Pogo RTP Operating and Maintenance Manual

Pogo RTP Dam
NID ID#AK00304

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Pogo RTP O&M Manual Revisions			
Revision #	**Date**	**Change**	**By**
Original	June 2007		AMEC
Rev 1	November 2011	Replaced entire document.	Pogo
Rev 2	October 2013	Updated entire document and figures & tables. Added Section 5.0 Exercises. Added Figure 1 Facility Location Map & Figure 7 Liese Creek Flumes. Updated Project Data Sheet. Updated drawing RTP piping and instrumentation diagram.	Pogo
Rev 3	December 2016	Updated entire document. Updated figures and tables. Added discussion of RTP Head Tank #2 and new pipelines. Added Table 4: Action Thresholds. Expanded discussion of settlement monument surveying.	Pogo
Rev 4	October 2019	Updated entire document, figures, and tables. Updated company responsible to Northern Star (Pogo) LLC. Added in discussion of additional monitoring well installation. Updated inspection frequency. Updated Project Data Sheet.	Pogo

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1.0 INTRODUCTION

Northern Star (Pogo) LLC is the operator of the Pogo gold mine, located 38 miles northeast of Delta Junction, Alaska.

The Pogo Recycle Tailings Pond (RTP) Dam (NID ID#AK00304) was constructed in 2004/2005. The Pogo RTP Dam is a lined rockfill structure constructed to provide storage of seepage and runoff water from Drystack Tailings Facility (DSTF), treated mine drainage, and surface runoff from other facilities. Water from the reservoir is used in the mining and milling process or treated and discharged.

The Pogo RTP Dam was approved to operate as a Class II (significant) hazard potential dam as defined in 11 AAC 93.157 on May 25, 2006. The first Periodic Safety Inspection (PSI) was conducted in 2007 and the certificate of approval to operate a dam was renewed on December 31, 2007. During the second PSI in 2010, Alaska Department Natural Resources (ADNR) pointed out some defects in the dam break analysis carried out in 2001/2002. It failed to evaluate the risk of inundation into the underground working area at the 1875 Portal and 1690 Portal and the influences to the Goodpaster River recreational cabins. Subsequently, ADNR decided to change the hazard potential class of Pogo RTP Dam from Class II to Class I (high). Pogo's certificate of approval to operate a dam was renewed on March 8, 2011.

Pogo conducted a new dam break analysis in April 2011 and it concluded that a hypothetical breach of the dam would lead to significant flooding in underground at the 1875 Portal and 1690 Portal. However, there is no expectation for inundation at the cabins along the Goodpaster River. This analysis endorsed the hazard potential class I for the Pogo RTP Dam.

In order to expand the capacity of DSTF from 7.5Mt to 20Mt, a new diversion ditch consisting of 5,800 ft-long north ditch and 2,650 ft-long south ditch was constructed approximately 150 ft above the existing ditch. The construction work commenced in April 2012 and completed in September 2013.

A third PSI was conducted on June 18, 2013. It concluded that the RTP Dam generally appeared to be in good condition, but it was recommended to reevaluate the hydrology and hydraulic modeling for the PMF to account for the new diversion ditch and the reduced capacity of Flume #1 and to verify the effect on the RTP Dam spillway.

A fourth PSI was conducted on June 14, 2016. The PSI Report for this inspection concludes that the RTP Dam is generally in good condition. The report recommends studying a potential grouting program at the southern flow path identified by Willowstick (2011); minor repairs to SD Flume #1; standardization of dam survey methodology, development of action level thresholds for dam settlement; updates to the O&M manual related to RTP Head Tank #2; and updates to the O&M Manual to produce action levels and contingencies for: possible overtopping of the diversion ditch and flumes in the O&M Manual, SCW performance, and LC Flume #2 conditions.

A fifth PSI was conducted from July 9-11, 2019. The PSI Report for this inspection concludes that the RTP Dam is in "*satisfactory condition*" as defined by the National Inventory of Dams (NID) Data Dictionary. "*Satisfactory*" is the highest level of condition assessment defined by the NID Data Dictionary. The report recommends quality control for survey of the dam crest; DSTF piezometer connection to a data center by telemetric methods; evaluation of mitigation options to reduce the potential of dam crest overtopping by wave action from a cost and risk perspective; bi-monthly flume inspections; grouting repair between the Flume #1 concrete structure and surrounding ground; current liquefaction assessment on the overburden soils in the foundation of the dam and for the DSTF; and removal of debris and vegetation from diversion ditches and South Diversion Ditch Flume #1.

The purpose of this Operation and Maintenance (O&M) Manual is to describe operating and monitoring procedures for the dam and reservoir under normal and unusual condition, and to provide guidance and procedures for monitoring, maintenance, and routine inspection for the Pogo RTP Dam.

2.0 OPERATIONS

2.1 Facility Descriptions

2.1.1 Reservoir and Dam

Figure 1 shows the facility location map for RTP Dam and the relevant facilities including the diversion ditch and Storm Water Pond.

The Pogo RTP Dam has a storage capacity of approximately 43.4 million gallons (Mgal). The Pogo RTP Dam is permitted for a crest elevation of 2,092 feet above mean sea level (amsl) which, as designed, results in a 40 Mgal capacity. The as-built configuration offers about 9% more storage capacity than the design configuration.

The Pogo RTP Dam serves as the impoundment where water can be stored prior to recycling or subsequent treatment and discharge to the environment. The Pogo RTP Dam impounds run off from the DSTF, captures natural flows from the catchment area below the limits of diversion ditch and the DSTF, and collects various plant site contact runoff water. Treated mine water may also be stored in cases when it cannot be discharged into the Goodpaster River as allowed by APDES Permit #AK-005334-1.

The dam is a membrane lined rockfill embankment with a hydraulic height of 65.7 feet. The dam crest is 35 feet wide and extends over a distance of 550 feet. The lined crest elevation is designed to be nominally 2,090 feet amsl, however, it was confirmed that the actual lined crest elevation ranged from 2,088.7 feet amsl to 2,089.4 feet amsl during the second PSI in 2010, by digging five holes at the crest of embankment.

2.1.2 Spillway

Located on the left abutment, the spillway intake structure is 8 feet wide rectangular reinforced concrete structure and discharges into a 6 feet diameter half corrugated steel pipe (CSP). The discharge from the south diversion ditch enters the channel on the downstream slope of the dam. A 20-inch HDPE pipe is connected to a concrete headwall of Flume #1 at the end of south diversion ditch. The 20-inch HDPE pipe transitions into a 10-foot long section of 24-inch CSP with elbow that outfalls in to the spillway CSP. The 6-foot diameter half spillway CSP then transitions to 8-foot in diameter. The channel is approximately 600 feet long and subsequently discharges into a rip rap outfall located in a channel that would return flows to Liese Creek in the event of spillway operation.

The elevation of the sharp crested weir located in the spillway inlet is at elevation 2,084 feet amsl. The spillway discharge curve is shown on **Drawing A0172-VII-042**. The spillway has a maximum discharge capacity of 440 cubic feet per second (cfs). The construction of new diversion ditch expanded the catchment area by 75.0 acres to 123.9 acres. AMEC estimated the peak outflow with 24-hour Probable Maximum Precipitation (PMP) event (11 inches rainfall within 24 hours) for pre-expansion conditions. The results were a peak inflow for the RTP of 208 cfs, a discharge for the spillway of 176 cfs, and the maximum RTP elevation of 2087.3 feet amsl. SRK reevaluated the peak outflow with 24-hour PMP event for post-expansion conditions. The results were a peak inflow for the RTP of 316 cfs, a discharge for the spillway of 279 cfs, and the maximum RTP elevation of 2088.3 feet amsl. Based on a wave height of 1.0 feet and an estimated wave run up of 1.3 feet calculated by AMEC, the reduction of spillway elevation may be required to provide enough freeboard to keep the wave run up below the liner elevation at the dam crest.

AMEC estimated the run-off rate at Flume #1 with 24-hour PMP event, and it was 310 cfs for pre-expansion conditions. AMEC evaluated that Flume #1 had a discharge capacity of 20 cfs with a 20-inch HDPE pipe. The evaluations conducted by SRK and Golder Associates indicate that probable maximum flood (PMF) resulting from the PMP could lead to a backup of water within the south diversion ditch and possible overflow into the RTP catchment. They recommended re-evaluation of the hydrology and hydraulic modeling for the PMF to account for the new diversion ditch and the flow capacity of Flume #1 to verify the effect on the spillway.

