*	**0.0004**	*0.0001*	**0.0001**	*0.0002*	**0.0002**	*0.0001*	**0.0001**
Cr	**0.0005**	*0.0007*	*0.0007*	*0.0007*	**0.0007**	*0.0005*	**0.0005**	*0.0005*	**0.0005**	*0.0005*	**0.0005**
Cu	**0.0006**	*0.001*	*0.001*	*0.001*	**0.001**	*0.0005*	**0.0005**	*0.0008*	**0.0008**	*0.0008*	**0.0008**
F	*0.724*	*0.724*	*0.724*	*0.724*	**0.724**	*0.23*	**0.23**	*0.724*	*0.724*	*0.724*	*0.724*
Fe	**2.15**	*1.29*	*1.29*	*1.29*	**1.29**	*1.3*	**1.3**	*1.123*	**1.123**	*0.276*	**0.276**
K	**1.11**	*2.12*	*2.12*	*2.12*	**2.12**	*2.53*	**2.53**	*2.99*	**2.99**	*7.23*	**7.23**
Mg	**5.4**	*11.52*	*11.52*	*11.52*	**11.52**	*35.6*	**35.6**	*36.15*	**36.15**	*75.8*	**75.8**
Mn	**0.184**	*0.107*	*0.107*	*0.107*	**0.107**	*0.157*	**0.157**	*0.14*	**0.14**	*0.102*	**0.102**
Na	**4.07**	*10.2*	*10.2*	*10.2*	**10.2**	*36.45*	**36.45**	*44.4*	**44.4**	*51*	**51**
Ni	**0.0012**	*0.0014*	*0.0014*	*0.0014*	**0.0014**	*0.0003*	**0.0003**	*0.0013*	**0.0013**	*0.0014*	**0.0014**
Pb	**0.00008**	*0.00022*	*0.00022*	*0.00022*	**0.00022**	*0.00006*	**0.00006**	*0.00015*	**0.00015**	*0.00016*	**0.00016**
Sb	*0.0015*	*0.0015*	*0.0015*	*0.0015*	**0.0015**	*0.0015*	*0.0015*	*0.0015*	*0.0015*	*0.0015*	*0.0015*
Se	**0.00009**	*0.0005*	*0.0005*	*0.0005*	**0.0005**	*0.0003*	**0.0003**	*0.0006*	**0.0006**	*0.0006*	**0.0006**
SO_4	**1.05**	**87.5**	**20.4**	**17.6**	**16.5**	*23.5*	**23.5**	*10.7*	**10.7**	*138.8*	**138.8**
Tl	**0.0001**	*0.0002*	*0.0002*	*0.0002*	**0.0002**	*0.000001*	**0.000001**	*0.0001*	**0.0001**	*0.0001*	**0.0001**
V*	*0.0054*	*0.0054*	*0.0054*	*0.0054*	*0.0054*	*0.0054*	*0.0054*	*0.0054*	*0.0054*	*0.0054*	*0.0054*
Zn	**0.003**	*0.0033*	*0.0033*	*0.0033*	**0.0033**	*0.003*	**0.003**	*0.003*	**0.003**	*0.003*	**0.003**

Notes

Source: Surface water monitoring, mean values from the most recent year of available data (bold values)

* Surface water data not available for V, mean groundwater value assumed

For unavailable data (data in italics), the nearest downstream value was assumed

Table 1-8 **Flow Rates from the Mine Site WWTF**

Time (yrs)	*Flow Mean (gpm)*	*Flow Standard Deviation (gpm)*
0	458	66
1	578	82
2	674	100
3	781	108
4	898	117
5	1026	123
6	1191	153
7	1065	138
8	1265	169
9	1424	180
10	1521	191
11	658	189
12	1294	161
13	1550	196
14	1419	163
15	77	9
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
500	0	0

Notes

Source: Mine Site probabilistic water quality model

Table 1-9 Mean Concentration in the Water from the Mine Site CPS (mg/L)

	Time (yrs)																					
Constituent	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***	***14***	***15***	***16***	***17***	***18***	***19***	***20***	***500***
Ag	0.000962	0.000928	0.000971	0.000992	0.000971	0.000952	0.000987	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000996	0.000958	0	0
Al	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0	0
Alk	90.9	155	79	90.1	72.7	61.8	53.1	36	44.1	41.7	42.2	41.7	49.2	47	47.2	31.6	34.4	33.9	46.3	38.1	0	0
As	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0
B	0.134	0.148	0.141	0.152	0.145	0.14	0.144	0.129	0.144	0.133	0.131	0.121	0.121	0.121	0.121	0.0934	0.102	0.0971	0.114	0.0871	0	0
Ba	0.105	0.167	0.0798	0.0934	0.0779	0.0671	0.0587	0.0294	0.0487	0.0514	0.0547	0.0442	0.0513	0.0463	0.0449	0.0238	0.0269	0.0289	0.0619	0.0473	0	0
Be	0.00101	0.000865	0.000951	0.00107	0.00101	0.000872	0.000921	0.00118	0.00134	0.0014	0.00138	0.0016	0.00131	0.00125	0.00135	0.00185	0.0022	0.00204	0.00131	0.000727	0	0
Ca	55.8	54.4	59.9	58.1	58.5	56	52	57.8	45.9	43	40.9	46.4	45.8	47.5	49.5	54.5	53.1	53.6	48.9	51.7	0	0
Cd	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.00385	0.00301	0	0
Cl	37.3	40.1	24.5	23.1	20.7	23.3	26.8	13.5	31.5	36.1	46.7	50.7	75.3	58.1	47.8	15.9	18.6	25.7	99.5	72.1	0	0
Co	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0	0
Cr	0.00453	0.00559	0.0058	0.00621	0.0063	0.0061	0.00618	0.00624	0.00621	0.00602	0.00594	0.00661	0.00773	0.00767	0.00757	0.00671	0.0066	0.00625	0.00658	0.00517	0	0
Cu	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0	0
F	1.92	2	1.81	1.89	1.86	1.9	1.95	1.37	1.96	2	2	2	2	2	2	1.52	1.54	1.55	2	2	0	0
Fe	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0	0
K	26.9	34	31.8	33.2	33.2	32.8	36	30.7	38.6	42.5	50.6	54.6	84.3	83.2	77.2	39.8	42.5	47.5	137	100	0	0
Mg	26.7	27.8	24.4	25.5	25.3	26.8	29.3	25.7	33	34.8	36	32.7	33.1	32	30.8	27.7	28.6	28.3	31.2	29.4	0	0
Mn	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0	0
Na	72.3	129	108	121	128	127	135	112	146	149	166	199	296	276	244	135	134	140	368	275	0	0
Ni	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0
Pb	0.0154	0.0138	0.0153	0.0171	0.0163	0.0145	0.015	0.0177	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0	0
Sb	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.0253	0	0
Se	0.00498	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0	0
SO_4	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	0	0
Tl	0.000146	0.000204	0.000217	0.000233	0.000233	0.000222	0.000257	0.000312	0.000355	0.000355	0.000352	0.000325	0.00032	0.000307	0.000313	0.000336	0.000377	0.000345	0.000277	0.00017	0	0
V	0.0101	0.00988	0.0101	0.0102	0.0103	0.0101	0.0102	0.0111	0.0117	0.0116	0.0117	0.0121	0.0125	0.0123	0.0126	0.013	0.0151	0.0146	0.0129	0.0103	0	0
Zn	0.388	0.388	0.388	0.388	0.388	0.388	0.388	0.388	0.388	0.388	0.388	0.387	0.388	0.388	0.388	0.388	0.388	0.388	0.366	0.274	0	0

Notes

Source: Mine Site probabilistic water quality model

Table 1-10 Standard Deviation of the Concentration in the Water from the Mine Site WWTF (mg/L)

	Time (yrs)																				
Constituent	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***	***14***	***15***	***16***	***17***	***18***	***19***	***20***	***500***
Ag	0.0000293	0.0000559	0.0000229	0.00000596	0.0000226	0.0000378	0.00001	0	0	0	0	0	0	0	0	0	0	0	0.00000338	0.0000305	0	0
Al	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alk	33.9	64.8	26.6	33.5	24.9	20.5	14.3	7.37	9.85	7.32	7.82	8.53	9.78	9.19	10.6	6.24	6.13	6.18	9.79	9.27	0	0
As	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	0.0321	0.035	0.0327	0.0386	0.0327	0.0324	0.0337	0.0262	0.0313	0.023	0.0251	0.025	0.0183	0.0172	0.0194	0.0163	0.0194	0.0182	0.0235	0.0215	0	0
Ba	0.0415	0.0762	0.0331	0.0377	0.0304	0.0248	0.0196	0.0061	0.0134	0.00914	0.0111	0.0113	0.0107	0.00911	0.0109	0.00498	0.00535	0.00609	0.0139	0.013	0	0
Be	0.000375	0.000285	0.000308	0.00037	0.000345	0.00027	0.000292	0.000377	0.000381	0.000393	0.000369	0.000469	0.000315	0.000308	0.000336	0.0005	0.000541	0.000532	0.000359	0.000291	0	0
Ca	8.84	9.52	8.37	8.64	8.77	9.26	8.63	8.11	6.95	5.61	5.28	6.66	5.18	5.44	6.14	9.74	9.51	9.23	6.06	6.13	0	0
Cd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00012	0.000688	0	0
Cl	17.1	18.9	12	11.1	10.2	11.5	12	6.12	12.2	10.3	13.8	19.3	20.9	15.3	14.2	6.83	9.39	12.4	24.4	29	0	0
Co	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	0.00149	0.00123	0.00113	0.00114	0.00116	0.00117	0.000988	0.000896	0.000997	0.000779	0.000934	0.000853	0.000804	0.000717	0.000748	0.000762	0.000755	0.000789	0.000951	0.00127	0	0
Cu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0.0599	0	0.152	0.0827	0.107	0.0764	0.0377	0.233	0.0331	0	0	0	0	0	0	0.253	0.204	0.217	0	0	0	0
Fe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K	6.46	6.94	5.06	4.57	4.54	4.72	6.01	3.8	7.59	6.5	10.2	13	17.1	15.9	16.1	8.04	9.58	13.3	34.9	34.7	0	0
Mg	5.43	5.8	5.1	5.27	5.35	5.65	5.26	4.95	4.24	3.42	3.22	4.06	3.16	3.31	3.75	5.94	5.8	5.63	3.7	3.74	0	0
Mn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na	26.4	42.8	34.9	40.8	39.4	41.3	41.8	35.6	41.7	32.7	39.6	52.5	65.2	54.6	53.7	37	37.3	43.1	92.2	95.3	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0.00235	0.00313	0.00271	0.00127	0.00181	0.00284	0.00284	0.00103	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00445	0	0
Se	0.0000121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.38E-07	0	0
SO_4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl	0.0000368	0.0000457	0.0000459	0.0000514	0.0000478	0.0000462	0.0000706	0.0000918	0.0000963	0.0000887	0.0000853	0.0000826	0.0000757	0.0000592	0.0000555	0.0000693	0.0000747	0.0000637	0.0000653	0.0000544	0	0
V	0.00232	0.0015	0.00111	0.00117	0.00117	0.00116	0.00126	0.00114	0.00152	0.00101	0.00131	0.00147	0.00127	0.00112	0.00127	0.00115	0.00162	0.0016	0.00183	0.00184	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0.000752	0	0	0	0	0	0	0.0175	0.079	0	0

Notes

Source: Mine Site probabilistic water quality model

Table 1-11 Function Coefficients to Determine Van Genuchten Parameters

	Coefficient			
Parameter	***mm***	***bm***	***mb***	***bb***
Ksat_Coeff (cm/s)	2.793	2.4585	-3.6293	-3.1175
ResMoist_Coeff (cm^3/cm^3)	-0.2417	0.0543	0.1173	-0.0155
AirSuct_Coeff (1/cm)	0.002036	0.008121	-0.015927	0.010728
VGBeta_Coeff (--)	-31.3442	8.6015	14.6871	-1.4748

Notes

Source: NorthMet Project, Waste Characterization Data Package, Section 10.3 Saturation and Oxygen Diffusion

$$\log(K_{sat}) = m_m(F)(\theta) + b_m(\theta) + m_b(F) + b_b$$

$$\alpha, \beta, \theta_r = m_m(F)(\theta) + b_m(\theta) + m_b(F) + b_b$$

Table 1-12a Hydraulic Properties of Different Classes of the LTVSMC Tailings

		Tailings Class		
Parameter	***Units***	***Coarse***	***Fine***	***Bulk (Other)***
LTVSMC_SG*	*(--)*	2.80	2.90	2.85
LTVSMC_Porosity*	*(cm^3/cm^3)*	0.412	0.493	0.440
LTVSMC_Ksat*	*(cm/s)*	SEE TABLE 1-12b	SEE TABLE 1-12b	8.02E-05
LTVSMC_ResMoist*	*(cm^3/cm^3)*	0.041	0.059	0.048
LTVSMC_AirSuct†	*(1/cm)*	0.024	0.001	0.011
LTVSMC_VGBeta†	*(--)*	2.0	1.6	2.0

Notes

* Source: Unsaturated modeling by the geotechnical group

† Source: Fit to data from the geotechnical group

Table 1-12b Saturated Conductivity of LTVSMC Tailings in Each Cell*

		Tailings Class		
Cell	***Units***	***Coarse***	***Fine***	***Bulk (Other)***
Cell 1E	*(cm/s)*	2.40E-03	2.75E-05	SEE TABLE 1-12a
Cell 2E	*(cm/s)*	2.24E-03	8.71E-05	SEE TABLE 1-12a
Cell 2W	*(cm/s)*	1.17E-03	1.10E-04	SEE TABLE 1-12a

Notes

* Source: Calibrated MODFLOW model of existing conditions

Table 1-13 Distribution Parameters for Flotation Fine Tailings Release

Distribution Fit to Humidity Cell Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Ca	SO_4 rate ratio	HCT	mg Ca / mg SO_4	Beta	1.18E+00	3.03E-01	8.17E-01	3.46E+00
K	SO_4 rate ratio	HCT	mg K / mg SO_4	Beta	2.63E-01	6.37E-02	1.71E-01	7.51E-01
Mg	SO_4 rate ratio	HCT	mg Mg / mg SO_4	Beta	2.18E-01	4.69E-02	1.62E-01	7.94E-01
Mn	Ni rate ratio	HCT	mg Mn / mg Ni	Beta	4.68E+00	2.08E+00	2.07E+00	9.31E+00
Na	SO_4 rate ratio	HCT	mg Na / mg SO_4	Beta	8.20E-02	1.77E-02	6.03E-02	2.64E-01
Se	SO_4 rate ratio	HCT	mg Se / mg SO_4	Beta	1.79E-05	5.29E-06	1.29E-05	6.09E-05
SO_4	Rate	HCT	mg SO_4/kg/week	Beta	1.88E+01	2.87E+00	2.66E+00	2.32E+01

Distribution Fit to Aqua Regia Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Ag	S ratio	Aqua Regia	mg Ag / mg S	Beta	1.54E-04	1.49E-05	1.35E-04	2.54E-04
As	S ratio	Aqua Regia	mg As / mg S	Beta	1.96E-03	2.53E-04	1.67E-03	4.89E-03
Ba	K ratio	Aqua Regia	mg Ba / mg K	Beta	2.66E-02	1.27E-03	1.83E-02	3.06E-02
Be	K ratio	Aqua Regia	mg Be / mg K	Beta	1.03E-04	1.51E-05	8.13E-05	2.32E-04
Cu	S ratio	Aqua Regia	mg Cu / mg S	Beta	9.30E-02	1.46E-02	5.29E-02	1.46E-01
Pb	S ratio	Aqua Regia	mg Pb / mg S	Beta	2.67E-03	6.16E-04	1.93E-03	9.32E-03
Sb	S ratio	Aqua Regia	mg Sb / mg S	Beta	1.08E-04	3.50E-05	6.67E-05	1.99E-04
Tl	S ratio	Aqua Regia	mg Tl / mg S	Beta	7.15E-05	7.35E-06	5.97E-05	1.41E-04
V	K ratio	Aqua Regia	mg V / mg K	Beta	2.53E-02	2.61E-03	7.01E-03	3.17E-02

Distribution Fit to Waste Rock Humidity Cell Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Cd	Zn rate ratio	2/3 HCT (2)	mg Cd / mg Zn	Beta	1.65E-02	1.20E-02	1.01E-03	5.84E-02
Co	Ni rate ratio	2/3 HCT (2)	mg Co / mg Ni	Beta	8.29E-02	3.91E-02	2.24E-02	2.06E-01
Zn	Ni rate ratio	2/3 HCT (2)	mg Zn / mg Ni	Beta	3.35E-01	3.70E-01	3.31E-02	1.60E+00

Distribution Fit to Microprobe Data or Mineral Formula

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Al	Ca ratio	Anorthite Formula	mg Al / mg Ca	Constant	1.35E+00	--	--	--
	Na ratio	Albite Formula	mg Al / mg Na	Constant	1.17E+00	--	--	--
Fe	S ratio	Pyrrhotite microprobe	mg Fe / mg S	Beta	1.62E+00	8.72E-02	1.49E+00	1.92E+00
	Mg ratio	Olivine microprobe	mg Fe / mg Mg	Beta	1.87E+00	6.75E-01	1.19E+00	4.51E+00
Ni	S ratio	Pyrrhotite microprobe	mg Ni / mg S	Beta	5.63E-03	6.65E-03	5.65E-04	4.00E-02

Distribution From Defined Concentration Cap

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Cl	No release	N/A	mg/L	Constant	0	--	--	--
B	Cap	Whistle Mine	mg/L	Constant	1.00E-01	--	--	--
Cr	Cap	Whistle Mine	mg/L	Constant	1.00E-02	--	--	--

Notes
- HCT indicates average rates from tailings humidity cells over the entire testing period.
- Aqua Regia indicates ratios from whole tailings testing.
- Cat 2/3 HCT (2) indicates average rates from Category 2/3 humidity cells over Condition 2, as defined in Large Table 1.
- All distributions from humidity cell data and aqua regia data represent the full range of the observed values, with no weighting. Distributions are shown in Large Figure 42 to Large Figure 45.
- Distributions from microprobe data represent the full range of the observed ratios for each mineral, with no weighting. Distributions are shown in Large Figure 21 and Large Figure 22.
- Constituents not shown above are modeled according to the mineral solubility methods described in Section 10.1.1.

