Pogo Plan of Operations

Submitted to:

Alaska Department of Environmental Conservation
Division of Water
610 University Avenue,
Fairbanks, Alaska 99709

Alaska Department of Natural Resources
Division of Mining, Land, and Water
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Prepared by:

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1.0 APPLICANT INFORMATION

1.1 Claim names

The Pogo Mine property consists of 1,281 state mining claims covering an area approximately 41,880 acres. The Pogo claim block lies in Sections 13, 14, 22-27, and 34-36 within T5S, R14E, Sections 18, 19, and 29-34 within T5S, R15E, Sections 1-3, 10-15, and 36 within T6S, R14E, and Sections 3-11, 14-23, and 29-32 within T6S, R15E, Fairbanks Meridian. The claim names, claim types, and claim owners for claims associated directly with Pogo Mine are listed in **Appendix A**.

1.2 Individual Completing Application

As the Reclamation Plan is incorporated into the Plan of Operations, the signature below fulfills the requirement of Alaska Administrative Code 11 AAC 97.310(a).

Chris Kennedy, General Manager, Pogo Mine

12-2-11
Date

1.3 Business Address

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1.5 Corporate Information

Sumitomo Metal Mining Co., Ltd.

Tokyo, Japan

Sumitomo Corporation

Tokyo, Japan

2.0 SITE ACCESS

2.1 Location

Sumitomo Metal Mining Pogo LLC (Pogo) is the operator of the Pogo gold mine, located 38 miles northeast of Delta Junction, Alaska (see **Figure 1.1**). This Plan of Operations (POO) outlines Pogo Mine activities through June 2010 and reflects site experience gained since operations began in 2005. Where appropriate, it builds upon the documents used for project permitting, including the 2002 Water Management Plan and Appendices, the 2003 Plan of Operations, and the 2003 Reclamation and Closure Plan. Where appropriate and where new information is available, this plan of operations supersedes any prior documents.

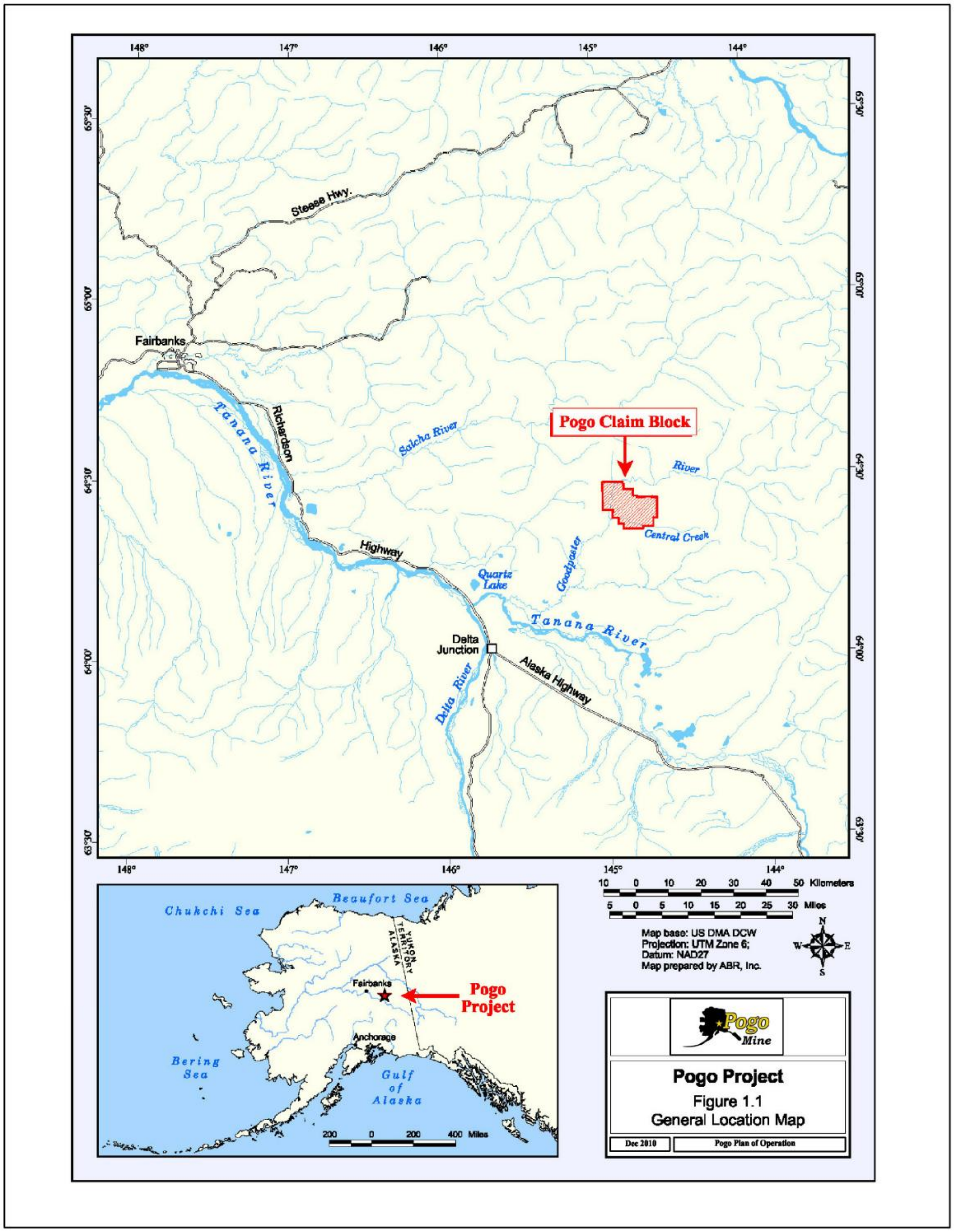
2.2 Access to Site

A 49 mile long, all-season road constructed along the Shaw Creek hillside route provides safe, reliable access to the Pogo property. Access is gained from the end of Shaw Creek Road, two miles from the Richardson Highway. The road crosses over the Trans-Alaska Pipeline System (TAPS), 2.5 miles from the Shaw Creek Road. There are four single-span bridges over creeks along the route, and one four span bridge crossing the Goodpaster River. All bridges are single lane with a maximum axle load rating of 60 tons and a posted maximum speed of 10 miles per hour (mph). The road and power transmission line routes are shown in **Figure 4.1**.

The access road is a controlled access industrial road. A security gate near the departure point at the end of Shaw Creek Road provides access control. A large sign stating the road is “private” and therefore closed to unauthorized traffic is posted at the security gate and at the TAPS crossing.

The design speed limit for the all-season road is 35 to 45 mph. The highest elevation along the road is 3,300 feet above mean sea level (ft amsl); the lowest 970 ft amsl. Roadside berms and guardrails are installed where appropriate. Radio contact is maintained between all vehicles and mine security.

Figure 1.1: General Location Map



All drivers undergo a road safety briefing prior to driving on the Pogo access road, and regular bus drivers are trained in first aid, emergency response. Buses carry emergency response equipment. Properly trained and qualified emergency response personnel will respond to accidents and medical emergencies on the access road. An environmental response team will respond to help, coordinate and cleanup spills as necessary.

Employees are transported onto the mine site by bus or appropriate company vehicles.

Summer and fall road maintenance includes grading and repairing of potholes, ruts and washboards, replacing damaged markers and signs, and maintaining drainage and sediment control structures. Winter and spring maintenance includes snow removal, road scarifying for improved traction, and drainage maintenance. Emergency maintenance is provided as necessary. Dust is minimized by enforcing low traffic speeds and using water or suppressing agents as needed.

Additional details on construction, operation, and reclamation of the access road is contained in the right-of-way application.

2.3 Mine Security

The mine security plan includes a combination of measures such as security personnel, closed-circuit television surveillance, security lighting, and fencing to ensure personnel and product security.

Security is provided at the main entrance gate from 6 am to 8 pm each day; all traffic on the road is monitored from the gate. Mine site security personnel monitor the remote security gate and road transport after hours (8 pm to 6 am) each day.

3.0 OPERATING PLAN / FACILITY DESCRIPTION

3.1 Facility Activity

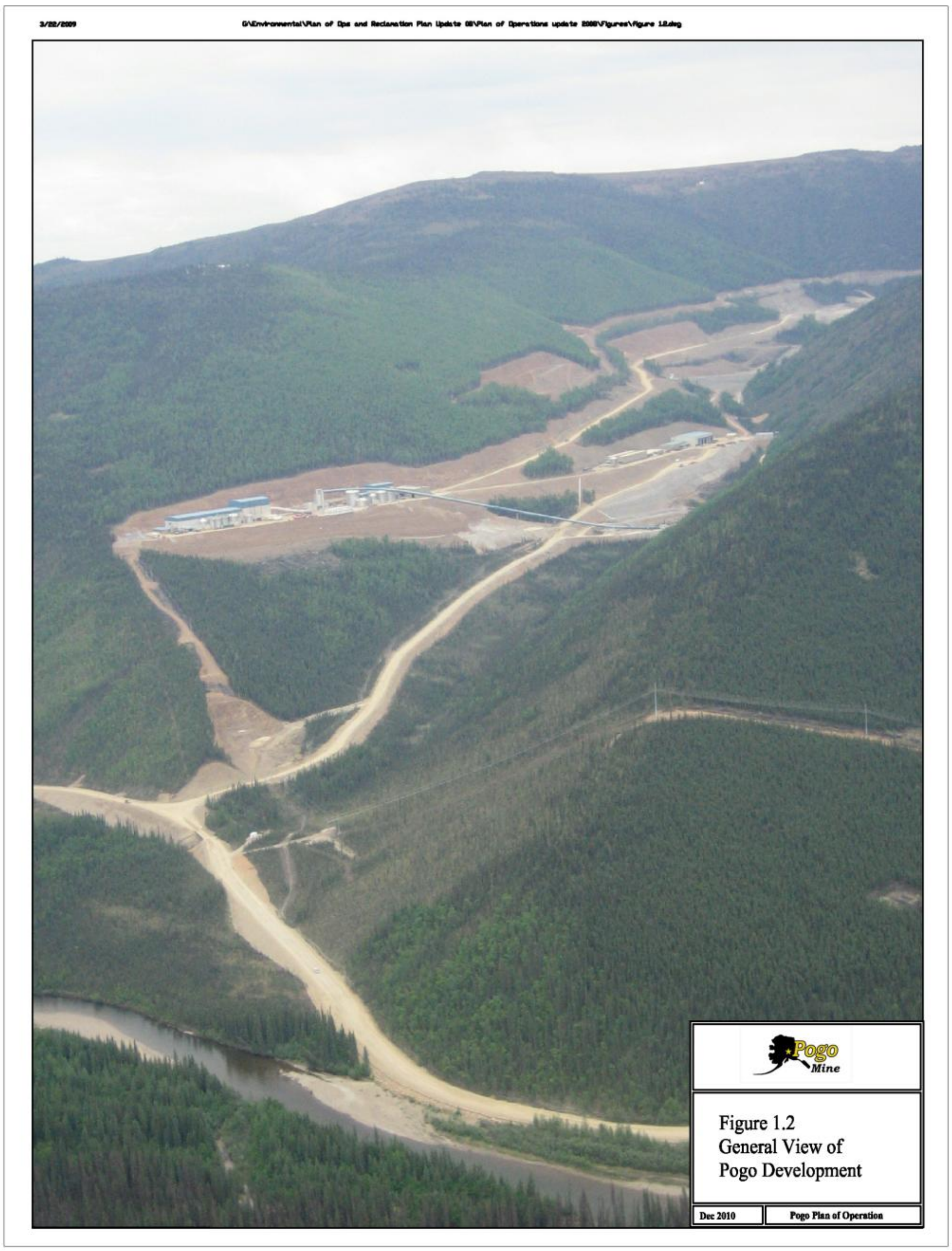
Pogo Mine is an underground mine that feeds gold ore to the mill at a rate of approximately 3,000 tons per day (tpd) and is permitted to feed gold ore at a rate of up to 3,500 tpd. The property produces between 380,000 to 400,000 ounces of gold annually.

