MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

WATER MANAGEMENT REPORT

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MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

WATER MANAGEMENT REPORT
VA101-126/12-7

Rev	Description	Date
0	Issued in Final	January 11, 2017
1	Issued with Marked Revisions	March 13, 2017
2	Issued with Post Closure Water Quality Memo and Updated Water Balance Model	August 15, 2017
3	Issued with Revisions identified in DEQ First Deficiency Review	March 14, 2018

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EXECUTIVE SUMMARY

Montana Resources, LLP (MR) is preparing a Permit Amendment (Amendment) application to provide for continued mining beyond 2020. The proposed Amendment involves raising the crest elevation of the YDTI West Embankment to 6,450 feet (ft) and commencing operation of the West Embankment Drain (WED). The proposed Amendment will provide approximately 12 years of additional mine life. ▲R2

The Water Management Report (WMR) has been prepared as part of the proposed Amendment technical design document as required by the Montana Code Annotated that requires the design document includes identification and consideration of the following water management details for the YDTI during construction, operations and post-closure:

- Description of the chemical and physical properties of the materials and solutions stored in the YDTI
- A detailed water balance
- Description of storm water controls
- Description of water, seepage and process solution routing, and
- Description of extreme storm event management plans.

The total YDTI drainage area, when the YDTI embankment is developed to 6,450 ft, will consist of approximately 3,900 acres of upstream watershed and 2,350 acres of disturbed impoundment area. ▲R2

Hydrological and meteorological data for the site is sourced from local climate stations. The main climate station referenced is the Bert Mooney Airport Station at Butte, as well as the Moulton Reservoir Station and the Bureau of Land Management Station located at Whitehall.

A detailed review of the chemical and physical properties of the tailings and water stored in and entering the YDTI was undertaken to provide a general characterization of the material stored in the impoundment. MR monitors four water quality sites directly related to the YDTI: three upstream watersheds up-gradient of the impoundment (Yankee Doodle Creek, Dixie Creek and Silver Bow Creek), and one site in the supernatant pond.

Yankee Doodle Creek is characterized as soft to moderately hard, neutral to slightly basic water with low sensitivity to acid inputs (good buffering capacity). Water in Dixie Creek is described as moderately hard, neutral to slightly basic, with good buffering capacity. The water quality in North Silver Bow Creek can be described as moderately hard, neutral to slightly basic water with moderate buffering capacity. Nitrogen-based nutrients were generally below the detection limit for all three up-gradient sites.

The supernatant pond water is described as very hard, basic to very basic water with good buffering capacity. Total dissolved solids are very high. Most of the detected metal concentrations were within or close to the ranges of concentrations observed in the upstream creeks. Exceptions include nickel and strontium, which were generally higher in the tailings pond samples than in the creek samples.

The key physical characteristics and geochemical observations of the tailings are as follows:

- The tailings dry density on the beach surface was reported to be approximately 73 to 79 pcf in 2014.
- The average d_{50} is 110 microns while the average d_{80} is 290 microns (2005 to current). These are 40 and 60 microns higher respectively than measured during the period 1987 through 1998.
- The tailings consist of loose to medium dense sand-silt materials, which generally become denser with depth. The tailings are highly stratified with inter-bedded layers of sand-silt.

- The tailings generally become finer grained with distance from the discharge point (due to particle segregation) ranging from sands and silty sands near the discharge point to sandy silts and silts at greater distance.
- The sandy tailings are generally non-plastic, but finer grained silt tailings settle farther from the discharge location are slightly plastic.
- Tailings slurry pH was basic in all samples, ranging from 8.7 to 10.
- Tailings are classified as potentially acid-generating materials.
- The main minerals in the tailings slurry are aluminum oxide and silicon dioxide.
- The main metal parameters in the tailings slurry are copper, manganese, phosphorus, titanium, and zinc.

The YDTI water balance model was developed to simulate the supply and demand for water on a month-by-month basis for the tailings impoundment, and includes water requirements from the initiation of MR mine operations in 1986, through current and continued operating conditions, and to ultimate closure of the facility.

The water balance model shows the facility operates in a deficit condition and therefore make-up water is required from an outside source i.e. Silver Lake. Post-closure the model indicates the supernatant pond volume will decrease to approximately 8,000 ac-ft within ten years and reduce to a steady-state volume of 500 ac-ft after 40 years, assuming an initial post closure pond volume of 17,000 ac-ft, based on the 50th percentile results. ▲R2

A mass load model to predict the water quality in the YDTI supernatant pond after closure was developed and calibrated to historic pond water quality records. The model predicts the pond water quality will generally improve until it is comparable to the chemistry of the surface water runoff from the watershed up-gradient of the YDTI approximately 20 years after closure of the facility. ▲R2

The key water management structures used during YDTI operations and/or post-closure include the following:

- Embankment benches and berms
- Embankment slope ditches and swales
- West Embankment Drain
- HsB Collection Area
- Number 10 Seep Pond and Weir, and
- YDTI Spillway.

Berms constructed on the downstream edge of embankment benches and roadways during operations have drainage cuts approximately every 500 ft to allow controlled drainage of surface runoff. Post-closure, surface water swales and ditches will be constructed every 100 feet along the regraded and reclaimed slopes during reclamation of the embankment.

The West Embankment Drain (WED) will intercept seepage migrating west of the YDTI as the tailings pond level increases above elevation 6,350 ft. The WED will be constructed along the upstream toe of the West Embankment facilitate gravity drainage south to the Extraction Pond, where the recovered water is pumped back to the YDTI. The WED will continue to be operated after closure.

Seepage from the YDTI East - West and North - South Embankments is collected at Horseshoe Bend (HsB) collection area. The seepage collected is discharged south to HsB Pond and treated in HsB water treatment plant. Number 10 seep system collects perched seepage flows on the downstream slope of the YDTI embankment approximately 250 ft above the HsB collection area. The seepage is collected in a pond and discharged into a pipeline that conveys the flow to the HsB collection area. The HsB collection area and the Number 10 seep system (pond and weir) will continue to operate after closure.

Runoff from extreme storm events and the Probable Maximum Flood (PMF) during operations and post-closure will be contained within the YDTI. A contingency spillway will be constructed during reclamation of the YDTI as an emergency water management system designed primarily to prevent overtopping of the embankment. The spillway will only convey flow when the water storage volume exceeds approximately 26,000 ac-ft, which would only occur with an exceptionally unlikely sequence of storm events in combination with a starting pond volume equal to the 95% percentile wet steady state pond volume. This storm sequence involves the 1 in 1,000 year 30-day rainfall event immediately followed by the PMF event, which is in turn immediately followed by an additional storm event. ▲ R3

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ABBREVIATIONS

ac-ft	acre-feet
EL	elevation
E	East
ft	feet
HDPE	High Density Polyethylene
HsB	Horseshoe Bend
in	inches
IDF	Inflow Design Flood
IRP	Independent Review Panel
KP	Knight Piésold Ltd.
MCA	Montana Code Annotated
MDEQ	Montana Department of Environmental Quality
MR	Montana Resources, LLP
N	North
NRCS	United States National Resource Conservation Service
pcf	pound per cubic inch
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
RWS	Reclaim Water System
S	South
SWE	snow water equivalent
TDS	Total Dissolved Solids
USGS	United States Geological Survey
W	West
WED	West Embankment Drain
WMP	Water Management Plan
WMR	Water Management Report
WTP	Water Treatment Plant
YDTI	Yankee Doodle Tailings Impoundment

1 – INTRODUCTION

1.1 GENERAL

Montana Resources, LLP (MR) operates an open pit copper and molybdenum mine located adjacent to the city of Butte, Montana in Silver Bow County. The mine produces copper sulfide concentrate, molybdenum disulfide concentrate, and copper precipitate (cement copper). MR is currently mining the Continental Pit at a nominal Concentrator throughput rate of approximately 50,000 tons per day.

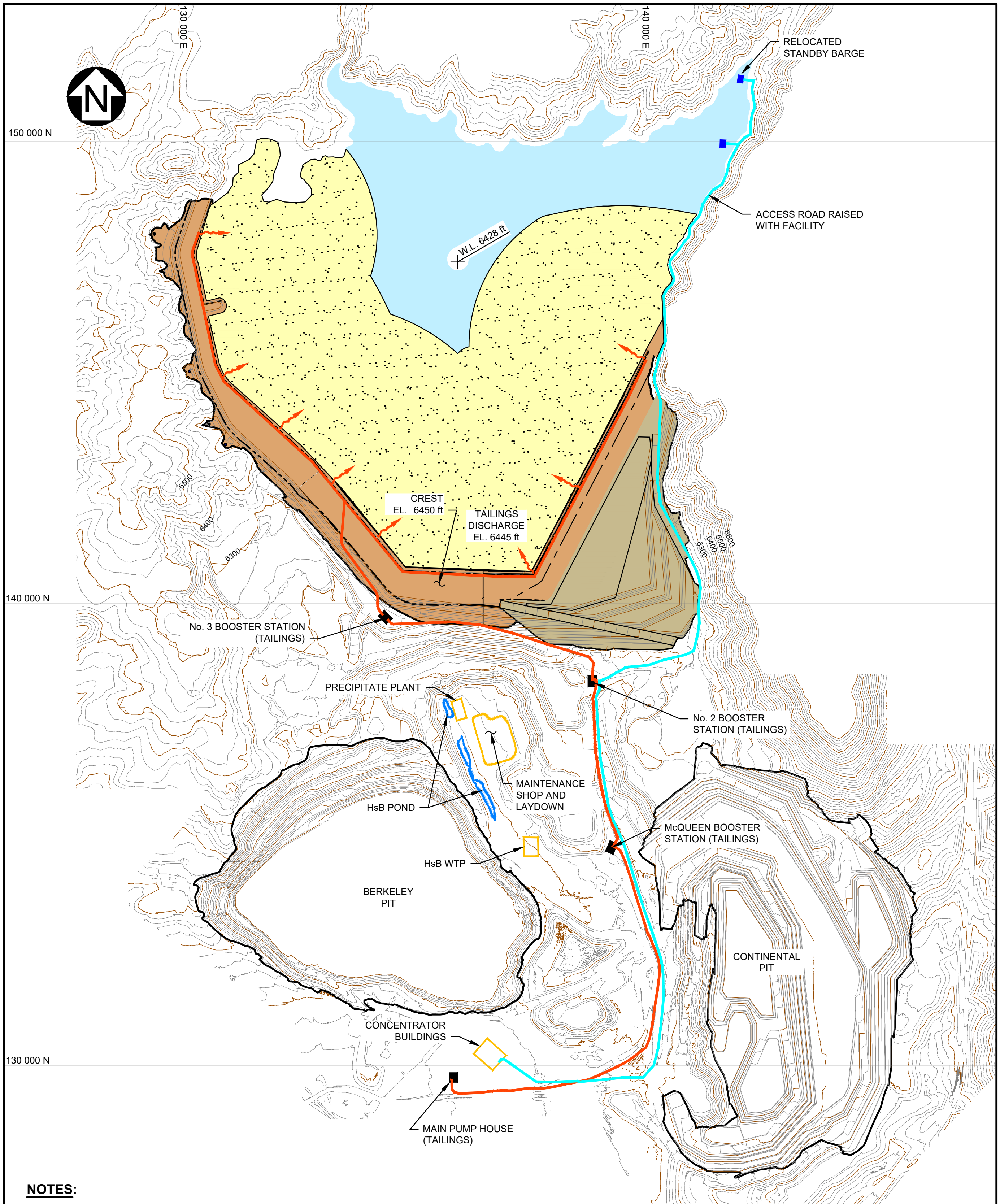
MR is preparing a Permit Amendment application (Amendment) to provide for continued mining beyond 2020. The proposed Amendment involves raising the crest elevation of the Yankee Doodle Tailings Impoundment (YDTI) West Embankment to 6,450 feet (ft) and commencing operation of the West Embankment Drain (WED), which will provide approximately 12 years of additional tailings storage. The YDTI general arrangement with the proposed 6,450 ft embankment crest in year 2031 (assuming continuous mine operations) is shown on Figure 1.1. ▲ R2

1.2 REPORT PURPOSE

This Water Management Report (WMR) has been prepared as part of the proposed Amendment technical design document, as required by Title 82, Chapter 4, Part 3, Section 76 of the Montana Code Annotated (MCA). MCA 82-4-376 requires the design document include identification and consideration of the following water management details for the YDTI during construction, operations and post-closure:

- Description of the chemical and physical properties of the materials and solutions stored in the YDTI
- A detailed water balance
- Description of storm water controls
- Description of water, seepage and process solution routing, and
- Description of extreme storm event management plans.

The WMR scope includes consideration of the YDTI embankments, beach, tailings pond and upstream watershed catchments. The report does not include consideration of water management for other mine facilities not directly associated with the proposed tailings impoundment raise i.e. Butte Concentrator, Precipitation Plant and associated Leach Pads, Continental Pit, Berkeley Pit, Horseshoe Bend (HsB) Collection Area, rockfill disposal sites and stockpiles.



NOTES:

1. COORDINATE SYSTEM AND ELEVATIONS ARE BASED ON MINE GRID.

LEGEND:

TAILINGS BEACH	TAILINGS DEPOSITION LOCATION
EMBANKMENT FILL	TAILINGS PIPELINE
ROCK DISPOSAL SITE	RECLAIM PIPELINE
MINE WATER	RECLAIM BARGE

SCALE A: 1500 0 1500 3000 4500 6000 7500 ft

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
1	02AUG'17	ISSUED WITH REPORT	DDF	MJC	KJB

MONTANA RESOURCES, LLP

YANKEE DOODLE TAILINGS IMPOUNDMENT

GENERAL ARRANGEMENT PLAN - 2031

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-126/12	7

FIGURE 1.1 REV 1

2 – SITE CONDITIONS

2.1 DRAINAGE NETWORK

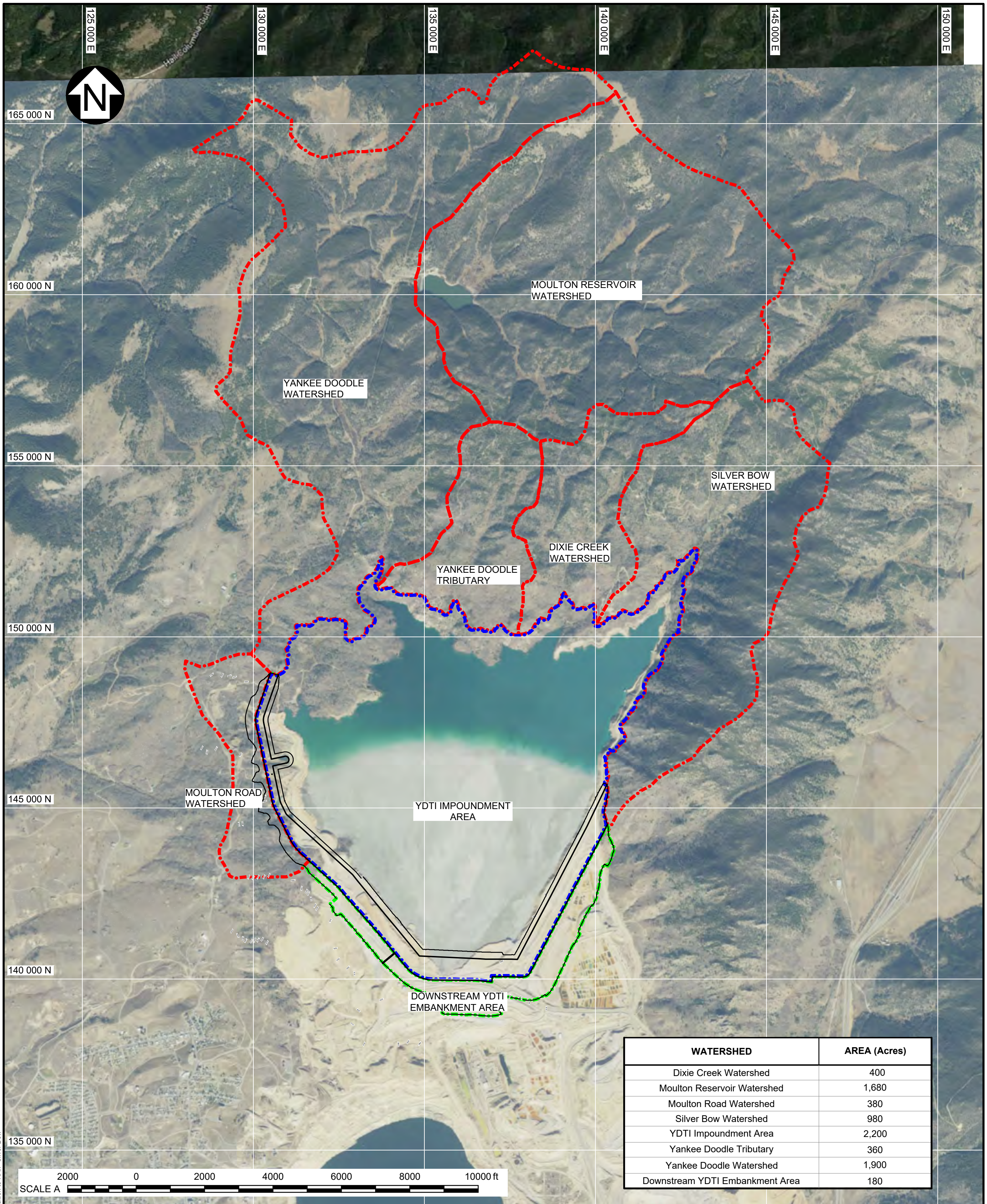
The mine site is bounded by the city of Butte to the south, Rampart Mountain to the east, and the town of Walkerville to the west. The YDTI facility is located on the north side of the mine site, and the area to the north (upstream) of the impoundment consists of the catchments for Yankee Doodle, Dixie, and Silver Bow Creeks. The YDTI water management drainage network is shown on Figure 2.1.

The YDTI facility consists of the following three drainage areas:

- Upstream watershed
- Impoundment area, and
- Downstream YDTI Embankment area.

The total YDTI drainage area, when the YDTI embankment is developed to 6,450 ft, will consist of approximately 4,000 acres of upstream area and 2,350 acres of impoundment area. Surface runoff from the upstream watershed will drain into the supernatant pond. The upstream watershed is considered as undisturbed from modern mining activities. Note; the upstream area excludes the Moulton Reservoir watershed (1,680 acres) as drainage from this area is collected and used for municipal water supply.

The impoundment area consists of approximately 45% tailings beach, 40% supernatant pond and 15% embankment during operations. The downstream slopes of the YDTI embankments, which comprise approximately 8% of the total YDTI impoundment area, or 180 acres, will drain downstream of the YDTI to the HsB collection area, while the runoff from the remaining impoundment area will drain to the impoundment supernatant pond.



WATERSHED	AREA (Acres)
Dixie Creek Watershed	400
Moulton Reservoir Watershed	1,680
Moulton Road Watershed	380
Silver Bow Watershed	980
YDTI Impoundment Area	2,200
Yankee Doodle Tributary	360
Yankee Doodle Watershed	1,900
Downstream YDTI Embankment Area	180

LEGEND:

- UPSTREAM WATERSHED
- YDTI IMPOUNDMENT AREA
- DOWNSTREAM YDTI EMBANKMENT AREA
- FUTURE EMBANKMENT EXTENTS

NOTES:

1. COORDINATE GRID IS ANACONDA MINE GRID
2. DIMENSIONS AND ELEVATIONS ARE IN FEET, UNLESS NOTED OTHERWISE.
3. ORTHOPHOTO DATED JULY 2013.

MONTANA RESOURCES, LLP

YANKEE DOODLE TAILINGS IMPOUNDMENT

WATER MANAGEMENT REVIEW
DRAINAGE NETWORK

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-126/12	7

FIGURE 2.1 REV 1

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
1	02AUG'17	ISSUED WITH REPORT	RSS	MJC	JGC

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XREF FILE(S): IMAGE FILE(S): 2015_NAIP_Silver_Bow North Addition to NAIP Silver Bow

2.2 HYDROMETEOROLOGY

Hydrological and meteorological data for the site is sourced from local climate stations. The main climate station referenced is the Bert Mooney Airport Station at Butte (1895 through current), but information is also considered from the Mouton Reservoir Station (1980 through 1986) located in the YDTI catchment area and the Bureau of Land Management Station located at Whitehall (2001 to present).

Annual snowpack data were obtained from five regional snow survey sites that are operated by the US National Resource Conservation Service (NRCS) in the general vicinity of the YDTI, and runoff coefficients were derived by comparing precipitation records with runoff data from three regional USGS streamflow stations located in the general vicinity of the mine site.

A detailed presentation of the hydrometeorology data for the site is presented in the KP Report '*Design Basis Report'*, June 2017 (KP, 2017a). A summary of the key data relevant to this Water Management Plan (WMP) is presented below.

- The mean daily temperature for the project site is estimated to be 39°F, with an extreme high of 104°F and an extreme low of -63°F. Highest temperatures generally occur between July and August, and lowest temperatures typically occur between December and February.
- The long-term mean annual precipitation for the project was estimated to be 15.9 inches. For water balance modeling purposes it was assumed that precipitation falls exclusively as rain from June through August and as snow from November through March, and that a mix of rain and snow occurs during the months of April, May, September and October.
- The sublimation for YDTI was estimated to be approximately 35% of the total winter snowfall, which equates to 2.5 in. per year. Sublimation losses are estimated to be distributed evenly from November through to March.
- The estimated mean annual pond evaporation is 28.1 inches, which includes the November to March sublimation estimate of 2.5 inches.
- An annual runoff coefficient of 0.15 was determined for upstream catchment areas, while a higher value of 0.25 was selected for disturbed areas.

2.3 RETURN PERIOD EXTREME PRECIPITATION

Annual extreme precipitation estimates for the YDTI were determined from daily precipitation data from the Bert Mooney Airport station (1895 – 2014). A detailed presentation of the return period extreme precipitation evaluation undertaken for the site is presented in the Design Basis Report (KP, 2017a). A summary of the key values relevant to this WMR is presented below.

- Estimates of extreme 24-hour precipitation events with return periods of 2, 5, 10, 25, 50, 100, 200, and 1,000 years were evaluated and are presented in Table 2.1. Consideration for orographic effects and climate change were also included in the calculations.
- The Probable Maximum Flood (PMF) is evaluated as the combination of the 24 hour Probable Maximum Precipitation (PMP) event (14.4 inches) and melt of the 1 in 100-year snowpack (14.6 inches), for a total runoff depth of 19 inches.

Table 2.1 Estimated Extreme 24 Hour Precipitation Events

Return Period Frequency (Years)	2	5	10	25	50	100	200	1,000
YDTI adjusted(1) (in.)	1.5	2.1	2.4	2.8	3.3	3.6	4.1	5.3

NOTES:
1. Values are adjusted for orographic effects and for climate change.

3 – CHARACTERISTICS OF MATERIAL CONTAINED WITHIN THE YDTI

The YDTI was originally constructed in 1963 and is comprised of a valley-fill style impoundment created by a continuous rockfill embankment. The total tailings mass currently stored in the impoundment is approximately 650 million cubic yards (M yd^3). The tailings supernatant pond is located on the north side of the facility and currently has a volume of approximately 30,000 ac-ft.

The 6,450 ft impoundment will provide a total tailings storage capacity of approximately 900 million cubic yards, which is a total impoundment storage capacity of approximately 1,100 to 1,500 M tons, assuming an average overall stored tailings dry density of about 90 to 95 pcf. The pond volume will decrease to an average operational volume of approximately 15,000 ac-ft. ▲R2

The tailings in the impoundment originate from the Berkeley Pit (1963 through 1983) and the Continental Pit (1986 through current). No tailings were discharged into the facility during two periods of Care and Maintenance from 1983 through 1986 and from 2000 through 2003.

A detailed review of the chemical and physical properties of the tailings and water stored in and entering the YDTI was undertaken to provide a general characterization of the material stored in the impoundment. The review memorandum is presented in Appendix A '*Montana Resources - Water and Tailings Characterization'*, March 2017 (KP, 2017b). A summary of the review is detailed below.

3.1 WATER QUALITY

MR monitors four water quality sites directly related to the YDTI: three watershed sites up-gradient of the impoundment and one site in the tailings pond, as follows:

- North Silver Bow Creek, Silver Bow Watershed
- Yankee Doodle Creek, Yankee Doodle Creek Watershed
- Dixie Creek, Dixie Creek Watershed, and
- Yankee Doodle Tailings Pond near the Reclaim Water Pump Station.

Water quality samples were collected twice annually from all sites between 2002 and 2014 inclusive, and periodically from the upstream watershed sites for several years prior. The sampling efforts generally targeted high flow months (early summer) and low flow (winter) months. The samples were analyzed for physical parameters, ions, nutrients, and total metals. Sufficient data have been reported to facilitate the calculation of basic summary statistics and the assessment of trends for most parameters.

3.1.1 Watershed Runoff

The three watersheds up-gradient of the YDTI are undisturbed from modern mining activities. The water in Yankee Doodle Creek is characterized as soft to moderately hard, neutral to slightly basic, with low sensitivity to acid inputs (good buffering capacity). The water in Dixie Creek is described as moderately hard, neutral to slightly basic, with good buffering capacity. The water in North Silver Bow Creek is described as moderately hard, neutral to slightly basic, with moderate buffering capacity. Nitrogen-based nutrients were generally below the detection limit for all three up-gradient sites.

3.1.2 Tailings Pond

The tailings pond water is described as very hard (median hardness 1,065 mg/L), basic to very basic, with good buffering capacity. Total dissolved solids (TDS) are also very high (median 1,706 mg/L).

The following ions are elevated relative to the upstream catchment runoff: potassium, sodium, calcium, magnesium, sulfate, and chloride. Nitrogen-based nutrients were detected in most samples. Most of the detected metal concentrations were within or close to the ranges of concentrations observed in the upstream creeks. Exceptions include nickel and strontium, which were generally higher in the tailings pond samples than in the creek samples.

3.2 TAILINGS CHARACTERIZATION

Characterization of the tailings in the impoundment was undertaken using data from routine MR tailings monitoring and tailings analysis undertaken as part of historical site investigation programs (2012, 2013 and 2015).

3.2.1 Tailings Physical Properties

The physical characteristics of the tailings are as follows:

- The tailings dry density on the beach surface was reported to be approximately 73 to 79 pcf (1.3 t/m^3 to 1.4 t/m^3) in 2014.
- The tailings average d_{50} is 90 microns, while the average d_{80} is 250 microns.
- The tailings consist of loose to medium dense sand-silt materials, which generally become denser with depth. The tailings are highly stratified with inter-bedded layers of sand-silt.
- The tailings generally become finer grained with distance from the discharge point (due to particle segregation), ranging from sands and silty sands near the discharge point to sandy silts and silts at greater distance.
- The sandy tailings are generally non-plastic, but finer grained silt tailings that settle farther from the discharge location are slightly plastic.

3.2.2 Tailings Geochemistry

The geochemical observations included the following:

- Tailings slurry pH was basic in all samples, ranging from 8.7 to 10
- Tailings are classified as potentially acid-generating materials
- The main minerals in the tailings slurry are aluminum oxide and silicon dioxide, and
- The main metals in the tailings slurry are copper, manganese, phosphorus, titanium, and zinc.

3.2.3 Pore Water Properties

The composition of the pore water samples is similar to that of the samples collected from the tailings pond. Chloride and sodium concentrations were elevated and nutrient concentrations were low in all pore water samples. Concentrations of nitrogen-based nutrients were slightly lower than those observed in the tailings pond. Phosphate was reported below the detection limit for all samples. Most metals were below the detection limit and those that were detected were reported at concentrations similar to those observed in the tailings pond.

4 – WATER BALANCE MODEL

▲ R2

The YDTI water balance model was developed to simulate the supply and demand for water on a month-by-month basis for the tailings impoundment. The model was created using GoldSim modeling software and includes water requirements from the initiation of MR mine operations, through current and continued operating conditions, to ultimate closure of the facility. Complete details of the model including input assumptions, model calibration parameters, and model results are summarized in the KP letter '*Updated Yankee Doodle Tailings Impoundment Water Balance Model',* July 2017 (KP, 2017c), which is included in Appendix B.

4.1 MODEL INPUTS

4.1.1 Structure and Objectives

The functionality of the model and the key model objectives were as follows:

- The water balance is limited to the YDTI and does not explicitly model the other facilities on site (i.e. open pits, active leach pads, etc.).
- The modeling timeline considers three main phases of operation:
  - 1986 through 2015: Current operating conditions (calibration period)
  - 2016 through 2031: Projected operating conditions
  - 2032 through 2081: Projected post-closure conditions
- The model results are presented for three scenarios: 5th, 50th and 95th percentiles, which correspond to abnormally dry, median, and abnormally wet conditions, respectively.
- Key modeling objective - Projected operating conditions: Supply the required process water to the concentrator using a minimum Silver Lake freshwater pumping rate of 2.0 Mgpd and a minimum YDTI pond volume of 15,000 ac-ft. The model introduced additional Silver Lake make-up water as necessary to achieve the minimum pond volume requirement.
- Key modeling objective - Post-closure conditions: Establish a self-equilibrating supernatant pond volume, with no volume restriction based on the inflows and outflows and with no Silver Lake freshwater make-up.

4.1.2 Input Assumptions and Parameters

The key input parameters and assumptions included the following:

- Hydrometeorological parameters used in the model were derived from the site climate evaluations undertaken for the Amendment application, as presented in Section 2.2.
- The model used measured values for the tailings production rates, the Silver Lake make-up water requirements, the HsB collection area flows, and the Berkeley Pit slope dewatering well flow rates.
- The model used estimated values for the site dust control water volume, the Continental Pit dewatering flow rate, and the volume of the YDTI pond in 1986 (start of model).
- A 2.0 Mgpd minimum freshwater requirement from Silver Lake was assumed in the water balance. The model introduced additional Silver Lake make-up water as required to maintain the operational YDTI supernatant pond volume at a minimum specified level of 15,000 ac-ft.
- A two-year drain-down period and subsequent steady HsB collection area flowrate was assumed for post-closure.

- The model was calibrated by comparing the modelled pond volume during the 'current operating conditions' period with measured pond volumes based on bathymetric survey results in 2004 through 2015.

4.2 MODEL RESULTS ▲ R2

A summary of the typical annual inflows and outflows for the YDTI during future operations (2016 to 2031) are shown in Table 4.1, based on the model's 50th percentile results. The system balance is in ▲ R3 a deficit of approximately 2.8 Mgpd based on a summation of inflows and outflows from the YDTI, excluding Silver Lake pumping. Therefore, with a minimum freshwater pumping rate of 2.0 Mgpd from Silver Lake, the deficit is 0.8 Mgpd.

During post-closure, based on the 50th percentile results, the pond volume will decrease by approximately 30% within the first two years, reduce to 8,000 ac-ft after ten years, and reach an equilibrium volume of approximately 500 ac-ft in 40 years.

Table 4.1 Summary of 50th Percentile YDTI Water Balance Future Operations (2016 through 2031)

YDTI Water Balance for Future Operations (MGPD)	
Inflows	
Direct precipitation on pond/beach	0.9
Runoff from contributing catchment	0.7
Water in Tailings Slurry	22.0
Total Inflows	**23.6**
Outflows	
Evaporation	1.2
Losses to tailings voids	4.5
Seepage losses from impoundment	4.2
Total Outflows	**9.9**
Balance	
Water Available for Reclaim (Inflows – Outflows)	13.7
Reclaim demand for Mill Processing	16.5
Make-up water requirement (Reclaim demand – water available)	**2.8**

5 – YDTI POST-CLOSURE WATER QUALITY MODEL

▲ R2

A YDTI mass load model was developed to simulate the water quality of the YDTI supernatant pond during operations and post-closure on a month-by-month basis. The excel model predicts the movement and accumulation of the chemical mass of each analyzed constituent by tracking the movement of water and estimating the constituent concentration in each water source. The model used the water routing and flow estimates from the KP water balance model (KP, 2017c). Complete details of the mass load model including input assumptions, calibration, and model results are summarized in the Schafer Limited Memorandum '*Mass Load Model of Yankee Doddle Tailings Pond',* May 2017 (Schafer, 2017), which is included in Appendix C.

5.1 MODEL INPUTS AND ASSUMPTIONS

The key input parameters and assumptions included the following:

- The source water quality is assumed to remain constant for the entire model period. Source water inputs included Silver Lake water and natural runoff from watersheds up-gradient of the YDTI.
- The model assumed future tailings water quality discharged into the YDTI is consistent with the tailings water quality during the calibration period and assumes a Continental ore mill feed.
- The model was calibrated to measured water quality in the YDTI pond for the period 2002 through 2014. This calibration period includes a portion of the shut-down period that occurred July 2000 through November 2003.
- The model assumes a closure cover will be placed on the tailings beach surface within three years of the end of mine operations and the beach runoff will then be similar to runoff from the natural watershed. Kinetic tests indicate the rate of sulfide oxidation is very slow and it would take almost three years for the reactive tailings to consume available acid neutralization potential (ANP), and more than seven years for all tailings to consume the ANP.

5.2 MODEL RESULTS

The key results from the mass load model includes the following:

- The calibrated model demonstrates a relatively good fit between the predicted and measured pond concentrations.
- The surface pond water quality is predicted to be similar to the chemistry of surface water runoff from the watershed up-gradient of the YDTI within about 20 years after closure.

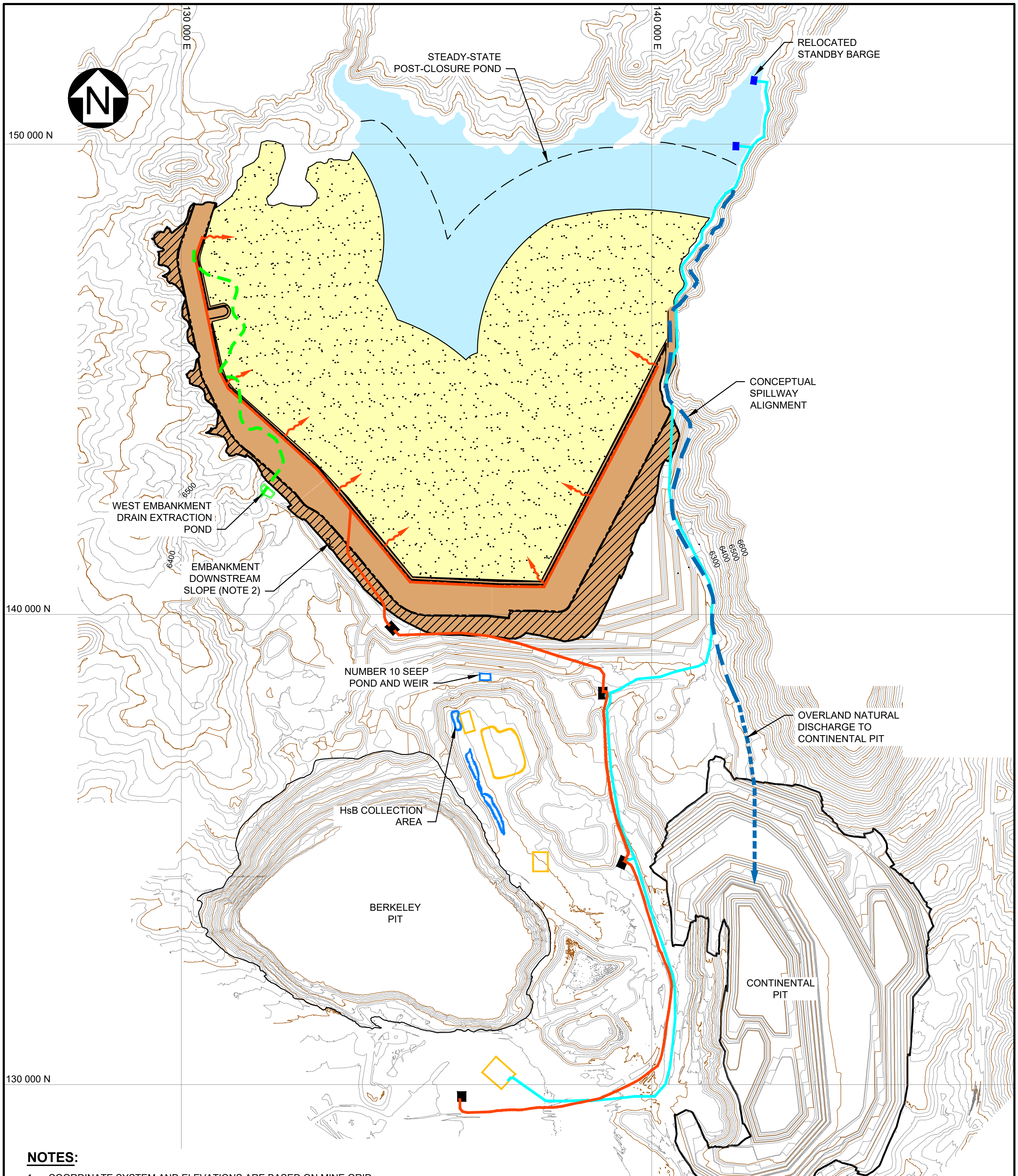
6 – YDTI WATER MANAGEMENT PLAN

The following WMP has been prepared for the YDTI.

The overall objective of the YDTI WMP is to protect the regional groundwater and surface water resources while meeting the operational and post-closure mine water demands. The WMP considers the water management requirements during both average climatic conditions and extreme storm events.