Table 1-14 Distribution Parameters for Flotation Coarse Tailings Release

Distribution Fit to Humidity Cell Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Ca	SO_4 rate ratio	HCT	mg Ca / mg SO_4	Beta	9.58E-01	3.34E-01	3.00E-01	1.60E+00
K	SO_4 rate ratio	HCT	mg K / mg SO_4	Beta	2.60E-01	8.16E-02	0.00E+00	4.91E-01
Mg	SO_4 rate ratio	HCT	mg Mg / mg SO_4	Beta	1.82E-01	3.32E-02	9.68E-02	5.46E-01
Mn	Ni rate ratio	HCT	mg Mn / mg Ni	Beta	3.37E+00	1.32E+00	1.80E+00	1.00E+01
Na	SO_4 rate ratio	HCT	mg Na / mg SO_4	Beta	6.86E-02	2.40E-02	3.58E-02	2.57E-01
Se	SO_4 rate ratio	HCT	mg Se / mg SO_4	Beta	1.75E-05	3.51E-06	0.00E+00	2.41E-05
SO_4	Rate	HCT	mg SO_4/kg/week	Beta	1.19E+01	2.55E+00	4.37E+00	2.13E+01

Distribution Fit to Aqua Regia Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Ag	S ratio	Aqua Regia	mg Ag / mg S	Beta	2.05E-04	3.41E-05	1.42E-04	5.45E-04
As	S ratio	Aqua Regia	mg As / mg S	Beta	1.82E-03	3.31E-04	9.17E-04	5.09E-03
Ba	K ratio	Aqua Regia	mg Ba / mg K	Beta	2.74E-02	1.81E-03	2.01E-02	4.02E-02
Be	K ratio	Aqua Regia	mg Be / mg K	Beta	9.77E-05	9.41E-06	5.71E-05	1.53E-04
Cu	S ratio	Aqua Regia	mg Cu / mg S	Beta	2.11E-01	5.25E-02	2.95E-03	7.00E-01
Pb	S ratio	Aqua Regia	mg Pb / mg S	Beta	2.88E-03	7.68E-04	1.18E-03	1.08E-02
Sb	S ratio	Aqua Regia	mg Sb / mg S	Beta	1.10E-04	3.06E-05	5.45E-05	2.50E-04
Tl	S ratio	Aqua Regia	mg Tl / mg S	Beta	9.44E-05	1.27E-05	6.67E-05	1.86E-04
V	K ratio	Aqua Regia	mg V / mg K	Beta	1.81E-02	2.66E-03	1.81E-03	3.00E-02

Distribution Fit to Waste Rock Humidity Cell Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Cd	Zn rate ratio	2/3 HCT (2)	mg Cd / mg Zn	Beta	1.65E-02	1.20E-02	1.01E-03	5.84E-02
Co	Ni rate ratio	2/3 HCT (2)	mg Co / mg Ni	Beta	8.29E-02	3.91E-02	2.24E-02	2.06E-01
Zn	Ni rate ratio	2/3 HCT (2)	mg Zn / mg Ni	Beta	3.35E-01	3.70E-01	3.31E-02	1.60E+00

Distribution Fit to Microprobe Data or Mineral Formula

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Al	Ca ratio	Anorthite Formula	mg Al / mg Ca	Constant	1.35E+00	--	--	--
	Na ratio	Albite Formula	mg Al / mg Na	Constant	1.17E+00	--	--	--
Fe	S ratio	Pyrrhotite microprobe	mg Fe / mg S	Beta	1.62E+00	8.72E-02	1.49E+00	1.92E+00
	Mg ratio	Olivine microprobe	mg Fe / mg Mg	Beta	1.87E+00	6.75E-01	1.19E+00	4.51E+00
Ni	S ratio	Pyrrhotite microprobe	mg Ni / mg S	Beta	5.63E-03	6.65E-03	5.65E-04	4.00E-02

Distribution From Defined Concentration Cap

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Cl	No release	N/A	mg/L	Constant	0	--	--	--
B	Cap	Whistle Mine	mg/L	Constant	1.00E-01	--	--	--
Cr	Cap	Whistle Mine	mg/L	Constant	1.00E-02	--	--	--

Notes

- HCT indicates average rates from tailings humidity cells over the entire testing period.
- Aqua Regia indicates ratios from whole tailings testing.
- Cat 2/3 HCT (2) indicates average rates from Category 2/3 humidity cells over Condition 2, as defined in Large Table 1.
- All distributions from humidity cell data and aqua regia data represent the full range of the observed values, with no weighting. Distributions are shown in Large Figure 46 to Large Figure 49.
- Distributions from microprobe data represent the full range of the observed ratios for each mineral, with no weighting. Distributions are shown in Large Figure 21 and Large Figure 22.
- Constituents not shown above are modeled according to the mineral solubility methods described in Section 10.1.1.

Table 1-15 **Category 1 Concentration Cap Distributions (Applied to the NorthMet Flotation Tailings and Buttress)**

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Ag	Limit	Dunka Seep	mg/L	Constant	0.0002	N/A	N/A	N/A
Al	Function pH (Solubility equation)		mg/L		N/A	N/A	N/A	N/A
Alkalinity	Function pH (AMAX data)		mg/L		N/A	N/A	N/A	N/A
As	Limit	Whistle Mine	mg/L	Constant	0.1	N/A	N/A	N/A
B	Limit	Whistle Mine	mg/L	Constant	0.1	N/A	N/A	N/A
Ba	Solubility equation				N/A	N/A	N/A	N/A
Be	Limit	Dunka Seep	mg/L	Constant	0.0004	N/A	N/A	N/A
Ca	Solubility equation				N/A	N/A	N/A	N/A
Cd	Function Zn limit, Cd/Zn release ratio				N/A	N/A	N/A	N/A
Cl	No limit				N/A	N/A	N/A	N/A
Co	Function pH (AMAX data)				N/A	N/A	N/A	N/A
Cr	Limit	Whistle Mine	mg/L	Constant	0.01	N/A	N/A	N/A
Cu	Function pH (AMAX data)				N/A	N/A	N/A	N/A
F	Solubility equation				N/A	N/A	N/A	N/A
Fe	Function pH (AMAX data)		mg/L		N/A	N/A	N/A	N/A
K	Function pH (AMAX data)		mg/L		N/A	N/A	N/A	N/A
Mg	Function Ca limit, Mg/Ca release ratio				N/A	N/A	N/A	N/A
Mn	Function pH (AMAX data)		mg/L		N/A	N/A	N/A	N/A
Na	Function pH (AMAX data)		mg/L		N/A	N/A	N/A	N/A
Ni	Function pH (AMAX data)		mg/L		N/A	N/A	N/A	N/A
Pb	Limit	Whistle Mine	mg/L	Constant	0.1	N/A	N/A	N/A
Sb	Limit	NorthMet Lab	mg/L	Uniform	N/A	N/A	0.0083	0.1
Se	Function SO4 limit, Se/SO4 release ratio				N/A	N/A	N/A	N/A
SO4	Solubility equation				N/A	N/A	N/A	N/A
Tl	Limit	Dunka Seep	mg/L	Constant	0.0002	N/A	N/A	N/A
V	Limit	Whistle Mine	mg/L	Constant	0.01	N/A	N/A	N/A
Zn	Function pH (AMAX data)		mg/L		N/A	N/A	N/A	N/A

N/A = not used

pH-based Range from AMAX Data
(95th percentile values, all units mg/L)

pH	Alkalinity	Co	Cu	Fe	K	Mn	Na	Ni	Zn
7.0	2.60E+01	2.80E-01	5.20E-01	4.00E-02	3.99E+01	3.08E-01	1.32E+02	5.91E+00	4.05E-01
7.1	3.45E+01	2.33E-01	2.85E-01	7.50E-02	4.61E+01	3.86E-01	1.38E+02	4.31E+00	2.93E-01
7.2	3.55E+01	1.36E-01	1.78E-01	1.01E-01	4.28E+01	1.75E-01	1.73E+02	2.08E+00	1.70E-01
7.3	3.59E+01	9.30E-02	2.00E-01	5.00E-02	5.04E+01	2.00E-01	2.31E+02	1.62E+00	1.33E-01
7.4	4.92E+01	7.00E-02	9.68E-02	4.20E-02	4.28E+01	1.72E-01	2.19E+02	1.28E+00	7.00E-02
7.5	4.82E+01	5.00E-02	1.00E-01	4.00E-02	4.60E+01	2.27E-01	2.18E+02	9.05E-01	9.64E-02
7.6	5.07E+01	4.00E-02	1.54E-01	7.75E-02	4.72E+01	2.10E-01	3.10E+02	4.55E-01	1.19E-01
7.7	5.04E+01	4.36E-02	1.23E-01	6.35E-02	4.37E+01	3.19E-01	4.68E+02	4.85E-01	1.15E-01
7.8	5.73E+01	6.00E-02	1.31E-01	5.50E-02	3.95E+01	2.05E-01	3.70E+02	3.75E-01	6.50E-02
7.9	4.00E+01	7.58E-02	5.73E-02	3.80E-02	4.80E+01	2.88E-01	3.90E+02	5.26E-01	8.88E-02
8.0	5.45E+01	1.00E-02	2.00E-02	2.00E-02	4.30E+01	1.40E-01	1.15E+02	2.00E-01	5.20E-02
8.1	6.90E+01	3.95E-02	3.95E-02	5.80E-02	4.57E+01	1.59E-01	3.13E+02	4.55E-01	2.48E-02

pH-based Range from AMAX Data
(maximum values, all units mg/L)

pH	Alkalinity	Co	Cu	Fe	K	Mn	Na	Ni	Zn
7.0	4.30E+01	6.20E-01	2.30E+00	4.00E-02	4.30E+01	3.80E-01	2.60E+02	1.30E+01	5.50E-01
7.1	4.10E+01	3.10E-01	7.50E-01	8.00E-02	4.80E+01	9.70E-01	5.91E+02	7.02E+00	3.70E-01
7.2	4.50E+01	1.50E-01	3.40E-01	7.00E-01	4.43E+01	2.40E-01	2.00E+02	3.42E+00	2.30E-01
7.3	3.60E+01	1.20E-01	2.60E-01	6.00E-02	5.90E+01	3.00E-01	2.60E+02	2.29E+00	2.30E-01
7.4	5.40E+01	8.00E-02	1.80E-01	6.00E-02	5.32E+01	1.90E-01	3.22E+02	1.35E+00	1.12E-01
7.5	5.27E+01	5.00E-02	1.30E-01	7.00E-02	6.00E+01	2.40E-01	3.13E+02	1.70E+00	1.00E-01
7.6	5.90E+01	6.00E-02	1.90E-01	2.10E-01	5.20E+01	2.30E-01	3.39E+02	1.07E+00	1.34E-01
7.7	5.10E+01	5.20E-02	1.31E-01	7.00E-02	5.00E+01	3.40E-01	5.55E+02	5.90E-01	1.20E-01
7.8	5.90E+01	7.00E-02	1.70E-01	6.00E-02	4.00E+01	2.40E-01	3.72E+02	4.20E-01	7.00E-02
7.9	4.00E+01	9.00E-02	6.00E-02	4.00E-02	4.90E+01	2.90E-01	3.95E+02	5.65E-01	9.00E-02
8.0	5.50E+01	1.00E-02	2.00E-02	2.00E-02	4.30E+01	1.40E-01	1.15E+02	2.00E-01	5.20E-02
8.1	7.00E+01	4.00E-02	4.00E-02	6.00E-02	4.60E+01	1.60E-01	3.17E+02	4.60E-01	2.50E-02

Notes

- All distributions from Whistle Mine data represent the detection limit used for nonacidic conditions.
- All distributions from Vangorda Mine data represent the highest observed concentration under acidic conditions.
- All distributions from AMAX data represent a uniform distribution between the 95th percentile and maximum observed value at the referenced pH for AMAX piles with 0.64% S. Data for pH values above 7.5 are used for Flotation Tailings as discussed in Section 10.4 (not for Category 1 waste rock).
- Concentration caps for all constituents not shown are calculated from the equations shown in Section 8.3.1.
- Distributions shown as constant indicate zero detections in the referenced data set, the detection limit is set as the concentration cap.

Table 1-16 Flotation Tailings Constituent Content

Constituent	*Units*	*NM_Content.Coarse_Content*	*NM_Content.Fine_Content*	*Buttress_Content*
Ag	mg/kg tailings	1.86E-01	2.13E-01	1.35E-01
Al	mg/kg tailings	3.56E+04	3.60E+04	4.07E+04
Alkalinity*	mg/kg tailings	1.00E+20	1.00E+20	1.00E+20
As	mg/kg tailings	2.43E+00	2.19E+00	2.47E+00
B	mg/kg tailings	5.00E+00	5.00E+00	7.94E+00
Ba	mg/kg tailings	4.86E+01	5.36E+01	4.07E+01
Be	mg/kg tailings	1.87E-01	1.84E-01	2.43E-01
Ca	mg/kg tailings	2.04E+04	1.98E+04	2.22E+04
Cd	mg/kg tailings	6.29E-02	6.50E-02	4.19E-01
Cl*	mg/kg tailings	1.00E+20	1.00E+20	1.00E+20
Co	mg/kg tailings	5.51E+01	4.56E+01	4.83E+01
Cr	mg/kg tailings	1.08E+02	9.89E+01	1.01E+02
Cu	mg/kg tailings	1.10E+02	2.22E+02	2.15E+02
F*	mg/kg tailings	1.00E+20	1.00E+20	1.00E+20
Fe	mg/kg tailings	6.78E+04	5.39E+04	6.17E+04
K	mg/kg tailings	1.83E+03	1.94E+03	1.40E+03
Mg	mg/kg tailings	4.08E+04	3.30E+04	4.00E+04
Mn	mg/kg tailings	7.52E+02	6.02E+02	7.01E+02
Na	mg/kg tailings	4.53E+03	4.69E+03	5.80E+03
Ni	mg/kg tailings	2.89E+02	2.46E+02	2.55E+02
Pb	mg/kg tailings	3.39E+00	3.21E+00	2.45E+00
Sb	mg/kg tailings	1.29E-01	1.21E-01	1.34E+00
Se	mg/kg tailings	5.20E-01	4.30E-01	1.00E+20
S	mg/kg tailings	1.21E+03	1.05E+03	1.90E+03
Tl	mg/kg tailings	8.86E-02	1.00E-01	4.78E+00
V	mg/kg tailings	4.54E+01	3.47E+01	3.32E+01
Zn	mg/kg tailings	7.04E+01	5.79E+01	6.83E+01

Notes

* Whole tailings content data not available. A high value of 1e20 ppm is used.

