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Output Water Balance

Component		Data Source	Calculation Method
CARIBOO PIT SUMP			
Water In	**Precipitation (on water surface)**	Weather Station	= precipitation * area
	Precipitation Runoff	Weather Station	= precipitation * runoff area * runoff coefficient
	Groundwater Infiltration	KP 2004 Water Balance	= 0 m3/month
Water Out	**Evaporation**	Weather Station	= evpaoration * water surface area
Balance	**Water Volume (month end)**	Calculated	= projected (based on fill curves from surveyed pit topography)
SPRINGER PIT SUMP			
Water In	**Precipitation (on water surface)**	Weather Station	= precipitation * area
	Precipitation Runoff	Weather Station	= precipitation * runoff area * runoff coefficient
	Groundwater Infiltration	KP 2004 Water Balance	= 33, 818 m3/month
Water Out	**Evaporation**	Weather Station	= evpaoration * water surface area
Balance	**Water Volume (month end)**	Calculated	= projected (based on fill curves from surveyed pit topography)
xcluding Cariboo Pit, Springer Pit, and NW Sump)			
Water In	**Wight Pit Dewatering**	Calculated	= 95,700 m3/month OR pump hours*puming rate OR based on LD flow
Water Out	**Dust control/sprinklers**	Calculated	= water truck volume * average # loads (may - oct) + sprinklers flow * time
GEOLOGY/MILL SUMP			
Water In	**Precipitation (on water surface)**	Weather Station	= precipitation * area
	Precipitation Runoff	Weather Station	= precipitation * runoff area * runoff coefficient OR field estimate from pipe
	From Geology	Estimation	= based on average person/equipment water use
Water Out	**Evaporation**	Weather Station	= evpaoration * water surface area
Balance	**Water Pumped to TSF**	Calculated	= water in - water out
LONG DITCH			
Water In	**Precipitation (on water surface)**	Weather Station	= area*precipitation
	Runoff/Seepage Collection	In Situ Flow Data	= average measured discharge rate
Water Out	**Evaporation (from water surface)**	Weather Station	= area*evaporation
SERDS DITCH + ORICA DITCH			
Water In	**Precipitation (on water surface)**	Weather Station	= area*precipitation
	Runoff/Seepage Collection	In Situ Flow Data	= average measured discharge rate
Water Out	**Evaporation (from water surface)**	Weather Station	= area*evaporation
NW DITCH			
Water In	**Precipitation (on water surface)**	Weather Station	= area*precipitation
	Runoff/Seepage Collection (PAG Ditch Discharge Rate	In Situ Flow Data	= average measured discharge rate of PAG Ditch + Bootjack Ditch
Water Out	**Evaporation (from water surface)**	Weather Station	= area*evaporation
WATER INTO TAILINGS (m^3)			
Precipitation	Supernatant	weather station data	= precipitation * area
	Beach	weather station data	= Same as supernatant (except * runoff coefficient)
Mill	Tailings (water)	mill production report; constants	= (100*tailings throughput/soilds content %) - tailings throughput OR mill flow rates readings
	Tailings Ditch (runoff)	estimation (visual/calculation)	= observation/area*precipitation*runoff coefficient
Seepage Ponds	Perimeter	weather station + field data	= precipitation + runoff + PTD+ Long Ditch + SERDS Ditch - evaporation
	Main	weather station + field data	= precipitation + runoff + MTD + STD - evaporation
	South	weather station + field data	= precipitation + seepage in - evap (runoff negligible)
Bulk Transfers	From pits, leachpad, etc.	Calculated	= Misc. transfers, ex. Wight Pit dewatering into Long Ditch
TOTAL			= sum of all "water in" + mill sump
WATER OUT OF TAILINGS (m^3)			
Evaporation	Supernatant	weather station data	= evaporation * area*0.7 (note: lake evap is ~ 70% of pan evap)
	Beach	weather station data	= evpaoration * evaporation factor * area
Recycled Supernatant	Recycled Supernatant	mill data+ constants OR pump hours	= slurry water - water in ore - water from well OR mill flow rate readings
Seepage	Toe Drains	flow monitoring; KP reports	= sum of PTD (FlowTracker), STD (FlowTracker), MTD (KP Reports)
	Seepage Lost	KP 2004 Water Balance	=constant
Retained in Tailings		mill production report, constants	= tailings*((water density/dry density) * (1/specific gravity))
Discharge		flow monitoring	= dischrge hours * discharge rate
TOTAL			= sum of all "water out"
SUPERNATANT SURPLUS/DEFICIT VOLUME (m^3)			
Monthly (Projected)			= monthly water in - water out (surplus/deficit)
Cumulative (Projected)			= annual sum of monthly totals
Cumulative (Actual - Bathymetric Survey)			= based on bathymetric survey
DIFFERENCE			= actual - projected
TAILINGS VOLUME INTO BASIN (m^3)			
Monthly		mill production reports; constants	= (monthly tailings throughput)/ specific gravity
Cummulative (Annual)			= annual sum of monthly totals
Cumulative (Since Startup)			= sum of monthly totals + cummulative total from previous year
Cummulative Water Retained in Tailings (Since Startup)			= sum of water retained (monthly + cummulative form previous year)
TOTAL VOLUME (TAILINGS + SUPERNATANT + WATER RETAINED IN TAILINGS) (m^3)			
Monthly (Projected)			= supernatant + tailings
Cumulative (Annual)			=annual sum of monthly totals
Cumulative (Since Startup)			= sum of monthly totals + cummulative total from previous year
TAILINGS WATER SURFACE ELEVATION (masl)			
Actual Elevation		survey value	= surveyed
Projected Elevation		bathymetric survey	= formula based on fill curve
DIFFERENCE			= actual - projected