2.1.3 Diversion Ditch

The diversion ditch aims to intercept “non-contact” surface water from areas unaffected by mine development. In order to expand the capacity of DSTF from 7.5Mt to 20Mt, a new diversion ditch was constructed in 2012-2013.

The new north diversion ditch is about 5,850 feet long and runs from Inlet 3 at an elevation of 2,750 feet amsl into the existing north diversion ditch at an elevation of about 2,404 feet amsl. The remaining 2,049 feet of existing north diversion ditch connects to Flume #2 at an elevation of 2,158 feet amsl. Flume #2 is composed of a 750 feet-long, 60-inch diameter open CSP culvert. It discharges into Liese Creek about 700 feet downstream of the RTP Dam. The discharge capacity of Flume #2 is estimated to be 164 cfs.

The new south diversion ditch is about 2,654 feet long and ranges in elevation from about 2,716 to 2,661 feet amsl. The new south diversion ditch connects to the existing ditch at about elevation 2,499 feet amsl via a 342-foot, 24-inch diameter HDPE pipe with intake and outlet structures. The discharge capacity of New South Flume is estimated to be 27 cfs (SRK, 2013a). The 2,329 feet-long existing south diversion ditch connects to Flume #1 at an elevation of 2,195 feet amsl. The water from the south diversion ditch discharges into the spillway via a 427-foot, 20-inch diameter HDPE pipe. The discharge capacity of Flume #1 is estimated to be 20 cfs (AMEC, 2006).

The diversion ditch is designed to intercept a one in 200-year, 24-hour precipitation event (4.6 inches within 24 hours). One foot of freeboard was incorporated into the design. The estimated design flow (200-year, 24-hour precipitation event) for post-expanded conditions calculated by SRK is 78 cfs at Flume #2 (north diversion ditch), 24 cfs at the New South Flume and 34 cfs at Flume #1 (south diversion ditch), respectively.

2.1.4 RTP Head Tank and Plumbing System

During normal operation of the Pogo RTP dam, the pond water is withdrawn by the RTP reclaim pumps located near the upstream toe of the RTP. Two 20 HP six inch submergible pumps (one for operation and the other for back up), each having a pumping capacity of 600 gpm, are set at 2,020 feet amsl. The reclaim pumps are:

- Manufactured by National Pump Company
- Model Number M14HC
- Motor type HITACHI 20 HP MOTOR (460 V, 3 Phase)

The pond water is sent to RTP Head Tank #1, a 55,000 gallon RTP Head Tank, and RTP Head Tank #2, a 31,000 gallon RTP Head Tank, both located on the right abutment via a 6-inch diameter HDPE pipeline. RTP Water is then sent to Mine Water Treatment Plant 3 (MWTP#3), Mill Plant, or underground working area by gravity flow. The maximum discharge rate is 500 gpm. When the treated mine water cannot be discharged into the Off-River Treatment Works (ORTW), the treated mine water is sent from MWTP#3 to the RTP Head Tank (up to 300 gpm). The schematic plumbing system around the RTP Head Tank is shown on **RTP Piping & Instrumentation Diagram Drawing** in **Appendix C**.

2.1.5 Storm Water Pond Discharge Pipeline

The Storm Water Pond located near the 1690 portal was constructed to gather the storm water from Mill Bench and Haul Road above Mill Bench. Two pumps are installed at the pond and collected storm water is sent to RTP via a 16-inch HDPE pipeline. The pipeline runs across the downstream dam face, across the top of spillway, and discharges over bedrock above the south-side of the dam and upstream of the spillway inlet. The storm water is pumped up intermittently depending on the weather. The water volume pumped up from Storm Water Pond to the RTP is approximately 0.5 – 1 million gallons per year.

2.1.6 Seepage Collection Wells

The seepage collection wells (SCWs) are located approximately 400 ft downstream of the RTP. There are currently four deep wells (SCW#5 - 8) and one shallow well (SCW#9) in operation. The SCWs collect groundwater (including any seepage from the RTP) and return it to the RTP Head Tank via a 4-inch HDPE pipeline (**Drawing RTP Piping & Instrumentation Diagram**). **Table 1** provides details on SCWs.

Table 1: Seepage Collection Well Information

SCW ID	Manf.	Model	HP	Voltage	Phase	Discharge in.	GPM	Casing in.	Pump Inlet ft
Well #5	Grundfos	40S50-15	5	460	3	2	25	5	67.50
Well #6	Grundfos	40S50-15	5	460	3	2	25	5	66.75
Well #7	Grundfos	40S50-15	5	460	3	2	25	5	71.00
Well #8	Grundfos	40S50-15	5	460	3	2	25	5	62.75
Well #9	Flygt	BS-2670.180	27	460	3	4	100	20	13

Figure 1: RTP Dam Facility Location Map

2.2 Storage Objective and Control of RTP

The RTP was originally designed to provide process makeup water for the Mill and underground drilling water. Most underground drilling water is now supplied by the underground water recycling system. Treated mine, RTP, and gravel pit pond water are the primary sources for process makeup water. Therefore, the RTP storage objective was changed to keeping a minimum volume of water as follows:

- Summer season (June to September): 5 Mgal target. This is enough to supply makeup water to the mill for about 20 days, assuming a water consumption rate of 100 gpm at the Mill. **Figure 2** shows the RTP reservoir volume-elevation curve. If the RTP water volume exceeds 5 Mgal (RTP reservoir elevation: 2,042 feet amsl), the RTP water is discharged into MWTP#3, treated and then discharged into ORTW. **Figure 3** shows the drawdown curve for 300 gpm discharge from the RTP.
- Winter season (October to May): 15 Mgal target. In order to handle a potential shortage of process makeup water during winter season, the RTP water storage volume is increased to 15 Mgal by the end of October. The water volume is then reduced over the winter to 5 Mgal before the spring breakup or by the end of May.

