# TAILINGS STORAGE FACILITY - TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL

| Document Metadata Overview | |
|---|---|
| Document Name: | Tailings Storage Facility - Tailings Operations, Maintenance and Surveillance (TOMS) Manual |
| Document Owner: | Environmental Sustainability Manager - US Region |

| Document Control Information | | | |
|---|---|---|---|
| Effective from | Version Number | Amendment Details | Amended By |
| 2021/05/03 | V1.5 | Updated for Existing Operations | Knight Piésold Ltd. |
| 2022/12/20 | V1.6 | Updated for Existing Operations | Knight Piésold Ltd. |
| | | | |
| | | | |
| | | | |
| | | | |

| Approval - Version 1.6 | | | |
|---|---|---|---|
| Approvals | Title | Signature | Date Signed |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# East Boulder Mine

## Tailings Storage Facility - Tailings Operations, Maintenance and Surveillance (TOMS) Manual

2022/12/20


### CONFIDENTIALITY STATEMENT



COMMITMENT ACCOUNTABILITY RESPECT ENABLING SAFETY

# TABLE OF CONTENTS

## TABLES



## FIGURES

# APPENDICES

# ABBREVIATIONS

CAP ..... Corrective Action Plan
CFR ..... Code of Federal Regulations
CORP ..... Consolidated Operations and Reclamation Plan
DSR ..... Dam Safety Review
EBM ..... East Boulder Mine
El ..... Elevation
EOR ..... Engineer of Record
EPP ..... Emergency Preparedness Plan
FMEA ..... Failings Modes and Effects Analysis
GM ..... General Manager
GPS ..... Global Positioning System
IRP ..... Independent Review Panel
ITRB ..... Independent Tailings Review Board
KP ..... Knight Piésold Ltd.
MCA ..... Montana Code Annotated
MDEQ ..... Montana Department of Environmental Quality
MSHA ..... Mine Safety and Health Administration
MT ..... Montana
NavStar ..... Geomatics Ltd.
PMF ..... Probable Maximum Flood
QA ..... Quality Assurance
QPP ..... Quantitative Performance Parameter
QRFG ..... Quick Reference Field Guide
ROD ..... Record of Decision
ROM ..... Run of Mine
RTFE ..... Responsible Tailings Facility Engineer
Stillwater ..... Sibanye Stillwater
SWPPP ..... Storm Water Pollution Prevention Plan
TOMS ..... Tailings Operations, Maintenance and Surveillance
TSF ..... Tailings Storage Facility
UAV ..... Unmanned Aerial Vehicles
USFS CGNF ..... United States Forest Service Custer Gallatin National Forest
VP ..... Vice President
VWP ..... vibrating wire piezometer

# 1.0 INTRODUCTION

## 1.1 SCOPE AND OBJECTIVES OF MANUAL

Sibanye Stillwater (Stillwater) owns and operates the East Boulder Mine (EBM), a platinum group metal mine located in south central Montana. The EBM consists of an underground mine, a concentrator, a Tailings Storage Facilities (TSF) and ancillary facilities. This Tailings Operations, Maintenance and Surveillance (TOMS) Manual has been prepared for the EBM TSF and its associated facilities. This TOMS Manual has been developed to meet the requirements of the Montana State Law as defined in Montana Code Annotated (MCA) Title 82 Chapter 4 Part 3 (MCA 82-4-379) (MT, 2019).

The objectives of this TOMS Manual include:

- Define the roles and responsibilities of Stillwater site personnel, third-party consultants, and government (Section 1.2)
- Define the training requirements for those involved in the operation, maintenance and surveillance of the TSF (Section 1.3)
- Outline the document control and revision procedures (Section 1.4)
- Provide an overview of the key components of the TSF and operating, maintenance and surveillance requirements (Sections 2 and 3)
- Define the surveillance, inspection, reporting and review requirements (Section 4)
- Present the Emergency Preparedness Plan (Section 5)

Appendix A provides a Quick Reference Field Guide (QRFG) for the operation of the TSF. The QRFG includes the Quantitative Performance Parameters (QPPs) and key information for the operation, monitoring and inspection of the TSF.

Reference documents for the EBM TSF are listed in Appendix B.

Appendix C includes the inspection schedules and the inspection log templates. These templates are to be utilized for daily data collection, and for information gathered during the routine inspections.

## 1.2 ROLES AND RESPONSIBILITIES

The following provides an overview of the responsibilities of Stillwater site personnel and third-party consultants, as well as the role of the Montana Department of Environmental Quality (MDEQ) and other government agencies.

### 1.2.1 STILLWATER MINE SITE PERSONNEL

The General Manager (GM) & Vice President (VP) of EBM Operations has the ultimate responsibility for the safety of the EBM TSF. The Concentrator Manager has been designated as Safety Manager for the TSF and is the primary contact for all matters relating to the operation, maintenance and surveillance of the TSF. The Concentrator Manager reports to the GM of EBM Operations and is responsible for the day-to-day operations of the TSF.

In addition to the Concentrator Manager, other key Stillwater personnel have roles and responsibilities relating to the operation, maintenance, and surveillance of the TSF. The organization and responsibilities chart is shown on Figure 1.1 A list of these key personnel and their responsibilities are provided on Table 1.1. Emergency contact information for Stillwater personnel is provided in Appendix A.

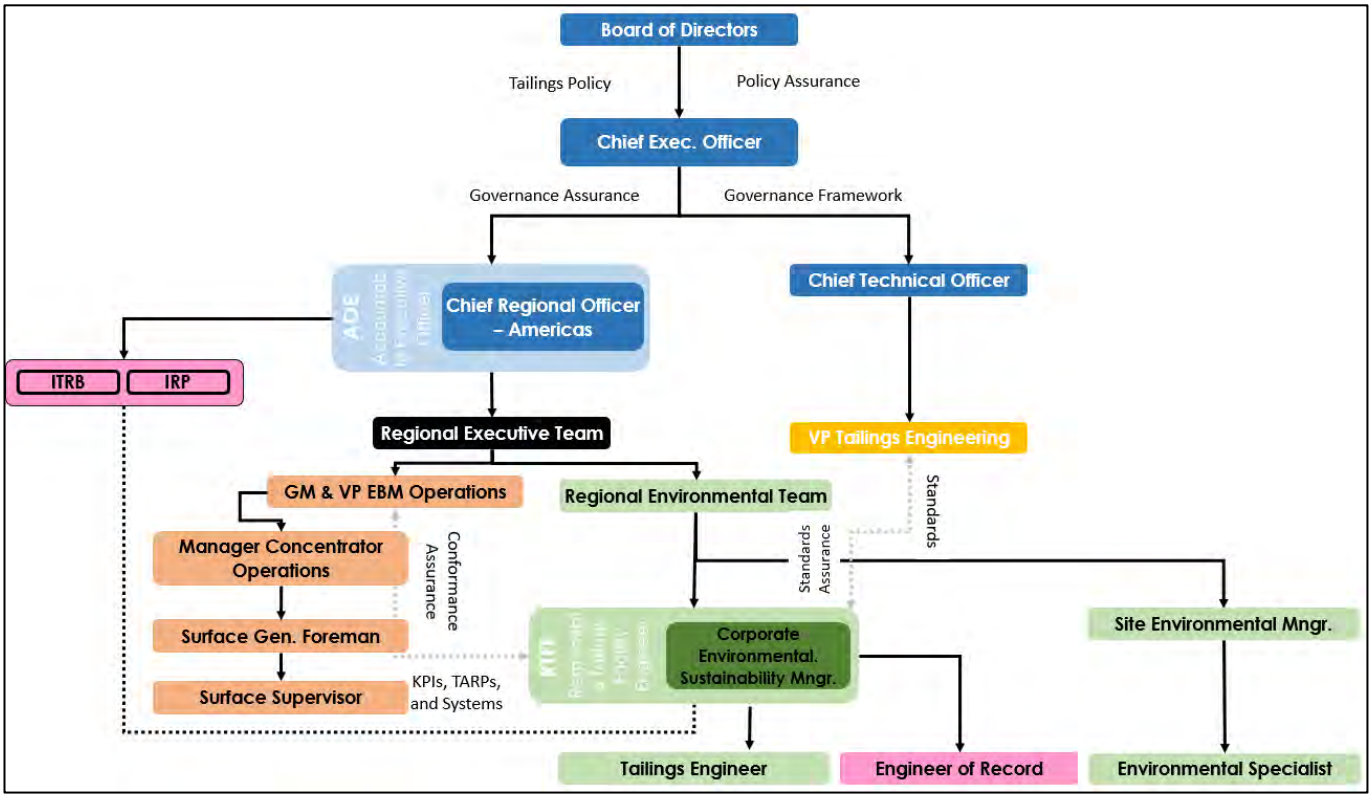



Figure 1.1 Organization and Responsibilities Chart

Table 1.1 Stillwater Personnel - Roles and Responsibilities

| Position | Responsibilities |
|---|---|
| GM of East Boulder Operations | • Provide oversight and leadership of all activities required for the safe and socially responsible operation of the mine site. Overall project review and implementation, and budget allocation. |
| Corporate Environmental Manager | • Provide oversight and leadership of all activities required for the socially and environmentally responsible operation of the mine site. Overall project review and implementation, and budget allocation<br>• Communications with Government Agencies and Stakeholders |
| Environmental Sustainability Manager<br>(Responsible Tailings Facility Engineer (RTFE)) | • Accountable for the integrity of the tailings facility (Requirement 8.5)<br>• Responsible for liaising with EOR, operations, planning, regulatory affairs, social performance and environment teams (Requirement 8.5)<br>• Responsible for implementation of the design<br>• Accountable for the establishment of a change management system (Requirement 6.5)<br>• Responsible for the monitoring system and communication of the results to the EOR, including performance reviews (Requirements 7.2, 7.3)<br>• Responsible, with the EOR, for the Construction Records Report (Requirement 6.3)<br>• Responsible for the OMS Manual (Requirement 6.4) |

| Position | Responsibilities |
|---|---|
| Concentrator Manager | • Person responsible for the safe operation of the TSF including overall operations, maintenance and surveillance and TOMS Manual updates and review<br>• Plan, coordinate, supervise, direct and review all activities related to the TSF construction and operation, tailings delivery and water reclaim, TSF water balance, and Emergency Preparedness Plan (EPP)<br>• Overall operations of the concentrator and supervision of concentrator personnel<br>• Overall concentrator operations contact responsible for Tailings Delivery System and Water Reclaim System<br>• Person responsible for inspection, maintenance, review and oversight of all areas of the tailings management and water reclaim operations, including tailings deposition, Tailings Delivery System, Water Reclaim System and Basin Underdrains<br>• Quarterly Dam Safety Inspections for the TSF<br>• Responsible for TSF water management<br>• Unusual Event inspections<br>• Implementation of EPP<br>• Coordinate supernatant pond surveys and soundings<br>• Responsible for task training of all tailings personnel |
| Tailings Engineer | • Plan, coordinate, advise, and review all operational activities related to environmental compliance functions (quarterly inspections, leak detection, water quality, TSF water balance). Ensure Stillwater remains in compliance with all applicable permits, rules and regulations related to these areas.<br>• Review and update TOMS Manual and EPP<br>• Coordinate supernatant pond surveys and soundings<br>• Quarterly TSF Inspections<br>• Monthly TSF and instrumentation inspections<br>• Implementation of EPP<br>• Instrumentation monitoring and review |
| Environmental Compliance Manager | • Plan, coordinate, advise, and review all operational activities related to environmental compliance functions (quarterly inspections, leak detection, water quality, TSF water balance). Ensure Stillwater remains in compliance with all applicable permits, rules and regulations related to these areas.<br>• Review and update TOMS Manual and EPP<br>• Implementation of EPP<br>• Communications with Government Agencies and Stakeholders |
| Surface General Foreman | • Monthly TSF inspections<br>• Weekly TSF inspections |
| Surface Supervisor | • Routine inspections of the Tailings Delivery System and Water Reclaim System during dayshift<br>• Weekly TSF inspections<br>• Annual Tailings Delivery System Inspection and Planned Maintenance |
| Concentrator Operations Supervisor | • Routine inspections of the Tailings Delivery System and Water Reclaim System during dayshift and night shift (counterpart to Surface Supervisor) |
| Surface Crew | • Efficiently operate the TSF within SMC standards, occasional supervision to ensure regulatory compliance<br>• Day shift inspections, report any unusual observations to Surface Supervisor<br>• Maintaining TSF operations within Stillwater standards and at the highest level of safety |

| Position | Responsibilities |
|---|---|
| Environmental Specialist(s) | • Quarterly TSF inspections<br>• Unusual Event inspections<br>• Maintaining environmental systems, wildlife protection and annual permit reporting<br>• Implementation of EPP<br>• Maintain TSF water balance tracking spreadsheet<br>• Geotechnical instrument monitoring and review (survey monuments, inclinometers, piezometers)<br>• Geotechnical instrument support, maintenance, and installation<br>• Monitoring and sampling of groundwater monitoring wells<br>• Organizing and reporting on all reclamation activities |
| Chief Engineer | • Technical support |
| Projects Engineer | • Coordinate TSF embankment raises<br>• Coordinate supernatant pond surveys and soundings |
| Safety Manager | • Emergency Response Team; Emergency Preparedness Plan; Emergency Response Planning; Emergency Response Binder; Training and/or ensure job hazard analyses are completed as required |

### 1.2.2 ENGINEER OF RECORD (EOR) AND THIRD-PARTY CONSULTANTS

A number of third-party consultants are involved in the design, construction and inspection of the TSF. The roles and responsibilities of the various third-party consultants and the Engineer of Record (EOR) are summarized in Table 1.2. Emergency contact information for the EOR and third-party contractors is provided in Appendix A.

Table 1.2 Stillwater Personnel - Roles and Responsibilities

| Role and Name | Responsibilities | Stillwater Contact |
|---|---|---|
| Engineer of Record<br>Knight Piésold Ltd.<br>EOR - Ken Brouwer, P.E.<br><br>Deputy EOR -<br>Craig N. Hall, P.Eng. | • Provide operational support to Stillwater<br>• Preparation of construction specifications and drawings and contract documentation, prescribe and oversee QA/QC activities, provide on-site personnel for construction monitoring activities and practices<br>• Review of instrumentation records, complete annual inspections and reporting | • Environmental Sustainability Manager<br>• Environmental Specialist(s)<br>• Corporate Environmental Manager |
| Independent Review Engineer(s) | • Provide independent reviews of the TSF including operation of the facility, engineering, and geotechnical reviews | • Environmental Sustainability Manager<br>• Corporate Environmental Manager |
| Hydrogeology Consultant | • Provide hydrogeological support to Stillwater | • Environmental Sustainability Manager<br>• Corporate Environmental Manager |
| Specialist Lining Contractor | • Qualified manufacturers and installers are used to supply and install the geosynthetics lining materials required for the TSF construction<br>• Complete detailed inspections and make repairs to the HDPE geomembrane on a semi-annual basis | • Environmental Specialist<br>• Concentrator Manager |

| Role and Name | Responsibilities | Stillwater Contact |
|---|---|---|
| Earthworks Contractor | • Local contractor with heavy equipment<br>• Qualified to construct engineered embankments, random fills, surface preparation for liner installation, reclamation earthworks, and other earthmoving activities | • Project Manager<br>• Concentrator Manager |
| Reclamation Contractor | • Reclamation work | • Environmental Specialist |

### 1.2.3 Regulatory Agencies

The jurisdiction for regulation of tailings impoundments resides with the MDEQ. Embankments for TSFs and water reservoirs subject to permits issued by MDEQ are specifically exempt from certain provisions of the *Montana Dam Safety Act* (MCA 85-15-107), and therefore are not subject to embankment hazard potential classification within the State (MCA 85-15-209). The MDEQ is the regulatory agency responsible for ensuring the applicable legislative requirements outlined in MCA 82-4-379, relating to this TOMS Manual, are met by Stillwater.

The Mine Safety and Health Administration (MSHA) is responsible for administering the provisions of the *Federal Mine Safety and Health Act* of 1977 (*Mine Act*) and enforcing compliance with mandatory safety and health standards. Title 30 Code of Federal Regulations (CFR) part 56.20010 requires that '*if failure of a water or silt retaining dam at a mine will create a hazard, it shall be of substantial construction and inspected at regular intervals*'. The *Mine Act* requires the MSHA inspect surface mines at least twice per year.

## 1.3 Training

Training is required for any personnel involved in the operation, maintenance, surveillance and inspection of the TSF. Training must be conducted by the Concentrator Manager, Concentrator General Foreman, or a suitably qualified individual familiar with the design, operation, maintenance and inspection of all civil and mechanical works associated with the TSF. Training sessions will be documented, and a record kept on file on Stillwater's electronic filing system.

The GM of EBM Operations, Concentrator Manager, Concentrator General Forman, Surface Supervisor, Tailings Engineer and Environmental Sustainability Manager must fully understand and be able to implement the TOMS Manual requirements and also ensure that all applicable mine personnel and contractors understand the requirements presented in the TOMS Manual.

Appropriate site personnel are responsible for being continually aware of the visual indications of the TSF performance. Anything observed that is outside of normal operating parameters, as outlined in this TOMS Manual, must be reported to the Concentrator Manager and/or Environmental Affairs Manager immediately.

## 1.4 Control and Revisions to the Manual

This TOMS Manual is a controlled document and specific procedures have been defined for the distribution, revision, and review as outlined below.

### 1.4.1 Distribution

The TOMS Manual will be controlled by the Environmental Sustainability Manager. The Environmental Sustainability Manager will be responsible for maintaining the latest version of the TOMS Manual on Stillwater's electronic file management system. The latest version of the TOMS Manual is also available on KP's FULCRUM data management site. The file location of the TOMS Manual on Fulcrum is shown in Figure 1.2 below.

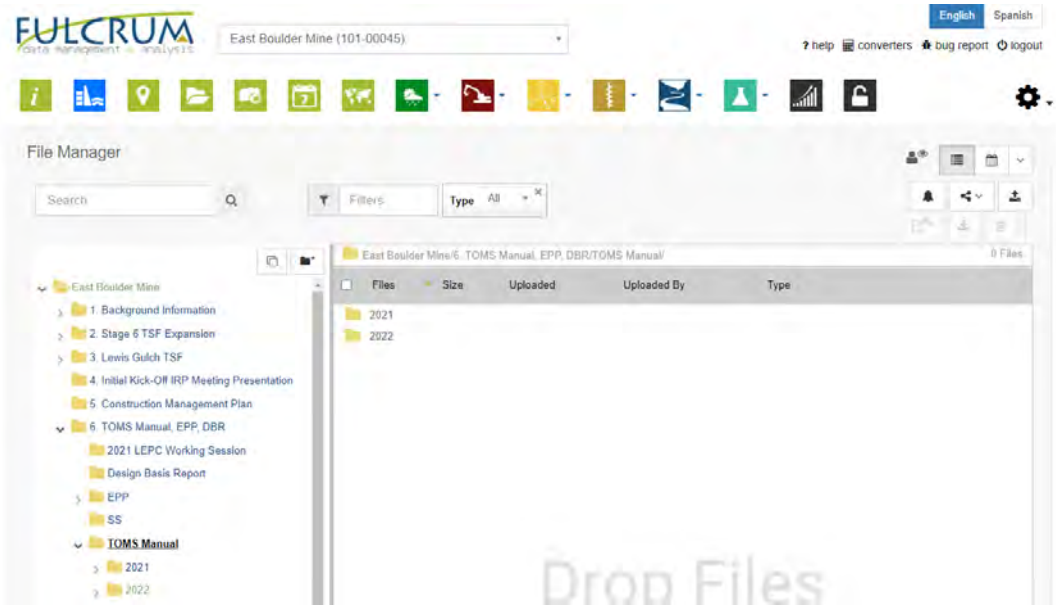



Figure 1.2 TOMS Manual Location on FULCRUM

### 1.4.2 Revisions

The TOMS Manual is required to be reviewed on an annual basis to ensure that it reflects the current operating conditions. The TOMS Manual will be reviewed in conjunction with the annual inspections and third-party reviews outlined in Section 4.

The EOR shall certify any revisions made to the TOMS Manual. The Environmental Sustainability Manager shall notify Stillwater's responsible personnel when revisions to the TOMS Manual are made.

## 1.5 Reference Documents

Pertinent references for the TSF and associated infrastructure are included in Appendix B. Electronic copies are available from Stillwater's electronic file management system.

## 1.6 Regulatory Requirements

The regulatory requirements and commitments that pertain to the construction, operation, and closure of the EBM TSF are summarized in the EBM Consolidated Operations and Reclamation Plan (CORP). The CORP includes all Environmental Impact Statements, associated Records of Decision (RODs), stipulations for the SWM and its facilities, and a list of applicable statutes and regulations.

## 1.7 Independent Tailings Review Board

Stillwater's Corporate Tailings Management Framework requires the appointment of an Independent Tailings Review Board (ITRB) to fulfill an oversight role of the operation of the EBM TSF. The ITRB members are also the Independent Review Panel (IRP) that was assembled to review the design of the future Stage 6 and Lewis Gulch TSFs at EBM as per 82-4-377 MCA (MT, 2019).

The ITRB's overall responsibility includes completing a review of the full TSF life cycle from design though closure planning. The ITRB reports directly to the Accountable Executive. Independent Tailings Review Board (ITRB) responsibilities include the following as per the Sibanye Global Tailings Management System:

- Review Corporate Tailings Mgmt. documents (Global Tailings Management System, Terms of Ref, etc.) against local legislation, the GISTM, ICMM Guidelines, and international best practice
- Review Tailings Roles (RTFE, EOR, etc.) regarding responsibilities and competency
- Site Review
- Documents - Tailings Operations, Surveillance, and Maintenance manual ( i.e. TOMS)
- Compliance - with the Corporate and Site specific documentation
- Review TSF Design and Engineering Documents – Design Reports, Design Criteria, Investigation Reports, etc.
- Understand the current TSF performance
- Reporting on any deviances and risks posed by the TSF to the Accountable Executive

# 2.0 DESCRIPTION OF THE TAILINGS STORAGE FACILITY

## 2.1 GENERAL

The following sections provide a brief summary of the design and management of the TSF and associated facilities. Additional information is available in the cited references listed in Appendix B.