Assumptions
1. Groundwater infiltration assumed negligible for: Ditches, Mill Geology Sump
2. Balance considered static in SEZ Pit Sump and SEZ Sump

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Assumed Constants	
beach evaporation factor	0.8
soilds content	35%
dry density	1.4
tailings specific gravity	2.65
water density	1
water content in ore	2.98%
TSF unrecoverable seepage (m^3/month)	5840
NEZ/Hwy to Heaven sprinkler use (m^3/h)	300
water truck daily water use (m^3/day)	8180

Area (m^2)	
Cariboo Pit Sump	19000
Cariboo Pit Runoff	96991
Springer Pit Sump	3000
Springer Pit Runoff	169000
Mill Sump	1550
Long Ditch	6800
SERDS Ditch + Orica Ditch	2200
NW Ditch	2000
TSF Supernatant Area	1820000
TSF Beach Area	530000
Perimeter Seepage Pond	2225
Perimeter Seepage Pond Runoff - Veg	58000
Perimeter Seepage Pond Runoff - Rock	16000
Main Seepage Pond	11930
Main Seepage Pond Runoff - Grass	100000
Main Seepage Pond Runoff - Rock	110000
South Seepage Pond	163

Pump/Flow Rates (m^3/mo)	
Geology Input into mill sump	76
Minimum domestic well water input	18000

Groundwater/Seepage Infiltration Rates (m^3/month)	
Cariboo Pit	0
Springer Pit	33,818
South Seepage Pond	2500

Runoff Coefficients			
Component	Low Flow	General	Freshet
Beach	0.9	0.9	0.9
Downstream Tailings Areas	0.0	0.7	1.0
Disturbed RSD Areas	0.0	0.6	1.0
Open Pit Areas	0.5	0.5	0.5
Mill Site Area	0.5	0.5	0.5

