APPENDIX L: Water Balance – Surface Water Transfer to Water Treatment Plant

October 7, 2015

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FS 64925
EMS 550121
OHS 550122

Mr. Bob Jacko
Vice President Operations
Tintina Resources Inc.
1110 - 1111 West Georgia Street
Vancouver, British Columbia
Canada, V6E 4M3

Dear Bob,

Re: Black Butte Copper Project Water Balance - Surface Water Transfer to Water Treatment Plant

The Black Butte Copper Project (the Project) is a proposed underground copper mine located approximately 32 km north of White Sulphur Springs, Montana. An update to the life-of-mine site wide water balance model has been completed by Knight Piésold (KP) to incorporate the transfer of surface water from the Process Water Pond and the Cemented Tailings Facility to the Water Treatment Plant, with subsequent treatment and release to the environment. Surface water includes direct precipitation on mine facilities, as well as runoff contributing to mine facilities. This letter details the model objectives, parameters, assumptions, and results.

1 – MODEL OBJECTIVES

This water balance is an update to the KP letter *Updated Water Balance with Wet and Dry* Years (KP, 2015a) issued to Tintina Resources Inc. (Tintina) on September 2, 2015. The primary objective of this update is to reflect the design change to convey all surface water from the Cemented Tailings Facility (CTF) and the Process Water Pond (PWP) to the Water Treatment Plant (WTP), which proportionally increases the water requirement from the underground source.

The model was developed using the GoldSim© modeling platform. Deterministic and stochastic approaches were used, and 15 years were modeled including two pre-production years and 13 years of operations.

2 – MODEL PARAMETERS AND ASSUMPTIONS

The following sections outline the parameters and assumptions that were used to create the water balance model. The model results are dependent on these assumptions, and only valid if the parameters remain as outlined below.

2.1 GENERAL

Cemented tailings disposal is the chosen waste management method for the Project. The tailings will be impounded in the CTF, as shown on Figure 1. The PWP will store water from various inputs such as mill circulating load and the mill reclaim water. The PWP also collects surface water runoff and precipitation reporting to the PWP, including the water transferred from the CTF; all of which will be conveyed to the WTP, treated, and released to the environment.

Make-up water for the PWP will be sourced from underground dewatering and is assumed to not require treatment. In addition, freshwater will be supplied to the mill for special uses from underground dewatering after it has been treated in the WTP. Any treated water not being used for mine operations will be released to the environment.

Meteorological parameters for the model were developed by KP using site specific data in conjunction with regional data as described in KP's meteorological data analysis memo VA15-02445 (KP, 2015b). The determined mean monthly precipitation and evaporation values are used as inputs in the model for each year. It is also assumed that the precipitation from November through to March falls as snow and accumulates as snowpack until the spring, when it melts during April and May. Therefore, the precipitation that accumulates between November and March will report to the PWP during April and May. A stochastic model was created with monthly coefficient of variations for the precipitation record to simulate dry year and wet year conditions.

The mill input and output requirements, along with miscellaneous freshwater requirements (truck wash, dust control etc.), were provided to KP by Tetra Tech (TT) via email correspondence with Jianhui Huang, dated September 16, 2015 (TT, 2015). The mill requirements were provided as annual rates for the life of mine. The preliminary inputs to the water balance model are shown in Table 1.

Table 1 Water Balance Inputs

Component	Units	Value	Source
Hydrometeorology			
Mean Annual Precipitation	mm	416	KP
Mean Annual Pond Evaporation	mm	514	KP
Runoff Coefficient (Undisturbed Ground)	mm	0.2	KP
Runoff Coefficient (Disturbed Ground /Facility Footprints)	mm	1.0	KP (Assumes no seepage from facilities)
Ore Production			
Ore Water to Mill	m^3/yr	12,000 to 52,000	John Huang, TT[1]
Tailings Production			
Nominal Mill Process rate	tonne/day	3,300	Tintina
Tailings Dry Density	tonne/m^3	2.0	Tintina
Tailings Specific Gravity	-	3.77	Tintina
Tailings Solids Content	-	74%	Tintina
Tailings Water to CTF	m^3/yr	51,000 to 221,000	John Huang, TT[1]
Tailings Water to Underground	m^3/yr	42,000 to 186,000	John Huang, TT[1]
Water Lost to Voids	%	100%	Assumption
Mill Process			
Freshwater Requirements	m^3/yr	44,000 to 192,000	John Huang, TT[1]
Water lost to Concentrate	m^3/yr	4,000 to 16,000	John Huang, TT[1]
Thickener Overflow	m^3/yr	938,000 to 4,107,000	John Huang, TT[1]
Required Water from the PWP	m^3/yr	979,000 to 4,286,000	John Huang, TT[1]
Other Freshwater Use	m^3/yr	49,000	John Huang, TT
Underground Dewatering	gpm	500	Hydrometrics