Table 1-17 Weathering Rates from the NorthMet Tailings

Constituent	***NM_Tailings_Weathering.Coarse_Weathering (mg/m² /month)***	***NM_Tailings_Weathering.Fines_Weathering (mg/m² /month)***
Ag	0.003	0.003
Al	7.1	7.5
Alk (as CaCO3)	2400	2500
As	2	0.096
B	2.1	1.8
Ba	0.12	0.14
Be	0.012	0.012
Ca	[redacted]	[redacted]
Cd	0.0024	0.0024
Cl	26	25
Co	0.009	0.011
Cr	0.016	0.018
Cu	0.23	0.17
F	2.9	3
Fe	1.2	2
K	230	240
Mg	210	190
Mn	0.71	0.8
Na	75	67
Ni	0.16	0.15
Pb	0.012	0.0094
Sb	0.28	0.25
Se	0.014	0.013
SO_4	1000	1600
Tl	0.0016	0.0012
V*	0	0
Zn	0.11	0.11

Notes

Data is from RS-46 (Waste Water Modeling - Tailings NorthMet Project; July 20, 2007)

* No data available for V, weathering load assumed to be zero

Table 1-18 Dissolved Oxygen Concentration in the FTB Pond

Month	*Distribution*	*Pond_DO_Mean (mg/L)*	*Pond_DO_SD (mg/L)*
January	Normal	14.2	0
February	Normal	14.2	0
March	Normal	14.2	0
April	Normal	13.5	0.5
May	Normal	11.4	0.5
June	Normal	10.2	0.5
July	Normal	9.7	0.5
August	Normal	9.9	0.5
September	Normal	11	0.5
October	Normal	13.1	0.5
November	Normal	14.2	0
December	Normal	14.2	0

Table 1-19 Distribution Parameters for LTVSMC Tailings Release

Distribution Fit to Humidity Cell Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Se	SO_4 rate ratio	HCT	mg Se / mg SO_4	Beta	7.22E-05	4.63E-05	3.04E-05	3.04E-04
SO_4	Rate	HCT	mg SO_4/kg/week	Beta	1.87E+00	5.02E-01	8.13E-01	2.54E+00
Zn	SO_4 rate ratio	HCT	mg Zn / mg SO_4	Beta	5.32E-05	9.20E-06	4.28E-05	8.33E-05

Distribution Fit to Aqua Regia Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Ag	S ratio	Aqua Regia	mg Ag / mg S	Beta	1.85E-04	1.51E-04	3.47E-05	1.99E-03
As	S ratio	Aqua Regia	mg As / mg S	Beta	1.11E-01	5.43E-02	2.85E-02	8.75E-01
Cd	S ratio	Aqua Regia	mg Cd / mg S	Beta	7.69E-05	6.83E-05	8.21E-06	4.62E-03
Co	S ratio	Aqua Regia	mg Co / mg S	Beta	4.10E-02	3.17E-02	9.94E-03	3.75E-01
Cu	S ratio	Aqua Regia	mg Cu / mg S	Beta	4.26E-02	3.66E-02	7.95E-03	7.00E-01
Ni	S ratio	Aqua Regia	mg Ni / mg S	Beta	1.71E-02	1.10E-02	3.46E-03	1.92E-01
Pb	S ratio	Aqua Regia	mg Pb / mg S	Beta	6.66E-03	3.95E-03	1.12E-03	4.17E-02
Sb	S ratio	Aqua Regia	mg Sb / mg S	Beta	3.44E-04	2.34E-04	8.93E-05	2.92E-03
Tl	S ratio	Aqua Regia	mg Tl / mg S	Beta	9.04E-05	7.48E-05	1.95E-05	8.33E-04

Distribution Fit to Microprobe Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Fe	S ratio	Pyrite microprobe	mg Fe / mg S	Beta	8.85E-01	1.36E-02	8.50E-01	9.06E-01

Distribution Fit to Observed Seepage Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Al	Cap	Well Data	mg/L	Uniform	--	--	5.00E-03	2.50E-02
B	Cap	Well Data	mg/L	Trunc. Normal	5.14E-01	7.0E-02	0.00E+00	1.00E+10
Be	Cap	Well Data	mg/L	Uniform	--	--	1.00E-04	2.50E-04
Ca	Cap	Well Data	mg/L	Trunc. Normal	1.17E+02	1.7E+01	0.00E+00	1.00E+10
Cl	Cap	Well Data	mg/L	Trunc. Normal	2.24E+01	1.8E+00	0.00E+00	1.00E+10
Cr	Cap	Well Data	mg/L	Trunc. Normal	5.99E-04	1.4E-04	0.00E+00	1.00E+10
K	Cap	Well Data	mg/L	Trunc. Normal	1.03E+01	2.1E+00	0.00E+00	1.00E+10
Mg	Ca ratio	Well Data	mg Mg / mg Ca	Trunc. Normal	1.63E+00	3.1E-01	0.00E+00	1.00E+10
Mn	Cap	Well Data	mg/L	Trunc. Normal	1.54E+00	3.9E-01	0.00E+00	1.00E+10
Na	Cap	Well Data	mg/L	Trunc. Normal	4.96E+01	1.1E+01	0.00E+00	1.00E+10
V	Cap	Well Data	mg/L	Uniform	--	--	5.00E-04	1.00E-03

Notes
- HCT indicates average rates from tailings humidity cells over the entire testing period.
- Aqua Regia indicates ratios from whole tailings testing.
- Cat 2/3 HCT (2) indicates average rates from Category 2/3 humidity cells over Condition 2, as defined in Large Table 1.
- All distributions from humidity cell data, aqua regia and microprobe data represent the full range of the observed values, with no weighting. Distributions are shown in Large Figure 50 to Large Figure 52.
- All distributions from well data represent calibrated distributions so that modeled concentrations at the Tailings Basin toes are best fits to observed data in GW001, GW006, GW007, GW012, SD004, and SD026. Distributions are shown in Large Figure 53 to Large Figure 55.
- Constituents not shown above are modeled according to the mineral solubility methods described in Section 10.1.2.

Table 1-20 Distribution Parameters for LTVSMC Tailings Disturbed Flushing Load

Distribution Fit to Leach Extraction Test Data

Constituent	Method	Source	Units	Distribution	Mean/Mode	St. Dev.	Minimum	Maximum
Ag	Load	Leach tests	mg/kg tailings	Beta	2.09E-05	4.85E-06	1.16E-05	3.73E-05
Al	Load	Leach tests	mg/kg tailings	Beta	2.16E-03	1.25E-03	1.26E-04	7.43E-03
Alkalinity	Load	Leach tests	mg/kg tailings	Beta	9.88E+01	2.62E+01	0.00E+00	1.27E+02
As	Load	Leach tests	mg/kg tailings	Beta	2.10E-03	2.96E-03	1.56E-04	2.15E-02
B	Load	Leach tests	mg/kg tailings	Beta	5.51E-02	1.98E-02	3.04E-02	1.90E-01
Ba	Load	Leach tests	mg/kg tailings	Beta	1.86E-03	2.96E-03	5.00E-05	2.00E-02
Be	Load	Leach tests	mg/kg tailings	Beta	7.50E-05	1.44E-05	5.00E-05	1.00E-04
Ca	Load	Leach tests	mg/kg tailings	Beta	1.79E+01	6.21E+00	9.30E+00	4.21E+01
Cd	Load	Leach tests	mg/kg tailings	Beta	1.50E-05	2.89E-06	1.00E-05	2.00E-05
Cl	Leach Load of Chloride is assumed to be 0 mg/kg			Beta	-1.00E+00	5.90E-02	-1.10E+00	-9.00E-01
Co	Load	Leach tests	mg/kg tailings	Beta	1.38E-04	1.00E-04	3.95E-05	4.97E-04
Cr	Load	Leach tests	mg/kg tailings	Beta	6.08E-04	6.87E-04	6.56E-05	4.00E-03
Cu	Load	Leach tests	mg/kg tailings	Beta	1.77E-03	1.13E-03	6.61E-04	8.00E-03
F	Load	Leach tests	mg/kg tailings	Beta	2.52E-01	2.08E-01	5.40E-02	1.53E+00
Fe	Load	Leach tests	mg/kg tailings	Beta	1.66E-02	1.20E-02	2.12E-03	4.88E-02
K	Load	Leach tests	mg/kg tailings	Beta	2.02E+00	2.15E+00	4.17E-01	1.00E+01
Mg	Load	Leach tests	mg/kg tailings	Beta	1.64E+01	8.20E+00	1.56E+00	6.28E+01
Mn	Load	Leach tests	mg/kg tailings	Beta	2.43E-02	3.33E-02	4.72E-04	2.51E-01
Na	Load	Leach tests	mg/kg tailings	Beta	3.67E+00	6.70E+00	2.33E-01	4.03E+01
Ni	Load	Leach tests	mg/kg tailings	Beta	5.98E-04	3.61E-04	1.91E-04	1.70E-03
Pb	Load	Leach tests	mg/kg tailings	Beta	3.75E-05	2.82E-05	1.67E-05	2.00E-04
Sb	Load	Leach tests	mg/kg tailings	Beta	7.50E-05	5.52E-05	3.33E-05	3.19E-04
Se	Load	Leach tests	mg/kg tailings	Beta	6.61E-04	6.73E-04	9.70E-05	4.93E-03
SO_4	Load	Leach tests	mg/kg tailings	Beta	2.14E+01	3.09E+01	1.27E+00	1.92E+02
Tl	Load	Leach tests	mg/kg tailings	Beta	7.50E-06	1.44E-06	5.00E-06	1.00E-05
V	Load	Leach tests	mg/kg tailings	Beta	8.01E-05	1.51E-05	3.74E-05	1.02E-04
Zn	Load	Leach tests	mg/kg tailings	Beta	1.08E-03	8.48E-05	4.00E-04	4.00E-03

Notes
- All distributions from leach extraction testing represent the full range of observed data.
- Distributions for constituents with no detections range from LOD/2 to LOD with a uniform distribution.
- Distributions are shown in Large Figure 56 to Large Figure 60.

Table 1-21 Calibration Factor for LTVSMC Metal Release Ratios

Constituent	*LTVSMC_Calib_Factor (--)*	*Ratio_or_Conc_LTV (--)*
Ag	0.0035	1
Al	1	0
Alk	1	0
As	0.0001	1
B	1	0
Ba	1	0
Be	1	0
Ca	1	0
Cd	0.0116	1
Cl	1	0
Co	0.0006	1
Cr	1	0
Cu	0.0005	1
F	1	0
Fe	0.0469	1
K	1	0
Mg	1	0
Mn	1	0
Na	1	0
Ni	0.0027	1
Pb	0.0003	1
Sb	0.0047	1
Se	0.015	1
SO_4	1	1
Tl	0.0107	1
V	1	0
Zn	0.2596	1

Notes

If the value is 1, the method of release is not by a release ratio to S (see Table 1-19).

Table 1-22 **LTVSMC Tailings Constituent Content**

Constituent	***Units***	***LTVSMC_Content***
Ag	mg/kg tailings	7.33E-02
Al	mg/kg tailings	1.92E+03
Alkalinity*	mg/kg tailings	1.00E+20
As	mg/kg tailings	2.82E+01
B	mg/kg tailings	5.15E+00
Ba	mg/kg tailings	1.03E+01
Be	mg/kg tailings	6.92E-01
Ca	mg/kg tailings	1.45E+04
Cd	mg/kg tailings	5.74E-02
Cl*	mg/kg tailings	1.00E+20
Co	mg/kg tailings	8.22E+00
Cr	mg/kg tailings	8.50E+01
Cu	mg/kg tailings	9.72E+00
F*	mg/kg tailings	1.00E+20
Fe	mg/kg tailings	9.88E+04
K	mg/kg tailings	6.24E+02
Mg	mg/kg tailings	8.09E+03
Mn	mg/kg tailings	4.61E+03
Na	mg/kg tailings	1.27E+02
Ni	mg/kg tailings	4.23E+00
Pb	mg/kg tailings	1.54E+00
Sb	mg/kg tailings	8.08E-02
Se	mg/kg tailings	4.94E-01
S	mg/kg tailings	3.29E+02
Tl	mg/kg tailings	2.00E-02
V	mg/kg tailings	1.00E+01
Zn	mg/kg tailings	9.67E+00

Notes

* Data not available. A high value of 1e20 ppm is assumed.

Table 1-23 Flotation Tailings Basin Dam Construction

Time (yrs)	North Dam		East Dam		South Dam		North Buttress		South Buttress	
	Cumulative Volume (CY)	Outer Area (acres)	Cumulative Volume (CY)	Outer Area (acres)	Cumulative Volume (CY)	Outer Area (acres)	Volume (CY)	Area (acres)	Volume (CY)	Area (acres)
0	0	0	0	0	0	0	0	0	0	0
0.001	2,480	55	0	0	0	0	573	45	0	0
1	2,480,000	55	0	0	0	0	572,950	45	0	0
2	3,330,000	55	0	0	0	0	1,145,900	45	0	0
3	4,180,000	69	0	0	0	0	1,145,900	45	0	0
4	5,010,000	82	0	0	0	0	1,145,900	45	0	0
5	5,840,000	95	0	0	0	0	1,145,900	45	0	0
6	6,640,000	108	0	0	0	0	1,145,900	45	0	0
7	7,440,000	133	0	0	0	0	1,145,900	45	0	0
7.001	7,440,679	147	64	15	64	15	1,145,900	45	109	15
8	8,119,298	160	63,684	15	63,684	15	1,145,900	45	108,500	15
9	8,807,046	174	123,144	15	123,144	15	1,145,900	45	217,000	15
10	9,502,192	187	178,904	15	178,904	15	1,145,900	45	325,500	15
11	10,122,932	193	234,529	17	249,040	22	1,145,900	45	325,500	15
12	10,723,773	198	293,703	20	335,524	29	1,145,900	45	325,500	15
13	11,306,931	204	356,030	22	436,538	35	1,145,900	45	325,500	15
14	11,874,271	209	421,179	24	550,549	42	1,145,900	45	325,500	15
15	12,532,555	215	501,645	26	703,050	50	1,145,900	45	325,500	15
16	13,173,732	221	584,518	29	870,250	58	1,145,900	45	325,500	15
17	13,799,473	226	669,564	31	1,050,713	65	1,145,900	45	325,500	15
18	14,411,219	232	756,579	33	1,243,202	73	1,145,900	45	325,500	15
18.001	14,411,793	232	756,666	33	1,243,398	73	1,145,900	45	325,500	15
19	14,985,672	241	843,762	37	1,439,065	82	1,145,900	45	325,500	15
20	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
20.001	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	
21	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
22	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
23	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
24	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
25	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
30	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
35	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
40	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
45	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
50	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15
500	15,547,561	249	934,025	40	1,644,414	91	1,145,900	45	325,500	15