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			2011			2012								
Component		**Units**	**October**	**November**	**December**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**
Days Per Month		**days**	31	30	31	31	29	31	30	31	30	31	31	30
Mill Production Report	**Mill Throughput-Concentrate**	**t/month**	692013	626400	676194	654260	590847	664644	729936	708415	706586	679897	705558	647364
Precip/Evap	**Precipitation**	**m/month**	0.0352	0.025	0	0	0	0	0.121	0.0322	0.118	0.04	0.0237	0.0204
	Snowpack (SWE)	**m/month**	0	0	1.05	0.76	0.93	1.96	0	0	0	0	0	0
	Evaporation	**m/month**	0.0211	0	0	0	0	0	0	0.046	0.0714	0.0884	0.0748	0.0658
	Sprinkers	**h/month**	0	0	0	0	0	0	0	0	0	0	60	60
	Water Truck	**d/month**	5	0	0	0	0	0	0	0	0	15	15	15
Pump Hours	**Discharge**	**h/month**	0	0	0	0	0	0	0	0	0	0	0	0
Pump Rate	**Discharge**	**m^3/h**	0	0	0	0	0	0	0	0	0	0	0	0
Flow Monitoring	**Process Tank to Mill**	**m^3/month**								67756	529780	69568	13374	50435
	TSF to Mill	**m^3/month**	1245912	1126074	1217019	1176958	1061139	1195924	1315175	1038956	979520	940553	1016733	936049
	Wight Pit to Cariboo Tank	**m^3/month**	97500	97500	97500	97500	97500	97500	97500	97500	97500	97500	75123	75123
	STD	**m^3/month**	65621	772416	79816	79816	74667	79816	77242	43658	73613	84102	104993	85925
	PTD	**m^3/month**	43390	71798	61335	61335	57378	61335	59357	63478	56506	88387	40980	59357
	MTD	**m^3/month**	15508	15008	15508	15508	14507	15508	15008	15508	15008	15508	15508	15008
	Long Ditch	**m^3/month**	94011.84	57542.4	56246.4	56246.4	52617.6	107136	181440	140348	109901	78611	77540	85147
	SERDS Ditch	**m^3/month**	51706.512	31648.32	30935.52	30935.52	28939.68	58924.8	99792	70174	65837	47542	22900	18144
	NW Ditch	**m^3/month**							28512	13392	11404.8	6160.32	6160.32	3965.76
	Mill Sump Inflow	**m^3/month**	133.92	129.6	0	0	0	26.784	1814.4	803.52	1296	133.92	133.92	129.6
	Tailings Ditch	**m^3/month**	0	0	0	0	0	0	233.28	0	336.96	0	0	0
	Misc. Bulk Transfers - TSF	**m^3/month**											22,377	22,377
Elevation (Surveyed)	**Cariboo Pit Sump**	**masl**	1085.16			1083.8	1083.66	1083.88	1085.36	1086	1088.64	1090.06	1087.81	1084.48
	Springer Pit	**masl**						1015.11	1017.69	1019.7	1022.18	1021.38	1015.86	1007.55
	Tailings	**m**	957.18	957.37	957.6	957.84	958.06	958.22	958.83	959.05	959.78	959.85	959.73	959.96
Volume	**Cariboo Pit**	**m^3**	890186	872346	854506	836664	831202	839786	898561	925364	1035923	1094804	1001164	863196
	Springer Pit	**m^3**	388777					144294	191919	231998	284788	267759	158138	0
	Bathymetric Survey	**m^3**									4760340		4900700	

Flow Rate Entry	**STD**	**m^3/s**	0.0245	0.298	0.0298	0.0298	0.0298	0.0298	0.0298	0.0163	0.0284	0.0314	0.0392	0.03315
	PTD	**m^3/s**	0.0162	0.0277	0.0229	0.0229	0.0229	0.0229	0.0229	0.0237	0.0218	0.033	0.0153	0.0229
	MTD	**m^3/s**	0.00579	0.00579	0.00579	0.00579	0.00579	0.00579	0.00579	0.00579	0.00579	0.00579	0.00579	0.00579
	Long Ditch	**m^3/s**	0.0351	0.0222	0.021	0.021	0.021	0.04	0.07	0.0524	0.0424	0.02935	0.02895	0.03285
	SERDS Ditch	**m^3/s**	0.019305	0.01221	0.01155	0.01155	0.01155	0.022	0.0385	0.0262	0.0254	0.01775	0.00855	0.007
	NW Ditch	**m^3/s**							0.011	0.005	0.0044	0.0023	0.0023	0.00153
	Mill Sump	**m^3/s**	0.00005	0.00005	0	0	0	0.00001	0.0007	0.0003	0.0005	0.00005	0.00005	0.00005
	Tailings Ditch	**m^3/s**	0	0	0	0	0	0	0.00009	0	0.00013	0	0	0