## 2.2 PROJECT DESCRIPTION

### 2.2.1 SITE LOCATION

The EBM is located approximately 16 miles from McLeod in Sweet Grass County, Montana, and is within the East Boulder River valley. The mine site location is shown on Figure 2.1. The general arrangement for the TSF is shown on Figure 2.2.

### 2.2.2 PROJECT HISTORY

The EBM was initially permitted in 1992. The Environmental Impact Statement and Hard Rock Mine Impact Plan for the EBM were updated in 1998. Construction of the mine began in 1999 and the mine reached commercial production in 2002.

The EBM comprises an underground platinum and palladium mine, a 2,500 ton per day concentrator, a TSF, and other ancillary facilities. The flotation concentrate is filtered and transported by truck to Stillwater's Smelter and Base Metals Refinery located in Columbus, Montana.

The mine operating permit allows for ongoing staged development of the TSF using Run of Mine (ROM) rockfill from the underground mine development as the primary embankment construction material. Glacial till borrow material was excavated from within the Stage 1 and Stage 2 tailings basins and used for embankment construction. Glacial till borrow material was excavated from the permitted borrow area adjacent to the TSF to supplement ROM rockfill for the Stage 3 and Stage 4 TSF construction.

### 2.2.3 PROCESS DESCRIPTION

Ore is delivered from the underground workings to the concentrator where it is crushed and upgraded to a concentrate that is shipped offsite to Stillwater's smelter and base metal refinery in Columbus, Montana for further upgrading. Milling involves a combination of crushing, grinding, flotation and filtration processes to produce the concentrate. The tailings predominantly consist of sand and silt sized rock fragments left over from the milling process. The tailings are pumped as slurry from the Concentrator to the underground Sand Plant or the Paste Plant located adjacent to the Nye TSF. The tailings pumped to the Sand Plant are separated into coarse sand and slimes fractions. The coarse sand fraction is dewatered and utilized as backfill in the underground mine. The remaining tailings (predominantly slimes fraction) are pumped to the EBM TSF as slurry. The process flow sheet is illustrated on Figure 2.3.

### 2.2.4 TAILINGS MANAGEMENT

The TSF was designed to store the fine tailings (slimes) that are not suitable for use as mine backfill as well as the whole tailings. Since commissioning of the TSF in 2002, approximately 55% of the total tailings (predominantly tailings slimes) have been pumped to the TSF for storage. Supernatant water is recycled to the Concentrator for re-use in the milling process via the Reclaim Water System.

Tailings are discharged into the TSF from a series of spigots located around the perimeter of the facility. The tailings discharge is rotated around the TSF in order to develop a low permeable tailings deposit against the upstream slope of the lined embankment and maintain the operating pond away from the embankment. Supernatant water is recycled to the Concentrator for re-use in the milling process via the Reclaim Water System.

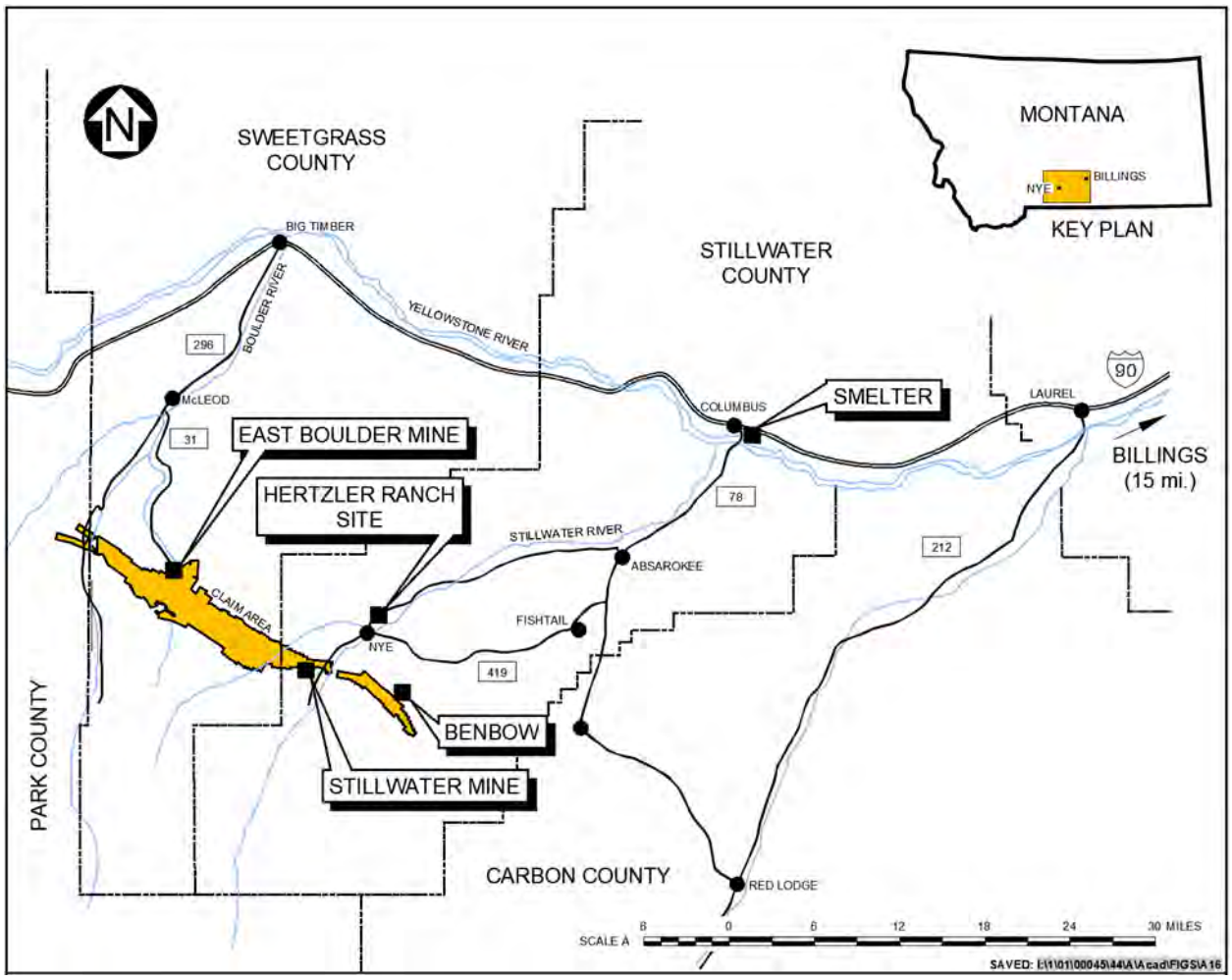
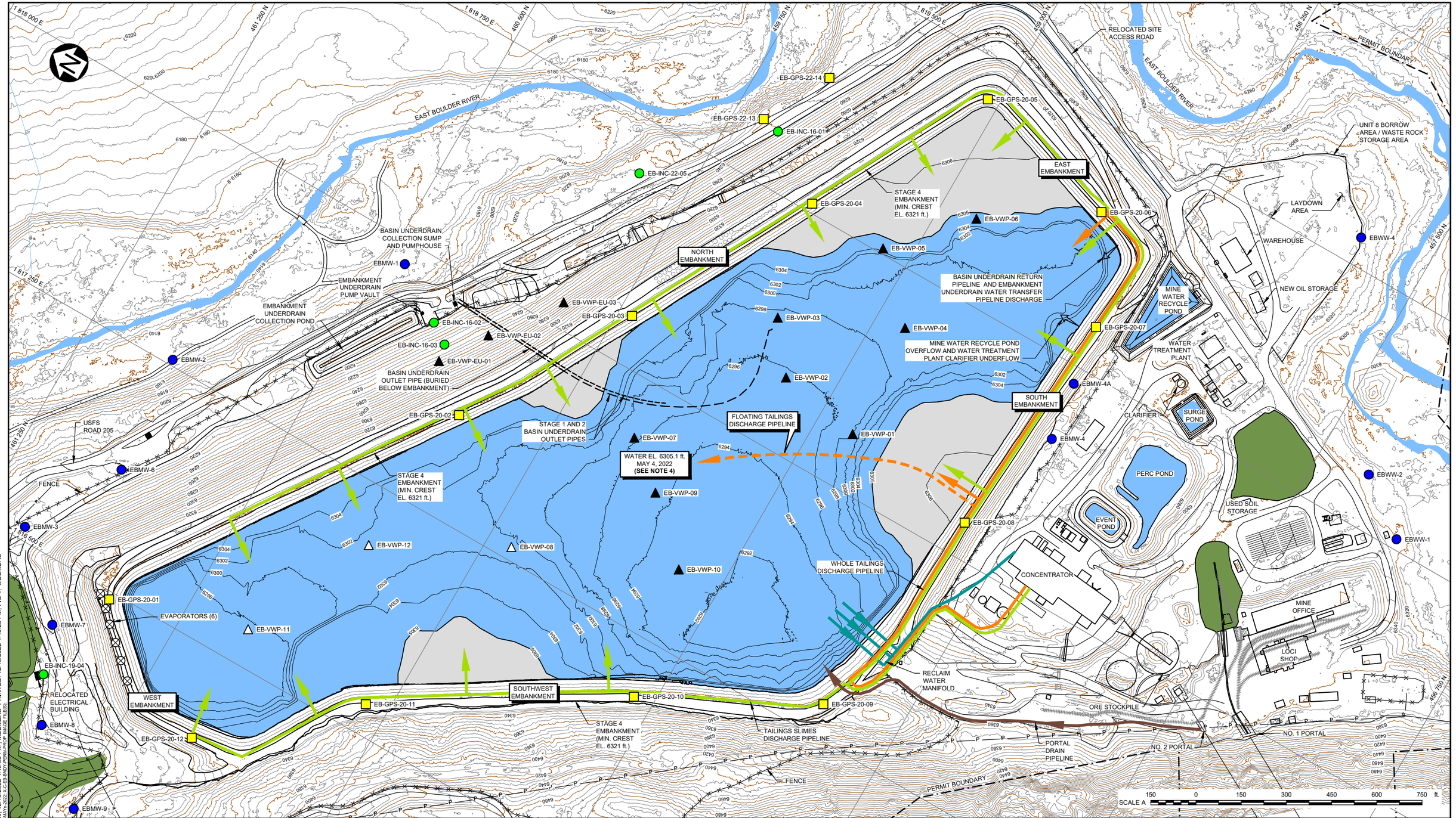



Figure 2.1 Site Location




**LEGEND:**

- WATER
- TAILINGS
- SURFACE SOIL STOCKPILE
- SURVEY MONUMENT
- VWP LOCATIONS (OPERATIONAL)
- VWP LOCATIONS (DECOMMISSIONED)
- SLOPE INCLINOMETER LOCATION
- MONITORING WELL LOCATION
- EVAPORATORS
- RECLAIM WATER PUMPS
- PORTAL DRAIN PIPELINE
- TAILINGS SLIMES DELIVERY PIPELINE
- PROPOSED FLOATING TAILINGS SLIMES DELIVERY PIPELINE
- WHOLE TAILINGS DELIVERY PIPELINE
- PROPOSED FLOATING WHOLE TAILINGS DELIVERY PIPELINE
- RECLAIM WATER PIPELINE
- ROAD
- POWERLINE
- PERMIT BOUNDARY (PROPOSED)
- FENCE

**NOTES:**

1. TOPOGRAPHY BASED ON LIDAR DATA PROVIDED BY STILLWATER MINING COMPANY JUNE 2018, SURVEY DATA PROVIDED BY WOITH ENGINEERING INC. FEBRUARY 2021, MAY 2021 AND SURVEY DATA PROVIDED BY TURNER MINING JUNE 2022.
2. CONTOUR INTERVAL IS 5 FEET.
3. HORIZONTAL DATUM IS MONTANA COORDINATE SYSTEM, SINGLE ZONE, NAD83 (1992). UNITS ARE IN INTERNATIONAL FEET. VERTICAL DATUM IS NGVD29.
4. TAILINGS SURFACE SHOWN ON THIS FIGURE WAS SURVEYED BETWEEN MAY 4 TO 6, 2022 BY COPPERSTONE TECHNOLOGIES.

| REV | DATE | DESCRIPTION | DESIGNED | DRAWN | REVIEWED |
|---|---|---|---|---|---|
| 0 | 20DEC'22 | ISSUED FOR INFORMATION | CNH | MMD | KJB |

SIBANYE STILLWATER

EAST BOULDER MINE

**GENERAL ARRANGEMENT**

Knight Piésold CONSULTING

| P/A NO. | REF NO. |
|---|---|
| NB101-45/58 | NB22-01384 |

**FIGURE 2.2** REV 0

SAVED: I:\01\00045\58\A\Acad\FIGS\B20 R0, 12/19/2022 4:49:03 PM, MDEMERS PRINTED: 12/19/2022 4:49:28 PM, FIG 1, MDEMERS
XREF FILE(S): X-C-TOPO-EASTB-NAD83; X-C-EB-TAL-SURFAMAY-2022; X-C-EB-BND-PERM-PROP IMAGE FILE(S):

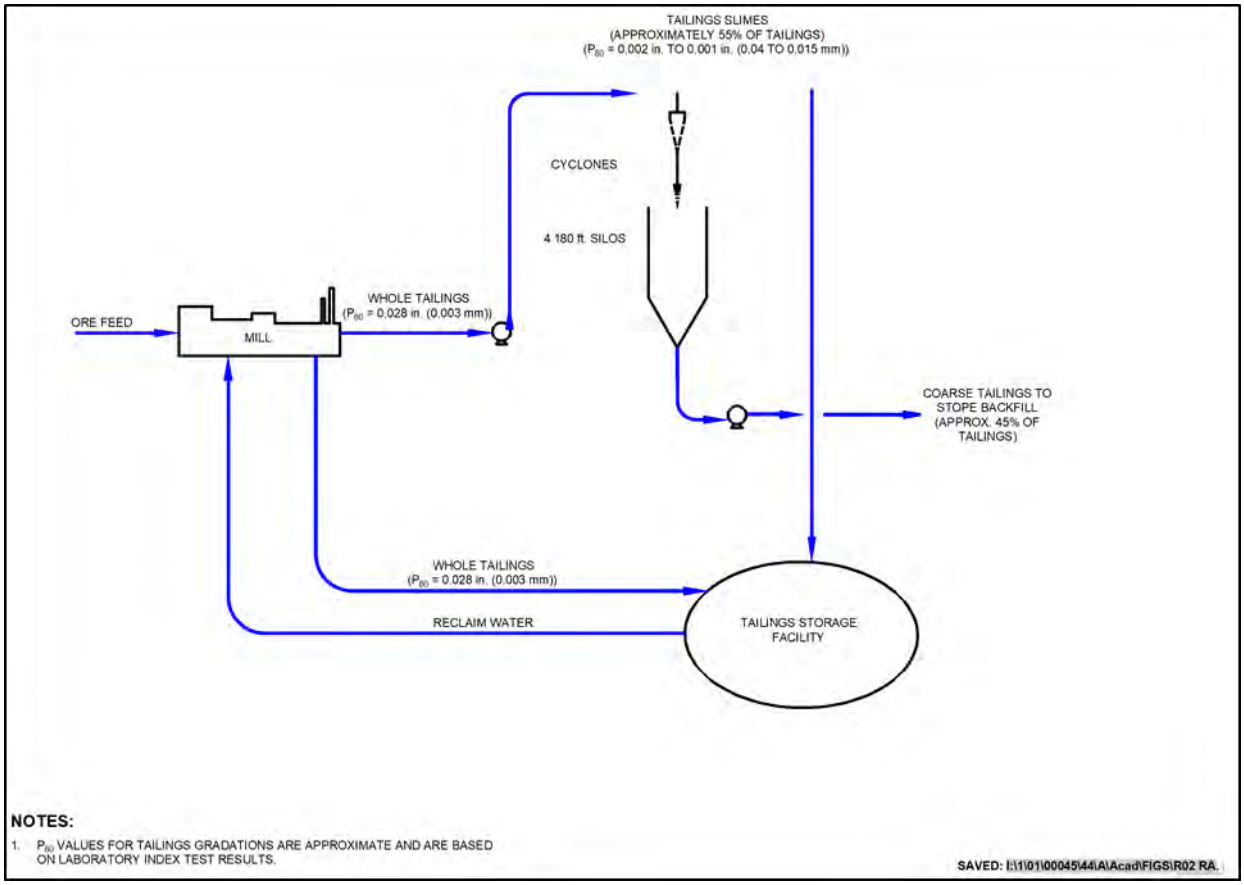



Figure 2.3 Process Flow Sheet

## 2.3 Design Basis and Operating Criteria

### 2.3.1 Overview

The principal objectives for the design and staged construction of the EBM TSF are to safely and securely manage tailings materials and to ensure complete protection of the regional groundwater and surface water flows (both during operations and in the long term) and to achieve effective reclamation at mine closure. The principal design features are as follows:

- Permanent, secure and total confinement of all solid waste materials within an engineered storage impoundment
- Control, collection and removal of free draining liquids from the tailings during operations and the prevention of uncontrolled leakage from the impoundment to the maximum practical extent
- The inclusion of monitoring features for all aspects of the impoundment to ensure performance goals are achieved
- Staged development of the TSF to distribute capital expenditure over the life of the mine

The design basis and operating parameters for the TSF and associated facilities are provided in detail within the design documents listed in Appendix B. The main components of the EMB TSF include the tailings embankment, embankment underdrain, tailings basin which includes a geosynthetic lining system and Basin Underdrain, tailings delivery system and water reclaim system. The key design and operating parameters are summarized in the Design Basis Report (KP, 2022). The TSF components are briefly described below (Table 2.1).

### 2.3.2 Tailings Embankment

The tailings embankments have been constructed from glacial till excavated from within the Stage 1 and Stage 2 storage cells, permitted borrow area and ROM rockfill from the underground mine development. The staged TSF construction is summarized below.

- Stage 1 was completed in 1999 and consisted of a single cell (Cell 1) with North, East and West confining embankments constructed to El. 6,285 ft.
- Stage 2 TSF was completed in 2006 and included an expansion to the west, with excavation of a second tailings storage cell (Cell 2) adjacent to the existing Stage 1 cell (Cell 1). A divider berm separated the two cells and allowed for independent operation of Cell 2. The Stage 2 construction included construction of North and West confining embankments to El. 6,285 ft.
- The Stage 3 TSF was completed in 2015 and included raising the embankments around Cells 1 and 2 to El. 6,305 ft. The embankments were raised with the downstream construction method using ROM rockfill from the underground mine development.
- The Stage 4 TSF was completed in 2020 and included raising the embankment to El. 6,321 ft. The embankments were raised with the downstream construction method using ROM rockfill from the underground mine development, and random fill from the permitted borrow area.
- Stillwater is currently placing ROM rockfill to construct the Stage 5 downstream embankment raise. Stage 5 will be constructed to El. 6,330 ft.
- Infrastructure relocation, foundation preparation and initial fill placement for the Stage 6 downstream embankment raise is schedule to commence in 2021. Stage 6 will be constructed to El. 6,344 ft.