Table 1-24 Flotation Tailings Basin Dam Elevations and Areas

Time (yrs)	*Crest Elevation* (feet)*	*Crest Area † (acres)*	*Beach Elevation ‡ (feet)*	*North Beach Area (acres)*	*East Beach Area (acres)*	*South Beach Area (acres)*	*Closure Beach (acres)*
0	1588.0	516.9	1570.0	0.00	0.00	0.00	0.00
[redacted]	[redacted]	516.9	1570.0	96.06	0.00	0.00	0.00
1	1588.0	516.9	1585.0	95.40	0.00	0.00	0.00
2	1600.0	518.5	1597.0	94.73	0.00	0.00	0.00
3	1612.0	520.1	1609.0	93.40	0.00	0.00	0.00
4	1625.0	521.7	1622.0	92.07	0.00	0.00	0.00
5	1636.0	522.5	1633.0	90.57	0.00	0.00	0.00
6	1649.0	523.4	1646.0	89.07	0.00	0.00	0.00
7	1661.0	529.4	1658.0	86.82	0.00	0.00	0.00
[redacted]	[redacted]	1271.2	1658.0	86.81	20.78	103.34	0.00
8	1669.0	1271.2	1666.0	78.62	20.78	103.34	0.00
9	1677.0	1300.2	1674.0	80.10	23.43	103.50	0.00
10	1681.5	1329.2	1678.5	81.58	26.07	103.65	0.00
11	1686.5	1335.6	1683.5	82.24	26.68	102.66	0.00
12	1691.5	1341.9	1688.5	82.91	27.29	101.67	0.00
13	1696.0	1348.2	1693.0	83.57	27.89	100.67	0.00
14	1700.5	1354.5	1697.5	84.23	28.50	99.68	0.00
15	1705.5	1351.1	1702.5	84.83	30.50	100.17	0.00
16	1710.0	1347.6	1707.0	85.42	32.51	100.67	0.00
17	1715.0	1344.1	1712.0	86.02	34.51	101.16	0.00
18	1719.5	1340.7	1716.5	86.61	36.51	101.65	0.00
[redacted]	[redacted]	1340.7	1716.5	86.61	36.51	101.65	188.64
19	1723.0	1331.6	1720.0	88.42	41.06	102.37	188.64
20	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
[redacted]	[redacted]	1322.5	1724.0	90.23	45.61	103.08	188.64
21	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
22	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
23	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
24	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
25	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
30	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
35	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
40	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
45	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
50	1727.0	1322.5	1724.0	90.23	45.61	103.08	188.64
[redacted]	[redacted]	1322.5	1724.0	90.23	45.61	103.08	188.64

Notes

* Elevation of the top of the dams (maximum water surface elevation)

† Plan view area created by a closed contour at the crest elevation

‡ Elevation at the point where the NorthMet tailings beaches meet the FTB dams

Table 1-25 Percentage of Seepage from Each Dam that Flows to Each Toe of the Tailings Basin

	North Dam				*East Dam*				*South Dam*			
Time (yrs)	***North***	***North-West***	***West***	***South***	***North***	***North-West***	***West***	***South***	***North***	***North-West***	***West***	***South***
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.001	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.001	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
8	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
9	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
10	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
11	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
12	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
13	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
14	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
15	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
16	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
17	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
18	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
18.001	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
19	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
20	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
20.001	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
21	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
22	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
23	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
24	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
25	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
30	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
35	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
40	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
45	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
50	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
500	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0

Notes

Year 0 represents existing conditions, Year 7 is the year before Cell 1E and Cell 2E merge, Year 18 represents the beginning of closure activities, Year 20 represents final closure.

Tan cells indicate that the feature does not exist at that time.

Table 1-26 **Volume of saturated tailings within the Flotation Tailings Basin Dams**

Time (yrs)	North Dam (acre-ft)				East Dam (acre-ft)				South Dam (acre-ft)			
	North	*North-West*	*West*	*South*	*North*	*North-West*	*West*	*South*	*North*	*North-West*	*West*	*South*
0	0	0	0	0	0	0	0	0	0	0	0	0
0.001	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	194	0	0	0	0	0	0	0	0	0	0	0
7	532	0	0	0	0	0	0	0	0	0	0	0
7.001	588	0	0	0	0	0	0	0	0	0	0	0
8	768	0	0	0	38	0	0	0	0	0	0	0
9	966	0	0	0	98	0	0	0	0	0	0	0
10	860	0	0	0	131	0	0	0	0	0	0	0
11	1255	0	0	0	191	0	0	0	0	0	0	0
12	1663	0	0	0	275	0	0	0	0	0	0	0
13	2050	0	0	0	352	0	0	0	0	0	0	0
14	2445	0	0	0	438	0	0	0	0	0	0	0
15	2924	0	0	0	540	0	0	0	0	0	0	0
16	3370	0	0	0	667	0	0	0	0	0	0	0
17	3876	0	0	0	791	0	0	0	0	0	0	0
18	4362	0	0	0	916	0	0	0	0	0	0	0
[redacted]	[redacted]	0	0	0	916	0	0	0	0	0	0	0
19	4880	0	0	0	1092	0	0	0	0	0	0	0
20	5453	0	0	0	1260	0	0	0	0	0	0	0
[redacted]	[redacted]	0	0	0	1260	0	0	0	0	0	0	0
21	5291	0	0	0	1260	0	0	0	0	0	0	0
22	5129	0	0	0	1260	0	0	0	0	0	0	0
23	4968	0	0	0	1260	0	0	0	0	0	0	0
24	4806	0	0	0	1260	0	0	0	0	0	0	0
25	4644	0	0	0	1260	0	0	0	0	0	0	0
30	3847	0	0	0	1260	0	0	0	0	0	0	0
35	3038	0	0	0	1260	0	0	0	0	0	0	0
40	2229	0	0	0	1260	0	0	0	0	0	0	0
45	1432	0	0	0	1260	0	0	0	0	0	0	0
50	623	0	0	0	1260	0	0	0	0	0	0	0
500	623	0	0	0	1260	0	0	0	0	0	0	0

Notes

The top of the LTVSMC tailings in Cell 2W is approximated as 1727 feet

The base of the LTVSMC Tailings Basin is approximated as 1500 feet.

Table 1-27 Percentage of Seepage from Each NorthMet Tailings Beach that Flows to Each Toe of the Tailings Basin

	North Beach				*East Beach*				*South Beach*				*Closure Beach*			
Time (yrs)	*North*	*North-West*	*West*	*South*	*North*	*North-West*	*West*	*South*	*North*	*North-West*	*West*	*South*	*North*	*North-West*	*West*	*South*
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.001	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.001	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	1.2	4.9	93.9	0.0	0.0	0.0	0.0
8	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	1.2	4.9	93.9	0.0	0.0	0.0	0.0
9	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	1.2	4.9	93.9	0.0	0.0	0.0	0.0
10	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	1.2	4.9	93.9	0.0	0.0	0.0	0.0
11	99.9	0.1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	1.0	4.3	94.7	0.0	0.0	0.0	0.0
12	99.7	0.3	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.9	3.7	95.4	0.0	0.0	0.0	0.0
13	99.6	0.4	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.7	3.1	96.2	0.0	0.0	0.0	0.0
14	99.4	0.6	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.6	2.5	96.9	0.0	0.0	0.0	0.0
15	99.3	0.7	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.5	1.8	97.7	0.0	0.0	0.0	0.0
16	99.1	0.9	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.3	1.2	98.5	0.0	0.0	0.0	0.0
17	99.0	1.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.2	0.6	99.2	0.0	0.0	0.0	0.0
18	98.8	1.2	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
18.001	98.8	1.2	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	29.3	40.8	24.5	5.4
19	98.8	1.2	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	29.0	41.4	23.9	5.7
20	98.8	1.2	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	28.7	42.0	23.3	6.0
20.001	98.8	1.2	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	28.7	42.0	23.3	6.0
21	98.8	1.2	0.0	0.0	100.0	0.0	0.0	0.0	0.1	0.0	0.0	99.9	30.6	40.6	22.5	6.3
22	98.9	1.1	0.0	0.0	100.0	0.0	0.0	0.0	0.3	0.0	0.0	99.7	32.4	39.2	21.7	6.7
23	*98.9*	*1.1*	*0.0*	*0.0*	*100.0*	*0.0*	*0.0*	*0.0*	*0.4*	*0.0*	*0.0*	*99.6*	*34.3*	*37.8*	*21.0*	*6.9*
24	99.0	1.0	0.0	0.0	100.0	0.0	0.0	0.0	0.5	0.0	0.0	99.5	36.2	36.4	20.2	7.2
25	99.0	1.0	0.0	0.0	100.0	0.0	0.0	0.0	0.6	0.0	0.0	99.4	38.1	35.0	19.4	7.5
30	99.2	0.8	0.0	0.0	100.0	0.0	0.0	0.0	1.3	0.0	0.0	98.7	47.4	28.0	15.5	9.1
35	99.4	0.6	0.0	0.0	100.0	0.0	0.0	0.0	1.9	0.0	0.0	98.1	56.8	21.0	11.7	10.5
40	99.6	0.4	0.0	0.0	100.0	0.0	0.0	0.0	2.5	0.0	0.0	97.5	66.1	14.0	7.8	12.1
45	99.8	0.2	0.0	0.0	100.0	0.0	0.0	0.0	3.2	0.0	0.0	96.8	75.5	7.0	3.9	13.6
50	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	3.8	0.0	0.0	96.2	84.8	0.0	0.0	15.2
500	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	3.8	0.0	0.0	96.2	84.8	0.0	0.0	15.2

Notes

Year 0 represents existing conditions, Year 7 is the year before Cell 1E and Cell 2E merge, Year 18 represents the beginning of closure activities, Year 20 represents final closure.

Tan cells indicate that the feature (unsaturated fine tailings, dams, and the existing pond in Cell 1E) does not exist at that time.

Table 1-28 **Volume of saturated tailings within the Flotation Tailings Basin Beaches**

	North Beach (acre-ft)				*East Beach (acre-ft)*				*South Beach (acre-ft)*				*Closure Beach (acre-ft)*			
Time (yrs)	*North*	*North-West*	*West*	*South*	*North*	*North-West*	*West*	*South*	*North*	*North-West*	*West*	*South*	*North*	*North-West*	*West*	*South*
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2179	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	3913	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	4601	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	5433	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	6103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[redacted]	[redacted]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	6022	0	0	0	104	0	0	0	0	0	0	0	0	0	0	0
9	6632	0	0	0	305	0	0	0	0	0	0	0	0	0	0	0
10	6983	0	0	0	456	0	0	0	0	5	21	409	0	0	0	0
11	7435	7	0	0	600	0	0	0	0	9	38	846	0	0	0	0
12	7894	24	0	0	750	0	0	0	0	12	50	1290	0	0	0	0
13	8315	33	0	0	892	0	0	0	0	12	54	1675	0	0	0	0
14	8732	53	0	0	1040	0	0	0	0	13	53	2067	0	0	0	0
15	9199	65	0	0	1266	0	0	0	0	13	47	2535	0	0	0	0
16	9625	87	0	0	1495	0	0	0	0	9	36	2965	0	0	0	0
17	10100	102	0	0	1760	0	0	0	0	7	21	3462	0	0	0	0
18	10525	128	0	0	2026	0	0	0	0	0	0	3914	0	0	0	0
18.001	10525	128	0	0	2026	0	0	0	0	0	0	3914	0	0	0	0
19	10824	131	0	0	2423	0	0	0	0	0	0	4136	0	0	0	0
20	11170	136	0	0	2873	0	0	0	0	0	0	4402	0	0	0	0
20.001	11170	136	0	0	2873	0	0	0	0	0	0	4402	0	0	0	0
21	10849	132	0	0	2873	0	0	0	4	0	0	4253	0	0	0	0
22	10539	117	0	0	2873	0	0	0	12	0	0	4101	0	0	0	0
23	10209	114	0	0	2873	0	0	0	16	0	0	3942	0	0	0	0
24	9898	100	0	0	2873	0	0	0	19	0	0	3795	0	0	0	0
25	9576	97	0	0	2873	0	0	0	22	0	0	3648	0	0	0	0
30	7975	64	0	0	2873	0	0	0	38	0	0	2900	0	0	0	0
35	6368	38	0	0	2873	0	0	0	42	0	0	2164	0	0	0	0
40	4754	19	0	0	2873	0	0	0	37	0	0	1447	0	0	0	0
45	3134	6	0	0	2873	0	0	0	24	0	0	728	0	0	0	0
50	1507	0	0	0	2873	0	0	0	1	0	0	20	0	0	0	0
[redacted]	[redacted]	0	0	0	2873	0	0	0	1	0	0	20	0	0	0	0

Notes

The top of the LTVSMC tailings in Cell 2E is approximated as 1570 feet

The top of the LTVSMC tailings in Cell 1E is approximated as 1658 feet

Table 1-29 Average Depth to the Phreatic Surface Within Unsaturated Areas

	North Dam		East Dam		South Dam		Closure Beach (feet)
Time (yrs)	Dam (feet)	Beach (feet)	Dam (feet)	Beach (feet)	Dam (feet)	Beach (feet)	
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.001	44.8	4.0	0.0	0.0	0.0	0.0	0.0
1	44.8	4.0	0.0	0.0	0.0	0.0	0.0
2	44.8	4.0	0.0	0.0	0.0	0.0	0.0
3	52.4	6.7	0.0	0.0	0.0	0.0	0.0
4	60.1	9.5	0.0	0.0	0.0	0.0	0.0
5	67.7	12.2	0.0	0.0	0.0	0.0	0.0
6	75.4	15.0	0.0	0.0	0.0	0.0	0.0
7	83.0	17.7	0.0	0.0	0.0	0.0	0.0
7.001	83.0	17.7	6.0	3.0	77.7	16.3	0.0
8	89.4	19.4	6.0	3.0	77.7	16.3	0.0
9	95.9	21.2	6.0	3.0	77.7	16.3	0.0
10	102.3	22.9	6.0	3.0	77.7	16.3	0.0
11	103.5	23.0	6.0	3.0	76.2	16.8	0.0
12	104.7	23.0	6.0	3.0	74.8	17.2	0.0
13	105.9	23.1	6.0	3.0	73.3	17.7	0.0
14	107.1	23.2	6.0	3.0	71.9	18.1	0.0
15	108.3	23.3	6.0	3.0	70.4	18.6	0.0
16	109.5	23.3	6.0	3.0	68.9	19.1	0.0
17	110.7	23.4	6.0	3.0	67.5	19.5	0.0
18	111.9	23.5	6.0	3.0	66.0	20.0	0.0
18.001	111.9	23.5	6.0	3.0	66.0	20.0	11.1
19	112.5	26.1	6.0	3.0	67.7	21.6	12.8
20	113.2	28.7	6.0	3.0	69.4	23.3	14.5
20.001	113.2	28.7	6.0	3.0	69.4	23.3	14.5
21	114.5	32.3	6.0	3.0	70.6	24.7	16.3
22	115.8	35.9	6.0	3.0	71.8	26.1	18.1
23	117.1	39.6	6.0	3.0	73.0	27.6	19.9
24	118.4	43.2	6.0	3.0	74.2	29.0	21.7
25	119.7	46.8	6.0	3.0	75.5	30.4	23.5
30	126.1	64.9	6.0	3.0	81.5	37.5	32.6
35	132.6	83.0	6.0	3.0	87.6	44.6	41.6
40	139.1	101.1	6.0	3.0	93.6	51.6	50.6
45	145.5	119.2	6.0	3.0	99.7	58.7	59.7
50	152.0	137.3	6.0	3.0	105.7	65.8	68.7
500	152.0	137.3	6.0	3.0	105.7	65.8	68.7

Notes

Year 0 represents existing conditions, Year 7 is the year before Cell 1E and Cell 2E merge, Year 18 represents the beginning of closure activities.

Tan cells indicate that the feature (unsaturated fine tailings, dams, and the existing pond in Cell 1E) does not exist at that time.