NOTES:

1. Range of values for the life of mine, based on the production schedule.

2.2 WATER MANAGEMENT

The PWP has been designed for a maximum operating volume of 200,000 m^3. This analysis assumes a minimum allowable pond volume of 120,000 m^3 and a maximum allowable volume of 200,000 m^3, thereby defining the operating range as 120,000 m^3 to 200,000 m^3.

The PWP starting volume of 120,000 m^3, likely sourced from underground dewatering, will be in-place two months prior to the start of operations. The PWP monthly make-up water is calculated as additional water required to satisfy mill water requirements once the minimum allowable volume is reached in the PWP.

Each modeled mine year starts in June, as it was assumed that the mill would initially begin operations following the spring freshet period (April and May) of the first year of operations. It is assumed that pond water accumulating in the CTF will be pumped to the PWP immediately. Surface water, as runoff, and direct precipitation reporting to the mill is assumed to be routed to the WTP.

A large percentage of runoff within the CTF and PWP catchment areas will be diverted via a surface water diversion ditch system and discharged downstream (Figure 1); however, there is still a portion of the catchment area surface runoff that reports to the respective facilities. The runoff coefficient for undisturbed ground was assumed to be 0.2 based on the Manhattan Design Standards report (Thomas, et al. 2008). A runoff coefficient of 1.0 was assumed for disturbed ground surfaces, as the facilities will be geomembrane-lined and therefore impervious. It was also conservatively assumed that there would be no seepage from lined facilities.

The portion of the surface water runoff that is not diverted around the CTF and PWP (Figure 1), as well as the precipitation that falls directly on the two facilities will be collected in the PWP and routed to the WTP for treatment prior to release to the environment. The make-up water required to operate the mill will be sourced from underground dewatering.

The water balance schematic, shown on Figure 2, was used as the basis for model development and shows the annual inflows and outflows from the facilities during the sixth year of production (year 6) under mean climatic conditions.

The site water management plan, as interpreted by KP based on discussions with Tintina, is described below:

- The primary source of reclaim water for the mill is the PWP.
- Surface water reporting to the CTF will be transferred to the PWP.
- Surface water reporting to the PWP, including that transferred from the CTF, will be transferred to the WTP where it will be treated prior to discharge to the environment.
- Additional make-up water required by the mill is assumed to be supplied from underground dewatering and stored in the PWP.
    - Note that make-up water required by the PWP is assumed to be untreated; however, freshwater required by the mill is assumed to be treated by the WTP.

Evaporation and direct precipitation on the PWP pond were accounted for in the water balance. The surface area was calculated for each time-step using the Depth-Area-Capacity (DAC) data for the facility.

2.3 GENERAL MODEL LIMITATIONS

The following limitations should be considered when reviewing the results of the water balance model.

- Increasing consolidation of the tailings was not accounted for in the model; instead it was assumed that all water locked in the cemented tailings voids is not recoverable (void loss).
- Snowpack, snowmelt and sublimation parameters are based on estimates as no detailed study has been conducted.

3 – WATER BALANCE MODEL RESULTS

Three separate scenarios were modeled using the life-of-mine water balance in order to obtain an understanding of the water requirements of the PWP during operations. The model was run deterministically for the mean case, and stochastically for the abnormally wet (95th percentile) and abnormally dry (5th percentile) cases. A gamma distribution was assumed for the precipitation data in the stochastic models and a Monte Carlo simulation was executed using 5,000 iterations. The estimated monthly precipitation volumes reporting to the proposed mine site, and the resulting effects on the volumes in the PWP, have been presented in terms of probabilities of occurrence for the three scenarios:

- **Scenario 1 – Mean**: The model was run deterministically and the results correspond to mean monthly climatic conditions (Figure 2).
- **Scenario 2 – 95th Percentile (Wet)**: The results correspond to abnormally wet conditions, and represent the climatic conditions to be exceeded once every 20 years, on average.