TABLE 2.1

SIBANYE STILLWATER
EAST BOULDER MINE

TAILINGS STORAGE FACILITY - TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
KEY DESIGN AND OPERATING PARAMETERS

Print Dec-21-22 17:50:20

| Item No. | Component | Design Criteria/Operating Criteria |
|---|---|---|
| 1.0 General Design Criteria | | |
| 1.1 | Codes and Standards | · ASTM, AASHTO, ACI, ANSI, MSHA, OSHA, NBC and related codes |
| 1.2 | Site Elevation | · 6100 to 6500 feet |
| 1.3 | Meteorological Parameters | · Average Annual Rainfall = 24 inches |
| | | · Annual Evaporation = 36 inches |
| | | · Mean Annual Temp = 40 degrees F |
| | | · Design Storm Event is 1/2 PMF = 26 inches |
| | | · PMF defined as 72 hour PMP (37 inches), plus snowmelt (15 inches). Total = 52 inches. |
| 1.4 | Hydrologic Evaluation and Hazard Rating (U.S. Army Corps of Engineers) | · During Operations: Low to Significant Hazard, Intermediate Height (40-100 feet high per stage) |
| | | · After Closure: Low to Significant Hazard, Large Size Category (>100 feet high) |
| 1.5 | Seismic Design | · The Maximum Design Earthquake (MDE) corresponds to the Maximum Credible Earthquake (MCE) |
| | | · Earthquake Magnitude = 7.0 |
| | | · Maximum Firm Ground Acceleration = 0.18 g |
| | | · Seismic coefficient = 0.10 g (Seismic Zone 2) |
| 2.0 Tailings Production | | |
| 2.1 | Tailings Production Information | · Approximately 55% of the total tailings production will report to the TSF |
| | | · Design Mill throughput = 2,000 tpd |
| | | · Project Mill throughput = 1,670 tpd |
| 2.2 | Solids Content of Tailings Slurry | · 35% (approximate) |
| 2.3 | Tailings Average Dry Density | · 70 pcf |
| 2.4 | Tailings Solids Specific Gravity | · 2.67 |
| 2.5 | Water Reclaim | · Design Capacity = 1,500 gpm |
| 3.0 Tailings Basin | | |
| 3.1 | Storage Capacity | · Stage 1 - 1.54 million cubic yards (El. 6279 ft.) |
| | | · Stage 2 - 1.67 million cubic yards (El. 6279 ft.) |
| | | · Stage 3 - 1.96 million cubic yards (El. 6299 ft.) |
| | | · Stage 4 - 1.80 million cubic yards (El. 6315 ft.) |
| | | · Stage 5 - 1.11 million cubic yards (El. 6325 ft.) |
| 3.2 | Operating Pond Volume | · Minimum Operating Pond Volume = 50 million gallons (153.6 acre-ft.), equivalent to 2.2 ft. of water El. 6296.8 to 6299 ft. (Stage 3) |
| | | · Maximum Recommended Operating Pond Volume = 150 million gallons (460.6 acre-ft.), equivalent to 4.7 ft. of water El. 6294.3 to 6299 ft. (Stage 3) |
| 3.3 | Design Freeboard | · During operations the total freeboard is 6 ft. including the following: |
| | | · Storage capacity for the PMF, approximately 331 acre-ft. |
| | | · Approximately 2.2 ft. for wave runup protection |
| | | · After closure the tailings surface will be graded to control runoff. Stormwater drainage provisions provided at final reclamation to provide routing for the PMF. No freeboard or spillway required. |
| 3.4 | Lining System | · 12 oz./yd$^2$ non-woven geotextile filter fabric as cushion layer |
| | | · 100 mil HDPE geomembrane installed overtop of non-woven geotextile |
| 3.5 | Basin Underdrain System | · Basin Underdrain layer (drainage layer (gravelly sand), perforated CPT collection pipes and HDPE conveyance pipes) installed over 100 mil HDPE geomembrane |
| | | · Fine random fill placed over the drain sections as a protective layer |
| | | · The underdrain collection pipeworks connect into solid steel outlet pipes (concrete encased) |
| | | · Underdrain collection system and the conveyance pipes drain by gravity to the collection sump |
| 4.0 Tailings Embankment | | |
| 4.1 | Embankment Crest Width | · 30 feet (minimum) for Stages 1 through 4 |
| | | · 21 feet (minimum) for Stage 5 |
| 4.2 | Embankment Height (Max.) | · Stage 1 & 2 - 95 feet (Crest El. 6285 feet) |
| | | · Stage 3 - 115 feet (Crest El. 6305 feet) |
| | | · Stage 4 - 131 feet (Crest El. 6321 feet) |
| | | · Stage 5 - 140 feet (Crest El. 6330 feet) |
| 4.3 | Embankment Slopes | · Downstream fill slopes for Stage 2, 3 and 4 = 1.6H:1V (temporary interim slopes) |
| | | · Downstream fill slope for Stage 5 = 2H:1V (final configuration) |
| | | · Upstream fill slopes = 2H:1V or 2.5H:1V |
| 4.4 | Embankment Fill Material | · Glacial material excavated from within TSF Cells 1 and 2 for Stage 1 and 2 |
| | | · ROM rockfill for on-going staged expansions |

TABLE 2.1

SIBANYE STILLWATER
EAST BOULDER MINE

TAILINGS STORAGE FACILITY - TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
KEY DESIGN AND OPERATING PARAMETERS

Print Dec-21-22 17:50:20

| Item No. | Component | Design Criteria/Operating Criteria |
|---|---|---|
| 4.5 | Stability Requirements | · The Minimum Acceptable Factors of Safety (US Corps of Engineers) are as follows: |
| | | · End of construction = 1.3 |
| | | · Long-term (full tailings pond) = 1.5 |
| | | · Seepage Condition = 1.3 |
| | | · Seismic (pseudo-static) = 1.1 |
| 4.6 | Embankment Underdrain System | · 12 oz/yd$^2$ non-woven geotextile cushion layer above and below HDPE geomembrane |
| | | · 80 mil textured (both sides) HDPE geomembrane |
| | | · Drainage layer (gravelly sand) with HDPE collection pipes |
| | | · Collection pipework gravity drains to collection sump. Collected water pumped back to TSF. |

I:\1\01\00045\58\A\Report\2022 East Boulder TOMS Manual Update\[Table 2.1 - East Boulder Key Design and Operating Parameters.xlsx]Table 2.1

### 2.3.3 EMBANKMENT UNDERDRAIN

The Embankment Underdrain was constructed below the Stage 4 and 5 North, East and West Embankments as part of the Stage 3 embankment construction. The Embankment Underdrain was installed as a voluntary nitrogen source reduction measure to control and collect meteoric water percolating through the ROM rockfill. The Embankment Underdrain consists of an HDPE geomembrane, non-woven geotextile, a sand and gravel drainage layer and collection pipework. The collected water gravity drains into a HDPE lined collection pond where the collected water is pumped into to the TSF or to the biological water treatment system.

### 2.3.4 TAILINGS BASIN

The TSF is projected to provide storage until 2031 based on current mining plans. The total capacity of the TSF (all 6 Stages) is approximately 11.6 million cubic yards (approx. 11.0 Mt). The tailings basin filling is dependent on actual concentrator throughput rates, tailings deposition characteristics, water inputs and outputs and in situ settled tailings density. The estimated filling schedule of the TSF is illustrated on Figure A.1 (Appendix A).

The minimum freeboard requirement for the Stage 4 Tailings Basin is 6 ft., which includes storage of the Probable Maximum Flood (PMF) and a dry freeboard allowance of 2 ft. for wave run-up. The maximum operating level of the Stage 4 TSF is 6,315 ft. The recommended operating pond volumes for the tailings basin are as follows:

- The minimum operating pond volume is approximately 50 million gallons (153.6 acre-ft.). Stillwater has indicated that this is the minimum water required to maintain sufficient water volume for operations. This is equivalent to an average of approximately 2.0 ft. of water over the basin area (El. 6,313 to 6,315 ft. for Stage 4).
- The maximum recommended operating pond volume is approximately 150 million gallons (460.6 acre-ft.). This is equivalent to an average of approximately 6 ft. of water over the basin area (El. 6,309 to 6,315 ft. for Stage 4). The current maximum recommended operating pond volume is based on maintaining a sufficient water cover over tailings surface to prevent dusting during the winter months. The maximum recommended pond volume may be reduced for the later TSF stages. It is noted that the EBM TSF may be safely operated with an operating pond volume that is greater than 150 million gallons as long as the 6 ft. minimum freeboard requirement is maintained.

The tailings basin is lined with a 100 mil HDPE geomembrane to minimize seepage from the tailings basin. The geomembrane is installed over a 12 oz/yd$^2$ non-woven geotextile cushion layer. A Basin Underdrain is installed over the floor of Cells 1 and 2 to promote tailings consolidation and reduce the pressure head on the lining system, thereby minimizing the potential for seepage from the TSF. The Basin Underdrain layer includes a granular drainage layer (gravelly sand), perforated CPT collection pipes and HDPE conveyance pipes. Coarse granular material was placed over the collection and conveyance pipe alignments as an additional drainage and erosion protection layer. The underdrain collection pipework is connected to concrete encased steel outlet pipes, which drain to the Basin Underdrain Collection Sump.

The Stage 1 and Stage 2 Basin Underdrains flow by gravity to the Underdrain Collection Sump. The Basin Underdrain water is pumped back to the east side of Cell 1 or to the Water Treatment Plant via a buried 3-inch HDPE pipe. The pipeline is buried adjacent to the site access road from the Underdrain Collection Sump to a manhole at the southeast corner of the TSF. A valve and pipe tee in the manhole allows water to be directed into the TSF or the Water Treatment Plant.

### 2.3.5 Seepage Collection System

There is no external seepage collection system for the EBM TSF. The HDPE geomembrane and Basin Underdrain layer in Cells 1 and 2 are the primary method for reducing seepage losses from the TSF. There are monitoring wells located downstream of the TSF which are utilized to pump collected seepage back to the TSF, if required.

### 2.3.6 Tailings Delivery System

Tailings are pumped from the underground Sand Plant or directly from the Concentrator to the TSF via separate HDPE pipelines. The pipeline is located on the west side of the Concentrator and runs to the southwest side of the TSF. The tailings delivery pipelines are connected to tailings discharge pipelines which are installed on the upstream side of the TSF embankments. The tailings discharge pipeline consists of butt fusion welded 8 inch diameter DR17 HDPE pipe. The tailings slurry can be discharged from up to eighteen (18) spigot locations that extend from the embankment crest down to near the tailings and supernatant pond surface.

The tailings slurry flow is monitored at both ends of the pipeline system. Visual monitoring of the tailings slurry flow is carried out at the TSF. Emergency shutoff for the tailings delivery system is located in the Concentrator.

### 2.3.7 Water Reclaim System

Three inclined reclaim pumps and pipelines are located at the south end of Cell 2, adjacent to the Concentrator. The pumps are connected to 6-inch diameter DR17 HDPE pipes which are connected to the steel Reclaim Pipe Manifold located adjacent to the TSF. The Reclaim Pipe manifold is connected to a 12 inch diameter DR 11 HDPE pipeline which extends to the Concentrator as illustrated on Figure 2.2.

## 2.4 Water Management

### 2.4.1 General

The EMB TSF supernatant water consists of tailings water, precipitation and basin runoff. Supernatant water is recycled back to the Concentrator via the Reclaim Water System described in Section 2.3.6. Seepage control for the TSF is provided by a HDPE geomembrane liner system and Basin Underdrain. Water collected from the Basin Underdrain is primarily removed from the TSF by transferring water from the Water Treatment Plant. Occasionally Basin Underdrain water is pumped back to the TSF. Water collected in the Embankment Underdrain is also pumped into the TSF.

There is an upstream catchment area located adjacent to the southwest side of the TSF. Runoff from this catchment area is directed to local percolation areas. Surface water management measures for the facility include ditches and sedimentation basins located along the access roads and adjacent areas.

### 2.4.2 Water Balance

The water balance for the EBM TSF is maintained by Stillwater. The water balance is updated on a monthly basis to reflect the operating conditions. The following data are pertinent to the operation of the TSF and are required to be tracked and included as part of the water balance:

- Tailings throughput and process water volumes delivered to the TSF
- Reclaim water volumes recycled to the Concentrator
- Water volumes transferred to the Water Treatment Plant via the Basin Underdrain
- Water volumes pumped from the Embankment Underdrain to the TSF
- Meteorological data

The water balance flow sheet is illustrated on Figure A.4 (Appendix A) and includes the average annual water additions and losses. The TSF water balance is reviewed on an annual basis as part of the EOR annual inspection.

## 2.5 CLOSURE PLAN

Reclamation of disturbed areas is being carried out during operations to the maximum extent practicable. The objectives of the reclamation plan are to stabilize disturbed areas to prevent soil loss, minimize visual impacts, and prevent air and water pollution. These objectives are accomplished through surface drainage, concurrent reclamation of downstream embankment slopes and interim revegetation of borrow areas using approved seed mixes.

Final reclamation of the TSF will generally include the following:

- Dewatering - Natural drying and evaporation will reduce the moisture content in the tailings. In addition, the Basin Underdrain will promote consolidation of the tailings mass. At closure, surface ponded water will be pumped out of the TSF. This water will be treated and discharged to the Percolation Pond. The Basin Underdrain may be operated for some time after closure.
- Capping - The TSF will be capped with a minimum 2 ft. thick layer of waste rock and/or borrow material. The closure cap and embankment slopes will be covered with 28 inches of surface soil.
- Revegetation - Revegetation measures will include seedbed preparation and seeding with approved seed mixes in the upper soil layer.

Final reclamation will include the construction of a closure spillway (i.e. drainage channel) for storm water runoff management. During closure, the Basin Underdrain and Embankment Underdrain waters will be pumped to the Water Treatment Plant or redirected to the percolation area adjacent to the underdrain sump. After closure, the Basin Underdrain and Embankment Underdrain sumps will be converted to percolation structures by removing the liners and pumps; and then filling with gravel. At that point, the Basin Underdrain and Embankment Underdrain seepage will be directed to the percolation structures and either percolate or overflow onto native ground beyond the sumps.

Additional information on the reclamation of the TSF is presented in the amended reclamation plan, which is structured to meet the requirements of the *Montana Metal Mine Reclamation Act*.

# 3.0 OPERATIONS, MAINTENANCE AND SURVEILLANCE

## 3.1 INTRODUCTION

The EMB TSF components and associated facilities are shown on Figure 2.2. These components and facilities must be inspected and maintained regularly to ensure that any changes to the conditions, performance, or any potentially hazardous condition can be identified and promptly addressed. Selected photographs of the facility and associated components are provided in Appendix D. Inspection and surveillance schedules are provided in Appendix C.

The Concentrator Manager is responsible for ensuring that surveillance is carried out as defined in this TOMS Manual. The Concentrator Manager is responsible for daily management of the TSF and directs the Surface Supervisor to carry out routine activities. The roles and responsibilities for the inspections are summarized in Section 1.2 of this TOMS Manual.

Routine inspections of the EMB TSF will be completed by the Concentrator Manager, General Foreman, Surface Supervisor, Environmental Sustainability Manager, and Environmental Coordinator(s) as per Table C1.1 (Appendix C):

Inspection reports should be reviewed by the Concentrator Manager and stored within Stillwater's electronic filing system. The quarterly Dam Surveillance reports shall be reviewed by the GM of EBM Operations. Additional (non-routine) inspections may be required as outlined following any unusual event or observation (e.g., earthquake or extreme rainfall event). A summary of the recommended actions following an unusual event are outlined in Appendix C2.

Additional (non-routine) inspections may be required as outlined following any unusual event or observation (e.g., earthquake or extreme rainfall event). A summary of the recommended actions following an unusual event are outlined in Appendix C2.

If an inspection is performed by the EOR following an unusual event or observation, and corrective actions are identified by the EOR, the same procedural framework outlined in Section 4.1 for an annual inspection will be followed for preparing, submitting and implementing the corrective action plan and schedule.

The Concentrator Manager and/or Environmental Compliance Manager must be made aware of any unusual events or observations and must contact the EOR as required. Typical examples of unusual events and observations to be made during such walkovers are outlined in Appendix C2.

Inspection forms are provided in Appendix C3 to help guide the observation and surveillance process. The inspection forms cover major items related the TSF and associated facilities.

Copies of completed inspection forms, data sheets and field notes must be provided to, and kept in Stillwater's electronic filing system, by the Environmental Compliance Manager. Any unusual observations must be reported to the Concentrator Manager and/or Environmental Compliance Manager immediately and will be responded to in accordance to the appropriate response level outlined in Section 5.3.

Additional details for each component of the facility are provided in the following sections.

The operation, maintenance and surveillance of the TSF is based on the use of current technologies. It is recognized that technology is evolving and other technologies should be considered as part of the future monitoring for the TSF. Several technologies that should be considered as part of future monitoring include:

- Landsat images to track tailings pond water volumes and construction progress over months and years, both for ongoing monitoring and for forensic evaluation
- Airborne or satellite-based InSAR to monitor ground movements
- Land-based time-lapse photography to document construction
- Unmanned aerial vehicles (UAVs or drones) to collect high-resolution imagery, LiDAR or Photogrammetry surveys to collect detailed topographic data on a regular basis
- Real-time and continuous record keeping

## 3.2 TAILINGS EMBANKMENT

### 3.2.1 OVERVIEW

The tailings embankments are constructed of glacial till and ROM rockfill and have been raised in stages using the downstream construction method as described in Section 2.3.2. Twelve survey monuments were installed on the Stage 4 embankment crest to monitor for settlement and/or displacement. The survey monuments include Global Positioning System (GPS) monitoring units that are programmed to collect 24 readings per day. An as-built survey of the Stage 4 embankment crest was made after the completion of Stage 4 embankment constructed in December 2019. A LIDAR survey of the TSF embankment was completed in May 2018. A LIDAR survey of the Stage 4 embankment will be completed in 2020. Four slope inclinometers are located along the downstream toe of the north and west embankments to monitor for potential movement in the embankment foundation. Vibrating wire piezometers (VWPs) are installed at the base of each slope inclinometer to monitor the phreatic surface in the embankment foundation. Monitoring requirements for instrumentation are summarized in Section 3.7.

The Embankment Underdrain collects meteoric water that percolates through the ROM rockfill. The collected water drains by gravity to a Collection Pond lined with HDPE geomembrane and the collected water is transferred to the TSF as described in Section 2.3.3. Vibrating wire piezometers are installed in the Embankment Underdrain to monitor the water level in the underdrain layer.

### 3.2.2 SURVEILLANCE AND MAINTENANCE

Regular surveillance of the embankments and associated structures should follow the schedule outlined in Appendix C1. Inspection forms are provided in Appendix C3. Typical observations to be made during surveillance include:

- Evidence indicating embankment structure deformation (e.g. slope bulging, cracks on the crest or crest settlement)
- Evidence indicating seepage, runoff or erosion
- Possible evidence suggesting internal erosion (piping) within the embankments (wet spots, seepage, etc.)
- Other unusual conditions in the impoundment area

The embankments and associated structures do not require regular maintenance; however, specific maintenance items may be identified as a result of regular observations and surveillance of the embankments. Maintenance items may include:

- Fill erosion gullies with properly compacted soil material. Seed or riprap repaired area to stabilize from future erosion
- Fill wildlife burrows
- Maintain grass cover by spraying weeds, fertilizing and watering as needed
- Maintain grading of the embankment crests to prevent potholes, rutting or other potential for standing water to accumulate
- Maintain fences to provide site security and to exclude wildlife from the embankments. Repair and/or re-vegetate damaged embankment surfaces.
- Perform regular inspections of the embankments and abutments to identify potential maintenance items

The integrity of the geomembrane lining in the Embankment Underdrain Collection Sump must be maintained to minimize seepage from the sump over the long term. Inspection of the geomembrane should be completed as part of the routine monthly inspections. Typical surveillance observations for the geomembrane include:

- Identification of defects in the geomembrane such as tears and holes
- Damage or degradation to geomembrane as a result of environmental exposure (e.g. ice, wind, UV damage, etc.)
- Identification of excess tension and trampolining in the geomembrane

Repairs to the geomembrane are required to be scheduled with a third-party geosynthetics installer if any defects or damage is identified.

The Embankment Underdrain collects meteoric water that percolates through the ROM rockfill and is operated continuously. Typical surveillance observations for the Embankment Underdrains include:

- Monitoring and documentation of Embankment Underdrain flows reporting to the Collection Sump
- Recording water volumes transferred from the Collection Sump to the TSF
- Monitoring the clarity of water from the Embankment Underdrain outlet pipeline
- Monitoring the Embankment Underdrain outlet pipeline for ice buildup during freezing conditions

Vibrating wire piezometers monitor the water level within the Embankment Underdrain. Monitoring requirements for the piezometers are summarized in Section 3.7.

Additional inspections are required after any unusual event. Appendix C2 outlines additional observations that will need to be documented. Appropriate repairs to the TSF will be implemented should any damage occur from an unusual event.

Stillwater completes a weekly quality assurance (QA) checklist to document the ongoing ROM rockfill placement for the embankment construction. A copy of the QA checklist is included in Appendix C4.

## 3.3 TAILINGS BASIN

### 3.3.1 OPERATIONAL OBJECTIVES

The projected rate at which the tailings accumulate within the basin, combined with storage provisions for make-up and storm water, determine the schedule for raising the embankments. The filling curve and staged construction sequence are shown on Figure A.2 (Appendix A). The minimum freeboard requirement for the impoundment is 6 ft. which includes storage of the PMF and a dry freeboard allowance of 2.2 ft. for wave run-up. The maximum operating level is 6 ft. below the embankment crest (El. 6,315 ft.).

Tailings deposition is to cease if the pond level exceeds the maximum operating level and the removal of water from the pond is to commence using the water reclaim system. There are no restrictions on the rate of filling or on the rate of drawdown for the supernatant pond, with respect to dam safety.

The tailings basin is lined with a geosynthetic lining system and a Basin Underdrain is installed along the base of Cells 1 and 2. Surveillance and maintenance for tailings basin filling, geosynthetic lining systems and the Basin Underdrains is required as part of the operation of the tailings basin. Vibrating wire piezometers are installed in the Basin Underdrain to monitor the response to pumping of the Basin Underdrain.

### 3.3.2 SURVEILLANCE AND MAINTENANCE

The pond level must be at least 6 ft. below the crest elevation under normal operating conditions. Emergency procedures, discussed in Section 5.0, must be followed if the pond exceeds the maximum operating level. Regular inspections of the pond level must be carried out as part of the routine inspections

according to the schedule outlined in Appendix C1 and the pond elevation should be recorded on a monthly basis. Inspection forms are included in Appendix C3.

Additional pond level inspections are required after an unusual event. The additional inspections are summarized in Appendix C2.

Maintaining the integrity of the geosynthetic lining system is integral for the safe operation of the TSF and to minimize seepage from the impoundment over the long term. Inspection of the geomembrane should be completed as part of the routine monthly inspections according to the schedule outlined in Appendix C1. Inspection forms are provided in Appendix C3. Typical surveillance observations for the geosynthetics include:

- Identification of defects in the geomembrane such as tears and holes
- Damage or degradation to geomembrane as a result of environmental exposure (e.g. ice, wind, UV damage, etc.)
- Identification of excess tension and trampolining in the geomembrane

Appropriate repairs are to be completed by third party geosynthetics installer if any defects or damage are identified.

Stillwater contracts a third-party geosynthetics installer to complete a detailed inspection of the HDPE geomembrane on a semi-annual basis in the spring and fall of each year. The semi-annual inspection reports include a summary of repairs made to the HDPE geomembrane and are kept on file in the Environmental Department and/or on Stillwater's electronic filing system.