Red = estimate
Blue = forumla

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Component		Calculation Method	2011			2012								
			2011	November	December	January	February	March	April	May	June	July	August	September
CARIBOO PIT SUMP														
Water In	Precipitation (on water surface)	= precipitation * area	669	475	0	0	0	0	39,539	612	2,242	760	450	388
	Precipitation Runoff	= precipitation * runoff area * runoff coefficient	1,707	1,212	0	0	0	0	100,919	1,562	5,722	1,940	1,149	989
	Groundwater Infiltration	= 0 m3/month	0	0	0	0	0	0	0	0	0	0	0	0
Water Out	Evaporation	= evpaoration * water surface area	401	0	0	0	0	0	0	874	1,357	1,680	1,421	1,250
Balance	Water Volume (month end)	= projected (based on fill curves from surveyed pit topography)	890,186	872,346	854,506	836,664	831,202	839,786	898,561	925,364	1,035,923	1,094,804	1,001,164	863,196
SPRINGER PIT SUMP														
Water In	Precipitation (on water surface)	= precipitation * area	106	75	0	0	0	3,090	-5,517	97	354	120	71	61
	Precipitation Runoff	= precipitation * runoff area * runoff coefficient	2,974	2,113	0	0	0	0	175,845	2,721	9,971	3,380	2,003	1,724
	Groundwater Infiltration	= 33, 818 m3/month	33,818	33,818	33,818	33,818	33,818	33,818	33,818	33,818	33,818	33,818	33,818	33,818
Water Out	Evaporation	= evpaoration * water surface area	63	0	0	0	0	0	0	138	214	265	224	197
Balance	Water Volume (month end)	= projected (based on fill curves from surveyed pit topography)	388,777					144,294	191,919	231,998	284,788	267,759	158,138	0
NW DITCH														
Water In	Precipitation (on water surface)	= area*precipitation	70	50	0	0	0	0	242	64	236	80	47	41
	Runoff/Seepage Collection (PAG Ditch Discharge Rate)	= average measured discharge rate of PAG Ditch + Bootjack Ditch							28,512	13,392	11,405	6,160	6,160	3,966
Water Out	Evaporation (from water surface)	= area*evaporation	42	0	0	0	0	0	0	92	143	177	150	132
Mill Process Tank (excluding Cariboo Pit, Springer Pit, and NW Sump)														
Water In	Wight Pit Dewatering		97,500	97,500	97,500	97,500	97,500	97,500	97,500	97,500	97,500	97,500	75,123	75,123
Water Out	Dust control/sprinklers	= water truck volume * average # loads (may - oct) + sprinklers flow * time	40,900	0	0	0	0	0	0	0	0	122,700	140,700	140,700
GEOLOGY/MILL SUMP														
Water In	Precipitation (on water surface)	= precipitation * area	55	39	0	0	0	0	3,226	50	183	62	37	32
	Precipitation Runoff	= precipitation * runoff area * runoff coefficient OR field estimate from pipe	134	130	0	0	0	27	1,814	804	1,296	134	134	130
	From Geology	= based on average person/equipment water use (76 m3/day)	76	76	76	76	76	76	76	76	76	76	76	76
Water Out	Evaporation	= evpaoration * water surface area	33	0	0	0	0	0	0	71	111	137	116	102
Balance	Water Pumped to TSF	= water in - water out OR pump hours * pumping rate	232	244	76	76	76	103	5,116	858	1,444	135	131	135
LONG DITCH														
Water In	Precipitation (on water surface)	= area*precipitation	239	170	0	0	0	0	823	219	802	272	161	139
	Runoff/Seepage Collection	= average measured discharge rate	94,012	57,542	56,246	56,246	52,618	107,136	181,440	140,348	109,901	78,611	77,540	85,147
Water Out	Evaporation (from water surface)	= area*evaporation	143	0	0	0	0	0	0	313	486	601	509	447
SERDS DITCH + ORICA DITCH														
Water In	Precipitation (on water surface)	= area*precipitation	77	55	0	0	0	0	266	71	260	88	52	45
	Runoff/Seepage Collection	= average measured discharge rate	51,707	31,648	30,936	30,936	28,940	58,925	99,792	70,174	65,837	47,542	22,900	18,144
Water Out	Evaporation (from water surface)	= area*evaporation	46	0	0	0	0	0	0	101	157	194	165	145
WATER INTO TAILINGS (m^3)														
Precipitation	Supernatant	= precipitation * area	64,064	45,500	0	0	0	-1,874,600	3,787,420	58,604	214,760	72,800	43,134	37,128
	Beach	= Same as supernatant (except * runoff coefficient)	18,656	13,250	0	0	0	0	1,102,930	17,066	62,540	21,200	12,561	10,812
Mill	Tailings (water)	= (100*tailings throughput/soilds content %) - tailings throughput	1,285,167	1,163,314	1,255,789	1,215,054	1,097,287	1,234,339	1,355,595	1,315,628	1,312,231	1,010,121	1,310,322	1,202,247
	Tailings Ditch (runoff)	= observation/area*precipitation*runoff coefficient	0	0	0	0	0	0	233	0	337	0	0	0