The embankment crest development to 6,450 ft will provide for continued mining beyond 2020. The YDTI facility will be reclaimed following the end of operations and will be retained in 'post-closure' status in perpetuity.

The YDTI water management systems proposed for operations and post-closure are shown on Figure 6.1.



NOTES:

1. COORDINATE SYSTEM AND ELEVATIONS ARE BASED ON MINE GRID.

LEGEND:

- TAILINGS BEACH
- EMBANKMENT FILL
- EMBANKMENT DOWNSTREAM SLOPE
- MINE WATER
- TAILINGS DEPOSITION LOCATION
- TAILINGS PIPELINE
- TAILINGS PUMP STATION
- WEST EMBANKMENT DRAIN
- RECLAIM PIPELINE
- RECLAIM BARGE
- MINE SITE INFRASTRUCTURE/ BUILDINGS

SCALE A: 1500 0 1500 3000 4500 6000 7500 ft

MONTANA RESOURCES, LLP

YANKEE DOODLE TAILINGS IMPOUNDMENT

WATER MANAGEMENT STRUCTURES OPERATIONS AND POST-CLOSURE

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-126/12	7

FIGURE 6.1 REV 1

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
1	15AUG'17	ISSUED WITH REPORT	RSS	MJC	KJB

6.1 OPERATIONAL WATER MANAGEMENT: AVERAGE CLIMATIC CONDITIONS

The YDTI water management during operations is driven by the water demands of the mine processes and site management systems.

6.1.1 YDTI Water Sources

The sources of water available to the YDTI during operations includes:

- Drainage and surface runoff from watersheds upstream of the YDTI
- Surface runoff from within the YDTI
- Tailings water, and
- Fresh water from Silver Lake.

Surface runoff from the upstream watershed flows directly into the YDTI supernatant pond via three creeks: Silver Bow Creek, Yankee Doodle Creek and Dixie Creek. The total contributing watershed area is approximately 4,000 acres. The Moulton Reservoirs #1 and #2, which store water for the town of Walkerville, are located in the upper reaches of the Yankee Doodle Creek watershed and have an additional total catchment area of approximately 1,680 acres. The Moulton Reservoir dams are designed to facilitate the emergency spill of excess water into Yankee Doodle Creek, which then flows downstream to the YDTI supernatant pond.

The impoundment area consists of three sub-components: the upstream embankment slopes and crest, the tailings beach, and the supernatant pond. Precipitation on the upstream embankment slopes either infiltrates into the embankment rockfill or produces surface runoff that flows to the tailings beach. Water on the tailings beach either drains down through the tailings mass or flows across the tailings beach to the supernatant pond.

Tailings discharge into the impoundment and onto the tailings beach surface, and consist of approximately 85% water by volume (35% tailings solids concentration by mass). Tailings water either drains down through the tailings mass or flows across the beach to the supernatant pond. Water draining down through the tailings mass near the west side of the impoundment drains into the West Embankment Drain (WED). The water collected in the WED is pumped back to the YDTI supernatant pond. ▲ R3

Precipitation that falls onto the downstream slopes of YDTI North-South (N-S) and East-West (E-W) Embankments either infiltrates into the embankment rockfill or generates surface runoff. Regardless, all the water collects in the HsB collection area.

Precipitation that falls onto the downstream slope of the YDTI West Embankment generates surface runoff that collects at the downstream toe of the embankment and infiltrates into the local groundwater system. The downstream slopes of the West Embankment are concurrently reclaimed; therefore, all the runoff generated is non-contact water. Low lying areas along the downstream toe of the West Embankment are infilled with clean drain rock during the initial construction of the embankment to provide water storage capacity during wetter periods, and allows for percolation to ground.

Fresh water from the Silver Lake Water System (Silver Lake) is delivered to the mine site to meet the mine freshwater requirements and to address make-up process water deficits.

6.1.2 YDTI Water Losses

The loss of water from the YDTI during operations includes:

- Seepage discharge at the HsB collection area
- Process water reclaim
- Water contained in the stored tailings, and
- Evaporation from the tailings beach and supernatant pond.

Tailings water that drains down and discharges into the HsB collection area as seepage water accounts for approximately 15% of water losses from the impoundment. Seepage water flows south from the HsB collection area and is ultimately treated in the HsB Water Treatment Plant (HsB WTP). The treated water is transferred to the Concentrator where it is used in the mine process and thereby introduced to the YDTI water management system as tailings water in the slurry discharged into the impoundment. Water associated with the HsB collection area is under separate jurisdiction not associated with the Mine Operating Permits. Management of this water is regulated under Federal jurisdiction during both mine operations and post closure. The water, associated with the HsB collection area, is currently treated and incorporated into the mine process water circuit. Post closure the water will be treated and discharged ▲ R3

Process water reclaimed from the supernatant pond accounts for approximately 60% of the water volume leaving the YDTI. The majority of the reclaim water is delivered to the Concentrator where it is used in the mine process and is recirculated to the YDTI as tailings water in the slurry discharged into the impoundment. A portion of the reclaim flow is diverted before the Concentrator to be used in the tailings pump station, HsB WTP and for mine site dust control.

Tailings solids are stored in the impoundment also contain pore water. Water loss retained within the tailings mass accounts for approximately 20% of water consumption in the YDTI water management system. Much of this stored tailings water will be recovered post-closure as the tailings mass drains.

Evaporation from the tailings beach and supernatant pond accounts for approximately 5% of the YDTI water losses. The evaporation water loss is permanently removed from the YDTI water management system.

6.1.3 Water management structures

Water management structures used for the YDTI during operations include the following:

- Embankment benches and berms
- West Embankment Drain (WED)
- HsB Collection Area, and
- Number 10 Seep Pond and Weir.

The YDTI embankments are constructed as a series of lifts and benches. The benches break up the embankment slopes and manage water drainage and erosion down the embankment face. Berms are placed on the downstream edges of embankment benches and roadways. The berms have drainage cuts approximately every 500 ft to allow controlled drainage of surface runoff from the benches and roads.

The WED is designed to intercept seepage migrating west of the YDTI above elevation 6,350 ft. The WED will be constructed along the upstream toe of the West Embankment with a -0.25% grade to facilitate gravity drainage south to the permanent Extraction Pond, where the recovered water will be pumped back to the YDTI. The KP Report entitled '*West Embankment Drain – Design Report'*, June 2017 (KP, 2017d), outlines the design basis, general arrangement and components of the drain.

Seepage from the YDTI E-W and N-S Embankments is collected at the HsB collection area, which is situated at the most southern area along the toe of the E-W Embankment, adjacent to the Precipitation Plant. Collected seepage is discharged south to the HsB Pond and treated in the HsB water treatment plant.

The Number 10 seep system collects perched seepage flows on the downstream slope of the YDTI embankment approximately 250 ft above the HsB collection area. The perched seepage discharge is collected in a drainage ditch and collection pond. The seepage discharges from the collection pond, over a v-notch weir, and into a pipeline that conveys the flow down the lower embankment slope to the HsB collection area.

6.2 POST-CLOSURE WATER MANAGEMENT: AVERAGE CLIMATIC CONDITIONS

The water management for the YDTI post-closure is governed by the reclamation plan for the facility. An overview of the facility reclamation for the facility constructed to 6,450 ft is presented in the KP Report entitled '*Reclamation Overview*, August 2017 (KP, 2017e). ▲R2

6.2.1 YDTI Water Sources

The YDTI post-closure water sources include:

- Drainage and surface runoff from watersheds upstream of the YDTI, and
- Surface runoff from within the YDTI.

Water supply to the YDTI during post-closure is limited to precipitation and associated surface runoff and infiltration drainage from the upstream and immediate catchments, as detailed in Section 3.1.1.

During post-closure, surface runoff from the upstream catchments will be the same as during the operational phase of the mine. However, during post-closure the YDTI embankment and tailings beach will be reclaimed with an alluvium capping and seeding, and the reclaimed surface is expected to result in less infiltration and reduced surface runoff as compared to the tailings surface.

6.2.2 YDTI Water Losses

The post closure water losses include:

- Seepage discharge at the HsB collection area, and
- Evaporation and evapotranspiration from the tailings beach and supernatant pond.

Seepage discharge at the HsB collection area will continue post-closure. The seepage rate will decrease progressively as the water stored in the tailings mass drains down. Seepage into the HsB collection area is anticipated to continue in perpetuity, with the rate governed by the size and volume of the impoundment supernatant pond.

Evaporation from the supernatant pond will fluctuate depending on the volume and surface area of the impoundment pond. Evapotranspiration will increase post-reclamation as the YDTI embankment slopes and tailings beach are vegetated and the tailings slimes beach is developed as a wetlands area.

6.2.3 Water Management Structures

Water management structures used for the reclaimed post-closure YDTI include the following:

- West Embankment Drain
- HsB Collection Area
- Number 10 Seep Pond and Weir
- Embankment slope ditches and swales, and
- YDTI Spillway.

The WED, HsB Collection Area and Number 10 Seep System will remain operational in post-closure and will continue to operate as detailed in Section 3.1.3. Seepage collected in the WED will continue to be pumped back to the supernatant pond, while seepage collected from the Number 10 seep and the HsB collection area will be treated and discharged.

Surface water swales and ditches will be constructed into embankment downstream slopes every 100 feet along the regraded and reclaimed slopes as part of the reclamation process. The concept includes grass lined swales in the upper reaches transitioning to riprap lined ditches and plunge pools in the lower reaches.

A spillway will be constructed as part of the post-closure YDTI reclamation activities to release excess water accumulated during extreme storm events from the impoundment and thereby reduce the risk of water pooling adjacent to the embankment. A conceptual layout of the spillway is presented in the Reclamation Overview (KP, 2018).

6.3 EXTREME STORM EVENT MANAGEMENT

The YDTI Inflow Design Flood (IDF) for the proposed Amendment design, as identified in the Design Basis Report (KP, 2017a), is the Probable Maximum Flood (PMF). The PMF, as detailed in Section 2.3 of this report, is the flood resulting from the 24-hour probable maximum precipitation (PMP) combined with the complete melt of the 1 in 100-year snowpack (total unit runoff of 19 inches), plus it assumes full failure of the upstream Moulton Reservoirs. A total runoff volume of approximately 20,000 acre-ft has been attributed to this event.

6.3.1 Extreme Storm Event Management During Operations

Management of the PMF during operations is already considered in the current design and operation of the YDTI, with the PMF runoff volume being contained within the YDTI impoundment.

The current operating permits for the facility require a freeboard allowance for storage of the PMF volume plus an additional five feet to be maintained between the embankment crest and the surface of the PMF engorged tailings pond. This freeboard requirement, based on the current facility configuration, is 22 ft; 17 ft for storage of the PMF plus 5 ft.

Storage of the PMF based on the current pond volume will result in water ponding directly adjacent to the upstream embankment slopes. The operational pond volume will be reduced as detailed in Section 4, which will in turn enable greater temporary water storage capacity on the tailings surface without water pooling adjacent to the embankment.

6.3.2 Extreme Storm Event Management Post-Closure ▲R3

Runoff from extreme storm events post-closure, including the PMF event, will be stored within the YDTI impoundment. A contingency spillway is also included in the YDTI closure configuration as an emergency water management system designed primarily to prevent overtopping of the embankment.

The post-closure spillway will facilitate the release of excess water from the impoundment to control the max elevation and extent of the pond, and thus prevent water pooling adjacent to the embankment. The YDTI spillway will not be operated as a routine water discharge system, and in all likelihood will never convey flow. It will only convey flow if an exceptionally unlikely sequence of storm events were to occur in combination with a starting pond volume equal to the 95% percentile wet steady state pond volume. This storm sequence involves the 1 in 1,000 year 30-day rainfall event immediately followed by the Probable Maximum Flood (PMF) event (probable maximum precipitation plus snowmelt), which is in turn immediately followed by an additional storm event.

The spillway will be constructed during reclamation and will only discharge water when the storage volume exceeds approximately 26,000 ac-ft. The maximum temporary PMF flood level in the pond will be at least 800 ft away from the beach/embankment interface with this configuration.

The spillway will be dimensioned with sufficient capacity to pass all extreme storm events including the PMF. Further details of the post-closure water management strategies and spillway conceptual layout are outlined in the Reclamation Overview (KP, 2018).

7 – REFERENCES ▲ R2

Knight Piésold Ltd. (KP, 2017a), 2017. Montana Resources Design Basis Report (KP Reference No. VA101-126/12-1), Vancouver, BC.

Knight Piésold Ltd. (KP, 2017b), 2017. Montana Resources - Water and Tailings Characterization (KP Reference No. VA17-00369), Vancouver, BC.

Knight Piésold Ltd. (KP, 2017c), 2017. Montana Resources – Updated Yankee Doodle Tailings Impoundment Water Balance Model (KP Reference No. VA17-00828), Vancouver, BC.

Knight Piésold Ltd. (KP, 2017d), 2017. West Embankment Drain – Design Report (KP Reference No. VA101-126/13-3), Vancouver, BC.

Knight Piésold Ltd. (KP, 2018), 2018. Reclamation Overview (KP Reference No. VA101-126/12-7), Vancouver, BC. ▲ R3

Montana Code Annotated (MCA), 2015. Title 82: Minerals, Oil, and Gas, Chapter 4: Reclamation, Part 3: Metal Mine Reclamation.
Available at: http://leg.mt.gov/bills/mca_toc/82_4_3.htm

8 – CERTIFICATION

This report was prepared and reviewed by the undersigned.

Prepared: for

Roanna Stewart, P.Eng.
Senior Engineer

MONTANA
KEN J.
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REGISTERED
PROFESSIONAL ENGINEER

Reviewed:

Ken Brouwer, P.E.
President

Approval that this document adheres to Knight Piésold Quality Systems:

APPENDIX A

MONTANA RESOURCES - WATER AND TAILINGS CHARACTERIZATION

(Pages A-1 to A-14)

MEMORANDUM

To:	Mr. Ken Brouwer	Date:	March 1, 2017
		File No.:	VA101-00126/12-A.01
From:	Catriona Jackson	Cont. No.:	VA17-00369
Re:	Montana Resources – Water and Tailings Characterization		

1 – INTRODUCTION

Montana Resources, LLP (MR) operates a copper-molybdenum open pit mine northeast of Butte, Montana with a nominal mill throughput of approximately 50,000 short tons per day. The tailings have been deposited into the Yankee Doodle Tailings Impoundment (YDTI) since 1963. The tailings are currently discharged at a single point from the crest of the Yankee Doodle Tailings Dam to form an extensive beach. A supernatant pond is maintained along the opposite end of the facility from the discharge point and comprises of process water and catchment runoff from areas undisturbed by modern mining activities. The purpose of this memorandum is to provide a description of the chemical and physical properties of the tailings and water stored in and entering the YDTI, based on the available data.

2 – YDTI WATER QUALITY CHARACTERIZATION

2.1 OVERVIEW

Water and tailings chemistry data for the YDTI and for the sample locations in the inflowing watersheds were provided by MR. The Yankee Doodle, Dixie Creek, and Silver Bow watersheds are up-gradient of the YDTI and sampling locations have been established upstream of the disturbed YDTI footprint in each watershed. Samples have been collected twice annually from all sites between 2002 and 2014 inclusive, and creek samples were also collected for several years prior to 2002. The sampling events have generally targeted high flow months (early summer) and low flow winter months. Samples have been analyzed for physical parameters, ions, nutrients, and total metals; however, for some analyses, results were reported as "NA" or "ND", indicating that they were not analyzed for the given parameter or that the concentration was below the laboratory detection limit. For most parameters, sufficient data has been reported to calculate basic summary statistics and to assess trends.

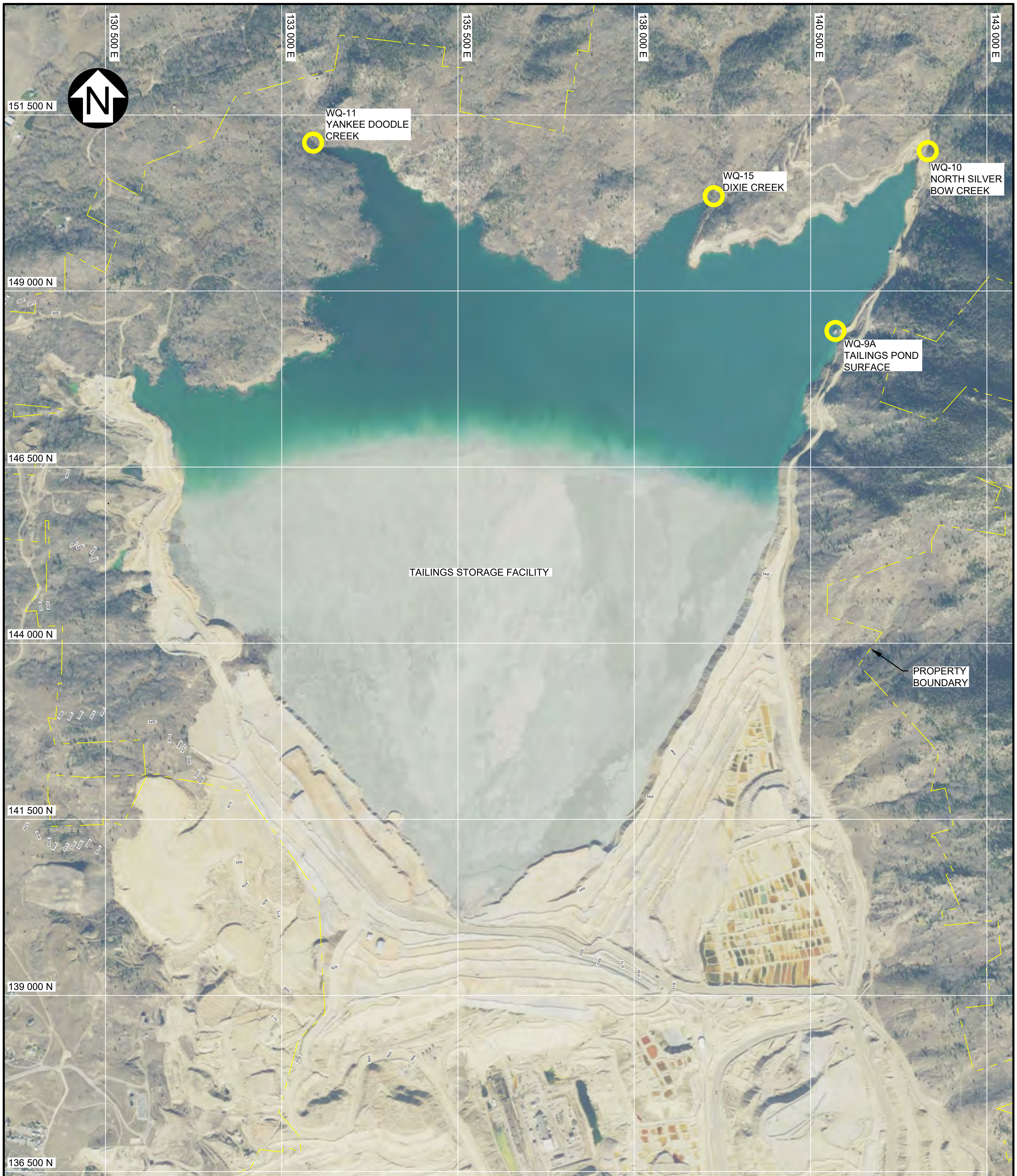
2.2 WATER QUALITY SAMPLE LOCATIONS

The YDTI is shown on Figure 1, with the four water quality monitoring sites. Water quality sample locations in the up-gradient watersheds are as follows:

- WQ-10, North Silver Bow Creek – Silver Bow Watershed, north of the YDTI
- WQ-11, Yankee Doodle Creek – Yankee Doodle Creek Watershed, north of the YDTI
- WQ-15, Dixie Creek – Dixie Creek Watershed, north of the YDTI

Water quality sample location in the YDTI is as follows:

- WQ-9A, Yankee Doodle Tailings Pond –near the Reclaim Water Pump Station



LEGEND:

WATER QUALITY MONITORING STATION

SCALE A 1000 0 1000 2000 3000 4000 5000 ft

NOTES:

1. COORDINATE GRID IS ANACONDA MINE GRID
2. CONTOUR LEVEL IS 5 FEET.
3. DIMENSIONS AND ELEVATIONS ARE IN FEET, UNLESS NOTED OTHERWISE.
4. SIT LOCATIONS ARE APPROXIMATE.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	01MAR'17	ISSUED WITH MEMO	CMJ	RM	JEM

MONTANA RESOURCES, LLP

YANKEE DOODLE TAILINGS IMPOUNDMENT

WATER QUALITY MONITORING LOCATIONS

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-126/12	VA17-00369

FIGURE 1 REV 0

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XREF FILE(S): IMAGE FILE(S): 2015_NAIP_Silver_Bow

2.3 QUALITY ASSURANCE/QUALITY CONTROL

The quality assurance and quality control (QA/QC) data checks for the water quality program are the responsibility of MR. However; the following analytical results have been excluded from the sample summary statistics on the basis of suspected QA/QC issues:

- WQ-11: one sample for iron was reported as 204 mg/L; however, there is a suspected unit error. All other samples were less than 1.2 mg/L.
- WQ-15: one sample was reported with an aluminum concentration of 57 mg/L; however, this is suspected to be erroneous.
- WQ-9A: three samples were reported to have aluminum concentrations over 100 mg/L in 2006 and 2007; these values are suspected to be erroneous.
- WQ-9A: one sample was reported with a nitrate plus nitrite concentration of 804 mg/L, which is more than 20 times the concentration of the next highest sample.

2.4 RESULTS

Qualitative descriptions of the water quality results for each site are summarized in the following subsections. The descriptions are based on general observations and, for physical parameters and nutrients, comparisons with values referenced in the following guidance documents:

- United States Environmental Protection Agency (US EPA) – Quality Criteria for Water (US EPA, 1986).
- United States Geological Survey (USGS) – Water Hardness and Alkalinity (USGS, 2016).
- Canadian Council of Ministers of the Environment (CCME) – Canadian water quality guidelines for the protection of aquatic life: Phosphorus (CCME, 2004).

Physical parameters in water are generally not considered directly for toxic properties, but may affect the toxicity of other parameters in water, such as metals. Water hardness, which consists of compounds of calcium, magnesium, and other ions, can modify the toxicity of some metals by reducing the bioavailability to aquatic life receptors. Water is classified as very soft, soft, moderately hard, hard, and very hard for hardness concentration ranges of 0-60 mg/L $CaCO_3$, 61-120 mg/L $CaCO_3$, 121-180 mg/L $CaCO_3$, and >180 mg/L $CaCO_3$, respectively (USGS, 2016). The pH of water can affect biological receptors directly or indirectly by affecting the toxicity of other parameters in water. Alkalinity is a measure of the buffering capacity of water, which reduces the sensitivity of pH to acidic inputs (US EPA, 1986).

Nutrient parameters may be nitrogen- or phosphorus-based and are used to define the structure of aquatic ecosystems. Changes in nutrient concentrations, such as nutrient over-enrichment, can result in major changes to the biological diversity of an ecosystem. In freshwater systems, phosphorus is generally the limiting nutrient that controls biological productivity and is used to define the trophic status. Water bodies containing low concentrations of total phosphorus (<0.010 mg/L) are defined as oligotrophic and can support diverse and abundant aquatic life. Water bodies containing elevated total phosphorus (>0.035 mg/L) are defined as eutrophic and often support uncontrolled plant growth and low biodiversity. Total phosphorus concentrations in the moderate ranges are categorized as mesotrophic or meso-eutrophic (CCME, 2004).

Metal concentrations in each water body were compared to laboratory detection limits (DLs) and to the concentration ranges observed in the other water bodies in the Project area; however, no official guidelines have been used as a basis of comparison. Sample concentrations for many metals ranged from below the detection limit to several orders of magnitude above the detection limit. Metals listed in the discussion of water quality in each water body were included on the basis of the number of samples that were reported above the detection limit. Metal concentrations that were reported above the detection limit in most samples are listed in the discussion; however, it is important to note that the concentrations were generally variable between sampling events.

2.4.1 'Undisturbed' Upstream Catchment Runoff

Water quality results for the sample locations in the creeks within each of the inflowing catchment areas are summarized in Appendix A in Table 1, Table 2, and Table 3, for WQ-11 (Yankee Doodle Creek), WQ-15 (Dixie Creek), and WQ-10 (North Silver Bow Creek), respectively. These catchments are considered to be undisturbed by modern mining, however there is evidence of historic mining activities throughout the areas.

Yankee Doodle Creek is characterized as soft to moderately hard (USGS, 2016), neutral to slightly basic water with low sensitivity to acid inputs (good buffering capacity). The median ion concentrations in Yankee Doodle Creek are shown on Figure 2. The major anion is bicarbonate and the major cation is calcium. Total phosphorous (TP) concentrations were generally high and associated trophic status ranged from meso-eutrophic to hyper-eutrophic, with most TP concentrations in the eutrophic range; however, nitrogen-based nutrients were below the detection limit in most samples. Metal concentrations were below the detection limit for some metals; however, exceptions include aluminum, arsenic, copper, iron, manganese, and strontium.

Water in Dixie Creek (WQ-15) is described as moderately hard, neutral to slightly basic, with good buffering capacity. The median ion concentrations in Dixie Creek are shown on Figure 3; the water type is calcium-bicarbonate. Most samples contained concentrations of total phosphorus, within the meso-eutrophic range; however, several samples (collected from 2005 to 2008) contained elevated phosphorus, within the hyper-eutrophic classification. Nitrogen-based nutrients were generally below the detection limit. The following metals were detected in most samples: aluminum, arsenic, copper, iron, manganese, silicon, and strontium.

The water quality in North Silver Bowl Creek (WQ-11) can be described as moderately hard, neutral to slightly basic water with moderate buffering capacity. The median ion concentrations in North Silver Bow Creek are shown on Figure 4; the water type is calcium-bicarbonate. Total phosphorus concentrations were within the meso-eutrophic or eutrophic classification ranges, with several elevated samples in the hyper-eutrophic range. Nitrogen-based nutrients were generally below the detection limit. Metal parameters were generally below the detection limit, with the exceptions of aluminum, arsenic, iron, manganese, silicon, and strontium.

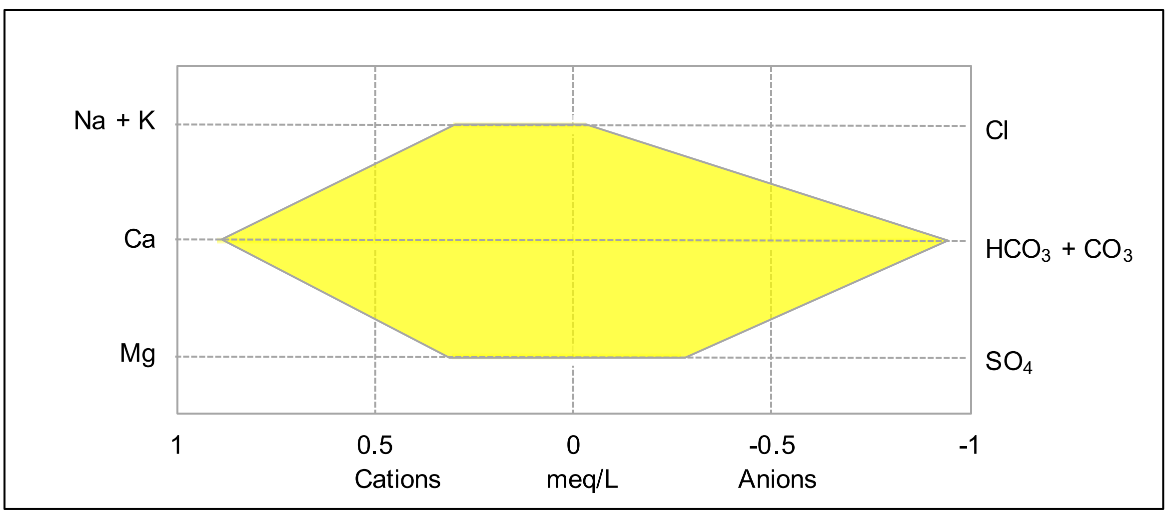

Figure 2 Graphical Representation of Median Ion Concentrations for WQ-11 (Yankee Doodle Creek)

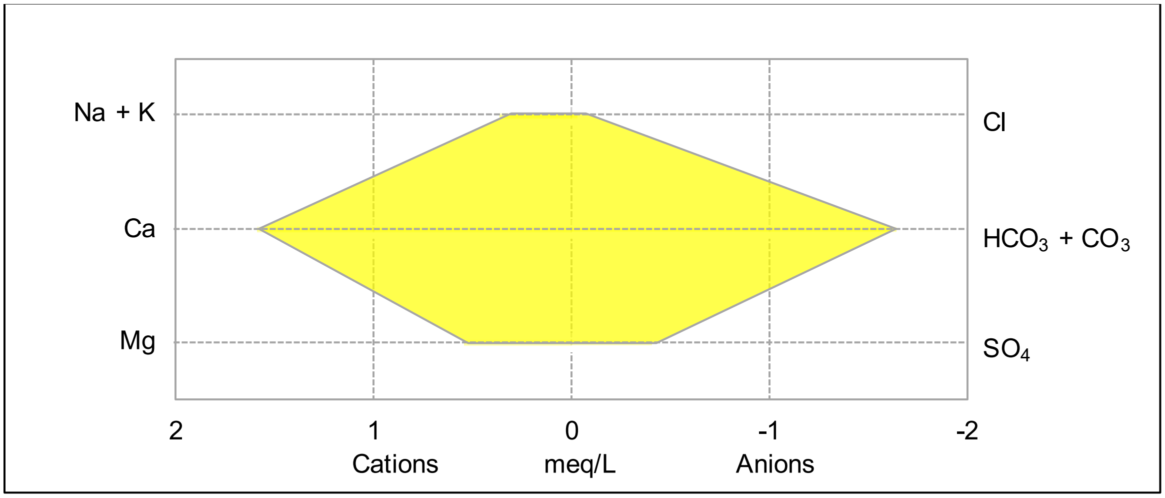

Figure 3 Graphical Representation of Median Ion Concentrations for WQ-15 (Dixie Creek)

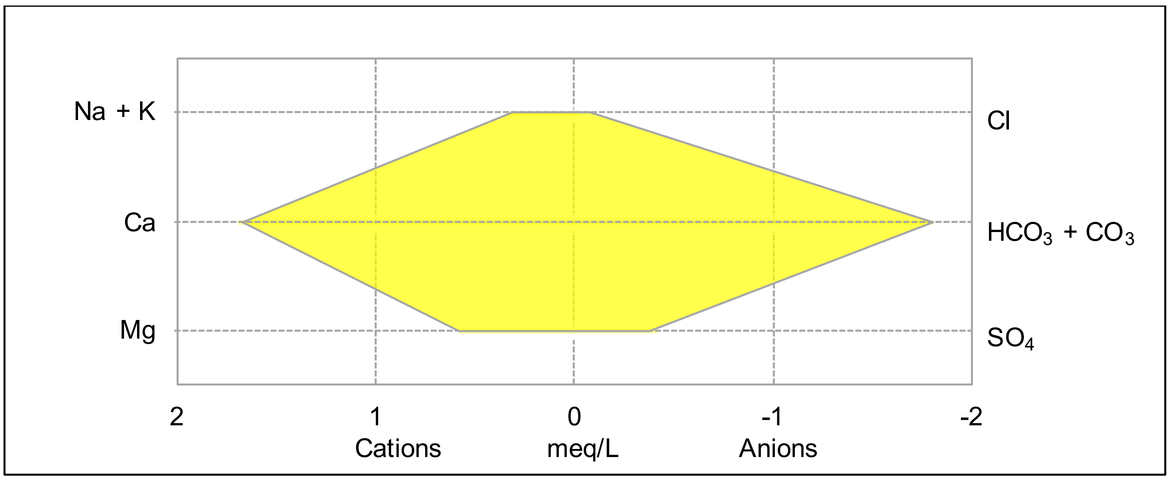

Figure 4 Graphical Representation of Median Ion Concentrations for WQ-10 (Silver Bow Creek)

2.4.2 Tailings Pond

A summary of the water quality data collected to date from the supernatant water within the YDTI (WQ-9A) is provided in Table 4 (Appendix A). The pond water is described as very hard (median hardness 1,065 mg/L), basic to very basic water with good buffering capacity. Total dissolved solids (TDS) are also very high (median 1,706 mg/L). The following ions are elevated relative to the undisturbed catchment runoff: potassium, sodium, calcium, magnesium, sulfate, and chloride. The median ion concentrations in the YTDI are shown on Figure 5. The dominant ion pair includes sulfate (median 1,080 mg/L) and calcium (403 mg/L). Total phosphorus was generally within the meso-eutrophic range, with sporadic samples in the hyper-eutrophic range. Nitrogen-based nutrients were detected in most samples. Most samples had detectable concentrations of the following metal parameters: aluminum, cadmium, copper, iron, lead, manganese, nickel, selenium, silicon, and strontium. Most of the detected metal concentrations were within or close to the ranges of concentrations observed in the undisturbed creeks. Exceptions include nickel and strontium, which were generally higher in the tailings pond samples than in the creek samples. Iron concentrations were comparable with those observed in Yankee Doodle Creek, but were higher than those observed in the other creeks. Zinc concentrations were generally within the range observed in the creek samples; however, several samples contained elevated concentrations.

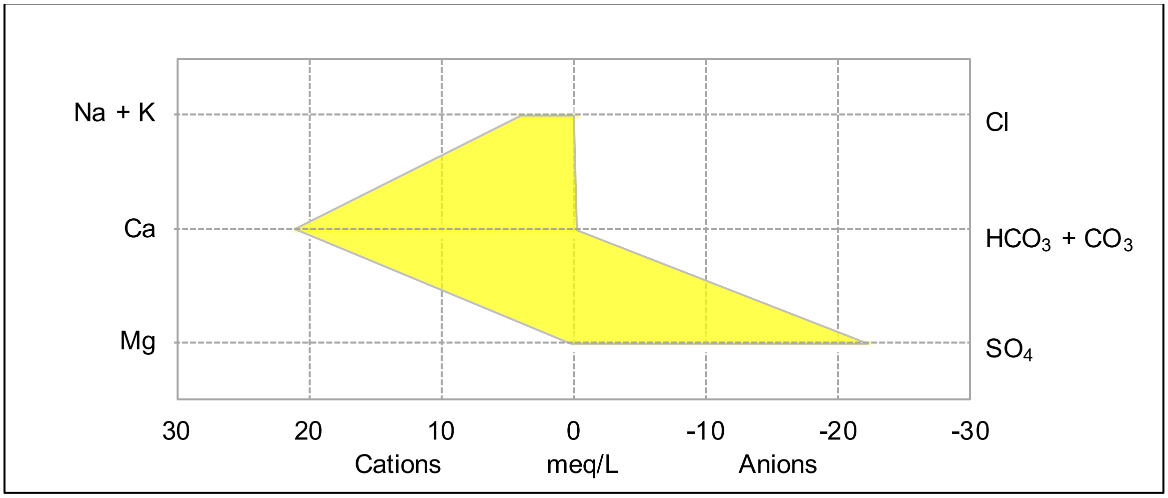

Figure 5 Graphical Representation of Median Ion Concentrations for WQ-9A (TSF Pond)

3 – TAILINGS CHARACTERIZATION

Site investigation reports were prepared by KP in 2012, 2013, and 2014, (KP 2013, 2014, and 2016, respectively) which include an analysis of tailings samples from the YDTI. Each report includes natural moisture content and particle size distribution results for tailings samples. Twenty-one additional tailings samples were analyzed for moisture content and specific gravity in 2015.

3.1 TAILINGS PHYSICAL PROPERTIES

The physical characteristics of the tailings are as follows:

- The tailings moisture content ranges reported each year are as follows:
  - 2012: 13% to 29%.
  - 2013: 25% to 38%.
  - 2014: 12% to 31%.
- The tailings dry density and specific gravity were reported in 2014 to be 1.3 t/m^3 to 1.4 t/m^3 and 2.7, respectively.
- The tailings are highly stratified with inter-bedded layers of sand-silt.
- The tailings consist of loose to medium dense sand-silt materials, which generally become denser with depth.
- The tailings generally become finer grained with distance from the discharge point (due to particle segregation) ranging from sands and silty sands near the discharge point to sandy silts and silts at greater distance.
- The sandy tailings are generally non-plastic, but finer grained silt tailings settle farther from the discharge location are slightly plastic.

Grain size analysis (GSA) results were reported annually from 1987 to 1998, and 2005 to 2012 and were used to calculate the tailings grain size distributions for each year. The d_{50} is the median diameter of the grain size distribution and the d_{80} represents diameter of the 80th percentile particle size. Both the d_{50} and the d_{80} are shown on Figure 6.

The median (d_{50}) grain size was elevated from approximately 60 microns in 1998 to 130 microns in 2005, and remained between 100 microns and 130 microns through to 2012. The d_{80} was on average approximately 160 microns larger than the d_{50}, and followed similar temporal trends as the d_{50} particle size. The maximum d_{80} was measured to be 310 microns in 2005.