A minimum value of 3 feet in the beaches and 6 feet in the dams was used

Table 1-30 Areas of the Flotation Tailings Pond

Time (yrs)	*Pond_Top_Area (acres)*	*Pond_Bottom_Area (acres)*
0	182.80	142.50
0.001	420.80	305.71
1	420.80	305.71
2	423.75	307.63
3	426.69	309.56
4	429.63	311.87
5	431.96	313.73
6	434.28	318.06
7	442.54	326.80
[illegible]	[illegible]	883.55
8	1068.44	883.55
9	1093.19	908.45
10	1117.94	933.56
11	1123.99	943.18
12	1130.04	952.85
13	1136.09	957.62
14	1142.14	962.40
15	1135.58	956.55
16	1129.02	950.70
17	1122.47	943.84
18	1115.91	936.99
18.001	905.32	758.01
19	905.32	758.01
20	905.32	758.01
500	905.32	758.01

Notes

* Areas at Year 0 represent the areas of the existing pond in Cell 2E

Table 1-31 Seepage Quantity and Direction from the NorthMet Flotation Tailings Pond

Time (yrs)	*Pond_Seepage_Rate (in/yr)*	*Pond_Seepage_Direction[N] (%)*	*Pond_Seepage_Direction[NW] (%)*	*Pond_Seepage_Direction[W] (%)*	*Pond_Seepage_Direction[S] (%)*	*Pond_Saturated_Volume (acre-ft)*
0	46.0	100.0	0.0	0.0	0.0	12796
0.001	14.6	100.0	0.0	0.0	0.0	23460
1	14.6	93.1	6.9	0.0	0.0	29772
2	14.6	86.1	13.9	0.0	0.0	35065
3	19.3	82.4	17.6	0.0	0.0	40429
4	24.0	78.8	21.2	0.0	0.0	46293
5	28.7	75.1	24.9	0.0	0.0	51295
6	33.4	71.5	28.5	0.0	0.0	57216
7	38.1	67.8	32.2	0.0	0.0	63615
7.001	38.1	67.8	32.2	0.0	0.0	153589
8	33.7	62.7	29.2	3.0	5.1	162136
9	29.3	57.7	26.2	6.0	10.1	174637
10	24.9	52.6	23.2	9.0	15.2	183622
11	25.4	53.2	21.9	8.9	16.0	190235
12	25.9	53.7	20.5	8.9	16.9	196909
13	26.4	54.3	19.2	8.9	17.6	203076
14	26.9	54.8	17.8	8.9	18.5	209297
15	27.4	55.4	16.5	8.8	19.3	213773
16	27.9	56.0	15.1	8.8	20.1	217619
17	28.4	56.5	13.8	8.7	21.0	221968
18	28.9	57.1	12.4	8.7	21.8	225692
18.001	28.9	57.1	12.4	8.7	21.8	183101
19	27.1	58.5	11.8	8.4	21.3	186270
20	25.2	60.0	11.2	8.0	20.8	189891
30	25.2	60.0	11.2	8.0	20.8	189891
30.001	6.5	60.0	11.2	8.0	20.8	189891
50	6.5	81.0	0.0	0.0	19.0	189891
500	6.5	81.0	0.0	0.0	19.0	189891

Notes

Values at year 0 represent the existing conditions of the pond in Cell 2E

Table 1-32 Areas Contributing Runoff to the Tailings Basin as it Develops

Time (yrs)	*Contr_Embank_Area_2E (acres)*	*Contr_Embank_Area_1E (acres)*	*Contr_Watershed_2E (acres)*	*Contr_Watershed_1E (acres)*
0	86.6	49.4	112.0	835.9
2	83.8	46.7	100.1	835.9
4	72.0	46.7	72.3	835.9
6	61.8	46.7	62.5	835.9
7	50.5	46.7	51.0	835.9
7.001	0.0	97.2	0.0	281.7
10	0.0	75.7	0.0	245.5
14	0.0	48.4	0.0	194.8
18	0.0	26.4	0.0	159.2
20	0.0	19.1	0.0	138.5
500	0.0	19.1	0.0	138.5

Notes

Year 0 represents existing conditions, Year 7 is the year before Cell 1E and Cell 2E merge,

Year 18 represents the beginning of closure activities, Year 20 represents final closure.

The area contributing runoff to Cell 2E is added to the area contributing to Cell 1E in years after the two cells have merged

Table 1-33 **Areas of the Existing LTVSMC Tailings Zones**

	Cell 2W			*Cell 1E*			*Cell 2E*		
Time (yrs)	*Coarse Tailings (m^2)*	*Fine Tailings (m^2)*	*Other (m^2)*	*Coarse Tailings (m^2)*	*Fine Tailings (m^2)*	*Other (m^2)*	*Coarse Tailings (m^2)*	*Fine Tailings (m^2)*	*Other (m^2)*
0	890,625	3,027,344	1,845,703	1,173,828	824,219	0	810,547	687,966	304,688
0.001	890,625	3,027,344	1,845,692	1,173,703	824,219	0	50,781	0	304,688
1	890,625	3,027,344	1,834,574	1,048,828	824,219	0	50,781	0	304,688
2	890,625	3,027,344	1,823,445	1,034,505	824,219	0	42,318	0	304,688
3	890,625	3,027,344	1,799,569	1,020,182	824,219	0	33,854	0	304,688
4	890,625	3,027,344	1,775,693	1,005,859	824,219	0	25,391	0	304,688
5	890,625	3,027,344	1,755,054	991,536	824,219	0	16,927	0	304,688
6	890,625	3,027,344	1,734,415	977,214	824,219	0	8,464	0	304,688
7	890,625	3,027,344	1,688,685	962,891	824,219	0	0	0	304,688
7.001	890,625	3,027,344	1,688,656	31,250	0	0	0	0	304,688
8	890,625	3,027,344	1,659,683	31,250	0	0	0	0	304,688
9	890,625	3,027,344	1,630,680	29,492	0	0	0	0	304,688
10	890,625	3,027,344	1,601,678	27,734	0	0	0	0	304,688
11	890,625	3,027,344	1,574,058	25,977	0	0	0	0	304,688
12	890,625	3,027,344	1,546,438	24,219	0	0	0	0	304,688
13	890,625	3,027,344	1,518,818	22,461	0	0	0	0	304,688
14	890,625	3,027,344	1,491,199	20,703	0	0	0	0	304,688
15	890,625	3,027,344	1,468,941	18,945	0	0	0	0	304,688
16	890,625	3,027,344	1,446,683	17,188	0	0	0	0	304,688
17	890,625	3,027,344	1,424,425	15,430	0	0	0	0	304,688
18	890,625	3,027,344	1,402,168	13,672	0	0	0	0	304,688
18.001	890,625	3,027,344	1,402,153	13,672	0	0	0	0	304,688
19	890,625	3,027,344	1,387,397	13,672	0	0	0	0	304,688
20	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
20.001	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
21	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
22	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
23	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
24	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
25	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
30	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
35	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
40	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
45	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
50	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688
500	890,625	3,027,344	1,372,626	13,672	0	0	0	0	304,688

Notes

Tan cells indicate that the feature is not present.

Table 1-34 Depth to the Water Table in the Existing LTVSMC tailings

Time (yrs)	Cell 2W			Cell 1E			Cell 2E		
	Coarse Tailings (ft)	Fine Tailings (ft)	Other (ft)	Coarse Tailings (ft)	Fine Tailings (ft)	Other (ft)	Coarse Tailings (ft)	Fine Tailings (ft)	Other (ft)
0	125.4	114.9	96.4	42.6	39.0	0.0	28.3	36.8	42.4
0.001	125.4	114.9	96.4	42.6	39.0	0.0	28.3	36.8	42.4
1	121.9	106.1	92.7	39.0	37.6	0.0	27.8	18.4	35.1
2	118.3	97.4	89.0	35.5	36.2	0.0	27.4	0.0	27.8
3	119.0	92.1	89.5	34.9	35.9	0.0	21.9	0.0	28.0
4	119.8	86.8	90.0	34.3	35.5	0.0	16.4	0.0	28.3
5	120.5	81.5	90.4	33.8	35.2	0.0	11.0	0.0	28.5
6	121.3	76.2	90.9	33.2	34.8	0.0	5.5	0.0	28.8
7	122.0	70.9	91.4	32.6	34.5	0.0	0.0	0.0	29.0
7.001	122.0	70.9	91.4	32.6	34.5	0.0	0.0	0.0	29.0
8	120.8	70.8	91.1	25.0	23.0	0.0	0.0	0.0	32.2
9	119.6	70.7	90.9	17.5	11.5	0.0	0.0	0.0	35.5
10	118.4	70.6	90.6	9.9	0.0	0.0	0.0	0.0	38.7
11	118.0	69.3	90.9	9.4	0.0	0.0	0.0	0.0	39.0
12	117.5	67.9	91.2	9.0	0.0	0.0	0.0	0.0	39.2
13	117.1	66.6	91.5	8.5	0.0	0.0	0.0	0.0	39.5
14	116.6	65.2	91.7	8.1	0.0	0.0	0.0	0.0	39.8
15	116.2	63.9	92.0	7.6	0.0	0.0	0.0	0.0	40.1
16	115.7	62.5	92.3	7.1	0.0	0.0	0.0	0.0	40.3
17	115.3	61.2	92.6	6.7	0.0	0.0	0.0	0.0	40.6
18	114.8	59.8	92.9	6.2	0.0	0.0	0.0	0.0	40.9
18.001	114.8	59.8	92.9	6.2	0.0	0.0	0.0	0.0	40.9
19	116.3	60.7	93.4	4.9	0.0	0.0	0.0	0.0	41.1
20	117.8	61.7	93.9	3.6	0.0	0.0	0.0	0.0	41.4
20.001	117.8	61.7	93.9	3.6	0.0	0.0	0.0	0.0	41.4
21	118.9	62.5	94.3	7.3	0.0	0.0	0.0	0.0	41.7
22	120.0	63.3	94.7	11.1	0.0	0.0	0.0	0.0	42.0
23	121.1	64.1	95.2	14.8	0.0	0.0	0.0	0.0	42.4
24	122.1	64.9	95.6	18.5	0.0	0.0	0.0	0.0	42.7
25	123.2	65.7	96.0	22.3	0.0	0.0	0.0	0.0	43.0
30	128.6	69.6	98.1	40.9	0.0	0.0	0.0	0.0	44.6
35	134.1	73.6	100.2	59.6	0.0	0.0	0.0	0.0	46.2
40	139.5	77.6	102.2	78.2	0.0	0.0	0.0	0.0	47.8
45	144.9	81.5	104.3	96.9	0.0	0.0	0.0	0.0	49.4
50	155.4	89.4	108.3	117.8	0.0	0.0	0.0	0.0	52.3
500	155.4	89.4	108.3	117.8	0.0	0.0	0.0	0.0	52.3

Notes

Year 0 represents existing conditions, Year 7 is the year before Cell 1E and Cell 2E merge, Year 18 represents the beginning of closure activities, Year 20 represents final closure.

Tan cells indicate that the feature does not exist at that time.

Table 1-35 **Seepage Direction from each zone in Cell 2W**

Time (yrs)	Coarse Tailings (%)				Fine Tailings (%)				Other (%)			
	North	North-West	West	South	North	North-West	West	South	North	North-West	West	South
0	0.7	37.4	44.6	17.3	1.4	50.2	47.2	1.2	11.3	39.9	44.2	4.6
0.001	0.7	37.4	44.6	17.3	1.4	50.2	47.2	1.2	11.3	39.9	44.2	4.6
1	0.3	36.1	45.9	17.7	0.7	49.5	48.8	1.0	6.4	45.4	42.6	5.6
2	0.0	34.8	47.2	18.0	0.0	48.7	50.4	0.9	1.7	50.8	41.0	6.5
3	0.0	32.7	49.8	17.5	0.0	47.6	51.5	0.9	1.6	49.7	42.1	6.6
4	0.0	30.6	52.4	17.0	0.0	46.5	52.7	0.8	1.5	48.6	43.2	6.7
5	0.0	28.5	55.0	16.5	0.0	45.5	53.8	0.7	1.1	47.6	44.4	6.9
6	0.0	26.4	57.6	16.0	0.0	44.4	55.0	0.6	1.0	46.5	45.5	7.0
7	0.0	24.3	60.2	15.5	0.0	43.3	56.1	0.6	0.9	45.4	46.6	7.1
7.001	0.0	24.3	60.2	15.5	0.0	43.3	56.1	0.6	0.9	45.4	46.6	7.1
8	0.0	25.2	59.5	15.3	0.0	43.7	55.8	0.5	1.2	45.2	46.8	6.8
9	0.0	26.2	58.8	15.0	0.0	44.2	55.4	0.4	1.5	45.1	47.0	6.4
10	0.0	27.1	58.1	14.8	0.0	44.6	55.1	0.3	1.8	44.9	47.2	6.1
11	0.0	26.8	58.4	14.8	0.0	44.4	55.3	0.3	1.9	44.5	47.4	6.2
12	0.1	26.6	58.6	14.7	0.0	44.2	55.5	0.3	2.1	44.0	47.6	6.3
13	0.1	26.3	58.9	14.7	0.0	44.0	55.8	0.2	2.1	43.6	47.8	6.5
14	0.1	26.1	59.2	14.6	0.0	43.8	56.0	0.2	2.2	43.2	48.0	6.6
15	0.1	25.8	59.5	14.6	0.1	43.6	56.2	0.1	2.4	42.7	48.2	6.7
16	0.3	25.5	59.7	14.5	0.1	43.4	56.4	0.1	2.5	42.3	48.4	6.8
17	0.2	25.3	60.0	14.5	0.1	43.2	56.7	0.0	2.6	41.8	48.6	7.0
18	0.3	25.0	60.3	14.4	0.1	43.0	56.9	0.0	2.7	41.4	48.8	7.1
18.001	0.3	25.0	60.3	14.4	0.1	43.0	56.9	0.0	2.7	41.4	48.8	7.1
19	0.4	25.0	59.9	14.7	0.1	43.2	56.7	0.0	2.7	41.4	48.6	7.3
20	0.4	25.0	59.5	15.1	0.1	43.5	56.4	0.0	2.7	41.4	48.4	7.5
20.001	0.4	25.0	59.5	15.1	0.1	43.5	56.4	0.0	2.7	41.4	48.4	7.5
21	0.4	25.6	58.9	15.1	0.2	43.9	55.9	0.0	2.9	41.3	48.2	7.6
22	0.4	26.1	58.3	15.2	0.2	44.3	55.4	0.1	3.1	41.2	48.0	7.7
23	0.5	26.7	57.6	15.2	0.3	44.8	54.9	0.0	3.3	41.1	47.8	7.8
24	0.6	27.2	57.0	15.2	0.3	45.2	54.5	0.0	3.6	40.9	47.6	7.9
25	0.5	27.8	56.4	15.3	0.4	45.6	54.0	0.0	3.7	40.8	47.4	8.1
30	0.6	30.6	53.3	15.5	0.7	47.7	51.5	0.1	4.7	40.3	46.4	8.6
35	0.7	33.4	50.2	15.7	1.0	49.9	49.1	0.0	5.7	39.7	45.4	9.2
40	1.0	36.2	47.0	15.8	1.2	52.0	46.7	0.1	6.8	39.1	44.4	9.7
45	1.1	39.0	43.9	16.0	1.5	54.1	44.2	0.2	7.7	38.6	43.4	10.3
50	14.6	31.1	35.2	19.1	8.9	55.5	35.4	0.2	11.1	36.1	41.6	11.2
500	14.6	31.1	35.2	19.1	8.9	55.5	35.4	0.2	11.1	36.1	41.6	11.2

Notes

Year 0 represents existing conditions, Year 7 is the year before Cell 1E and Cell 2E merge, Year 18 represents the beginning of closure activities, Year 20 represents final closure.