Operation of the Basin Underdrains minimizes the head on the geomembrane thereby reducing the potential for seepage from the facility and promoting consolidation of the deposited tailings. The Basin Underdrains should be operated continuously. Typical observations for the Basin Underdrains to be made during surveillance include:

- Monitoring and documenting the Basin Underdrain flows
- Recording volumes pumped from the Basin Underdrain
- Monitoring the clarity of water from the Basin Underdrain return pipeline
- Monitoring the Basin Underdrain pipeline for ice buildup during freezing conditions

The VWPs installed in the Cell 1 and Cell 2 Basin Underdrains were installed to confirm the effectiveness of the underdrains. The piezometers monitor the pressure in the underdrains and the response to the Basin Underdrain pumping. Monitoring requirements for the piezometers are summarized in Section 3.7. Close monitoring of the pond elevation, depth, area and volume is important for the following reasons:

- To ensure that there is a sufficient volume of water available as make-up water while the pond is frozen and precipitation is at a minimum
- To enable monitoring of the supernatant pond depth/area/volume so that tailings characteristics such as settled dry density can be determined
- To monitor water recoveries
- To enable the correlation of the pond level with other data, such as the pore pressures (from the piezometers) and drain flow rates

## 3.4 SEEPAGE COLLECTION SYSTEM

There is no external seepage collection system for the EBM TSF. If additional seepage collection measures are deemed to be necessary, based on environmental monitoring data, a seepage collection system would be designed and implemented. This TOMS Manual would then be revised to integrate the required operating, monitoring and surveillance measures related to the seepage collection system.

## 3.5 TAILINGS DELIVERY SYSTEM

### 3.5.1 OPERATIONAL OBJECTIVES

The tailings slurry is pumped from the underground Sand Plant or directly from the Concentrator to the TSF. The components of the tailings delivery system are described in Section 2.3.6. Operation of the tailings delivery system is based on rotational discharge of tailings whereby a group of spigots are operated for a period of time and then deposition is transferred to another group of spigots for a period of time, etc. This strategy controls the supernatant pond location and develops a well-drained and relatively flat tailings surface that optimizes the storage capacity within the TSF. The 2-year (January 2021 to December 2022) tailings deposition plan for the TSF is illustrated in Appendix E. The tailings deposition plan is reviewed on an annual basis as part of the EOR annual inspection.

### 3.5.2 SURVEILLANCE AND MAINTENANCE

The tailings discharge pipeline does not require significant external adjustments during normal operations. However, the following points must be remembered during operation of the pipeline:

- Do not close all of the valves along the tailings discharge pipeline as they may be permanently blocked from sanding or suffer damage from excessively high pressures
- Ensure that there is an open pathway for tailings to exit the pipeline before switching tailings lines or after any spigots are relocated
- Flush the pipeline with water prior to shut down or relocation

The tailings delivery and discharge pipelines will be inspected and maintained regularly to ensure that the system operates properly. The tailings discharge location should be noted as part of the routine inspections. Appendix C1 provides a schedule for regular surveillance of the tailings delivery system. Inspection forms are provided in Appendix C3. Typical surveillance observations should seek to identify:

- Locations of excessive wear of the pipeline
- Evidence indicating leakage from the pipeline
- Wear at the bends on the butt-welded joints in the section of the pipeline installed on surface at the TSF
- Identification of pipe sections that are worn on one side that may be rotated so the unworn section conveys the tailings; or, worn sections that require replacement

Additional inspections are required after an unusual event. Appendix C2 outlines additional observations that will need to be documented. Repairs to the system may be required after any unusual event.

## 3.6 WATER RECLAIM SYSTEM

### 3.6.1 OPERATIONAL OBJECTIVES

Supernatant water is recycled from the TSF to the Concentrator for use as process water in the Concentrator. The components of the tailings water reclaim system are described in Section 2.3.7. The reclaim pumps may be operated from the Concentrator control room or from the breaker panel located adjacent to the tailings embankment next to the reclaim manifold.

The reclaim pipeline does not require any external adjustments during normal operations. However, the reclaim system should be drained during maintenance periods or during a prolonged shutdown under extreme cold conditions.

### 3.6.2 Surveillance and Maintenance

The water reclaim system shall be inspected according to the schedule outlined in Appendix C1 and an inspection log will be completed as provided in Appendix C3. Typical items to inspect during surveillance of the reclaim pipeline include:

- Flow rates
- Locations of excessive wear of the pipeline
- Evidence indicating leakage from the pipeline
- Monitor supernatant pond and reclaim pump elevations
- Monitor the tailings surface elevation adjacent to the reclaim pumps
- Ice buildup around the reclaim pumps and pipelines during freezing conditions

Additional inspections are required after any unusual event. Appendix C2 outlines additional observations that must be documented. Repairs to the reclaim pumps and pipelines may be required after any unusual event.

## 3.7 Instrumentation

### 3.7.1 Operational Objectives

Instrumentation is installed to assist with the monitoring of the TSF in order to evaluate compliance with design objectives. The instrumentation includes the following:

- Survey Monuments on the Embankment Crest to measure vertical and lateral movement of the embankment.
- Slope Inclinometers at the downstream toe of the embankment to monitor potential movement in the foundation.
- Vibrating Wire Piezometers in the Basin Underdrains to monitor the effectiveness of the Basin Underdrain system.
- Vibrating Wire Piezometers in the Embankment Underdrain to monitor the phreatic surface above the underdrain layer.
- Groundwater Monitoring Wells to monitor water quality downstream of the TSF. Water quality is monitored and reported separately under the Water Resources Monitoring Plan.

The locations of the survey monuments, slope inclinometers. piezometers and monitoring wells are shown on Figure A.1 (Appendix A).

### 3.7.2 Surveillance and Maintenance

Instrumentation components are regularly monitored. Instrumentation is connected to and viewable in real-time in GeoExplorer, an instrumentation monitoring software package (NavStar, 2017). The instrumentation data is collected, plotted and reported according to the schedule outlined in Appendix C1. The instrumentation data is reviewed by the EOR on a quarterly basis. The EOR must be notified of any anomalous trends or values above the specified trigger levels. Additional readings and inspections as outlined in Appendix C2 will be required after any unusual event or observation. The trigger levels for the survey monuments, slope inclinometers, vibrating wire piezometers are provided in the QRFG (Appendix A).

The instruments may require occasional maintenance which could include:

- The piezometer wires may need to be cut and re-attached if the readout box is unable to acquire data.
- Piezometer wires that are exposed may become corroded and may need to be trimmed until a fresh surface is exposed to allow readings to be taken.

- Protection of survey monuments from equipment traffic on embankment crest and other disturbances may be required during maintenance work. Survey monuments need to be re-established and protected after construction of each new embankment stage.
- Slope inclinometers must be maintained according to the manufacturer's instructions.

## 3.8 Surface Water Management

There are no upstream catchment areas reporting to the Hertzler TSF. Meteoric water reporting to the TSF includes direct precipitation to the tailings basin and runoff from the embankment crest. Surface water management measures for the facility include ditches and sedimentation basins located along the access roads and adjacent areas. The ditches and sedimentation basins are inspected and maintained as part of the Storm Water Pollution Prevention Plan (SWPPP).

## 3.9 Riverbank Erosion Monitoring Plan

Erosion of the East Boulder River escarpment has been identified as a potential hazard along a section of the TSF where the site access road and possibly the embankment toe could be undercut if erosion was extensive and if left unaddressed. Monitoring of the riverbank and site access road to confirm that riverbank erosion is not adversely impacting the site access road or TSF embankment includes:

- Annual topographic survey of the riverbank and escarpment following freshet. Additional surveys will be completed following storm events greater than or equal to the 1 in 200 year 24-hour precipitation event.
- Flow monitoring at station EBR-003 to document flow levels in the river during freshet and storm events (available on USGS website).
- Quarterly inspections of the riverbank and site access road by mine personnel as part of the quarterly TSF inspections.

If migration of the lower riverbank occurs, the riverbank and site access road monitoring shall be increased as follows:

- The frequency of topographic surveys will be increased
- Inspections of the riverbank escarpment and site access road by mine personnel will be increased to monthly intervals

If migration of the riverbank results in oversteepening and/or slumping of the escarpment, the EOR will implement appropriate mitigation measures to stabilize the escarpment slope and site access road.

# 4.0 SAFETY INSPECTIONS, REPORTING AND REVIEWS

## 4.1 QUARTERLY AND ANNUAL INSPECTION

Quarterly and Annual inspections of the TSF and associated facilities are required to evaluate current and past performance and to observe potential deficiencies in condition, performance and/or operation. The Environmental Sustainability Manager is responsible for arranging the inspections. The level of dam safety evaluation will be based on detailed observations made by the EOR and/or Deputy EOR and on relevant information on the TSF operations collected by site personnel. Additional reviews may also be required to follow up on reports of unusual events or observations.

The Environmental Sustainability Manager, Concentrator Manager and/or Environmental Coordinator should accompany the EOR during the annual inspection. The EOR and/or Deputy will evaluate the safety of the TSF and incorporate a review of the following:

- The condition of the TSF and operating practices
- TOMS Manual
- The availability of all documents pertaining to dam safety on site
- The site surveillance practice
- Changes in relevant regulatory requirements since the last inspection

The EOR will issue an annual inspection report after completing the review. The report will include the following at a minimum:

- Conclusions on the status of the TSF
- Statement indicating completion of recommendations from previous inspections and reviews
- New recommendations if necessary

The annual inspections and reporting for the EMB TSF includes the following:

- The EOR shall inspect the TSF annually during operations or as required during closure pursuant to a reclamation plan.
- The EOR will prepare a report describing the scope of the inspection and recommended actions for the proper operation and maintenance of the EMB TSF.
- The EOR will submit the report to Stillwater, DEQ and United States Forest Service Custer Gallatin National Forest (USFS CGNF). The EOR shall immediately notify the DEQ, Stillwater and USFS CGNF if the facility presents an imminent threat or has the potential for an imminent threat to human health or the environment.

Should the annual inspection report contain recommendations, the following actions will be taken:

- Stillwater will prepare a Corrective Action Plan (CAP) and schedule to guide the implementation of the recommendations made by the EOR.
- Stillwater will submit the CAP and schedule to the EOR.
- The EOR will review the CAP and schedule and verify that the proposed corrective actions are reasonably expected to effectively address the recommendations made in the annual report.
- Stillwater will submit the verified CAP and schedule to the DEQ within 120 days following the date of the inspection.
- Stillwater will implement the CAP in accordance with the implementation schedule.

## 4.2 INDEPENDENT REVIEW

The ITRB completes annual reviews of the TSF as per Stillwater's internal corporate governance document. The IRP will conduct periodic reviews of the Stage 6 TSF during construction and operations as per the approved design documentation. As the IRP consists of the same ITRB members, the annual reviews by the ITRB will satisfy the periodic IRP reviews. The ITRB and IRP will complete separate reporting to Stillwater and DEQ as appropriate.

## 4.3 THIRD-PARTY REVIEW

The principle objective of a third-party Dam Safety Review (DSR) is to ascertain that a dam has an adequate margin of safety, based on the current engineering practice and updated design input data. A third-party review may also be carried out to address a specific problem.

A third-party qualified engineer will be responsible for conducting the DSR at the EBM TSF. The engineer conducting the review must be qualified to conduct safety evaluations and be familiar with designs and other site-specific conditions and requirements pertaining to the operation of the TSF and associated facilities; but ideally should not have been involved in the design, construction or operations of the TSF.

A third-party review at the EBM TSF will be carried out every 5 years and this scheduling requirement should be confirmed or revised at the time of each annual inspection. The next review scheduled for the EBM TSF is in 2025, as a third-party review was completed in 2020.

# 5.0 EMERGENCY PREPAREDNESS PLAN

## 5.1 GENERAL

An Emergency Preparedness Plan (EPP) (Stillwater, 2022) has been developed to enable Stillwater to:

- Identify emergency and hazardous conditions threatening the facility
- Expedite effective response actions to prevent failure
- Reduce loss of life, minimize property damage and protect the environment, should failure occur

In the event that Stillwater is unable to comply with any of the terms and conditions of the operating permit, due to any cause, Stillwater will:

- Immediately notify the DEQ of the failure to comply
- Immediately take action to stop, contain, and clean up unauthorized discharges or otherwise stop the non-compliance, correct the problem, and if applicable, repeat sampling and analysis of any non-compliance immediately
- Submit a detailed written report to the DEQ within thirty (30) days (5 days for upsets and bypasses), unless requested earlier by the DEQ. The report will contain a description of the non-compliance, including exact dates and times, if the non-compliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the non-compliance.

## 5.2 FAILURE MODES AND EFFECTS ANALYSIS

A high-level Failure Modes and Effects Analysis (FMEA) was completed for the TSF to inform the dam breach assessment that was completed to support the development of the EPP. Credible failure modes that have been identified for the EBM are related to a breach the facility that would lead to a release of water and tailings solids. These failure modes are related to hypothetical structural, foundation, and/or erosional failures.

Therefore, Stillwater has developed an EPP for the scenario of a hypothetical failure of the EBM TSF that would result in a flash flood downstream of the TSF due to a release of water and tailings solids. A breach analysis has been completed for the EBM TSF to estimate the downstream flood inundation zone. In turn, this identified the residences and roads that are at risk downstream of the TSF. The dam breach inundation maps are included into the EPP (Stillwater, 2022.

Each of the above listed failure modes, and their contributing factors, have been taken into consideration in determining the potential emergency conditions.

## 5.3 EMERGENCY CONDITIONS

The EPP (Stillwater, 2022) should be referred to if emergency conditions are suspected or have been identified. Two levels of emergency conditions (or warning signs) can be identified with respect to the site operations. These are defined as follows:

- Level 1 - Conditions that represent a potential emergency are those that if sustained or allowed to progress may result in an emergency, but no emergency situation is imminent.
- Level 2 - An emergency condition is defined by either failure of a significant component of the TSF and/or associated facility, or a significant failure of the performance of a component of the TSF. Such failure may have already occurred or be imminent.

For each level of emergency condition, the EPP identifies subsequent response and/or corrective actions, including emergency notification contacts.

# 6.0 REFERENCES


Knight Piésold Ltd. (KP), 2022. *East Boulder Mine TSF Design Basis Report.* December 5. North Bay, Ontario. Ref. No. NB101-45/58-1 Rev 0.

NavStar Geomatics Ltd. (NavStar), 2017. *GeoExplorer 6*. Version 2.4.0.0. Kelowna, British Columbia.

Sibanye Stillwater (Stillwater), 2022. *Tailings Storage Facility - Emergency Preparedness Plan (EPP)*. December 19. V1.4.

State of Montana (MT), 2019. *Montana Code Annotated (MCA) 2017*. Title 82. Minerals, Oil, and Gas Chapter 4. Reclamation. Part 3. Metal Mine Reclamation.

# 7.0 CERTIFICATION

This report was prepared and reviewed by the undersigned.

We hereby certify that the following:

- This TOMS Manual is consistent with the design of the EBM TSF;
- The inspections and monitoring described in this TOMS Manual are reasonably sufficient to ensure the EBM TSF will perform as intended and will reasonably be expected to detect deviations if they occur; and
- The Emergency Preparedness Plan (EPP) describes reasonable measures that can be taken to protect human health and the environment.


Prepared:

Craig N. Hall, P.Eng.
Knight Piésold Ltd. - Managing Principal
Deputy Engineer of Record for East Boulder Mine Tailings Storage Facility

Reviewed:

Matt Wolfe
Environmental Sustainability Manager - US Region

The Engineer of Record has reviewed this manual and hereby certifies the following:

- This TOMS Manual is consistent with the design of the EBM TSF;
- The inspections and monitoring described in this TOMS Manual are reasonably sufficient to ensure the EBM TSF will perform as intended and will reasonably be expected to detect deviations if they occur; and
- The Emergency Preparedness Plan (EPP) describes reasonable measures that can be taken to protect human health and the environment.


Reviewed: _____

Ken J. Brouwer, P.E.
Knight Piésold Ltd. - Principal Engineer
Engineer of Record for East Boulder Mine Tailings Storage Facility

# Appendix A

## Quick Reference Field Guide

(Pages A-1 to A-6)

# APPENDIX A
# QUICK REFERENCE FIELD GUIDE

## 1.0 INTRODUCTION

This Quick Reference Field Guide (QRFG) provides a concise summary of key information for the operation, monitoring and surveillance of the East Boulder Mine (EBM) Tailings Storage Facility (TSF). The Quantitative Performance Parameters (QPPs), instrumentation trigger levels and locations, and tailings and water management details for the TSF are summarized below.

## 2.0 QUANTITATIVE PERFORMANCE PARAMETERS

QPPs represent measurable parameters to confirm that the TSF is being operated in accordance with the design intent. QPPs for the EBM TSF are summarized in Table A.1.

Table A.1 TSF Quantitative Performance Parameters

| Parameter | Stage | Value |
|---|---|---|
| Crest Elevation | Stage 4 | 6,321 ft. |
| | Stage 5 | 6,330 ft. |
| | Stage 6 | 6,344 ft. |
| Minimum Freeboard | Stage 4 | 6 ft. |
| | Stage 5 | 5 ft. |
| | Stage 6 | 10.5 ft. |
| Maximum Operating Level | Stage 4 | El. 6,315 ft. |
| | Stage 5 | El. 6,325 ft. |
| | Stage 6 | El. 6,333.5 ft. |
| Crest Width | Stage 4 | 30 ft. |
| | Stage 5 | 21 ft. |
| | Stage 6 | 21 ft. |
| Embankment Slope Angle | Stage 4 | Upstream: 2H:1V<br>Downstream: 1.6H:1V |
| | Stage 5 | Upstream: 2H:1V<br>Downstream: 2H:1V |
| | Stage 6 | Upstream: 2H:1V<br>Downstream: 1.75 to 2.0H:1V |
| Recommended Operating Pond Volume | Stages 4 and 5 | Minimum: 50 M gal |
| | | Maximum: 150 M gal |

# 3.0 INSTRUMENTATION

Instrumentation has been installed in the EBM TSF to monitor the performance of the embankment and the Cell 1 and Cell 2 Basin Underdrains. The embankment survey monuments, embankment slope inclinometers and select vibrating wire piezometers (VWPs) are designated as QPPs for monitoring the performance of the TSF. The QPPs specify a displacement trigger level for the survey monuments and slope inclinometers and a piezometric trigger elevation for the piezometers. If the trigger levels are reached for the survey monuments, slope inclinometers and piezometers are reached, appropriate notifications are provided, and Unusual Event monitoring and reporting is triggered. The instrumentation locations for the Stage 4 TSF are shown on Figure A.1. The slope inclinometer sections are illustrated on Figure A.2. Instrumentation trigger levels are summarized in Table A.2.

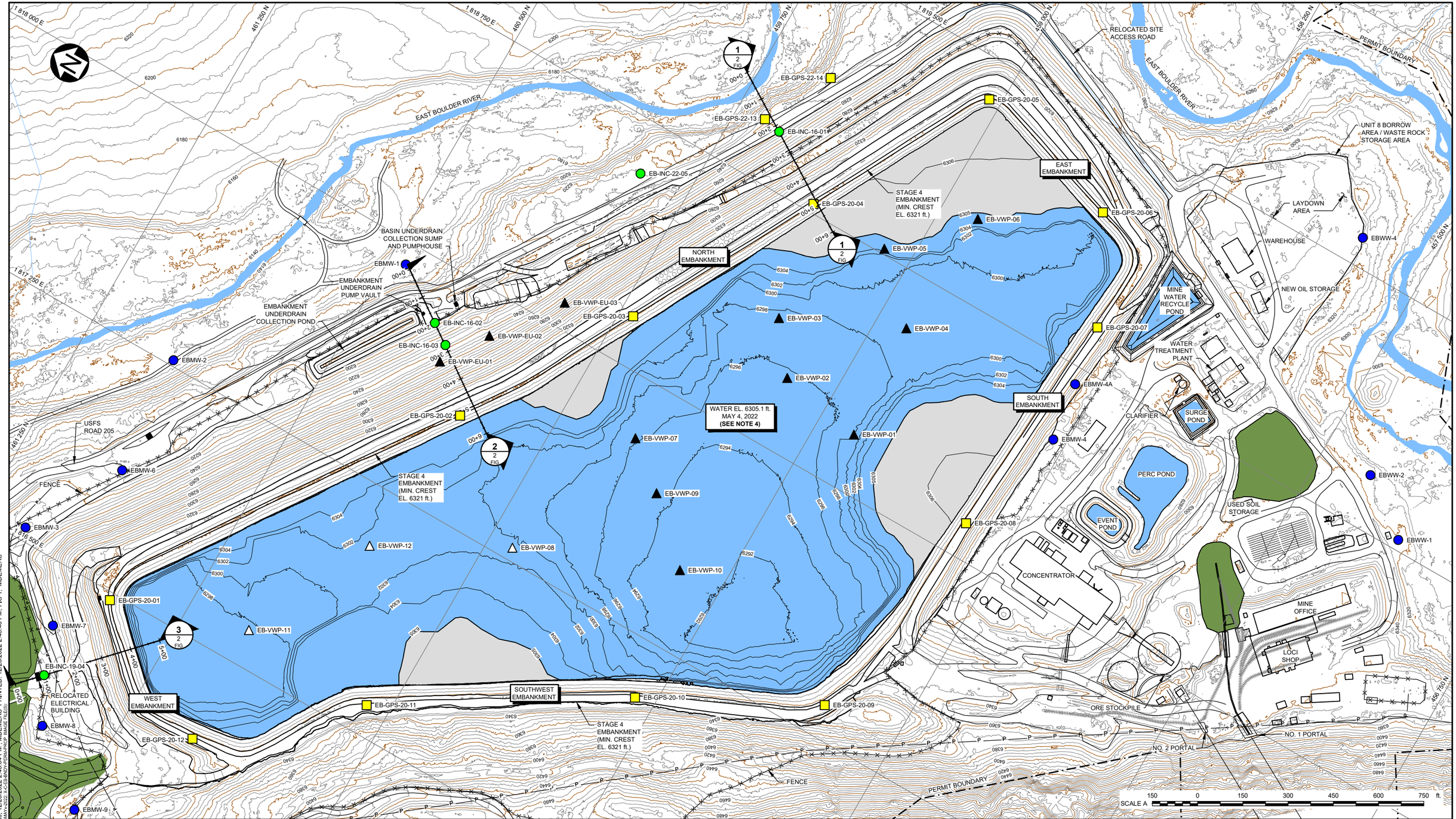
If an instrumentation trigger level is exceeded, inspections of the embankment crest and slopes are required to be completed to determine if indications of displacement such as cracking, sloughing, slumping or seepage are present. If no indications of displacement or adverse operating conditions are observed, the inspection observations should be documented, and the instrumentation should continue to be monitored. If indications of displacement or adverse operating conditions are observed, refer to the Emergency Preparedness Plan (EPP) (Stillwater, 2022) and contact the Engineer of Record (EOR).