The mine consists of the following major elements:

- Underground cut-and-fill mining with conveyor access for transfer of ore to the surface;
- Surface gold mill for gold recovery through gravity concentration, flotation and cyanide leaching;
- Tailings preparation facilities, including cyanide detoxification and filtration, to produce paste backfill for the underground mine workings and dewatered tailings material suitable for placement in a drystack facility on the surface;
- Drystack tailings facility (DSTF) to disposed the dewatered tailings materials and waste rocks and the recycle tailings pond (RTP) to collect the seepage and runoff water from the drystack tailing facility;
- 250 person upper camp and 126 person lower camp with recreation and catering facilities for each;
- Transmission line along the Shaw Creek Hillside route, and on-site electrical distribution system;
- 49 mile all-season road constructed along the Shaw Creek Hillside route; and
- A water management system that maximizes recycling and treats all waters affected by the project in accordance with applicable federal and state legislation.

An aerial photo of the mine is provided on **Figure 1.2**, As-built drawings are **Figures 1.3 – 1.3d** in **Appendix B** for the project facilities.

Figure 1.2: General View of Pogo Development



3.2 General Operating Criteria

Some general operating criteria for the mine are outlined below.

Milling Rate

- Average operating production .... 3,000 tpd
- Average eventual production.. 3,500 tpd

Mining Rate (Ore)... same as milling rate

Current projected mine life @ 3,000 tpd... 7 years

Development rock to surface for remaining 7 years of mine life.......... 2.6 million tons

Employees and contractors required to operate facility

- @ 2,500 tpd..297
- @ 3,500 tpd..360

Energy requirements for mine operation

- @ 2,500 tpd...10 mega watts (MW)
- @ 3,500 tpd...14 MW

3.3 Environmental Management

3.3.1 Environmental, Health and Safety Policy

Pogo Gold Mine is located northwest of Delta Junction, Alaska. The Mine is operated by Sumitomo Metal Mining Co., Ltd. and is a Joint Venture between Sumitomo Metal Mining Co., Ltd. and Sumitomo Corporation.

Pogo Mine recognizes Environment, Health and Safety management as a core competency and value and is committed to protecting employees, contractors and visitors from safety and health hazards and minimizing environmental impact arising from the Operation. The full commitment and active participation of all employees, contractors and visitors is required in achieving this goal.

To meet this commitment, Pogo Mine will:

1. Strive to achieve a goal of zero workplace injuries;
2. Meet or exceed all Environment, Health and Safety regulations, laws, permits and voluntary commitments to which Pogo has subscribed;
3. Identify hazards and mitigate risk through proactive elimination or control;

4. Reduce waste and pollution through prevention or control measures;
5. Train employees in safe work procedures and standards and highlight the personal commitment and responsibility of each employee to work safely and prevent injury to themselves and others and to safeguard the assets of Pogo;
6. Train employees on environmental policies and guidelines and emphasize the responsibility of each employee to act as good stewards and to safeguard the environment;
7. Ensure that all contractors, suppliers, visitors and other third parties understand and adhere to the Pogo Mine Environment, Health and Safety policy, standards, procedures and guidelines;
8. Ensure transparency by effectively communicating to all stakeholders our performance on the Environment, Health, Safety and Operational aspects of our Business; and
9. Strive to continually improve our management and performance in the Environment, Health and Safety areas.

Measurement of our performance in Environment, Health and Safety will be tracked against established goals and key performance indicators; these goals will be reviewed on a regular basis to promote continuous improvement.

4.0 ANCILLARY FACILITIES

4.1 Power Supply & Backup

Power is supplied to the mine via a 50 mile long, 13.8 kilo volt (kV), three phase transmission line constructed along the Shaw Creek Hillside access route (see **Figure 4.1** in **Appendix B**). The transmission line is constructed of wooden H-poles with horizontal conductors. The Pogo transmission line is connected to Golden Valley Electric Association‟s, Alaska (GVEA‟s) Fairbanks to Delta Junction transmission line at a substation on the west end of the project near the trans-Alaska pipeline north of Shaw Creek. The terminus substation is located adjacent to the mill building in the Liese Creek Valley.

At the end of mine life, the transmission line will be removed and the right-of-way reclaimed. Additional details on the power line construction, operation and reclamation are contained in the right-of-way application that is part of this project documentation series.

Site backup power is supplied by two 1,000 and one 2000 kilo watt (kW) generators at the mill, paste backfill plant and upper/lower camps. This is sufficient to power key motors, pumps, water treatment, and lighting both underground and on surface on an emergency basis.

4.2 Maintenance/Warehouse Complex/Administration

4.2.1 Maintenance Facility

The maintenance area contains three maintenance bays, a welding bay and wash bay. Major repairs and rebuilds are performed at this facility. Firewall protection between adjoining walls of the complex has been installed. The maintenance facility also has tool storage areas and offices for administrative groups.

4.2.2 Warehouse

A warehouse facility with heated storage inside and cold storage outside is adjoined to the maintenance facility with firewalls between. The warehouse includes offices for the warehouse supervisor, inventory buyer and inventory control and provides delivery access and unloading points for vendor supplies. Two smaller warehouses located in the lower camp, as well as a number of lower yard locations are utilized for the storage of warehouse inventory items.

4.2.3 Administration Building

The main administration building is a two-story, clad, modular structure containing the following:

- Offices and cubicles for senior staff, administrative, supervisory and technical personnel;
- Reception area;
- Conference rooms;
- Lunch and training room;
- Print and photocopy room;
- Washrooms;
- Clean and dirty locker and shower facilities;
- Communications room; and
- Miscellaneous storage areas.

4.3 Communications System

The two major components of the Pogo communications system are a microwave-based telephone system and a local radio repeater system. These are described below. Also, in case of a loss of the microwave based communication system, the site utilizes satellite telephones in such emergency situations.

4.3.1 Microwave Telephone System

The microwave telephone system combines secure voice, fax, Internet and computer networking into a single network infrastructure that accesses telephone and Internet gateways.

4.3.2 Radio System

A radio repeater system enables omni-directional, two-way communication within an approximate 15 mile radius. The repeater works in conjunction with preprogrammed

5 watts (W), handheld radios. The repeater consists of a 25 W radio powered by a bank of lead-acid batteries, recharged by a self-regulating solar panel and a wind generator. The repeater utilizes duplex frequencies licensed to Pogo for their exclusive use. The repeater is connected to a bi-directional antenna that is directed toward Delta Junction and Pogo camp.

4.4 Potable Water Supply

Water is collected from two 8-inch diameter wells, at depths of 61.5 and 53.3 feet below ground surface (ft bgs). They are located near the Goodpaster River and are in direct influence of surface waters. Two potable water plants (PWSID#) 2372643 and 2372658 treat and distribute the water respectively to the lower and upper camps. The water is ozonated, filtered, disinfected with chlorine, and a corrosion inhibitor, orthophosphate, added prior to distribution.

The potable system for upper camp was designed for a maximum of 25,000 gallons per day (gpd) (at max 28 gallons per minute (gpm)) and the lower camp was designed for a maximum of 7,500 gpd (at max of 20 gpm). Both potable water systems are operated within the limitations described in Pogo Mine Potable Water System Permits PWSID 372643 and PWSID 372685.

4.5 Firewater

The firewater system utilizes an 180,000 gallons surge tank that is sourced from the drinking water wells.

4.6 Upper Camp Facility

The upper employee camp is located in the Liese Creek Valley. The camp is a pre-engineered modular structure capable of housing approximately 250 people. The camp, shown on **Figure 1.3c** in **Appendix B**, includes the following:

- Single status housing units;
- Washroom and shower facilities;
- Kitchen facilities;
- Dining area;
- Recreation area;
- Entertainment area; and

- Laundry facilities.

The lower camp is used for contractors and the exploration group. A new lower camp was commissioned in January 2010 as shown in **Figure 1.3a** in **Appendix B**, in order to provide a suitable accommodation for the mining contractors. The remaining single "B wing" from the construction camp is utilized for year round contractor accommodations until camp closure when it will be demobilized. The location of the "new" lower camp is on previously disturbed ground and was raised approximately 4 feet to the 100 year flood elevation. The old exploration camp has been demolished. These facilities include the following:

- Double or single housing units;
- Washroom and shower facilities;
- Kitchen facilities;
- Dining area;
- Recreation area;
- Entertainment area; and
- Laundry facilities.

4.7 Sewage Treatment

An Alaska Department of Environmental Conservation (ADEC)-approved 72,000 gpd sewage treatment plant is located near the 1525 portal as shown on **Figure 1.3a** in **Appendix B**. This treatment plant services both the upper and lower camps.

The sewage treatment plant is connected to the lower camp and upper camp with heat traced gravity flow lines to lift stations. The sewage plant uses ultra violet (UV) effluent disinfection for final treatment. The treated effluent is discharged to the Goodpaster River at an average rate of 23 gpm (Outfall 002). The effluent limits are provided in Pogo Mine Alaska Pollutant Discharge Elimination System (APDES) Permit No. AK0053341.

4.8 Site Roads

Site roads are shown on **Figures 1.3 to 1.3d** in **Appendix B**.

4.9 Airstrip

A 3,000 ft long x 75 ft wide gravel airstrip was built to support construction operations when winter road access is not available. The airstrip is maintained for the life of the operations and is available until Phase IV Water treatment and post-closure reclamation (refer to **Figure 1.3b** in **Appendix B**).

4.10 Meteorological Stations

New Meteorological (Met) Stations will be located on Pogo Ridge (refer to **Figure 1.3e in Appendix B**) and Pogo Airstrip (refer to **Figure 1.3f in Appendix B**). Their purpose is to collect data to support air quality and hydrologic modeling. Each station will have a ten meter guyed tower with a two foot by two foot concrete base pad. The Datalogger™ system will be placed in a weather proof enclosure at the base of each tower. Each station will measure the following parameters:

(2) Wind Speed (m/s) (at 10-meters);

(2) Wind Direction (degrees) (at 10-meters);

(2) Sigma Theta (degrees);

(2) Air Temperature and vertical temperature difference (degree C) (at 2 meters and 10 meters elevation);

(2) Solar Radiation (W/m2); and

(1) Heated Precipitation gauge with wind shield (inches).

Each of the monitoring stations will be powered by electrical service with a backup battery and solar power system. The airstrip site is readily accessible by vehicle; however, the ridge site is accessible by helicopter or ATV only.