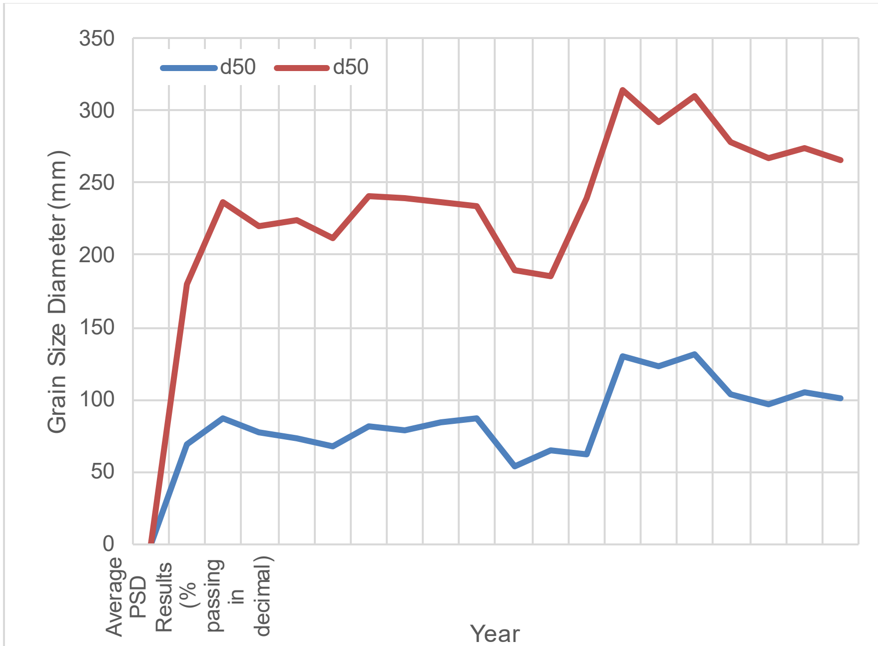

Figure 6 Grain Size Analysis

3.2 TAILINGS GEOCHEMISTRY

Tailings samples have undergone geochemical analysis (whole element scan of tailings solids) on a quarterly basis since 1998. A summary of the geochemical data collected to date is provided in Table 5 (Appendix A). General observations include the following:

- Paste pH was basic in all samples, ranging from 8.7 to 10.
- The neutralization potential / acid potential (NP/AP) ratios were reported for eight samples beginning in 2014 Q2 through 2016 Q1, which ranged from 0.34 to 0.53. This range classifies them as potentially acid-generating materials.
- The primary mineral detected was silicon dioxide (SiO_2; 66% to 69%) and the secondary mineral detected was aluminum oxide (Al_2O_3; 13% to 14%). Other minerals identified is smaller quantities (1% to 6%) were of calcium oxide, iron, iron oxide, potassium oxide, magnesium oxide, and sulfur.
- The main metal parameters identified were copper, manganese, phosphorus, titanium, and zinc, with smaller concentrations of barium, molybdenum, and vanadium.

3.3 PORE WATER PROPERTIES

The pore water is described as follows:

- Measured pore water pressures indicate that there is a downward flow of water in the tailings, with equilibrium pore water pressures typically below hydrostatic. These pore pressure conditions are indicative of the influence of the relatively more pervious underlying natural ground and the adjacent free-draining rockfill embankment, which allow for drainage from the tailings deposit.
- Water pressures at most locations in the tailings generally increase as the tailings beach is raised and the pond level rises. Variations in water levels may be attributed to meandering tailings streams that can cause a local and temporary increase in water levels.

Pore water samples were collected using peeper cells and piezometers, which are common methods of analyzing pore water chemistry. Seven peeper cell samples and five piezometer samples were analyzed for ions, nutrients, and metal parameters. The ion composition of the pore water samples is similar to that of the samples collected from the supernatant pond (WQ-9A), with calcium and sulfate as the dominant anions. Chloride and sodium concentrations were also elevated, at similar levels to WQ-9A. Nutrient concentrations

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were low in all pore water samples. Concentrations of nitrogen-based nutrients were slightly lower than those observed at WQ-9A and phosphate was reported below the detection limit for all samples. Most metals were below the detection limit and metal parameters that were detected were reported at concentrations similar to those observed at WQ-9A.

4 – CONCLUSIONS

Samples of tailings and water within the YDTI and waters in the reporting catchments have been collected since 1998 and have been used to describe the characteristics of materials in the YDTI. Three creeks drain into the YDTI and have been sampled for water quality: Yankee Doodle Creek, Dixie Creek, and the North Silver Bow Creek. The creek waters are all of the calcium-bicarbonate type, with moderate hardness, low to moderate TDS, neutral to slightly basic pH, and good buffering capacity. Water within the YDTI is of the calcium-sulfate type and is very hard, alkaline, and has elevated TDS and metals in comparison with the upstream creeks in the reporting catchments. The tailings are characterized as having a basic paste pH, NP/AP ratios indicative of potentially acid generating conditions, and are dominantly comprised of aluminum oxide and silicon dioxide.

5 – REFERENCES

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Approval that this document adheres to Knight Piésold Quality Systems: DDF

Attachments:
Appendix A Surface Water Quality and Geochemical Analysis Summary Data

APPENDIX A

SURFACE WATER QUALITY AND GEOCHEMICAL ANALYSIS SUMMARY DATA

(Pages A-1 to A-5)

SURFACE WATER QUALITY
SUMMARY DATA

TABLE 1 - SITE WQ-11 - YANKEE DOODLE CREEK

Parameter	ND	NA	Detected Samples	Summary Statistics Min	5th P	Mean	Median	95th P	Max
Potassium	1	2	32	1.6	1.7	2.6	2.0	4.2	9.3
Sodium	0	2	33	3.6	4.1	6.1	5.8	9.4	10
Calcium	0	2	33	6.9	11	19	18	29	34
Magnesium	0	2	33	1.7	2.5	3.9	3.7	5.6	6.0
Sulfate	0	2	33	6.6	7.4	16	13	29	46
Chloride	7	2	26	0.09	0.51	1.3	1.0	2.4	2.8
Carbonate	23	11	1	N/A	N/A	N/A	N/A	N/A	N/A
Bicarbonate	0	3	32	32	35	66	57	105	112
TDS @ 180 ^{o}C	0	2	33	60	69	114	117	155	178
Hardness as $CaCO_3$	0	2	32	24	37	63	60	93	112
Alkalinity as $CaCO_3$	0	2	33	32	34	59	54	86	92
Conductivity (umhos/cm)	0	2	14	91	93	152	139	227	235
pH	0	1	17	6.7	6.9	7.5	7.4	8.2	8.7
Acidity as $CaCO_3$	13	2	20	-73	-66	-26	-29	7.1	9.0
TSS	27	2	6	6.0	6.3	12.8	12.5	20.8	22.0
Fluoride	0	3	32	0.066	0.071	0.13	0.12	0.19	0.30
Nitrate plus Nitrite as N	17	2	16	0.016	0.030	0.082	0.058	0.23	0.25
Total Phosphorous as P	0	2	33	0.010	0.026	0.089	0.070	0.19	0.21
ORP (mV)	0	3	15	146.0	174.7	241.4	220.0	334.3	342.0
Aluminum	12	2	21	0.0063	0.017	0.34	0.30	1.1	1.2
Arsenic	1	2	32	0.0030	0.0038	0.0082	0.0061	0.016	0.029
Boron	0	35	0	-	-	-	-	-	-
Cadmium	25	1	9	0.00007	0.00013	0.0092	0.0010	0.041	0.050
Chromium	0	35	0	-	-	-	-	-	-
Copper	16	1	18	0.0026	0.0038	0.019	0.012	0.043	0.12
Iron	2	1	32	0.02	0.04	6.9	0.5	1.3	204.0
Lead	20	1	14	0.00010	0.00012	0.00060	0.00043	0.0015	0.0025
Lithium	0	35	0	-	-	-	-	-	-
Manganese	2	1	32	0.0016	0.0053	0.041	0.027	0.11	0.29
Mercury	0	34	0	-	-	-	-	-	-
Nickel	10	13	12	0.00083	0.00085	0.15	0.0017	0.85	1.0
Selenium	16	14	5	0.0005	0.0014	0.0046	0.0050	0.0070	0.0075
Silicon	0	2	33	6.7	10	13	13	15	16
Silver	0	35	0	-	-	-	-	-	-
Strontium	3	2	30	0.0056	0.0058	0.093	0.089	0.20	0.20
Thallium	20	12	3	0.00010	0.00010	0.00022	0.00014	0.00040	0.00042
Vanadium	0	35	0	-	-	-	-	-	-
Zinc	22	1	12	0.0066	0.0084	0.026	0.020	0.073	0.12
Water Temperature ^{o}C	0	9	26	-0.30	0.25	8.2	9.0	15	18
Air Temperature ^{o}C	0	8	27	-13	-11	7.5	6.0	25	27

NOTES:
1. UNITS ARE mg/L UNLESS OTHERWISE STATED.
2. "ND": SAMPLES THAT WERE BELOW THE METHOD DETECTION LIMIT (MDL).
3. "NA": SAMPLES FOR WHICH THE DATA ARE NOT APPLICABLE.
4. "-": DATA ARE INSUFFICIENT FOR STATISTICS.

SURFACE WATER QUALITY
SUMMARY DATA

TABLE 2 - SITE WQ-15 - DIXIE CREEK

Parameter	ND	NA	Detected Samples	Summary Statistics Min	5th P	Mean	Median	95th P	Max
Potassium	0	4	26	1.8	1.9	2.3	2.2	3.0	3.0
Sodium	0	4	26	5.5	5.7	7.3	7.1	8.9	9.0
Calcium	0	4	26	24	25	32	32	37	38
Magnesium	0	4	26	4.9	5.0	6.5	6.6	7.3	8.0
Sulfate	0	4	26	9.7	10	19	19	29	31
Chloride	8	4	18	0.54	0.57	0.91	0.85	1.3	2.0
Carbonate	20	10	0	N/A	N/A	N/A	N/A	N/A	N/A
Bicarbonate	0	5	25	55	80	105	100	140	165
TDS @ 180 ^{o}C	0	4	26	87	122	160	150	192	452
Hardness as $CaCO_3$	0	4	25	81	85	105	108	122	126
Alkalinity as $CaCO_3$	0	4	26	55	79	97	97	120	135
Conductivity (umhos/cm)	0	4	10	185	187	229	232	264	268
pH	0	4	11	6.9	7.0	7.6	7.6	8.0	8.0
Acidity as $CaCO_3$	6	5	19	-125	-112	-14	-85	98	910
TSS	24	4	2	13	13	17	17	20	20
Fluoride	0	4	26	0.047	0.071	0.13	0.12	0.19	0.25
Nitrate plus Nitrite as N	14	4	12	0.011	0.012	0.096	0.024	0.37	0.66
Total Phosphorous as P	3	4	23	0.010	0.017	0.078	0.030	0.16	0.83
ORP (mV)	0	4	13	153	168	289	302	405	481
Aluminum	13	4	13	0.026	0.030	4.5	0.10	23	57
Arsenic	0	4	26	0.0011	0.0026	0.0079	0.0070	0.016	0.018
Boron	0	30	0	-	-	-	-	-	-
Cadmium	17	4	9	0.00004	0.00007	0.00061	0.00030	0.0020	0.0028
Chromium	0	30	0	-	-	-	-	-	-
Copper	12	4	14	0.0019	0.0020	0.0058	0.0043	0.015	0.021
Iron	3	4	23	0.021	0.022	0.18	0.12	0.39	1.3
Lead	16	4	10	0.000064	0.000073	0.00056	0.00026	0.0020	0.0023
Lithium	0	30	0	-	-	-	-	-	-
Manganese	3	4	23	0.0011	0.0018	0.040	0.020	0.072	0.34
Mercury	0	30	0	-	-	-	-	-	-
Nickel	13	8	9	0.0010	0.0011	0.28	0.0029	1.3	1.5
Selenium	20	8	2	0.0053	0.0054	0.0067	0.0067	0.0080	0.0081
Silicon	0	4	26	9.7	9.9	11	11	12	14
Silver	1	29	0	-	-	-	-	-	-
Strontium	0	4	26	0.10	0.13	0.19	0.20	0.24	0.24
Thallium	18	8	4	0.00027	0.00028	0.045	0.039	0.10	0.10
Vanadium	0	30	0	-	-	-	-	-	-
Zinc	18	4	8	0.010	0.010	1.7	0.025	8.7	13
Water Temperature ^{o}C	0	11	19	0.4	0.5	6.3	7.0	13	13
Air Temperature ^{o}C	0	11	20	-10	-8	7	8	24	27

NOTES:
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4. "-": DATA ARE INSUFFICIENT FOR STATISTICS.

SURFACE WATER QUALITY
SUMMARY DATA

TABLE 3 - SITE WQ-10 - SILVER BOW CREEK

Parameter	ND	NA	Detected Samples	Summary Statistics Min	5th P	Mean	Median	95th P	Max
Potassium	0	0	42	1.9	2.0	2.9	3.0	3.3	3.5
Sodium	0	0	42	4.8	5.0	6.2	6.0	7.0	7
Calcium	0	0	42	25	27	33	34	39	40
Magnesium	0	0	42	5.0	5.8	8.2	7.1	8.0	54
Sulfate	0	0	42	14	15	20	20	24	25
Chloride	21	0	21	0.38	0.49	0.8	0.8	1.1	1.7
Carbonate	23	11	8	0	0	2.0	0	10.4	16.0
Bicarbonate	0	1	41	79	90	116	110	141	150
TDS @ 180 °C	0	0	42	72	105	149	151	180	276
Hardness as $CaCO_3$	0	0	41	86	91	112	115	128	129
Alkalinity as $CaCO_3$	1	0	41	79	82	103	106	118	123
Conductivity (umhos/cm)	0	1	13	191	193	237	244	272	282
pH	0	0	16	6.6	6.8	7.7	7.8	8.4	8.5
Acidity as $CaCO_3$	20	0	22	-131	-120	-61	-88	7.0	12
TSS	30	1	11	5.0	5.5	26	11.0	93	127
Fluoride	1	0	41	0.071	0.084	0.15	0.14	0.21	0.25
Nitrate plus Nitrite as N	25	0	17	0.021	0.021	0.124	0.060	0.45	0.54
Total Phosphorous as P	3	0	39	0.010	0.019	0.053	0.030	0.15	0.17
ORP (mV)	0	2	16	132	146	252	252	359	426
Aluminum	15	0	27	0.025	0.026	0.23	0.16	0.6	1.0
Arsenic	10	0	32	0.0018	0.0020	0.0050	0.0045	0.010	0.012
Boron	4	38	0	-	-	-	-	-	-
Cadmium	35	0	7	0.000053	0.000058	0.00027	0.00032	0.00043	0.00046
Chromium	4	38	0	-	-	-	-	-	-
Copper	25	0	17	0.0010	0.0010	0.0076	0.0030	0.024	0.040
Iron	2	0	40	0.040	0.058	0.25	0.16	0.62	2.1
Lead	30	1	11	0.00028	0.00032	0.0015	0.0010	0.0043	0.0045
Lithium	4	38	0	-	-	-	-	-	-
Manganese	2	0	40	0.0070	0.011	0.055	0.038	0.11	0.33
Mercury	3	38	0	-	-	-	-	-	-
Nickel	17	13	12	0.0012	0.0013	0.019	0.0023	0.091	0.15
Selenium	23	16	2	0.00050	0.00088	0.0043	0.0043	0.0077	0.0081
Silicon	0	0	42	7.9	8.2	9.4	9.2	11	11
Silver	4	38	0	-	-	-	-	-	-
Strontium	0	0	42	0.1530	0.1844	0.219	0.200	0.30	0.30
Thallium	27	13	2	0.00010	0.00011	0.00019	0.00019	0.00027	0.00028
Vanadium	4	38	0	-	-	-	-	-	-
Zinc	34	0	8	0.0100	0.0115	0.024	0.025	0.033	0.03
Water Temperature °C	0	9	33	0.00	0.34	5.3	3.0	13	15
Air Temperature °C	0	7	35	-10	-10	4.5	4.0	23	29

NOTES:
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4. "-": DATA ARE INSUFFICIENT FOR STATISTICS.

SURFACE WATER QUALITY
SUMMARY DATA

TABLE 4 - SITE WQ-9A - POND

Parameter	ND	NA	Detected Samples	Summary Statistics Min	5th P	Mean	Median	95th P	Max
Potassium	0	0	25	19	23	29	28	35	50
Sodium	0	0	25	65	70	86	80	112	156
Calcium	0	0	25	160	231	403	423	522	668
Magnesium	2	0	20	0.2	0.2	1.7	0.9	6.1	8.0
Sulfate	0	0	25	507	626	1,080	1,080	1,446	1,940
Chloride	0	0	25	8.3	9.9	13	12	21	26
Carbonate	5	1	18	10	12	32	32	51	54
Bicarbonate	10	1	13	4.8	5.5	28	24	65	78
TDS @ 180 ^{o}C	0	0	25	860	1,092	1,927	1,706	2,818	7,464
Hardness as $CaCO_3$	0	0	24	402	575	1,020	1,065	1,311	1,690
Alkalinity as CaCO3	0	0	25	20	23	52	40	103	134
Conductivity (umhos/cm)	0	0	13	1,100	1,292	1,865	1,970	2,454	2,580
pH	0	0	15	7.7	7.8	9.8	10	11	11
Acidity as CaCO3	4	2	16	-140	-87	-30	-22	4.8	7.0
TSS	9	0	11	5.0	5.0	20	11	58	73
Fluoride	0	0	25	0.8	0.9	2.0	1.8	4.0	5.7
Nitrate plus Nitrite as N	1	0	22	0.53	0.72	2	1.8	3.4	4
Total Phosphorous as P	2	0	23	0.010	0.013	0.056	0.030	0.16	0.32
ORP (mV)	0	1	14	24.0	26	172	138	311	344
Aluminum	2	0	18	0.0	0.0	0	0.2	1	2
Arsenic	1	0	19	0.0013	0.0016	0.0045	0.0040	0.0073	0.014
Boron	0	25	0	-	-	-	-	-	-
Cadmium	5	0	14	0.000037	0.00017	0.00079	0.00073	0.0018	0.0024
Chromium	0	25	0	-	-	-	-	-	-
Copper	5	0	19	0.0031	0.0051	0.034	0.010	0.13	0.22
Iron	3	0	20	0.026	0.028	0.24	0.083	0.81	2.5
Lead	5	0	14	0.00018	0.00022	0.00068	0.00045	0.0021	0.0029
Lithium	0	25	0	-	-	-	-	-	-
Manganese	1	0	22	0.0019	0.0028	0.077	0.012	0.16	1.1
Mercury	0	25	0	-	-	-	-	-	-
Nickel	4	0	17	0.0008	0.0029	0.017	0.015	0.035	0.047
Selenium	2	0	22	0.0010	0.0039	0.0087	0.0077	0.015	0.021
Silicon	0	0	24	1.0	4.2	7.2	7.6	9.0	9.2
Silver	0	25	0	-	-	-	-	-	-
Strontium	0	0	25	0.80	1.0	1.7	1.7	2.8	2.9
Rubidium	0	14	1	0.033	0.033	0.033	0.033	0.033	0.033
Antimony	0	14	1	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043
Molybdenum	0	14	1	1.2	1.2	1.2	1.2	1.2	1.2
Tungsten	0	14	1	0.035	0.035	0.035	0.035	0.035	0.035
Uranium	0	14	1	0.001	0.001	0.001	0.001	0.001	0.001
Thallium	17	0	3	0.000021	0.000029	0.00013	0.00010	0.00026	0.00028
Vanadium	0	25	0	-	-	-	-	-	-
Zinc	11	0	12	0.010	0.010	0.071	0.019	0.24	0.28
Water Temperature oC	0	8	17	1.3	1.6	9.3	5.9	20	20
Air Temperature oC	0	8	17	-8.3	-5.2	8.2	4.0	28	28

NOTES:
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GEOCHEMICAL ANALYSIS
SUMMARY DATA

TABLE 5 - TAILINGS

Parameter	ND	Detected Samples	Summary Statistics Min	5th P	Mean	Median	95th P	Max
% Al	0	54	0.88	1.1	1.7	1.2	1.3	4.7
% Al2O3	0	8	13	14	14	14	14	14
% Ca	0	54	0.51	0.67	0.73	0.74	0.79	0.91
% CaO	0	8	1.6	1.8	1.8	1.8	1.8	1.9
% Carbon (total)	0	8	0.14	0.16	0.17	0.17	0.18	0.20
% Carbonate	0	8	0.40	0.44	0.50	0.53	0.56	0.57
% Ox Mo	0	0	-	-	-	-	-	-
% S (ASARCO)	0	0	-	-	-	-	-	-
% Cr2O3	8	0	-	-	-	-	-	-
% Fe	0	54	1.9	2.3	2.5	2.5	2.7	3.4
% Fe2O3	0	8	3.7	3.8	4.1	4.0	4.4	4.6
% HCL Extractable S	0	8	1.1	1.1	1.3	1.2	1.5	1.5
% Insoluble SO4 as S	0	8	0.28	0.30	0.38	0.38	0.42	0.58
% K	0	51	0.59	0.70	1.2	0.7	0.82	3.6
% K2O	0	8	5.1	5.2	5.3	5.2	5.3	5.4
% Mg	0	54	0.29	0.68	0.73	0.78	0.87	0.97
% MgO	0	8	1.4	1.6	1.7	1.7	1.8	1.9
% MnO	0	8	0.050	0.058	0.061	0.060	0.07	0.07
% Na	0	52	0.014	0.020	0.083	0.022	0.031	0.49
% Na2O	0	8	0.92	1.0	1.1	1.0	1.1	1.2
% P2O5	0	8	0.12	0.14	0.15	0.15	0.16	0.17
% Si	0	51	0.039	0.052	3.8	0.1	0.46	24
% SiO2	0	8	66	66	67	68	69	69
% S-N-EX	6	37	0.010	0.02	0.20	0.05	0.09	1.4
% S-PYR	1	45	0.020	0.89	1.2	1.1	1.5	2.1
% S-SO4	1	45	0.030	0.11	0.23	0.22	0.3	0.6
% S-Tot.	0	54	0.770	1.4	1.7	1.6	2.1	2.9
% TiO2	0	8	0.400	0.45	0.46	0.46	0.49	0.5
% V2O5	0	8	0.010	0.018	0.018	0.020	0.02	0.02
% Water Soluble SO4	0	8	0.080	0.08	0.098	0.095	0.11	0.12
ABP T/THO	0	19	-57	-38	-28	-25	-17	-7.8
Acid Leachable % SO4-S	5	3	0.030	0.045	0.06	0.06	0.075	0.09
AGP T/THO	0	43	22	44	55	53	67	91
ANP T/THO	0	46	10	14	20	21	24	31
AP (t CaCO3/1000 t)	0	8	34	34	40	38	45	48
HNO3 Extractable S	0	8	0.17	0.21	0.24	0.24	0.29	0.31
Net NP	0	8	-31	-29	-23	-21	-17	-15
NP (t CaCO3/1000 t)	0	8	15	17	17	17	18	19
Paste pH	0	8	8.7	8.9	9.0	9.1	9.1	9.4
pH	0	54	8.0	8.8	9.2	9.2	9.6	10
ppm Ag	0	8	0.55	0.57	0.64	0.64	0.71	0.72
ppm As	15	39	0.16	3.3	7.3	4.6	5.9	61
ppm B	8	0						
ppm Ba	0	51	67	77	136	82	93	440
ppm Be	0	8	0.39	0.41	0.43	0.42	0.46	0.49
ppm Bi	23	28	0.89	1.7	52	20	130	170
ppm Cd	22	32	0.33	0.51	0.71	0.67	0.89	1.5
ppm Co	7	44	8.6	10	12	12	13	19
ppm Cr	8	43	7.9	9.7	14	12	15	39
ppm Cu	0	54	350	450	576	531	663	1100
ppm Hg	8	0						
ppm Mn	0	54	220	320	340	348	359	475
ppm Mo	0	54	36	59	74	70	82	144
ppm Ni	9	45	6.1	7.1	8.6	8.0	8.5	25
ppm P	0	51	450	563	607	590	649	810
ppm Pb	0	54	13	26	38	31	48	120
ppm Sb	34	17	0.045	0.074	0.42	0.15	0.8	0.8
ppm Se	16	35	0.41	0.78	3.9	1.0	1.4	63
ppm Sn	23	28	1.6	1.9	4.4	2.7	4.4	17
ppm Sr	0	51	21	35	59	47	75	130
ppm Ti	0	51	650	911	1069	1040	1220	1500
ppm Tl	0	8	0.34	0.36	0.39	0.40	0.42	0.45
ppm V	0	51	42	52	59	56	63	80
ppm Zn	0	54	97	150	190	176	219	403
SMP Buffer	0	8	7.9	7.9	7.9	7.9	8.0	8.0

NOTES:
1. "ND": SAMPLES THAT WERE BELOW THE METHOD DETECTION LIMIT (MDL).
2. "DETECTED SAMPLES": SAMPLES ABOVE THE MDL; NOT ALL PARAMETERS WERE ANALYZED FOR EACH SAMPLE.
3. "-": DATA ARE INSUFFICIENT FOR STATISTICS.

APPENDIX B

YANKEE DOODLE TAILINGS IMPOUNDMENT WATER BALANCE MODEL

(Pages B-1 to B-41)

July 6, 2017

File No.:VA101-00126/12-A.01
Cont. No.:VA17-00828

Mr. Ken Brouwer
President
Knight Piésold Ltd.
Suite 1400 - 750 West Pender Street
Vancouver, British Columbia
Canada, V6C 2T8

Dear Ken,

Montana Resources – Updated Yankee Doodle Tailings Impoundment Water Balance Model

1 – INTRODUCTION

Montana Resources, LLP (MR) operates an open pit copper and molybdenum mine located immediately northeast of Butte, Montana. MR is currently preparing a Permit Amendment (Amendment) application to provide for continued tailings deposition into the Yankee Doodle Tailings Impoundment (YDTI) beyond 2020. The proposed Amendment will provide approximately 12 years of additional mine life.

The YDTI water balance model was developed to simulate the supply and demand for water on a month-by-month basis for the tailings impoundment. The model was used to assess water requirements throughout the mine's life, from the initiation of MR mine operations, through current and future operating conditions, to the ultimate closure of the facility. The water balance was created using GoldSim, a dynamic probabilistic simulation modelling software used extensively for mine site water management applications.

2 – MODEL OVERVIEW

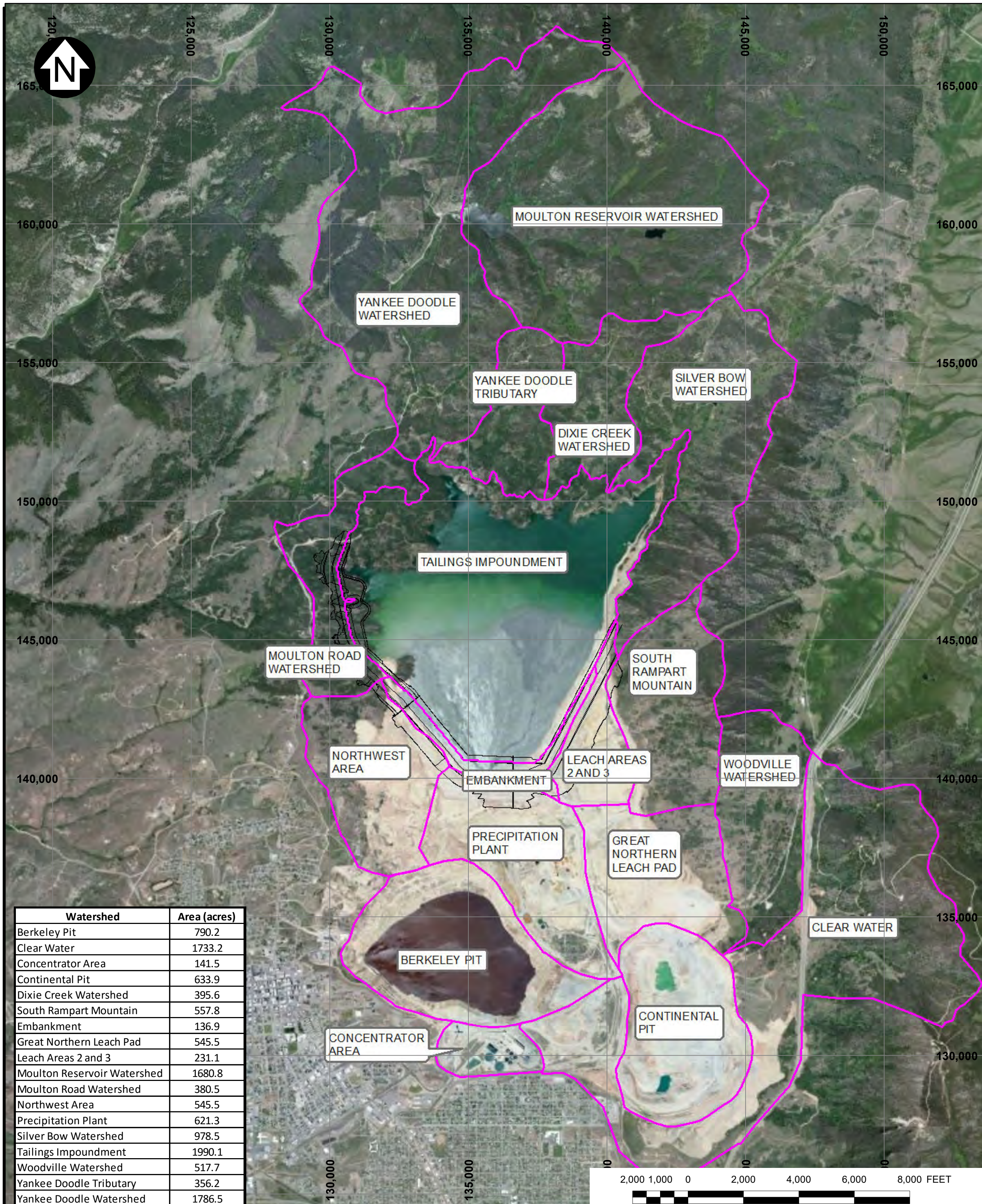
The intent of this letter is to document the model input assumptions for the historic, current, and future conditions, and to summarize the predicted magnitude and extent of any water surplus and/or deficit conditions in the YDTI. The water balance outlined in this letter is limited to the YDTI and does not explicitly model the other facilities on site (i.e. open pits, active leach pads, etc.). The mine site layout and catchment areas are shown on Figure 2.1.

The modeling timeline commences in 1986, at the beginning of MR mining operations of the Continental Pit, carries through to the end of October 2015 for current operating conditions, extends to the end of 2031 for future operating conditions, and includes a 50-year post closure period through to the end of 2081. The model includes the period from July 2000 through October 2003, when mining operations were suspended.

The YDTI supernatant pond is the critical component of the water balance model. The key water management constraints imposed on the model were a minimum Silver Lake freshwater pumping rate of 2.0 Mgpd and a minimum pond volume of 15,000 ac-ft during operational years. The model introduced additional Silver Lake make-up water as necessary to achieve the minimum pond volume requirement.

Post-closure, the supernatant pond volume was modelled with no restriction of inflows and outflows and no Silver Lake freshwater make-up.

The model of current and future operations is shown schematically on Figure 2.2, and the key model assumptions and parameters are detailed in Table 2.1 and described in the following sections.



Watershed	Area (acres)
Berkeley Pit	790.2
Clear Water	1733.2
Concentrator Area	141.5
Continental Pit	633.9
Dixie Creek Watershed	395.6
South Rampart Mountain	557.8
Embankment	136.9
Great Northern Leach Pad	545.5
Leach Areas 2 and 3	231.1
Moulton Reservoir Watershed	1680.8
Moulton Road Watershed	380.5
Northwest Area	545.5
Precipitation Plant	621.3
Silver Bow Watershed	978.5
Tailings Impoundment	1990.1
Woodville Watershed	517.7
Yankee Doodle Tributary	356.2
Yankee Doodle Watershed	1786.5

LEGEND:

CATCHMENT

FUTURE EMBANKMENT EXTENTS

NOTES:

1. BASE MAP: MICROSOFT BING MAP.

2. COORDINATE GRID IS IN FEET.
COORDINATE SYSTEM: ANACONDA MINE GRID.

3. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:60,000 FOR 8.5x11 (LETTER) PAPER. ACTUAL SCALE MAY DIFFER ACCORDING TO CHANGES IN PRINTER SETTINGS OR PRINTED PAPER SIZE.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
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MONTANA RESOURCES, LLP

YANKEE DOODLE TAILINGS IMPOUNDMENT

WATER BALANCE CATCHMENT AREAS

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P/A NO. VA101-126/12

REF NO. VA17-00828

FIGURE 2.1

REV 0

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CONSULTING

TABLE 2.1

MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

WATER BALANCE INPUTS AND ASSUMPTIONS

Print Jun/22/17 11:19:31

Model Input		Description	Value	Units	Source	Date
Mill Process / Tailings Production	Tailings Solids Production	Historical rate varies. Future rate of production of 18 M short ton/year.	varies	ton/yr	Historical mining rates from 1986 to 2007 provided by MR via email on Mar 9, 2016. Historical mining rates from 1986 to 2015 and future rate presented in KP Memo VA16-00607 dated May 3, 2016.	9-Mar-16
	Slurry Solids Content	By weight	35	%	KP Design Basis Report VA101-126/12-1 Rev A dated February 11, 2016	11-Feb-16
	Tailings S.G.		2.8	-	KP Memo VA16-00014	18-Mar-16
	Tailings Dry Density	Dry Density for "New/Fresh' Tailings	85	lb/ft^3	KP estimate via email from R. Stewart	8-Oct-15
	Water Content in Ore		3	%	Josh Shutey (MR Senior Mine Engineer), by phone	7-Oct-15
	Dust Control		300,000	gpd	Based on 2014 and 2015 water truck counts provided by Mark Thompson (MR) by email	4-Nov-15
	Concentrate Water	Includes both Cu and Mo concentrate	5.61	gpm	Based on solids mass concentration values provided by Josh Shutey (MR Senior Mine Engineer) by email	3-May-16
YDTI Properties	Minimum Pond Volume	Only applies from Nov 2015 to Dec 2031	15,000	Acre-ft	Assumption	-
	Initial Pond Volume	At start of model Jan 1986	16,000	Acre-ft	Assumption/Calibration	19-Jun-16
	Pond Area	Based on measured pond areas prior to Nov 2015. After Nov 2015 based on Filling Curves and Area-Capacity relationships.	varies	acre	Measured pond areas provided by MR. Filling Curves and Area-Capacity relationships: KP MUCK3D model (VA101-126/12 workfiles #33 and 34)	22-Jun-17
	Beach Area	Based on measured pond areas prior to Nov 2015. After Nov 2015 based on Filling Curves and Area-Capacity relationships.	varies	acre	Measured pond areas provided by MR. Filling Curves and Area-Capacity relationships: KP MUCK3D model (VA101-126/12 workfiles #33 and 34)	22-Jun-17
	Seepage Losses	Based on HsB flows	varies	gpm	Calculated in model	-
	Silver Lake Inflows	1986 - 2015	varies		Data provided by MR	13-Apr-16
		2016 and Beyond	varies		Calculated in model with a minimum rate of 2.5 Mgpd	24-Feb-17
Horseshoe Bend	Measured Flows and Seepage	Measured at weir or water treatment plant	varies	gpm	Provided by MR	28-Sep-15
	Predicted Monthly Average	Before Closure: Average of measured monthly flows from Nov 2007 – Oct 2015	varies	-	Assumption	-
		After Closure	1000	gpm	This is an assumption and works out to approximately 700 gpm seepage from the YDTI	-
	Water Treatment Plant (WTP)	WTP Recycle to Mill	89.6	%	Calculated from WTP flows provided by MR, Mark Thompson	3-Nov-15
		Sludge/Reject to Berkeley Pit	10.4	%	Calculated from WTP flows provided by MR, Mark Thompson	3-Nov-15
Continental Pit	Dewatering Rate	Average rate	500,000	gpd	Provided by MR, Mark Thompson by email.	19-Aug-16
Berkeley Pit Groundwater Wells	Pumping Rate	Average rate	226	gpm	Starts in 2015 and continues into closure. Based on average pumping rate data from Jan-Mar 2016 provided by MR, Mark Thompson.	11-Jul-16
Catchment Areas	YDTI Impoundment	Tailings Impoundment = Contour 6500 ft	1990.1	acres	KP GIS Figure "Water Balance – Catchment Areas"	7-Jul-16
	Areas contributing to YDTI	Yankee Doodle Watershed below Moulton Reservoir	1786.5	acres		
		Yankee Doodle Tributary	356.2	acres		
		Dixie Creek Watershed	395.6	acres		
		Silver Bow Watershed	978.5	acres		
		Moulton Road Watershed	380.5	acres		
	Areas contributing to HsB	Northwest Area	545.5	acres		
		YDTI Embankment	136.9	acres		
		Leach Pad 2 and 3	231.1	acres		
		South Rampart Mountain	557.8	acres		
		Precipitation Plant	621.3	acres		
	Woodville Watershed		517.7	acres		
	Areas Contributing to Dredge Pond at Concentrator	Clear Water	1733.2	acres		
		Concentrator Area	141.5	acres		
		Great Northern Leach Pad	545.5	acres		
	Berkeley Pit		790.2	acres		
Hydrometeorological Parameters	Mean Annual and Monthly Precipitation	Based on stringfiles from Butte Mooney Airport and Schafer Limited LLC Memo "MBMG Climate Information" dated Mar. 29, 2016	15.9	in/yr	Butte Mooney Airport data were uplifted to match the mean monthly precipitation values presented in the Schafer memo	29-Mar-16
	Mean Annual and Monthly Air Temperature	Based on stringfiles from Butte Mooney Airport	39	°F	KP memo VA15-03327	1-Feb-16
	Rain/Snow	Based on air temperature and precipitation stringfiles	-	-		
		Min temperature for Rain	-2	°C	Assumption	
		Max temperature for Snow	2	°C	Assumption	
	Mean Annual and Monthly Sublimation	Schafer Limited LLC Memo "MBMG Climate Information" dated Mar. 29, 2016	2.5	in/yr	0.5 in/yr from November to April	29-Mar-16
	Snowmelt	Based on air temperature stringfile	-	-		
		Snowmelt Factor	1	in/°F	Assumption	
		Base Temperature	0	°C	Assumption	
	Mean Annual and Monthly Pond Evaporation	Calculated based on Thornthwaite equation and Schafer Limited LLC Memo "MBMG Climate Information" dated Mar. 29, 2016	25.7	in/yr	Data generated using the Thornthwaite equation model in GoldSim were uplifted to match the mean monthly precipitation values presented in the Schafer memo	29-Mar-16
		Latitude of Temp Station	45.9	-		
		Heat Index, I	24.2	-	Calculated	
	Runoff Coefficients	Pond Surface	1	-		
		Undiverted/Undisturbed Areas	0.15	-	Based on concurrent measured streamflows (USGS 12323500, 12323240, 12323600) and Butte Airport Precipitation. Modified from 0.20 in KP letter VA15-02546 for calibration.	19-Jun-16
		YDTI Embankment/Disturbed Areas	0.25	-	Calibrated to match observed pond volumes	19-Jun-16
		Tailings Beach	varies	-	During Operations 0.3 is used matching the disburbed areas coefficient. During Closure 0.15 is used matching the undisturbed coefficient as the area will be seeded.	19-Jun-16