Table 1-36 Volume of saturated tailings under each zone of Cell 2W

Time (yrs)	Coarse Tailings (acre-ft)				Fine Tailings (acre-ft)				Other (acre-ft)			
	North	North-West	West	South	North	North-West	West	South	North	North-West	West	South
0	[redacted]	[redacted]	9973	3868	1174	42097	39581	1006	3365	11883	13164	1370
[redacted]	[redacted]	[redacted]	9973	3868	1174	42097	39581	1006	3365	11883	13164	1370
1	69	8350	10617	4094	633	44769	44136	[redacted]	[redacted]	13962	13101	1722
2	0	8325	11291	4306	0	47215	48863	873	539	16111	13003	2061
3	0	7772	11837	4159	0	48036	51971	908	510	15837	13416	2103
4	0	7219	12362	4011	0	48769	55272	839	480	15562	13833	2145
5	0	6680	12891	3867	0	49524	58558	762	354	15310	14280	2219
6	0	6141	13399	3722	0	50087	62045	677	323	15013	14690	2260
7	0	5615	13911	3582	0	50563	65510	701	294	14844	15236	2321
7.001	0	5615	13911	3582	0	50563	65510	701	294	14844	15236	2321
8	0	5890	13907	3576	0	51063	65202	584	397	14954	15484	2250
9	0	6193	13898	3545	0	51680	64776	468	502	15087	15722	2141
10	0	6477	13886	3537	0	52181	64466	351	609	15193	15971	2064
11	0	6429	14009	3550	0	52379	65238	354	648	15169	16157	2113
12	24	6410	14122	3542	0	52606	66055	357	721	15110	16346	2163
13	24	6361	14246	3555	0	52796	66955	240	726	15083	16536	2249
14	24	6341	14384	3547	0	53015	67781	242	767	15064	16738	2301
15	24	6291	14509	3560	122	53197	68570	122	842	14974	16903	2350
16	73	6246	14623	3552	123	53407	69405	123	882	14918	17070	2398
17	49	6219	14750	3564	124	53581	70325	0	922	14826	17238	2483
18	74	6173	14890	3556	125	53783	71169	0	963	14768	17408	2533
18.001	74	6173	14890	3556	125	53783	71169	0	963	14768	17408	2533
19	97	6091	14593	3581	124	53743	70537	0	965	14803	17377	2610
20	96	6008	14299	3629	124	53791	69742	0	968	14838	17347	2688
20.001	96	6008	14299	3629	124	53791	69742	0	968	14838	17347	2688
21	95	6090	14013	3592	246	54022	68789	0	1037	14774	17243	2719
22	94	6146	13729	3579	245	54250	67843	[redacted]	[redacted]	14711	17138	2749
23	[redacted]	[redacted]	13424	3543	366	54594	66902	0	1175	14640	17027	2778
24	[redacted]	[redacted]	13159	3509	364	54811	66088	0	1280	14541	16923	2809
25	[redacted]	[redacted]	12884	3495	483	55023	65159	0	1313	14478	16820	2874
30	[redacted]	[redacted]	11542	3357	824	56165	60640	[redacted]	[redacted]	14157	16300	3021
35	[redacted]	[redacted]	10264	3210	1148	57262	56344	0	1982	13805	15787	3199
40	[redacted]	[redacted]	9051	3043	1341	58116	52193	[redacted]	[redacted]	13463	15288	3340
45	[redacted]	[redacted]	7932	2891	1633	58885	48109	[redacted]	[redacted]	13154	14789	3510
50	2301	4901	5547	3010	9161	57129	36439	[redacted]	[redacted]	12057	13894	3741
[redacted]	[redacted]	4901	5547	3010	9161	57129	36439	[redacted]	[redacted]	12057	13894	3741

Notes

The top of the LTVSMC tailings in Cell 2W is approximated as 1727 feet

The base of the LTVSMC Tailings Basin is approximated as 1500 feet.

Table 1-37 **Seepage Direction from each zone in Cell 2E**

Time (yrs)	Coarse Tailings (%)				Fine Tailings (%)				Other (%)			
	North	North-West	West	South	North	North-West	West	South	North	North-West	West	South
0	94.6	5.4	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
0.001	94.6	5.4	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
1	48.0	52.0	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
2	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
3	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
4	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
5	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
6	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
7	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
7.001	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
8	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
9	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
10	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
11	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
12	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
13	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
14	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
15	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
16	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
17	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
18	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
18.001	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
19	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
20	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
20.001	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
21	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
22	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
23	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
24	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
25	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
30	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
35	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
40	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
45	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
50	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0
500	1.5	98.5	0.0	0.0	100.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0

Notes

Year 0 represents existing conditions, Year 7 is the year before Cell 1E and Cell 2E merge, Year 18 represents the beginning of closure activities, Year 20 represents final closure.

Table 1-38 **Volume of saturated tailings under each zone of Cell 2E**

Time (yrs)	Coarse Tailings (acre-ft)				Fine Tailings (acre-ft)				Other (acre-ft)			
	North	North-West	West	South	North	North-West	West	South	North	North-West	West	South
0	7901	451	0	0	5644	0	0	0	2049	29	0	0
0.001	12927	738	0	0	11900	0	0	0	2049	29	0	0
1	6562	7109	0	0	11900	0	0	0	2591	37	0	0
2	206	13528	0	0	11900	0	0	0	3133	44	0	0
3	208	13630	0	0	11900	0	0	0	3118	44	0	0
4	209	13709	0	0	11900	0	0	0	3096	44	0	0
5	210	13765	0	0	11900	0	0	0	3081	44	0	0
6	210	13799	0	0	11900	0	0	0	3059	43	0	0
7	210	13810	0	0	11900	0	0	0	3044	43	0	0
7.001	210	13810	0	0	11900	0	0	0	3044	43	0	0
8	210	13810	0	0	11900	0	0	0	2806	40	0	0
9	210	13810	0	0	11900	0	0	0	2561	36	0	0
10	210	13810	0	0	11900	0	0	0	2324	33	0	0
11	210	13810	0	0	11900	0	0	0	2301	33	0	0
12	210	13810	0	0	11900	0	0	0	2286	32	0	0
13	210	13810	0	0	11900	0	0	0	2264	32	0	0
14	210	13810	0	0	11900	0	0	0	2242	32	0	0
15	210	13810	0	0	11900	0	0	0	2220	32	0	0
16	210	13810	0	0	11900	0	0	0	2205	31	0	0
17	210	13810	0	0	11900	0	0	0	2183	31	0	0
18	210	13810	0	0	11900	0	0	0	2160	31	0	0
18.001	210	13810	0	0	11900	0	0	0	2160	31	0	0
19	210	13810	0	0	11900	0	0	0	2145	30	0	0
20	210	13810	0	0	11900	0	0	0	2123	30	0	0
20.001	210	13810	0	0	11900	0	0	0	2123	30	0	0
21	210	13810	0	0	11900	0	0	0	2101	30	0	0
22	210	13810	0	0	11900	0	0	0	2079	30	0	0
23	210	13810	0	0	11900	0	0	0	2049	29	0	0
24	210	13810	0	0	11900	0	0	0	2027	29	0	0
25	210	13810	0	0	11900	0	0	0	2004	28	0	0
30	210	13810	0	0	11900	0	0	0	1886	27	0	0
35	210	13810	0	0	11900	0	0	0	1767	25	0	0
40	210	13810	0	0	11900	0	0	0	1648	23	0	0
45	210	13810	0	0	11900	0	0	0	1529	22	0	0
50	210	13810	0	0	11900	0	0	0	1314	19	0	0
500	210	13810	0	0	11900	0	0	0	1314	19	0	0

Notes

The top of the LTVSMC tailings in Cell 2E is approximated as 1570 feet

The base of the LTVSMC Tailings Basin is approximated as 1500 feet.

Table 1-39 Seepage Direction from each zone in Cell 1E

Time (yrs)	Coarse Tailings (%)				Fine Tailings (%)				Other (%)				Pond (%)			
	North	North-West	West	South	North	North-West	West	South	North	North-West	West	South	North	North-West	West	South
0	62.7	4.5	0.0	32.8	41.1	16.3	0.0	42.6	0.0	0.0	0.0	0.0	27.4	16.6	10.4	45.6
0.001	62.7	4.5	0.0	32.8	41.1	16.3	0.0	42.6	0.0	0.0	0.0	0.0	27.4	16.6	10.4	45.6
1	33.1	18.6	0.0	48.3	28.0	24.3	0.0	47.7	0.0	0.0	0.0	0.0	20.8	20.3	10.4	48.5
2	3.5	32.7	0.0	63.8	15.1	32.2	0.0	52.7	0.0	0.0	0.0	0.0	14.5	23.9	10.3	51.3
3	2.8	37.0	0.7	59.5	12.4	32.1	1.4	54.1	0.0	0.0	0.0	0.0	12.0	22.1	12.5	53.4
4	2.1	41.3	1.4	55.2	9.7	32.0	2.8	55.5	0.0	0.0	0.0	0.0	9.5	20.2	14.8	55.5
5	1.4	45.7	2.0	50.9	6.9	31.9	4.2	57.0	0.0	0.0	0.0	0.0	7.0	18.4	17.0	57.6
6	0.8	50.0	2.6	46.6	4.2	31.8	5.6	58.4	0.0	0.0	0.0	0.0	4.5	16.5	19.3	59.7
7	0.1	54.3	3.3	42.3	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
7.001	0.1	54.3	3.3	42.3	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
8	0.0	45.9	5.4	48.7	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
9	0.1	37.4	7.4	55.1	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
10	0.0	29.0	9.5	61.5	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
11	0.0	25.4	8.3	66.3	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
12	0.0	21.8	7.1	71.1	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
13	0.0	18.1	6.0	75.9	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
14	0.0	14.5	4.8	80.7	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
15	0.0	10.9	3.5	85.6	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
16	0.0	7.3	2.3	90.4	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
17	0.0	3.6	1.2	95.2	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
18	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
18.001	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
19	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
20	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
20.001	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
21	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
22	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
23	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
24	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
25	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
30	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
35	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
40	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
45	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
50	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8
500	0.0	0.0	0.0	100.0	1.5	31.7	7.0	59.8	0.0	0.0	0.0	0.0	2.0	14.7	21.5	61.8

Notes

Year 0 represents existing conditions, Year 7 is the year before Cell 1E and Cell 2E merge, Year 18 represents the beginning of closure activities, Year 20 represents final closure.

Gray cells indicate that the feature (unsaturated fine tailings, dams, and the existing pond in Cell 1E) does not exist at that time.

Table 1-40 Volume of saturated tailings under each zone of Cell 1E

Time (yrs)	Coarse Tailings (acre-ft) North	Coarse Tailings (acre-ft) North-West	Coarse Tailings (acre-ft) West	Coarse Tailings (acre-ft) South	Fine Tailings (acre-ft) North	Fine Tailings (acre-ft) North-West	Fine Tailings (acre-ft) West	Fine Tailings (acre-ft) South	Other (acre-ft) North	Other (acre-ft) North-West	Other (acre-ft) West	Other (acre-ft) South
0	20987	1506	0	10979	9961	3951	0	10325	0	0	0	0
0.001	20988	1506	0	10980	9961	3951	0	10325	0	0	0	0
1	11824	6644	0	17254	6866	5959	0	11697	0	0	0	0
2	1286	12019	0	23449	3746	7988	0	13073	0	0	0	0
3	1037	13702	259	22034	3084	7983	348	13454	0	0	0	0
4	783	15407	522	20592	2420	7984	699	13847	0	0	0	0
5	526	17159	751	19112	1726	7978	1050	14256	0	0	0	0
6	302	18906	983	17621	1054	7979	1405	14654	0	0	0	0
7	38	20673	1256	16105	[illegible]	[illegible]	1761	15042	0	0	0	0
7.001	46	24749	1504	19279	483	10201	2253	19243	0	0	0	0
8	0	20947	2464	22225	483	10201	2253	19243	0	0	0	0
9	46	17092	3382	25182	483	10201	2253	19243	0	0	0	0
10	0	13271	4347	28143	483	10201	2253	19243	0	0	0	0
11	0	11625	3799	30345	483	10201	2253	19243	0	0	0	0
12	0	9979	3250	32546	483	10201	2253	19243	0	0	0	0
13	0	8287	2747	34749	483	10201	2253	19243	0	0	0	0
14	0	6639	2198	36951	483	10201	2253	19243	0	0	0	0
15	0	4992	1603	39199	483	10201	2253	19243	0	0	0	0
16	0	3343	1053	41402	483	10201	2253	19243	0	0	0	0
17	0	1649	550	43605	483	10201	2253	19243	0	0	0	0
18	0	0	0	45808	483	10201	2253	19243	0	0	0	0
18.001	0	0	0	45808	483	10201	2253	19243	0	0	0	0
19	0	0	0	45813	483	10201	2253	19243	0	0	0	0
20	0	0	0	45817	483	10201	2253	19243	0	0	0	0
20.001	0	0	0	45817	483	10201	2253	19243	0	0	0	0
21	0	0	0	45805	483	10201	2253	19243	0	0	0	0
22	0	0	0	45792	483	10201	2253	19243	0	0	0	0
23	0	0	0	45779	483	10201	2253	19243	0	0	0	0
24	0	0	0	45767	483	10201	2253	19243	0	0	0	0
25	0	0	0	45754	483	10201	2253	19243	0	0	0	0
30	0	0	0	45691	483	10201	2253	19243	0	0	0	0
35	0	0	0	45628	483	10201	2253	19243	0	0	0	0
40	0	0	0	45565	483	10201	2253	19243	0	0	0	0
45	0	0	0	45502	483	10201	2253	19243	0	0	0	0
50	0	0	0	45431	483	10201	2253	19243	0	0	0	0
500	0	0	0	45431	483	10201	2253	19243	0	0	0	0

Notes

The top of the LTVSMC tailings in Cell 1E is approximated as 1658 feet

The base of the LTVSMC Tailings Basin is approximated as 1500 feet.

Gray cells indicate that the feature (unsaturated fine tailings, dams, and the existing pond in Cell 1E) does not exist at that time.

Table 1-41 Stage-Area-Storage Relationship in the HRF

Elevation (ft)	*Area (acres)*	*Volume (acre-ft)*
1570	34.07	0.00
1572	35.06	69.13
1574	36.04	140.23
1576	37.02	213.29
1578	38.01	288.32
1580	38.99	365.33
1582	39.98	444.29
1584	40.96	525.23
1586	41.94	608.13
1588	42.93	693.01
1590	43.91	779.85
1592	44.90	868.66
1594	45.88	959.43
1596	46.86	1052.18
1598	47.85	1146.89
1600	53.05	1244.83
1602	54.33	1352.22
1604	55.61	1462.16
1606	56.89	1574.66
1608	58.17	1689.71
1610	59.45	1807.33
1612	60.73	1927.50
1614	62.00	2050.23
1616	63.28	2175.52
1618	64.56	2303.37
1620	65.84	2433.77
1622	67.12	2566.73
1624	68.40	2702.25
1626	69.68	2840.33
1628	70.96	2980.97
1630	77.08	3125.62
1632	78.49	3281.19
1634	79.91	3439.59
1636	81.32	3600.82
1638	82.74	3764.88
1640	84.15	3931.77
1642	85.57	4101.50
1644	86.99	4274.06
1646	88.40	4449.44
1648	89.82	4627.66
1650	96.54	4810.30

Table 1-42 Hydrometallurgical Residue Facility Evolution

Time (yrs)	*Crest_El (ft)*	*Forest_WS_Area (acres)*	*Cell2W_WS_Area (acres)*
0	1570	0.0	0.0
3	1600	42.0	14.9
6	1630	24.1	0.0
13	1650	25.3	0.0
[redacted]	[redacted]	25.3	0.0

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Table 1-43 FTB WWTP Effluent Concentration

Constituent	***Effluent_Conc (mg/L)***
Ag	0.001
Al	0.125
Alk (as CaCO3)	100
As	0.01
B	0.4
Ba	0.005
Be	0.004
Ca	75
Cd	0.004
Cl	1.3
Co	0.005
Cr	0.011
Cu	0.016
F	0.05
Fe	0.3
K	0.5
Mg*	3.05
Mn	0.05
Na	2
Ni	0.09
Pb	0.007
Sb	0.031
Se	0.005
SO_4	9
Tl	0.00056
V	0.05
Zn	0.215

Notes

Effluent concentrations are based on the expected effluent of the chosen RO system

* Magnesium value set so that the effluent hardness is 200 mg/L

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

Table 1-45

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Table 1-46 Groundwater Flow Path Characteristics

Variable Name	*Units*	*Description*	*Groundwater Flow Path*			
			[N]	*[NW]*	*[W]*	*[S]**
HD	[m]	Downstream water table elevation	443.2	438.6	430	0
La	[m]	Total flow path length	3260	3715	5410	1
w	[m]	Average flow path width	1920	2090	2920	0
Init_Grad	[--]	Initial hydraulic gradient (determines flow capacity)	-0.00444	-0.00514	-0.00736	0
Eval_Loc1	[m]	Length from the upstream end (basin toe) to the first evaluation location on the flow path	1205	1325	3110	0

<u>Notes</u>

* South [S] flow path not actually modeled.