- **Scenario 3 – 5th Percentile (Dry)**: The results correspond to abnormally dry conditions, and represent the climatic conditions expected to be exceeded 19 years out of 20, on average (i.e. volumes will not exceed these values more than once every 20 years, on average).

The estimated PWP pond volume prior to the surface water transfer to the WTP and groundwater transfer to the PWP is shown on Figure 3, for all three climatic scenarios. The volume trends show that there is sufficient storage capacity in the PWP during abnormally wet year scenarios (95th percentile). There is also sufficient volume to support the project in a dry year (5th percentile), when the groundwater source is used as make-up water.

The PWP pond volume, after surface water transfer to the WTP and groundwater transfer to the PWP, is shown on Figure 4; which shows that the pond volume for each scenario is similar after the water transfer is included in the model. The amount of water transferred to the WTP and released to the environment is greater than the amount required to keep the pond volume within the mean scenario operating range for mean and abnormally wet conditions. The results for all 3 scenarios are outlined in the sections below.

3.1 SCENARIO 1 RESULTS (MEAN)

The PWP will be supplemented with approximately 163,000 m^3 of groundwater make-up throughout the year, on average. The average annual surface water transfer from the PWP to the WTP is 110,000 m^3. The annual groundwater make-up requirements and surface water transfer to the WTP, for the life of mine, are shown in Table 2.

Table 2 Scenario 1: Mean PWP Make-Up Water Requirements and Surface Water Transfers (m^3)

Year	Total Groundwater to PWP	Surface Water Transfer from PWP to WTP
1	109,000	107,000
2	142,000	110,000
3	178,000	110,000
4	181,000	110,000
5	184,000	110,000
6	181,000	110,000
7	188,000	110,000
8	193,000	110,000
9	190,000	110,000
10	186,000	110,000
11	185,000	110,000
12	141,000	110,000
13	56,000	110,000

It should be noted that groundwater make-up is only required during the winter months. The PWP fluctuates between approximately 120,000 m^3 and 170,000 m^3, after the surface water and groundwater transfers.

3.2 SCENARIO 2 RESULTS (95TH PERCENTILE, ABNORMALLY WET)

The groundwater make-up requirements are the same under abnormally wet climatic conditions as mean climatic conditions (Table 2 above), but the average annual surface water transfer from the PWP to the WTP is increased to 232,000 m^3 per year, on average. The annual surface water transfer volumes to the WTP are summarized in Table 3.

Table 3 Scenario 2: 95th Percentile (Abnormally Wet) Annual Surface Water Transfer to WTP (m^3)

Year	Surface Water Transfer to WTP
1	227,000
2	231,000
3	232,000
4	232,000
5	230,000
6	234,000
7	235,000
8	232,000
9	233,000
10	232,000
11	230,000
12	231,000
13	232,000

The PWP pond volume fluctuates between 120,000 m^3 and 170,000 m^3 under wet climatic conditions, which is the same as Scenario 1, as shown on Figure 4. This is achieved by transferring a larger volume of surface water from the PWP to the WTP, and releasing it to the environment (232,000 m^3), than the volume of groundwater that is transferred back to the PWP (110,000 m^3).

3.3 SCENARIO 3 RESULTS (5%TH PERCENTILE, ABNORMALLY DRY)

The groundwater make-up requirements are the same under abnormally dry climatic conditions as mean climatic conditions, but the average annual surface water transfer from the PWP to the WTP is reduced to 34,000 m^3 per year. The annual surface water transfer volumes to the WTP are summarized in Table 4.

Table 4 Scenario 3: 5th Percentile (Abnormally Dry) Annual Surface Water Transfer to WTP (m^3)

Year	Surface Water Transfer to WTP
1	32,000
2	35,000
3	34,000
4	34,000
5	35,000
6	34,000
7	35,000
8	35,000
9	34,000
10	34,000
11	34,000
12	34,000
13	35,000

The PWP pond volume remains the same as that for Scenarios 1 and 2, as shown on Figure 4. The volume of surface water that is transferred from the PWP to the WTP, and released to the environment (34,000 m^3), is less than the volume of groundwater that is transferred back to the PWP (110,000 m^3) in this Scenario.