Figure 2: RTP Volume-Elevation Curve

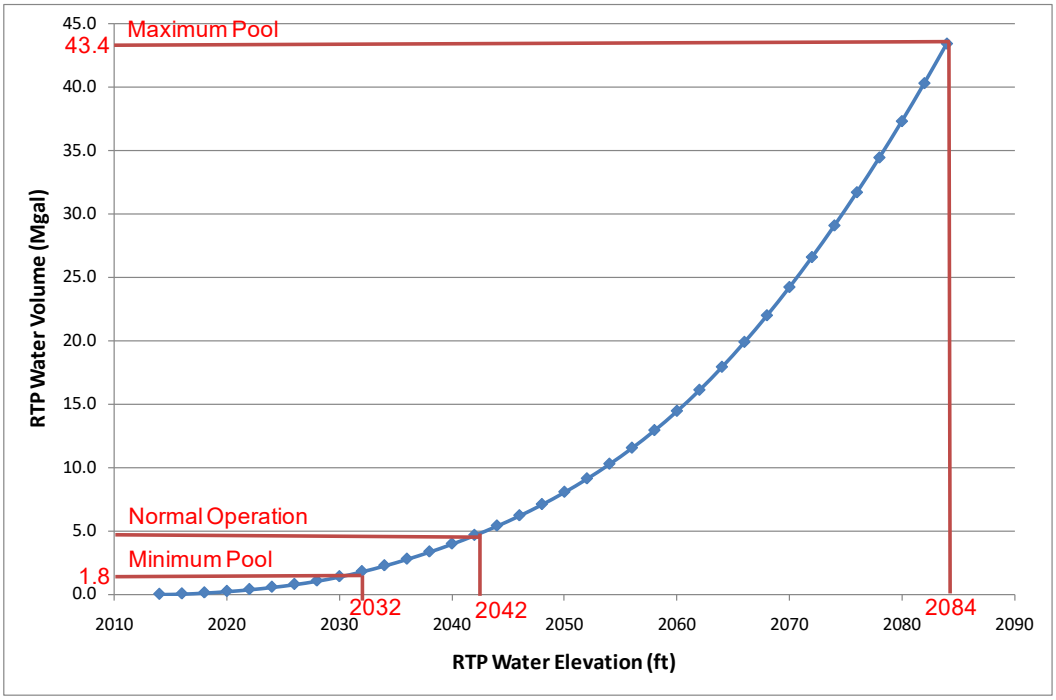
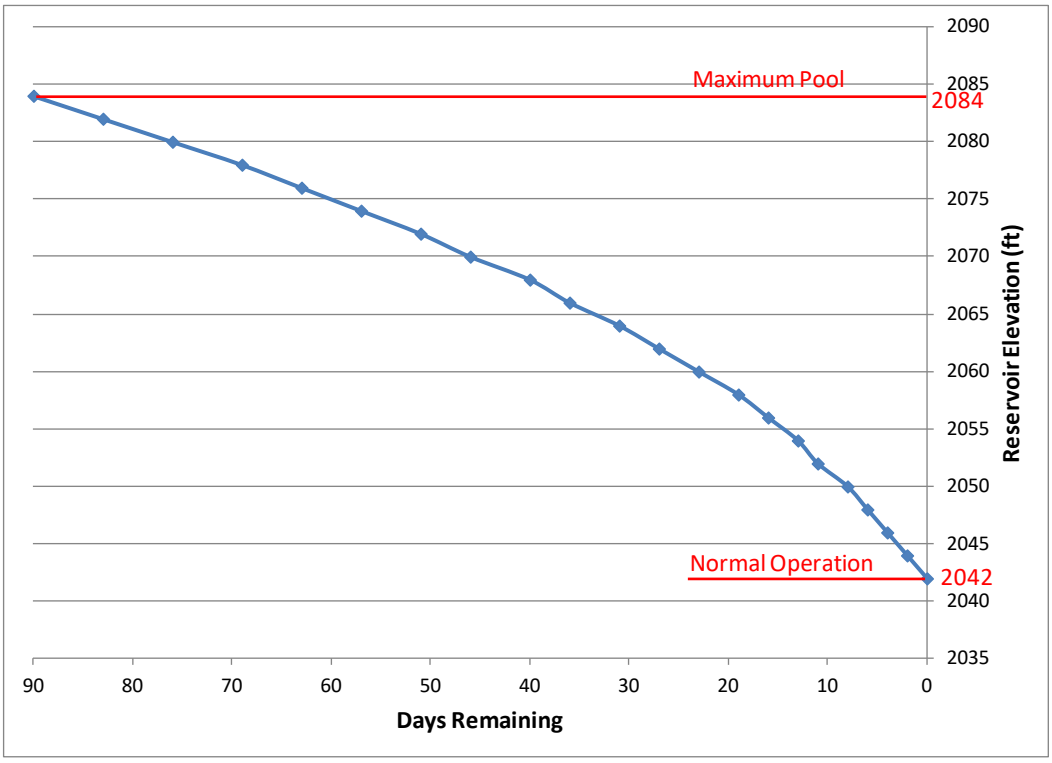


Figure 3: Drawdown Curve for 300 gpm Discharge from RTP



2.3 Monitoring

The monitoring and frequencies are summarized in **Table 2**. **Figure 4** shows the location of monitoring points.

2.3.1 Reservoir Water Elevation and Volume

The reservoir elevation is measured by the pressure transducer installed at the RTP reclaim pump station at the bottom of the reservoir. The pressure transducer is connected to the Data Communication System (DCS) and the data are recorded automatically and reported in the "Quick Morning Report from DCS" issued by the Mill Department on a daily basis.

2.3.2 Seepage Collection Wells Pump-up Rate

The pump-up rates of the SCWs are monitored by two flow meters which are connected to the DCS. One flow meter is for SCW#5 - 8, and the other is for SCW#9. The daily average flow rates are reported in the "Quick Morning Report from DCS" issued by the Mill Department.

The pump-up rates of the SCWs vary by season and can be correlated to RTP water elevation. Historically, the pump up rate from SCW#5 - 8 increased from 70 gpm up to 170 gpm in relation to the reservoir elevation. The rate reduced by approximately 50 gpm in 2013 due to grouting conducted in April 2013 (see **Figures 5 and 6**). SCW#9 dried up when the reservoir elevation is 2,062 feet amsl (RTP volume: 16 Mgal) or lower. Once the reservoir level exceeded 2,062 feet amsl, the pump up rate from SCW#9 increased up to 170 gpm in proportion to the reservoir elevation (see **Figures 5 and 7**) SCW#9 remains dry in 2013 even though the reservoir level reached to 2,064 feet amsl in late September. The combined pump up rate from SCW#5 - 8 and SCW#9 historically ranges between 70 gpm and 340 gpm under normal operating conditions.

2.3.3 Flow Rate from Drystack Tailings Facility Flow-through Drain

The flow rate from DSTF flow-through drain is monitored at Liese Creek Flume #1 upstream of the RTP (see **Figure 4**). Liese Creek Flume #1 was installed in April 2013. A pressure transducer is installed during summer season to monitor the water level every two hours. The data is downloaded from the pressure transducer by Environmental Staff periodically, and this information is used to evaluate the water balance of the RTP along with the flows recorded by flow meters placed throughout the system.

2.3.4 Liese Creek Flow Downstream of Seepage Collection Wells

Liese Creek flow downstream of the SCWs is monitored at Liese Creek Flumes #2, #3, and #4, installed in April 2013 (see **Figure 1**). A pressure transducer is installed during summer season to monitor the water level every two hours. The data is downloaded from the pressure transducer by Environmental Department bi-monthly.

2.3.5 Dam Crest Elevation

Two survey monuments were established on the dam crest in 2010. The elevation of these monuments is surveyed in September by the mine surveyors. The initial survey was conducted in September 2010, results are as follows:

- Center monument: 2,089.920 ft
- Spillway side monument: 2,091.682 ft

The center monument has historically settled about 0.3 feet since 2012, and the spillway monument has historically ranged between 0.032 feet downward to 0.018 feet upward.

Monument surveys are completed by Pogo surveyors at the request of Environmental staff. Environmental staff should ensure that surveyors use consistent methodology when measuring monument elevations, and when possible the survey should be completed by a Pogo surveyor who is familiar with the RTP Dam and its survey history. Environmental staff should compare all survey results with past survey results to determine the extent and trend of variance in the elevation readings. Particular attention should be given to unusual survey results or survey results that fall outside of the historical range. Repeat surveying may be necessary to determine whether survey variance represents actual change or variation from survey methodology.

2.3.6 Groundwater Monitoring Wells

Two groundwater monitoring wells (MW11-001A, MW11-001B) were constructed between DSTF and RTP in 2011 to monitor the groundwater down gradient of DTSF. Three groundwater monitoring wells (MW12-500, MW12-501, MW12-502) were constructed in 2012 and four additional monitoring wells (MW18-001, MW18-002, MW18-003A, MW18-003B) were constructed in 2018 approximately 450 feet downstream of the RTP Dam toe. These wells are sampled and compared with baseline conditions and permit trigger limits.

More details on groundwater monitoring are described in the **Pogo Mine Monitoring Plan**.

2.3.7 Meteorological Stations

Two Meteorological (Met) Stations were constructed at Pogo in 2011, one on Pogo Ridge and the other in Pogo Airstrip area. Their purpose is to collect data to support air quality and hydrologic modeling. Each station has a ten meter guyed tower with a two foot by two foot concrete base pad. The Datalogger™ system is placed in a weather proof enclosure at the base of each tower. Each station measures the following parameters:

- Wind Speed (m/s) (at 10-meters);
- Wind Direction (degrees) (at 10-meters);
- Sigma Theta (degrees);
- Air Temperature and vertical temperature difference (degree C) (at 2 meters and 10 meters elevation);

- Solar Radiation (W/m^2);
- Barometric Pressure;
- Heated Precipitation gauge with wind shield (inches); and
- Evaporation rate (Airstrip station only)

Each of the monitoring stations is powered by electrical service with a backup battery and solar power system. Both sites are readily accessible by vehicle.