Table 1-47 Flow_Control, 1 if the SW location in the row contributes flow to the SW location in the column

Location	*PM12*	*PM12_2*	*PM12_3*	*PM12_4*	*PM13*	*MLC3*	*MLC2*	*TC1*	*PM19*	*UC1*	*PM11*
PM12	1	1	1	1	1	0	0	0	0	0	0
PM12_2	0	1	1	1	1	0	0	0	0	0	0
PM12_3	0	0	1	1	1	0	0	0	0	0	0
PM12_4	0	0	0	1	1	0	0	0	0	0	0
PM13	0	0	0	0	1	0	0	0	0	0	0
MLC3	0	0	1	1	1	1	1	0	0	0	0
MLC2	0	0	1	1	1	0	1	0	0	0	0
TC1	0	0	1	1	1	0	0	1	1	0	0
PM19	0	0	1	1	1	0	0	0	1	0	0
UC1	0	0	0	0	1	0	0	0	0	1	1
PM11	0	0	0	0	1	0	0	0	0	0	1

Table 1-48 **Surface Water Characteristics**

Surface Water Evaluation Point	*Lengths (m)*	*XS_Area (m^2)*
PM-12	6381	10
PM-12.2	6324	30
PM-12.3	14343	30
PM-12.4	5865	30
PM-13	5892	30
MLC-3	1210	5
MLC-2	2575	5
TC-1	1325	5
PM-19	2554	5
UC-1	10	5
PM-11	3300	5

Notes

Lengh based on GIS data

Area based on modeling assumptions

Table 1-49a Contributing Areas to each Surface Water Evaluation Point, Existing Conditions

Surface Water Evaluation Point	*Incremental Tributary Area (sq mi)**				
	Surface Water			*Groundwater*	
	Natural Areas	*Cell 2W Dams*	*Cell 2E Dams*	*Non-Modeled Flow Path*	*Modeled Flow Path*
PM-12	18.97	0	0	18.97	0
PM-12.2	14.12	0	0	14.12	0
PM-12.3	41.28	0	0	41.28	0
PM-12.4	11.38	0	0	10.94	0.44
PM-13	8.91	0	0	6.22	5.66
MLC-3	1.36	0	0.04	0.73	0.00
MLC-2	2.17	0	0	1.08	2.42
TC-1	1.94	0.16	0.08	0	0
PM-19	1.76	0	0	0	3.00
UC-1	0	0.03	0	0	0
PM-11	2.97	0.37	0	0	0

Table 1-49b Contributing Areas to each Surface Water Evaluation Point, Project Conditions

Surface Water Evaluation Point	*Incremental Tributary Area (sq mi)**				
	Surface Water			*Groundwater*	
	Natural Areas	*Cell 2W Dams*	*Cell 2E Dams*	*Non-Modeled Flow Path*	*Modeled Flow Path*
PM-12	18.97	0	0	18.97	0
PM-12.2	14.12	0	0	14.12	0
PM-12.3	41.28	0	0	41.28	0
PM-12.4	11.38	0	0	10.94	0.43
PM-13	8.91	0	0	6.22	5.57
MLC-3	1.34	0	0	0.73	0.00
MLC-2	2.17	0	0	1.08	2.34
TC-1	1.83	0	0	0	0
PM-19	1.76	0	0	0	2.95
UC-1**	0	0.03	0	0	0
PM-11	2.87	0	0	0	0
Containment System	*Incremental Tributary Area (sq mi)**				
	Surface Water			*Groundwater*	
	Natural Areas	*Cell 2W Dams*	*Cell 2E Dams*	*Non-Modeled Flow Path*	*Modeled Flow Path*
North	0.08	0	0.12	0	0.08
NorthWest	0.05	0.16	0	0	0.05
West	0.1	0.37	0	0	0.1
South	0	0	0	0	0

Notes

* Surface runoff areas are equal to or greater than the sum of groundwater areas. This is due to runoff from the Tailings Basin, where recharge is not applied because it is accounted for in seepage.

** All flow leaving UC-1 flows to the West containment system.

Table 1-50 Distribution of Watershed Yield by Month

Percentile	Watershed_Yield (cfs per square mile)											
	January	***February***	***March***	***April***	***May***	***June***	***July***	***August***	***September***	***October***	***November***	***December***
MIN	0.010	0.010	0.016	0.029	0.238	0.040	0.041	0.020	0.025	0.029	0.055	0.039
1%	0.012	0.010	0.016	0.040	0.306	0.043	0.045	0.023	0.029	0.033	0.062	0.040
5%	0.036	0.017	0.025	0.057	0.464	0.099	0.062	0.036	0.036	0.062	0.106	0.052
10%	0.041	0.027	0.032	0.113	0.578	0.204	0.077	0.045	0.050	0.094	0.136	0.062
20%	0.046	0.034	0.041	0.433	0.759	0.340	0.113	0.066	0.087	0.147	0.159	0.084
35%	0.057	0.045	0.051	0.838	1.099	0.555	0.204	0.101	0.170	0.215	0.215	0.108
50%	0.069	0.054	0.057	1.501	1.529	0.832	0.340	0.159	0.272	0.306	0.283	0.125
65%	0.084	0.062	0.071	2.197	2.069	1.268	0.540	0.249	0.430	0.408	0.385	0.170
80%	0.100	0.070	0.113	3.237	3.024	1.989	0.883	0.498	0.725	0.634	0.510	0.227
90%	0.109	0.085	0.249	4.470	4.222	2.797	1.785	0.861	1.373	1.119	0.736	0.294
95%	0.147	0.102	0.860	6.288	5.956	3.487	3.030	1.443	1.789	1.669	0.963	0.362
99%	0.227	0.113	4.596	10.622	14.760	6.320	5.443	2.660	5.614	4.417	1.538	0.530
MAX	0.249	0.159	8.766	16.874	19.479	12.344	8.947	3.216	8.935	5.130	1.880	0.566

Notes

* Based on USGS gage 04017000 data and 88.3 sq. mile drainage area

Table 1-51 Variation in Precipitation and Evaporation Throughout Each Year

Month	***Annual_P_Variation (yr/mon)***	***Annual_E_Variation (yr/mon)***
January	0.028	0.000
February	0.023	0.000
March	0.034	0.033
April	0.062	0.093
May	0.112	0.136
June	0.146	0.145
July	0.139	0.165
August	0.134	0.164
September	0.139	0.134
October	0.097	0.093
November	0.052	0.037
December	0.034	0.000

Notes

* Based on National Weather Service (NWS) sites closest to the Plant Site using the Minnesota Climatology Working Group's High Density Network (HiDen)

Table 1-52 Initial_Mass_LTVSMC_Basin, Initial Mass in the LTVSMC Tailings Basin

Constituent	Toes[N] (tonnes)	Toes[NW] (tonnes)	Toes[W] (tonnes)	Toes[S] (tonnes)	UnsatFine2W (tonnes)	UnsatCoarse2W (tonnes)	UnsatBanks2W (tonnes)	UnsatFine1E (tonnes)	UnsatCoarse1E (tonnes)	UnsatFine2E (tonnes)	UnsatCoarse2E (tonnes)	UnsatBanks2E (tonnes)
Ag	6.15E-07	5.38E-07	7.42E-07	1.29E-06	2.04E-03	5.85E-04	1.12E-03	9.37E-04	2.65E-04	4.19E-04	5.49E-05	4.32E-05
Al	6.11E-05	8.27E-05	1.19E-04	1.24E-04	5.29E-01	7.50E-02	1.10E-01	4.34E-02	2.30E-02	3.26E-02	1.20E-02	6.85E-03
Alkalinity	1.69E+00	1.67E+00	2.35E+00	3.05E+00	9.98E+03	1.41E+03	2.08E+03	8.20E+02	4.33E+02	6.16E+02	2.27E+02	1.29E+02
As	2.58E-05	1.42E-05	1.78E-05	5.22E-05	3.62E-02	1.06E-02	2.04E-02	1.69E-02	4.81E-03	7.61E-03	1.00E-03	7.87E-04
B	1.82E-03	2.69E-03	3.92E-03	3.32E-03	1.81E+01	2.57E+00	3.77E+00	1.49E+00	7.86E-01	1.12E+00	4.12E-01	2.34E-01
Ba	1.12E-03	4.87E-04	5.34E-04	2.52E-03	8.41E-01	9.62E-02	1.31E-01	4.59E-02	2.91E-02	3.82E-02	1.91E-02	9.82E-03
Be	1.08E-06	1.09E-06	1.51E-06	2.27E-06	6.17E-03	8.75E-04	1.28E-03	5.03E-04	2.68E-04	3.81E-04	1.40E-04	7.99E-05
Ca	2.70E-01	5.64E-01	8.46E-01	4.47E-01	4.12E+03	5.84E+02	8.57E+02	3.35E+02	1.79E+02	2.54E+02	9.37E+01	5.34E+01
Cd	6.97E-07	7.14E-07	1.01E-06	1.43E-06	2.93E-03	8.64E-04	1.66E-03	1.38E-03	3.91E-04	6.21E-04	8.16E-05	6.40E-05
Cl	1.27E-01	1.36E-01	1.90E-01	2.65E-01	7.91E+02	1.12E+02	1.64E+02	6.43E+01	3.43E+01	4.87E+01	1.80E+01	1.02E+01
Co	9.39E-06	1.57E-05	2.36E-05	1.75E-05	7.85E-02	2.26E-02	4.34E-02	3.61E-02	1.02E-02	1.62E-02	2.14E-03	1.67E-03
Cr	2.88E-06	3.46E-06	4.90E-06	5.95E-06	2.11E-02	3.00E-03	4.39E-03	1.72E-03	9.17E-04	1.30E-03	4.80E-04	2.74E-04
Cu	1.07E-05	1.48E-05	2.17E-05	2.29E-05	6.81E-02	1.96E-02	3.77E-02	3.12E-02	8.92E-03	1.41E-02	1.86E-03	1.45E-03
F	2.19E-02	9.32E-03	9.28E-03	5.88E-02	1.31E+00	1.85E-01	2.72E-01	1.14E-01	5.67E-02	8.05E-02	2.97E-02	1.69E-02
Fe	1.16E-02	2.52E-02	3.87E-02	1.99E-02	1.33E+02	3.85E+01	7.39E+01	6.20E+01	1.75E+01	2.76E+01	3.64E+00	2.84E+00
K	5.91E-02	5.96E-02	8.43E-02	1.03E-01	3.63E+02	5.14E+01	7.55E+01	2.95E+01	1.58E+01	2.24E+01	8.24E+00	4.70E+00
Mg	4.76E-01	9.22E-01	1.38E+00	7.74E-01	6.69E+03	9.48E+02	1.39E+03	5.44E+02	2.90E+02	4.12E+02	1.52E+02	8.66E+01
Mn	2.06E-03	6.98E-03	1.07E-02	2.97E-03	5.44E+01	7.71E+00	1.13E+01	4.47E+00	2.36E+00	3.35E+00	1.24E+00	7.04E-01
Na	3.97E-01	3.43E-01	4.61E-01	8.57E-01	1.75E+03	2.48E+02	3.63E+02	1.42E+02	7.59E+01	1.08E+02	3.97E+01	2.26E+01
Ni	1.79E-05	3.04E-05	4.56E-05	3.51E-05	1.50E-01	4.37E-02	8.38E-02	6.95E-02	1.99E-02	3.12E-02	4.13E-03	3.22E-03
Pb	7.59E-06	3.69E-06	4.30E-06	1.69E-05	6.38E-03	1.84E-03	3.53E-03	2.94E-03	8.37E-04	1.32E-03	1.74E-04	1.36E-04
Sb	1.55E-06	1.37E-06	1.89E-06	3.26E-06	5.20E-03	1.51E-03	2.88E-03	2.40E-03	6.80E-04	1.08E-03	1.42E-04	1.11E-04
Se	3.10E-06	2.75E-06	3.80E-06	6.52E-06	1.04E-02	3.03E-03	5.81E-03	4.82E-03	1.38E-03	2.17E-03	2.86E-04	2.23E-04
SO4	1.34E+00	1.96E+00	2.93E+00	2.36E+00	9.61E+03	2.78E+03	5.34E+03	4.43E+03	1.26E+03	1.99E+03	2.63E+02	2.05E+02
Tl	1.02E-06	8.66E-07	1.19E-06	2.16E-06	3.17E-03	9.31E-04	1.78E-03	1.50E-03	4.21E-04	6.67E-04	8.76E-05	6.84E-05
V	2.47E-05	1.18E-05	1.34E-05	5.51E-05	2.64E-02	3.75E-03	5.50E-03	2.15E-03	1.15E-03	1.63E-03	6.01E-04	3.42E-04
Zn	6.87E-05	4.53E-05	5.85E-05	1.49E-04	1.33E-01	3.86E-02	7.40E-02	6.15E-02	1.75E-02	2.77E-02	3.64E-03	2.85E-03

Notes
* The values presented in this table are subject to change upon refinement or further development of the existing conditions Plant Site model

Table 1-53 Initial_Mass_Rate, Initial Mass Transport Rate in the LTVSMC Tailings Basin

Constituent	Cell2W_Fines (kg/day)	Cell2W_Coarse (kg/day)	Cell2W_Banks (kg/day)	Cell1E_Fines (kg/day)	Cell1E_Coarse (kg/day)	Cell1E_Pond (kg/day)	Cell2E_Fines (kg/day)	Cell2E_Coarses (kg/day)	Cell2E_Banks (kg/day)	Cell2E_Pond (kg/day)
Ag	1.96E-04	9.72E-05	1.56E-04	4.99E-05	4.35E-05	5.13E-04	3.84E-05	2.00E-05	1.13E-05	2.37E-04
Al	5.08E-02	1.24E-02	1.52E-02	2.32E-03	3.78E-03	5.13E-02	2.99E-03	4.39E-03	1.79E-03	2.37E-02
Alkalinity	9.57E+02	2.34E+02	2.87E+02	4.37E+01	7.14E+01	1.33E+03	5.64E+01	8.23E+01	3.38E+01	8.05E+02
As	3.46E-03	1.76E-03	2.83E-03	9.02E-04	7.90E-04	2.41E-02	6.96E-04	3.63E-04	2.05E-04	1.28E-02
B	1.74E+00	4.25E-01	5.20E-01	7.94E-02	1.30E-01	1.28E+00	1.02E-01	1.50E-01	6.13E-02	7.10E-01
Ba	8.06E-02	1.59E-02	1.81E-02	2.45E-03	4.81E-03	1.28E+00	3.50E-03	6.93E-03	2.57E-03	5.92E-01
Be	5.92E-04	1.45E-04	1.77E-04	2.68E-05	4.43E-05	1.03E-03	3.48E-05	5.09E-05	2.09E-05	4.73E-04
Ca	3.95E+02	9.68E+01	1.18E+02	1.79E+01	2.95E+01	1.33E+02	2.33E+01	3.40E+01	1.40E+01	8.05E+01
Cd	2.81E-04	1.43E-04	2.30E-04	7.36E-05	6.43E-05	5.13E-04	5.65E-05	2.95E-05	1.67E-05	2.37E-04
Cl	7.58E+01	1.86E+01	2.27E+01	3.43E+00	5.67E+00	1.18E+02	4.46E+00	6.52E+00	2.68E+00	5.44E+01
Co	7.52E-03	3.74E-03	5.98E-03	1.92E-03	1.68E-03	3.08E-03	1.48E-03	7.71E-04	4.34E-04	1.42E-03
Cr	2.02E-03	4.96E-04	6.06E-04	9.17E-05	1.51E-04	2.56E-03	1.19E-04	1.74E-04	7.14E-05	1.18E-03
Cu	6.51E-03	3.25E-03	5.19E-03	1.66E-03	1.45E-03	6.66E-03	1.28E-03	6.67E-04	3.77E-04	2.37E-03
F	1.25E-01	3.07E-02	3.75E-02	6.15E-03	9.36E-03	3.02E+01	7.38E-03	1.08E-02	4.42E-03	1.04E+01
Fe	1.28E+01	6.38E+00	1.02E+01	3.31E+00	2.86E+00	1.28E-01	2.52E+00	1.31E+00	7.41E-01	7.10E-02
K	3.48E+01	8.52E+00	1.04E+01	1.57E+00	2.59E+00	4.46E+01	2.05E+00	2.99E+00	1.23E+00	2.84E+01
Mg	6.41E+02	1.57E+02	1.92E+02	2.90E+01	4.78E+01	2.41E+02	3.77E+01	5.52E+01	2.26E+01	1.56E+02
Mn	5.22E+00	1.28E+00	1.56E+00	2.39E-01	3.91E-01	2.46E-01	3.07E-01	4.49E-01	1.84E-01	1.87E-01
Na	1.68E+02	4.11E+01	5.02E+01	7.60E+00	1.25E+01	4.00E+02	9.87E+00	1.44E+01	5.91E+00	1.82E+02
Ni	1.44E-02	7.24E-03	1.16E-02	3.71E-03	3.24E-03	6.66E-03	2.86E-03	1.49E-03	8.44E-04	2.37E-03
Pb	6.13E-04	3.06E-04	4.91E-04	1.57E-04	1.38E-04	8.20E-03	1.21E-04	6.29E-05	3.55E-05	3.79E-03
Sb	4.99E-04	2.50E-04	4.00E-04	1.28E-04	1.12E-04	1.28E-03	9.87E-05	5.14E-05	2.90E-05	5.92E-04
Se	1.00E-03	5.01E-04	8.04E-04	2.57E-04	2.24E-04	2.56E-03	1.98E-04	1.03E-04	5.83E-05	1.18E-03
SO4	9.21E+02	4.61E+02	7.39E+02	2.36E+02	2.07E+02	4.87E+02	1.82E+02	9.49E+01	5.35E+01	3.08E+02
Tl	3.04E-04	1.54E-04	2.47E-04	7.92E-05	6.90E-05	8.71E-04	6.08E-05	3.17E-05	1.79E-05	4.02E-04
V	2.54E-03	6.21E-04	7.60E-04	1.15E-04	1.90E-04	2.77E-02	1.49E-04	2.18E-04	8.95E-05	1.28E-02
Zn	1.28E-02	6.40E-03	1.03E-02	3.28E-03	2.87E-03	6.66E-02	2.53E-03	1.32E-03	7.43E-04	3.08E-02