M:\1\01\00126\16\A\Data\Task 735 Water Balance Update\GoldSim Models\[MR_WBM_assumptions_034-037.xlsx]Table 2.1 Inputs

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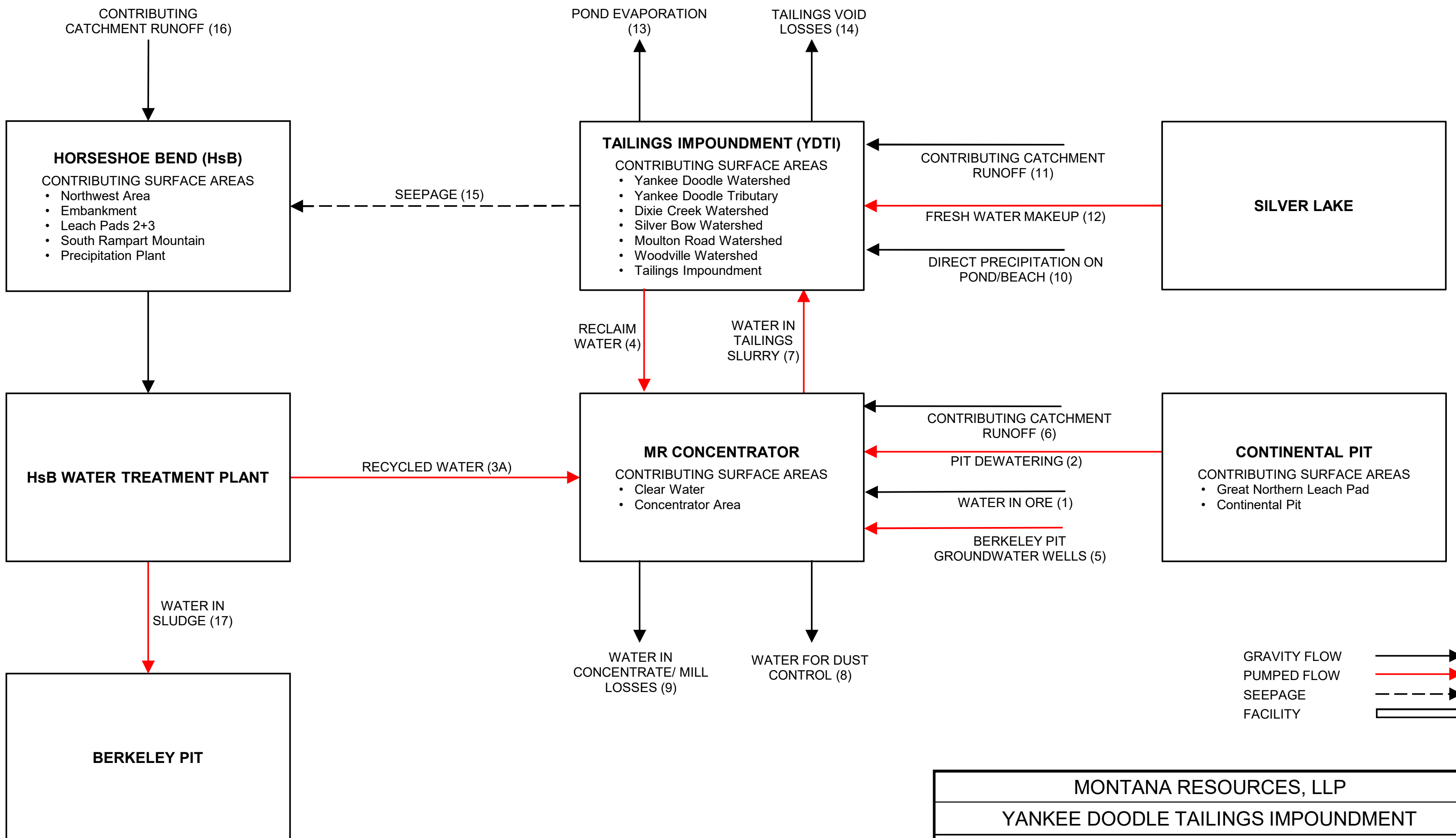

NOTES:
1. FLOW ROUTING PRESENTED FOR FUTURE OPERATIONS MODEL. ALTERNATIVE ROUTING HISTORICALLY USED IS NOT PRESENTED.
2. SEEPAGE ENTERS BERKELEY PIT FROM HORSESHOE BEND HOWEVER THE FLOWRATE IS MINIMAL AND THEREFORE IS NOT REFLECTED IN THE WATER BALANCE MODEL.

MONTANA RESOURCES, LLP

YANKEE DOODLE TAILINGS IMPOUNDMENT

WATER BALANCE FLOW SCHEMATIC

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-126/12	VA17-00828

FIGURE 2.2 REV 0

REV	DATE	DESCRIPTION	PREP'D	RVW'D
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3 – HYDROMETEOROLOGICAL PARAMETERS

The climate values estimated for the YDTI facility are presented in the Memorandum "Reference Climatic Data for the Yankee Doodle Tailings Area near Butte, Montana," dated May 2, 2016, by William M. Schafer, Schafer Limited LLC (Schafer). The memo is included with this letter as Appendix A. The estimated long-term monthly average precipitation and evaporation values for the YDTI facility, as provided in the Schafer memo, are presented in Table 3.1 below.

Table 3.1 Monthly Average Precipitation and Evaporation for YDTI

Month	Estimated Average Precipitation (in)	Potential Free Water Evaporation including Sublimation (in)
January	1.22	0.5
February	0.96	0.5
March	1.06	0.5
April	1.47	2.12
May	2.14	2.95
June	2.22	3.70
July	1.53	5.43
August	1.11	4.93
September	1.52	3.34
October	1.06	3.16
November	0.63	0.5
December	0.99	0.5
Annual	**15.92**	**28.13**

The water balance model is run on a monthly time step. The key climate input values for the water balance model are the more than 100 years of precipitation and temperature records for the Butte Bert Mooney Airport (1895 – 2014) climate station (Butte Airport). These data are available from the Western Regional Climate Center (WRCC) website and are summarized in Table A.1 and Table A.2 in Appendix B.

Monthly factors were applied to the precipitation records so that the long-term average values match those presented in the Schafer memo for the YDTI facility. These factors largely account for the differences in elevation between the airport and the YDTI facility. The temperature values did not require adjustment to match those in the memo. For the period of MR mine operations prior to 2014 (1986 to 2014), when measured climate data are available, the measured data (with the Schafer memo precipitation factors applied) were used in the model. For the period after 2014, for which climate data are not available, the historical datasets were stepped through incrementally by year for the entire record, thereby preserving the inherent cyclical nature of the climate record while simulating possible future climate conditions. For instance, for modelling 2015 onwards, the first model run used the dataset starting in 1895; the second model run used the dataset starting in 1896 with the 1895 values added to the end of the data string; the third model run used the dataset starting in 1897 with the 1895 and 1896 values added to the end of the data string; and so on. This generated a wide range of climate inputs and a corresponding range of predicted results for each month of each phase of the project.

The distribution of rainfall versus snowfall was determined in the model based on the temperature time series. For example, if the temperature for a given month was less than 28.4°F (-2 °C), then the precipitation for the month was modelled to fall exclusively as snow; however, if the temperature was greater than 35.6 °F (+2 °C), it was modelled to fall as rain. When the temperature was between 28.4 °F and 35.6 °F, the amount of precipitation falling as snow was assumed to vary linearly with temperature.

Snowmelt amount and timing were determined as a function of the amount of snow accumulation, the sublimation rate, and the monthly temperature. Sublimation was determined to be 0.5 inches per month from November to March, as discussed in the Schafer memo. A snowmelt factor was used to determine the rate at which the snowpack could melt. The typical range of this value is 1.1 to 4.0 in/mon/°F (US Department of Agriculture, 2004). The snowmelt factor was assumed to be 1.1 in/mon/°F for the water balance model, since this value resulted in a snowmelt distribution similar to that of the applicable regional snowpack records (KP, 2016).

The amount of water available for runoff was then calculated as the sum of rainfall and snowmelt in a given month.

The runoff coefficient for the undisturbed catchments above the YDTI was estimated by comparing the Butte Airport precipitation values with concurrent measured streamflow (runoff) values from three regional USGS streamflow stations located in the general vicinity of the project site: German Gulch (12323500), Blacktail Creek (12323240) and Silver Bow Creek (12323600). The resulting ratios of annual runoff to annual precipitation for these stations are 0.51, 0.16 and 0.21. These values represent a wide range, but given the project area conditions of much higher evaporation than precipitation, and the fact that sublimation was separately accounted for in the model, the runoff coefficient values towards the lower end of the range are likely most realistic. Accordingly, a runoff coefficient of 0.15 was selected for undisturbed catchment areas in the model, while a higher value of 0.25 was selected for disturbed areas. The selection of these values was supported by the good match between modelled and measured YDTI pond volumes for the period of 2004 to 2015.

Pond evaporation from the YDTI supernatant pond, which is approximately equal to potential evapotranspiration (PET), was calculated using the empirical Thornthwaite equation (Thornthwaite, 1948) and the temperature time series. Minor monthly factors were then applied to the calculated evaporation values to make mean monthly evaporation values consistent the Schafer memo values for the YDTI facility.

Potential future changes in the climate, beyond the substantial cyclical patterns and trends inherent in the long-term historical precipitation and temperature records for Butte Airport, were not considered in the YDTI water balance model. Climate change modeling for Montana generally results in predictions of increases in temperature and increases in winter and spring precipitation (IPCC, 2013). These changes have offsetting effects on the annual water budget, and accordingly the models predict little to no change in annual mean runoff (IPCC, 2013). These finding are supported by the US EPA (2016), who state that for Montana “Warmer temperatures increase evaporation and water use by plants. Increases in rainfall, however, are likely to offset these losses so that soil moisture increases slightly or remains about the same as today.” As such, major changes to annual deficit conditions in the YDTI pond due to climate change are not anticipated. However, the timing of runoff into the YDTI pond could be a little different than what is simulated with the current YDTI water balance model because warmer temperatures would result in proportionally more winter rainfall and less winter snowfall, and correspondingly more winter runoff and less spring and summer runoff.

4 – INPUT ASSUMPTIONS

4.1 YDTI SUPERNATANT POND

The YDTI receives direct runoff from the Yankee Doodle Watershed, the Yankee Doodle Tributary, the Moulton Road Watershed, the Dixie Creek Watershed, the Silver Bow Watershed, and the Tailings Impoundment Watershed, as well as direct precipitation. The Moulton Reservoir Watershed does not contribute runoff to YDTI, as it is captured behind the Moulton Reservoir Dam and is used for Butte’s municipal water supply. No water is released from the reservoir into the YDTI except as spillway discharge under exceptionally wet conditions, so no water from this watershed is assumed for the purpose of the water balance. Additionally, runoff from the Woodville Watershed is pumped with the tailings slurry water to the YDTI during operations.

Fresh water from Silver Lake is introduced to the water balance as a YDTI input. Additional details on the Silver Lake flows are discussed in Section 4.4 below.

Water losses from the YDTI supernatant pond include evaporation, unrecoverable water held in the tailings voids, and seepage. Seepage from the facility is collected at Horseshoe Bend and is discussed in Section 4.2 below.

4.2 HORSESHOE BEND FLOWS AND SEEPAGE

Horseshoe Bend (HsB), which is an area located downstream of the YDTI, receives runoff from the Northwest Area, the Embankment, Leach Pads 2 and 3, South Rampart Mountain, and the Precipitation Plant Area, as well as seepage from the tailings impoundment. The catchment areas are shown on Figure 2.1.

From 1986 to early 1996, HsB flows were directed to the Berkeley Pit, and then from 1996 to 2000, they were recycled directly to the YDTI. When MR operations were suspended during the period of July 2000 to November 2003, the flows were again directed to the Berkeley Pit. Since November 2003, HsB flows have been treated in the HsB Water Treatment Plant (WTP) and then returned to the process via the MR Concentrator.

The flow rates at the Horseshoe Bend (HsB) area have been measured regularly using a weir since 1996, as illustrated on Figure 4.1. The water balance model for the proposed YDTI raise and future operations uses average monthly HsB weir flows based on the measured data from November 2007 through October 2015, as presented in Table 4.1. The November 2007 through October 2015 data were selected because they are recent, they extend over a period of uninterrupted operations, and they were measured with a reliable flow measuring device.

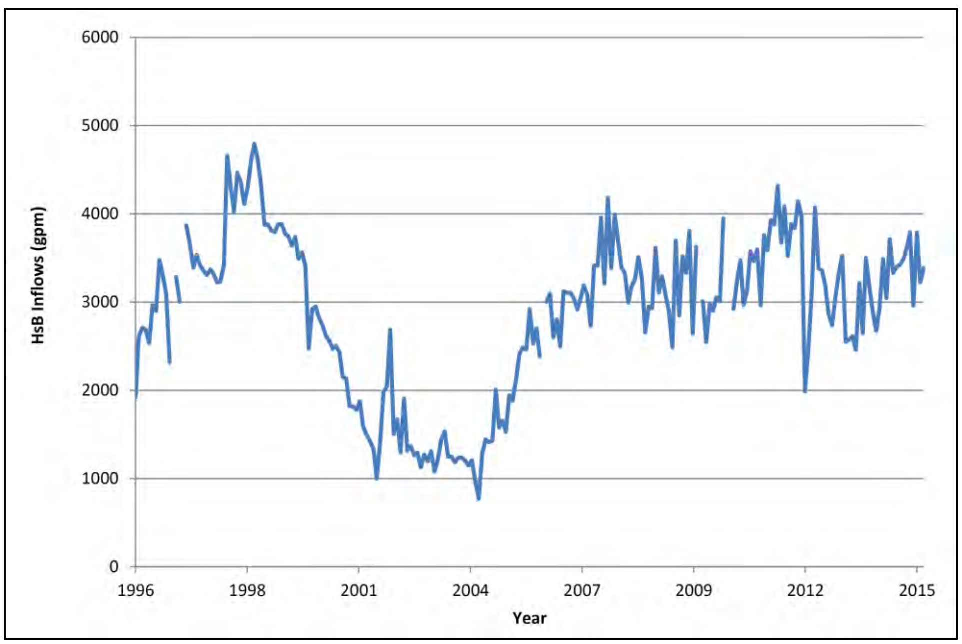


Figure 4.1 Horseshoe Bend Weir – Monthly Discharge Hydrograph

Table 4.1 Predicted Average Monthly HsB Flows

Month	Average Monthly HsB Flow (gpm)
January	3,547
February	3,291
March	3,378
April	3,159
May	3,134
June	3,172
July	3,425
August	3,312
September	3,089
October	3,143
November	3,289
December	3,186

For modelling purposes, the estimated surface water runoff from areas contributing flow to HsB was subtracted from the total measured HsB weir flow in order to estimate the seepage from the YDTI. The estimate of HsB weir flow generated from YDTI seepage versus surface water runoff is presented in the results section in Table C1 in Appendix C.

4.3 HORSESHOE BEND WATER TREATMENT PLANT

The HsB Water Treatment Plant (WTP) is located between the Berkeley and Continental Pits, and began operating in November 2003. It receives all surface runoff from the HsB area, seepage from the YDTI, and overflow from the Precipitation Plant operations. The measured HsB weir flow, as shown on Figure 4.1, was used as the assumed inflow to the WTP. Approximately 90% of the treated water is delivered to the MR Concentrator and the remaining 10% is sent to the Berkeley Pit as sludge. These percentage values were derived from measured values.

4.4 SILVER LAKE WATER USAGE

Fresh water from the Silver Lake Water System ("Silver Lake") is delivered to the mine site to meet the Concentrator's freshwater requirements, to address make-up process water deficits, and to meet regulatory agency facility-management requirements (YDTI fugitive emission control required by MR Air Quality Permit).

Table 4.2 summarizes the historical annual Silver Lake water usage since 1986. Silver Lake water usage from 1986 to 1995 was estimated by MR based on pumping records, while water usage from April 1996 to April 2014 was based on measured monthly flow data. No Silver Lake water was delivered to the site during the mine suspension period between July 2000 and October 2003. When milling operations were restarted in November 2003, the Silver Lake water supply was recommenced and usage was increased to re-establish the supernatant pond of the YDTI. MR have made a number of process changes over the last 12 months in an effort to reduce Silver Lake water usage. The MR Concentrator currently requires a minimum of approximately 2.0 Mgpd of freshwater for processing.

In the water balance model, Silver Lake inflow was assumed to be added directly to the YDTI pond, with reclaim water (including the Silver Lake water component) supplied from the YDTI to the MR Concentrator, as required. In reality, Silver Lake water can be delivered to either the YDTI pond or the MR Concentrator; however, the water balance model was simplified with a single Silver Lake delivery location since the routing does not affect the model results.

For future operations, the Silver Lake freshwater usage was derived as a function of the water balance. Silver Lake water was supplied at a minimum rate of 2.0 Mgpd, which was increased as required to maintain the operational YDTI supernatant pond volume at 15,000 ac-ft. Silver Lake usage is further discussed in the results section of this letter.

Table 4.2 Silver Lake Water Usage

Year	Annual Average Flow (million gallons per day)
1986	8.2
1987	6.0
1988	10.6
1989	7.3
1990	5.7
1991	4.1
1992	4.1
1993	4.0
1994	4.0
1995	3.8
1996	2.5
1997	2.7
1998	1.6
1999	1.5
2000	0.7
2001	0.0
2002	0.0
2003	0.8
2004	7.9
2005	8.9
2006	7.1
2007	4.6
2008	3.6
2009	3.4
2010	3.0
2011	1.8
2012	3.7
2013	6.9
2014	7.5
2015	6.3

4.5 CONTINENTAL PIT

MR mining operations commenced in 1986 with the mining of the Continental Pit, which is located southeast of the YDTI, as shown on Figure 2.1. The Continental Pit is still being actively mined and the annual production schedule used in the model is summarized in Table 4.3. The annual production rate for future operations beyond 2015 was assumed to be 18 million tons/year.

In the model, water collected by the pit dewatering system, including surface water runoff from the Great Northern Leach Pad and Continental Pit catchment areas and groundwater inflows, is pumped to the MR Concentrator. MR provided an average pumping rate estimate of 0.5 million gpd.

Table 4.3 Annual Production Schedule

Year	Annual Mill Production (millions of tons)
1988	17.2
1989	17.5
1990	17.0
1991	17.6
1992	17.8
1993	16.8
1994	15.2
1995	14.9
1996	16.0
1997	15.2
1998	19.3
1999	18.8
2000[(1,2)]	8.0
2001[(2)]	0.0
2002[(2)]	0.0
2003[(1,2)]	1.6
2004	17.2
2005	18.2
2006	18.1
2007	18.4
2008	17.9
2009	18.0
2010	17.2
2011	16.7
2012	18.1
2013	17.1
2014	17.2
2015	17.7
Future	18.0

NOTES:
1. Mill production in 2000 represents 6 months of production and in 2003 represents two months of production.
2. Mill production was ceased when mining operations were suspended from July 2000 through October 2003.

4.6 BERKELEY PIT

The Berkeley Pit was not included in the model as it does not contribute to the YDTI or Concentrator.

4.7 PRECIPITATION PLANT OPERATIONS

The Precipitation Plant water routing system includes the collection and absorption of YDTI seepage flows that occur east of the main HsB seepage collection area. The routing of these seepage flows into the Precipitation Plant process allows the plant to operate without external make-up water supply and in a water surplus situation. Without these additional seepage flows, the Precipitation Plant process would operate with a water deficit. Surplus YDTI seepage water that has entered the Precipitation Plant exits the plant via a gravity overflow pipeline into the lower HsB Pond. The model accounts for this overflow as well as surface runoff from the Precipitation Plant area in the HsB flow values as discussed in Section 4.3.

The internal routing of water associated with the leach pads and the Precipitation Plant was not included in the model.

4.8 CONCENTRATOR

During operations, the Concentrator receives water from the HsB Water Treatment Plant, Continental Pit dewatering, water content in ore, reclaim water from the YDTI, and contributing catchment runoff from the Clear Water Ditch area. Additionally, since 2015, an estimated 226 gpm of groundwater from the Berkeley Pit slope dewatering wells has been diverted to the Concentrator. This rate of discharge was estimated based on the average 2015 pumping rate.

Water uses at the Concentrator include losses due to water in the concentrate, water used for dust control, and water in the tailings slurry sent to the YDTI.

4.9 POST-CLOSURE TAILINGS FACILITY SEEPAGE LOSSES

Flows at HsB were monitored during the suspension and maintenance period in 2000 to 2003. The characteristics of these flows were used to estimate how seepage from the YDTI is expected to change as the mine transitions in the future from operations into closure. During the 2000 to 2003 suspension and maintenance period, it took approximately two years for the flows at HsB to approach a steady state rate due to drain-down of the tailings mass. Once the flows stabilized, the average flow rate measured at HsB was equal to approximately 1,000 gpm.

The water balance uses the following assumptions for seepage from the YDTI during closure, which is based on the HsB characterization above:

- Assumes a two year drain-down period, with seepage rates decreasing linearly during that time.
- Following the drain-down period, a steady state closure pond will be established with an assumed seepage rate of 1,000 gpm. Note that the 1,000 gpm flowrate includes approximately 300 gpm of runoff.

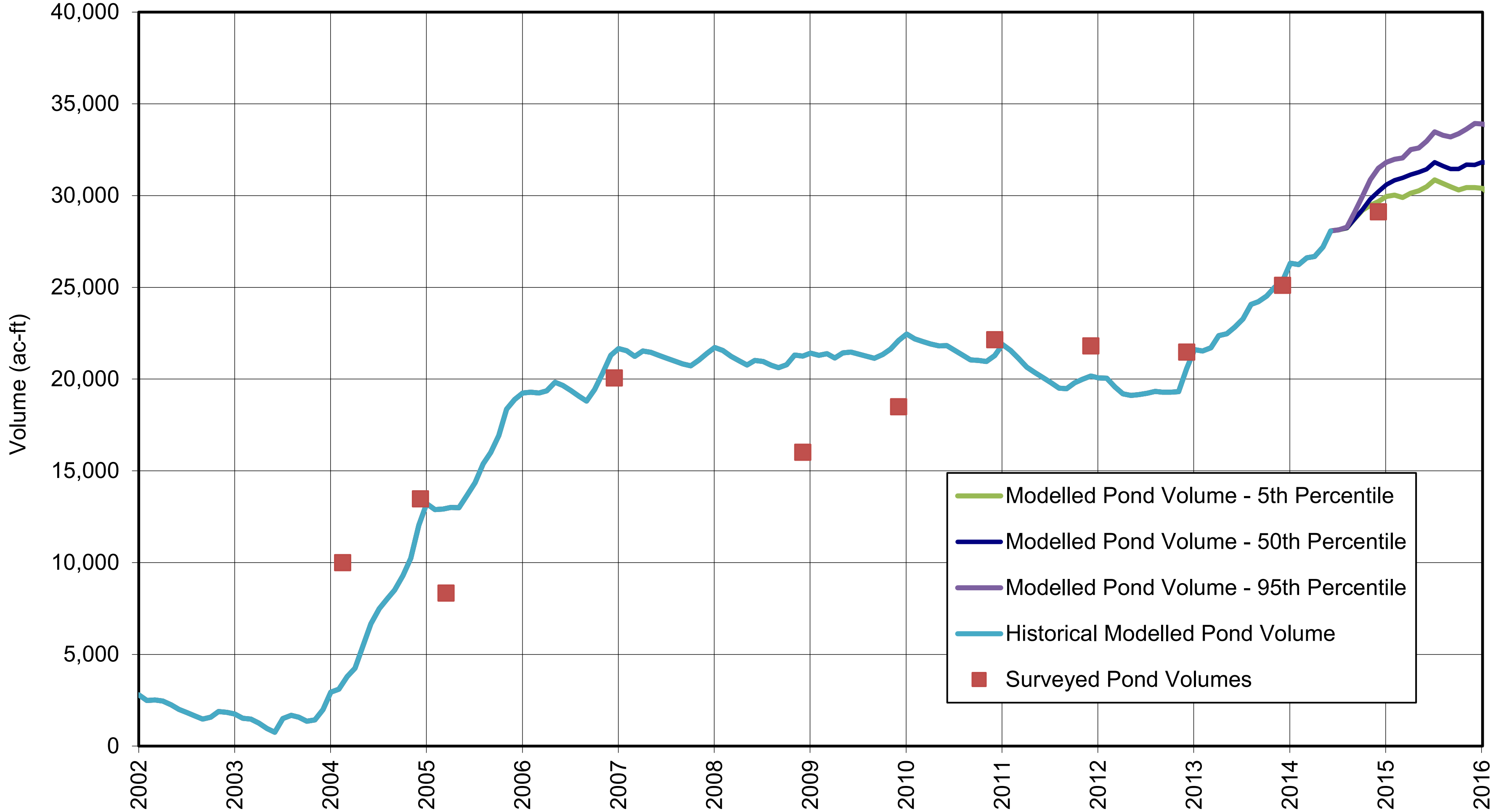
5 – MODEL CALIBRATION

The YDTI water balance model was run on a monthly basis for five model periods, three historic and two future:

- Pre-suspension Operations: 1986 through June 2000.
- Suspension: July 2000 to October 2003.
- Post-suspension Operations: October 2003 to October 2015.
- Future Operations: November 2015 to December 2031.
- Post Closure: January 2032 to December 2081.

MR provided measured YDTI pond volumes from July 2004 to June 2015. These values were compared with the model results presented on Figure 5.1 to assess how well the model simulates actual conditions.

The measured pond volumes generally match well with the modelled pond volumes, as shown on the figure, recognizing that there is some uncertainty associated with the measured values due to the difficulty in obtaining accurate bathymetric data at the pond edges. Based on this comparison, the model is considered to be reasonably well calibrated.



NOTES:

1. 15% RUNOFF COEFFICIENT FOR UNDISTURBED AREAS, 25% RUNOFF COEFFICIENT FOR DISTURBED AREAS, AND 16,000 AC-FT 1986 STARTING POND VOLUME.
2. INCLUDES MINIMUM SILVER LAKE INFLOWS OF 2.0 MGPD FROM JAN 2016 TO DEC 2031.
3. 15,000 AC-FT MINIMUM POND VOLUME FROM NOV 2015 TO DEC 2031.

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MONTANA RESOURCES, LLP

YANKEE DOODLE TAILINGS

YANKEE DOODLE TAILINGS IMPOUNDMENT
SIMULATED SUPERNATANT POND VOLUMES
CALIBRATION PERIOD

Knight Piésold CONSULTING

P/A NO.	REF. NO.	
VA101-126/12	VA17-00828	
FIGURE 5.1		REV 0

6 – MODEL RESULTS

As discussed in Section 3 – Hydrometeorology Inputs, the water balance was modelled deterministically from 1986 to 2014 using available measured temperature and precipitation. For the period after 2014, for which climate data are not available, the water balance was modelled stochastically using the historical temperature and precipitation datasets stepped through incrementally by year for the entire record, thereby preserving the inherent cyclical nature of the climate record while simulating possible future climate conditions. The results presented for the stochastic modelling period after 2014 are shown for:

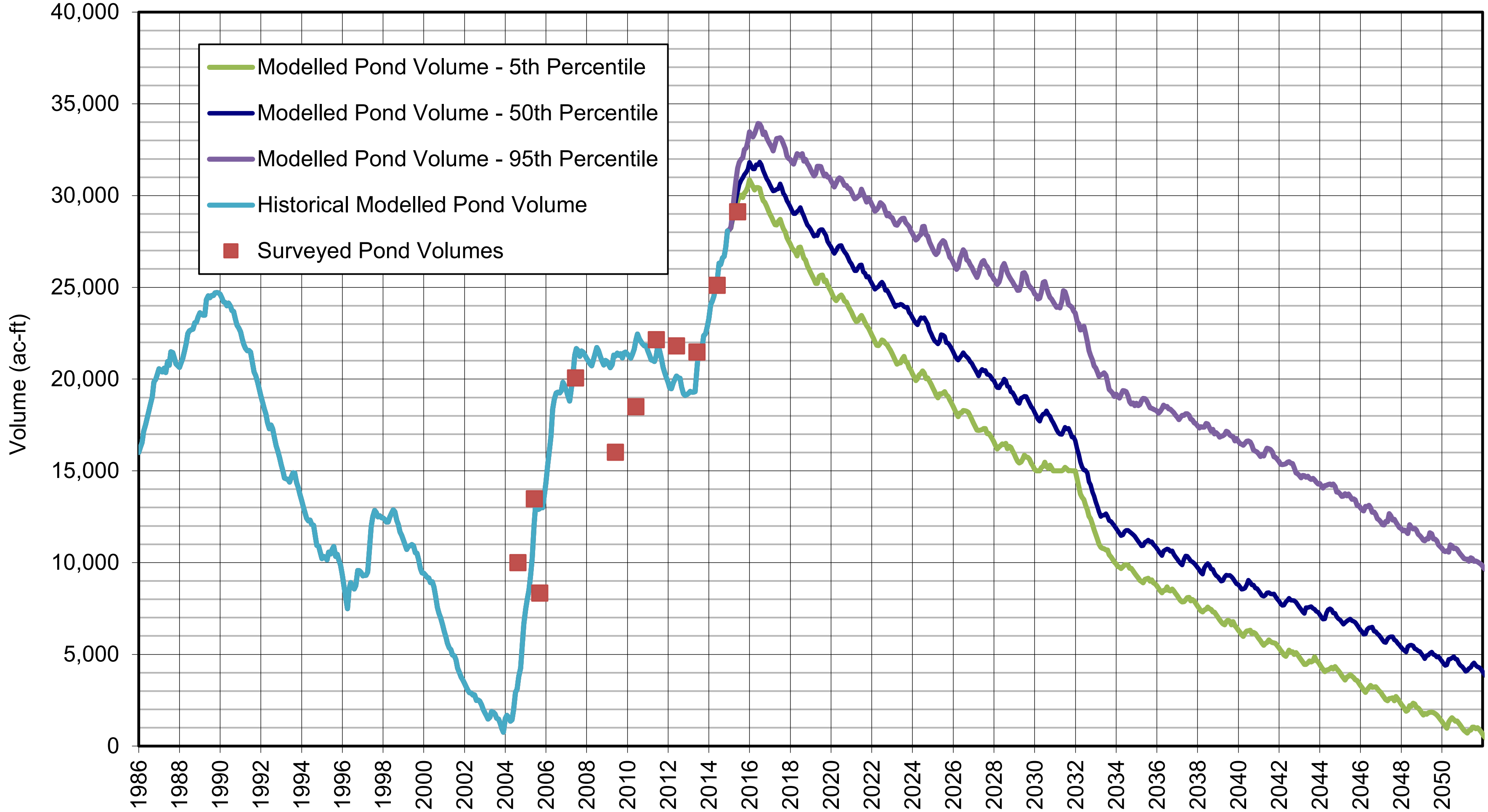
- 5th Percentile: The results correspond to abnormally dry conditions as only 5 percent of the results were lower.
- 50th Percentile: The results correspond to the median or "normal" conditions as 50 percent of the results were higher and 50 percent were lower.
- 95th Percentile: The results correspond to abnormally wet conditions as only 5 percent of the results were higher.

A summary of the typical annual inflows and outflows for the YDTI during future operations (2016 to 2031) are shown in Table 6.1, based on the model's 50th percentile results. Based on a summation of inflows and outflows from the YDTI, excluding Silver Lake pumping, the system balance is in a deficit of approximately 2.8 Mgpd. Therefore, with a minimum freshwater pumping rate of 2.0 Mgpd from Silver Lake, the deficit is 0.8 Mgpd.

Table 6.1 Summary of 50th Percentile YDTI Water Balance Future Operations Results

YDTI Water Balance for Future Operations (MGPD)	
Inflows	
Direct precipitation on pond/beach	0.9
Runoff from contributing catchment	0.7
Water in Tailings Slurry	22.0
Total Inflows	**23.6**
Outflows	
Evaporation	1.2
Losses to tailings voids	4.5
Seepage losses from impoundment	4.2
Total Outflows	**9.9**
Balance	
Water Available for Reclaim (Inflows – Outflows)	13.7
Reclaim demand for Mill Processing	16.5
Make-up water requirement (Reclaim demand – water available)	**2.8**

The monthly inputs and outputs for each major mine component are summarized in Table C1 in Appendix C for the entire modeling timeline on an average annual basis, corresponding to the model 50th percentile values. The YDTI supernatant pond volumes simulated in the water balance are shown on Figure 6.1 for the period from 1986 to 2051 and on Figure 6.2 for the period from 1986 to 2081. The figures present model results corresponding to the 5th, 50th, and 95th percentile values for the period after the historical climate data ends in 2014.



NOTES:
1. 15% RUNOFF COEFFICIENT FOR UNDISTURBED AREAS, 25% RUNOFF COEFFICIENT FOR DISTURBED AREAS, AND 16,000 AC-FT STARTING POND VOLUME.
2. INCLUDES MINIMUM SILVER LAKE INFLOWS OF 2.0 MGPD FROM JAN 2016 TO DEC 2031.
3. 15,000 AC-FT MINIMUM POND VOLUME FROM NOV 2015 TO DEC 2031.