Table 2: Pogo RTP Dam Monitoring Items

Items	Location	Frequency	Monitoring
RTP Reservoir water level and volume	RTP pump station	Daily	Pressure transducer connected to DCS
Seepage collection well pump-up rate	Seepage collection wells	Daily	Flow meters connected to DCS
Flow rate from DSTF flow-through drain	Liese Creek Flume #1	Bi-hourly (Summer period)	Water level is collected with pressure transducer
Flow rate into Liese Creek downstream of SCWs	Liese Creek Flume #2	Bi-Hourly (Summer period)	Water level is collected with pressure transducer
Flow rate into Liese Creek downstream of all RTP appurtenances	Liese Creek Flume #3	Bi-Hourly (Summer period)	Water level is collected with pressure transducer
Dam Crest Elevation	Dam crest survey monuments	Twice per year (March, September)	Mine surveyor provides survey results
Groundwater Monitoring Wells (MW11s, MW12s)	MW11-001A, 001B MW12-500, 501, 502	Quarterly	Water samples are collected by environmental staff
Groundwater Monitoring Wells (MW18s)	MW18-001, MW18-002, MW18-003A, MW18-003B	Monthly (MW18-001), Quarterly	Water samples are collected by environmental staff
Met Stations	Pogo Ridge & Airstrip Area	Hourly	Wind speed and direction, air temp, solar radiation, precipitation

Figure 4: Pogo RTP Dam Monitoring Locations

Figure 5: RTP Elevation and SCW Flow Rates

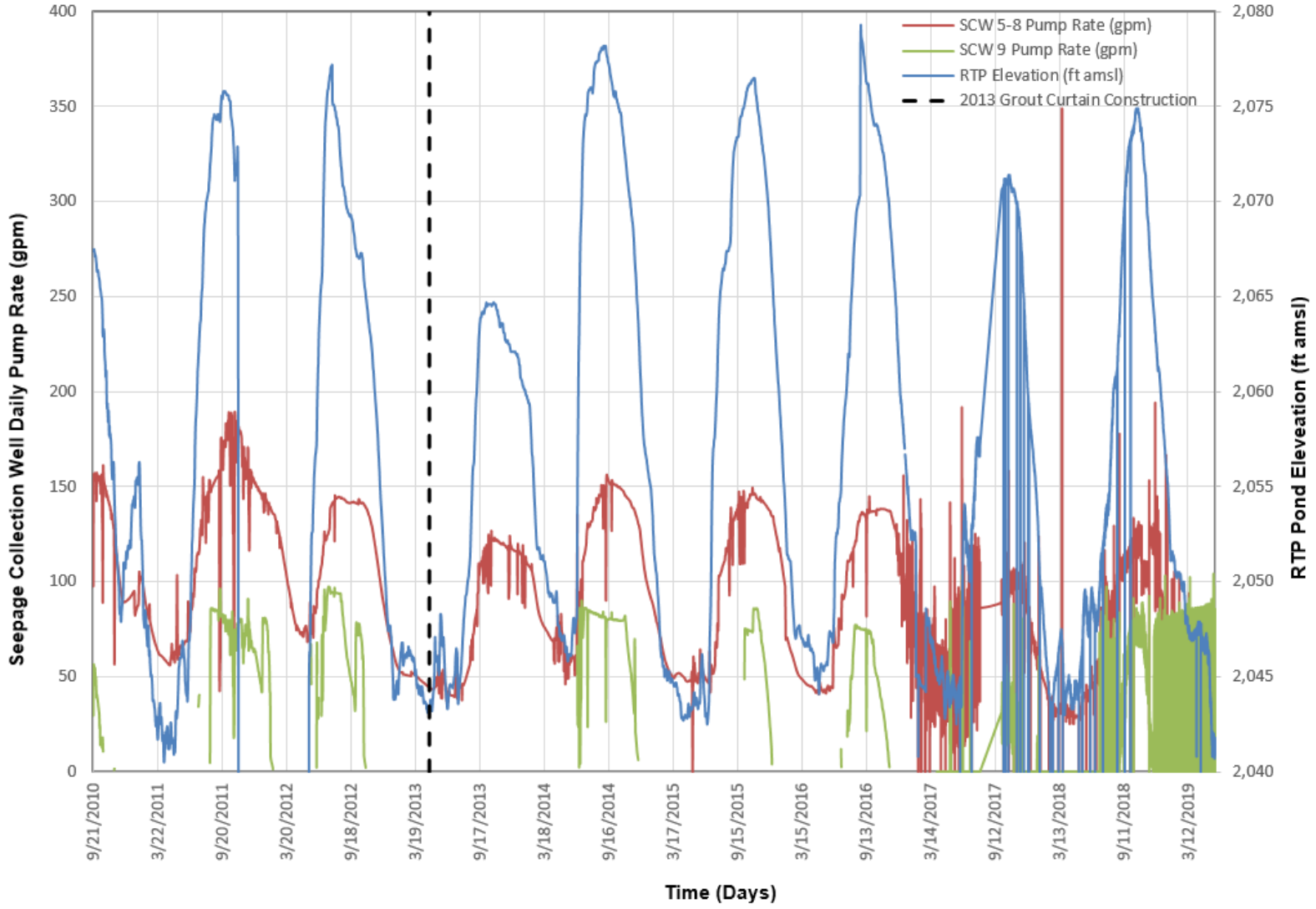


Figure 6: SCW#5-#8 Pump Rate and RTP Reservoir Elevation (9/21/2010–4/21/2014) vs (4/22/2014-12/5/2016)

Figure 7: SCW#9 Pump Rate and RTP Reservoir Elevation (9/21/2010–4/21/2014) vs (4/22/2014-12/5/2016)