Notes

* The values presented in this table are subject to change upon refinement or further development of the existing conditions Plant Site model

Table 1-54 Expected_Toe_Conc, Expected Existing Constituent Concentrations at the Toes of the Tailings Basin

Constituent	***Expected_Toe_Conc[N] (ug/L)***	***Expected_Toe_Conc[NW] (ug/L)***	***Expected_Toe_Conc[W] (ug/L)***	***Expected_Toe_Conc[S] (ug/L)***
Ag	0.11	0.09	0.09	0.11
Al	10	10	10	10
Alkalinity	305000	277100	278900	262900
As	4.7	2.3	2.1	4.6
B	325	425	465	280
Ba	200	80	62	220
Be	0.2	0.18	0.18	0.2
Ca	47380	93000	99950	37200
Cd	0.13	0.11	0.12	0.12
Cl	22900	22650	22600	22950
Co	1.8	2.8	3	1.6
Cr	0.52	0.56	0.57	0.51
Cu	1.9	2.3	2.4	1.9
F	5000	5000	5000	6000
Fe	2100	4140	4540	1710
K	10720	10020	10160	8920
Mg	84200	153700	165000	64770
Mn	[redacted]	[redacted]	1250	230
Na	72200	57500	55400	74600
Ni	3.2	5	5.3	3
Pb	1.4	0.6	0.5	1.5
Sb	0.28	0.23	0.22	0.29
Se	0.57	0.45	0.45	0.57
SO4	244000	323000	344000	205000
Tl	0.19	0.14	0.14	0.19
V	5.4	5.4	5.4	5.4
Zn	12.6	7.5	6.9	13.1

Notes

* The values presented in this table are subject to change upon refinement or further development of the existing conditions Plant Site model

Table 2-1 Output Constituents for the Plant Site Model

Constituent
Ag
Al
Alk
As
B
Ba
Be
Ca
Cd
Cl
Co
Cr
Cu
F
Fe
Hardness
K
Mg
Mn
Na
Ni
Pb
Sb
Se
SO_4
Tl
V
Zn

Table 2-2 Output Locations for the Plant Site Model

Surface Water Evaluation Locations

Evaluation Location	*Applicable Standards*
PM-12	SW
PM-12.2	SW
PM-12.3	SW
PM-12.4	SW
PM-13	SW
MLC-3	SW
MLC-2	SW
TC-1	SW
PM-19	SW
UC-1	SW
PM-11	SW

Groundwater Evaluation Locations

Flowpath	*Evaluation Locations*	*Applicable Standards*	*Receiving Surface Water Node*
North	Prop. Bound.	GW	MLC-2
North-West	Prop. Bound.	GW	PM-19
West	Prop. Bound.	GW	PM-13

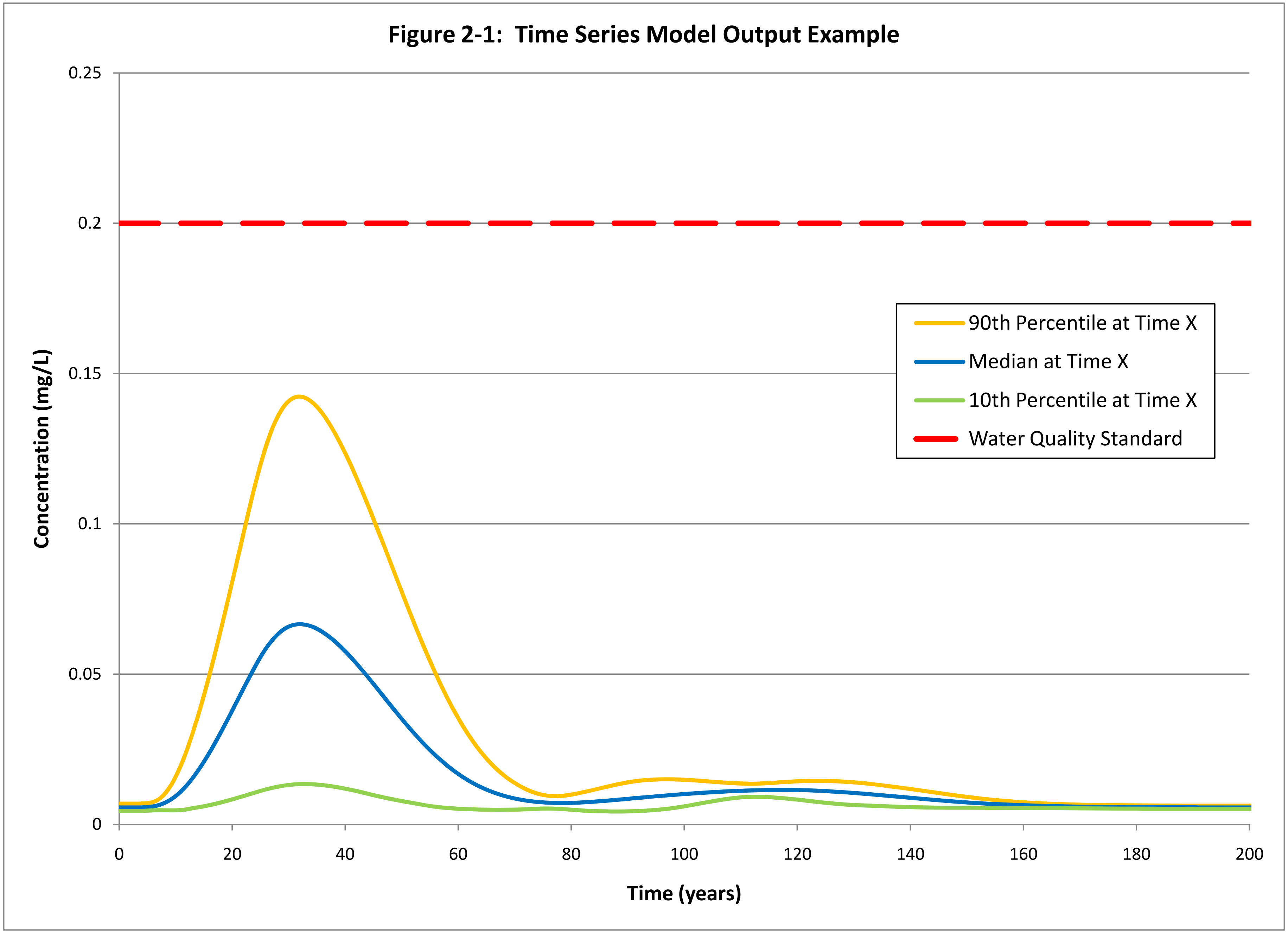

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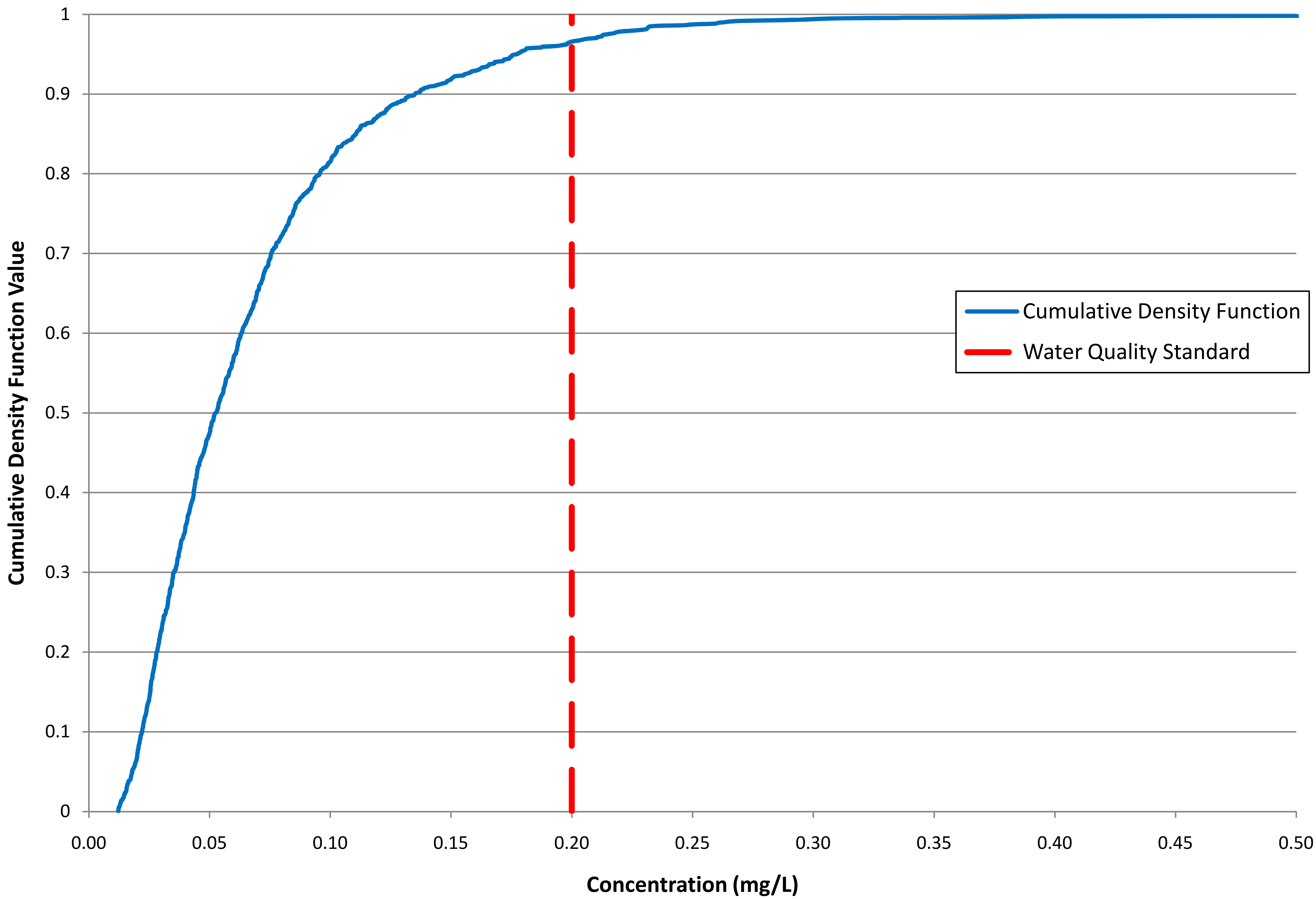
Figure 2-2: Cumulative Density Function Model Output Example



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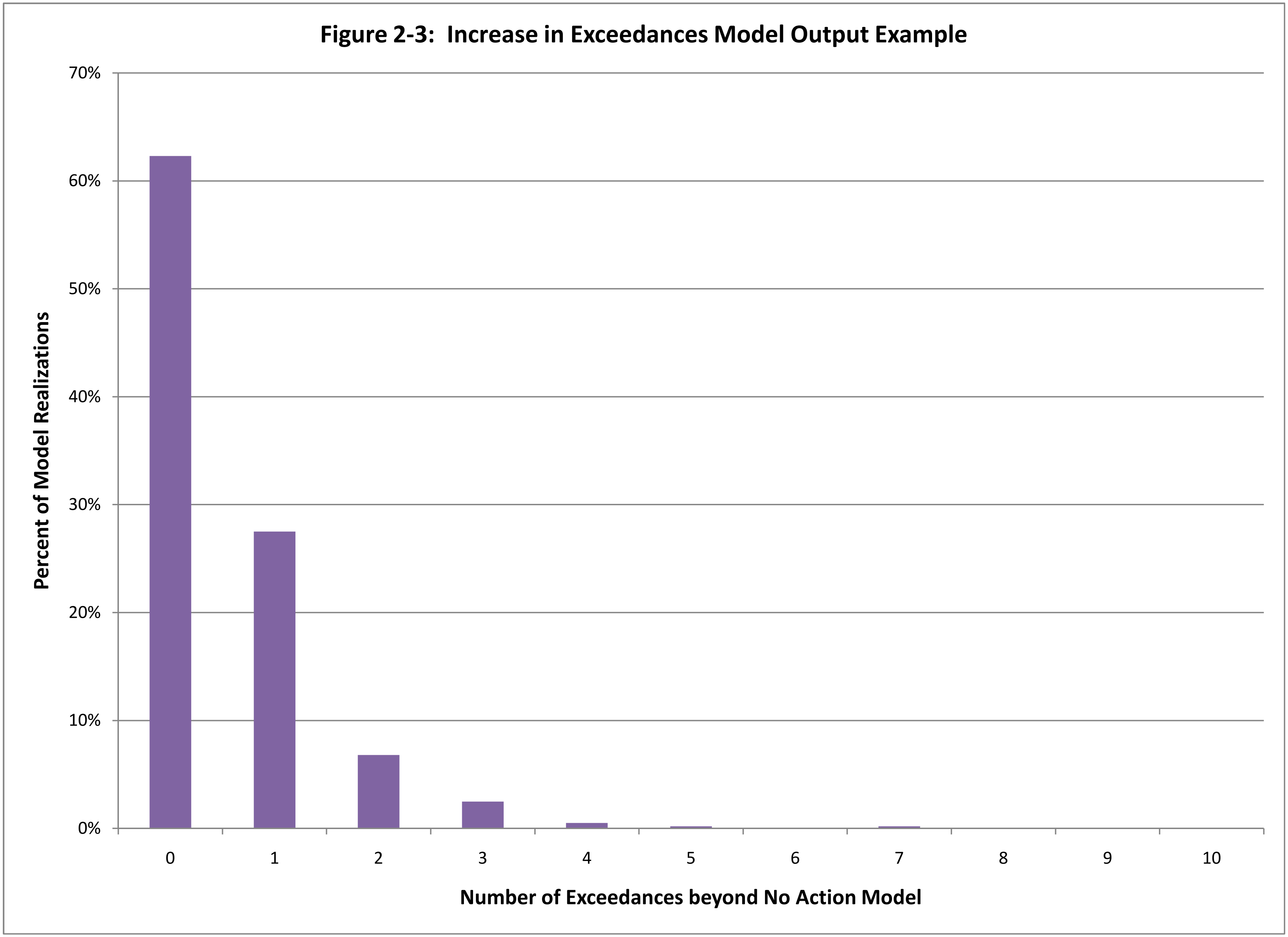

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