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MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

YANKEE DOODLE TAILINGS IMPOUNDMENT
SIMULATED SUPERNATANT POND VOLUMES
MINIMUM SILVER LAKE INFLOWS OF 2.0 MGPD

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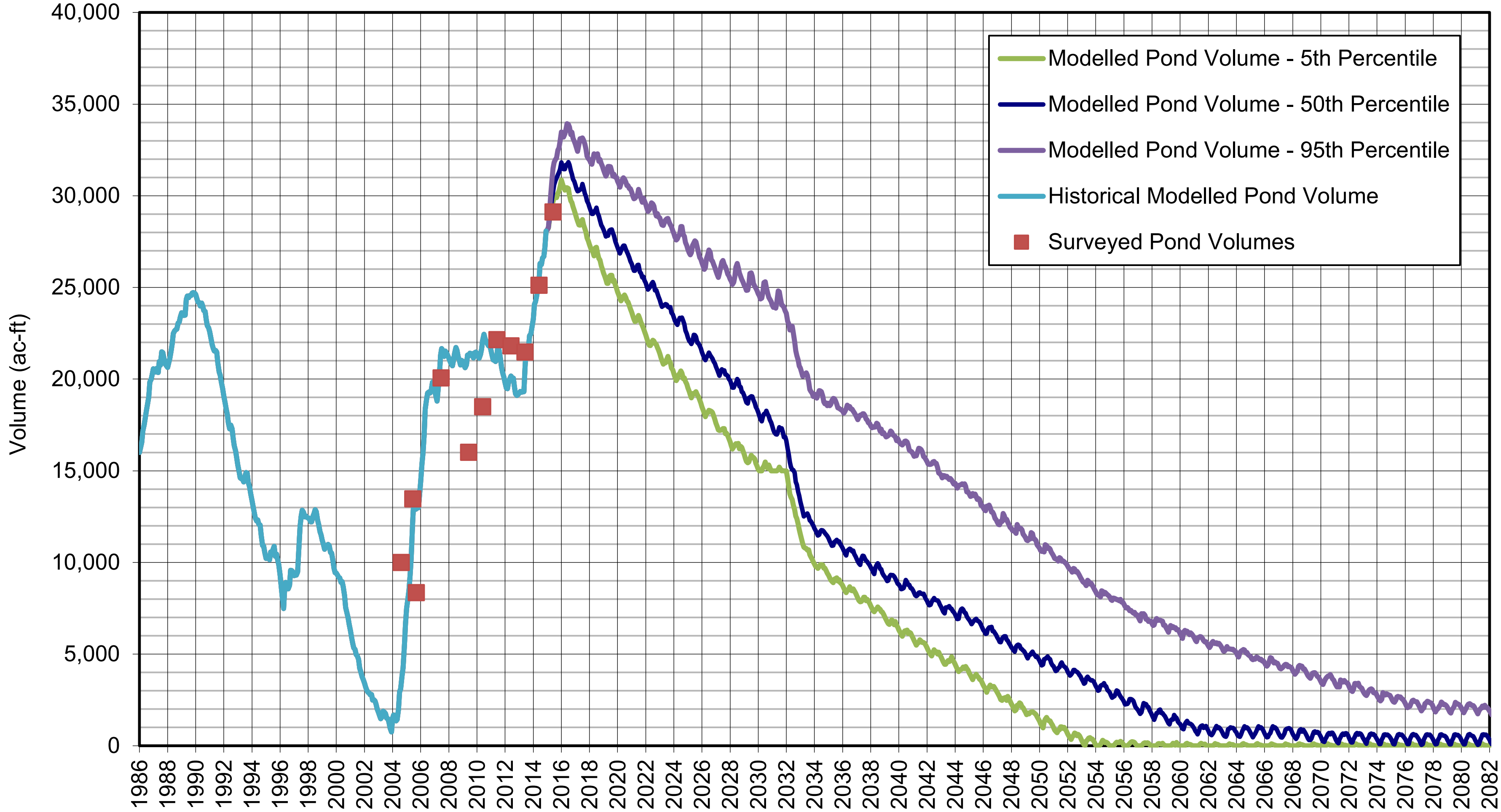
P/A NO. VA101-126/12
REF. NO. VA17-00828

FIGURE 6.1
REV 0



NOTES:
1. 15% RUNOFF COEFFICIENT FOR UNDISTURBED AREAS, 25% RUNOFF COEFFICIENT FOR DISTURBED AREAS, AND 16,000 AC-FT STARTING POND VOLUME.
2. INCLUDES MINIMUM SILVER LAKE INFLOWS OF 2.0 MGPD FROM JAN 2016 TO DEC 2031.
3. 15,000 AC-FT MINIMUM POND VOLUME FROM NOV 2015 TO DEC 2031.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	20JUN'17	ISSUED WITH LETTER	NWS	RSS

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YANKEE DOODLE TAILINGS IMPOUNDMENT

YANKEE DOODLE TAILINGS IMPOUNDMENT
SIMULATED SUPERNATANT POND VOLUMES
MINIMUM SILVER LAKE INFLOWS OF 2.0 MGPD

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P/A NO. VA101-126/12

REF. NO. VA17-00828

FIGURE 6.2

REV 0

Table 6.2 presents a summary of the annual average modelled system balance based on a minimum Silver Lake pumping rate of 2.0 Mgpd.

Table 6.2 Summary of System Balance for Future Operations

Percentile	System Balance (MGPD)
5th	0.9 Deficit
50th	0.8 Deficit
95th	0.6 Deficit

Figure 6.1 shows that the 5th, 50th, and 95th percentile results correspond to pond volumes progressively decreasing during operations due to the system balance deficit shown in Table 6.2. Note that the pond volume only drops to the minimum allowable volume of 15,000 ac-ft during future operations, for the 5th percentile case, approximately two years before closure.

During post-closure, the water balance indicates that the supernatant pond volume will decrease for all three percentiles evaluated, as shown on Figure 6.2. For the 50th percentile case, the pond volume will decrease by approximately 30% within the first two years, reduce to 8,000 ac-ft after ten years, and reach an equilibrium volume of less than 1,000 ac-ft in 30 years.

The accuracy of the water volumes simulated in the water balance is ultimately limited by the accuracy of the model inputs and assumptions. It is recommended that the inputs used in the model continue to be monitored and that review and update of the water balance be undertaken periodically as more data become available, especially if site conditions and/or water routing change.

7 – SILVER LAKE FRESHWATER SUPPLY SENSITIVITY ANALYSIS

The water balance model detailed in Sections 5 and 6 was the baseline scenario, which assumed Silver Lake freshwater was delivered to the Site at a minimum flowrate of 2.0 Mgpd, with additional freshwater introduced as required to maintain the supernatant pond volume at 15,000 ac-ft during operations.

A sensitivity analysis was conducted to determine how the water balance model results, specifically the YDTI pond volumes, are impacted when considering alternate minimum freshwater process requirements. The water balance model was evaluated for three alternate minimum freshwater requirement scenarios during future operations.

The results for the three scenarios (1, 1.5, and 2.5 million gpd) are discussed below and corresponding tables and figures are presented in Appendix D

- Freshwater Requirement = 1 million gpd: Figure D1 and Table D1 show that the 5th, 50th, and 95th percentile pond volumes all draw down to 15,000 ac-ft rapidly during future operations, with the 50th percentile reaching 15,000 ac-ft in approximately nine years (2015 through to 2024).
- Freshwater Requirement = 1.5 million gpd: Figure D2 and Table D2 show that the 5th and 50th percentile pond volumes draw down to 15,000 ac-ft during future operations more slowly than the 1 million gpm case, with the 50th percentile reaching 15,000 ac-ft in approximately 12 years (2015 through to 2027). The 95th percentile result indicates that the pond draws down but does not reach the 15,000 ac-ft target operational pond volume prior to closure.
- Freshwater Requirement = 2.5 million gpd: Figure D3 and Table D3 show that the 5th, 50th, and 95th percentile pond volumes all steadily decrease during future operations but do not draw down to the 15,000 ac-ft target operational pond volume until after closure.

We trust that this analysis is suitable for your purposes. If you have any questions or require additional assistance please contact the undersigned.

Yours truly,
Knight Piésold Ltd.

PROFESSIONAL PROVINCE OF N. W. SMITH # 37707 BRITISH COLUMBIA ENGINEER
July 6, 2017

Prepared: ______________________ Reviewed: ______________________
Nathan Smith, BASc, P.Eng. — Senior Engineer
Jaime Cathcart, Ph.D., P.Eng. — Specialist Hydrotechnical Engineer | Associate

Approval that this document adheres to Knight Piésold Quality Systems:

Attachments:

Appendix A	Schafer Limited LLC (Schafer) Climate Memo
Appendix B	Mean Monthly Precipitation and Mean Monthly Temperature Tables
Appendix C	Calibrated Water Balance Model Results
Appendix D	Silver Lake Pumping Sensitivity Analysis Water Balance Model Results

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APPENDIX A

SCHAFER LIMITED LLC (SCHAFER) CLIMATE MEMO

(Pages A-1 to A-7)

Memorandum

May 6, 2016

To: Mr. Mark Thompson, Montana Resources LLP.
Bob Anderson, Hydrometrics
Roanna Stewart, Knight Piesold
Adrianne Yang, Golder

From: William M. Schafer, Schafer Limited LLC

Re: Reference Climatic Data for the Yankee Doodle Tailings Area near Butte, Montana

Purpose and Scope

The purpose of this Memorandum is to describe the basis for selection of reference climate information used to characterize the Montana Resources LLP (MR) mine area near the Yankee Doodle Tailings (YDT). The YDT is located at an elevation of about 6,300 amsl (Figure 1) and is just northeast of Butte, Montana. The purpose of the climatic information is to assess potential hydrologic effects of the mine during operations and after closure. Methods used to assess hydrologic effects include but are not limited to water balance models, models evaluating the performance of soil Evapotranspiration or ET covers constructed on mine facilities to reduce infiltration of meteoric water, and calibration of groundwater and surface water flow models. Sufficient climate data is required to assess both historical and future variations in daily average precipitation, precipitation that occurs as snow, temperature, and potential evaporation and transpiration.

Climate Data Sources

Several sources of climate information were consulted as part of this effort including public data from the Western Regional Climate Center (WRCC 2016), and a water balance study performed by the Montana Bureau of Mines and Geology for MR in 2001 and 2002 (MBMG 2002). WRCC publishes data for most weather stations operated by the Federal government in the western US. Principal data sets acquired from WRCC included daily rainfall, snow, and maximum and minimum temperature from the Bert Mooney Airport (1895 to present) and Moulton Reservoir (1980 to 1986). More intensive data were obtained from a BLM station in Whitehall (2001 to present) for daily precipitation, maximum and minimum temperature plus relative humidity, solar radiation and wind speed. A summary of limited pan evaporation data was available for a few stations (Bozeman, Dillon and Canyon Ferry). The MBMG water balance provided the best available on-site evaporation data.

Two climate models were used to extrapolate climatic data in space and time: PRISM (2016) and CLIMGEN (WSU 2016). The PRISM model was developed at Oregon State University as a tool to spatially average meteorological data accounting for orographic and rain-shadow effects. PRISM was used to account for location adjustments in precipitation data between the airport and Butte and the YDT, a distance of a few miles and about 1,000 feet in elevation gain. CLIMGEN was developed at Washington State University and allows site-calibrated meteorological data to be extrapolated in time, creating a continuous long-term synthetic data set.

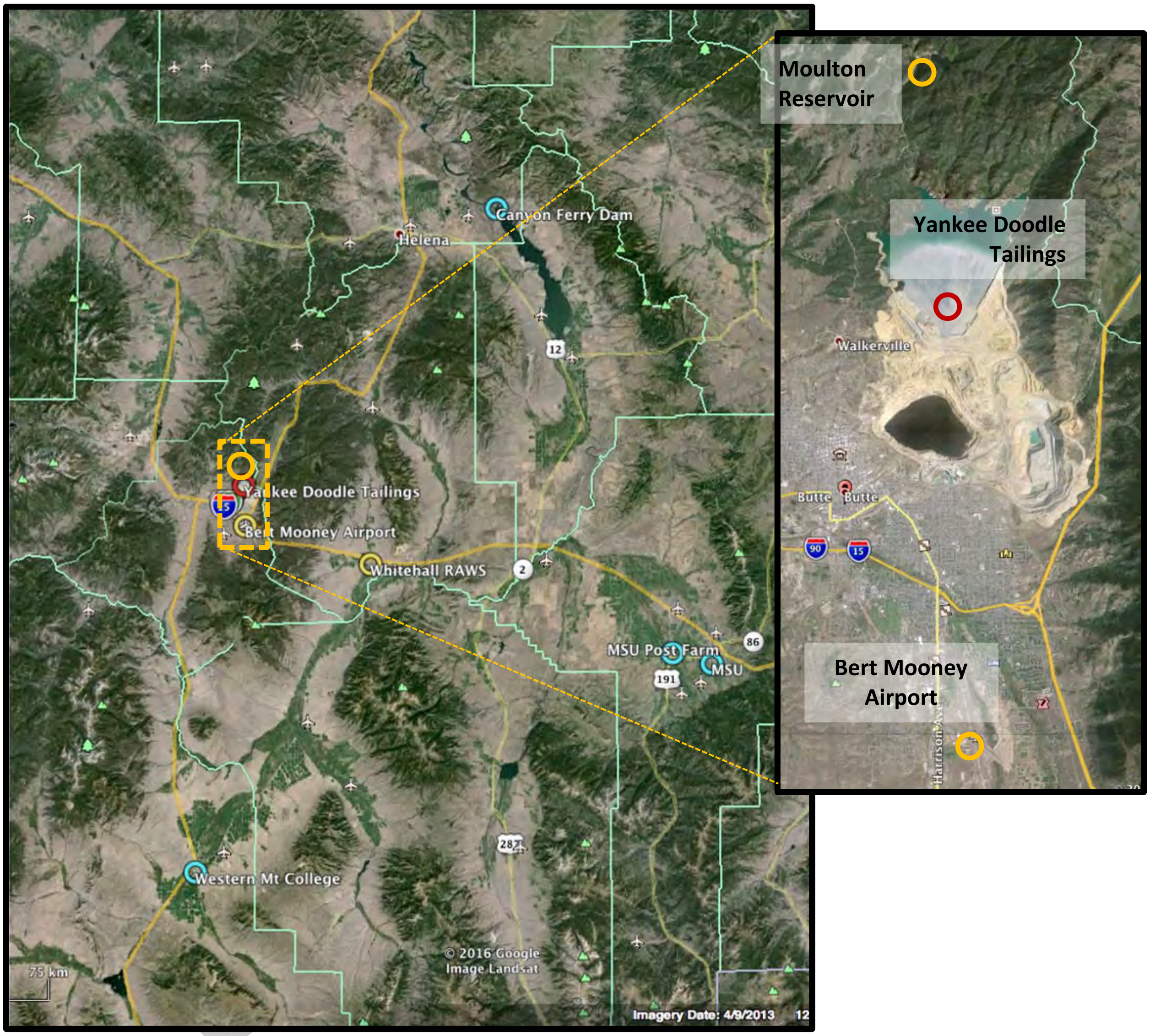

Figure 1. Location of climatic stations referenced in this report.

Approach

Development of a long-term climate data set for the YDT consisted of three steps,

- creation of a combined data set for the Bert Mooney Airport containing each of the necessary meteorological observations. Data were either collected at the airport location (precipitation and temperature) or were based on observations at nearby stations (solar radiation, relative humidity and wind from Whitehall),

- forecasting a long-term (200 year) synthetic data set (in CLIMGEN) representing daily average observations at the Airport, and

- adjusting the precipitation and evaporation estimates using PRISM to the YDT location.

Combined Climate Data for the Bert Mooney Airport

Daily average precipitation and maximum and minimum temperature data for January 1, 1915 to December 3, 2015 from the Bert Mooney Airport (Table 1) were combined with solar radiation, minimum and maximum relative humidity and wind speed from Whitehall for May 2001 to December 3, 2015. This combined data set was then modeled to extrapolate the data in time and spatially to adjust for elevation differences between the airport and the YDT area.

Temporal Extrapolation of a Synthetic Daily Climate Record

The CLIMGEN model uses statistical algorithms to simulate daily and seasonal rainfall and temperature distributions and can then use the site-specific statistical coefficients to extrapolate long-term climate records. All climatic parameters had an adequate period of record to facilitate analysis in CLIMGEN. A 200 year daily data set was created in CLIMGEN representing conditions at the Bert Mooney airport. Monthly precipitation matched closely for the airport data and the synthetic data (Figure 2). The distribution of annual rainfall for 100 years of actual data at the airport were compared to the synthetic data series in Figure 3. The annual rainfall quantities were ranked from smallest to largest and were normalized as a cumulative frequency distribution. The minimum (7 inches) maximum (20 inches) annual precipitation and the median (12.5 inches) were similar for actual and synthetic data. The synthetic data had fewer dry (< 10 inch) and wet (15 inch) rainfall years than the actual record.

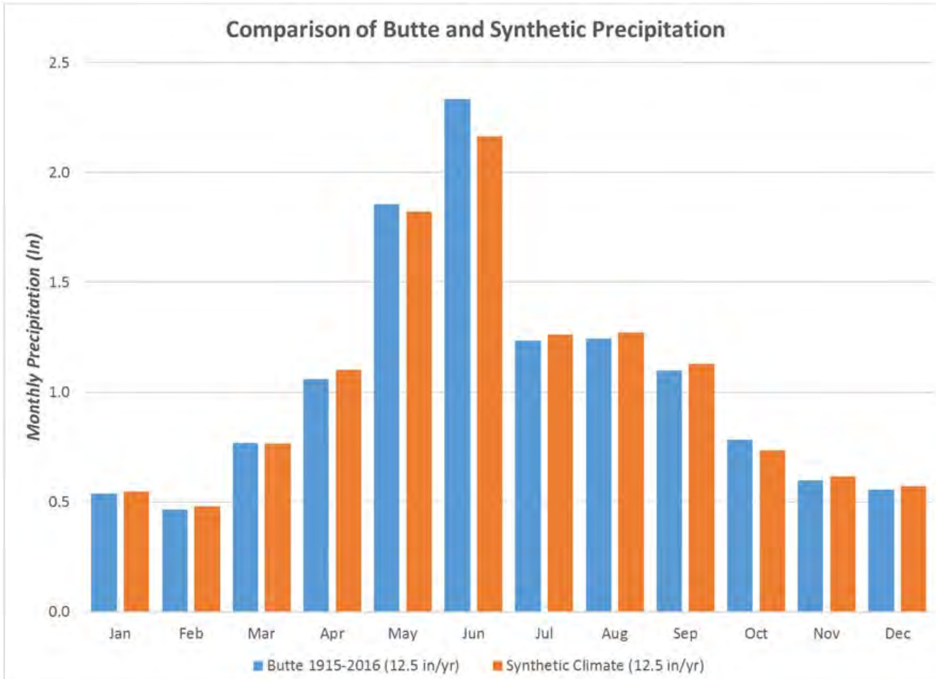

Figure 2. Comparison of monthly precipitation at Bert Mooney Airport to synthetic data.

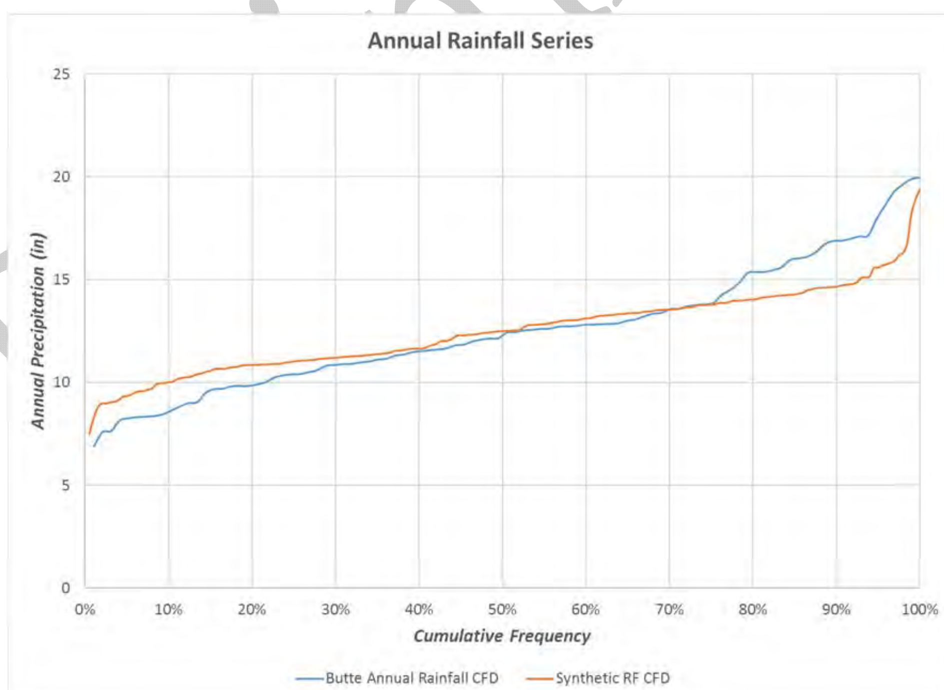

Figure 3. Comparison of annual precipitation at Bert Mooney Airport to synthetic data.

Spatial Adjustment of Climatic Data to YDT Area

The PRISM model was used to correct precipitation data by assessing predicted monthly precipitation at the airport versus the YDT area for a 20-year period of record. Estimated precipitation at YDT was divided by the Butte estimates to develop monthly correction coefficients (Table 1). Average annual precipitation at the YDT was found to be 15.92 inches compared to 12.47 inches at the airport. Differences were greatest in winter when frontal weather systems dominate and were smallest in summer when most rainfall occurs from convective storms. PRISM does not provide a means of adjusting evapotranspiration so ET calibration is discussed in the next section.

Estimating Reference Evapotranspiration

Direct observations of pan evaporation were only available from stations that were more than 60 miles from Butte and were not considered representative. On-site evaporation data collected from MBMG were infrequently recorded for a single year and did not provide adequate temporal detail to create a long-term daily climate record. Therefore, the Penman-Monteith equation (PME, Eqn [1]) was used to predict annual reference evapotranspiration for the Butte airport (FAO 2006).

The PME is widely used to estimate monthly evapotranspiration from a reference surface consisting of well-irrigated grass maintained at a canopy height of 12 cm. Evapotranspiration from irrigated grass will differ from pan evaporation or evaporation from a pond so adjustments are usually required. Since the magnitude of differences vary seasonally, monthly coefficients are often used to equate PME estimates to free water loss from ponds or lakes.

$$\lambda ET = \frac{\Delta(R_n - G) + \rho_a c_p \frac{(e_s - e_a)}{r_a}}{\Delta + \gamma\left(1 + \frac{r_s}{r_a}\right)} \qquad [1]$$

where Rn is the net radiation, G is the soil heat flux, $(e_s - e_a)$ represents the vapor pressure deficit of the air, ρ_a is the mean air density at constant pressure, c_p is the specific heat of the air, Δ represents the slope of the saturation vapor pressure temperature relationship, γ is the psychrometric constant, and r_s and r_a are the (bulk) surface and aerodynamic resistances.

Estimated annual ET was 44 inches using the PME, which is slightly higher than the regional pan evaporation stations which averaged 36.8 inches from April to October. Pan evaporation data was not recorded for November through March and water loss for these months was estimated to be about 0.5 mm/d or 0.5 inches per month (Allen 1996). Data from Allen for snow cover conditions were mostly used to derive estimated sublimation.

MBMG also installed a Class A Evaporation Pan just north of the YDT, which recorded 36.6 inches of evaporation for March 2001 to October 2002. Class A pans are known to over-predict evaporation from lakes and reservoirs due to temperature and humidity effects. A pan coefficient of 0.7 is often used to adjust pan readings (Dunne and Leopold 1978) (Table 1). An estimated sublimation rate of 0.5 inches per month was used for the November-March time frame. Monthly coefficients were developed to adjust from the PME estimates to estimate estimated free water surface loss. The coefficients are low in winter and spring and increase through the summer and early fall time frame (Table 1). This seasonality is attributed to gradual warming of the pan through the year that tends to increase evaporation rate. The adjusted free water annual evaporation for the YDT area is 28.1 inches

Monthly average solar radiation, minimum and maximum relative humidity and wind speed are provided in Table2. A spreadsheet containing daily estimated values for precipitation, free water evaporation, temperature, solar radiation, relative humidity and wind speed are available upon request.

Table 1. Monthly average precipitation and evaporation for Bert Mooney Airport and YDT.

Month	Butte Airport Precipitation (in) 1915-2015	Multiplier derived from PRISM to convert from airport to YDT	Estimated Average Precipitation (in) at YDT	Potential ET from PME (in)	Multiplier to adjust Potential ET from PME to Free Water Loss at YDT	Potential Free Water Evaporation adjusted to YDT (in)
Jan	0.55	224%	1.22	1.48	34%	**0.5**
Feb	0.48	200%	0.96	1.73	29%	**0.5**
Mar	0.77	138%	1.06	2.65	19%	**0.5**
Apr	1.10	133%	1.47	3.72	57%	2.12
May	1.82	117%	2.14	5.06	58%	2.95
Jun	2.17	103%	2.22	6.02	61%	3.70
Jul	1.26	121%	1.53	6.86	79%	5.43
Aug	1.27	87%	1.11	5.97	83%	4.93
Sep	1.13	135%	1.52	4.32	77%	3.34
Oct	0.74	144%	1.06	3.00	105%	3.16
Nov	0.62	101%	0.63	1.87	27%	**0.5**
Dec	0.57	174%	0.99	1.41	35%	**0.5**
Annual	**12.47**		**15.92**	**44.08**		**28.13**

Table 2. Monthly average temperature, solar radiation, relative humidity and wind speed for YDT area.

Month	Daily Maximum Temperature (Celsius)	Daily Minimum Temperature (Celsius)	Average Daily Solar Radiation (MJ/m²)	Average Maximum Relative Humidity (%)	Average Minimum Relative Humidity (%)	Average Wind Speed (m/s)
Jan	-1.0	-14.7	6.7	95.2	30.5	3.6
Feb	1.6	-12.3	10.4	93.5	31.2	3.3
Mar	5.1	-8.4	14.8	91.1	31.1	3.5
Apr	10.4	-3.5	19.3	90.4	33.2	3.2
May	15.8	1.2	22.0	88.5	34.2	2.8
Jun	20.5	5.0	24.7	85.1	32.8	2.6
Jul	26.2	7.6	25.7	80.6	26.0	2.3
Aug	26.0	6.9	21.9	79.3	23.5	2.2
Sep	19.9	2.3	17.4	82.6	26.7	2.3
Oct	12.9	-2.8	11.5	87.4	29.6	2.8
Nov	4.4	-9.1	7.4	90.5	31.0	3.3
Dec	-0.3	-13.7	5.6	94.7	30.8	3.2
Annual Average	**11.8**	**-3.4**	**15.6**	**88.2**	**30.0**	**2.9**

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APPENDIX B

MEAN MONTHLY PRECIPITATION AND MEAN MONTHLY TEMPERATURE TABLES

(Pages B-1 to B-2)

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TABLE B.1

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TOTAL MONTHLY PRECIPITATION TIME SERIES

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Year	Precipitation (inches)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1895	0.9	0.1	0.3	0.3	1.1	0.9	1.1	0.2	1.2	0.2	0.3	0.5	**7.0**
1896	0.3	0.4	0.3	0.6	1.4	1.1	1.2	0.9	2.0	0.5	1.6	1.0	**11.1**
1897	1.2	0.7	1.0	1.6	1.4	3.0	1.2	0.3	1.0	1.1	1.5	1.1	**15.2**
1900	0.3	1.1	1.2	2.8	2.9	0.7	1.1	0.5	1.4	2.1	0.2	0.4	**14.6**
1901	0.6	0.7	1.7	2.4	3.4	2.0	0.6	0.3	0.9	0.5	0.0	1.7	**14.6**
1902	0.0	1.0	0.8	1.4	3.2	0.8	1.2	0.3	0.1	0.2	0.7	0.9	**10.3**
1903	0.4	0.1	1.3	1.3	1.2	0.8	0.7	0.6	0.5	0.7	1.9	0.9	**10.3**
1904	1.4	2.9	2.1	0.3	1.0	1.0	2.0	0.4	0.0	0.1	0.1	1.4	**12.6**
1905	0.7	0.1	1.2	0.9	2.1	3.2	1.8	1.0	0.5	0.7	0.4	0.2	**12.4**
1906	1.1	1.7	0.9	1.7	3.6	2.0	0.2	2.2	0.5	0.0	0.8	1.0	**15.7**
1907	0.8	1.0	0.6	1.3	1.3	2.9	2.8	2.2	1.5	0.2	0.1	0.2	**14.8**
1908	0.5	0.8	0.9	0.4	5.7	4.2	0.7	0.8	2.5	1.3	0.2	0.2	**18.0**
1909	1.6	0.1	1.5	0.9	2.5	1.8	3.5	0.7	3.3	1.0	2.7	1.2	**20.6**
1910	0.4	0.6	0.8	0.2	1.7	1.8	0.5	0.8	2.2	1.4	1.6	0.3	**12.0**
1911	1.7	0.6	0.2	2.4	2.2	3.3	0.4	1.7	1.2	3.3	1.0	1.1	**19.0**
1913	0.3	0.1	0.6	1.4	1.6	8.9	1.7	1.1	0.5	0.7	0.5	0.1	**17.6**
1914	1.2	0.6	0.2	1.1	1.9	2.5	1.0	0.0	0.3	1.4	0.2	0.0	**10.3**
1915	0.5	0.6	0.6	0.7	2.9	4.8	2.3	0.3	1.4	0.0	1.2	1.5	**16.7**
1916	1.1	0.5	1.1	1.3	2.8	2.6	1.5	0.4	2.0	1.0	1.0	1.7	**16.9**
1917	0.8	1.5	1.1	0.9	2.2	2.1	0.5	0.0	1.5	1.4	0.2	1.7	**13.9**
1918	1.9	0.8	3.2	1.4	0.6	1.1	2.5	1.1	1.9	1.5	0.4	0.0	**16.4**
1919	0.3	0.9	0.6	0.7	0.5	0.5	0.2	0.6	0.4	1.4	1.8	1.8	**9.7**
1920	0.2	0.9	2.1	1.3	1.5	2.3	0.9	1.3	1.0	2.1	0.3	0.5	**14.3**
1921	1.0	0.5	1.6	1.0	2.4	2.3	1.0	0.9	1.8	0.3	3.0	1.3	**17.1**
1922	0.3	1.1	0.9	2.9	1.5	2.4	1.3	3.3	0.3	0.1	0.9	0.5	**15.3**
1923	0.3	0.6	0.8	1.0	2.3	1.9	1.3	1.1	0.2	0.9	0.4	0.7	**11.7**
1924	0.6	0.8	1.3	0.4	0.7	0.7	1.4	0.3	0.7	0.7	1.0	0.4	**9.0**
1925	0.7	0.0	1.0	1.3	2.4	2.6	1.4	1.0	2.1	2.4	0.0	1.3	**16.1**
1926	0.6	0.9	0.4	0.4	2.0	1.8	1.8	1.6	1.7	0.2	1.2	0.9	**13.4**
1927	0.9	1.0	0.9	0.8	5.8	0.7	0.9	3.0	1.2	1.2	2.1	1.4	**19.9**
1928	1.9	0.6	0.5	1.1	0.3	2.3	1.6	2.5	0.8	1.1	0.1	1.0	**13.6**
1929	1.6	1.3	1.3	2.3	0.8	1.9	0.3	0.2	1.2	0.8	0.3	1.0	**12.8**
1930	1.0	0.4	1.0	2.3	0.7	1.1	0.4	1.4	1.8	1.0	0.3	0.1	**11.6**
1932	0.4	0.1	0.5	1.1	0.8	2.1	2.0	1.1	0.1	1.2	0.3	0.5	**10.2**
1933	0.3	0.4	0.1	0.4	1.8	0.7	0.1	2.2	0.5	0.6	0.2	0.4	**7.6**
1934	0.1	0.9	0.5	0.5	0.1	4.1	0.4	0.4	0.6	1.8	0.2	0.8	**10.3**
1935	0.2	0.1	0.5	1.3	1.3	1.3	0.9	0.3	0.0	0.6	0.2	0.1	**6.9**
1936	0.3	0.8	0.1	1.3	0.9	3.8	1.4	0.9	0.5	0.5	0.2	0.3	**10.9**
1937	0.3	0.2	0.7	0.4	0.5	1.3	4.4	0.7	1.8	0.2	0.1	0.4	**10.9**
1938	0.2	0.3	1.3	0.6	4.7	4.5	2.4	0.7	0.3	1.4	0.6	0.0	**16.9**
1941	0.1	0.2	0.4	1.4	2.2	2.7	2.0	1.3	1.5	0.9	0.6	1.2	**14.5**
1942	0.7	0.5	0.6	1.5	2.9	1.8	0.2	0.3	0.3	0.5	1.0	0.5	**10.8**
1943	1.2	0.7	0.6	2.3	1.3	1.9	0.8	2.2	0.4	0.7	0.6	0.2	**12.7**
1944	0.2	0.6	0.2	0.4	2.8	5.1	0.6	1.4	1.1	0.4	0.5	0.2	**13.3**
1945	0.2	0.1	0.9	0.7	2.4	2.2	0.2	0.2	1.0	0.6	0.7	0.8	**9.9**
1946	0.3	0.3	0.7	0.3	2.4	1.4	1.5	1.6	3.3	1.8	1.2	0.7	**15.4**
1947	0.7	0.5	0.8	1.1	0.3	3.6	1.1	1.0	3.5	1.3	1.5	0.6	**16.0**
1948	0.7	0.7	0.8	0.6	2.6	5.4	2.4	1.6	0.6	0.4	0.4	0.9	**17.0**
1949	0.5	0.9	0.6	0.6	1.7	2.4	0.6	0.7	1.7	0.6	0.5	0.3	**11.4**
1950	0.7	0.3	1.7	0.8	1.1	2.1	1.5	1.0	1.3	0.5	1.2	0.6	**12.7**
1951	0.9	0.8	1.0	0.9	1.8	0.9	0.6	1.7	1.0	1.0	0.4	1.2	**12.1**
1952	0.3	0.9	1.5	0.3	3.1	2.1	1.8	0.9	0.2	0.1	0.8	0.2	**12.0**
1953	0.7	1.0	0.5	1.4	2.2	2.5	0.0	0.4	0.4	0.2	0.2	0.3	**9.8**
1954	0.5	0.1	0.2	0.8	0.6	2.0	0.5	1.8	0.7	0.3	0.0	0.1	**7.6**
1955	0.3	0.2	0.6	1.2	1.6	3.0	2.6	0.0	1.1	0.4	0.7	1.1	**12.7**
1956	0.5	0.0	0.2	1.3	1.2	1.6	1.9	2.0	0.5	1.0	0.1	0.3	**10.5**
1957	0.5	0.2	0.6	0.5	2.7	1.8	0.6	0.6	1.0	0.9	0.1	0.3	**9.8**
1958	0.1	0.2	0.5	1.4	1.1	4.2	0.9	1.5	0.7	0.1	0.4	0.4	**11.5**
1959	0.1	0.9	0.1	0.3	1.9	2.9	0.8	1.4	0.9	0.8	0.5	0.1	**10.6**
1960	0.4	0.2	0.8	1.1	1.2	1.1	0.3	2.0	0.5	0.2	0.4	0.3	**8.4**
1961	0.0	0.1	0.8	1.1	2.2	1.2	1.9	0.7	2.2	0.4	0.4	0.1	**11.0**
1962	0.6	0.6	0.5	0.2	2.6	1.7	2.2	1.6	0.1	1.0	1.1	0.3	**12.4**
1963	1.1	0.1	0.6	1.4	1.5	3.4	0.6	0.5	1.7	1.3	0.5	0.4	**13.1**
1964	0.8	0.3	0.7	1.0	1.6	4.6	0.5	1.6	0.3	0.0	0.5	1.1	**13.0**
1965	0.4	0.3	0.6	1.0	1.4	3.6	0.7	2.5	2.2	0.4	0.4	0.3	**13.7**
1966	0.3	0.3	0.3	0.3	0.8	2.4	0.2	0.5	1.6	0.5	0.4	0.5	**8.2**
1967	0.5	0.2	1.1	2.6	3.0	3.8	0.5	0.2	1.0	2.2	0.3	0.7	**16.0**
1968	0.9	0.1	0.6	1.0	1.7	2.4	0.2	2.4	2.1	0.4	1.0	0.3	**12.9**
1969	1.7	0.2	0.2	1.3	2.2	5.8	2.4	0.4	0.7	0.4	0.2	0.2	**15.6**
1970	0.4	0.3	1.1	0.4	1.1	1.6	2.1	0.5	1.8	0.6	0.8	0.3	**10.8**
1971	0.7	0.3	0.9	1.0	1.6	1.9	0.2	1.1	0.9	0.5	0.5	0.7	**10.4**
1972	1.1	0.3	1.4	0.4	0.6	1.2	0.8	1.2	0.4	0.3	0.2	0.5	**8.4**
1973	0.2	0.8	0.3	0.6	0.9	2.2	0.4	0.5	0.7	1.0	0.7	0.7	**8.8**
1974	0.2	0.3	0.9	0.1	1.8	0.3	0.5	2.0	0.4	0.8	0.5	0.6	**8.3**
1975	1.4	0.6	0.8	2.5	1.7	1.9	3.5	2.0	0.5	3.1	0.5	0.4	**18.6**
1976	0.2	0.4	0.3	0.5	1.3	3.3	0.9	2.4	2.0	0.3	0.2	0.1	**11.8**
1977	0.8	0.0	0.7	0.7	1.6	1.8	1.8	1.3	3.2	0.6	0.5	0.8	**13.8**
1978	0.3	0.7	0.5	1.4	2.0	0.7	2.4	1.2	2.4	0.1	0.4	0.5	**12.6**
1979	0.4	0.5	0.5	1.9	0.5	0.9	0.4	1.9	0.1	0.5	0.4	0.2	**8.3**
1980	0.5	0.7	0.9	1.5	4.5	4.6	1.3	1.4	2.3	1.1	0.7	0.2	**19.6**
1981	0.1	0.5	1.0	1.0	4.8	1.8	1.0	0.4	0.8	0.9	0.9	0.4	**13.6**
1982	0.8	0.4	1.8	0.9	1.7	3.0	0.8	0.4	1.4	0.6	0.3	0.8	**12.8**
1983	0.1	0.2	0.9	0.6	1.0	1.8	3.0	2.4	1.2	0.6	0.3	0.6	**12.6**
1984	0.3	0.5	0.7	1.1	1.4	2.8	0.7	1.4	0.7	0.6	0.6	0.3	**11.0**
1985	0.2	0.3	0.7	0.2	1.7	1.2	0.3	1.5	1.8	0.8	0.6	0.2	**9.5**
1986	0.3	0.9	0.9	0.7	1.0	1.6	1.5	1.8	2.5	0.3	1.3	0.1	**12.8**
1987	0.2	0.5	0.9	0.3	3.9	0.5	4.2	1.5	0.1	0.0	0.2	0.6	**12.8**
1988	0.5	0.2	0.6	1.2	2.0	0.8	0.3	0.2	1.1	0.4	0.6	0.6	**8.3**
1989	1.3	0.7	1.2	0.9	1.7	0.8	1.9	1.6	1.5	1.1	0.4	0.6	**13.8**
1990	0.5	0.1	0.7	0.7	2.2	1.2	0.9	2.3	0.1	0.3	0.6	0.3	**9.8**
1991	0.5	0.2	1.4	0.9	2.4	2.4	0.2	0.9	1.5	0.7	0.8	0.4	**12.1**
1992	0.4	0.2	0.6	0.3	1.0	4.1	1.6	0.7	0.6	1.4	0.6	0.4	**11.6**
1993	0.6	0.7	0.4	1.7	1.8	4.3	3.1	3.1	0.1	1.3	0.3	0.6	**18.0**
1994	0.1	0.4	0.3	1.2	2.5	1.4	2.2	0.2	0.1	1.7	1.5	0.5	**12.1**
1995	0.5	0.5	1.1	1.5	2.1	4.6	3.4	0.5	2.2	0.7	1.2	0.9	**19.3**
1996	0.9	1.3	1.4	1.6	3.1	1.3	1.5	1.5	0.8	0.6	1.3	2.0	**17.1**
1997	1.4	0.7	1.1	1.8	3.1	4.2	3.0	1.7	0.6	1.6	0.6	0.2	**20.0**
1998	0.9	0.4	1.0	1.8	2.7	3.2	1.8	0.5	1.0	0.4	0.7	1.1	**15.5**
1999	0.4	0.5	0.6	1.5	2.2	2.1	0.1	2.9	0.5	0.1	0.2	0.5	**11.5**
2000	0.4	0.5	0.6	0.6	1.9	0.5	0.6	0.2	1.1	1.6	0.4	0.2	**8.6**
2001	0.2	0.1	0.6	1.5	0.9	2.5	1.4	0.4	1.0	1.1	0.5	0.3	**10.4**
2002	0.5	0.2	0.4	0.8	1.6	2.6	1.0	2.5	1.2	0.1	0.3	0.2	**11.1**
2003	0.7	0.9	0.4	2.6	1.1	1.0	0.4	1.8	0.2	0.1	0.3	0.4	**9.7**
2004	0.3	0.2	0.2	1.5	2.0	2.0	0.9	2.0	1.4	0.3	0.1	0.4	**11.1**
2005	0.0	0.2	0.7	0.9	2.9	2.5	0.4	1.7	1.3	1.0	1.0	0.8	**13.2**
2006	0.5	0.2	0.5	3.1	1.3	2.8	0.7	0.1	0.5	2.1	0.3	0.4	**12.4**
2007	0.1	0.8	0.3	1.1	2.8	2.1	0.6	0.7	2.6	1.1	0.3	0.2	**12.6**
2008	0.6	0.4	0.1	0.6	1.8	2.3	1.0	0.7	0.6	0.3	1.0	0.7	**10.0**
2009	0.2	0.2	1.3	1.1	1.0	2.5	1.2	2.9	0.7	1.3	0.2	0.1	**12.5**
2010	0.7	0.2	0.4	1.1	2.9	4.1	1.0	2.1	1.1	0.7	0.5	0.6	**15.4**
2011	0.3	0.4	0.6	0.9	2.6	3.9	0.7	0.7	0.4	0.7	0.3	0.3	**11.8**
2012	0.1	0.2	1.2	1.2	1.2	1.1	2.2	0.2	0.0	0.4	1.0	0.3	**9.0**
2013	0.3	0.1	0.3	0.2	2.4	1.7	0.7	1.6	3.0	0.6	0.2	0.2	**11.3**
2014	0.2	0.6	1.3	1.4	0.8	3.4	0.7	3.1	1.0	0.8	1.0	0.6	**14.8**
Minimum	**0.0**	**0.0**	**0.1**	**0.1**	**0.1**	**0.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**6.9**
Average	**0.6**	**0.5**	**0.8**	**1.1**	**1.9**	**2.3**	**1.2**	**1.2**	**1.1**	**0.8**	**0.6**	**0.6**	**12.7**
Maximum	**1.9**	**2.9**	**3.2**	**3.1**	**5.8**	**8.9**	**4.4**	**3.3**	**3.5**	**3.3**	**3.0**	**2.0**	**20.6**