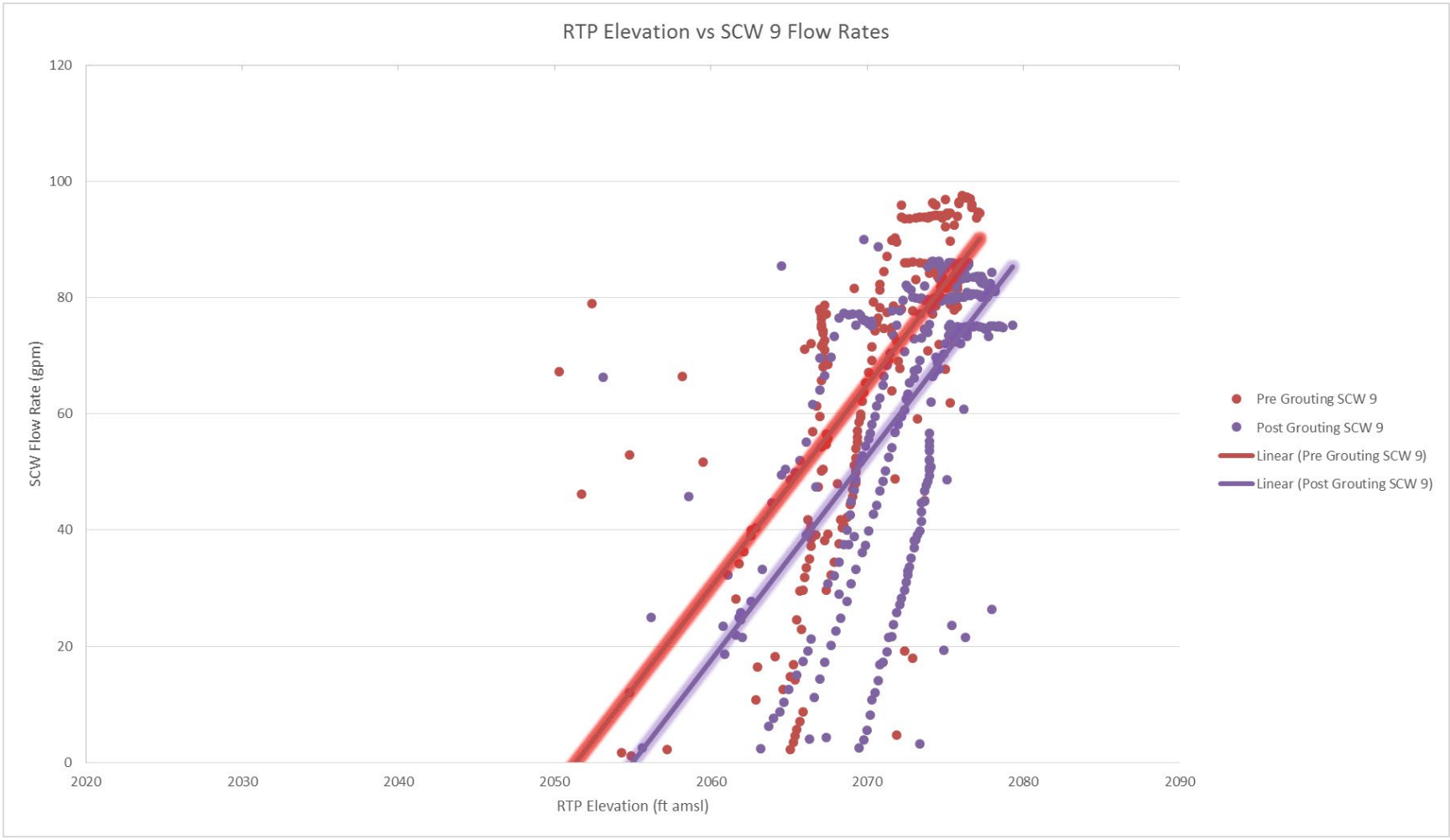
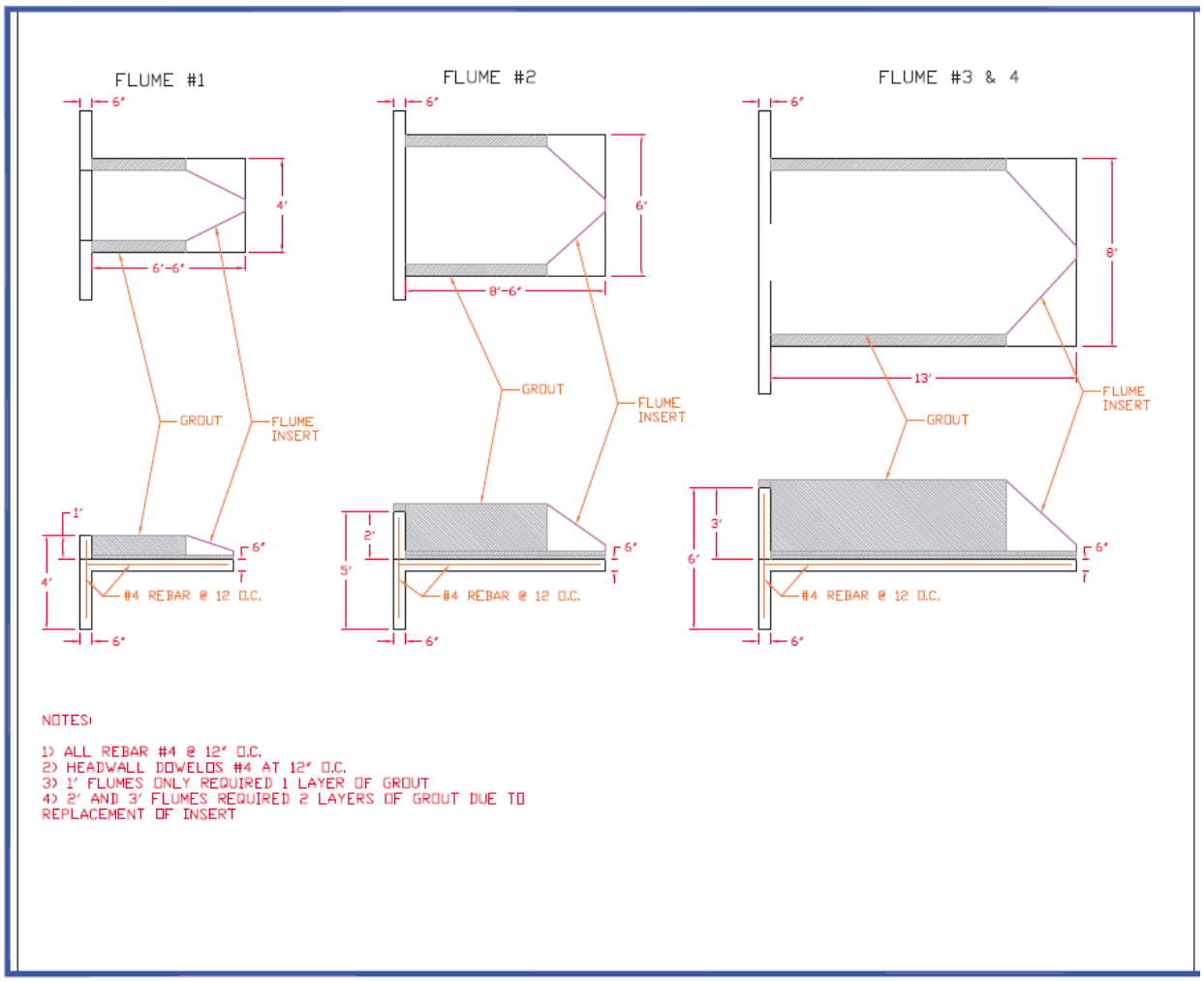


Figure 8: Liese Creek Flumes



3.0 MAINTENANCE

This section summarizes the routine and preventative maintenance activities for the RTP site.

Table 3: Action Thresholds

Item	Inspection Frequency	Action Threshold	Recommended Response
Seepage collection well condition and operation	Weekly	Deviation from normal operations	Investigate and contact Pogo Maintenance for repair
Liese Creek Flumes 1-4	Bi-Monthly (seasonal)	Erosion or significant change in structure	Investigate and contact Pogo Maintenance for repair
Diversion Ditch: LC Flume 2	Monthly (seasonal)	Erosion or significant change in structure	Investigate and contact Pogo Maintenance for repair
RTP Dam and Abutments	Weekly	Vegetation, subsidence, erosion, collapse, etc	Investigate and contact Pogo Maintenance for repair
Spillway	Weekly	Corrosion, damage, or irregularities	Investigate and contact Pogo Maintenance for repair
Diversion Ditch	Monthly (seasonal)	Flumes or ditch damaged or flow restricted	Investigate and contact Pogo Maintenance for repair
Dam Crest Monuments	Twice per year (March, September)	Review all results	Compare survey readings with historical trends, request a second survey if results deviate significantly

3.1 Dam and Abutments

The dam and abutments are inspected weekly. Any vegetation on dam and abutments is cleared, and the obstacles such as wood debris in the pond removed if possible.

3.2 Spillway

The spillway is inspected during the weekly inspection, and after any spill event. The inspection includes checks for signs of corrosion, irregularities in the spillway

profile, damage from ice or rocks, and signs of piping along the flume outfall. Any damage to the structure will be repaired. Inspection information is input into Pogo's INX system.

Debris or rocks that fall into the spillway conduit is removed. Prior to the spring freshet, major ice accumulation within the spillway is mechanically or steam cleared if needed.

3.3 Diversion Ditch

Major aufeis accumulation in the diversion ditches is managed each spring prior to the freshet. The objective is to provide the proper flow path for the freshet, so that the ice will naturally thaw in the proper locations. It is imperative to keep the water flow within the ditches and off the adjacent access road.

3.4 Seepage Collection Wells

Environmental staff is responsible for weekly visual inspection of the seepage well pump controllers and flow meters. Any deviation from normal operations will be brought to the attention of the Maintenance Department.

There is no requirement for routine maintenance for the seepage collection pumps by the manufacture. The pumps are exchanged when any malfunction occurs.

3.5 RTP Pumps, Head Tank and Affiliated Facilities

Mill Department is responsible for daily inspection of the RTP pumps, head tank, and affiliated facilities. Any deviation from normal operations will be brought to the attention of the Maintenance Department.

There is no requirement for routine maintenance for the RTP reclaim pumps by the manufacture. The pumps are exchanged when any malfunction occurs.

3.6 Liese Creek Flumes

Environmental staff is responsible for bi-monthly visual inspection of the Liese Creek Flumes during the summer season. The accumulated sediments in the flumes are removed by hand. There is no requirement for routine maintenance for the Liese Creek Flumes.