Table A.2 TSF Instrumentation Trigger Levels

| Instrumentation | Purpose | Trigger Level | |
|---|---|---|---|
| Embankment Survey Monuments (12 Monuments) | Monitor potential displacement of the embankment crest | 24-hour average displacement (ΔEl, ΔN, ΔE) > 1 in. (25 mm) | |
| | | 24-hour average 3D displacement > 2 in. (50 mm) | |
| Embankment Slope Inclinometers (4 Inclinometers) | Identify potential movement in the embankment foundation | Level 1 | > 0.4 in. (10 mm)<br>DoD =0.188 (10 ft. tiltmeter spacing)<br>DoD = 0.094 (20 ft. tiltmeter spacing) |
| | | Level 2 | > 1.0 in. (25 mm)<br>DoD = 0.47 (10 ft. tiltmeter spacing)<br>DoD = 0.235 (20 ft. tiltmeter spacing) |
| Embankment Slope Inclinometer VWPs (3 VWPs) | Monitor phreatic surface in the embankment foundation | SMC-16-01: El. >6,240 ft.<br>INC-16-02: El. >6,190 ft.<br>INC-19-04: El. >6,240 ft.<br>(Phreatic surface fluctuates seasonally) | |
| Basin Underdrain VWPs (12 VWPs) | Monitor Basin Underdrain response to pumping | No trigger level - underdrain performance monitoring only<br>(Piezo head fluctuates with Basin Underdrain pumping) (1) | |
| Embankment Underdrain VWPs (3 VWPs) | Monitor phreatic surface in the Embankment Underdrain | PZ-EU-02: El. 6217.7 ft., Embankment Underdrain Overflow Elevation (2) | |

NOTES:

1. LEVEL 1 EXCEEDANCES REQUIRE DAILY REVIEW OF INCLINOMETER READINGS TO BE IMPLEMENTED AND CONTINGENCY OR REMEDIAL MEASURES TO BE DEVELOPED IF TRIGGER LEVELS CONTINUE TO BE EXCEEDED.
2. LEVEL 2 EXCEEDANCES REQUIRE AN UNUSUAL CONDITION INVESTIGATION AND ACTION PLAN (STILLWATER, 2022).
3. DOD = DEGREES OF DISPLACEMENT.
4. NOTIFY THE ENGINEER OF RECORD IF BASIN UNDERDRAIN PIEZOMETERS ARE NOT RESPONDING TO BASIN UNDERDRAIN PUMPING.
5. NOTIFY THE ENGINEER OF RECORD IF EMBANKMENT UNDERDRAIN PIEZOMETERS INDICATE WATER LEVEL IS ABOVE THE OVERFLOW ELEVATION.




**LEGEND:**

- WATER
- TAILINGS
- SURFACE SOIL STOCKPILE
- SURVEY MONUMENT
- VWP LOCATIONS (OPERATIONAL)
- VWP LOCATIONS (DECOMMISSIONED)
- SLOPE INCLINOMETER LOCATION
- MONITORING WELL LOCATION
- ROAD
- POWERLINE
- PERMIT BOUNDARY (PROPOSED)
- FENCE

**NOTES:**

1. TOPOGRAPHY BASED ON LIDAR DATA PROVIDED BY STILLWATER MINING COMPANY JUNE 2018, SURVEY DATA PROVIDED BY WOITH ENGINEERING INC. FEBRUARY 2021, MAY 2021 AND SURVEY DATA PROVIDED BY TURNER MINING JUNE 2022.
2. CONTOUR INTERVAL IS 5 FEET.
3. HORIZONTAL DATUM IS MONTANA COORDINATE SYSTEM, SINGLE ZONE, NAD83 (1992). UNITS ARE IN INTERNATIONAL FEET. VERTICAL DATUM IS NGVD29.
4. TAILINGS SURFACE SHOWN ON THIS FIGURE WAS SURVEYED BETWEEN MAY 4 TO 6, 2022 BY COPPERSTONE TECHNOLOGIES.

| REV | DATE | DESCRIPTION | DESIGNED | DRAWN | REVIEWED |
|---|---|---|---|---|---|
| 0 | 20DEC'22 | ISSUED FOR INFORMATION | CNH | MMD | KJB |



SIBANYE STILLWATER

EAST BOULDER MINE

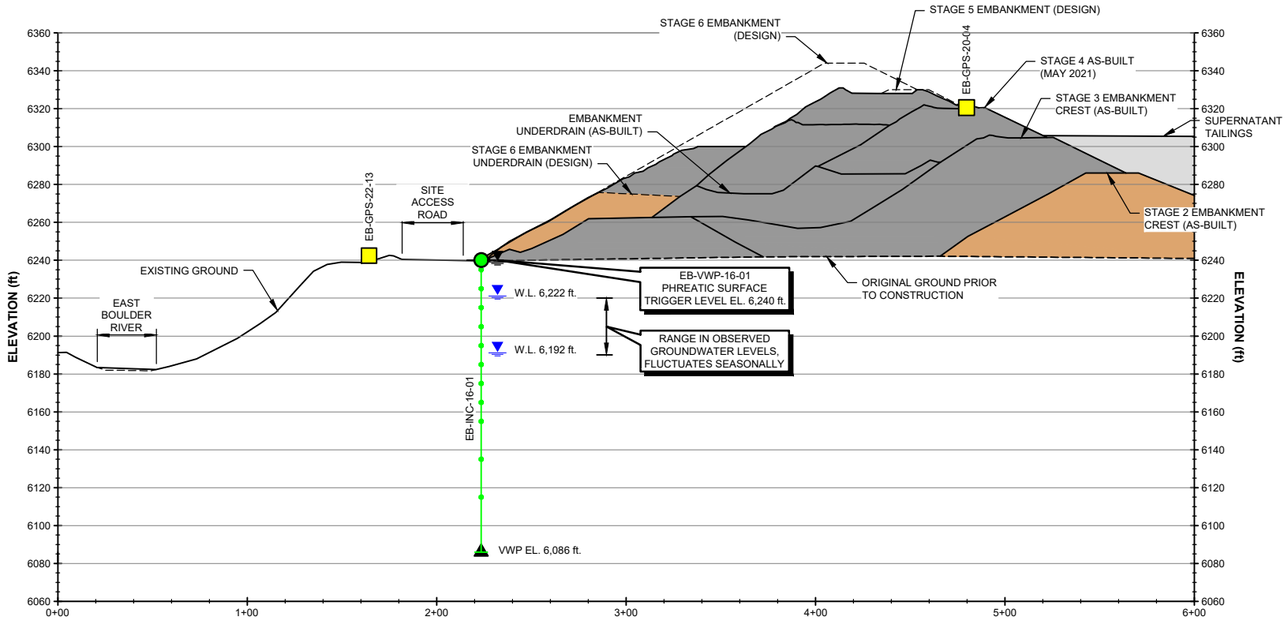
# TAILINGS STORAGE FACILITY STAGE 4 INSTRUMENTATION LOCATIONS

Knight Piésold CONSULTING

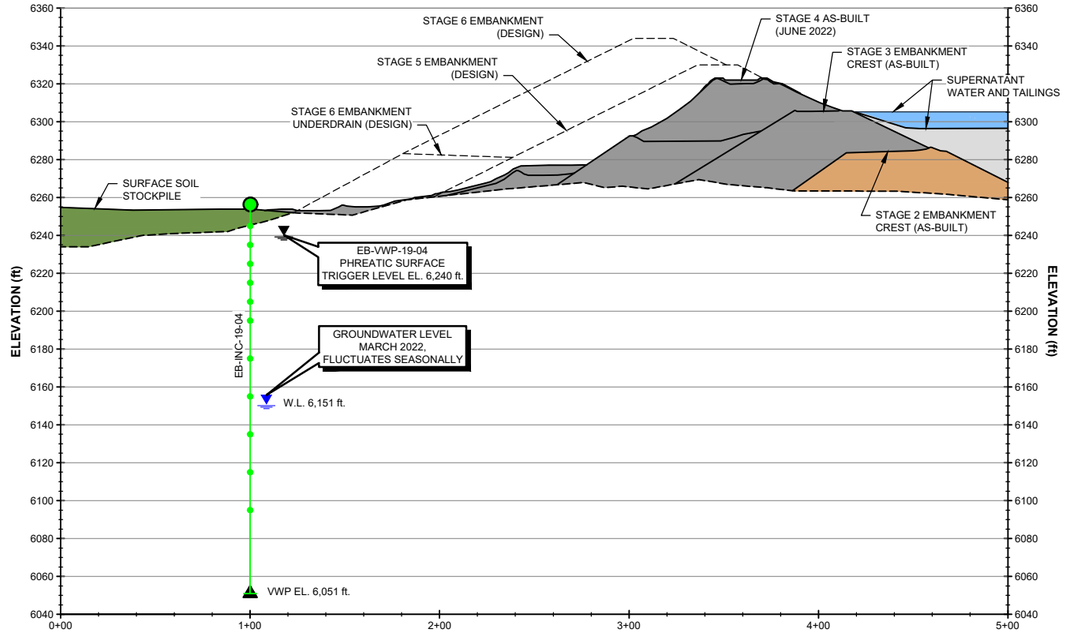
P/A NO. NB101-45/58 | REF NO. NB22-01384

FIGURE A.1 | REV 0

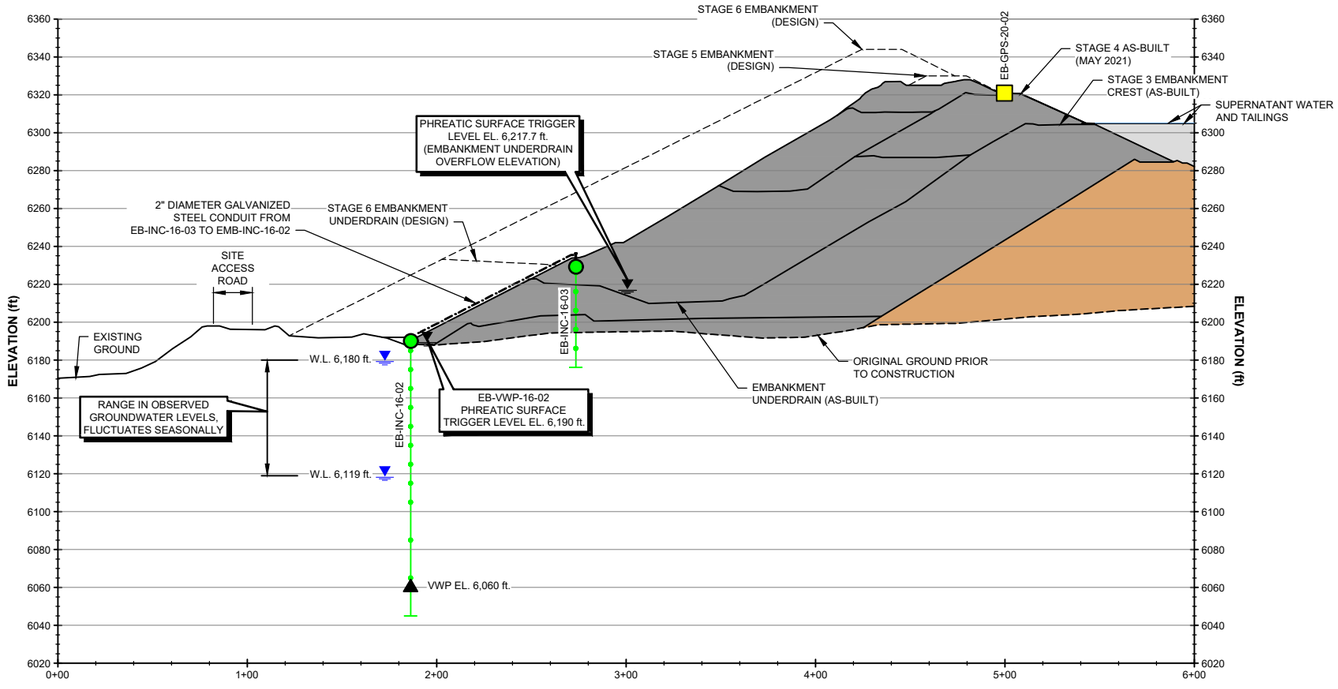
SAVED: I:\1\01\00045\58\A\acad\FIGS\B21 R0, 12/20/2022 2:48:04 PM, MDEMERS PRINTED: 12/20/2022 2:48:46 PM, FIG 1, MDEMERS
XREF FILES: ) X-C-TOPO-EASTB-NAD83; X-C-EB-TAL-SURV-MAY4-2022; X-C-EB-BNDY-PERM-PROP IMAGE FILES: )




1 / 1 FIG **SECTION**
**EB-INC-16-01**
SCALE A




3 / 1 FIG **SECTION**
**EB-INC-19-04**
SCALE A




2 / 1 FIG **SECTION**
**EB-INC-16-02 AND EB-INC-16-03**
SCALE A

**LEGEND:**

- WATER
- TAILINGS
- RANDOM FILL
- ROM ROCKFILL
- SURFACE SOIL STOCKPILE
- SURVEY MONUMENT (STAGE 4)
- SLOPE INCLINOMETER LOCATION
- INCLINOMETER SENSOR LOCATION
- MEASURED WATER LEVEL
- PHREATIC SURFACE TRIGGER LEVEL
- VIBRATING WIRE PIEZOMETER LOCATION
- 2 in GALVANIZED STEEL CONDUIT

**NOTES:**

1. SECTIONS DEVELOPED FROM VARIOUS SURVEYS FOR EMBANKMENT STAGES 2, 3 AND 4 AND WERE PROVIDED BY STILLWATER MINING COMPANY. ADDITIONAL LIDAR DATA PROVIDED BY STILLWATER MINING COMPANY JUNE 2018, SURVEY DATA PROVIDED BY WOITH ENGINEERING INC. FEBRUARY 2021, MAY 2021 AND SURVEY DATA PROVIDED BY TURNER MINING JUNE 2022.
2. HORIZONTAL DATUM IS MONTANA COORDINATE SYSTEM, SINGLE ZONE, NAD83 (1992). UNITS ARE IN INTERNATIONAL FEET. VERTICAL DATUM IS NGVD29.
3. TAILINGS SURFACES SHOWN ON THIS FIGURE WERE SURVEYED BETWEEN MAY 4 TO 6, 2022 BY COPPERSTONE TECHNOLOGIES.

SCALE A: 40 0 40 80 120 160 200 ft

| REV | DATE | DESCRIPTION | DESIGNED | DRAWN | REVIEWED |
|---|---|---|---|---|---|
| 0 | 20DEC'22 | ISSUED FOR INFORMATION | CNH | MMD | KJB |

SIBANYE STILLWATER

EAST BOULDER MINE

**TAILINGS STORAGE FACILITY**
**SLOPE INCLINOMETER**
**SECTIONS**

Knight Piésold CONSULTING

| P/A NO. | REF NO. |
|---|---|
| NB101-45/58 | NB22-01384 |

**FIGURE A.2** REV 0



SAVED: I:\101\100045\58\AA\cad\FIGS\B22 R0, 12/20/2022 2:51:35 PM, MDEMERS PRINTED: 12/20/2022 2:52:25 PM, FIG 2, MDEMERS
XREF FILE(S): X-C-TOPO-EASTBHABS1, X-C-EB-ST6-ABL1, X-C-EB-TAILSURV-JUNE-2022 1 IMAGE FILE(S)

# 4.0 TAILINGS AND WATER MANAGEMENT

The TSF staging and filling schedule are illustrated on Figure A.3. Tailings deposition must cease if the supernatant pond level exceeds the maximum operating level and the removal of water from the TSF basin is required to immediately commence using the water reclaim system. There are no restrictions on the rate of filling or on the rate of drawdown for the supernatant pond, with respect to dam safety. The location of the tailings discharge and reclaim water pipework for the Stage 4 TSF is shown in Figure 2.2. The water balance flowsheet for the TSF is illustrated in Figure A.4 with the average annual water additions and losses.

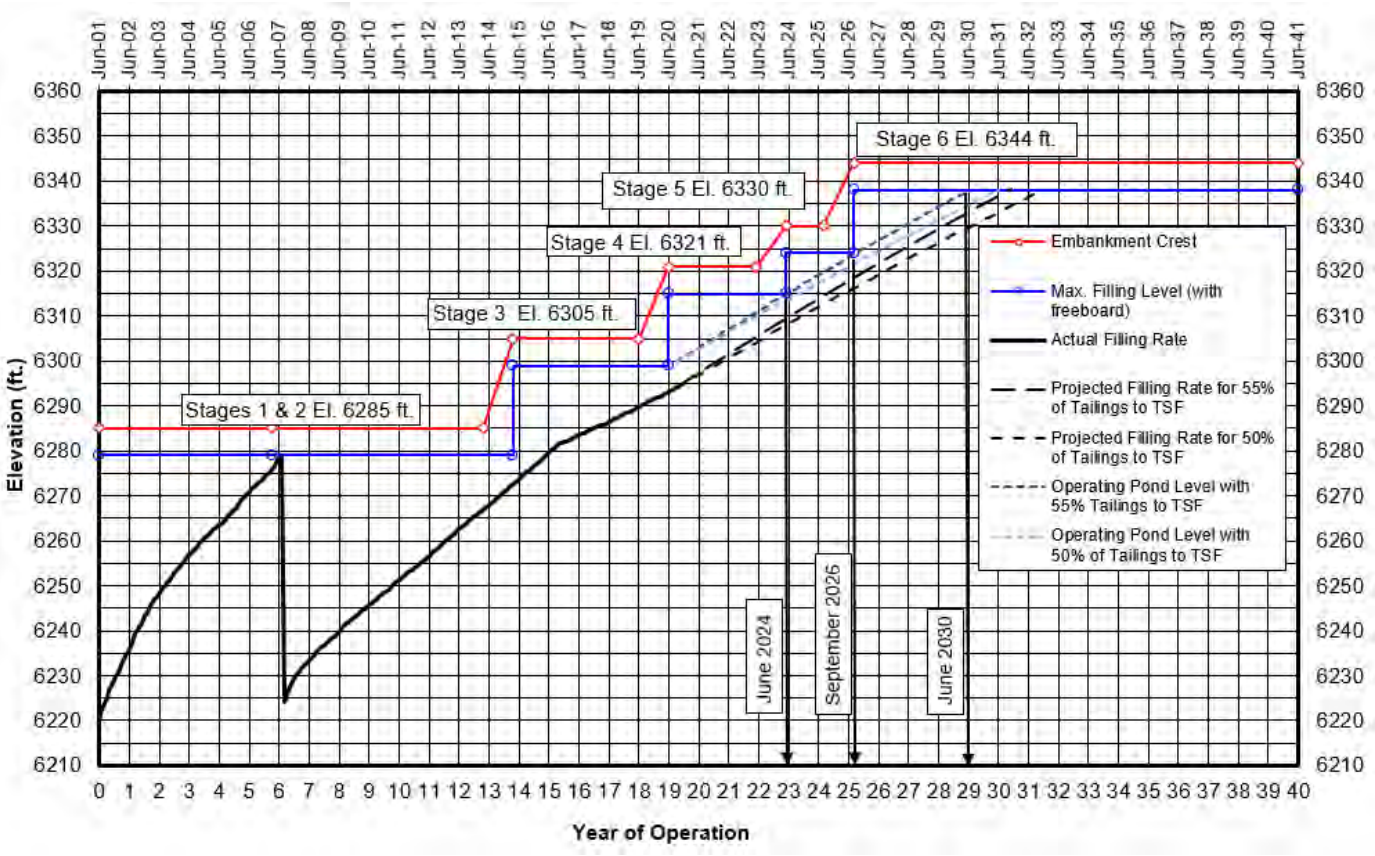



Figure A.3 TSF Filling Curve

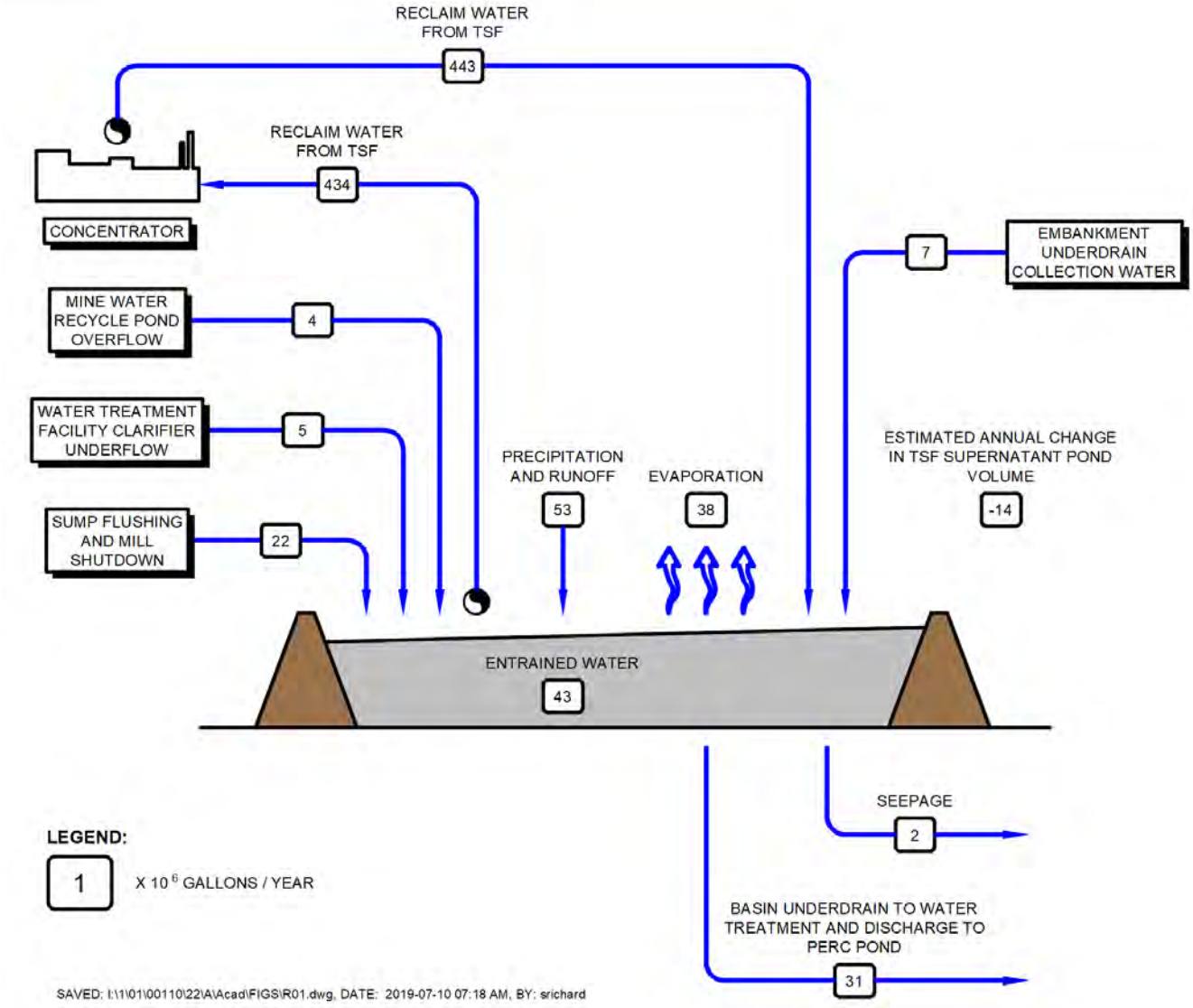



Figure A.4 Water Balance Flowsheet

# Appendix B
## References

(Page B-1)

# APPENDIX B
# REFERENCE DOCUMENTS


International Engineering Company (IECO), 1988. Jackpine Project, Sweet Grass County, Montana, Preliminary Tailings Impoundment Engineering Report.