5.0 GEOLOGY & MINING

5.1 Geology & Ore Resources

The gold resource within the Pogo Upland Mining Lease includes sub-parallel quartz veins hosted in a sequence of amphibolite-grade, paragneiss and orthogneiss of probable Proterozoic to mid-Paleozoic age. Mid-Cretaceous, granitic, plutons and dykes intrude the gneisses, which in turn are generally cut by the veins. A post-vein, diorite pluton has been age dated at 94 million years before present (Ma) age, constraining the minimum age of the deposit.

The gneissic rock sequence is interpreted as part of the Lake George sub terrene of the Yukon-Tanana terrene, which extends from Fairbanks into the Yukon Territory. Typical lithologies include intercalated biotite-quartz-feldspar gneiss, hornblende-rich gneiss, chlorite-sillimanite gneiss, calc-silicate gneiss, quartz-rich gneiss, and granitic orthogneiss. Well developed and regionally extensive foliation and folding within the gneiss largely pre-dates the ore vein structures.

The granitoid intrusive rocks are considered the source of the gold-bearing fluids that contributed to the gold endowment at Pogo. In particular, the Goodpaster batholith to the north of the deposit is thought to be the general source of the dikes and gold veins observed in the mine. Similar granitoids have a causative relationship to a number of “plutonic-related” gold deposits in the region, including the Fort Knox deposit near Fairbanks (McCoy et al., 1997). Intrusive rocks within the mine area include granite, quartz monzonite, quartz diorite, diorite and basalt. Most intrusive rocks are likely of Late Cretaceous age as suggested by samples that yield a range of ages from 107 Ma to 92 Ma, using U-Pb and Ar40/Ar39 age-dating techniques. Some of the dikes appear to utilize the same structures as the ore veins.

Several fault sets, exhibiting a range of orientations, are documented within the mine area. Drill data and underground exposures reveal widespread faults with steep northeast to east orientations. The Liese Creek and Graphite faults are two northwest striking faults present in the mine area which have significant contributions to overall inflows of water from surface. Low angle faults, though not well expressed on the surface, are also well documented underground, particularly where they bound Liese-type quartz veins. The Liese-type veins are low-angle sub-parallel veins currently comprising the majority of the Geologic Resource.

Mine Reserves, as of end-of-year 2009, lay entirely within three of these „Liese" veins: L1, L2, and L3 (see **Figure 5.1**). As of year-end 2009, Proven and Probable Reserves stood at 6 million metric tonnes of 14.7 grams per ton (g/t) material for 2.8 million ounces. The Geologic Resource, outside the Reserve, stood at 4.5 million metric tonnes of 11.42 g/t material for 1.66 million ounces, including 2.9 million metric tonnes of Inferred Resource at a grade of 8.72 g/t.

Fluid inclusions from the Liese veins indicate un-mixing of a dense, carbonic, moderately saline fluid, with most gold deposition occurring at temperatures of 250 to 380 degrees Celsius (C) when the carbonic phase boiled. Methane is occasionally observed in the fluid, indicating fairly reduced conditions, and hence bisulfide complexing of the gold. Isochores for the fluids indicate depositional pressures of approximately 2 kilo bars (kbar), or 7 km lithostatic.

As mineralizing fluids boiled sulfide complexes destabilized, causing Au, Bi, As, and Te to come out of solution. These elements are correlated in sampling, with the best correlation being between Au and Bi at 0.89. Visual inspection of drill core from the L1 and L2 veins indicates that arsenopyrite, pyrite, pyrrhotite, loellingite, chalcopyrite, bismuthinite, native bismuth, and native gold are present in most vein intercepts. Galena, sphalerite, molybdenite, and tetradymite have also been noted but they are not common. Maldonite and a variety of Bi-Pb-Ag tellurides have been noted in polished sections. Native gold accounts for 95.5% of the total gold with 2.1% as maldonite, and 2.4% in solid solution with loellingite, arsenopyrite, and pyrite. Sulfides generally average less than 3% for a given Liese vein intercept.

5.2 Mine Plan

5.2.1 Mine Access

Three portals are used to provide safe and efficient access to the Pogo ore body, as listed below. The number used to refer to each portal represents their elevation above sea level in feet.

- 1525 portal that was constructed during the advanced exploration phase;
- 1875 portal in the Liese Creek Valley; and
- 1690 portal in the Liese Creek Valley.

The 1525 portal is used primarily for intake ventilation and is also used for access for mining contractors. The 1875 portal is the primary access for workers, supplies, equipment and provides intake ventilation. The 1690 portal is used primarily for conveyor access to the mine and for exhaust ventilation.

5.2.2 Development

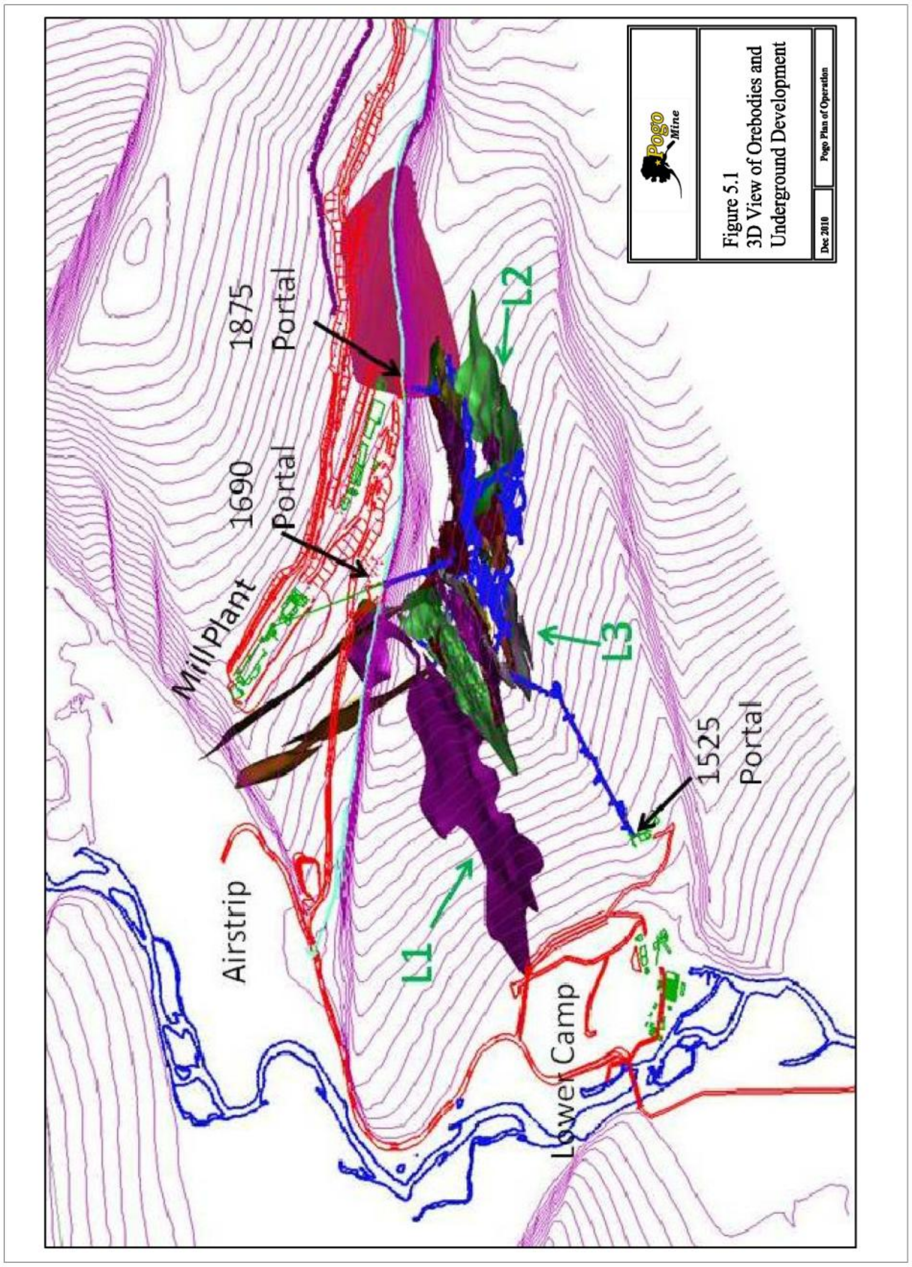
Underground development consists primarily of lateral and ramp development, with some raise development for ventilation and emergency egress.

The ore body is accessed via a series of ramps and stope access drifts. Ramps have nominal dimensions of 19 ft wide x 16 ft high. They are driven at a 15% grade with flattened segments at stope access intersections, resulting in an average grade of 13.5%. The ramps are located a minimum of 50 ft from the footwall of the ore body.

Stope access drifts are developed from the haulage ramps at vertical intervals of 50 ft and driven perpendicular to both the ramp and the strike of the stope it accesses. Stopes are mined in both directions from the stope access drift intersection to the lateral extents of the ore zone. The access drifts are designed near the center of the stope‟s strike length to maintain two active faces for the majority of the stope‟s life.

Figure 5.1 shows a 3D rendering of the expected development.

Figure 5.1: 3D View of Orebodies and Underground Development



5.2.3 Mining Method

Cut-and-fill mining is the primary mining method used at Pogo. This method is selective and yields a high overall ore recovery at a low dilution factor, as mining conforms to the shape of the deposit. All production drilling is conducted by rubber tired drill jumbos. After the stopes are mined, paste backfill is used to fill all mining voids. A simplified cross-section of cut-and-fill mining is shown in **Figure 5.2**. Mining equipment includes two-boom electric hydraulic jumbos, LHD units, rockbolters, service vehicles and explosive loading trucks. Mechanized rockbolters are used to support the ground in stopes greater than 15 ft x 15 ft, smaller stopes are supported with hand held jackleg drills.

To maximize ore recovery along the contacts and to minimize ore loss, breasting, slashing and benching is carried out in the stopes as a final cleanup of remaining ore prior to backfilling.