4.0 INSPECTION

Table 4: Inspection Requirements

Facility	Frequency	Responsible	Remarks
Seepage Collection Wells	Weekly	Environmental Department	Check controller and flow meters
RTP Head Tank	Daily	Mill Department	Check controller and flow meters
Liese Creek Flumes	Bi-Monthly (seasonal)	Environmental Department	Check erosion, sediment accumulation, etc.
RTP Dam and Pond	Weekly	Environmental Department	Check housekeeping and general conditions, erosion, subsidence, vegetation, and spillway condition
Diversion Ditch, LC Flume #1, LC Flume #2	Monthly (seasonal)	Environmental Department	Check erosion, sediment accumulation, aufeis accumulation, etc

4.1 Daily Inspection

The RTP Head Tanks are inspected daily by Mill staff. Staff check pump operations, tank levels, and flow rates and record values in Pogo's DCS database.

4.2 Weekly Inspection

The RTP Dam and DSTF are inspected visually by the environmental staff on a weekly basis. This inspection includes visual inspection of the seepage collection well system. Staff check pump operations and flow rates. The inspection form is attached in **Appendix B**. The inspection results are input into Pogo's INX database by the inspector for recording.

Table 3 summarizes the requirements of visual inspection.

4.3 Monthly Inspection

The North and South Diversion Ditches, LC Flume #1, and LC Flume #2 are inspected visually by the environmental staff on a monthly basis when access is not blocked by snow. The inspection form is attached in **Appendix B**. The inspection results are input into Pogo's INX database by the inspector for recording.

4.4 Bi-Monthly Inspection

The Liese Creek Flumes are inspected visually by the environmental staff on a bi-monthly basis. If a large rain event occurs, the flumes are inspected on an as-needed basis. The inspection form is attached in **Appendix B**. The inspection results are input into Pogo's INX database by the inspector for recording.

4.5 Periodic Safety Inspection

A PSI should be performed every three years as required by 11 AAC 93.159. A PSI must be performed by a qualified engineer. Prior approval of the engineer and the scope of the inspection must be agreed upon in advance with the Alaska Department of Natural Resources (ADNR). The draft PSI report shall be submitted to ADNR within 30 days after the visual inspection of the dam.

5.0 EXERCISES

5.1 Orientation Exercise

An annual orientation exercise keeps responsible parties informed about the Emergency Action Plan (EAP). The Environmental Department is responsible for holding the annual orientation exercise with Senior Management and other relevant parties.

5.2 Table-top Exercise

Table-top exercises test the EAP. The Safety Department is responsible for holding the table-top exercises with Senior Management and other relevant parties in collaboration with Environmental Department. The first table-top exercise was held in 2011 and is conducted every three years thereafter. Table-top exercises were held in 2014 and 2017, with the next exercise planned for 2020.

6.0 UNUSUAL OCCURENCES

The unusual occurrences identified in this section include:

- Earthquake
- Extreme precipitation
- High water level

6.1 Earthquake

If an appreciable earthquake event occurs (strong enough to be felt by site personnel), site personnel will inspect the Pogo RTP Dam site, including the dam, spillway, diversion ditch, and SCWs, and Mill Department will inspect the RTP reclaim pumps and Head Tank. Any deviation from normal operations will be reported to the Safety, Health and Environmental Manager.

6.2 Extreme Precipitation

Extreme rainfall is defined as rainfall exceeding two inches in 24 hours. Rainfall information for Pogo Mine site can be obtained at the USGS home page called “Real-Time Water Data for Alaska.” The address of relevant home page is:

http://waterdata.usgs.gov/ak/nwis/uv?cb_00065=on&cb_00060=on&cb_00045=on&format=gif_default&period=7&site_no=15477740

During these types of rainfall events, the pond condition will be observed and the spillway inspected to make sure it is clear of debris.

6.3 High Water Level

If the reservoir elevation exceeds the elevation of spillway floor (2,080.5 feet amsl), Tier 1 response actions will be activated in accordance with approved **Emergency Action Plan for the Pogo RTP Dam (NID ID#AK00304)**.

7.0 REFERENCES

- U.S. Department of the Interior Bureau of Reclamation, 2001, Water Management Manual
- Teck-Pogo, 2002, Pogo Project Water Management Plan
- ADEC, 2012, Waste Management Permit # 2011DB0012
- ADNR, 2005, Guidelines for Cooperation with the Alaska Dam Safety Program
- AMEC, 2004, RTP Dam Design Report
- AMEC, 2006, RTP Dam 2004-2005 As-built Report
- AMEC, 2011, Pogo RTP Dam Second Periodic Safety Inspection Report
- SRK, 2011, Pogo Mine RTP Dam Break Analysis
- Pogo, 2016, Emergency Action Plan for the Pogo RTP Dam
- SRK, 2013, Pogo Mine – RTP Dam Spillway and Associated Discharge Structures Verification
- SRK, 2013, DSTF Diversion Ditches Design Calculations
- Golder, 2013, Periodic Safety Inspection Report No. 3 – Recycle Tailings Pond Dam
- Golder, 2016, Periodic Safety Inspection Report No. 4 – Recycle Tailings Pond Dam
- AECOM, 2019, Periodic Safety Inspection Report No. 5 – Recycle Tailings Pond Dam
- Pogo, 2019, Pogo Mine Monitoring Plan

Appendix A

Pogo RTP Dam Project Data Sheet

POGO RECYCLE TAILINGS POND (RTP) DAM
PROJECT DATA SHEET

GENERAL

Dam Name:	Pogo Recycle Tailings Pond (RTP) Dam
NID Number:	AK00304
Hazard Class:	I (significant)
Purpose:	Water management impoundment
Year Built:	2005 (dam, roads, and diversion ditches)
Year Modified:	2013 (grout curtain improvements, new diversion ditches)
Location:	64.4512° latitude, -144.8926° longitude
Reservoir Name:	Recycle Tailings Pond
River or Creek Name:	Liese Creek
Owner:	Northern Star Resources Ltd.
Owner Contact:	Katie Schumacher, Environmental Engineer
Address:	PO Box 145, Delta Junction, AK 99737 Phone: (907) 895-2730 Fax: (907) 895-2866 Email: kschumacher@nsrltd.com

DAM

Type:	Membrane lined rockfill
Core Type:	Rockfill dam with composite membrane liner system on upstream face and grout curtain in foundation rock
Crest Length:	550 feet
Crest Width:	35 feet (at liner elevation)
Crest Elevation:	2088.7 feet amsl (minimum liner elevation), ~2,091 feet amsl (riprap)
Crest Height (from d/s toe):	90.7 feet (2088.7 feet amsl minus 1,998 feet amsl)
Hydraulic Height:	69 feet (2,084 feet amsl at spillway crest minus 2,015 feet amsl)

PRIMARY SPILLWAY

Type:	Reinforced concrete rectangular suppressed sharp-crested weir
Location:	South abutment
Spillway Crest Elevation:	2,084 feet amsl
Top Width:	8 feet
Bottom Width:	8 feet
Length:	140 feet (approx. from 2006 AMEC as-built drawings)
Discharge Capacity at Dam Crest:	303 cfs at 2,088.7 feet amsl

EMERGENCY SPILLWAY None

OUTLET WORKS

Type:	Pumped withdrawal via two steel pipes
Location:	Near center of dam crest alignment, inside HDPE piping along upstream slope and dam crest
Invert Elevation:	2,021 feet amsl
Outlet Invert Elevation:	2,107 feet amsl
Diameter:	8 inches (each)
Length:	N/A
Outlet Type:	Two head tanks at dam crest
Discharge Capacity into Head tank:	1.3 cfs

Page 1 of 2

POGO RECYCLE TAILINGS POND (RTP) DAM
PROJECT DATA SHEET

RESERVOIR

Normal Water Surface Elevation:	2,042 feet amsl
Normal Storage Capacity:	14.3 acre-feet
Maximum Water Surface Elevation:	2,084 feet amsl (spillway crest elevation)
Maximum Storage Capacity:	133.2 acre-feet
Max. Surface Area at Spillway Crest:	5 acres (approx.)