4 - CONCLUSIONS AND RECOMMENDATIONS

It is necessary to supplement the PWP with make-up water from the underground source in order to achieve the design minimum pond volume based on the water balance and the conditions outlined in this letter. The results of the three scenarios modeled are outlined below:

All Scenarios

- Average annual groundwater make-up required to sustain the minimum pond volume = 163,000 m^3

Scenario 1 (Mean Conditions)

- Average annual surface water volume transferred from the PWP to the WTP = 110,000 m^3

Scenario 2 (Abnormally Wet Year)

- Average annual surface water volume transferred from the PWP to the WTP = 232,000 m^3

Scenario 3 (Abnormally Dry Year)

- Average annual surface water volume transferred from the PWP to the WTP = 34,000 m^3

It is recommended that the life-of-mine water balance model be updated as further information becomes available.

Please contact the undersigned with any questions or comments.

Yours truly,
Knight Piesold Ltd.

PROFESSIONAL PROVINCE OF M. HODZIC # 39224 BRITISH COLUMBIA ENGINEER Oct. 7, 2015

Prepared: Mediha Hodzic, P.Eng.
Project Engineer

Reviewed: Ken Embree, P.Eng.
Managing Principal, Vancouver

Approval that this document adheres to Knight Piesold Quality Systems:

Attachments:

Figure 1 Rev 1	Water Balance Model - Catchment Area Figure
Figure 2 Rev 1	Annual Water Balance Schematic (m^3/year) – Mean Case – Year 6
Figure 3 Rev O	Process Water Pond Monthly Volumes - Estimate Prior to Water Transfers
Figure 4 Rev O	Process Water Pond Monthly Volumes - Post Water Transfers

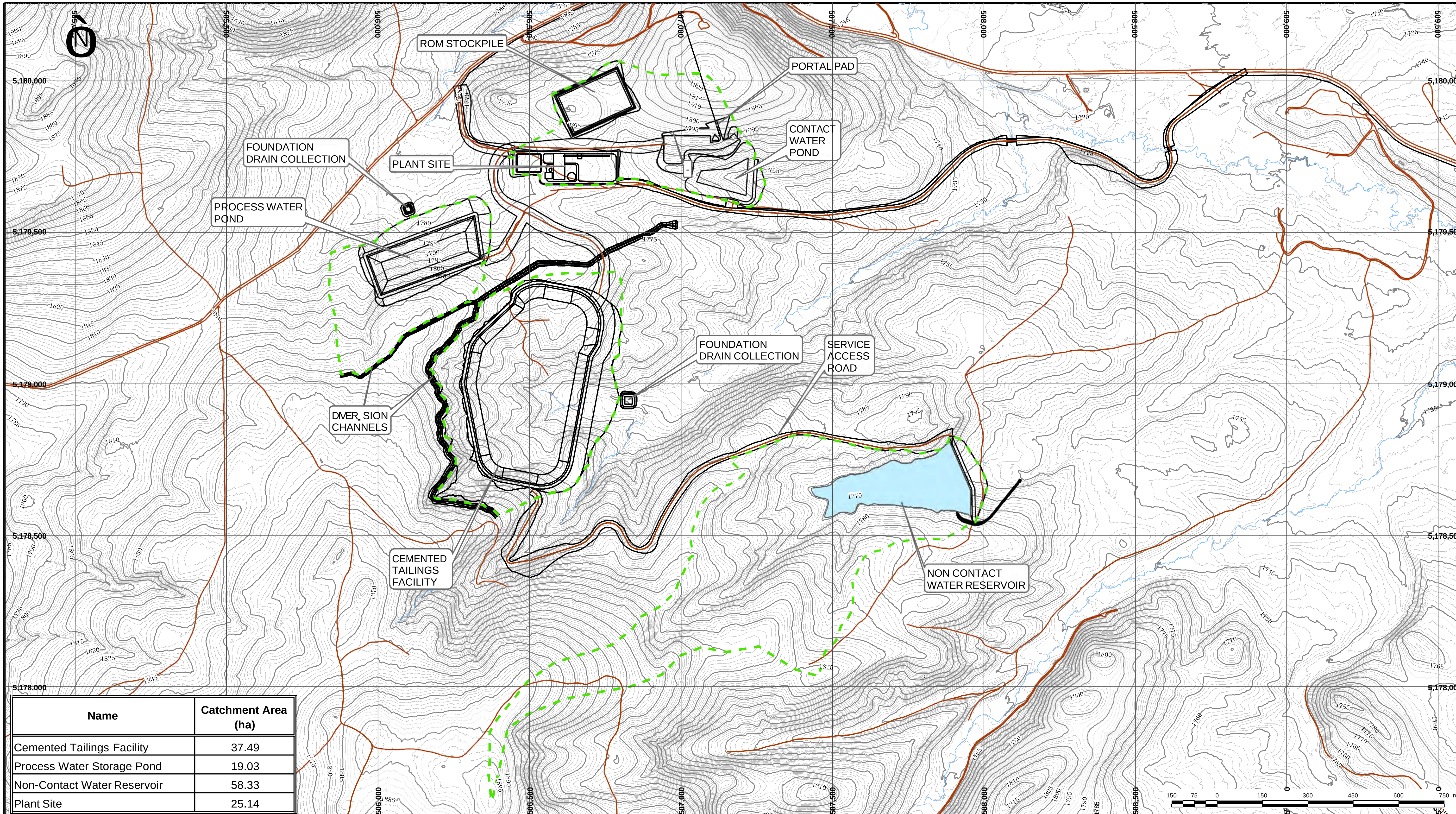
References:

Knight Piesold Ltd. (KP). 2015a. *Black Butte Copper Project - Updated Water Balance with Wet and Dry Years.* Doc. No. VA101-460/3, VA15-03006. Prepared for Tintina Resources Inc. September 2, 2015.

Knight Piesold Ltd. (KP). 2015b. *Black Butte Copper Project Meteorology Data Analysis Update.* Doc. No. VA101-460/3, VA15-02445. Prepared for Tintina Resources Inc. May 27, 2015.

Tetra Tech (TT). 2015. Huang, Jianhui. "Update; Amee Mining." Message to Bob Jacko and Greg Magoon. September 16, 2015. E-mail.

Thomas, Dean, and Hoskins. *Design Standards and Specification Policy.* Manhattan, Montana: Town of Manhattan, Montana, 2008.



Name	Catchment Area (ha)
Cemented Tailings Facility	37.49
Process Water Storage Pond	19.03
Non-Contact Water Reservoir	58.33
Plant Site	25.14

LEGEND:

- ROAD
- CONTOUR (1 m)
- CONTOUR (5 m)
- STREAM
- CATCHMENT BOUNDARY
- MINE FACILITIES

NOTES:

1. BASE MAP: LIDAR 1 m CONTOURS AND STREAMS.
2. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 12N.
3. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:12,000 FOR 11x17 (TABLOID) PAPER. ACTUAL SCALE MAY DIFFER ACCORDING TO CHANGES IN PRINTER SETTINGS OR PRINTED PAPER SIZE.
4. CONTOUR INTERVAL IS 1 METRE.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
1	25SEP'15	ISSUED WITH LETTER	MH	CAC	KDE
0	21AUG'15	ISSUED WITH LETTER	MH	AMD	KDE