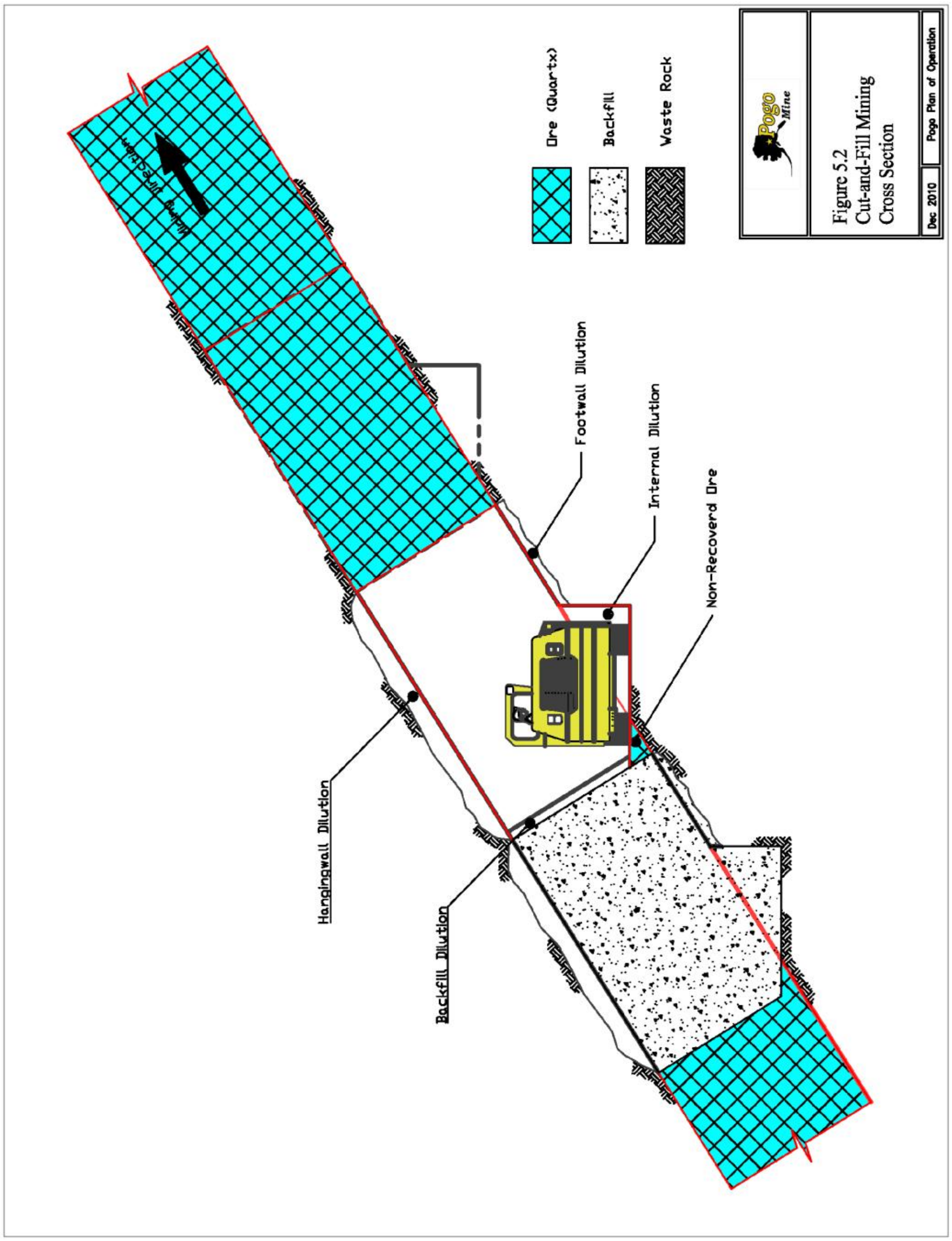
5.2.4 Ore Haulage

Ore is hauled from the stopes to the underground ore storage bin using 9 yd^3 LHD units and 50 ton haul trucks. The ore bin is fitted with a grizzly and a hydraulic rock breaker to reduce oversize material. Ore from the bin is fed onto a conveyor with a pan feeder and transported to the surface coarse ore bin for feed into the mill.

5.2.5 Development Rock Haulage

Development rock is trucked to the surface via the 1525 and 1875 portals and placed according to the rock segregation plan described in **Section 5.4**.

Figure 5.2: Cut-and-Fill Mining Cross Section



5.3 Temporary Ore Storage

As a normal part of mining, ore is produced at different rates in comparison to the steady operations of the mill. Mining operations store excess ore underground when possible. When this is not possible, the excess ore is stored at a temporary surface stockpile beneath the supply conveyor to the mill just above the 1690 portal. Ore from this temporary stockpile is hauled to the mill when the conveyor requires maintenance or back underground to provide steady mill feed. This temporary stockpile has a high turnover rate to reduce the oxidation potential.

5.4 Development Rock Segregation & Storage

Development rock is mined, brought to surface, segregated by individual blasted rounds, and held for assay (see **Table 2.1** for quantities). When the assays are complete, the material is classified as "mineralized" or "non-mineralized" based on the standard operating procedure for rock segregation that is summarized below.

To classify the rock, drill cuttings from blast holes that comprise each development blast are sampled and assayed on site. If the material is above either 0.5% sulfur or 600 milligrams per kilogram (mg/kg) arsenic, the blasted rock is classified as "mineralized." If the assay does not exceed these thresholds, the material is classified as "non-mineralized."

The mineralized development rock is stored at the temporary development rock placement area near the portals until it can be trucked to the dry stack facility and encapsulated in the tailings.

Optimization of the mine plan and layouts resulted in modifications to development rock quantities, with the current forecast shown in **Table 5.1**.

Table 5.1: Development Rock Quantities (tons)

	2010	2011	2012	2013	2014	2015	2016	2017	Total
Mineralized Rock to Underground	5,000	5,000	5,000	5,000	5,000	5,000	5,000	2,500	37,500
Mineralized Rock to Surface	146,522	143,634	142,022	79,557	55,232	42,242	44,638	8,467	662,314
Non-mineralized Rock to Surface	321,985	315,847	312,423	179,683	127,992	100,389	105,482	23,305	1,487,106
Total Development Rock	473,507	464,481	459,445	264,240	188,224	147,631	155,120	34,272	2,186,920

Non-mineralized development rock is used as bulk fill on roads and pads, for construction of the toe berm of the drystack, and as riprap.

5.5 Backfill Distribution

The underground mining method requires that mined-out areas be backfilled with material to help provide ground support while the adjacent ore panel is mined. Mill tailings mixed with cement (paste backfill) provide part of the necessary support. **Figure 5.3** depicts the backfill cycle.

The paste is made in the paste backfill plant, located on the surface near the mill. At the backfill plant, on an average approximately six to eight percent cement is added to the mixture to give it strength after curing. From the plant, the paste is pumped via a steel pipeline to the mine. A typical designed paste unconfined compressive strength is 30 pounds per square inch (psi) after 2 weeks.

To prepare the stopes for fill, all services are removed, including the air and water pipelines and electrical cable. High density polyethylene pipe (HDPE) and breather lines are installed in the highest areas of the stope and extended to the back end of the stope, where filling begins. The HDPE pipe is left in the stope as part of the fill process.

Shotcrete paste barricades are constructed near the access area to contain the cemented paste fill in the stope. During pouring, the paste builds up and pushes out towards the barricade, completely filling the mined void. As the stope fills, small explosive charges are blasted with detonating cord to break the pipe (at couplers) and retreat the active pipe outlet back to the barricade.

5.6 Mine Equipment

5.6.1 Mobile Equipment

All stopes with a vertical height greater than 10 ft are developed using two-boom electric hydraulic jumbo drills. Single-boom electric hydraulic jumbos are used in narrower stopes. Rockbolters are used for installing ground support Two sizes of Loaders (LHD) units are currently used: 9 cubic yards (yd^3) and 4 yd^3. The 9 yd^3 LHDs are used to muck ore from stopes with a vertical height greater than 15 ft to the remuck, ore bin and to load trucks. The 4 yd^3 LHDs are used in narrower stopes with a vertical height of 10 ft.

Fifty-ton diesel haulage trucks are used to haul ore to the grizzly and development rock to surface.

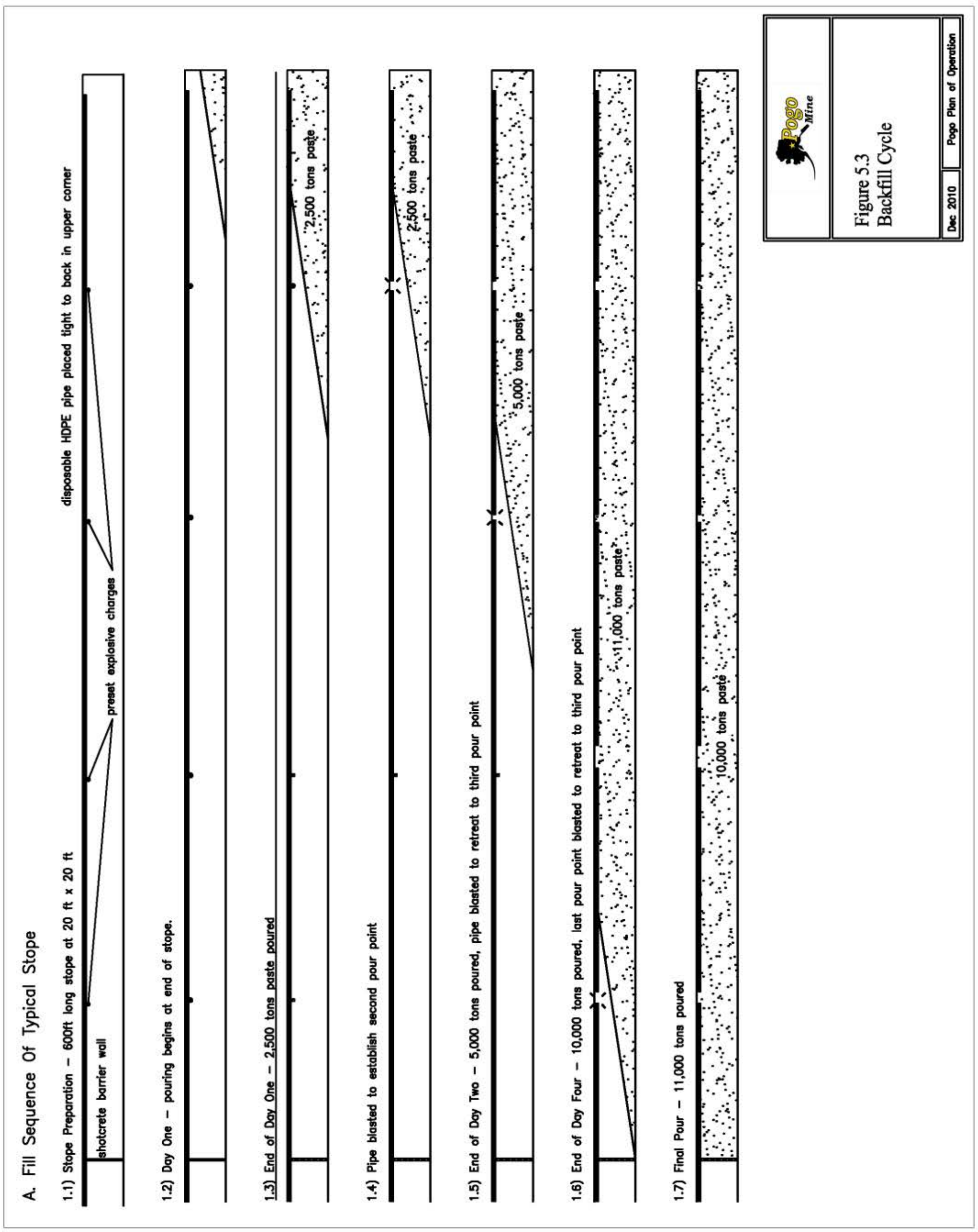
Bulk pumpable emulsion is the primary explosive used. Two service units with man baskets are used to load emulsion in drill holes. Packaged emulsion explosives are used in small stopes where the pump units cannot access or as a backup if a unit is down for repair.

Two scissor deck units and two flat bed units are used for installing mine services and to transport supplies.

Mine supervisors and mechanics operate pick-up trucks for underground transportation. Miners are transported into the mine with tractors.

A grader is provided for road maintenance and a bulldozer for stope clean up.