HYDROLOGY

Drainage Basin Area:	0.19 square miles (new diversion ditches system)
Average Annual Rainfall:	19 inches
100 Year/24 Hour Rainfall:	4.3 inches
100 Year Flood:	112 cubic feet per second
Probable Maximum Precipitation:	11 inches
Flood of Record:	1.88 inches in 21 hours on June 2, 2006
Probable Maximum Flood:	473 cfs (SRK 2013)
Floods of Record:	1.88 inches in 21 hours on 22 June 2006 (AMEC 2011) 1.45 inches in 2 hours on June 10, 2017 (Sumitomo 2017)
Inflow Design Flood:	473 cfs

Page 2 of 2

Appendix B

RTP Dam Weekly and Monthly Inspection Forms

Reference No: 80285

Inspections - Pogo Checklist

PGO - ENV - RTP Dam & Dry Stack Weekly Inspection - PGO - ENV - RTP Dam & Dry Stack Weekly Inspection

Prompt	Yes	No	N/A	Explanation	Comments
Seepage Collection Wells	☐	☐	☐	Are all pumps running in Auto Mode? Do the well motor speeds and water levels indicate that the wells are working properly?	
RTP Dam	☐	☐	☐	Are dam faces free of vegetation, erosion, collapse, subsidence? Is downstream dam free of seepage? Is dam crest free of subsidence and damage to facilities? Are reservoir walls free of erosion and collapse?	
Spillway Inlet (Concrete) and Outfall (Flume)	☐	☐	☐	Is spillway inlet (concrete) free of cracks and properly connected to flume (culvert)? Is spillway outfall (flume) free of damage, obstacles and erosion on the ground?	
Drystack	☐	☐	☐	is the dry stack free of unusual cracks and signs of settlement? is the dry stack free of bulging and seepage? Is the dry stack free of erosion, rills, and gullies? Are 2% slopes being maintained?	
Diversion Ditches - North, South (Upper), South (Lower) – to be completed monthly	☐	☐	☐	Are Diversion ditch flumes free of obstacles and damage? Are diversion ditches free of erosion, sediment accumulation, aufeis, obstacles, and damage?	

Reference No: 80557

Inspections - Pogo Checklist

PGO - ENV - Liese Creek Flume Weekly Inspection - (Bimonthly) - PGO - ENV - Liese Creek Flume Weekly Inspection - (Bimonthly)

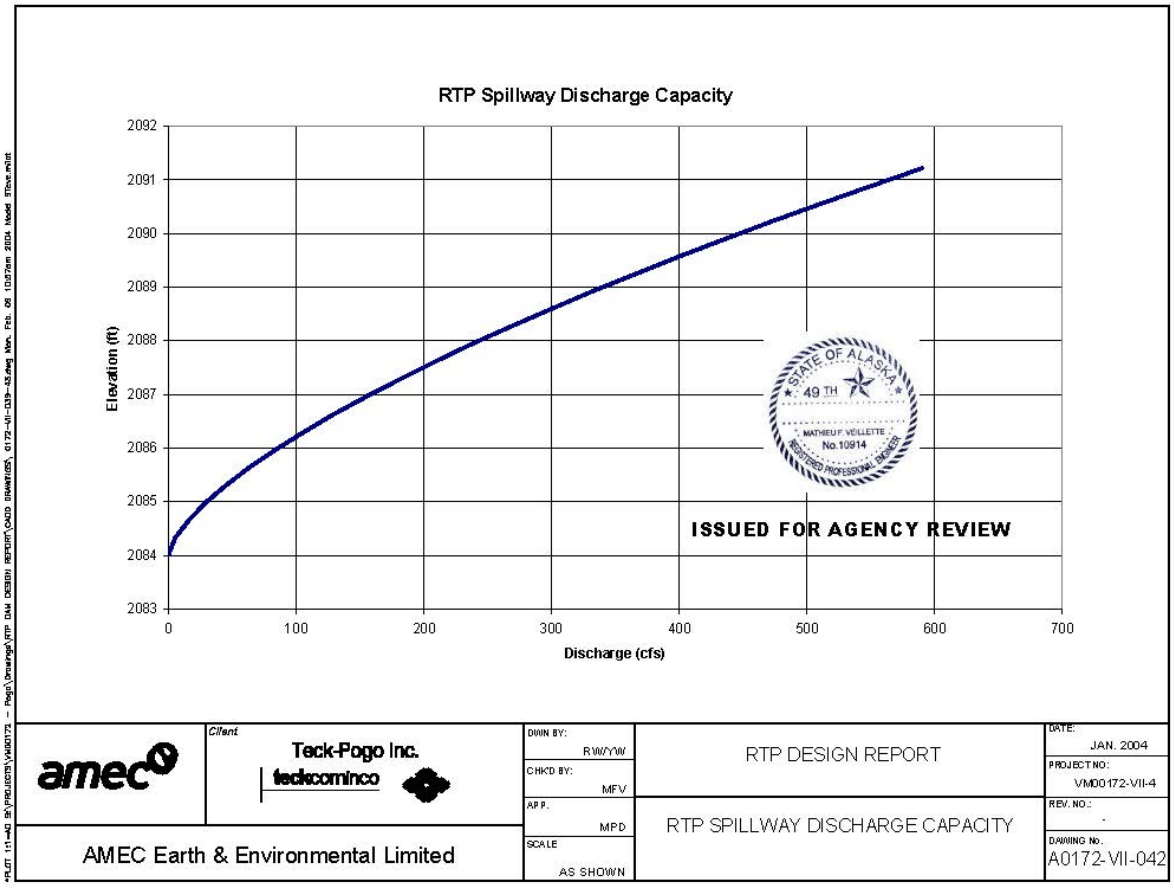
Prompt	Yes	No	N/A	Explanation	Comments
Flume #1 Dry stack Toe	☐	☐	☐	Has debris / sediment been cleared from the flume? Is the flume free of erosion and settling? Has the stilling well been flushed? Download / calibrate data logger. Inspect desiccant for data logger, replace if pink. Note the manual weir reading in the comments.	
Flume #2 below Seepage Collection Wells	☐	☐	☐	Has debris / sediment been cleared from the flume? Is the flume free of erosion and settling? Has the stilling well been flushed? Download / calibrate data logger. Inspect desiccant for data logger, replace if pink. Note the manual weir reading in the comments.	
Flume #3 North Diversion Ditch Return	☐	☐	☐	Has debris / sediment been cleared from the flume? Is the flume free of erosion and settling? Has the stilling well been flushed? Download / calibrate data logger. Inspect desiccant for data logger, replace if pink. Note the manual weir reading in the comments.	
Flume #4 Liese Creek Bridge	☐	☐	☐	Has debris / sediment been cleared from the flume? Is the flume free of erosion and settling? Has the stilling well been flushed? Download / calibrate data logger. Inspect desiccant for data logger, replace if pink. Note the manual weir reading in the comments.	