International Engineering Company (IECO), 1990. East Boulder Project Geotechnical Report.

International Engineering Company (IECO), 1990. East Boulder Project, Sweet Grass County, Montana, Preliminary Tailings Impoundment Engineering Report.

Knight Piésold Ltd. (KP), 1998. East Boulder 1998 Site Investigation Program. Ref. No. 30333/6-3, Rev 0.

Knight Piésold Ltd. (KP), 1998. Tender Documents for Stage 1 Tailings Storage Facility Construction. Ref. No. 30333/6-9.

Knight Piésold Ltd. (KP), 1998. Plan of Work - Plant Site Investigations and Detailed Design of Tailings Impoundment. Ref. No. 30333/6-1.

Knight Piésold Ltd. (KP), 2000. Stage 1 Construction Report. Ref. No. 31333/8-6, Rev 0.

Knight Piésold Ltd. (KP), 2000. Land Application Disposal (LAD) System - Basic Engineering Report. Ref. No. 31333/12-6, Rev 0.

Knight Piésold Ltd. (KP), 2000. Technical Specifications for Embankment Construction Using Materials from Mining Operations. Ref. No. 31333/8-5, Rev 1.

Knight Piésold Ltd. (KP), 2004. Detailed Design of Ongoing Expansions. Ref. No. NB101-00045/6 (31333/17-1), Rev 2.

Knight Piésold Ltd. (KP), 2005. Detailed Design of Ongoing Expansions. Ref. No. NB101-00045/6 (31333/17-1), Rev. 3.

Knight Piésold Ltd. (KP), 2005. Detailed Design of Ongoing Expansions. Ref. No. 31333/17-1, Rev 5.

Knight Piésold Ltd. (KP), 2006. Stage 2 Construction Report. Ref. No. NB101-45/12-1, Rev 0.

Knight Piésold Ltd. (KP), 2012. Stillwater Mining Company East Boulder Mine Nitrogen Source Reduction Options for TSF Embankments. Ref. No. NB101-45/23-1, Rev A.

Knight Piésold Ltd. (KP), 2013. TSF Embankment Nitrogen Source Reduction Design Summary. Ref. No. NB101-45/24-1, Rev 1.

Knight Piésold Ltd. (KP), 2018. Stage 3 Construction Report. Ref. No. NB101-45/41-1, Rev 0.

Knight Piésold Ltd. (KP), 2020. Stage 4 Construction Report. Ref. No. NB101-45/46-1, Rev 0.

Knight Piésold Ltd. (KP), 2022. East Boulder Mine TSF Design Basis Report. Ref. No. NB101-45/48-1, Rev 0.

Montana Department of Environmental Quality and U.S.D.A. Forest Service (DEQ), 2012. Record of Decision for the Final Environmental Impact Statement for the Stillwater Mining Company's Revised Water Management Plans and Boe Ranch LAD.

Sibanye Stillwater (Stillwater), 2022. Tailings Storage Facility - Emergency Preparedness Plan (EPP). V1.4.

# Appendix C
## Inspection and Surveillance

Appendix C1
Inspection and Surveillance Schedule

Appendix C2
Unusual Events and Occurrences Requiring Non-Routine Walkovers

Appendix C3
Inspection Forms

Appendix C4
Weekly Embankment QA Checklist

# Appendix C1

## Inspection and Surveillance Schedule

(Page C1-1)

TABLE C1.1

SIBANYE STILLWATER
EAST BOULDER MINE

TAILINGS STORAGE FACILITY - TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
INSPECTION AND SURVEILLANCE SCHEDULE

Print Dec-21-22 12:08:45

| Component | Description | Operations | Inspection and Surveillance | Responsible Parties |
|---|---|---|---|---|
| Tailings Embankments | Perimeter embankments around the TSF. | Grade embankment crest to prevent standing water. | Inspect the embankments weekly and look for evidence indicating instability or deformation. | Surface Crew |
| | | | Inspect downstream face weekly for evidence of seepage, runoff, erosion or piping. | Concentrator Manager, Surface Crew, Environmental Compliance Supervisor |
| | | | Take photographs of the embankments semi-annually. | Environmental Compliance Supervisor |
| Tailings Basin | Process water and tailings solids storage in an HDPE lined basin. Basin underdrain layer to reduce seepage and promote tailings consolidation. | Pond required to store 72 hr PMP event plus provide an additional 2.2 feet of freeboard. Maximum operating pond level is 6 feet below the crest elevation during normal operations. | Record Tailings throughput daily. | Concentrator Manager, Surface General Foreman |
| | | Compare pond levels with design filling schedules. | Inspect the tailings discharge location weekly and note the approximate extent of beach development in the facility. | Concentrator Manager |
| | | Relocate spigots as necessary to develop the tailings beach around the perimeter of the impoundment. | Inspect the tailings beach daily. Note any sinkholes or excessive beach erosion. | Surface Crew |
| | | | Inspect the geomembrane monthly. | Surface General Foreman |
| | | | Measure and monitor the pond water levels weekly. | Environmental Coordinator |
| | | | Take photographs of the pond semi-annually. | Environmental Compliance Supervisor |
| | | | Determine the volume of the supernatant pond annually (prior to winter freeze-up) by sounding the pond depths from a boat. | Concentrator Manager |
| Tailings Delivery System | Consists of the tailings delivery pipeline and discharge spigots around perimeter of impoundment. | Ensure that the discharge pipeline is fully flushed prior to relocating any pipe work. | Inspect the pipeline weekly for evidence indicating leakage. | Concentrator Manager, Surface Crew |
| | | Ensure that there is always an open path for the tailings to exit during operations and discharge relocation. | Conduct detailed inspections of the tailings pipeline during pipeline maintenance. | Concentrator Manager |
| | | Keep spigot points downstream of active spigotting sections open to allow the unused pipeline to drain. | | |
| | | Maintain non-erosive laminar flow over the tailings beaches. | | |
| Reclaim Water Pipeline | Consists of the 3 inclined reclaim pumps and pipes, reclaim manifold from tailing impoundment to the mill, reclaim water pipeline and booster pump station adjacent to the mine site. | Ensure that the pipeline is fully drained during maintenance periods or prolonged shutdown under extreme cold conditions. | Inspect the pipeline weekly for evidence of leakage. | Concentrator Manager, Surface Crew |
| | | The inclined pumps and booster pump may be controlled from the Mill control room, or breather panel on the dam crest. | Conduct a detailed inspection of the inclined pumps annually for corrosion, wear and tear, etc. and make necessary repairs. | Concentrator Manager, Surface Crew |
| | | Monitor the water and tailings elevation relative to the inclined pump location. | Monitor and assess the inclined pump elevation weekly and determine if pumps to be raised. | Concentrator Manager, Surface Crew |
| | | | Conduct detailed inspections of the reclaim pipeline during pipeline maintenance. | Concentrator Manager, Surface Crew |
| Instrumentation | Includes vibrating wire piezometers, survey monuments, groundwater monitoring wells and slope inclinometers. | Piezometers, slope inclinometers, and survey monuments transmit data to Navstar monitoring system. | Review instrumentation data monthly. | Environmental Coordinator |
| | | Instrumentation data plotted and reviewed on Navstar's GeoExplorer software. | Check condition of instrumentation. | Environmental Coordinator |
| | | Check condition of instrumentation and complete maintenance as required. | Provide instrumentation data quarterly to EOR for review. | Environmental Coordinator |
| | | Make note of any instrumentation that is not functioning. | Monitor water levels in each groundwater monitoring well and obtain water quality samples as required by permits. Data is compiled by the Environmental Supervisor and a report is forwarded to the appropriate agencies annually. | Environmental Coordinator |
| | | Follow manufacture's instructions for instrumentation operation. | | |
| | | Notify EOR of any anomalous trends in the data. | | |

I:\1\01\00045\58\A\Report\2022 East Boulder TOMS Manual Update\App C - Inspection and Surveillenance\[Table C1.1 - East Boulder Monitoring-2022-12-21.xlsx]Table C1.1

# Appendix C2

## Unusual Events and Occurrences Requiring Non-Routine Walkovers

(Page C2-1)

TABLE C2.1

SIBANYE STILLWATER
EAST BOULDER MINE

TAILINGS STORAGE FACILITY - TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
UNUSUAL EVENTS AND OCCURRENCES REQUIRING NON-ROUTINE WALKOVERS

Print Dec-21-22 12:18:49

| Event/Observation | Recommended Action |
|---|---|
| Extreme rainfall | Monitor the TSF pond level. Confirm pond level is below the maximum operating level.<br>Monitor the LAD Storage Pond. Confirm pond level is below the maximum operating level.<br>Inspect the TSF embankments for signs of concentrated runoff and erosion.<br>Inspect the TSF embankments for indications of localized slumping or instability.<br>Note areas of saturated or soft ground.<br>Inspect surface water management ditches and sediment ponds along access roads. |
| Water levels rising in the TSF more than expected and with 2 ft. of the maximum operating level | Monitor pond levels Weekly.<br>Develop plan to slow or stop the water level rise (stop tailings deposition, transfer water to the LAD Storage Pond and/or underground mine). Contact the EOR. |
| Water levels rising in the TSF more than expected and with 1 ft. of the maximum operating level | Monitor pond levels daily.<br>Initiate plan to slow or stop the water level rise (stop tailings deposition, transfer water to the LAD Storage Pond and/or underground mine). Contact the EOR. |
| Significant earthquake event (See Note 1.) | Read all instrumentation.<br>Follow inspection and reporting procedures if instrumentation readings exceed trigger levels. |
| Rupture of pipeline at the embankment | Stop pumping tailings to the TSF and stop reclaiming water to the mill.<br>Check the upstream slope and crest for erosion.<br>Take photographs and make notes of exact location and cause (if known) of leak. Contact the EOR. |
| Significant, rapid erosion of embankment slopes; Sudden seepage break on embankment slope or downstream of embankment in form of continuous seepage or boils | Estimate seepage flow rate. Estimate size of area.<br>Take photographs and make notes of exact location (if known) of erosion. Contact the EOR. |
| Minor surface erosion on embankment crest and/or slopes | Repair as necessary.<br>Determine the cause of the erosion. |
| Soft toe condition or minor seepage at the downstream slope or toe | Conduct embankment walkovers daily until the problem is understood and addressed.<br>Monitor seepage development (e.g. clarity, content/quality, extent etc.).<br>Prepare to carry out corrective repairs.<br>Contact the EOR if appropriate. |
| High turbidity in Basin Underdrain flow | Reduce or suspend underdrain pumping.<br>Collect sample for suspended solids determination.<br>Prepare to carry out corrective repairs.<br>Contact the EOR if appropriate. |
| Extended power failure | Drain the reclaim water and tailings delivery pipelines if power failure occurs during extreme freezing temperatures.<br>Flush the tailings delivery pipelines prior to restarting tailings deposition. |
| Exceedance of instrumentation trigger levels | Refer to trigger levels in QRFG. Re-check the readings.<br>Continue monitoring daily until readings return to normal.<br>Contact the EOR if appropriate. |
| Failure of reclaim water and/or Tailings Delivery Pipeline resulting in erosion of the embankment crest | Document and repair as necessary.<br>Monitor water levels daily.<br>Ensure backup pumps are available.<br>Repair or replace failed pumps ASAP. |
| Tailings Delivery Pipeline blocked | Stop tailings discharge.<br>Flush pipeline with water to clear obstruction.<br>Inspect the pipeline for damages or leaks.<br>Determine the cause or reason for blockage. |
| Minor cracks developing at the embankment crest or slope | Conduct embankment walkovers daily until the problem is understood and addressed.<br>Monitor crack development (e.g. crack size, extent, etc.).<br>Prepare to carry out corrective repairs.<br>Contact the EOR if appropriate. |
| Geomembrane damage due to unusual environmental occurrences (ice, wind, erosion damages, etc.) | Document the extent of the geomembrane damage. Identify a repair plan. Contact the Geomembrane Installer to complete the repairs. |
| Other events/observations | Use judgement, consult your peers. |

I:\1\01\00045\58\A\Report\2022 East Boulder TOMS Manual Update\App C - Inspection and Surveillenance\[Table C2.1 - East Boulder Unusual Events.xlsx]Table C2.1

NOTE:

1. A SIGNIFICANT EARTHQUAKE IS DEFINED AS AN EARTHQUAKE THAT COULD POTENTIALLY DISPLACE, DAMAGE OR CAUSE AN EMBANKMENT TO CRACK OR SETTLE, RESULTING IN A LOSS OF STRUCTURAL INTEGRITY OR FREEBOARD. THE OCCURRENCE OF AN EARTHQUAKE GREATER THAN MAGNITUDE 5.0 ON THE RICHTER SCALE WITHIN 60 MILES (100 KILOMETERS) OF THE FACILITY WILL AUTOMATICALLY TRIGGER A LEVEL 1 OR HIGHER CONDITION. ASSESSING AND REPORTING POTENTIAL DAMAGE CAUSED BY AN EARTHQUAKE WILL BE THE REQUIRED REMEDIAL ACTION.

# Appendix C3

## Inspection Forms

TABLE C3.1

SIBANYE STILLWATER
EAST BOULDER MINE

TAILINGS STORAGE FACILITY - TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
WEEKLY TSF INSPECTION
(Surface Supervisor or Surface Crew)

Print Dec-21-22 15:35:42

| | | | |
|---|---|---|---|
| Inspectors: | | Inspection Date: | Inspection Time: |
| Name: | Title: | Signature: | |
| Name: | Title: | Signature: | |
| Weather Conditions | Precipitation (24hr): | Wind Speed: | |
| | Temperature °F: | Sky: Clear Partly Cloudy Cloudy Overcast | |
| Samples Collected: | Yes No | | |

| TAILINGS EMBANKMENT | | | |
|---|---|---|---|
| Crest of Dam | Condition/Issue/Defect Present (circle one) | | Comments |
| Cracking | Yes | No | |
| Subsidence, Depressions | Yes | No | |
| Lateral Deformation | Yes | No | |
| Standing Water or Wet Areas | Yes | No | |
| Upstream Slope | | | |
| Liner Trampoline (due to potential displacement of underlying subgrade) | Yes | No | |
| Liner Bulging (due to potential displacement of underlying subgrade) | Yes | No | |
| Excessive Ice Build-up and/or Snow Accumulation | Yes | No | |
| Ice Rafting on Geomembrane | | | |
| Downstream Slope | | | |
| Cracking | Yes | No | |
| Subsidence | Yes | No | |
| Bulging, Sliding or Sloughing | Yes | No | |
| Erosion | Yes | No | |
| Animal Burrows | Yes | No | |
| Damp Areas | Yes | No | |
| Seeps, Soft Areas | Yes | No | |

| TAILINGS BASIN | | | |
|---|---|---|---|
| Basin Filling | Condition/Issue/Defect Present (circle one) | | Comments |
| Tailings Beach Location (sinkholes or excessive erosion) | Yes | No | |
| Pond Elevation (estimated from marked location (ft.)) | | | |
| Tailings Beach Development (approx. area) | | | |
| Tailings Discharge Location (Spigot No.) | | | |

| TAILINGS DELIVERY SYSTEM | | | |
|---|---|---|---|
| Pipelines | Condition/Issue/Defect Present (circle one) | | Comments |
| Pipeline Leakage (external inspection) | Yes | No | |
| Pipeline Damage (external inspection) | Yes | No | |
| Valves - Conditions/Issues Identified (external inspection) | Yes | No | |
| Maintenance Activities (repairs and replacements) | | | |
| | | | |
| | | | |

| WATER RECLAIM SYSTEM | | | |
|---|---|---|---|
| Pipelines and Pumps | Condition/Issue/Defect Present (circle one) | | Comments |
| Pipeline Leakage (external inspection) | Yes | No | |
| Pipeline Damage (external inspection) | Yes | No | |
| Valves - Conditions/Issues Identified (external inspection) | Yes | No | |
| Maintenance Activities (repairs and replacements) | | | |
| | | | |
| | | | |

| OTHER | |
|---|---|
| Other Issues or Observations Identified | Comments |
| | |
| | |
| | |
| | |
| | |

I:\1\01\00045\58\A\Report\2022 East Boulder TOMS Manual Update\App C - Inspection and Surveillenance\[Table C3.1 to C3.4- East Boulder Inspection Log Templates.xlsx]Mill Wkly TSF Inspection_Hertz

TABLE C3.2

SIBANYE STILLWATER
EAST BOULDER MINE

TAILINGS STORAGE FACILITY - TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
MONTHLY TSF INSPECTION
(Surface Supervisor)

Print Dec-21-22 15:36:34

| | | | |
|---|---|---|---|
| Inspectors: | | Inspection Date: | Inspection Time: |
| Name: | Title: | Signature: | |
| Name: | Title: | Signature: | |

| | | |
|---|---|---|
| Weather Conditions | Precipitation (24hr): | Wind Speed: |
| | Temperature °F: | Sky: Clear Partly Cloudy Cloudy Overcast |
| NOTE: Photograph all conditions, issues or defects identified. | | |

| | | | | | |
|---|---|---|---|---|---|
| Photos Taken: | Yes | No | Instrumentation Data Collected: | Yes | No |
| Samples Collected: | Yes | No | Data Collection Sheets Completed: | Yes | No |

| TAILINGS EMBANKMENT | | | |
|---|---|---|---|
| Crest of Dam | Condition/Issue/Defect Present (circle one) | | Comments |
| Cracking | Yes | No | |
| Subsidence, Depressions | Yes | No | |
| Lateral Deformation | Yes | No | |
| Standing Water or Wet Areas | Yes | No | |
| Excessive Ice Build-up and/or Snow Accumulation | Yes | No | |
| Upstream Slope | | | |
| Liner Trampoline (due to potential displacement of underlying subgrade) | Yes | No | |
| Liner Bulging (due to potential displacement of underlying subgrade) | Yes | No | |
| Excessive Ice Build-up and/or Snow Accumulation | Yes | No | |
| Ice Rafting on Geomembrane | | | |
| Downstream Slope | | | |
| Cracking | Yes | No | |
| Subsidence | Yes | No | |
| Bulging, Sliding or Sloughing | Yes | No | |
| Erosion | Yes | No | |
| Animal Burrows | Yes | No | |
| Damp Areas | Yes | No | |
| Seeps, Soft Areas | Yes | No | |
| TAILINGS BASIN | | | |
| Basin Filling | Condition/Issue/Defect Present/Observation (circle one) | | Comments |
| Tailings Beach Location (sinkholes or excessive erosion) | Yes | No | |
| Freeboard minimum of 6 feet below crest required | Yes | No | |
| Pond Elevation (estimated from marked location (ft.)) | | | |
| Tailings Beach Development (approx. area) | | | |
| Tailings Discharge Location (Spigot No.) | | | |
| Geomembrane | | | |
| Defects (holes, tears, ice, wind, uv degradation, etc.) | Yes | No | |
| Tension/Trampoline | Yes | No | |
| Areas of Previous Repair | | | |
| Concerns or Issues with Conditions | Yes | No | |
| Basin Underdrain | | | |
| Pump Operating | Yes | No | |
| Sump and Pumphouse (concerns or issues with conditions) | Yes | No | |
| Clarity of Discharge Water (WTP Sample Port) | Clear Cloudy Dirty | | |
| Excessive Ice Buildup during Freezing Conditions | Yes | No | |
| TAILINGS DELIVERY SYSTEM | | | |
| Pipelines | Condition/Issue/Defect Present/Observation (circle one) | | Comments |
| Pipeline Leakage (external inspection) | Yes | No | |
| Pipeline Damage (external inspection) | Yes | No | |
| Valves - Conditions/Issues Identified (external inspection) | Yes | No | |
| Spigot Inspection (issue identified) | Yes | No | |
| Record Spigot Locations (Spigot No.) | | | |
| Excessive Ice Buildup during Freezing Conditions | Yes | No | |
| WATER RECLAIM SYSTEM | | | |
| Pipelines and Pumps | Condition/Issue/Defect Present/Observation (circle one) | | Comments |
| Pipeline Leakage (external inspection) | Yes | No | |
| Pipeline Damage (external inspection) | Yes | No | |
| Valves - Conditions/Issues Identified (external inspection) | Yes | No | |
| Pumps - Conditions/Issues Identified (external inspection) | Yes | No | |
| Excessive Ice Buildup during Freezing Conditions | Yes | No | |
| OTHER | | | |
| Other Issues or Observations Identified | Comments | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