Figure 5.3: Backfill Cycle



5.6.2 Fixed Equipment

Major pieces of underground fixed equipment used include the following:

- Main and auxiliary fans;
- Propane mine air heaters and storage tanks;
- Ventilation doors and regulators;
- Main and auxiliary pumps;
- Air compressors;
- Portable refuge stations;
- Grizzly;
- Hydraulic rock breaker;
- Conveyor belt feeder;
- Conveyor belt; and
- Equipment for furnishing the underground preventative maintenance facility, refuge stations, latrines, storage areas, and explosive and cap magazines.

5.7 Mine Facilities

5.7.1 Ventilation

Due to the ventilation requirements of the underground diesel equipment, equipment service bays, and other miscellaneous demands, the Pogo mine requires a total airflow of 500 kilo cubic feet per minute (kcfm).

Two fresh air intakes are used: the 1525 portal and the 1875 portal. Each portal is equipped with two propane burner‟s to heat the cold air in winter to prevent temperatures from dropping below freezing inside the mine.

Exhaust air exits the mine from the 1690 portal. To ensure proper airflow, two 350 horse power (hp) fans are installed in bulkheads along the 1690 conveyor / exhaust drift. Ventilation doors, auxiliary fans, ventilation tubing, and regulators are installed as the mine is developed to direct appropriate air quantities to the various work areas.

5.7.2 Conveyor

A 42-inch wide x 2,500-ft long conveyor, approximately 1,200 ft of which is located underground in the 1690 conveyor ramp, conveys ore to the mill. The surface portion of the conveyor transports the ore to a 1000 ton (live capacity) storage bin located adjacent to the mill.

The conveyor's drive head pulley is in an enclosure at the top of the 1,000 ton storage bin, while the conveyor's vertical gravity take-up is located in the mine. The conveyor is suspended from chains for its entire underground length to facilitate cleanup.

The conveyor is anchored at intervals along one side of the drift wall. Vehicle access is provided along the length of the conveyor drift. Above ground, the conveyor is elevated and housed in a prefabricated tubular gallery that also carries mine services.

A self-cleaning magnet is located near the ore bin apron feeder and is designed to remove any ferrous metal that may harm the conveyor or downstream process equipment. A second conveyor transfers ore from the storage bin to the mill.

5.7.3 Underground Equipment Maintenance

Mine equipment maintenance is performed both underground and at surface. A preventative underground service bay has been developed in the center of the mine for minor repairs. All major equipment repairs are performed in the surface shop.

5.7.4 Electrical Distribution System

Electrical power is delivered to the mine from the surface substation at 13.8 kV. The 13.8 kV power cable is fed into the mine through the 1525 and 1690 portals. Distribution centers are located throughout the mine to convert the power to 480 volt (V) for mine equipment and auxiliary ventilation.

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5.7.5 Underground Communications

The mine is served by a leaky feeder system that enables communication via portable hand-held radios. Base radios have been installed in most of the mining equipment. Hand held radios are also available. Base radios are installed at each underground electrical transformer location.

A fixed telephone system is installed in the mine as a backup system, with telephones located at each refuge station and electrical transformer.

The mine is equipped with a stench gas emergency warning system, which can be initiated at the 1525 portal and the 1875 portal.

5.7.6 Compressed Air

Compressed air for drilling, pumps and the maintenance shops is supplied by an electric air compressor installed at the 1525 Portal. Compressed air is distributed to the primary development drives through 4-inch diameter pipes and to the stopes through 2-inch pipes. When the stoping lift is complete, compressed air lines installed in the stope access drifts and stoping areas are recovered and re-used for subsequent stope lifts.

5.7.7 Service Water

Mine service water is distributed throughout the mine in 4-inch pipelines suspended in the upper corner of the ramps. The pipelines are reduced to a 2-inch diameter in the stope accesses and stopes. When a stoping lift is completed, water lines installed in the stope accesses and stoping areas are recovered and reused in subsequent stope lifts.

A mine service water recycling system was installed near the 1230 mine sumps underground in January 2009. It filters the sump water to reuse as mine service water.

5.7.8 Refuge Stations

Mine Safety and Health Administration (MSHA) requires that refuge chambers be provided in areas from which mine personnel may not be able to escape during an emergency. Currently four portable refuge chambers are located in mining blocks. This will eventually increase to five as mining progresses. Refuge chambers are equipped as per MSHA and 30 Code of Federal Regulations (CFR). First aid equipment and other necessities are provided.

5.7.9 Emergency Egress

Personnel typically exit the mine through the 1875 portal. In an emergency, the 1525 portal and 1690 portal may also be used, and in some ventilation raises, manway ladders are installed.

5.7.10 Fueling

From surface storage at the mine shop, fuel is delivered to the mining equipment by a mobile fuel truck.

5.7.11 Diamond Drilling

Diamond drilling is used to define the orebody and assist in access development placement, reserve estimation and short and long-range planning.

6.0 MILLING

6.1 Milling Facilities

The mill facilities are located in the Liese Creek Valley, parallel to a portion of the site access road. The general layout of the plant site facilities, including the mill and backfill plant, is shown in **Figure 6.2** in **Appendix B**. **Figure 1.2** shows a photo of the site facilities. The mill facilities consist of two main buildings: one houses the grinding, gravity, flotation, cyanide leach and carbon in pulp (CIP) processes and the other building contains the tailings dewatering and paste backfill processes.

Gold is recovered from the mined ore using a milling method consisting of: 1. Grinding the ore to a fine particle size to liberate the gold contained in the ore; 2. Recovering a portion of the gold using gravity methods; 3. Floating the remaining gold and sulfide minerals using froth flotation; and 4. Recovering the gold from the flotation concentrate using cyanide leach (see **Figure 6.1** in **Appendix B** for Process Flow Diagram). The cyanide process is isolated from any contact with the environment. The cyanide slurry is detoxified, and the residual cyanide contacted material contained underground in the paste backfill.

Operation of the Pogo mill proved that the ore is amenable to gravity recovery and approximately one third of the gold may be recovered in this manner. The use of gravity recovery and flotation allows for the downsizing of cyanide leach, cyanide detoxification, and carbon recovery. Reducing the size of the cyanide leach circuit in turn reduces the amount of cyanide required for ore processing.

The gravity process recovers less than 1% by weight of the mill feed with up to 40% of the recovered gold. The gravity circuit concentrate is leached in an intensive cyanide leach circuit to extract the gold from the concentrate. After leaching the residue is then combined with the flotation concentrate material at the starting point of the conventional cyanide leach circuit.

The flotation process recovers the gold not collected in the gravity circuit into a sulfide rich concentrate representing about 10% by weight of the mill feed. This concentrate is leached in a conventional cyanide leach circuit to extract the gold from the concentrate.

All of the cyanide leach circuits are designed to prevent contact between slurry and the external environment. Following leaching, the cyanide slurry is detoxified and placed underground as paste backfill to fill the void created during mining.

The Pogo mill produces two types of tailings:

Tailings from the flotation circuit. Approximately 90% of the total tailings mass consist of finely ground sand and traces of sulfide mineralization. Half the tailings are filtered and trucked to the surface drystack tailings placement facility. Filtered tailings are reduced to 15% moisture or less prior to placement. The filtrate water is recycled back into the mill process. The rest of the tailings are combined with the detoxified cyanide leach tailings and placed in the mine (see **Figure 5.3**).

Tailings from the cyanide leach circuit. Tailings from the cyanide leach circuit comprise the remaining 10% of the total tailings mass. All are used to make paste backfill after going through the cyanide detoxification circuit, ensuring that most of the sulfide minerals contained in the ore are returned to their original location.

In summary, the Pogo process flow sheet accomplishes the following critical objectives:

- Minimizes the amount of sulfide and arsenic mineralization in the surface drystack tailings facility;
- Ensures that cyanide contacts the minimum amount of ore possible and that all material that has come into contact with cyanide is isolated underground as cemented paste backfill; and
- Ensures that all cyanide-bearing solutions are treated to detoxify cyanide to the lowest practical level.

The milling unit operations are described in **Sections 6.1.1 to 6.1.6** below.

6.1.1 Grinding

Ore is conveyed from the surface storage bin to a grinding circuit consisting of a Semi-Autogenous Grinding (SAG) mill and a ball mill. The ore is mixed with recycled water and ground by the tumbling action of steel balls to produce a target particle size of 80% less than 65 microns (µm), at a slurry density of 35% solids by weight.

6.1.2 Gravity Circuit

All of the ground slurry is directed to a trash screen and then to a centrifugal gravity concentrator that separates the particles according to differences in specific gravity and recovers any “free” gold. Approximately 15-40% of the gold is currently being recovered in this fashion.

Concentrates from the gravity circuit are leached in an Intensive Leach Reactor (ILR), and the residue is reground in a dedicated regrind mill to isolate the cyanide solutions. The reground residue is then pumped as slurry to the head of the conventional cyanide leach circuit. Gold bearing solution from the ILR is pumped to the gold electrowinning circuit located in the refinery.

6.1.3 Flotation & Concentrate Regrind

After grinding and gravity concentration, the slurry reports to the flotation circuit. In this circuit, finely ground minerals are recovered according to mineral type and surface chemistry to a froth phase; this is created by frother and collector reagents in agitated and aerated tanks. The flotation concentrate amounts to approximately 10% by weight of the initial ore fed to the mill. This flotation concentrate is reground to a powder like consistency (target 80% passing 15 μm) to liberate fine gold from the sulfide minerals.

6.1.4 Cyanide Leach & Carbon-in-Pulp (CIP)

Before entering the leach circuit, the reground concentrate is pre-aerated with oxygen. Cyanide is then introduced to dissolve the gold in the flotation concentrate material. The leached slurry is then directed to CIP tanks, where the dissolved gold is adsorbed onto activated carbon granules suspended in the pulp.

The leach and CIP circuits have two thickeners that permit cyanide solution from the CIP tailings to be recycled to the beginning of the leaching circuit. Pre-aeration and solution recycling minimizes the requirement for cyanide in the process.

6.1.5 Carbon Stripping, Electrowinning, Refining

The gold-loaded carbon from the CIP circuit is periodically stripped of its gold in a carbon elution pressure vessel. Loaded solution passes through electrowinning cells and the gold is collected as sludge in the bottom of the cells as well as plated onto stainless steel wool cathodes. The gold is then removed from the cathodes by pressure washing and melted to produce gold dore. The stripped carbon is reactivated by acid washing, followed by thermal regeneration in a horizontal kiln, and recycled back to the CIP circuit.

6.1.6 Cyanide Detoxification

Residual cyanide in the CIP tailings from the cyanide leach circuit undergoes detoxification by means of a Sulfur Dioxide / air cyanide detoxification process. The Sulfur Dioxide / air process uses a mixture of sodium metabisulfite solution and air sparged in agitated tanks to oxidize the cyanide. Lime is added to maintain a slurry pH of 8.0 to 9.5, and copper sulfate is added as a catalyst. Following this process, the CIP tailings are used to make paste backfill for the mine.

ADEC Waste Disposal Permit limits the Weak Acid Dissociable (WAD) Cyanide in the CIP tailings to be used for paste backfilling as follows: “At least 90% of the samples shall contain less 10 mg/kg of WAD cyanide and none of samples shall contain more than 20 mg/kg of WAD cyanide.”