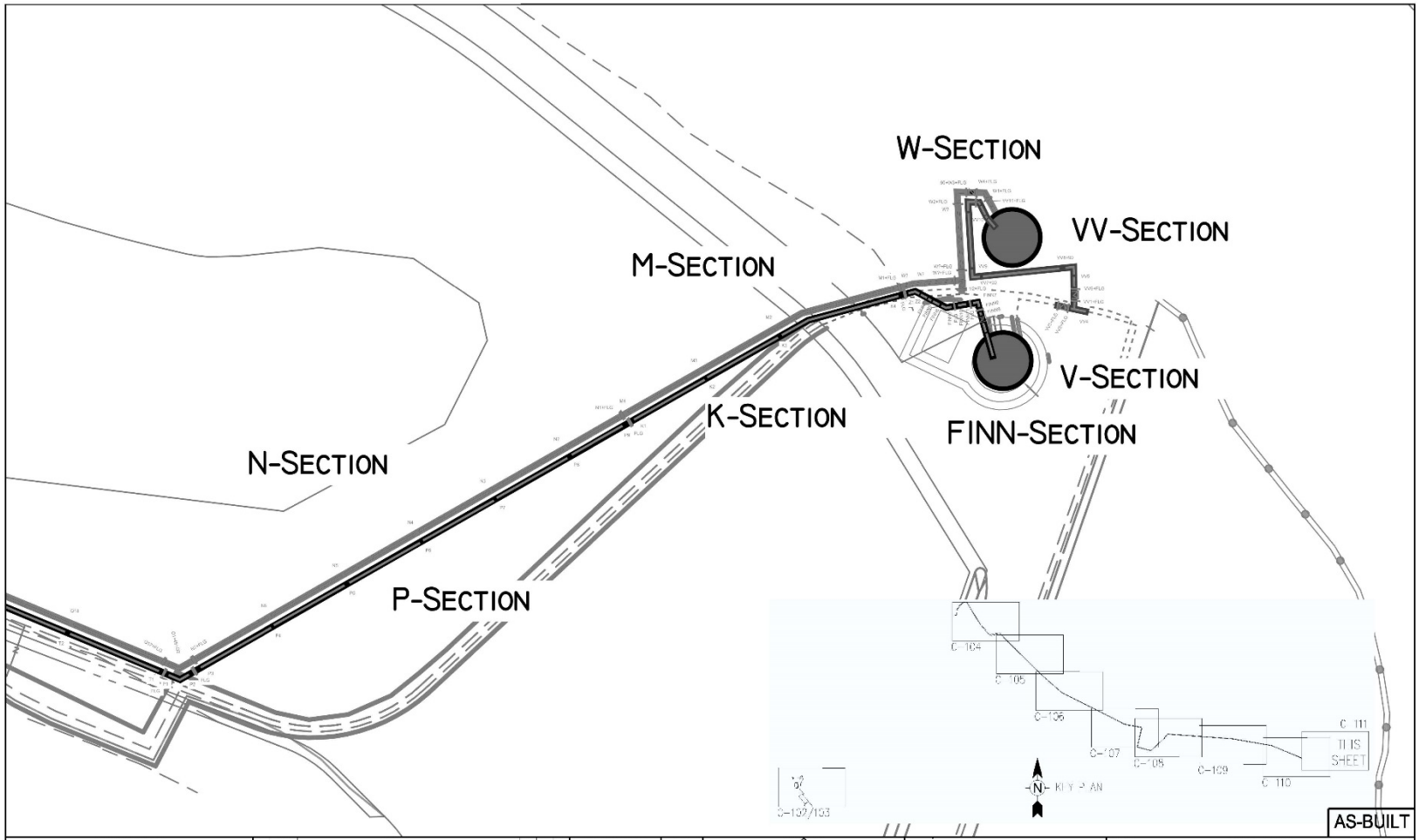
Appendix C

Drawings:

A0172-VII-042: RTP Spillway Discharge Capacity

Pogo Mine Water Treatment Plant #3 Exterior Pipeline – 1875 Portal to RTP Tanks (Sheet C-111)


RTP Spillway Discharge Capacity
Elevation (ft)
2092
2091
2090
2089
2088
2087
2086
2085
2084
2083
0
100
200
300
400
500
600
700
Discharge (cfs)
STATE OF ALASKA
49 TH
MATHIEU F. VEILLETTE
No.10914
REGISTERED PROFESSIONAL ENGINEER
ISSUED FOR AGENCY REVIEW
amec
Client
Teck-Pogo Inc.
teckcominco
AMEC Earth & Environmental Limited
DWN BY: RW/YW
CHK'D BY: MFV
APP. MPD
SCALE AS SHOWN
RTP DESIGN REPORT
RTP SPILLWAY DISCHARGE CAPACITY
DATE: JAN. 2004
PROJECT NO: VM00172-VII-4
REV. NO.: -
DRAWING No. A0172-VII-042



REFERENCE DRAWINGS	NO.	DATE	REVISION	BY	CHK	APP'D
	00	10-3-13	1875 PORTAL TO RTP TANKS (A)	MC		

CONNECTING RECORD	DATE
UPS	
DSVR	
CWS	
ATP	
ATP	
SCALE: 1/8" = 1'-0"	

M2C1
CONSTRUCTION & INVESTING
P.O. Box 1702
Delta Junction, Alaska 99737
Tel:907-895-5143
Fax:907-895-5143

POGO MINE
MINING DONE RIGHT

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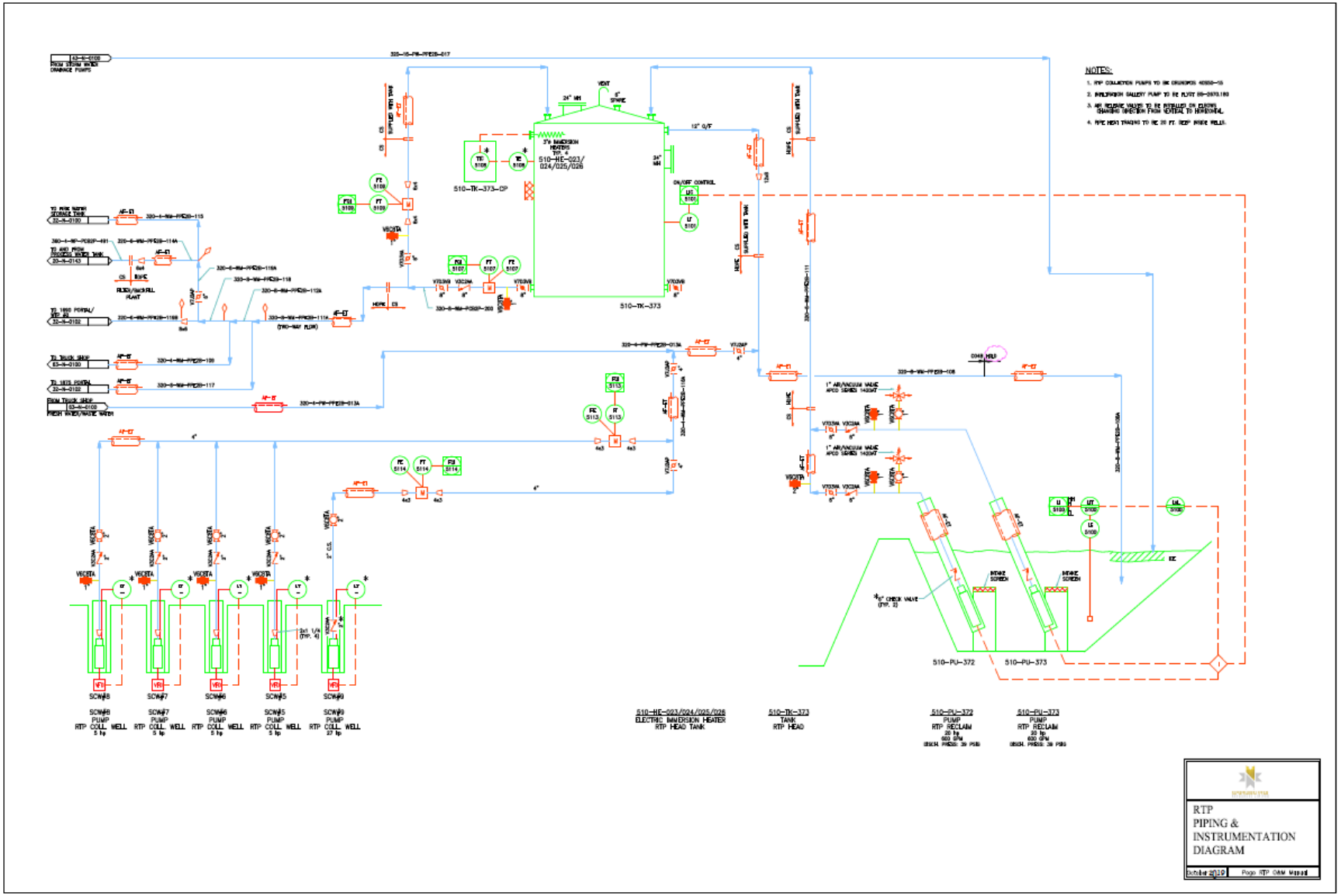
TITLE OF DRAWING:
POGO MINE
MINE WATER TREATMENT PLANT #3
EXTERIOR PIPELINE 1875 PORTAL TO RTP TANKS
DELTA JUNCTION, ALASKA

WORK ORDER	DRAWING NUMBER	REV	SHEET
410	EXTERIOR PIPELINE	0	C-111
AREA: –			DF: –


NOTES:
510-TK-373
510-HE-023/024/025/026
ELECTRIC IMMERSION HEATER
RTP HEAD TANK
510-TK-373
TANK
RTP HEAD
510-PU-372
PUMP
RTP RECLAIM
510-PU-373
PUMP
RTP RECLAIM
RTP
PIPING &
INSTRUMENTATION
DIAGRAM
October 2019
Pogo RTP O&M Manual