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

WATER BALANCE MODEL CATCHMENT AREA FIGURE

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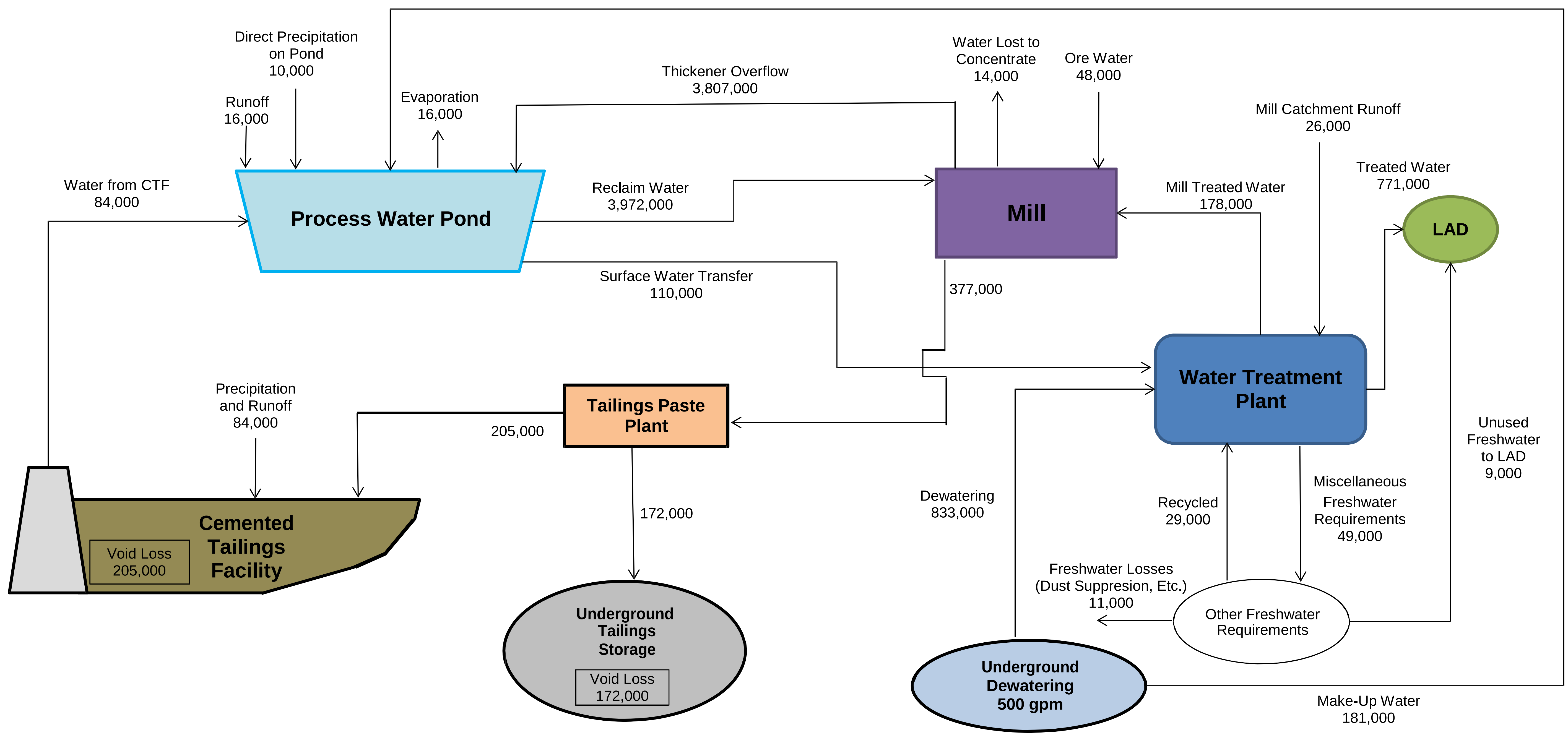
P/A NO. VA101-460/3 | REF NO. VA15-03200

FIGURE 1 | REV 1



NOTES:

1. ALL WATER VOLUMES ARE EXPRESSED IN UNITS OF CUBIC METRES PER YEAR.
2. WATER IN TAILINGS PASTE IS ASSUMED TO BE UNRECOVERABLE.
3. SEEPAGE IS ASSUMED TO BE ZERO AS THE FACILITIES ARE LINED.
4. LAD = LAND APPLICATION AND DISPOSAL.