7.0 POGO MINE WASTE MANAGEMENT

The Pogo mine produces a variety of wastes the majority being tailings and mine rock with lesser amounts of general construction debris and other solid waste. About 40% of tailings will be placed underground as paste backfill. The remaining tailings are dewatered by pressure filtration and placed in a surface tailings facility or “drystack” in Liese Basin. So far, about 4.4 million tons of tailings and waste rocks have been placed to the drystack tailings facility, which has an estimated maximum height of 200 feet and contain approximately 7.4 million tons of capacity. The drystack facility has been designed to allow future expansion and is permitted to a capacity of 20 million tons in the Waste Disposal Permit.

7.1 Paste Backfill

As described in **Section 3.1**, the Pogo mine produces two tailings products: flotation tailings and cyanide leach tailings. CIP tailings represent approximately 10% of the total volume of milled waste material, contain most of the sulfides, and are the only waste material that had contact with cyanide.

After detoxification of the cyanide leach tailings, the cyanide leach tailings are mixed together with some of the flotation tailings and cement producing “paste backfill” and placed in the mined-out stope areas underground for ground support. Placement of all the cyanide leach tailings in the paste ensures safe and permanent disposal underground. In 2008, Pogo sampled the paste backfill mixtures and confirmed that the NP/AP (neutralization potential/acid potential) ratio of all samples was greater than the 1.4 target value proposed during project design (SRK 2008, Sobek Acid base Accounting).

In the event there are no stopes ready for backfill, cyanide leach tailings can be temporarily stored in a tank at the mill, allowing for milling operations to continue between paste pours. Once the temporary storage is full, the mill will shut down.

7.2 Surface Tailings Treatment Facility

The surface tailings treatment facility has two separate components, the drystack and the RTP. These components are described below.

7.2.1 Drystack Tailings Facility

The drystack has been in operation since February 2006. The drystack has two distinct zones: the "shell" area, which provides structural stability for the facility; and the "general placement area," which is used for general tailings placement and mineralized rock placement and which is not required to contribute strength. The shell is comprised of non-mineralized development rock and compacted tailings. As of September 2010, about 4,395,000 tons of material has been placed at Drystack Tailings Facility, which includes 2,678,000 tons of drystack tailings, 606,000 tons of mineralized rock, and 1,111,000 tons of non-mineralized rock. The capacity of the current facility is estimated to be about 7.4 million tons, and it is expected that the current facility will fill by the end of 2013, based on the as-built survey conducted in September 2010 and the life of mine plan (see **Figures 7.1 a-h covering years 2010-2017**). The preliminary study to expand the capacity up to 20 million tons has been conducted, and the route of new diversion ditch determined. Following the detailed engineering study, the new diversion ditch needs to be constructed. The detailed design including the slope stability evaluation of the expanded drystack tailings facility will be submitted to the relevant agencies and the required permit amendments obtained prior to the construction of new diversion ditch. Currently Pogo is prohibited from placing tailings over the diversion ditches as is illustrated in **Figures 7.1d through 7.1h**. The Pogo DSTF Construction and Maintenance Plan is provided in **Appendix F**.

<u>Shell Area</u>

The first shell (rock fill shell) was constructed using non-mineralized rock only to a width of 100 feet. Non-mineralized rock is placed in three ft lifts on the design 3:1 (horizontal: vertical) slope to construct a shell for the tailings general placement. The second shell (composite shell 1), which has been constructed since 2009, is constructed using non-mineralized rock and drystack tailings. Non-mineralized rock is placed at the face slope in three feet lifts on the 3:1 slope to a width of 20 feet, then the drystack tailings is placed in one foot lifts and compacted. The width of the second shell is about 150 feet. The construction of the third shell (composite shell 2) will commence in 2011 using same method as the second shell.

Prior to the shell construction, the toe berm was extended downstream. Approximately one foot of organics and soil was cleared and grubbed from the drystack footprint area and stockpiled for future use as growth media. A 1.5 ft thick layer of non-mineralized rock was placed as an erosion control / drainage blanket over the entire drystack footprint after grubbing is completed. A haul road along the north side of the drystack is used to access the stack. Various access points to the benches are created from the main haul road as the facility rises.

General Placement Area

Tailings and mineralized development rock is co-disposed year-round in the general placement area. The rock is encapsulated in the tailings to minimize the oxidation of any sulfide minerals present. Rock is not placed in the general placement area until there is a two foot minimum of compacted flotation tailings covering the area. The rock is placed in nine foot maximum lifts before another two feet of tailings cover is placed over the rock. The mineralized rock may not be placed within 50 feet from the perimeter of DSTF.

The same compaction procedures used in creating the structural shell are used in the general placement area, despite its lower requirement for structural strength. This effort aids trafficability and other operational considerations.

Snow and ice is taken into consideration during construction of the general placement area. Since the performance of the drystack does not depend on quality compaction in the general placement area, tailings and mineralized rock may be mixed with small amounts of snow and ice prior to placement; however, all reasonable attempts are made to minimize the amount that becomes buried in the stack.

Access to the general placement area is via a haul road between the plant site and drystack. As construction of the drystack continues, this haul road is progressively buried. No re-routing of this haul road is required.

Compaction Requirements

The tailings are placed and compacted in accordance with the Pogo DSTF Construction and Maintenance Plan (**Appendix F**).

Sedimentation Control

Drystack erosion translates into a sediment load in the RTP, thus specific sedimentation control measures are used to keep erosion to a minimum. These control measures have proven effective as very little tailings have reached the RTP. To achieve these results at Pogo, the following measures described below are taken.

Drystack Geometry. The use of two percent slopes to limit erosion on the tailings. The slope face of the shells is covered with non-mineralized rock to minimize the erosion of drystack tailings at the slope face.

Drystack Compaction. Both the shell area and general placement area are compacted, but the shell area is the most erosion resistant.

Equipment Operations. The drystack shells are developed as a combination of terraces to prevent equipment from causing erosion.

Managing Runoff. Silt fences are used for erosion control as necessary.

Dust Control

Tailings have the potential to create dust, especially when they have been frozen or desiccated by the sun. The drystack area in the Liese Basin is not overly exposed to sun, and wind velocities are lower than on adjacent ridges. Observations from snowpack distributions in the basin show that drifting in the lower basin is not a concern.

Best management practices are used to control dust during drystack operations such as; compacting the tailings, controlling traffic on the drystack, and limiting the use of equipment to active placement area(s) only. Summer moisture from rainfall assists in keeping the surface moisture content within an acceptable range although prolonged periods of warm weather with low humidity may require building silt fences around non-active placement areas. In winter, silt fences are required if the shell is exposed. During this time, natural or artificial snow coverings provide cover for the shell area.

Surface Water Management

Flow-through Drains

All runoff in and around the tailings drystack facility is directed to the RTP by means of a network of ditches and drains. Flow-through drains are constructed in the existing stream valleys within the drystack area to augment the existing drainage courses and allow them to pass runoff under the stack.

At present, flows in these channels are above the water table (by approximately 10 ft in most cases) due to accumulated organic detritus in the bottom of the channel. The drainage courses have been prepared appropriately to remove this blinding layer. With this blinding layer removed and the diversion ditch in place, it is unlikely there would ever be any appreciable water near surface in the existing drainage courses.

Nonetheless, for additional security following mine closure, the flow-through drains are designed to carry a significant capacity of water compared to previously measured flows in Liese Creek.

The rockfill used in the flow-through drains is between 12-inch and 36-inch in size, and covered with a filter material to prevent fines migrating in from the drystack tailings. The rockfill is placed at about 1H:1V, resulting in a drain base width of 21 ft, crest width of 9 ft and height of 6 ft. The corresponding flow capacity of such a drain is approximately equivalent to a 1:10,000-year/24-hour storm event with no allowance for freeboard and without the benefits of the diversion ditch.

Perimeter of Drystack Tailings Facility

The non-mineralized waste rock is placed at the perimeter of drystack tailings facility to allow any runoff from precipitation that bypasses the major diversion ditch above the site is lead to the flow-through drains. All flows or seepage from the drystack passes to the RTP and treated as necessary.

Monitoring

Bi-annual survey records of the drystack, truck loads, and tonnage data are recorded. Visual inspections are recorded. Annual as-built surveys are scheduled for September for the annual site as-built drawing.

Geotechnical monitoring is conducted at the shell area in order to confirm if the drystack is compacted as designed. This monitoring includes geotechnical testing such as Standard Proctor Test, particle size distribution and Atterberg Limits, and in-situ density and moisture content using Troxler nuclear gauge.

Contingency

Tailings handling and placement procedures are designed to accommodate equipment breakdowns and unforeseen weather events. Equipment is sized so that duty hours are low and/or backups are included. Underground mine equipment can also provide backup for loading and hauling.

Drystack Tailings Facility Construction and Maintenance Plan

The Drystack Tailings Facility Construction and Maintenance Plan will be updated and submitted to the agencies for review. It will become part of the Plan of Operation by reference and will be included as **Appendix F**. It will consider the current construction design, appropriate QA/QC procedure based on the revised slope stability analysis, and the updated life of mine plan.

7.2.2 RTP Facility

The RTP is designed to collect seepage from the drystack so that it can be treated before discharge. The RTP also collects all runoff from the drystack tailings facility and provides adequate retention time for settling of solids as well as providing surge storage capacity so that the drystack tailings runoff can be treated before discharge.

The RTP dam has a maximum storage capacity of approximately 43.6 million gallons (Mgal) and was permitted for a crest elevation of 2092 ft amsl. The dam is a membrane lined rockfill embankment with a hydraulic height of 67 feet. The dam crest is 35 feet wide and extends over a distance of 550 feet. The sharp crested weir located in the spillway inlet is at elevation 2084 ft amsl. The spillway has a maximum discharge capacity of 440 cubic feet per second (cfs). The spillway intake structure is constructed from reinforced concrete and discharges into a channel lined with a corrugated steel pipe. This 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. A grout curtain located beneath the upstream toe of the dam was installed to limit seepage through the foundation bedrock while the use of a composite liner on the upstream face of the dam was installed to limit seepage through the dam embankment. During normal dam operations, water is pumped from the reservoir via two HDPE pipes emptying into a head tank. The RTP is operated in accordance with the Pogo RTP Operating and Maintenance Manual (**Appendix G**).

Seepage collection wells (SCW) are installed 150 ft downstream of the toe to capture seepage and return it to the RTP pond. Five wells are currently functional, and consist of four deep wells (60 – 70 feet in depth) and one shallow well (13 feet in depth). Seepage collected by SCWs is returned to RTP Head Tank via HDPE pipeline. SCW 1-4 (never functional) were properly plugged and abandoned in 2011.

Three water monitoring wells (MW) are installed about 330 feet downstream of the seepage collection wells below the RTP dam.

For more information on the RTP facility or water management in general, see **Section 8**.

7.3 Other Wastes

Besides tailings and mine rock, other types of non-hazardous materials are generated at Pogo and require storage or disposal. As per Pogo‟s Waste Disposal Permit 0131-BA002, these non-hazardous materials may be placed in the drystack or underground.