Seepage Ponds	Perimeter	= precip + runoff + PTD+ LD+ SERDS - evap	190,907	162,300	148,517	148,517	138,936	305,908	200,411	276,352	238,270	214,432	142,496	163,571
	Main	= precip + runoff + MTD + STD - evap	86,084	791,122	95,324	95,324	89,174	323,912	-315,880	65,763	105,224	99,032	119,892	100,391
	South	= pump hours * pumping rate	2,502	2,504	2,500	2,500	2,500	2,668	2,200	2,498	2,508	2,492	2,492	2,493
Bulk Transfers	Pits, Leachpad, etc.												22,377	22,377
TOTAL		= sum of all "water in"	1,647,612	2,178,234	1,502,206	1,461,472	1,327,973	-7,670	6,138,026	1,736,769	1,937,315	1,420,213	1,653,404	1,539,154
WATER OUT OF TAILINGS (m^3)														
Evaporation	Supernatant	= evaporation * area*0.7 (note: lake evap is ~ 70% of pan evap)	38,402	0		0	0	0	0	83,720	129,948	160,888	136,136	119,756
	Beach	= evpaoration * evaporation factor * area	8,946	0	0	0	0	0	0	19,504	30,274	37,482	31,715	27,899
	Recycled Supernatant	= water content in or /(1-water content in ore) * tailings throughput	1,245,912	1,126,074	1,217,019	1,176,958	1,061,139	1,195,924	1,315,175	1,038,956	979,520	940,553	1,016,733	936,049
Seepage	Toe Drains	= sum of PTD (FlowTracker), STD (FlowTracker), MTD (KP Reports)	124,519	859,222	156,660	156,660	146,553	156,660	151,606	122,644	145,126	187,997	161,481	160,289
	Seepage Lost	=constant	5,840	5,840	5,840	5,840	5,840	5,840	5,840	5,840	5,840	5,840	5,840	5,840
Retained in Tailings		= (tailings/dry density) * void ratio	186,526	168,841	182,263	176,350	159,258	179,149	196,748	190,947	190,454	183,261	190,177	174,492
Discharge		= dischrge hours * discharge rate	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		= sum of all "water out"	1,610,145	2,159,977	1,561,781	1,515,809	1,372,790	1,537,573	1,669,370	1,461,611	1,481,162	1,516,020	1,542,082	1,424,326
SUPERNATANT SURPLUS/DEFICIT VOLUME (m^3)														
Monthly (Projected)		= monthly water in - water out (surplus/deficit)	37,467	18,257	-59,575	-54,337	-44,817	-1,545,243	4,468,656	275,158	456,153	-95,807	111,321	114,829
Cumulative (Projected)		= annual sum of monthly totals	1,383,240	1,401,497	1,341,922	1,287,585	1,242,769	-302,475	4,166,182	4,441,340	4,897,493	4,664,533	4,775,854	5,015,529
Cumulative (Actual - Bathymetric Survey)		= based on bathymetric survey									4,760,340		4,900,700	
DIFFERENCE		= actual - projected									-137,153		124,846	
TAILINGS VOLUME INTO BASIN (m^3)														
Monthly		= (tailings throughput)* days per month) / specific gravity	261,137	236,377	255,168	246,891	222,961	250,809	275,448	267,326	266,636	256,565	266,248	244,288
Cummulative (Annual)		= annual sum of monthly totals	261,137	497,514	752,682	999,572	1,222,534	1,473,343	1,748,790	2,016,117	2,282,753	2,539,318	2,805,566	3,049,854
Cumulative (Since Startup)		= sum of monthly totals + cummulative total from previous year	27,406,658	27,904,172	28,159,340	28,406,230	28,629,192	28,880,001	29,155,448	29,422,775	29,689,411	29,945,976	30,212,224	30,456,512
Cummulative Water Retained in Tailings (Since Startup)		= sum of water retained (monthly + cummulative form previous year)	23,785,102	22,666,692	22,835,533	23,017,796	23,194,146	23,353,404	23,532,553	23,729,302	23,920,249	24,103,510	23,157,076	23,331,568
TOTAL VOLUME (TAILINGS + SUPERNATANT + WATER RETAINED IN TAILINGS) (m^3)														
Monthly (Projected)		= supernatant + tailings	485,130	423,475	377,855	368,904	337,402	-1,115,285	4,940,852	733,432	913,244	344,018	567,747	533,609
Cumulative (Annual)		=annual sum of monthly totals	485,130	908,606	1,286,461	1,655,365	1,992,767	877,482	5,818,335	6,551,766	7,465,010	7,809,028	8,376,775	8,910,384
Cumulative (Since Startup)		= sum of monthly totals + cummulative total from previous year	53,926,318	54,834,924	55,212,779	55,581,683	55,919,085	54,803,800	59,744,653	60,478,084	58,370,000	58,714,018	58,270,000	58,803,609
TAILINGS WATER SURFACE ELEVATION (masl)														
Actual Elevation		= surveyed	957.18	957.37	957.60	957.84	958.06	958.22	958.83	959.05	959.78	959.85	959.73	959.96
Projected Elevation		= formula based on fill curve	957.79	958.20	958.37	958.54	958.69	958.19	960.38	960.69	959.78	959.93	959.73	959.97
DIFFERENCE		= actual - projected	-0.61	-0.83	-0.77	-0.70	-0.63	0.03	-1.55	-1.64	0.00	-0.08	0.00	-0.01

red = entered value