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BLACK BUTTE COPPER PROJECT

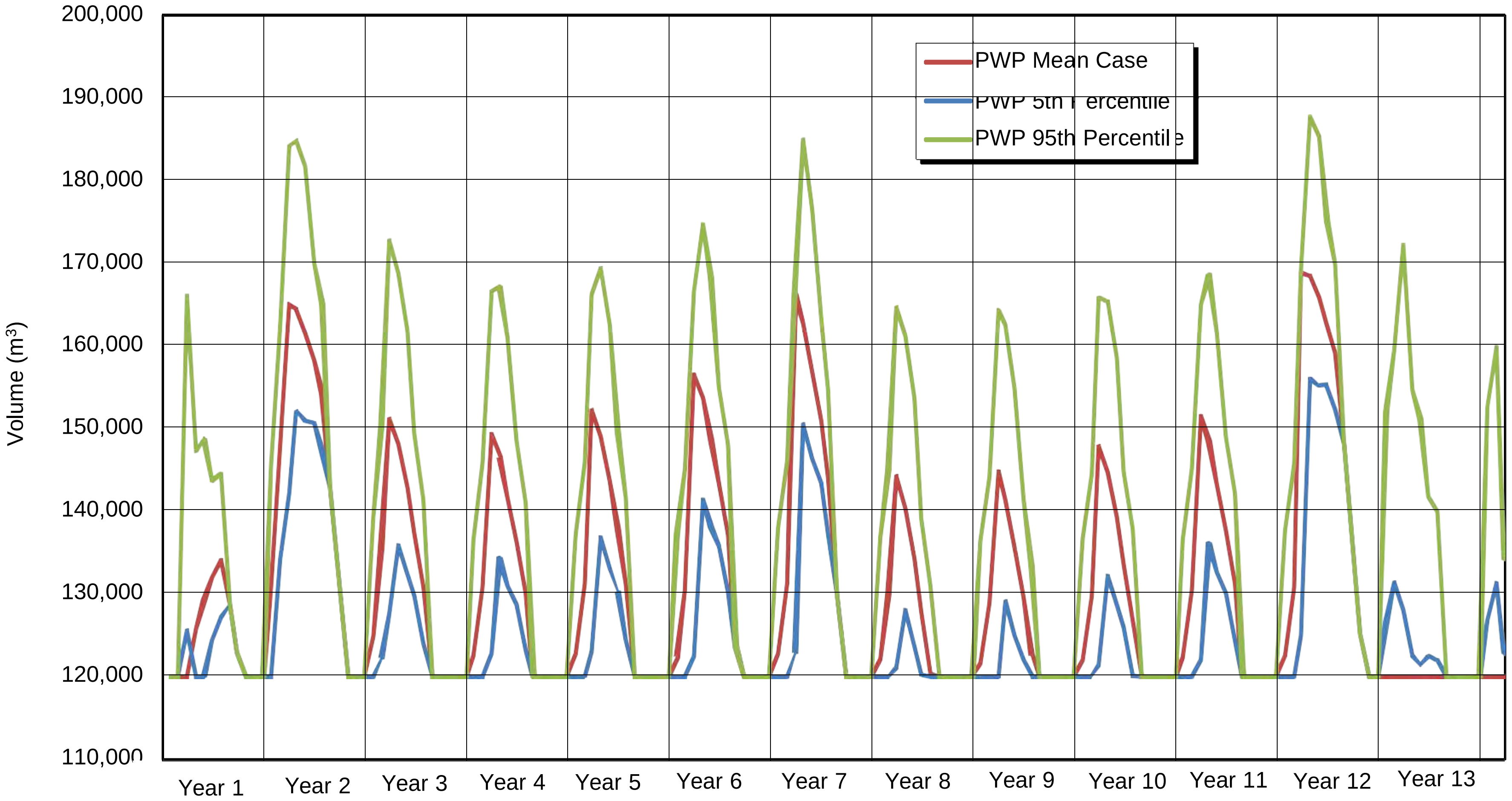
ANNUAL WATER BALANCE SCHEMATIC (m^3/year)
MEAN CASE
YEAR 6

Knight Piésold CONSULTING

P/A NO.	REF. NO.
VA101-460/3	VA15-03200

FIGURE 2 REV 1

REV	DATE	DESCRIPTION	PREP'D	RVW'D
1	07OCT'15	ISSUED WITH LETTER	BW	MH



NOTES:

1. AN INITIAL VOLUME OF 120,000 m^3 IS ADDED TO THE PWP 2 MONTHS PRIOR TO THE START OF OPERATIONS.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	01OCT'15	ISSUED WITH LETTER	BW	MH