M:\1\01\00126\12\A\Data\Task 353 - Water Balance\Task 353.1000 - Operational Water Balance\1_Inputs\Climate\[Climate Stringfiles.xlsx]Table_MonthlyPrecip

0	23JUN'17	ISSUED WITH LETTER VA17-00828	NWS	JGC
REV	DATE	DESCRIPTION	PREP'	RVW'D

Knight Piésold CONSULTING

TABLE B.2

MONTANA RESOURCES LLP
MONTANA RESOURCES

AVERAGE MONTHLY TEMPERATURE TIME SERIES

Print Jun/23/17 10:41:05

Year	Average Temperature (°F)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1895	18.5	22.6	27.7	42.4	47.9	51.8	60.9	63.3	49.0	45.7	29.3	20.5	**40.0**
1896	26.2	29.9	26.8	34.7	41.8	58.9	65.3	62.3	50.8	44.0	23.2	32.3	**41.3**
1897	19.2	22.5	21.7	41.6	56.7	55.4	59.9	65.7	54.4	43.8	30.3	23.1	**41.2**
1900	30.2	23.9	37.6	44.7	52.5	63.8	63.9	59.2	51.3	43.8	33.7	30.5	**44.6**
1901	25.5	20.6	30.2	36.5	51.4	49.3	65.7	63.0	45.8	48.3	38.2	26.5	**41.7**
1902	21.6	31.6	30.5	40.0	50.5	54.5	60.3	60.9	51.6	46.4	32.8	26.6	**42.3**
1903	27.2	20.7	30.8	38.7	45.8	59.5	60.2	63.1	50.8	47.3	32.7	28.7	**42.1**
1904	26.6	26.2	30.3	43.4	49.1	55.9	62.2	64.7	56.9	47.4	40.7	28.3	**44.3**
1905	24.4	22.4	37.0	42.0	46.0	53.9	63.9	64.0	56.4	37.1	33.3	23.9	**42.0**
1906	25.3	27.8	22.1	43.0	46.8	53.4	66.9	62.0	52.7	43.5	30.6	31.4	**42.1**
1907	14.7	32.3	34.2	38.8	47.1	52.2	61.9	59.0	54.6	49.4	36.0	26.4	**42.2**
1908	25.7	27.7	32.2	44.4	46.7	51.1	67.8	62.4	57.2	42.4	34.6	25.6	**43.1**
1909	22.9	29.3	33.6	35.3	45.6	57.5	63.4	64.9	54.3	45.6	33.8	18.1	**42.0**
1910	21.3	20.1	42.7	48.5	53.0	59.6	67.7	61.1	51.9	48.3	33.6	26.0	**44.5**
1911	25.0	19.0	37.6	37.4	46.8	59.0	63.1	60.1	50.1	38.9	26.9	22.7	**40.6**
1913	25.7	16.6	27.1	41.8	48.6	58.0	61.3	64.9	54.4	38.2	34.0	22.9	**41.1**
1914	28.2	24.7	35.9	40.7	50.7	55.5	66.2	63.0	52.8	44.0	37.5	19.5	**43.2**
1915	23.2	29.9	35.4	48.0	46.4	51.2	58.6	67.1	49.6	45.1	27.0	21.7	**41.9**
1916	9.8	27.4	40.5	41.8	41.8	52.3	63.7	61.5	53.5	39.9	26.7	18.8	**39.8**
1917	19.2	24.4	23.2	36.1	46.7	54.9	68.6	63.7	58.3	45.0	41.1	33.4	**42.9**
1918	23.4	24.6	38.4	38.4	46.4	64.4	65.2	61.2	56.2	46.4	29.8	26.5	**43.4**
1919	29.3	24.1	34.1	44.1	52.0	63.5	69.2	66.4	56.5	34.7	27.2	19.7	**43.4**
1920	27.7	25.9	28.0	32.8	45.1	54.1	67.6	64.8	55.0	40.6	30.7	27.6	**41.6**
1921	27.5	32.1	35.5	38.5	49.7	60.9	67.0	64.7	47.6	49.5	33.1	22.7	**44.1**
1922	17.7	18.3	29.7	36.4	47.9	61.8	64.1	66.1	59.0	49.0	30.0	21.6	**41.8**
1923	25.7	21.1	30.2	39.9	48.5	56.2	68.7	63.7	57.3	41.0	36.9	23.6	**42.7**
1924	22.0	32.6	27.5	39.1	52.2	56.6	64.8	63.2	55.1	45.1	31.7	17.7	**42.3**
1925	27.6	33.7	35.2	44.3	53.0	57.3	68.0	62.3	53.5	37.6	33.2	31.8	**44.8**
1926	24.1	32.0	34.9	46.1	50.5	59.1	67.7	63.2	46.8	46.2	35.5	24.2	**44.2**
1927	22.9	26.7	32.9	38.7	43.3	58.6	65.8	60.1	53.2	46.6	35.4	17.3	**41.8**
1928	24.9	23.2	34.8	38.4	55.3	53.6	65.6	61.5	56.3	44.2	35.1	24.8	**43.1**
1929	15.9	19.2	33.7	36.7	48.6	56.9	66.6	67.4	48.5	45.0	32.0	32.1	**41.9**
1930	6.7	32.0	30.5	48.3	50.6	58.6	68.0	67.5	56.3	41.4	32.6	24.9	**43.1**
1932	10.9	20.9	24.3	38.5	48.5	56.5	63.1	60.7	51.4	38.3	34.4	9.9	**38.1**
1933	16.6	10.1	29.6	36.6	43.0	60.1	65.8	59.6	50.6	46.4	34.2	29.6	**40.2**
1934	26.9	29.5	37.8	45.6	54.6	55.2	64.5	63.8	48.3	45.3	35.3	19.0	**43.8**
1935	17.4	23.2	26.2	33.7	43.2	53.4	63.2	59.7	52.9	38.6	23.6	20.3	**37.9**
1936	17.4	4.5	28.3	40.0	52.7	57.8	67.3	61.3	49.4	40.1	21.0	19.9	**38.3**
1937	-5.5	16.9	25.7	36.5	49.5	53.9	64.1	60.4	53.9	45.5	31.6	21.7	**37.8**
1938	16.4	22.1	28.9	39.1	43.9	56.1	62.2	60.3	57.3	41.6	23.9	23.0	**39.6**
1941	20.5	24.9	33.6	38.1	48.4	55.8	63.3	60.8	45.5	38.9	30.8	18.6	**39.9**
1942	7.3	10.3	22.8	40.6	42.9	50.8	63.4	61.3	52.9	41.1	26.7	22.6	**36.9**
1943	8.8	18.6	17.8	43.2	43.2	51.8	61.2	60.2	52.8	43.4	31.0	17.9	**37.5**
1944	15.8	19.8	24.0	39.2	47.8	52.6	60.1	58.2	51.4	46.3	25.9	15.5	**38.0**
1945	22.1	24.8	28.7	34.1	45.9	50.5	62.8	61.4	48.8	44.4	26.7	16.3	**38.9**
1946	18.0	21.1	33.6	41.6	44.7	54.2	63.6	59.8	49.3	33.9	25.3	23.7	**39.1**
1947	13.1	22.0	30.6	39.0	49.5	50.3	64.2	60.4	50.7	44.9	21.6	18.8	**38.8**
1948	16.0	16.3	19.4	38.2	47.7	56.8	58.5	59.3	50.7	41.6	26.5	9.4	**36.7**
1949	-1.8	13.1	22.8	42.1	49.9	53.2	61.0	62.0	51.4	35.4	38.3	18.3	**37.1**
1950	9.1	23.1	25.3	36.3	42.4	52.1	58.6	58.7	48.1	43.1	25.9	24.0	**37.2**
1951	10.0	20.5	20.5	36.8	46.8	48.6	61.8	57.9	48.7	37.9	26.6	13.6	**35.8**
1952	14.2	15.1	18.2	40.4	48.1	55.0	59.7	60.1	53.8	43.9	20.8	18.0	**37.3**
1953	29.5	23.9	30.9	34.8	42.6	52.9	63.6	60.5	54.5	43.7	34.3	23.5	**41.2**
1954	19.0	29.0	23.1	38.9	47.7	49.7	64.2	57.6	51.3	39.5	36.6	19.3	**39.7**
1955	13.9	15.4	18.3	33.7	43.8	53.5	61.2	62.3	49.9	42.4	19.1	16.0	**35.8**
1956	15.4	14.3	25.4	38.2	48.9	55.3	61.7	57.4	52.2	39.7	26.8	25.3	**38.4**
1957	5.4	22.0	29.6	35.7	49.2	54.7	62.3	60.8	51.0	39.3	25.9	25.5	**38.4**
1958	18.8	29.1	25.2	35.8	53.6	54.4	58.0	62.5	49.8	42.9	27.5	26.7	**40.3**
1959	20.7	14.0	27.8	37.2	41.5	55.8	60.7	57.3	48.0	39.6	21.5	21.8	**37.2**
1960	13.4	15.5	26.4	36.5	45.0	55.5	65.1	57.2	51.9	40.4	29.2	19.8	**38.0**
1961	23.0	31.7	30.6	35.3	47.4	60.7	64.4	65.4	44.6	38.5	24.0	16.5	**40.2**
1962	6.7	17.7	21.8	41.3	46.1	54.8	59.5	58.3	51.0	43.9	27.1	22.9	**37.6**
1963	7.4	34.4	35.2	38.6	50.0	55.0	62.5	62.8	57.9	47.3	32.1	17.4	**41.7**
1964	17.0	19.2	24.8	36.3	47.5	54.6	65.2	57.9	49.5	42.8	27.9	18.2	**38.4**
1965	23.0	23.3	20.2	40.6	43.9	54.8	62.0	59.2	41.0	44.8	34.1	19.6	**38.9**
1966	20.2	18.0	27.9	37.1	51.4	54.3	65.6	61.3	56.1	41.4	30.9	19.8	**40.3**
1967	23.0	25.0	25.0	31.8	43.8	53.2	63.7	63.7	55.7	40.9	28.2	12.9	**38.9**
1968	11.5	22.3	33.8	34.5	43.6	53.0	62.6	57.0	49.2	39.8	25.6	14.9	**37.3**
1969	13.4	14.2	20.5	41.7	50.8	53.4	61.1	62.6	53.0	35.1	31.2	20.8	**38.1**
1970	18.3	29.7	23.5	33.4	48.5	59.2	65.0	64.7	47.5	37.2	29.3	17.3	**39.4**
1971	23.1	27.1	26.6	37.9	48.2	54.3	62.2	66.8	46.9	37.3	29.0	15.0	**39.5**
1972	16.8	22.7	36.2	37.2	47.8	57.9	60.4	63.4	49.2	39.3	27.7	11.6	**39.2**
1973	13.8	15.2	29.3	35.5	47.9	55.9	64.0	62.8	50.4	41.9	27.3	24.0	**39.0**
1974	13.8	25.3	27.8	41.1	43.6	60.7	65.2	59.4	51.8	42.9	30.8	17.5	**40.0**
1975	13.4	9.4	17.8	24.9	40.2	49.1	62.5	55.2	48.7	38.5	25.4	22.8	**34.0**
1976	20.6	23.5	24.5	39.1	52.4	54.1	63.3	60.1	52.6	40.6	29.6	23.0	**40.3**
1977	11.5	26.3	26.4	42.8	47.8	60.2	60.8	59.7	50.5	41.6	28.4	21.4	**39.8**
1978	20.7	22.4	33.5	40.2	44.7	56.2	63.1	58.8	51.9	41.7	18.8	6.0	**38.2**
1979	-1.8	19.5	29.3	37.9	47.7	56.4	62.6	60.2	54.9	41.5	20.7	27.1	**38.0**
1980	9.2	22.5	25.8	42.3	48.7	54.8	63.2	58.3	53.5	41.2	29.4	31.2	**40.0**
1981	26.9	25.8	34.9	41.9	48.1	55.9	63.5	66.0	54.8	41.5	30.8	20.5	**42.5**
1982	16.2	13.8	25.1	32.0	45.0	56.0	62.5	63.5	49.7	39.6	21.6	14.3	**36.6**
1983	22.7	25.7	32.2	35.4	45.2	53.4	61.2	66.8	50.4	45.0	31.6	4.0	**39.5**
1984	23.3	25.1	31.9	35.9	47.5	53.9	64.0	64.5	47.9	37.7	26.6	10.1	**39.0**
1985	8.2	11.5	25.7	44.4	49.9	56.8	67.2	57.4	45.1	37.7	12.9	11.9	**35.7**
1986	22.7	23.0	38.2	38.7	47.5	60.0	57.7	62.2	46.6	41.3	24.8	17.9	**40.0**
1987	16.9	26.6	31.9	44.7	50.3	58.0	59.7	56.6	53.5	41.8	30.3	18.1	**40.7**
1988	12.8	26.8	30.6	41.4	48.6	61.5	64.2	60.6	50.4	46.9	28.3	18.8	**40.9**
1989	18.6	7.0	27.9	39.6	45.8	55.7	66.0	58.5	50.7	40.1	32.9	18.9	**38.5**
1990	24.4	23.7	31.4	41.8	45.0	54.2	63.0	62.1	57.3	39.4	32.5	10.2	**40.4**
1991	17.3	32.9	29.9	37.5	45.8	53.8	63.5	65.1	54.1	38.6	23.8	20.6	**40.2**
1992	19.5	28.8	38.7	42.3	51.1	58.4	58.4	60.2	51.4	44.0	26.0	13.5	**41.0**
1993	12.5	12.0	33.5	38.9	52.3	52.9	54.7	56.6	50.9	41.6	23.5	21.5	**37.6**
1994	27.8	18.7	34.3	40.6	50.7	56.6	62.2	63.3	55.6	38.7	22.9	19.6	**40.9**
1995	17.2	27.4	30.3	37.8	46.0	54.5	62.4	60.9	52.6	38.4	33.8	22.1	**40.3**
1996	14.9	21.7	26.4	40.2	44.9	57.7	64.7	61.4	50.4	40.0	28.5	20.7	**39.3**
1997	16.5	21.3	30.7	35.2	49.7	56.7	61.5	62.2	55.1	41.1	28.6	17.1	**39.6**
1998	21.7	24.0	30.7	40.7	49.6	51.6	67.2	65.0	58.2	41.4	33.0	17.3	**41.7**
1999	25.3	25.7	31.9	37.5	46.2	55.2	61.9	64.1	50.4	43.8	38.2	22.3	**41.9**
2000	22.6	29.7	34.6	43.6	49.0	57.6	65.6	63.9	50.6	41.0	15.3	14.3	**40.6**
2001	14.8	14.0	31.2	37.1	49.2	54.8	62.9	64.7	55.7	41.1	32.7	18.7	**39.7**
2002	19.8	20.7	22.4	36.0	45.6	55.4	65.2	57.6	51.9	34.2	27.1	23.0	**38.2**
2003	23.5	16.6	31.8	38.7	46.8	54.9	66.6	65.1	52.1	43.9	21.8	20.5	**40.2**
2004	17.2	21.4	36.9	40.9	45.9	54.3	62.7	59.9	49.5	41.2	29.5	26.0	**40.4**
2005	21.7	26.3	32.0	38.6	46.8	53.0	63.8	60.7	51.1	43.5	27.5	15.8	**40.0**
2006	25.3	18.2	30.6	41.0	49.3	59.2	67.8	60.7	51.9	39.1	29.5	19.1	**41.0**
2007	16.4	25.2	36.4	40.3	48.9	57.9	69.8	61.5	50.7	40.7	29.0	18.6	**41.3**
2008	14.8	24.1	26.8	32.9	46.0	53.3	62.7	60.7	49.8	40.4	33.3	15.5	**38.4**
2009	21.9	26.4	27.6	36.6	47.9	53.3	61.7	60.9	57.2	35.2	28.6	14.4	**39.3**
2010	21.3	21.0	34.0	38.6	42.3	53.6	60.7	59.2	52.5	44.4	24.7	17.3	**39.1**
2011	21.2	17.0	31.2	34.1	44.0	52.5	62.9	62.9	55.3	43.1	24.9	18.8	**39.0**
2012	25.2	23.9	36.1	42.1	45.4	56.2	66.6	63.2	54.4	39.5	28.9	19.5	**41.7**
2013	16.1	21.8	31.4	35.9	48.4	57.1	66.3	63.6	54.7	36.7	30.9	17.7	**40.0**
2014	24.5	14.2	30.3	38.8	47.7	53.0	65.5	61.1	52.5	45.7	24.4	22.3	**40.0**
Minimum	**-5.5**	**4.5**	**17.8**	**24.9**	**40.2**	**48.6**	**54.7**	**55.2**	**41.0**	**33.9**	**12.9**	**4.0**	**34.0**
Average	**18.7**	**22.5**	**29.6**	**39.0**	**47.6**	**55.5**	**63.5**	**61.6**	**51.9**	**41.9**	**29.2**	**20.6**	**40.1**
Maximum	**30.2**	**34.4**	**42.7**	**48.5**	**56.7**	**64.4**	**69.8**	**67.5**	**59.0**	**49.5**	**41.1**	**33.4**	**44.8**

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0	23JUN'17	ISSUED WITH LETTER VA17-00828	NWS	JGC
REV	DATE	DESCRIPTION	PREP'D	RVW'D

APPENDIX C

CALIBRATED WATER BALANCE MODEL RESULTS

(Pages C-1 to C-2)

Knight Piésold
CONSULTING

TABLE C1

MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

ANNUAL WATER BALANCE RESULTS

Print Jun/22/17 10:27:03

Flow Path Number	Description	Annual Volume (MGPD)																												
		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	MR Concentrator																													
	Inflows																													
1	Water in Ore	0.3	0.4	0.4	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.2	0.0	0.0	0.0	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.4
2	Continental Pit Dewatering	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.0	0.0	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3a	Recycled Water from HsB Water Treatment Plant	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	0.3	1.5	2.6	3.6	4.3	4.2	4.1	4.2	4.5	4.6	3.8	4.1	4.3
4	YDTI Reclaim to Process	14.9	20.3	20.4	20.0	20.6	20.9	19.6	17.8	17.1	18.6	17.4	22.6	22.0	9.4	0.0	0.0	1.6	18.6	18.7	17.6	17.3	16.9	17.0	15.8	15.1	16.7	16.2	16.1	16.1
5	Berkeley Pit Groundwater Wells	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
6	Runoff to MR Concentrator	0.3	0.2	0.4	0.2	0.3	0.3	0.4	0.3	0.5	0.4	0.6	0.4	0.3	0.1	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3
	Outflows																													
7	Water in Tailings Slurry	15.6	21.0	21.3	20.8	21.4	21.7	20.5	18.5	18.1	19.5	18.5	23.5	22.9	9.7	0.0	0.0	2.0	21.0	22.2	22.1	22.4	21.9	22.0	20.9	20.4	22.1	20.9	21.0	21.6
8	Water for Dust Control	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	0.1	0.0	0.0	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Water in Concentrate/Mill Losses	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Balance																													
	Total Inflows	15.9	21.3	21.6	21.1	21.7	22.1	20.8	18.8	18.4	19.8	18.8	23.8	23.2	9.9	0.0	0.0	2.0	21.3	22.5	22.4	22.7	22.2	22.3	21.2	20.7	22.4	21.2	21.3	21.9
	Total Outflows	15.9	21.3	21.6	21.1	21.7	22.1	20.8	18.8	18.4	19.8	18.8	23.8	23.2	9.9	0.0	0.0	2.0	21.3	22.5	22.4	22.7	22.2	22.3	21.2	20.7	22.4	21.2	21.3	21.9
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Yankee Doodle Tailings Impoundment																													
	Inflows																													
10	Direct Precipitation on Pond/Beach	0.8	0.5	1.0	0.6	0.7	0.7	1.2	0.7	1.4	1.1	1.7	1.0	0.8	0.6	0.7	0.5	0.4	0.5	0.5	0.6	0.7	0.6	0.8	1.0	0.9	0.6	0.8	0.9	0.9
11	Runoff to Tailings Impoundment	0.8	0.5	0.9	0.6	0.7	0.7	1.1	0.7	1.2	1.0	1.4	0.9	0.7	0.5	0.6	0.6	0.5	0.7	0.7	0.8	0.8	0.5	0.8	0.9	0.7	0.5	0.7	0.8	0.8
7	Water in Tailings Slurry	15.6	21.0	21.3	20.8	21.4	21.7	20.5	18.5	18.1	19.5	18.5	23.5	22.9	9.7	0.0	0.0	2.0	21.0	22.2	22.1	22.4	21.9	22.0	20.9	20.4	22.1	20.9	21.0	21.6
3b	Collected Water from HsB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	4.6	5.5	5.9	2.6	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
	Outflows																													
13	Pond Evaporation	1.3	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.2	1.2	1.2	1.4	1.3	1.4	1.3	0.6	0.6	0.6	0.6	0.6	0.9	1.1	1.1	1.3	1.6	1.5	1.4	1.5	1.5
14	Water lost in Tailings Voids	3.2	4.3	4.3	4.2	4.4	4.4	4.2	3.8	3.7	4.0	3.8	4.8	4.7	2.0	0.0	0.0	0.4	4.3	4.5	4.5	4.6	4.4	4.5	4.3	4.2	4.5	4.2	4.3	4.4
15	Seepage from Impoundment	3.8	4.0	3.7	3.9	3.8	3.8	3.5	3.8	3.4	3.4	3.6	4.9	5.5	4.2	2.5	1.9	1.4	1.3	2.4	3.4	4.2	4.3	4.1	4.1	4.5	4.8	3.8	4.0	4.3
4	Tailings Reclaim Water for Process	14.9	20.3	20.4	20.0	20.6	20.9	19.6	17.8	17.1	18.6	17.4	22.6	22.0	9.4	0.0	0.0	1.6	18.6	18.7	17.6	17.3	16.9	17.0	15.8	15.1	16.7	16.2	16.1	16.1
	Balance																													
	Total Inflows	17.2	22.0	23.2	21.9	22.8	23.1	22.7	19.9	20.7	24.7	26.2	30.9	30.3	13.4	1.3	1.1	2.9	22.1	23.5	23.5	23.9	23.0	23.6	22.8	21.9	23.3	22.4	22.7	23.2
	Total Outflows	23.1	30.0	29.7	29.4	30.0	30.6	28.5	26.7	25.4	27.2	26.0	33.6	33.4	16.9	3.8	2.5	4.0	24.7	26.2	26.2	27.0	26.8	26.7	25.6	25.3	27.5	25.6	25.9	26.2
12	Silver Lake Transfer Water (based on measured/min flows)	6.0	10.6	7.3	5.7	4.1	4.1	4.0	4.0	3.8	2.5	2.7	1.6	1.5	0.7	0.0	0.0	0.9	7.9	8.9	7.1	4.6	3.6	3.4	3.0	1.8	3.7	6.9	7.5	6.3
12	Silver Lake Transfer Water (based on model)	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Change in YDTI Pond Volume	0.1	2.7	0.9	-1.8	-3.1	-3.4	-1.7	-2.8	-0.8	0.0	2.8	-1.1	-1.6	-2.8	-2.6	-1.4	-0.3	5.3	6.1	4.5	1.6	-0.2	0.4	0.2	-1.6	-0.5	3.6	4.3	3.3
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Horseshoe Bend and/or Water Treatment Plant																													
	Inflows																													
15	Seepage from Impoundment	3.8	4.0	3.7	3.9	3.8	3.8	3.5	3.8	3.4	3.4	3.6	4.9	5.5	4.2	2.5	1.9	1.4	1.3	2.4	3.4	4.2	4.3	4.1	4.1	4.5	4.8	3.8	4.0	4.3
16	Runoff to Horseshoe Bend	0.5	0.3	0.6	0.4	0.5	0.5	0.7	0.4	0.9	0.6	1.0	0.6	0.5	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.5	0.4	0.5	0.6	0.5	0.4	0.5	0.5	0.5
	Outflows																													
3	Treated Water to MR Concentrator or the Environment / Collected Water to Berkeley Pit or YDTI	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.5	2.6	3.6	4.3	4.2	4.1	4.2	4.5	4.6	3.8	4.1	4.3
17	Sludge to Berkeley Pit	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	0.2	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5
	Balance																													
	Total Inflows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.7	2.9	4.0	4.8	4.7	4.6	4.7	5.0	5.2	4.3	4.6	4.8
	Total Outflows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.7	2.9	4.0	4.7	4.7	4.6	4.7	5.0	5.2	4.3	4.6	4.8
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

M:\1\01\00126\16\A\Data\Task 735 Water Balance Update\Results\[MR_WBM_Permitting_034.xlsx]Table C1A

0	20JUN'17	ISSUED WITH LETTER VA17-00828	NWS	RSS
REV	DATE	DESCRIPTION	PREP'D	RVW'D

TABLE C1 CONTINUED

MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

ANNUAL WATER BALANCE RESULTS

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Flow Path Number	Description	Annual Volume (MGPD)																	
		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Post Closure
	MR Concentrator																		
	Inflows																		
1	Water in Ore	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.0	0.0
2	Continental Pit Dewatering	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0
3a	Recycled Water from HsB Water Treatment Plant	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	0.0	0.0
4	YDTI Reclaim to Process	16.6	16.5	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.5	16.5	16.5	0.0	0.0
5	Berkeley Pit Groundwater Wells	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	0.0
6	Runoff to MR Concentrator	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	0.0
	Outflows																		
7	Water in Tailings Slurry	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	0.0	0.0
8	Water for Dust Control	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	0.0
9	Water in Concentrate/Mill Losses	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	0.0
	Balance																		
	Total Inflows	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	0.0	0.0
	Total Outflows	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	0.0	0.0
	Balance	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	0.0
	Yankee Doodle Tailings Impoundment																		
	Inflows																		
10	Direct Precipitation on Pond/Beach	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.5
11	Runoff to Tailings Impoundment	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6
7	Water in Tailings Slurry	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	0.0	0.0
3b	Collected Water from HsB	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	0.0
	Outflows																		
13	Pond Evaporation	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	0.9	0.6
14	Water lost in Tailings Voids	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0.0	0.0
15	Seepage from Impoundment	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.4	1.0
4	Tailings Reclaim Water for Process	16.6	16.5	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.5	16.5	16.5	0.0	0.0
	Balance																		
	Total Inflows	23.8	23.7	23.6	23.6	23.6	23.5	23.5	23.5	23.6	23.5	23.5	23.5	23.5	23.5	23.4	23.5	1.3	1.1
	Total Outflows	27.0	26.8	26.7	26.6	26.6	26.4	26.4	26.3	26.3	26.3	26.2	26.2	26.2	26.2	26.2	26.1	4.3	1.5
12	Silver Lake Transfer Water (based on measured/min flows)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0
12	Silver Lake Transfer Water (based on model)	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	0.0
	Change in YDTI Pond Volume	-1.2	-1.1	-1.0	-1.0	-0.9	-0.9	-0.9	-0.8	-0.8	-0.8	-0.8	-0.7	-0.7	-0.7	-0.7	-0.7	-3.0	-0.4
	Balance	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	0.0
	Horseshoe Bend and/or Water Treatment Plant																		
	Inflows																		
15	Seepage from Impoundment	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.4	1.0
16	Runoff to Horseshoe Bend	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Outflows																		
3	Treated Water to MR Concentrator or the Environment / Collected Water to Berkeley Pit or YDTI	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.5	1.3
17	Sludge to Berkeley Pit	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.1
	Balance																		
	Total Inflows	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.0	1.4
	Total Outflows	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.0	1.4
	Balance	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	0.0

M:\1\01\00126\16\A\Data\Task 735 Water Balance Update\Results\[MR_WBM_Permitting_034.xlsx]Table C1B

REV	DATE	DESCRIPTION	PREP'D	RVW'D
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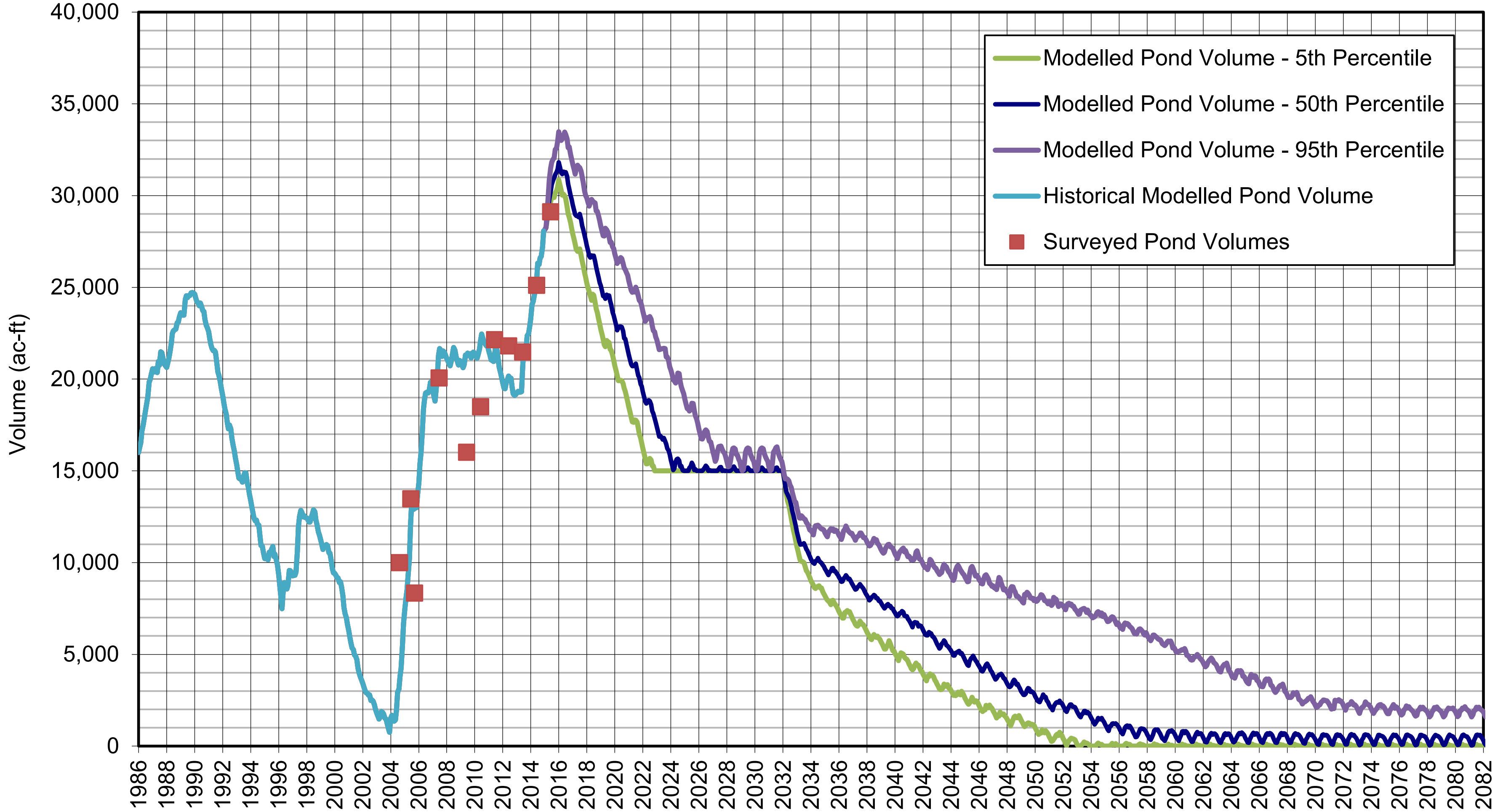
APPENDIX D

SILVER LAKE PUMPING SENSITIVITY ANALYSIS WATER BALANCE MODEL RESULTS

(Pages D-1 to D-9)



NOTES:

1. 15% RUNOFF COEFFICIENT FOR UNDISTURBED AREAS, 25% RUNOFF COEFFICIENT FOR DISTURBED AREAS, AND 16,000 AC-FT STARTING POND VOLUME.
2. INCLUDES MINIMUM SILVER LAKE INFLOWS OF 1.0 MGPD FROM JAN 2016 TO DEC 2031.
3. 15,000 AC-FT MINIMUM POND VOLUME FROM NOV 2015 TO DEC 2031.