I:\1\01\00045\58\A\Report\2022 East Boulder TOMS Manual Update\App C - Inspection and Surveillenance\[Table C3.1 to C3.4- East Boulder Inspection Log Templates.xlsx]Mill Monthly TSF Inspection

TABLE C3.3

SIBANYE STILLWATER
EAST BOULDER MINE

TAILINGS STORAGE FACILITY - TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
QUARTERLY TSF INSPECTION
(Tailings Engineer or Concentrator Manager)

Print Dec-21-22 15:36:34

| | | | | |
|---|---|---|---|---|
| Inspectors: | | Inspection Date: | Inspection Time: | |
| Name: | Title: | | Signature: | |
| Name: | Title: | | Signature: | |
| Weather Conditions | Precipitation (24hr): | | Wind Speed: | |
| | Temperature °F: | | Sky: Clear Partly Cloudy Cloudy Overcast | |
| Photos Taken: | Yes No | | Instrumentation Data Collected: | Yes No |
| Samples Collected: | Yes No | | Data Collection Sheets Completed: | Yes No |

| TAILINGS EMBANKMENT | | | | |
|---|---|---|---|---|
| Crest of Dam | Condition/Issue/Defect Present (circle one) | | Comments | Photos Taken |
| Cracking | Yes | No | | |
| Subsidence, Depressions | Yes | No | | |
| Lateral Deformation | Yes | No | | |
| Standing Water or Wet Areas | Yes | No | | |
| Excessive Ice Build-up and/or Snow Accumulation | Yes | No | | |
| Upstream Slope | | | | |
| Liner Trampoline (due to potential displacement of underlying subgrade) | Yes | No | | |
| Liner Bulging (due to potential displacement of underlying subgrade) | Yes | No | | |
| Excessive Ice Build-up and/or Snow Accumulation | Yes | No | | |
| Excessive Ice Build-up and/or Snow Accumulation | | | | |
| Downstream Slope | | | | |
| Cracking | Yes | No | | |
| Subsidence | Yes | No | | |
| Bulging, Sliding or Sloughing | Yes | No | | |
| Erosion | Yes | No | | |
| Animal Burrows | Yes | No | | |
| Damp Areas | Yes | No | | |
| Seeps, Soft Areas | Yes | No | | |
| Vegetation (Reclamation) | | | | |
| Wet Ground Vegetation | Yes | No | | |
| Poor Growth | Yes | No | | |
| Destroyed by Erosion | Yes | No | | |
| Instrumentation | | | | |
| Survey Monuments - Inspect Condition (damaged or maint needed) | Yes | No | | |
| Piezometers - Inspect Condition (damaged or maint needed) | Yes | No | | |
| Slope Inclinometers - Inspect Condition (damaged or maint needed) | Yes | No | | |
| Areas of Previous Repair | | | | |
| Concerns or Issues with Conditions | Yes | No | | |

| TAILINGS BASIN | | | | |
|---|---|---|---|---|
| Basin Filling | Condition/Issue/Defect Present/ Observation (circle one) | | Comments | Photos Taken |
| Tailings Beach Location (sinkholes or excessive erosion) | Yes | No | | |
| Freeboard Minimum of 6 feet below Crest Required | Yes | No | | |
| Pond Elevation (estimated from marked location (ft.) | | | | |
| Tailings Beach Development (approx. area (ft.)) | | | | |
| Tailings Discharge Location (Spigot No.) | | | | |
| Geomembrane | | | | |
| Defects (holes, tears, ice, wind, uv degradation, etc.) | Yes | No | | |
| Tension/Trampoline | Yes | No | | |
| Areas of Previous Repair | | | | |
| Concerns or Issues with Conditions | Yes | No | | |
| Basin Underdrain | | | | |
| Pump Operating | Yes | No | | |
| Sump and Pumphouse (concerns or issues with conditions) | Yes | No | | |
| Clarity of Discharge Water (WTP Sample Port) | Clear Cloudy Dirty | | | |
| Excessive Ice Buildup during Freezing Conditions | Yes | No | | |

| TAILINGS DELIVERY SYSTEM | | | | |
|---|---|---|---|---|
| Pipelines | Condition/Issue/Defect Present/Observation (circle one) | | Comments | Photos Taken |
| Pipeline Leakage (external inspection) | Yes | No | | |
| Pipeline Damage (external inspection) | Yes | No | | |
| Valves - Conditions/Issues Identified (external inspection) | Yes | No | | |
| Spigot Inspection (issue identified) | Yes | No | | |
| Record Spigot Locations (Spigot No.) | | | | |
| Excessive Ice Buildup during Freezing Conditions | Yes | No | | |

| WATER RECLAIM SYSTEM | | | | |
|---|---|---|---|---|
| Pipelines and Pumps | Condition/Issue/Defect Present (circle one) | | Comments | Photos Taken |
| Pipeline Leakage (external inspection) | Yes | No | | |
| Pipeline Damage (external inspection) | Yes | No | | |
| Valves - Conditions/Issues Identified (external inspection) | Yes | No | | |
| Pumps - Conditions/Issues Identified (external inspection) | Yes | No | | |
| Inclined Pump Elevation (set elevation acceptable) | Yes | No | | |
| Excessive Ice Buildup during Freezing Conditions | Yes | No | | |

| SURFACE WATER MANAGEMENT (COMPLETED AS PART OF THE SWPPP) | | | | |
|---|---|---|---|---|
| Ditches, Sediment Collection | Condition/Issue/Defect Present (circle one) | | Comments | Photos Taken |
| Blockages | Yes | No | | |
| Flowing Water, Boils or Seeps | Yes | No | | |
| Signs of Erosion | Yes | No | | |

| FENCING | | | | |
|---|---|---|---|---|
| Fencing | Yes | No | | |

| OTHER | | |
|---|---|---|
| Other Issues or Observations Identified | Comments | Photos Taken |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

I:\1\01\00045\58\A\Report\2022 East Boulder TOMS Manual Update\App C - Inspection and Surveillenance\[Table C3.1 to C3.4- East Boulder Inspection Log Templates.xlsx]Env. or Mill Quarterly Insp.

TABLE C3.4

SIBANYE STILLWATER
EAST BOULDER MINE

TAILINGS STORAGE FACILITY - TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
UNUSUAL EVENT INSPECTION
(Tailings Engineer or Concentrator Manager)

Print Dec-21-22 15:39:25

| | | | |
|---|---|---|---|
| Inspectors: | | Inspection Date: | Inspection Time: |
| Name: | | Title: | Signature: |
| Name: | | Title: | Signature: |
| Weather Conditions | | Precipitation (24hr): | Wind Speed: |
| | | Temperature °F: | Sky: Clear Partly Cloudy Cloudy Overcast |
| Photos Taken: | Yes No | Instrumentation Data Reviewed: | Yes No |
| Samples Collected: | Yes No | | |

| Event | Comments | Photo |
|---|---|---|
| EXTREME RAINFALL EVENT (2 inches in 24 hours) | | |
| Monitor TSF Pond Level. Confirm Pond Level is below Maximum Operating Level | | |
| Inspect Embankments for Signs of Concentrated Runoff and Erosion | | |
| Inspect Embankments for Indications of Localized Slumping or Instability | | |
| Note Areas of Saturated or Soft Ground | | |
| Inspect Surface Water Management Ditches and Sediment Ponds along Access Roads | | |
| TSF POND LEVEL WITHIN 2 ft. MAXIMUM OPERATING LEVEL | | |
| Monitor Pond Level Weekly | | |
| Develop Plan to Reduce Pond Level | | |
| TSF POND LEVEL WITHIN 1 ft. MAXIMUM OPERATING LEVEL | | |
| Monitor Pond Level Daily | | |
| Initiate Plan to Reduce Pond Level | | |
| SIGNIFICANT EARTHQUAKE EVENT (Magnitude greater than 5 within 60 miles) | | |
| Review Instrumentation Readings | | |
| Carry Out Detailed Walkover of TSF, Pipelines and Associated Structures if Instrumentation Trigger Levels are Exceeded | | |
| Investigate Downstream and Upstream (visible) Slopes for Cracks, Bulging Settlement or Deformation | | |
| Look for and note any Seepage, particularly the Rate of Seepage Flow at the Embankment Toe and Clarity | | |
| Review all Surface Monument and Slope Inclinometer Readings | | |
| Inspect Downstream Embankment slope for Sand Boils and Sinkholes | | |
| Inspect Tailings Beach for Whirlpools | | |
| Discuss findings with Engineer of Record | | |
| Check and ensure that the Basin Underdrain Sumps and Pumps are Functioning | | |
| RUPTURE OF PIPELINE AT THE EMBANKMENT | | |
| Stop Pumping Tails to the TSF and Stop Reclaiming Water to Mill | | |
| Check Upstream Slope and Crest for Erosion | | |
| Take Photographs and make Notes of Exact Location and Cause of Erosion (if known), Contact EOR | | |
| SIGNIFICANT EROSION OF THE EMBANKMENT SLOPES; SEEPAGE ON THE EMBANKMENT SLOPE OR DOWNSTREAM OF THE EMBANKMENT TOE | | |
| Estimate Seepage Flow Rate. Estimate Size of Area. | | |
| Take Photographs and make Notes of Exact Location and Cause (if known) of Erosion | | |
| Contact the EOR | | |
| SIGNIFICANT TEAR OR DEFECT IN GEOMEMBRANE | | |
| Document Location and Extent of Tear/Defect | | |
| Develop Repair Plan | | |
| | | |
| EXCEEDANCE OF INSTRUMENTATION TRIGGER LEVEL | | |
| Embankment Inspection Observations | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| OTHER OBSERVATIONS | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

I:\1\01\00045\58\A\Report\2022 East Boulder TOMS Manual Update\App C - Inspection and Surveillenance\[Table C3.1 to C3.4- East Boulder Inspection Log Templates.xlsx]Unusual Events Insp.

# Appendix C4

## Weekly Embankment QA Checklist

(Page C4-1)

SIBANYE STILLWATER
EAST BOULDER MINE
TAILINGS STORAGE FACILITY

# WEEKLY QA/QC INSPECTION CHECKLIST FOR ROUTINE FILL PLACEMENT BY MINE OPERATIONS

## GENERAL INFORMATION

*Week Ending:* _____ *General Location:* _____

*Time:* _____ *Station Interval:* _____

*Weather:* _____ *Offset from S.O.L.:* _____

*Temperature:* _____ *Subgrade Elevation:* _____

*Inspector:* _____ *Source of Material:* _____

## FOUNDATION OR UNDERLYING SURFACE

*Sub-grade Material:* _____ *Stakes Placed:* _____

*Compaction Applied:* _____ *Stake Location Checked:* _____

*Boulders Removed:* _____ *New Sed. Control Measures:* _____

*Topsoil Removed:* _____ *FILL PLACEMENT APPROVED:* _____

NOTES:

## FILL PLACEMENT

*Material:* _____ *Compaction Applied:* _____

*Material Description:* _____ *Compactor Type:* _____

*Max. Particle Size:* _____ *No. of Passes:* _____

*Gradation Req. Met.:* _____ *Compaction Spec. Met.:* _____

*Lift Thickness:* _____ *LIFT APPROVED:* _____

Sample Collected: Sa.No./Sta/OS/El:

NOTES:

## GENERAL COMMENTS

*Estimated Volume of Material Placed:* _____ *Loads* _____ cubic yards

Other: _____

_____

_____

Signed _____ _____

Date

# Appendix D

## Selected Site Photos

(Pages D-1 to D-7)

PHOTO 1 - TSF overview looking southeast.

PHOTO 2 - North Embankment looking west.

PHOTO 3 - North Embankment upstream slope and crest looking northwest.

PHOTO 4 - West Embankment crest and upstream slope, looking south. Evaporators located on upstream embankment crest.

PHOTO 5 - East Embankment looking north.

PHOTO 6 - Upstream slope of Southwest Embankment with reclaim water pipelines.

PHOTO 7 - Southwest Embankment looking southeast. Surface Soil Stockpile E above embankment crest.

PHOTO 8 - South Embankment downstream slope looking east.

PHOTO 9 - GPS survey monument on East Embankment crest.

PHOTO 10 – Ponding on West Embankment crest looking south.

PHOTO 11 - East Embankment, Stage 6 ROM rockfill and surface soil placement on outer slope, looking south.

PHOTO 12 - North Embankment, Stage 6 ROM rockfill placement, looking west.

PHOTO 13 – Floating Tailings Discharge line from the Southwest embankment, looking north.

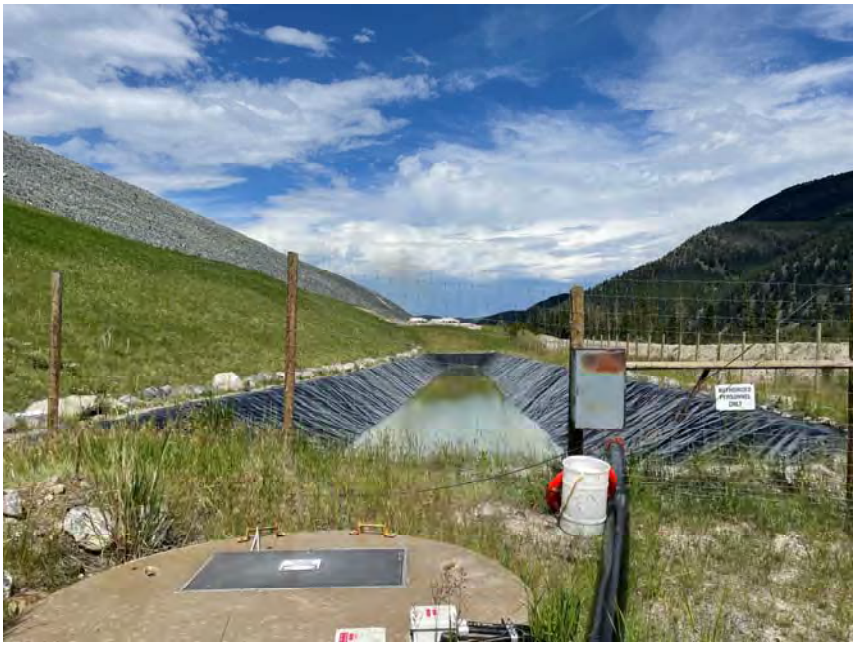
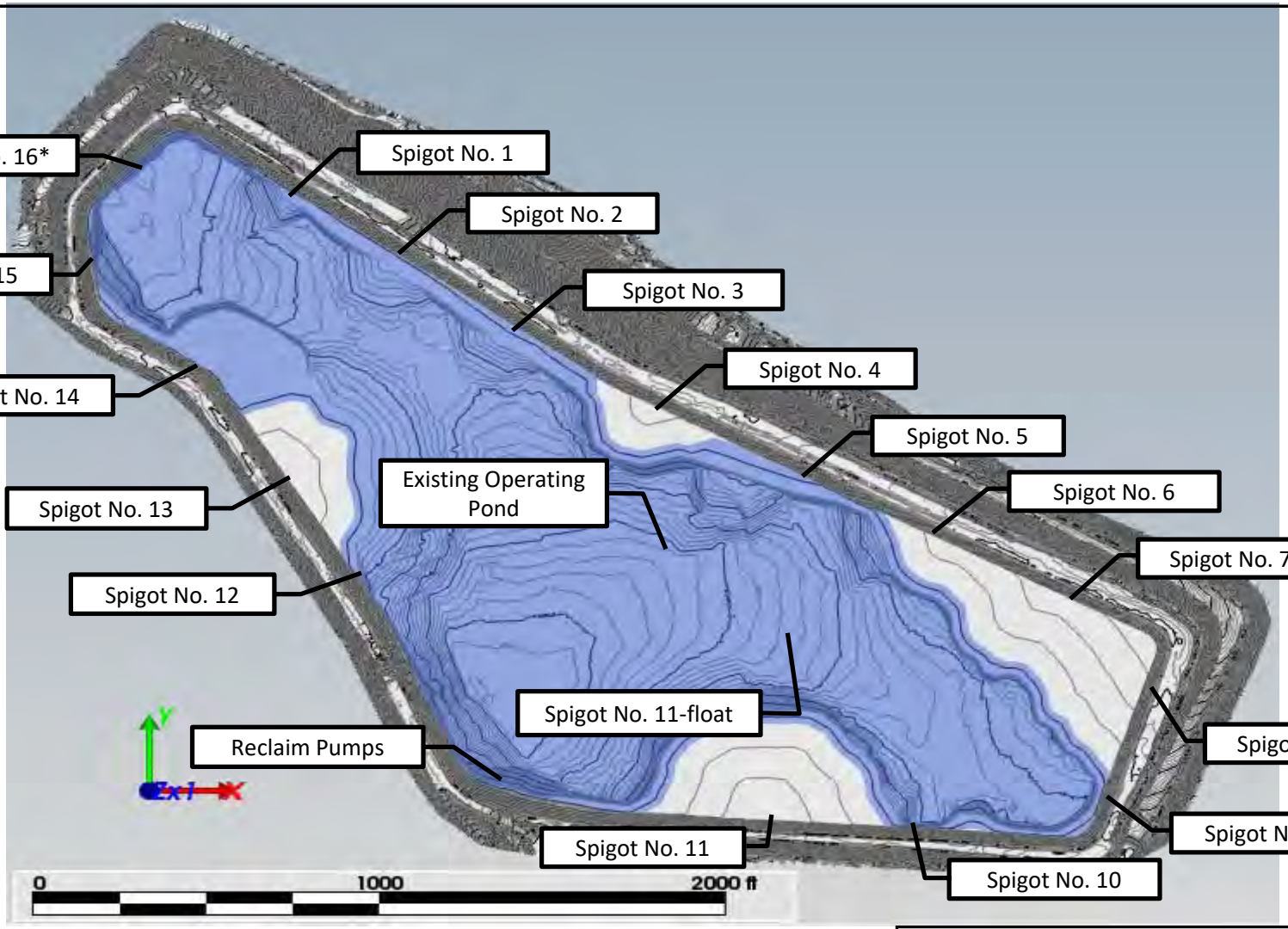


PHOTO 14 - Embankment Underdrain Collection Pond looking west.