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

PROCESS WATER POND
MONTHLY VOLUMES
ESTIMATE PRIOR TO WATER TRANSFERS

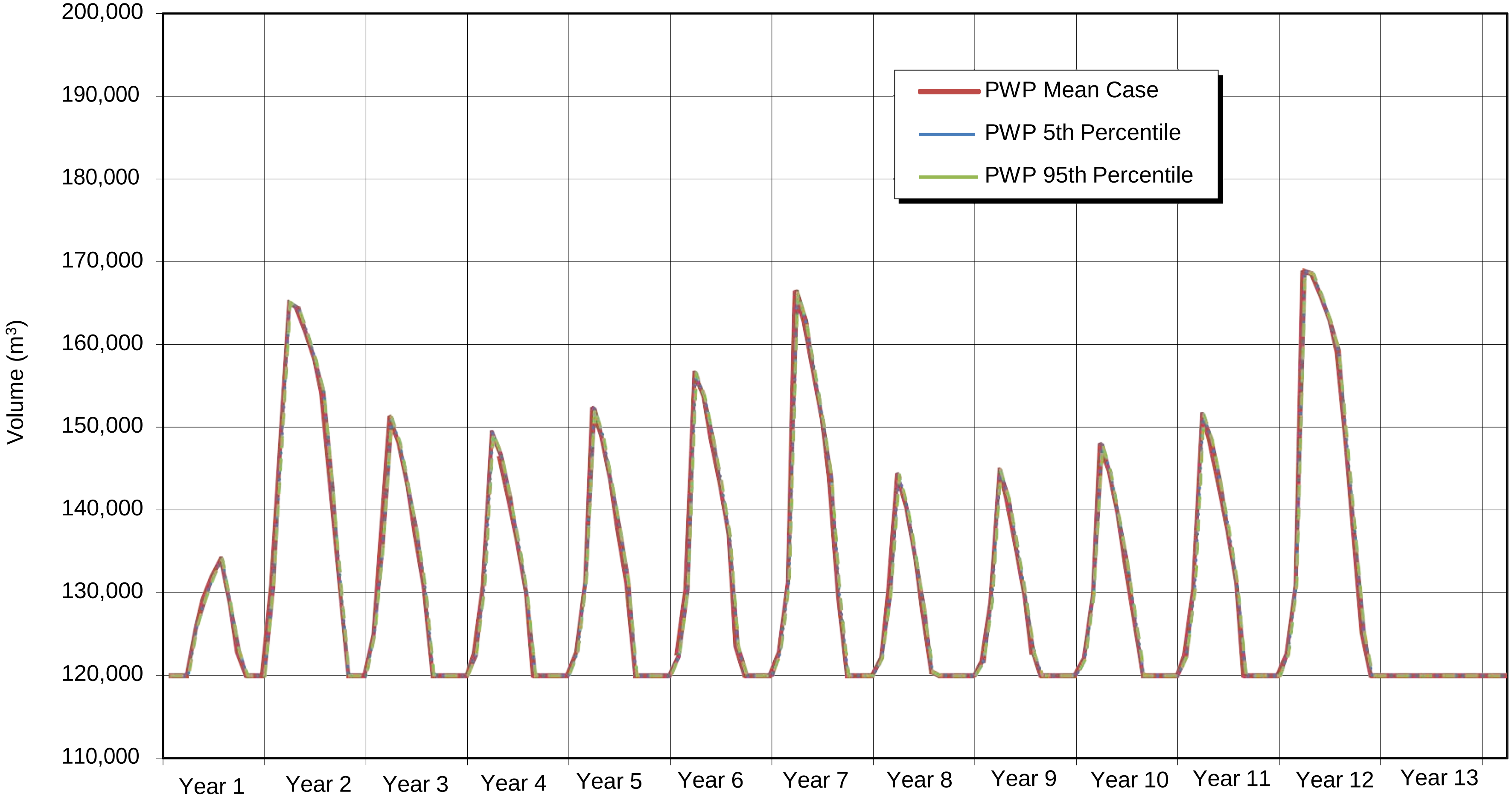
Knight Piésold CONSULTING

P/A NO. VA101-460/3

REF. NO. VA15-03200

FIGURE 3

REV 0



NOTES:

1. AN INITIAL VOLUME OF 120,000 m^3 IS ADDED TO THE PWP 2 MONTHS PRIOR TO THE START OF OPERATIONS.

0	01OCT'15	ISSUED WITH LETTER	BW	MH
REV	DATE	DESCRIPTION	PREP'D	RVW'D

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

PROCESS WATER POND
MONTHLY VOLUMES
POST WATER TRANSFERS

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P/A NO.	REF. NO.	
VA101-460/3	VA15-03200	
FIGURE 4		REV 0