- Settled solids from sumps, ditches, and degritting basins;
- Settle solids from the water treatment plant;
- Dewatered water treatment plant sludge, including the sludge generated during the advanced exploration phase; dewatered sewage sludge meeting the requirements of Section 1.2.2.6 of Pogo‟s Waste Disposal Permit 0131-BA002;
- Incinerator ash and residue;
- Ash from combustion of scrap wood material;
- Iron (drill steel, balls, empty case, etc);
- Used ventilation tubing and used filter press cloth;
- Empty plastic and glass containers; inert domestic waste;
- Construction debris;
- Tires;
- Spill cleanup debris approved by ADEC;
- Non-terne plated used oil filters that have been gravity hot-drained; and
- And such material as would otherwise be disposed of in a surface landfill without special handling.

An incinerator near the lower camp is used to incinerate all kitchen wastes, dewatered sewage sludge, and other cardboard, paper, and burnable wastes from the project.

A burn pit, near the gravel ponds in lower camp, is used to dispose of clean wood and cardboard composed mainly of large debris from shipping containers and packaging. A burn permit is obtained on a yearly basis from Alaska Department of Natural Resources (ADNR).

These materials may NOT be disposed into the surface landfill, the surface tailings drystack facility or the underground facility, unless otherwise provided or approved in writing by ADEC:

- Other than interstitial waters entrained in the tailings or past backfill tailings, treated or untreated process water in quantities or concentrations that would exceed water quality standards in 18 Alaska Administrative Code (AAC) 70;
- Chemical containers (unless triple rinsed) and discarded or unused chemicals;
- Un-combusted household waste;
- Laboratory wastes other than wash waters, neutralized acids and neutralized bases;
- Sewage solids that are untreated and/or have less than 10% solids by weight;
- Asbestos waste;
- Hazardous wastes, as defined by 40 CFR, Part 261, including radioactive material, explosives, strong acids and untreated pathogenic waste. This prohibition does not preclude disposal of residual wastes included as byproducts of the beneficiation process due to recycling f refinery slag, fire assay crucibles and cupels;
- Fuels, oil, transformers, paint, equipment and packing material;
- Glycol and solvents;
- Batteries; and
- CIP tailings except when subjected to cyanide destruction as required by section 1.2.3 of Pogo‟s Waste Disposal Permit 0131-BA002 and disposed underground as part of the paste backfill tailings.

These materials are taken off site for disposal.

- Screen material containing wood chips and carbon from the CIP and rougher concentrate screens (containing low levels of cyanide and gold) are shipped to a smelter;
- SAG mill liners may be recycled to the fabrication plant;
- Acid containers when feasible are shipped to the producer for re-use;
- Cyanide shipping containers comprised of wood are burned onsite with the burnable waste;

- All cyanide shipping containers comprised of bags are tripled rinsed and taken with the non-burnable trash off-site to a landfill;
- Used ball mill grease is delivered to an off-site incinerator;
- Wash bay sludge is delivered to an approved off site incinerator; and
- Used rags and absorbs containing petroleum are shipped off-site for incineration or they are incinerated on-site.

7.4 Waste Rock Storage

There are two temporary storage piles for waste rock storage. One is outside of the 1875 portal and the other outside of the 1525 portal. The underground trucks bring the waste rock to the surface. The surface haul trucks move the mineralized rock to the drystack general placement area. Non-mineralized rock is hauled to the various areas where it is used.

8.0 WATER MANAGEMENT

8.1 Overview

The purpose of the Pogo water management plan is to provide a framework for the collection and treatment of water to achieve the following objectives:

- Ensure the reliability of water supply for all process and potable needs;
- Protect the operations from flooding, erosion, interference from groundwater, precipitation and runoff; and
- Control and treat water that comes into contact with project facilities in an environmentally sound manner before discharge.

For additional background, see the Pogo "Water Management Plan" (February 2002 and June 2002).

In 2008, the Pogo Mine experienced 15 inches of summer precipitation, amounting to the seventh wettest year in the 50 year record for the Big Delta dataset. This amount of rain presented some challenges to operations due to increased groundwater inflows into the mine and significant surface runoff into the RTP. These challenges were met pro-actively by accepting the production curtailments necessary to store up to 12 million gallons of water in the mine until it could be treated and discharged. This short term approach reinforced the importance of the overall water management strategy to Pogo‟s long-term success, and in late 2008 prompted an internal re-investigation of the assumptions and design criteria associated with the water management plan.

The major elements of this investigation included:

1. A review by AMEC of the precipitation events as compared to the model used during permitting, (see AMEC 2008, Pogo Precipitation Review);
2. A review by an external consultant to update the mine inflow forecast with or without the contingent options of grouting and diversion of the Liese Creek surface flows, (see Brown 2009, Pogo Mine Inflow Evaluation and Control Review);
3. A review of the mine water treatment and discharge system for potential flow capacity upgrades or optimizations (EM Associates 2009, Water Treatment Plant Upgrades – Phase II); and

4. An internal review of the mine services water supply.

In summary, although the precipitation was intense, it was within the envelope of the original 19 inches annual average model. The 2008 mine inflows of up to 180 gpm were within the forecast range, but future inflows are now expected to increase as the mine expands and deepens. These inflows continue to be mitigated as necessary by grouting as contemplated in the contingency plans during permitting. Upgrades to the underground recycle system included a new filter and pumping system installed underground. This system is recycling mine services (collected groundwater) water, which reduces the amount of RTP surface water introduced into the mine and thus the amount of water that must be treated and discharged.

The overall water management strategy and various water streams, inflows and outflows relevant to the Pogo Mine are summarized below.

8.2 Overall Water Collection, Treatment & Discharge Strategy

The major components of the overall water collection, treatment, and discharge strategy for the project are shown in **Figure 8.1** in **Appendix B**. Water treatment plant #1 (WTP #1) is located underground inside the 1525 portal. Water treatment plant #2 (WTP #2) is located outside of the 1525 portal.

WTP #1 discharges to the final tank at WTP #2 where the water can then be returned to the mill or discharge to the off-river treatment works (ORTW). In case of an emergency, treated water can be pumped from the WTP#2 to the RTP for storage. Pogo is capable of continuously monitoring the treated effluent for pH, turbidity, and conductivity. Plant performance is monitored using these parameters, allowing for the automatic shutoff of any discharge during process problems.

8.3 Process Water

The Pogo process plant is designed to maximize the recycling of water (see **Figure 8.2** in **Appendix B**). The only water released from the process is to the tailings as part of the cemented backfill or as residual moisture in the surface drystack. Additional water necessary to make paste slurry is either RTP water or non-cyanide contacted raw water in the mill.

The total process water requirement is 147 gpm at 2,500 tpd. Make up water from external sources is used to replace the water entrained in the tailings material. In order of priority, mine drainage water, RTP water and fresh water is used to satisfy this requirement.

8.4 Mine Water

Mine water inflows are highly variable depending on the geology and hydrogeology of active stopes and ramps in the mine. Underground water management is an important component of the operation of the Pogo mine.

Based on 5 years of experience gained from existing underground mine workings and the detailed hydrogeological investigations completed to date, the expected inflows to the mine have been reasonably estimated (Brown 2009) and are summarized in **Table 8.1**.

Table 8.1: Expected Mine Inflows

Water Management Strategy	Average Inflow	
	2009	2015
Uncontrolled inflow	240 gpm	499 gpm
Grout Liese Fault	178 gpm	286 gpm
Grout Liese and Graphite Faults	138 gpm	170 gpm

Using a combination of mine planning to schedule work near the water bearing faults and grouting mine inflows are maintained within the original design envelope.

Pogo began grouting in 2009, and it significantly contributes to controlling the underground seepage. Curtain grouting is applied to grout the water bearing faults such as Liese Creek ahead of advancing drifts. When water inflow is found in the drift, 60 feet long grout holes are drilled using a jumbo at the perimeter of drift, and then fine ground cement mixed with water is pumped into the holes at high pressure using a grout pump through mechanical packers set at the collar of grout holes. A couple of check holes are drilled after 24-hr curing time. Secondary grouting may be conducted if water inflow still exists. After completing the grouting procedure, the drift is advanced by 40 feet and is grouted again. If the water inflow can‟t be controlled by grouting, this stope may be paste backfilled.

A Tracer Test conducted in 2010 doesn‟t show any evidence of a connection between Liese Creek surface water and underground mine.

A Mine Water Recycling System was introduced in 2010 in conjunction with the construction of new 1230 Mine Sumps. This system filters sump water using sand filters and reduces the amount of RTP water sent to underground by as much as 150 gpm. It also reduces the pump up requirements of underground water from mine sumps to the mine water treatment plants.

8.5 Surface Water & Runoff

All surface water and runoff from the plant site and tailing drystack area is collected in the RTP immediately downstream of the tailing drystack facility. As shown on **Figures 8.4 and 8.5** in **Appendix B**, a system of monitoring wells is installed downstream of the RTP to monitor the performance of the RTP seepage collection system.

To minimize the amount of precipitation and runoff that comes into contact with project facilities and then drains to the RTP, a diversion ditch was constructed along both sides of the Liese Creek basin uphill of the tailings drystack facility. This ditch is operated and maintained throughout the life of the mine and during decommissioning.

The storm water is controlled in accordance with the Storm Water Pollution Prevention Plan (SWPPP) and Best Management Practices (BMPs) Plan. The stormwater sump collects runoff from the haul roads, the plant site, and the campsite. The mill site and campsite pads are sloped toward the high-wall, with drainage directed to the stormwater sump. The mill site and campsite pads were constructed with impervious soil in order to reduce potential infiltration of stormwater and to help direct any spills to the sump. The stormwater pumping system has a large pump capable of handling a rate sufficient to accommodate a 5-year/6-hour storm. Both pumps are connected to emergency standby power. In addition, the site layout has been planned so that in the event of a storm surge that cannot be handled by the pumping system, excess water is directed over a weir and down the 1690 portal conveyor drift into the mine, where it can be stored as necessary.

Ice is removed from the ditches before spring breakup as necessary to ensure adequate ditch capacity is available for the freshet. Potentially contaminated ice or snow removed from the mill site pad or other areas is placed so that it drains to the RTP.

8.5.1 Drystack Runoff

The RTP is designed to capture runoff and seepage from the drystack. The design of the drystack, placement of materials, operation, and drainage control is described in **Section 7.2.1**.

Samples of the tailings taken since startup generally show that the arsenic and sulfur concentrations are within the range observed during the kinetic testing completed prior to construction. The pore water concentrations for both arsenic and sulfur are below those predicted in the Pogo 2002 Water Management Plan. On average, operational drystack tailings contain roughly twice as much arsenic as the bench and pilot plant tailings. The sulfur concentrations are approximately a third higher for the drystack tailings (SRK, 2009, Review of Arsenic Concentrations in Dry Stack Tailings).

8.5.2 Recycle Tailings Pond (RTP)

Water that accumulates in the RTP is used to fulfill all additional process makeup requirements that are not being met by mine water flow. In periods where precipitation inflows are inadequate, makeup fresh water is taken from the gravel ponds and pumped to WTP #2. RTP water is routed to the plant and the process water tank.

8.6 Excess Water Management, Treatment & Discharge

Optimized storage at the RTP is 12 million gallons. This water is primarily used at the mill as make up water. When storage is greater than 12 million gallons the water from the RTP is treated at Water Treatment Plant #2 (WTP #2) and discharged to the ORTW. Excess water from the underground mine that can‟t be recycled is treated at Water Treatment Plant #1 (WTP #1) and discharged to WTP #2 for use at the mill or it is discharged to the ORTW.