# Appendix E

## Tailings Deposition Plan

(Pages E-1 to E-7)




**NOTES:**

1. SPIGOT 16 TO BE INSTALLED MID-YEAR 2022.
2. POND ELEVATION SHOWN AT 6305.1 ft MEASURED AT TIME OF MAY 2022 SURVEY.
3. BASE SURFACE DISPLAYS BATHYMETRIC SURVEY COMPLETE IN MAY 2022 PROVIDED BY SMC.

| REV | DATE | DESCRIPTION | PREP'D | RVW'D |
|---|---|---|---|---|
| 0 | 20DEC'22 | ISSUED FOR INFORMATION | MJT | CNH |

SIBANYE STILLWATER

EAST BOULDER MINE

**TAILINGS STORAGE FACILITY**
**TAILINGS SPIGOT LOCATIONS**

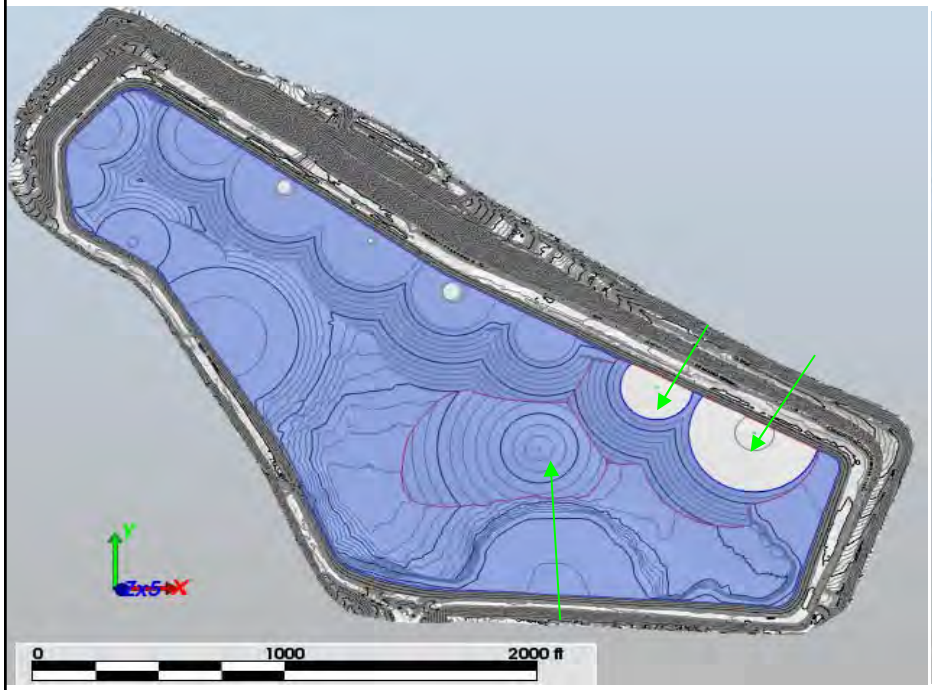
Knight Piésold CONSULTING

P/A NO. NB101-45/58

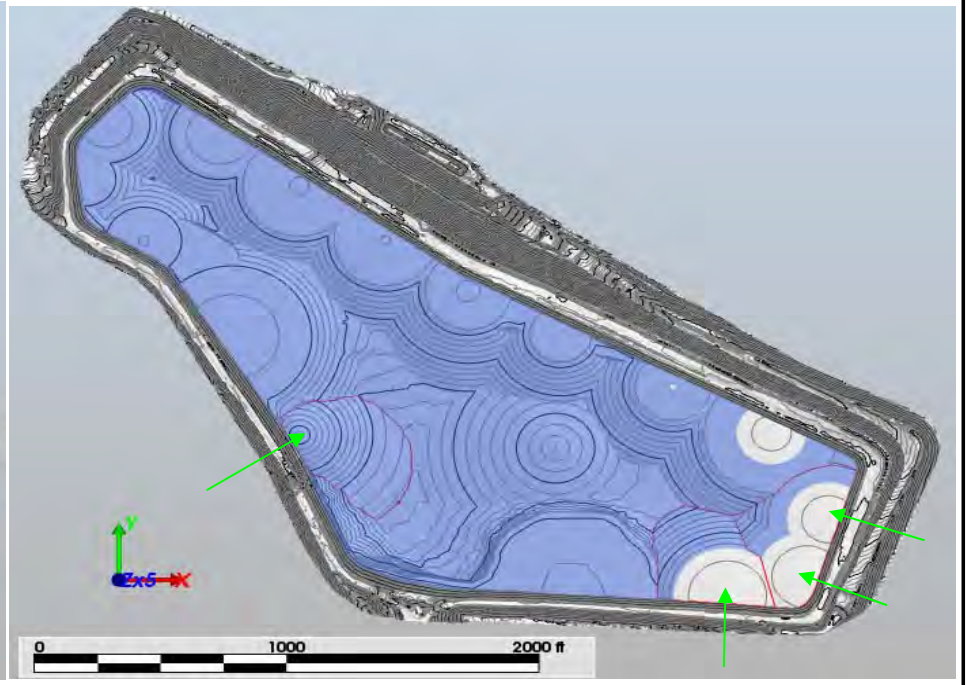
REF. NO. NB22-01384

**FIGURE E.1**

REV 0




**September - October 2022**
**Spigots No. 6/ No. 7/ No. 11 Float**
**Beach Area = 5.2 acres**




**November - December 2022**
**Spigots No. 8, 9 10, 11**
**Beach Area = 6.1 acres**

**NOTES:**

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

| REV | DATE | DESCRIPTION | PREP'D | RVW'D |
|---|---|---|---|---|
| 0 | 20DEC'22 | ISSUED FOR INFORMATION | MJT | CNH |

SIBANYE STILLWATER

EAST BOULDER MINE

**TAILINGS STORAGE FACILITY**
**TAILINGS DEPOSITION LOCATIONS**
**SEPTEMBER TO DECEMBER 2022**

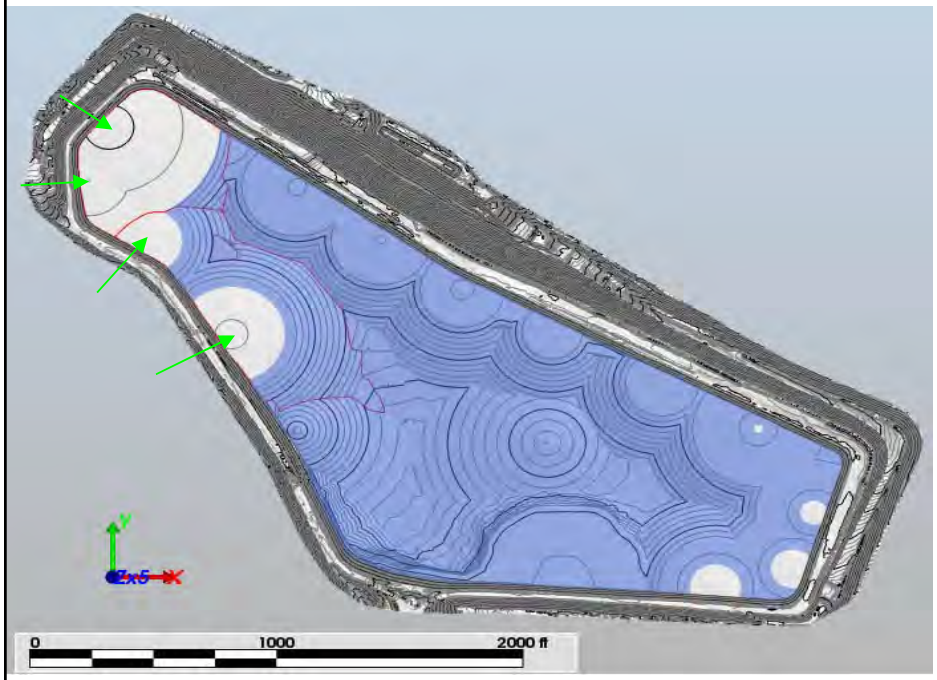
Knight Piésold CONSULTING

P/A NO. NB101-45/58

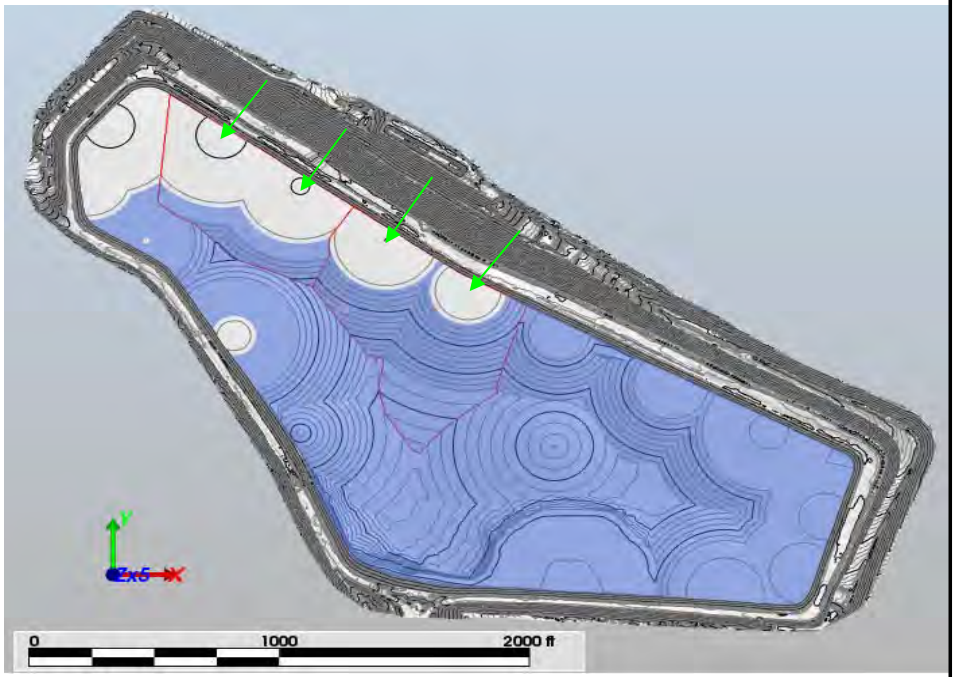
REF. NO. NB22-01384

**FIGURE E.2**

REV 0




**January - February 2023**
**Spigots No. 13, 14, 15, 16**
**Beach Area = 11.6 acres**




**March - April 2023**
**Spigots No. 1, 2, 3, 4**
**Beach Area = 14.1 acres**

**NOTES:**

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

| REV | DATE | DESCRIPTION | PREP'D | RVW'D |
|---|---|---|---|---|
| 0 | 20DEC'22 | ISSUED FOR INFORMATION | MJT | CNH |

SIBANYE STILLWATER

EAST BOULDER MINE

**TAILINGS STORAGE FACILITY**
**TAILINGS DEPOSITION LOCATIONS**
**JANUARY TO APRIL 2023**

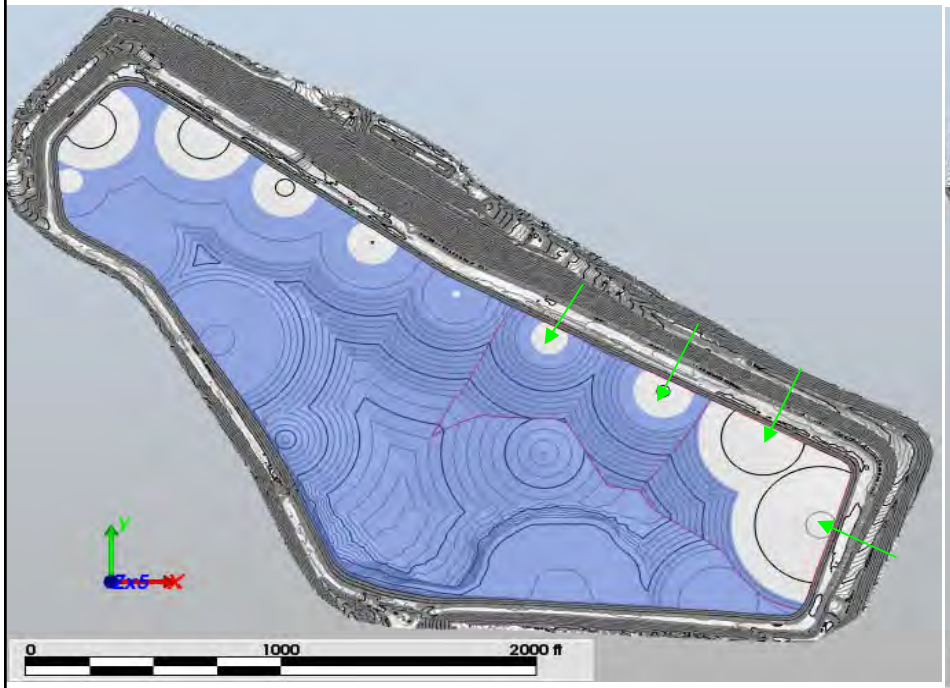
Knight Piésold CONSULTING

P/A NO. NB101-45/58

REF. NO. NB22-01384

**FIGURE E.3**

REV 0




**May - June 2023**
**Spigots No. 5, 6, 7, 8**
**Beach Area = 14.3 acres**


**July - August 2023**
**Spigots No. 9, 10, 11, 11-Float**
**Beach Area = 7.6 acres**

**NOTES:**

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

| REV | DATE | DESCRIPTION | PREP'D | RVW'D |
|---|---|---|---|---|
| 0 | 20DEC'22 | ISSUED FOR INFORMATION | MJT | CNH |

SIBANYE STILLWATER

EAST BOULDER MINE

**TAILINGS STORAGE FACILITY**
**TAILINGS DEPOSITION LOCATIONS**
**MAY TO AUGUST 2023**

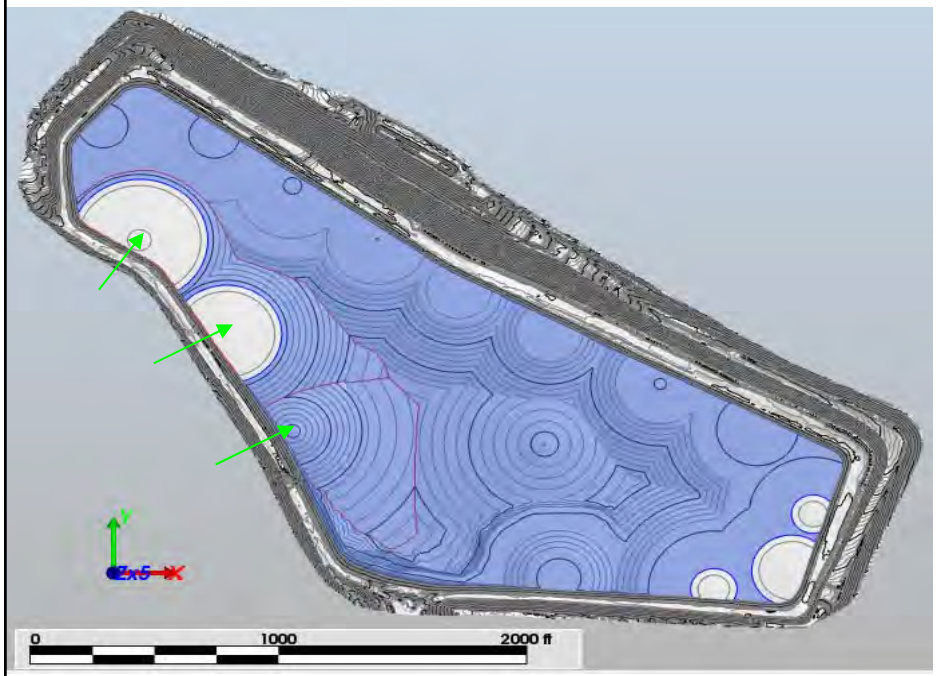
Knight Piésold CONSULTING

P/A NO. NB101-45/58

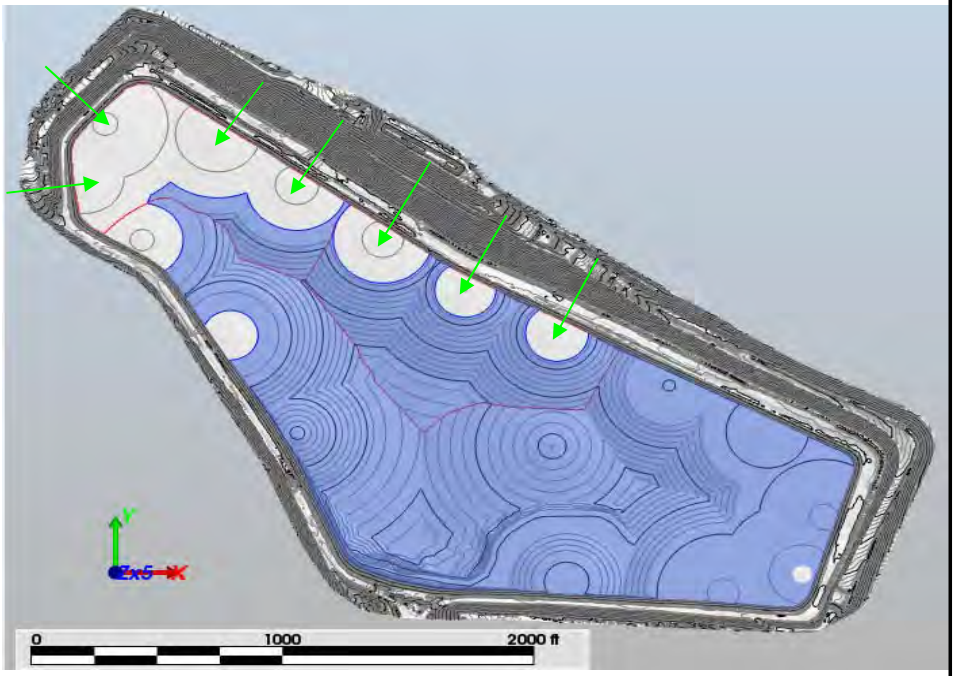
REF. NO. NB22-01384

**FIGURE E.4**

REV 0




**September - October 2023**
**Spigots No. 12, 13, 14**
**Beach Area = 8.7 acres**




**November - December 2023**
**Spigots No. 15, 16, 1, 2, 3, 4, 5**
**Beach Area = 15.7 acres**

**NOTES:**

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

| REV | DATE | DESCRIPTION | PREP'D | RVW'D |
|---|---|---|---|---|
| 0 | 20DEC'22 | ISSUED FOR INFORMATION | MJT | CNH |

SIBANYE STILLWATER

EAST BOULDER MINE

**TAILINGS STORAGE FACILITY**
**TAILINGS DEPOSITION LOCATIONS**
**SEPTEMBER TO DECEMBER 2023**

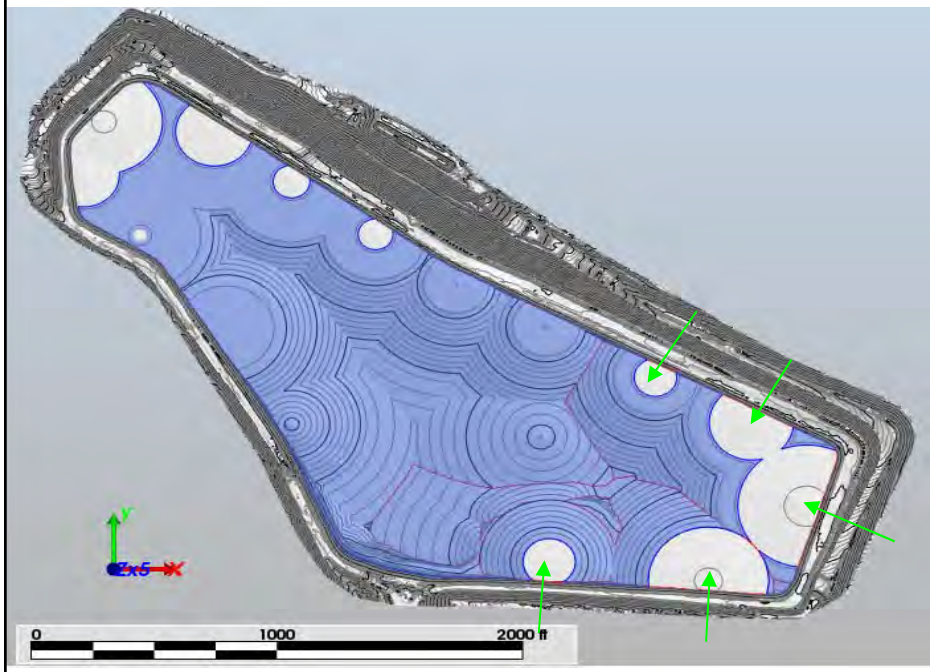
Knight Piésold CONSULTING

P/A NO. NB101-45/58

REF. NO. NB22-01384

**FIGURE E.5**

REV 0




**January - February 2024**
**Spigots No. 6, 7, 8, 10, 11**
**Beach Area = 14.8 acres**


**March - April 2024**
**Spigot No. 12**
**Beach Area = 3.8 acres**

**NOTES:**

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

| REV | DATE | DESCRIPTION | PREP'D | RVW'D |
|---|---|---|---|---|
| 0 | 20DEC'22 | ISSUED FOR INFORMATION | MJT | CNH |

SIBANYE STILLWATER

EAST BOULDER MINE

**TAILINGS STORAGE FACILITY**
**TAILINGS DEPOSITION LOCATIONS**
**JANUARY TO APRIL 2024**

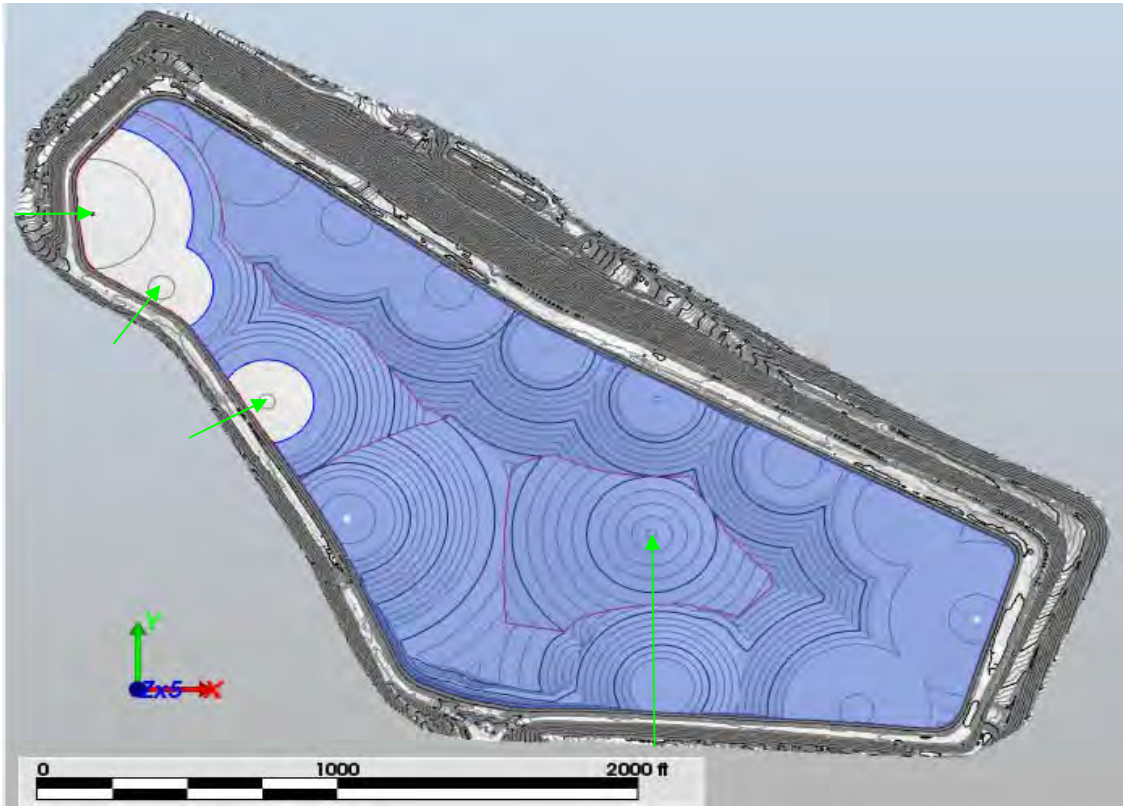
Knight Piésold CONSULTING

P/A NO. NB101-45/58

REF. NO. NB22-01384

**FIGURE E.6**

REV 0




**May - June 2024**
**Spigots No. 13, 14, 15, 11-Float**
**Beach Area = 7.0 acres**

**NOTES:**

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

| REV | DATE | DESCRIPTION | PREP'D | RVW'D |
|---|---|---|---|---|
| 0 | 20DEC'22 | ISSUED FOR INFORMATION | MJT | CNH |

SIBANYE STILLWATER

EAST BOULDER MINE

**TAILINGS STORAGE FACILITY**
**TAILINGS DEPOSITION LOCATIONS**
**MAY TO AUGUST 2024**

Knight Piésold CONSULTING

P/A NO. NB101-45/58

REF. NO. NB22-01384

**FIGURE E.7**

REV 0