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MONTANA RESOURCES, LLP

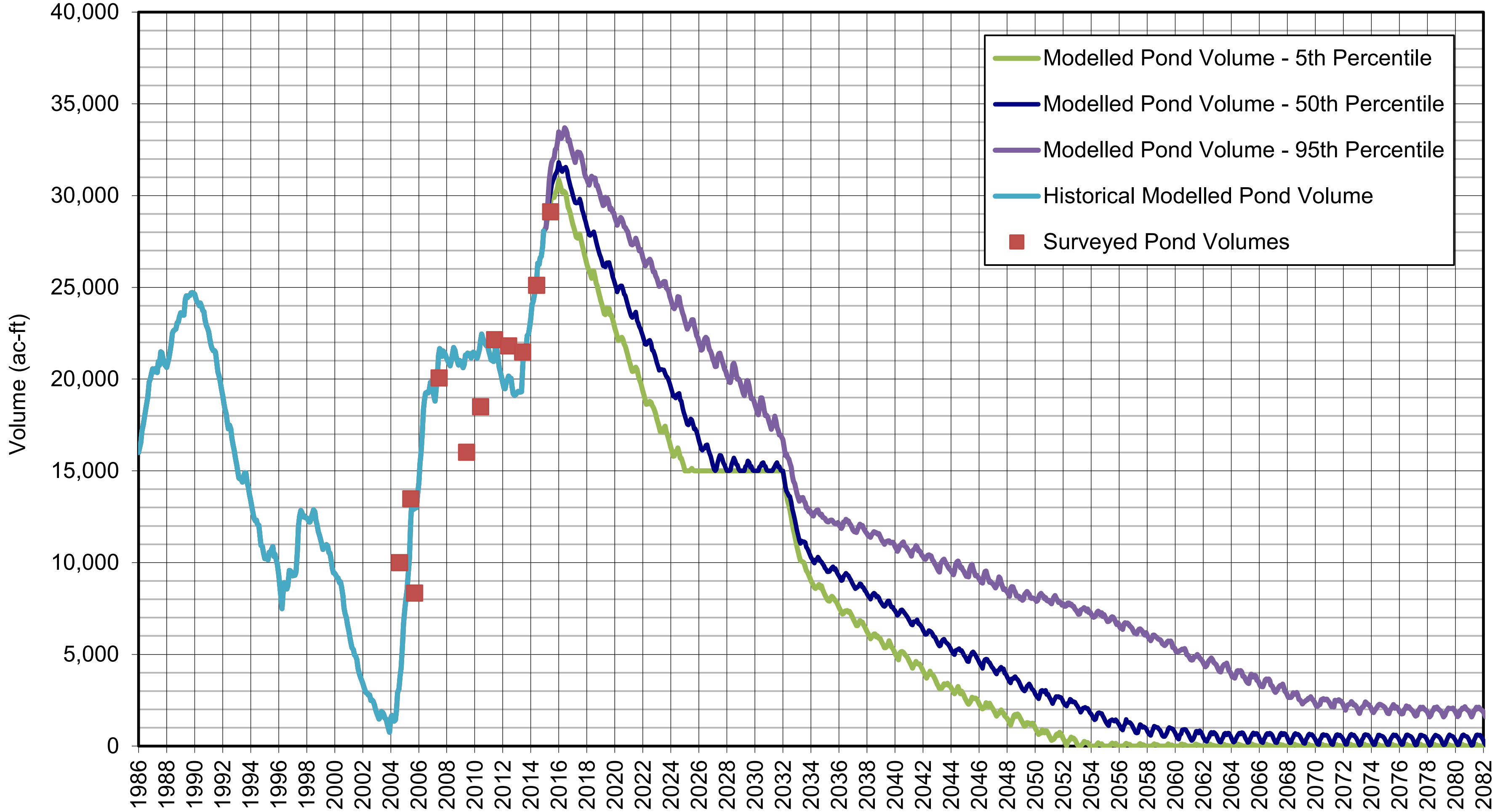
YANKEE DOODLE TAILINGS IMPOUNDMENT

YANKEE DOODLE TAILINGS IMPOUNDMENT
SIMULATED SUPERNATANT POND VOLUMES
MINIMUM SILVER LAKE INFLOWS OF 1.0 MGPD

Knight Piésold CONSULTING

P/A NO.	REF. NO.
VA101-126/12	VA17-00828

FIGURE D1 — REV 0



NOTES:
1. 15% RUNOFF COEFFICIENT FOR UNDISTURBED AREAS, 25% RUNOFF COEFFICIENT FOR DISTURBED AREAS, AND 16,000 AC-FT STARTING POND VOLUME.
2. INCLUDES MINIMUM SILVER LAKE INFLOWS OF 1.5 MGPD FROM JAN 2016 TO DEC 2031.
3. 15,000 AC-FT MINIMUM POND VOLUME FROM NOV 2015 TO DEC 2031.

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REV	DATE	DESCRIPTION	PREP'D	RVW'D

MONTANA RESOURCES, LLP

YANKEE DOODLE TAILINGS IMPOUNDMENT

YANKEE DOODLE TAILINGS IMPOUNDMENT
SIMULATED SUPERNATANT POND VOLUMES
MINIMUM SILVER LAKE INFLOWS OF 1.5 MGPD

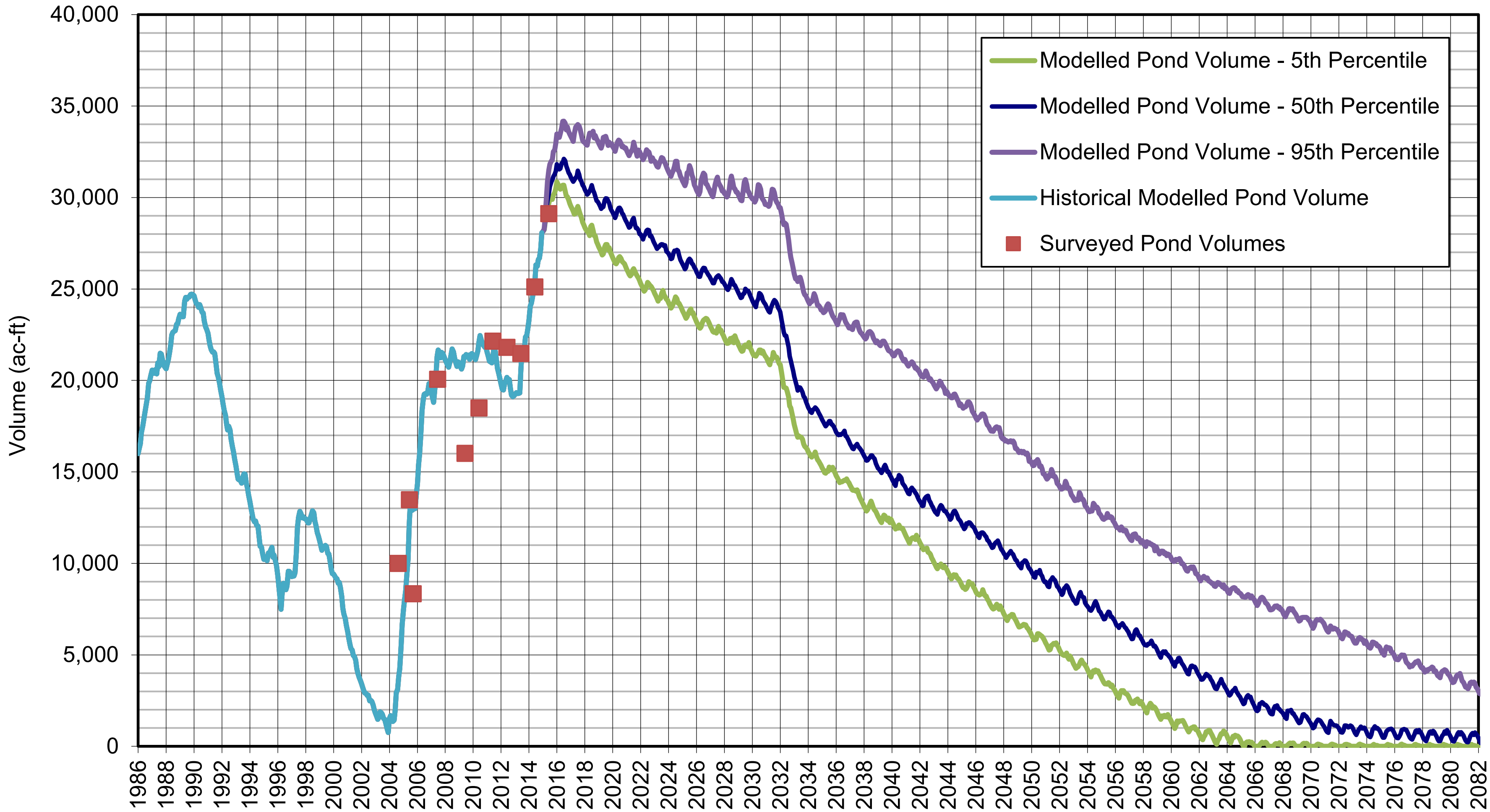
Knight Piésold CONSULTING

P/A NO. VA101-126/12

REF. NO. VA17-00828

FIGURE D2

REV 0



NOTES:
1. 15% RUNOFF COEFFICIENT FOR UNDISTURBED AREAS, 25% RUNOFF COEFFICIENT FOR DISTURBED AREAS, AND 16,000 AC-FT STARTING POND VOLUME.
2. INCLUDES MINIMUM SILVER LAKE INFLOWS OF 2.5 MGPD FROM JAN 2016 TO DEC 2031.
3. 15,000 AC-FT MINIMUM POND VOLUME FROM NOV 2015 TO DEC 2031.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	20JUN'17	ISSUED WITH LETTER	NWS	RSS

MONTANA RESOURCES, LLP

YANKEE DOODLE TAILINGS IMPOUNDMENT

YANKEE DOODLE TAILINGS IMPOUNDMENT
SIMULATED SUPERNATANT POND VOLUMES
MINIMUM SILVER LAKE INFLOWS OF 2.5 MGPD

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P/A NO. VA101-126/12

REF. NO. VA17-00828

FIGURE D3

REV 0

Knight Piésold
CONSULTING

TABLE D1

MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

ANNUAL WATER BALANCE RESULTS - MINIMUM SILVER LAKE INFLOWS OF 1.0 MGPD

Print Jun/22/17 11:27:30

Flow Path Number	Description	Annual Volume (MGPD)																												
		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	MR Concentrator																													
	Inflows																													
1	Water in Ore	0.3	0.4	0.4	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.2	0.0	0.0	0.0	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.4
2	Continental Pit Dewatering	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.0	0.0	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3a	Recycled Water from HsB Water Treatment Plant	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	0.3	1.5	2.6	3.6	4.3	4.2	4.1	4.2	4.5	4.6	3.8	4.1	4.3
4	YDTI Reclaim to Process	14.9	20.3	20.4	20.0	20.6	20.9	19.6	17.8	17.1	18.6	17.4	22.6	22.0	9.4	0.0	0.0	1.6	18.6	18.7	17.6	17.3	16.9	17.0	15.8	15.1	16.7	16.2	16.1	16.1
5	Berkeley Pit Groundwater Wells	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
6	Runoff to MR Concentrator	0.3	0.2	0.4	0.2	0.3	0.3	0.4	0.3	0.5	0.4	0.6	0.4	0.3	0.1	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3
	Outflows																													
7	Water in Tailings Slurry	15.6	21.0	21.3	20.8	21.4	21.7	20.5	18.5	18.1	19.5	18.5	23.5	22.9	9.7	0.0	0.0	2.0	21.0	22.2	22.1	22.4	21.9	22.0	20.9	20.4	22.1	20.9	21.0	21.6
8	Water for Dust Control	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	0.1	0.0	0.0	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Water in Concentrate/Mill Losses	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Balance																													
	Total Inflows	15.9	21.3	21.6	21.1	21.7	22.1	20.8	18.8	18.4	19.8	18.8	23.8	23.2	9.9	0.0	0.0	2.0	21.3	22.5	22.4	22.7	22.2	22.3	21.2	20.7	22.4	21.2	21.3	21.9
	Total Outflows	15.9	21.3	21.6	21.1	21.7	22.1	20.8	18.8	18.4	19.8	18.8	23.8	23.2	9.9	0.0	0.0	2.0	21.3	22.5	22.4	22.7	22.2	22.3	21.2	20.7	22.4	21.2	21.3	21.9
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Yankee Doodle Tailings Impoundment																													
	Inflows																													
10	Direct Precipitation on Pond/Beach	0.8	0.5	1.0	0.6	0.7	0.7	1.2	0.7	1.4	1.1	1.7	1.0	0.8	0.6	0.7	0.5	0.4	0.5	0.5	0.6	0.7	0.6	0.8	1.0	0.9	0.6	0.8	0.9	0.9
11	Runoff to Tailings Impoundment	0.8	0.5	0.9	0.6	0.7	0.7	1.1	0.7	1.2	1.0	1.4	0.9	0.7	0.5	0.6	0.6	0.5	0.7	0.7	0.8	0.8	0.5	0.8	0.9	0.7	0.5	0.7	0.8	0.8
7	Water in Tailings Slurry	15.6	21.0	21.3	20.8	21.4	21.7	20.5	18.5	18.1	19.5	18.5	23.5	22.9	9.7	0.0	0.0	2.0	21.0	22.2	22.1	22.4	21.9	22.0	20.9	20.4	22.1	20.9	21.0	21.6
3b	Collected Water from HsB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	4.6	5.5	5.9	2.6	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
	Outflows																													
13	Pond Evaporation	1.3	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.2	1.2	1.2	1.4	1.3	1.4	1.3	0.6	0.6	0.6	0.6	0.6	0.9	1.1	1.1	1.3	1.6	1.5	1.4	1.5	1.5
14	Water lost in Tailings Voids	3.2	4.3	4.3	4.2	4.4	4.4	4.2	3.8	3.7	4.0	3.8	4.8	4.7	2.0	0.0	0.0	0.4	4.3	4.5	4.5	4.6	4.4	4.5	4.3	4.2	4.5	4.2	4.3	4.4
15	Seepage from Impoundment	3.8	4.0	3.7	3.9	3.8	3.8	3.5	3.8	3.4	3.4	3.6	4.9	5.5	4.2	2.5	1.9	1.4	1.3	2.4	3.4	4.2	4.3	4.1	4.1	4.5	4.8	3.8	4.0	4.3
4	Tailings Reclaim Water for Process	14.9	20.3	20.4	20.0	20.6	20.9	19.6	17.8	17.1	18.6	17.4	22.6	22.0	9.4	0.0	0.0	1.6	18.6	18.7	17.6	17.3	16.9	17.0	15.8	15.1	16.7	16.2	16.1	16.1
	Balance																													
	Total Inflows	17.2	22.0	23.2	21.9	22.8	23.1	22.7	19.9	20.7	24.7	26.2	30.9	30.3	13.4	1.3	1.1	2.9	22.1	23.5	23.5	23.9	23.0	23.6	22.8	21.9	23.3	22.4	22.7	23.2
	Total Outflows	23.1	30.0	29.7	29.4	30.0	30.6	28.5	26.7	25.4	27.2	26.0	33.6	33.4	16.9	3.8	2.5	4.0	24.7	26.2	26.2	27.0	26.8	26.7	25.6	25.3	27.5	25.6	25.9	26.2
12	Silver Lake Transfer Water (based on measured/min flows)	6.0	10.6	7.3	5.7	4.1	4.1	4.0	4.0	3.8	2.5	2.7	1.6	1.5	0.7	0.0	0.0	0.9	7.9	8.9	7.1	4.6	3.6	3.4	3.0	1.8	3.7	6.9	7.5	6.3
12	Silver Lake Transfer Water (based on model)	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Change in YDTI Pond Volume	0.1	2.7	0.9	-1.8	-3.1	-3.4	-1.7	-2.8	-0.8	0.0	2.8	-1.1	-1.6	-2.8	-2.6	-1.4	-0.3	5.3	6.1	4.5	1.6	-0.2	0.4	0.2	-1.6	-0.5	3.6	4.3	3.3
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Horseshoe Bend and/or Water Treatment Plant																													
	Inflows																													
15	Seepage from Impoundment	3.8	4.0	3.7	3.9	3.8	3.8	3.5	3.8	3.4	3.4	3.6	4.9	5.5	4.2	2.5	1.9	1.4	1.3	2.4	3.4	4.2	4.3	4.1	4.1	4.5	4.8	3.8	4.0	4.3
16	Runoff to Horseshoe Bend	0.5	0.3	0.6	0.4	0.5	0.5	0.7	0.4	0.9	0.6	1.0	0.6	0.5	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.5	0.4	0.5	0.6	0.5	0.4	0.5	0.5	0.5
	Outflows																													
3	Treated Water to MR Concentrator or the Environment / Collected Water to Berkeley Pit or YDTI	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.5	2.6	3.6	4.3	4.2	4.1	4.2	4.5	4.6	3.8	4.1	4.3
17	Sludge to Berkeley Pit	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	0.2	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5
	Balance																													
	Total Inflows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.7	2.9	4.0	4.8	4.7	4.6	4.7	5.0	5.2	4.3	4.6	4.8
	Total Outflows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.7	2.9	4.0	4.7	4.7	4.6	4.7	5.0	5.2	4.3	4.6	4.8
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

M:\1\01\00126\16\A\Data\Task 735 Water Balance Update\Results\[MR_WBM_Permitting_035.xlsx]Table D1A

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	20JUN'17	ISSUED WITH LETTER VA17-00828	NWS	RSS

Knight Piésold
CONSULTING

TABLE D1 CONTINUED

MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

ANNUAL WATER BALANCE RESULTS - MINIMUM SILVER LAKE INFLOWS OF 1.0 MGPD

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Flow Path Number	Description	Annual Volume (MGPD)																	
		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Post Closure
	MR Concentrator																		
	Inflows																		
1	Water in Ore	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.0	0.0
2	Continental Pit Dewatering	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0
3a	Recycled Water from HsB Water Treatment Plant	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	0.0	0.0
4	YDTI Reclaim to Process	16.6	16.5	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.5	16.5	16.5	0.0	0.0
5	Berkeley Pit Groundwater Wells	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	0.0
6	Runoff to MR Concentrator	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	0.0
	Outflows																		
7	Water in Tailings Slurry	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	0.0	0.0
8	Water for Dust Control	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	0.0
9	Water in Concentrate/Mill Losses	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	0.0
	Balance																		
	Total Inflows	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	0.0	0.0
	Total Outflows	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	0.0	0.0
	Balance	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	0.0
	Yankee Doodle Tailings Impoundment																		
	Inflows																		
10	Direct Precipitation on Pond/Beach	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.5
11	Runoff to Tailings Impoundment	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6
7	Water in Tailings Slurry	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	0.0	0.0
3b	Collected Water from HsB	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	0.0
	Outflows																		
13	Pond Evaporation	1.7	1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.5
14	Water lost in Tailings Voids	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0.0	0.0
15	Seepage from Impoundment	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.4	1.0
4	Tailings Reclaim Water for Process	16.6	16.5	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.5	16.5	16.5	0.0	0.0
	Balance																		
	Total Inflows	23.8	23.6	23.6	23.5	23.5	23.4	23.4	23.4	23.5	23.4	23.4	23.4	23.5	23.4	23.4	23.4	1.3	1.1
	Total Outflows	26.9	26.6	26.5	26.4	26.3	26.2	26.2	26.1	26.2	26.1	26.1	26.1	26.1	26.1	26.1	26.1	4.3	1.4
12	Silver Lake Transfer Water (based on measured/min flows)	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	0.0	0.0
12	Silver Lake Transfer Water (based on model)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.4	1.6	1.6	1.6	1.6	1.6	1.6	0.0	0.0
	Change in YDTI Pond Volume	-2.2	-2.0	-1.9	-1.8	-1.8	-1.8	-1.7	-1.7	-0.7	-0.3	-0.1	-0.1	-0.1	0.0	0.0	0.0	-3.0	-0.3
	Balance	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	0.0
	Horseshoe Bend and/or Water Treatment Plant																		
	Inflows																		
15	Seepage from Impoundment	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.4	1.0
16	Runoff to Horseshoe Bend	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Outflows																		
3	Treated Water to MR Concentrator or the Environment / Collected Water to Berkeley Pit or YDTI	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.5	1.3
17	Sludge to Berkeley Pit	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.1
	Balance																		
	Total Inflows	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.0	1.4
	Total Outflows	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.0	1.4
	Balance	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	0.0

M:\1\01\00126\16\A\Data\Task 735 Water Balance Update\Results\[MR_WBM_Permitting_035.xlsx]Table D1B

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	20JUN'17	ISSUED WITH LETTER VA17-00828	NWS	RSS

Knight Piésold CONSULTING

TABLE D2

MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

ANNUAL WATER BALANCE RESULTS - MINIMUM SILVER LAKE INFLOWS OF 1.5 MGPD

Print Jun/22/17 11:30:04

Flow Path Number	Description	Annual Volume (MGPD)																												
		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	MR Concentrator																													
	Inflows																													
1	Water in Ore	0.3	0.4	0.4	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.2	0.0	0.0	0.0	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.4
2	Continental Pit Dewatering	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.0	0.0	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3a	Recycled Water from HsB Water Treatment Plant	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	0.3	1.5	2.6	3.6	4.3	4.2	4.1	4.2	4.5	4.6	3.8	4.1	4.3
4	YDTI Reclaim to Process	14.9	20.3	20.4	20.0	20.6	20.9	19.6	17.8	17.1	18.6	17.4	22.6	22.0	9.4	0.0	0.0	1.6	18.6	18.7	17.6	17.3	16.9	17.0	15.8	15.1	16.7	16.2	16.1	16.1
5	Berkeley Pit Groundwater Wells	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
6	Runoff to MR Concentrator	0.3	0.2	0.4	0.2	0.3	0.3	0.4	0.3	0.5	0.4	0.6	0.4	0.3	0.1	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3
	Outflows																													
7	Water in Tailings Slurry	15.6	21.0	21.3	20.8	21.4	21.7	20.5	18.5	18.1	19.5	18.5	23.5	22.9	9.7	0.0	0.0	2.0	21.0	22.2	22.1	22.4	21.9	22.0	20.9	20.4	22.1	20.9	21.0	21.6
8	Water for Dust Control	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	0.1	0.0	0.0	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Water in Concentrate/Mill Losses	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Balance																													
	Total Inflows	15.9	21.3	21.6	21.1	21.7	22.1	20.8	18.8	18.4	19.8	18.8	23.8	23.2	9.9	0.0	0.0	2.0	21.3	22.5	22.4	22.7	22.2	22.3	21.2	20.7	22.4	21.2	21.3	21.9
	Total Outflows	15.9	21.3	21.6	21.1	21.7	22.1	20.8	18.8	18.4	19.8	18.8	23.8	23.2	9.9	0.0	0.0	2.0	21.3	22.5	22.4	22.7	22.2	22.3	21.2	20.7	22.4	21.2	21.3	21.9
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Yankee Doodle Tailings Impoundment																													
	Inflows																													
10	Direct Precipitation on Pond/Beach	0.8	0.5	1.0	0.6	0.7	0.7	1.2	0.7	1.4	1.1	1.7	1.0	0.8	0.6	0.7	0.5	0.4	0.5	0.5	0.6	0.7	0.6	0.8	1.0	0.9	0.6	0.8	0.9	0.9
11	Runoff to Tailings Impoundment	0.8	0.5	0.9	0.6	0.7	0.7	1.1	0.7	1.2	1.0	1.4	0.9	0.7	0.5	0.6	0.6	0.5	0.7	0.7	0.8	0.8	0.5	0.8	0.9	0.7	0.5	0.7	0.8	0.8
7	Water in Tailings Slurry	15.6	21.0	21.3	20.8	21.4	21.7	20.5	18.5	18.1	19.5	18.5	23.5	22.9	9.7	0.0	0.0	2.0	21.0	22.2	22.1	22.4	21.9	22.0	20.9	20.4	22.1	20.9	21.0	21.6
3b	Collected Water from HsB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	4.6	5.5	5.9	2.6	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
	Outflows																													
13	Pond Evaporation	1.3	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.2	1.2	1.2	1.4	1.3	1.4	1.3	0.6	0.6	0.6	0.6	0.6	0.9	1.1	1.1	1.3	1.6	1.5	1.4	1.5	1.5
14	Water lost in Tailings Voids	3.2	4.3	4.3	4.2	4.4	4.4	4.2	3.8	3.7	4.0	3.8	4.8	4.7	2.0	0.0	0.0	0.4	4.3	4.5	4.5	4.6	4.4	4.5	4.3	4.2	4.5	4.2	4.3	4.4
15	Seepage from Impoundment	3.8	4.0	3.7	3.9	3.8	3.8	3.5	3.8	3.4	3.4	3.6	4.9	5.5	4.2	2.5	1.9	1.4	1.3	2.4	3.4	4.2	4.3	4.1	4.1	4.5	4.8	3.8	4.0	4.3
4	Tailings Reclaim Water for Process	14.9	20.3	20.4	20.0	20.6	20.9	19.6	17.8	17.1	18.6	17.4	22.6	22.0	9.4	0.0	0.0	1.6	18.6	18.7	17.6	17.3	16.9	17.0	15.8	15.1	16.7	16.2	16.1	16.1
	Balance																													
	Total Inflows	17.2	22.0	23.2	21.9	22.8	23.1	22.7	19.9	20.7	24.7	26.2	30.9	30.3	13.4	1.3	1.1	2.9	22.1	23.5	23.5	23.9	23.0	23.6	22.8	21.9	23.3	22.4	22.7	23.2
	Total Outflows	23.1	30.0	29.7	29.4	30.0	30.6	28.5	26.7	25.4	27.2	26.0	33.6	33.4	16.9	3.8	2.5	4.0	24.7	26.2	26.2	27.0	26.8	26.7	25.6	25.3	27.5	25.6	25.9	26.2
12	Silver Lake Transfer Water (based on measured/min flows)	6.0	10.6	7.3	5.7	4.1	4.1	4.0	4.0	3.8	2.5	2.7	1.6	1.5	0.7	0.0	0.0	0.9	7.9	8.9	7.1	4.6	3.6	3.4	3.0	1.8	3.7	6.9	7.5	6.3
12	Silver Lake Transfer Water (based on model)	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Change in YDTI Pond Volume	0.1	2.7	0.9	-1.8	-3.1	-3.4	-1.7	-2.8	-0.8	0.0	2.8	-1.1	-1.6	-2.8	-2.6	-1.4	-0.3	5.3	6.1	4.5	1.6	-0.2	0.4	0.2	-1.6	-0.5	3.6	4.3	3.3
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Horseshoe Bend and/or Water Treatment Plant																													
	Inflows																													
15	Seepage from Impoundment	3.8	4.0	3.7	3.9	3.8	3.8	3.5	3.8	3.4	3.4	3.6	4.9	5.5	4.2	2.5	1.9	1.4	1.3	2.4	3.4	4.2	4.3	4.1	4.1	4.5	4.8	3.8	4.0	4.3
16	Runoff to Horseshoe Bend	0.5	0.3	0.6	0.4	0.5	0.5	0.7	0.4	0.9	0.6	1.0	0.6	0.5	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.5	0.4	0.5	0.6	0.5	0.4	0.5	0.5	0.5
	Outflows																													
3	Treated Water to MR Concentrator or the Environment / Collected Water to Berkeley Pit or YDTI	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.5	2.6	3.6	4.3	4.2	4.1	4.2	4.5	4.6	3.8	4.1	4.3
17	Sludge to Berkeley Pit	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	0.2	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5
	Balance																													
	Total Inflows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.7	2.9	4.0	4.8	4.7	4.6	4.7	5.0	5.2	4.3	4.6	4.8
	Total Outflows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.7	2.9	4.0	4.7	4.7	4.6	4.7	5.0	5.2	4.3	4.6	4.8
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

M:\1\01\00126\16\A\Data\Task 735 Water Balance Update\Results\[MR_WBM_Permitting_036.xlsx]Table D2A

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	20JUN'17	ISSUED WITH LETTER VA17-00828	NWS	RSS

Knight Piésold CONSULTING

TABLE D2 CONTINUED

MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

ANNUAL WATER BALANCE RESULTS - MINIMUM SILVER LAKE INFLOWS OF 1.5 MGPD

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Flow Path Number	Description	Annual Volume (MGPD)																	
		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Post Closure
	MR Concentrator																		
	Inflows																		
1	Water in Ore	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.0	0.0
2	Continental Pit Dewatering	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0
3a	Recycled Water from HsB Water Treatment Plant	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	0.0	0.0
4	YDTI Reclaim to Process	16.6	16.5	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.5	16.5	16.5	0.0	0.0
5	Berkeley Pit Groundwater Wells	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	0.0
6	Runoff to MR Concentrator	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	0.0
	Outflows																		
7	Water in Tailings Slurry	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	0.0	0.0
8	Water for Dust Control	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	0.0
9	Water in Concentrate/Mill Losses	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	0.0
	Balance																		
	Total Inflows	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	0.0	0.0
	Total Outflows	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	0.0	0.0
	Balance	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	0.0
	Yankee Doodle Tailings Impoundment																		
	Inflows																		
10	Direct Precipitation on Pond/Beach	1.0	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.5
11	Runoff to Tailings Impoundment	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6
7	Water in Tailings Slurry	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	0.0	0.0
3b	Collected Water from HsB	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	0.0
	Outflows																		
13	Pond Evaporation	1.7	1.5	1.4	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.5
14	Water lost in Tailings Voids	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0.0	0.0
15	Seepage from Impoundment	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.4	1.0
4	Tailings Reclaim Water for Process	16.6	16.5	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.5	16.5	16.5	0.0	0.0
	Balance																		
	Total Inflows	23.8	23.6	23.6	23.5	23.6	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.5	23.4	23.4	23.4	1.3	1.1
	Total Outflows	27.0	26.7	26.6	26.5	26.4	26.3	26.3	26.2	26.2	26.1	26.1	26.1	26.2	26.1	26.1	26.1	4.3	1.4
12	Silver Lake Transfer Water (based on measured/min flows)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.0	0.0
12	Silver Lake Transfer Water (based on model)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.8	1.0	1.0	1.0	0.0	0.0
	Change in YDTI Pond Volume	-1.7	-1.6	-1.5	-1.4	-1.3	-1.3	-1.3	-1.3	-1.2	-1.2	-1.2	-0.5	-0.4	-0.2	-0.1	-0.1	-3.0	-0.3
	Balance	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	0.0
	Horseshoe Bend and/or Water Treatment Plant																		
	Inflows																		
15	Seepage from Impoundment	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.4	1.0
16	Runoff to Horseshoe Bend	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Outflows																		
3	Treated Water to MR Concentrator or the Environment / Collected Water to Berkeley Pit or YDTI	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.5	1.3
17	Sludge to Berkeley Pit	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.1
	Balance																		
	Total Inflows	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.0	1.4
	Total Outflows	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.0	1.4
	Balance	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	0.0

M:\1\01\00126\16\A\Data\Task 735 Water Balance Update\Results\[MR_WBM_Permitting_036.xlsx]Table D2B

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	20JUN'17	ISSUED WITH LETTER VA17-00828	NWS	RSS

TABLE D3

MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

ANNUAL WATER BALANCE RESULTS - MINIMUM SILVER LAKE INFLOWS OF 2.5 MGPD

Print Jun/22/17 11:32:02

Flow Path Number	Description	Annual Volume (MGPD)																												
		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	MR Concentrator																													
	Inflows																													
1	Water in Ore	0.3	0.4	0.4	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.2	0.0	0.0	0.0	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.4
2	Continental Pit Dewatering	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.0	0.0	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3a	Recycled Water from HsB Water Treatment Plant	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	0.3	1.5	2.6	3.6	4.3	4.2	4.1	4.2	4.5	4.6	3.8	4.1	4.3
4	YDTI Reclaim to Process	14.9	20.3	20.4	20.0	20.6	20.9	19.6	17.8	17.1	18.6	17.4	22.6	22.0	9.4	0.0	0.0	1.6	18.6	18.7	17.6	17.3	16.9	17.0	15.8	15.1	16.7	16.2	16.1	16.1
5	Berkeley Pit Groundwater Wells	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
6	Runoff to MR Concentrator	0.3	0.2	0.4	0.2	0.3	0.3	0.4	0.3	0.5	0.4	0.6	0.4	0.3	0.1	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3
	Outflows																													
7	Water in Tailings Slurry	15.6	21.0	21.3	20.8	21.4	21.7	20.5	18.5	18.1	19.5	18.5	23.5	22.9	9.7	0.0	0.0	2.0	21.0	22.2	22.1	22.4	21.9	22.0	20.9	20.4	22.1	20.9	21.0	21.6
8	Water for Dust Control	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	0.1	0.0	0.0	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Water in Concentrate/Mill Losses	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Balance																													
	Total Inflows	15.9	21.3	21.6	21.1	21.7	22.1	20.8	18.8	18.4	19.8	18.8	23.8	23.2	9.9	0.0	0.0	2.0	21.3	22.5	22.4	22.7	22.2	22.3	21.2	20.7	22.4	21.2	21.3	21.9
	Total Outflows	15.9	21.3	21.6	21.1	21.7	22.1	20.8	18.8	18.4	19.8	18.8	23.8	23.2	9.9	0.0	0.0	2.0	21.3	22.5	22.4	22.7	22.2	22.3	21.2	20.7	22.4	21.2	21.3	21.9
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Yankee Doodle Tailings Impoundment																													
	Inflows																													
10	Direct Precipitation on Pond/Beach	0.8	0.5	1.0	0.6	0.7	0.7	1.2	0.7	1.4	1.1	1.7	1.0	0.8	0.6	0.7	0.5	0.4	0.5	0.5	0.6	0.7	0.6	0.8	1.0	0.9	0.6	0.8	0.9	0.9
11	Runoff to Tailings Impoundment	0.8	0.5	0.9	0.6	0.7	0.7	1.1	0.7	1.2	1.0	1.4	0.9	0.7	0.5	0.6	0.6	0.5	0.7	0.7	0.8	0.8	0.5	0.8	0.9	0.7	0.5	0.7	0.8	0.8
7	Water in Tailings Slurry	15.6	21.0	21.3	20.8	21.4	21.7	20.5	18.5	18.1	19.5	18.5	23.5	22.9	9.7	0.0	0.0	2.0	21.0	22.2	22.1	22.4	21.9	22.0	20.9	20.4	22.1	20.9	21.0	21.6
3b	Collected Water from HsB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	4.6	5.5	5.9	2.6	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
	Outflows																													
13	Pond Evaporation	1.3	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.2	1.2	1.2	1.4	1.3	1.4	1.3	0.6	0.6	0.6	0.6	0.6	0.9	1.1	1.1	1.3	1.6	1.5	1.4	1.5	1.5
14	Water lost in Tailings Voids	3.2	4.3	4.3	4.2	4.4	4.4	4.2	3.8	3.7	4.0	3.8	4.8	4.7	2.0	0.0	0.0	0.4	4.3	4.5	4.5	4.6	4.4	4.5	4.3	4.2	4.5	4.2	4.3	4.4
15	Seepage from Impoundment	3.8	4.0	3.7	3.9	3.8	3.8	3.5	3.8	3.4	3.4	3.6	4.9	5.5	4.2	2.5	1.9	1.4	1.3	2.4	3.4	4.2	4.3	4.1	4.1	4.5	4.8	3.8	4.0	4.3
4	Tailings Reclaim Water for Process	14.9	20.3	20.4	20.0	20.6	20.9	19.6	17.8	17.1	18.6	17.4	22.6	22.0	9.4	0.0	0.0	1.6	18.6	18.7	17.6	17.3	16.9	17.0	15.8	15.1	16.7	16.2	16.1	16.1
	Balance																													
	Total Inflows	17.2	22.0	23.2	21.9	22.8	23.1	22.7	19.9	20.7	24.7	26.2	30.9	30.3	13.4	1.3	1.1	2.9	22.1	23.5	23.5	23.9	23.0	23.6	22.8	21.9	23.3	22.4	22.7	23.2
	Total Outflows	23.1	30.0	29.7	29.4	30.0	30.6	28.5	26.7	25.4	27.2	26.0	33.6	33.4	16.9	3.8	2.5	4.0	24.7	26.2	26.2	27.0	26.8	26.7	25.6	25.3	27.5	25.6	25.9	26.2
12	Silver Lake Transfer Water (based on measured/min flows)	6.0	10.6	7.3	5.7	4.1	4.1	4.0	4.0	3.8	2.5	2.7	1.6	1.5	0.7	0.0	0.0	0.9	7.9	8.9	7.1	4.6	3.6	3.4	3.0	1.8	3.7	6.9	7.5	6.3
12	Silver Lake Transfer Water (based on model)	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Change in YDTI Pond Volume	0.1	2.7	0.9	-1.8	-3.1	-3.4	-1.7	-2.8	-0.8	0.0	2.8	-1.1	-1.6	-2.8	-2.6	-1.4	-0.3	5.3	6.1	4.5	1.6	-0.2	0.4	0.2	-1.6	-0.5	3.6	4.3	3.3
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Horseshoe Bend and/or Water Treatment Plant																													
	Inflows																													
15	Seepage from Impoundment	3.8	4.0	3.7	3.9	3.8	3.8	3.5	3.8	3.4	3.4	3.6	4.9	5.5	4.2	2.5	1.9	1.4	1.3	2.4	3.4	4.2	4.3	4.1	4.1	4.5	4.8	3.8	4.0	4.3
16	Runoff to Horseshoe Bend	0.5	0.3	0.6	0.4	0.5	0.5	0.7	0.4	0.9	0.6	1.0	0.6	0.5	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.5	0.4	0.5	0.6	0.5	0.4	0.5	0.5	0.5
	Outflows																													
3	Treated Water to MR Concentrator or the Environment / Collected Water to Berkeley Pit or YDTI	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.5	2.6	3.6	4.3	4.2	4.1	4.2	4.5	4.6	3.8	4.1	4.3
17	Sludge to Berkeley Pit	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	0.2	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5
	Balance																													
	Total Inflows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.7	2.9	4.0	4.8	4.7	4.6	4.7	5.0	5.2	4.3	4.6	4.8
	Total Outflows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.6	5.5	5.9	4.6	3.0	2.3	1.8	1.7	2.9	4.0	4.7	4.7	4.6	4.7	5.0	5.2	4.3	4.6	4.8
	Balance	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

M:\1\01\00126\16\A\Data\Task 735 Water Balance Update\Results\[MR_WBM_Permitting_037.xlsx]Table D3A

REV	DATE	DESCRIPTION	PREP'D	RVW'D
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Knight Piésold
CONSULTING

TABLE D3 CONTINUED

MONTANA RESOURCES, LLP
YANKEE DOODLE TAILINGS IMPOUNDMENT

ANNUAL WATER BALANCE RESULTS - MINIMUM SILVER LAKE INFLOWS OF 2.5 MGPD

################

Flow Path Number	Description	Annual Volume (MGPD)																	
		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Post Closure
	MR Concentrator																		
	Inflows																		
1	Water in Ore	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.0	0.0
2	Continental Pit Dewatering	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0
3a	Recycled Water from HsB Water Treatment Plant	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	0.0	0.0
4	YDTI Reclaim to Process	16.6	16.5	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.5	16.5	16.5	0.0	0.0
5	Berkeley Pit Groundwater Wells	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	0.0
6	Runoff to MR Concentrator	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	0.0
	Outflows																		
7	Water in Tailings Slurry	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	0.0	0.0
8	Water for Dust Control	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	0.0
9	Water in Concentrate/Mill Losses	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	0.0
	Balance																		
	Total Inflows	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	0.0	0.0
	Total Outflows	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	22.3	22.2	22.2	22.2	0.0	0.0
	Balance	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	0.0
	Yankee Doodle Tailings Impoundment																		
	Inflows																		
10	Direct Precipitation on Pond/Beach	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.6
11	Runoff to Tailings Impoundment	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6
7	Water in Tailings Slurry	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	22.0	21.9	21.9	21.9	0.0	0.0
3b	Collected Water from HsB	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	0.0
	Outflows																		
13	Pond Evaporation	1.8	1.7	1.6	1.6	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.1	1.1	1.2	1.2	1.1	0.7
14	Water lost in Tailings Voids	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0.0	0.0
15	Seepage from Impoundment	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.4	1.0
4	Tailings Reclaim Water for Process	16.6	16.5	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.6	16.5	16.5	16.6	16.5	16.5	16.5	0.0	0.0
	Balance																		
	Total Inflows	23.8	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.5	23.6	23.6	23.6	23.5	23.5	23.5	1.4	1.2
	Total Outflows	27.0	26.9	26.8	26.8	26.8	26.6	26.6	26.5	26.5	26.4	26.4	26.4	26.4	26.3	26.4	26.3	4.5	1.7
12	Silver Lake Transfer Water (based on measured/min flows)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.0	0.0
12	Silver Lake Transfer Water (based on model)	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	0.0
	Change in YDTI Pond Volume	-0.7	-0.7	-0.6	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3	-3.1	-0.5
	Balance	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	0.0
	Horseshoe Bend and/or Water Treatment Plant																		
	Inflows																		
15	Seepage from Impoundment	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.4	1.0
16	Runoff to Horseshoe Bend	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Outflows																		
3	Treated Water to MR Concentrator or the Environment / Collected Water to Berkeley Pit or YDTI	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.5	1.3
17	Sludge to Berkeley Pit	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.1
	Balance																		
	Total Inflows	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.0	1.4
	Total Outflows	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.0	1.4
	Balance	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	0.0

M:\1\01\00126\16\A\Data\Task 735 Water Balance Update\Results\[MR_WBM_Permitting_037.xlsx]Table D3B

REV	DATE	DESCRIPTION	PREP'D	RVW'D
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APPENDIX C

MASS LOAD MODEL OF YANKEE DOODLE TAILINGS POND

(Pages C-1 to C-11)

Memorandum

May 17, 2017

To: Mark Thompson, Montana Resources LLC

From: William M. Schafer, Schafer Limited LLC

Re: Mass Load Model of Yankee Doodle Tailings Pond

Purpose and Scope

The purpose of this evaluation is to predict water quality in the Yankee Doodle Tailings Impoundment (YDTI) supernatant pond during and after closure and reclamation of the Montana Resources mine.

Methods

Mass Load Model

Water quality in the YDTI supernatant pond was predicted using a mass load model. In a mass load model, transport and accumulation of the chemical mass of each constituent is predicted by tracking movement of water and measuring or estimating the constituent concentration in each water source. Load is calculated from flow rate and concentration as in equation [1]. Flows of water into and out of the Yankee Doodle Tailings Facility were modeled by Knight Piesold (2017).

$$\text{Load (M/d)} = \text{Flow } (L^3/d) * \text{Concentration } (M/L^3) \qquad [1]$$

Where: M = mass
L^3 = volume
D = days

Model Calibration

Average flows for all monthly gains or losses of water to or from the YDTI pond were calculated in a water balance model (Knight Piesold 2017). Results were placed in a spreadsheet that was used to determine mass loads (Figure 1). Mass load predictions were made separately for each constituent of interest.

The mass load model was calibrated to measured water quality in the YDTI Pond for the historic period from 2002 to 2014. Measured values or reasonable estimates of concentrations were available for all sources of water in the system except for the concentration in the tailings slurry discharged to the impoundment. Therefore, loads were evaluated for individual constituents by using a solver routine to select the concentration in tailings slurry that

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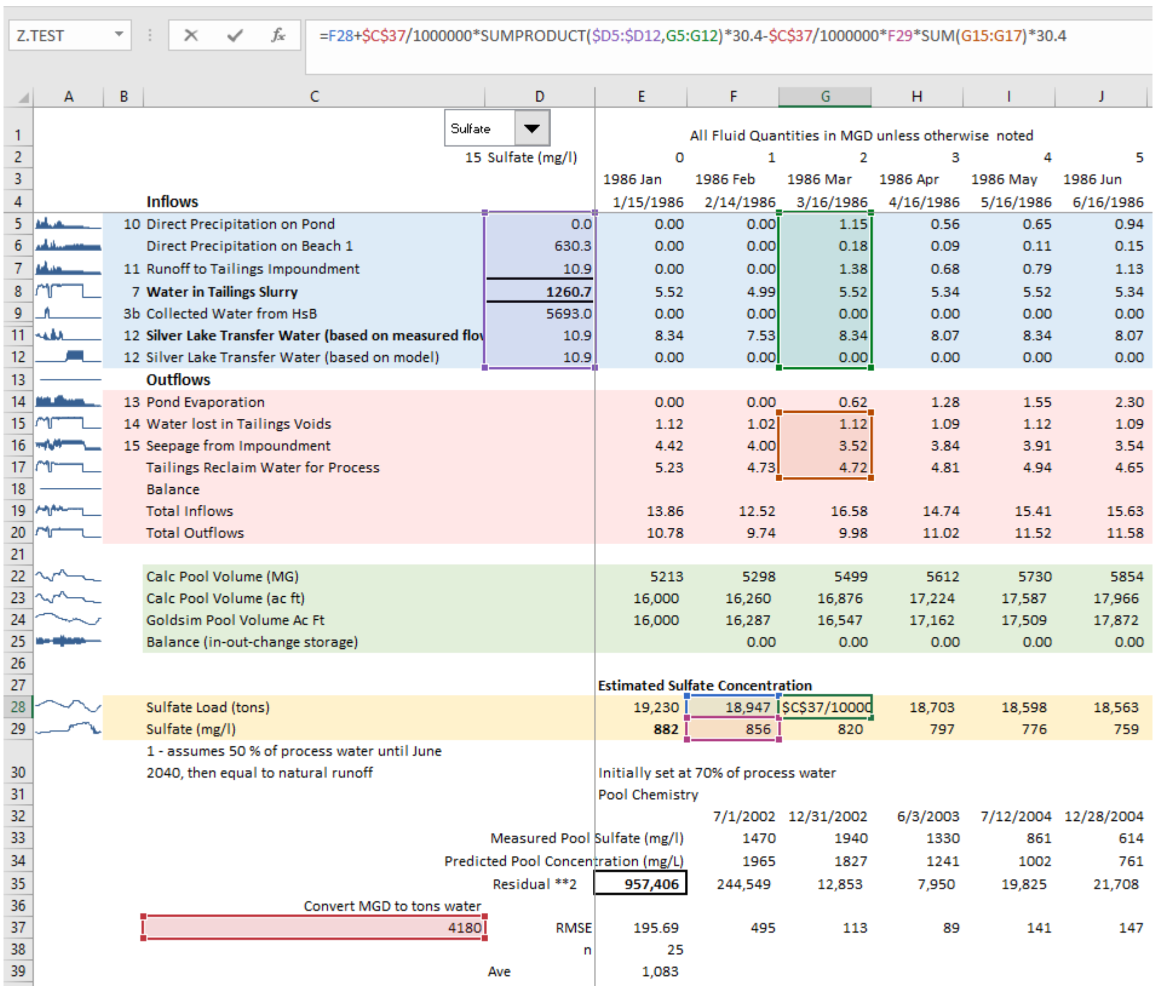
provided the best fit to observed water quality in the Pond. This was achieved by having the solver seek the minimum value for the sum of squares of the residual difference between measured and predicted Pond water quality. The residual term was based on about 25 pond concentration measurements between 2002 and 2014. By calibrating model response in this manner, future concentrations in the pond can be predicted based on the water balance by employing the estimated slurry concentration from the calibration period. This approach assumes that constituent concentrations in all source waters will remain constant through time. These water quality assumptions are discussed further in section titled **Expected Geochemical Trends in Source Waters**. The equation used to calculate load in the pond for time step 2 is highlighted in Figure 1. Inputs of water to and losses from the YDTI pond are shown in Table 1.



Z.TEST

=F28+$C$37/1000000*SUMPRODUCT($D5:$D12,G5:G12)*30.4-$C$37/1000000*F29*SUM(G15:G17)*30.4

	A	B	C	D	E	F	G	H	I	J
1				Sulfate	All Fluid Quantities in MGD unless otherwise noted					
2				15 Sulfate (mg/l)	0	1	2	3	4	5
3					1986 Jan	1986 Feb	1986 Mar	1986 Apr	1986 May	1986 Jun
4			**Inflows**		1/15/1986	2/14/1986	3/16/1986	4/16/1986	5/16/1986	6/16/1986
5		10	Direct Precipitation on Pond	0.0	0.00	0.00	1.15	0.56	0.65	0.94
6			Direct Precipitation on Beach 1	630.3	0.00	0.00	0.18	0.09	0.11	0.15
7		11	Runoff to Tailings Impoundment	10.9	0.00	0.00	1.38	0.68	0.79	1.13
8		7	**Water in Tailings Slurry**	**1260.7**	5.52	4.99	5.52	5.34	5.52	5.34
9		3b	Collected Water from HsB	5693.0	0.00	0.00	0.00	0.00	0.00	0.00
11		12	**Silver Lake Transfer Water (based on measured flo**	10.9	8.34	7.53	8.34	8.07	8.34	8.07
12		12	Silver Lake Transfer Water (based on model)	10.9	0.00	0.00	0.00	0.00	0.00	0.00
13			**Outflows**							
14		13	Pond Evaporation		0.00	0.00	0.62	1.28	1.55	2.30
15		14	Water lost in Tailings Voids		1.12	1.02	1.12	1.09	1.12	1.09
16		15	Seepage from Impoundment		4.42	4.00	3.52	3.84	3.91	3.54
17			Tailings Reclaim Water for Process		5.23	4.73	4.72	4.81	4.94	4.65
18			Balance							
19			Total Inflows		13.86	12.52	16.58	14.74	15.41	15.63
20			Total Outflows		10.78	9.74	9.98	11.02	11.52	11.58
21										
22			Calc Pool Volume (MG)		5213	5298	5499	5612	5730	5854
23			Calc Pool Volume (ac ft)		16,000	16,260	16,876	17,224	17,587	17,966
24			Goldsim Pool Volume Ac Ft		16,000	16,287	16,547	17,162	17,509	17,872
25			Balance (in-out-change storage)			0.00	0.00	0.00	0.00	0.00
26										
27					**Estimated Sulfate Concentration**					
28			Sulfate Load (tons)		19,230	18,947	$C$37/10000	18,703	18,598	18,563
29			Sulfate (mg/l)		**882**	856	820	797	776	759
			1 - assumes 50 % of process water until June							
30			2040, then equal to natural runoff		Initially set at 70% of process water					
31					Pool Chemistry					
32						7/1/2002	12/31/2002	6/3/2003	7/12/2004	12/28/2004
33				Measured Pool Sulfate (mg/l)		1470	1940	1330	861	614
34				Predicted Pool Concentration (mg/L)		1965	1827	1241	1002	761
35				Residual **2	**957,406**	244,549	12,853	7,950	19,825	21,708
36			Convert MGD to tons water							
37			4180	RMSE	195.69	495	113	89	141	147
38				n	25					
39				Ave	1,083					

Figure 1. Mass load model from Excel showing the formula for calculating sulfate load.

Table 1. Gains and losses of water for the YDTI based on the water balance model (Knight Piesold 2017).

Source	Average Flow Contribution for 2007-2012 (MGD)	Water Quality Model Assumption
2007 to 2012 Inflows (26.45 MGD)		
Rainfall on Pond	0.62	Assumed equal to 1 mg/L for major ions
Runoff from Beach	0.14	Assumed 50 % of concentration tailings slurry to account for partial dilution by rainfall
Runoff to Tailings from Upgradient Watershed	0.70	Same as Silver Lake
Water in Tailings Slurry	21.61	Determined using solver to generate best fit to pond chemistry
Water Pumped from Horseshoe Bend Area	0.00	Measured
Make-Up Water	3.37	Measured in Silver Lake water source
2007 to 2012 Outflows (26.47 MGD)		
Pond Evaporation	1.26	No effect on chemical load, but increases concentration
Water Lost to Void Space	4.40	Concentration assumed to be same as previous time step in model
Seepage Loss	4.35	Concentration assumed to be same as previous time step in model
Water Reclaimed for Processing in Mill	16.46	Concentration assumed to be same as previous time step in model
Pond		
Pond	Ave 2007-2012 20,900 ac ft	Model prediction and pond water quality measurements

Results

The predicted concentration of key constituents in the tailings slurry is shown in Table 1 in comparison with the average concentration measured in the pond for the 2002 to 2014 calibration dates. The average residual was calculated for each constituent as the predicted concentration minus the measured concentration and is presented as the root mean square error. The final predicted pond concentration about 20 years into the post-closure phase is also shown in Table 1.

Table 1. Estimated concentration in tailings, average measured pond concentration for 2002 to 2014, average residual and final pond concentration.

Constituent [1] Concentration (mg/L)	Estimated Mill Water Concentration [1]	Average Pond Water Quality for Calibration Period	Root Mean Square Error [2] for modeled vs Measured	Predicted Concentration in Dec 2059
Lab Conductivity (umhos/cm)	2,398	1,958	228	471
Alkalinity as CaCO3	36	52	27	83
Calcium	499	403	84	125
Magnesium	-	9	19	6
Sodium	107	86	20	23
Potassium	36	29	6	8
Sulfate	1,261	1,083	196	256
Chloride	16	13	4	4
Fluoride	2.2	2.1	1.8	0.5
Aluminum	0	0.5	1.2	<0.1
Iron	0	5.6	16.1	<0.1
Manganese	0	2.7	7.8	<0.1
Copper	0	0.2	0.5	<0.1
Zinc	0	0.2	1.8	<0.1

1 – Concentration calculated from a solver routine in Excel to minimize the squared residual errors between measured and predicted sulfate
2 – Average difference between predicted and measured values for pond constituent concentration

Water Quality Trends

Major Ions

The mass load model showed a relatively good fit between predicted and measured pond concentrations for the 2002 to 2014 calibration period. The calibration period spanned a critical time in the evolution of pond chemistry that included the end of a temporary shut-down from July 2000 to October 2003, included a spike in make-up water to increase the pond elevation, and covered many years of more routine operation during which the pond level remained constant. Predicted trends in calcium, sulfate and copper are shown in Figure 2 through 4.

The predicted pond concentrations of sulfate showed a large increase in 1996 to 2000 when water from Horseshoe Bend area was being pumped to the tailings. After 2000, Horseshoe Bend water was treated and sent to the mill for re-use. Concentrations tended to decline from 2000 to 2003 in response to shutting off inputs of mine water (mining suspension) and seepage losses from the pond. Concentrations are predicted to decrease in the post-closure period. The gradually decreasing concentration that occurs during post-closure indicates that the effect of load removal due to seepage losses of pond water is greater than the concentrating effect of evaporation (which decreases the stored pond volume and evapo-concentrates the remaining load). Overall, pond water quality should reflect the chemistry of surface water runoff from the watershed upgradient of the YDTI by about 20 years after closure (year 2060 in model).

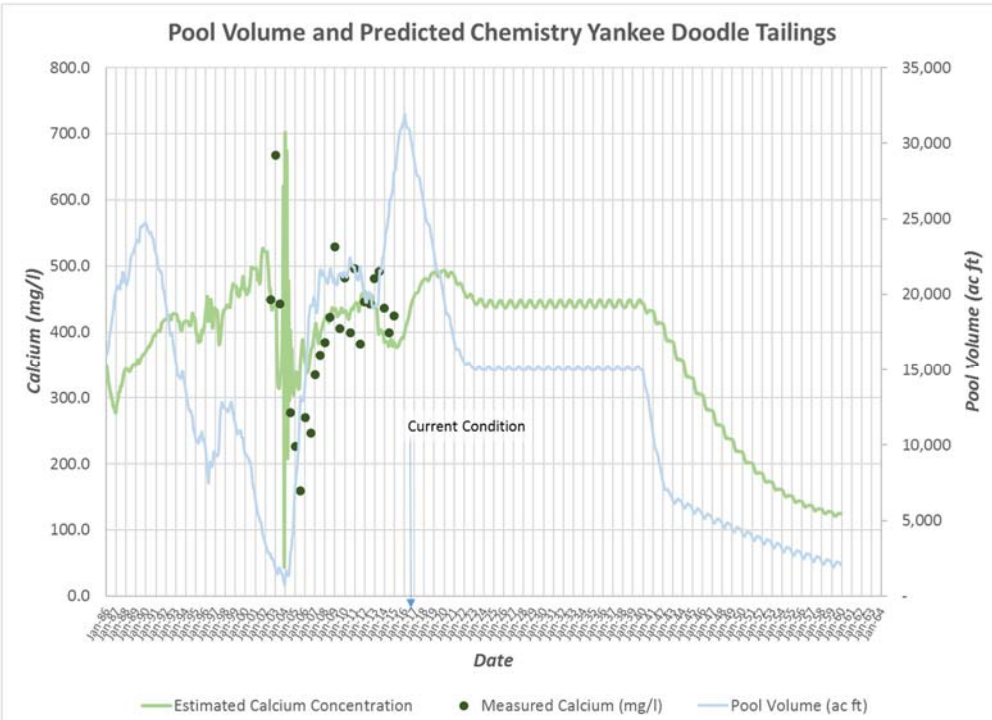


Figure 2. Predicted calcium trends – YDTI.

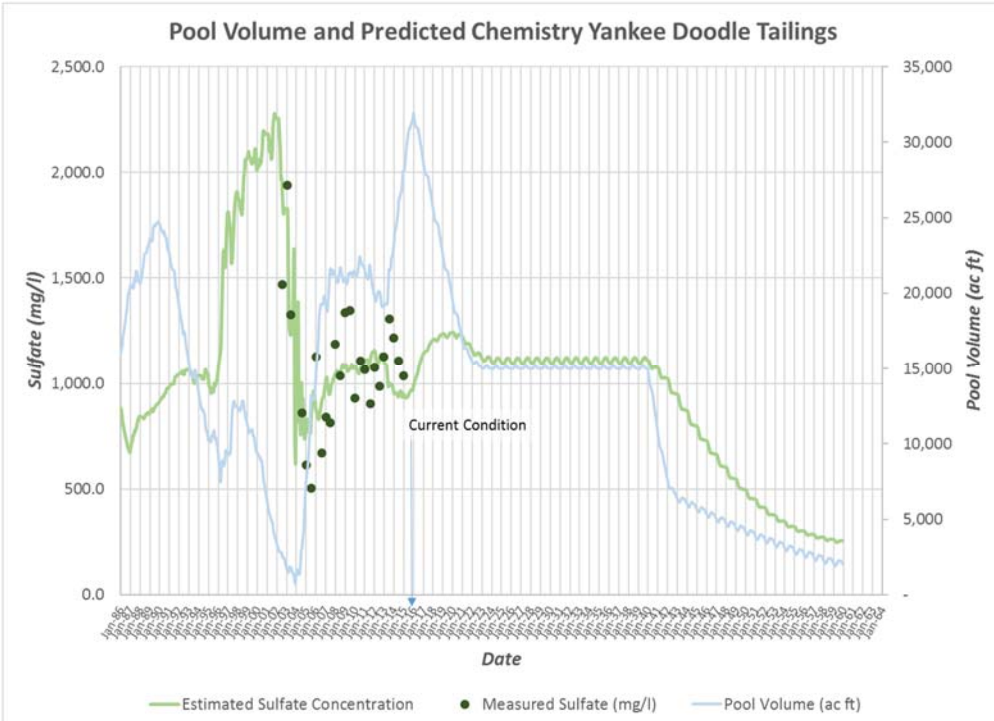


Figure 3. Predicted sulfate trends – YDTI.

Metals

The mass load model overestimates the pond concentration of copper and other metals evaluated (aluminum, iron, manganese and zinc, Table 1). Metal levels in tailings slurry would have to be zero to achieve the minimum square error term. These results indicate that metals are not chemically conservative in the tailings system. When a solution high in metals (such as the Horseshoe Bend water pumped to the YDTI in 1996 to 2000) was added to the system, the mass of metals from Horseshoe Bend were not detected in the pond, meaning that their solubility limit was exceeded and they precipitated from solution. Metal precipitation occurred because of the alkaline nature of the tailings water.

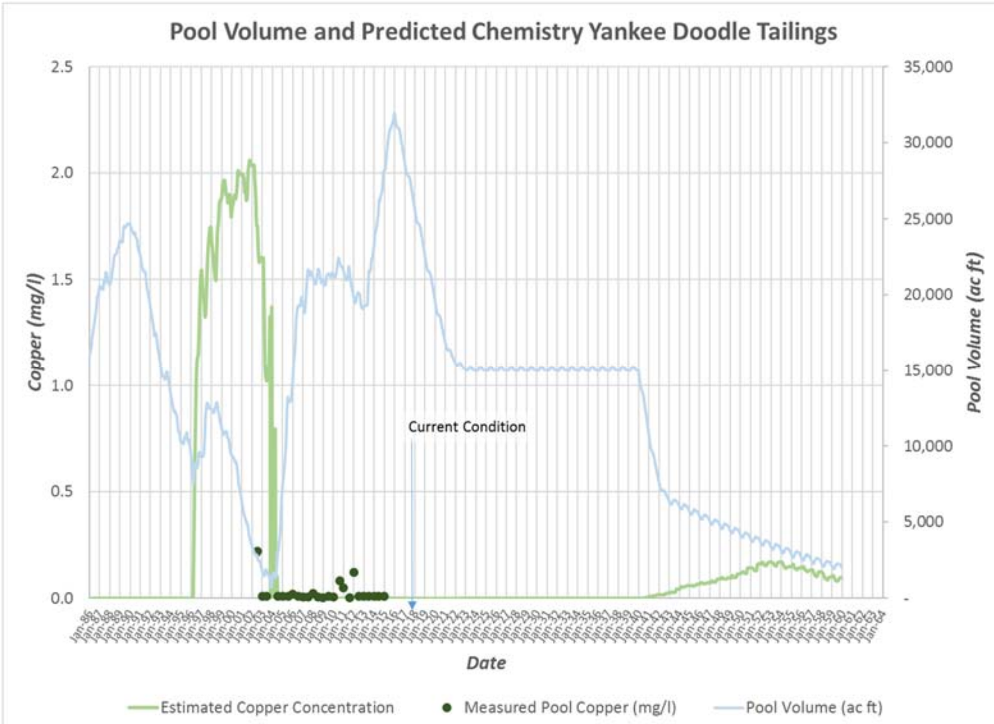


Figure 4. Predicted copper trends – YDTI.

Expected Geochemical Trends in Source Waters

A critical foundation assumption for the mass load model is that source water quality remains constant for the entire period modeled. No change in concentration would be expected for rainfall, Silver Lake water (used for make-up), and natural runoff from the watershed upgradient of the YDTI. Discussion of the remaining terms in the model follows.

Water in Tailings Slurry

The tailings slurry accounts for 91 % of the sulfate loading and a similar proportion of load for other major ions in the YDTI pond. The chemistry of mill process water (tailings slurry water) is determined by two fundamental processes. The first is the release of soluble loads from the processed ore. This ore rinse-off is difficult to measure but should remain nearly constant if the ore characteristics remain similar through time. The Continental Pit ore mined east of the Continental Fault should remain constant and the model should be accurate if Continental ore is the primary mill feed. If Berkeley Pit type ore is directed to the mill, process water quality may change.

A second factor affecting mill process water quality is the chemical makeup of water coming into the mill. Most major ion loads in mill input water will remain in solution during processing. Therefore, if mill feed water concentrations increase, then mill process water concentrations will also rise. The primary mill feed is reclaim water from the pond.

Consequently, as pond concentrations decline below their long-term average, the model will tend to overpredict pond water quality and will underpredict during times of rising concentration. Since no large shifts in pond concentration are predicted over the remaining mine life, model bias from this factor should be small.

Horseshoe Bend Water

Untreated Horseshoe Bend water only reached the pond for a short period in the late 1990's. Measured water quality was available for this time frame, so the assumed concentration in Horseshow Bend water is based on water quality data.

Runoff from Tailings Beach

Water quality for beach runoff, which accounts for only 1 % of overall sulfate loads in the model, was assumed to be one-half the concentration of tailing slurry. This assumption reflects expected dilution of water contained in the tailings by precipitation. In the model, the water quality of runoff from the beach is changed approximately 1 year after cessation of mining to reflect placement of a thin layer of cover to prevent dust. A thicker soil cover will be completed and vegetated within approximately 3 years after cessation of mining. After cover placement, beach runoff will be chemically similar to runoff from the natural watershed.

If the tailings beach acidifies, loading may be appreciably higher than was used in the model. However, given the relatively small contribution of the beach to overall loading, the effect on overall pond water quality is expected to be small. In addition, the geochemical nature of YDTI tailings derived from Continental Pit ore is such that appreciable acidification is unlikely in the three years after closure (see discussion below).

ARD Risk in Tailings

The acid generation potential (AGP) and acid neutralization potential (ANP) for YDTI impoundment tailings for samples collected over the last 20 years is shown in Figure 6 and 7. Tailings ranged from 0.7 to about 3 % pyritic sulfur and ANP ranged from 10 to 30 kg/t as $CaCO_3$. The overall balance of AGP and ANP indicates that most tailings are likely to become acidic given sufficient time to oxidize. However, all tailings samples were neutral to alkaline in pH when sampled. This is because process water is strongly alkaline and acidification is unlikely to occur until all ANP is consumed by acid.

Based on kinetic tests of Continental rock (MR Plan of Operations (2017), the rate of sulfide oxidation is very slow (<0.1 % of available sulfides oxidized each week). Given this rate of oxidation, it would take almost three years for the most reactive tailings to consume available ANP and more than 7 years for all tailings to consume their ANP (Figure 8). Covers would be placed well before this lag period is over. Oxidation rate will greatly decrease after cover placement because of the greater distance that oxygen would have to travel by diffusion to reach the sulfide tailings zone. Also, even if tailings were to acidify after cover placement, surface runoff water would not contact the tailings directly. Therefore, the loading rates for runoff from the tailings beach used in the mass load are considered representative of operating and post-closure conditions.

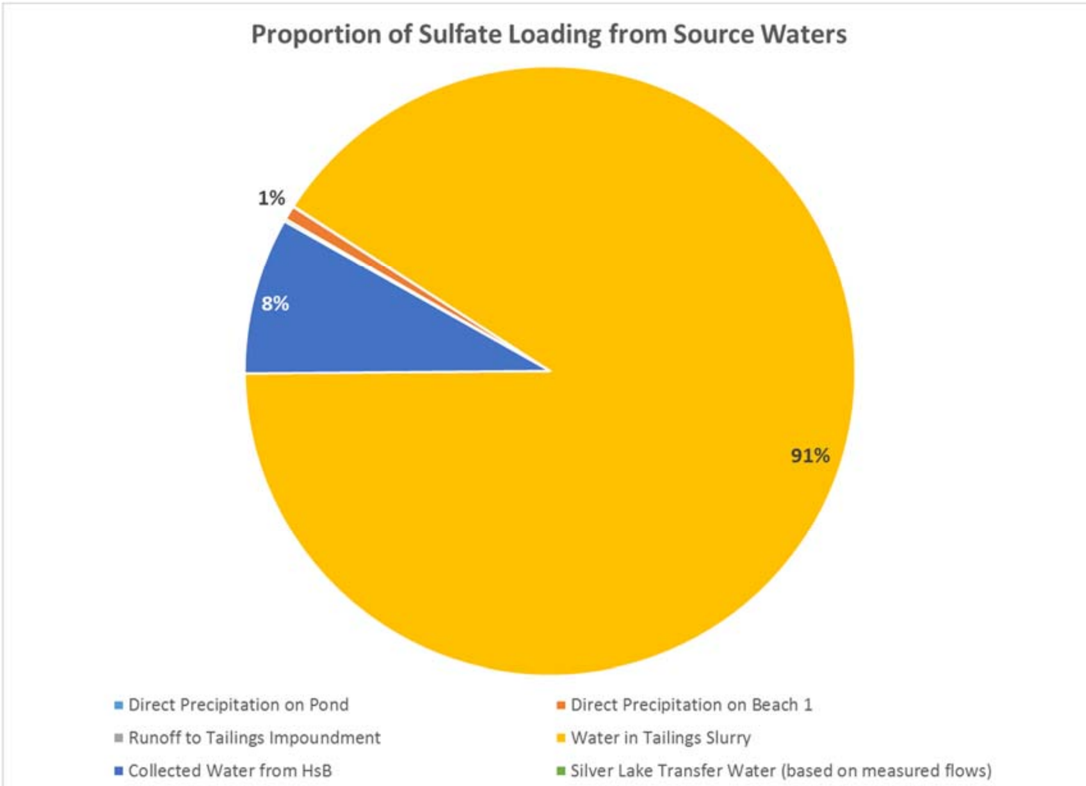


Figure 5. The proportion of sulfate load from different source waters averaged over the model duration.

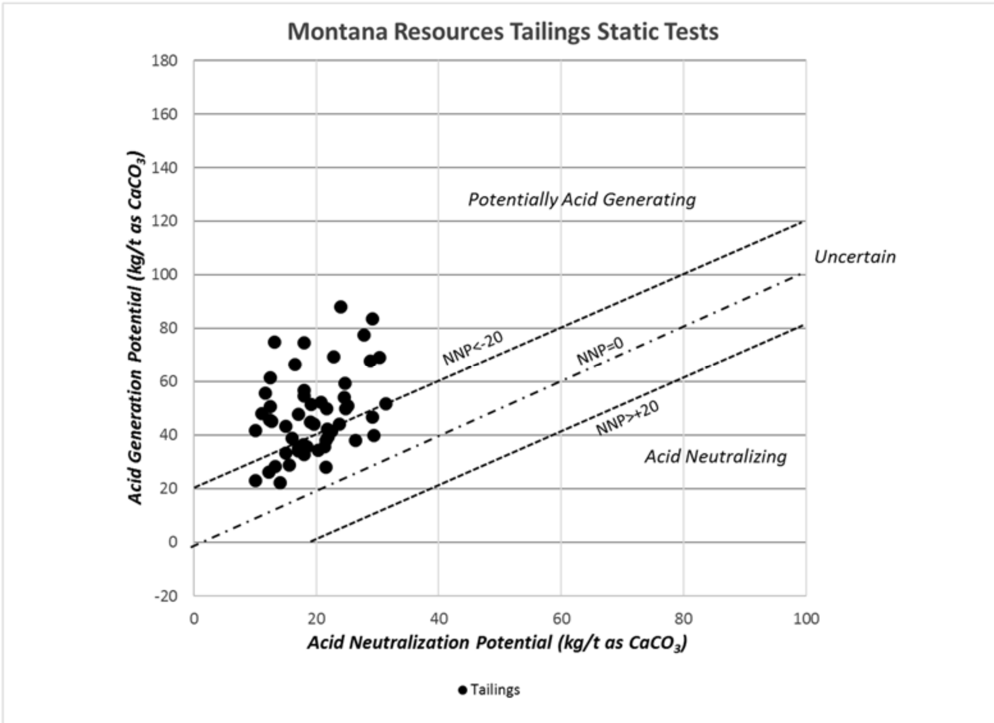


Figure 6. ANP and AGP of YDTI tailings from 1998 to present.

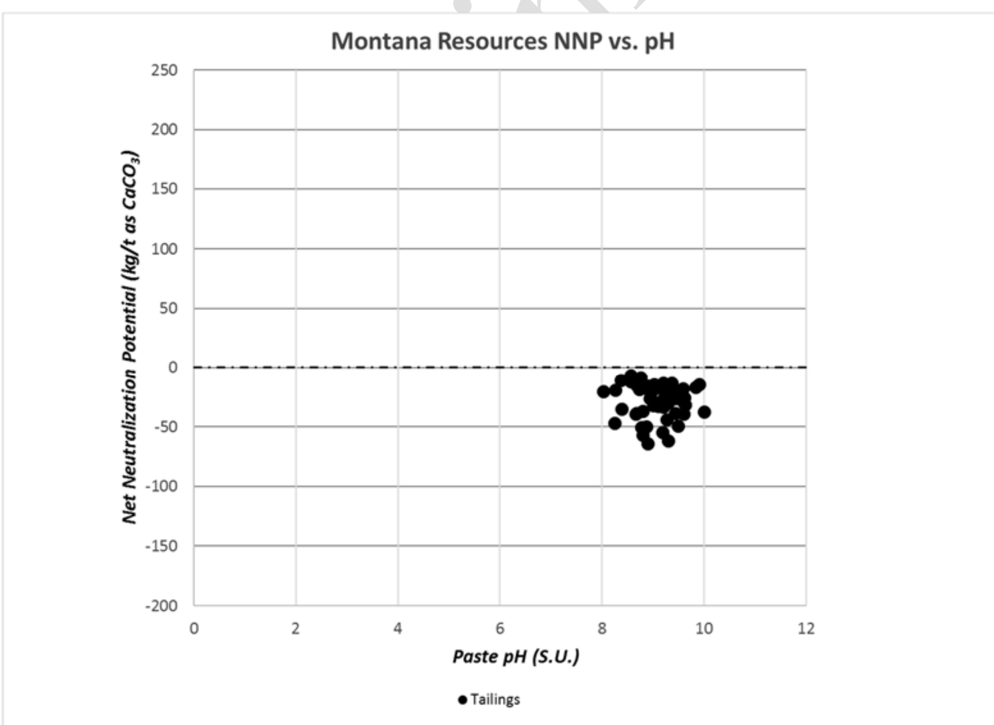


Figure 7. Net Neutralization Potential and Paste pH of YDTI tailings from 1998 to present.

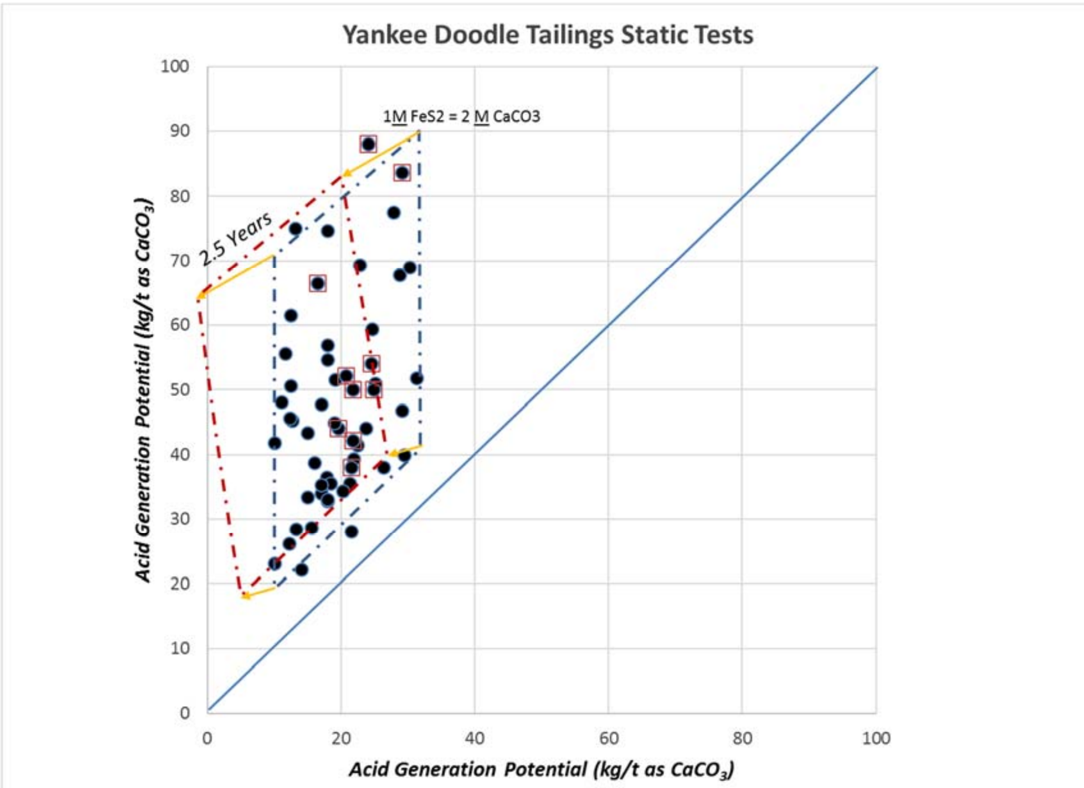


Figure 8. Expected changes in ANP and AGP of YDTI tailings as sulfides oxidize over time. Nearly three years would be required for the most reactive tailings to become acidic.

References

Knight Piesold. 2017. Yankee Doodle Tailings Impoundment Water Management Report. 15 pgs plus attachements.

MR. 2017. Montana Resources Continental Mine Operations Plan. Submitted to MDEQ.