WTP #2 removes suspended solids, arsenic, and other metals then the effluent is mixed and aerated in the off-river treatment works (ORTW) before final discharge to the Goodpaster River. The water treatment process is described in **Sections 8.6.1** and **8.6.2**.

8.6.1 Chemical Treatment Process System (WTP#2)

The water treatment plant utilizes four processes to remove contaminants from the water before discharge. These processes are:

- High-density sludge (HDS) process to achieve enhanced co-precipitation of metals, including arsenic; and
- As necessary, lime softening and recarbonation to remove calcium and magnesium via precipitation and thereby reduce total dissolved solids (TDS).

A third process, sulfide precipitation is available as a contingent measure if additional treatment is necessary to achieve the expected metals concentrations. The proposed treatment system is not sensitive to variations in feed chemistry.

The final stage of the treatment system includes a multi-media pressure filter to polish the treated water for removal of residual suspended solids prior to release to the Off-River Treatment Works. Excess sludge generated by the process is dewatered using a filter press to produce a cake for disposal in the drystack or with tailings backfill.

8.6.2 Off-River Treatment Works (ORTW)

The ORTW provides the final polishing step in the water treatment process. Details of the system are shown in **Figures 8.6** and **8.7** in **Appendix B**. It consists of two ponds constructed from gravel pits that were excavated for project development. The primary pond is connected to the river by an open channel. Water is pumped from the primary to the secondary pond via a shore-based pump station and a buried steel pipe. The ponds are not lined allowing water to flow between the river and the ponds.

The pump inlet screen is sized at 0.25-inch, with inlet velocities of less than 0.5 feet per second (ft/s) to protect fish from moving into the chamber.

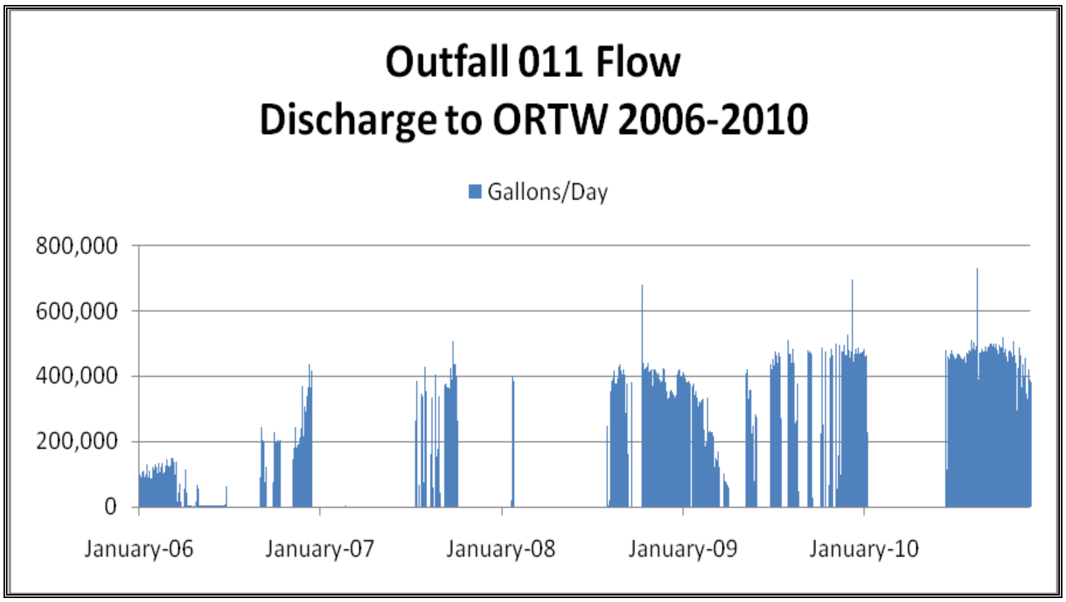
Effluent from the water treatment plant is discharged to the mixing chamber of the ORTW pump station, at a maximum rate of 600 gpm. Flow data collected concurrently from the WTP#2 effluent and a flow meter at the ORTW pump station is used to control the pump output and maintain a maximum 25:1 mix ratio. The United States Geologic Survey (USGS) gauging station located near the Goodpaster bridge monitors the river flows. If winter icing conditions affect the gauging station, manual means of flow measurement are available to guide plant operations. Water is not pumped from the primary pond when the river flow is below 20 cfs.

A mixing well and static inline mixers force the water to mix in the large steel pipe that conveys the water between the ponds. Additional mixing occurs in the secondary pond, assisted by the aeration treatment system. An overflow weir in the outlet works of the secondary pond maintains a stable pond elevation and prevents fish from entering the pond from the downstream direction. At a discharge rate of 400 gpm from the water treatment plant, the secondary pond has approximately 24 to 48 hours' residence time, which provides ample time to respond to potential upset conditions at WTP#2 by closing the shutoff valve in the outlet works of the secondary pond. The outlet of secondary pond near the weir provides a consistent and reliable monitoring location. The sampling facilities are located in a heated, weather-protected enclosure. The ORTW Effluent limitations are available in Pogo‟s APDES AK-005334-1 permit for Outfall 001.

8.6.3 Site Runoff & Discharge

During the years 2006 through 2010, site runoff and mine drainage was treated and discharged to the ORTW at an average rate of 44, 27, 91, 146, and 151 gpm respectively. The daily discharge is shown in **Chart 8.3** below:

Chart 8.3: Discharge to ORTW 2006-2010



Using the 19 inch annual average precipitation model used during project permitting, the forecast average discharge rate is 189 gpm as shown on **Figure 8.3**. It shows the site-wide water balance.

8.6.4 Water Treatment Plant #2 (WTP#2) Effluent Quality

WTP#2 effluent limitations are available in Pogo‟s NPDES Permit #AK-005334-1 for Outfall 011.

8.7 Fresh Water

Fresh water from the gravel pits near the 1525 portal is added to the RTP, MWTP #2, or the 1230 sump when other sources do not adequately meet process requirements.

8.8 Stormwater

Material site A below the mill was developed into a stormwater sedimentation pond for non-contact runoff. Overflow from the pond is filtered through the alluvial fill of the Road 6 embankment and diffused back into the groundwater in the Goodpaster Valley below the mouth of Liese Creek. An overflow weir controls the pond elevation to allow for storm surge modulation and sediment removal.

Well-defined practices known as “BMPs” (best management practices) are used for stormwater management to control runoff water quality. The primary parameter controlled is sediment. Oils and greases are controlled at their sources to ensure stormwater does not become contaminated with these materials.

In accordance with national standards, the stormwater BMPs adhere to the following design criteria:

- Design and construct drainage ditches as required;
- Provide spill planning, spill control materials and response teams to rapidly control oil, chemical or other spills that may affect Stormwater;
- Reclaim disturbed areas as soon as practicable after disturbance including regrading, topsoil establishment, revegetation with approved seed mixes and plantings, and maintenance of reclaimed areas to help establish the program;
- Maintain roads and travel areas to minimize erosion; and
- Grade roads and disturbed areas so that flows are directed to appropriate control facilities.

Refer to Pogo‟s SWPPP for more details.

9.0 REAGENT MANAGEMENT

9.1 Underground Storage

9.1.1 Supplies

Mining supplies are stored on the surface and in underground drifts. Supplies are regularly moved into the mine for mining activities. The major supplies are; roof bolts, welded wire, pipe, ventilation tubing, drill steel and bits.

9.1.2 Explosives

Explosives are hauled to site by truck and stored underground. Bulk emulsion is stored in two steel tanks underground. Locked storage magazines are provided for caps, detonating cord, primers and boosters.

9.2 Surface Storage

9.2.1 Mill Reagents

Reagents are purchased in normal commercial bulk containers or packaging, such as tote bins, barrels, palletized sacks, super sacks, etc. These packages are loaded into shipping containers at origin and shipped to site to provide security and protection against spills and loss throughout the transportation process. Upon delivery at site, reagents are stored in a covered building adjacent to the mill (see **Figure 6.2** in **Appendix B**) or stored in the shipping containers on site until they can be stored within the mill storage area. All covered storage areas have a concrete floor and are bermed or sloped to collect any spillage and aid in cleanup.

Reagents are mixed inside the mill building in appropriate tankage before being pumped to their addition points in the process. Any spills are contained within the concrete berms of the reagent area and collected in a sump for disposal or return to the process tanks.

Lime – Lime is used for controlling the slurry pH during leaching, water treatment, and cyanide detoxification. Lime is slaked in a ball mill slaker and added where required from a circulating pipe loop of hydrated lime slurry.

Sodium Cyanide – Sodium cyanide is used to dissolve gold. The cyanide is transported as dry briquettes in secure shipping containers and is stored in a reagent storage building that provides adequate secondary containment.

The contents of the cyanide mixing tank are mechanically agitated to enhance dissolution. After the cyanide has dissolved, the solution is transferred to the cyanide storage tank for distribution by centrifugal pumps to the leaching and stripping circuits.

Activated Carbon – Activated carbon is received in 1,000 pounds (lb) bulk bags and used to capture dissolved gold from the leached slurry. Carbon fines are collected and stored on site in tote bins. To recover residual gold values, these tote bins are periodically shipped to an off-site smelter for handling and disposal.

Sodium Hydroxide – This chemical is used to raise the pH in the carbon stripping circuit and neutralize after carbon acid washing. The sodium hydroxide is received as pellets packaged in steel drums containing 500 lb and is mixed with water in batches to form a 20% solution. The solution is prepared in a caustic solution tank between periods of usage thereby eliminating the need for a transfer pump and separate storage tank.

Nitric Acid – Nitric acid is used to acid wash the carbon (after stripping) to remove calcium scale buildup. The acid is delivered in returnable stainless steel drums containing approximately 100 lbs of concentrated acid solution per drum. Acid washing solution is prepared in a batch mixing tank at strength of 5% by volume. The solution is circulated through a carbon acid wash vessel using a recirculating pump system until the solution pH increases to 7.0. At this point, acid washing is complete and the spent acid solution is pumped to the mill process. The carbon is rinsed with process water prior to being advanced to the reactivation kiln feed tank. Acid solution is prepared in a single tank between periods of usage, thereby eliminating the need for a transfer pump and separate storage tank. Different storage methods of nitric acid, including bulk totes, are being considered to further improve the safety of handling the concentrated acid.

Sulfuric Acid – This is used for pH control in the cyanide detoxification circuit.

Potassium Amyl Xanthate – PAX is used as a flotation reagent to collect sulfide and gold-bearing minerals.

Polydadmac – Polydadmax is used as a fines depressant for controlling the flotation of silt-like particles, resulting in improved thickening and flotation performance.

Aero 6697 Promoter – This reagent is used as a flotation reagent to promote the recovery of gold-bearing minerals.

Aerfroth 549 – Aerofroth 549 MIBC is used as a frothing agent in the flotation circuit.

Flocculant – Flocculant assists with solids settling in the thickeners of the milling process. Dry flocculant is delivered to the site in 2,000 lb bags and stored in the mill reagent area, where it is mixed using a wet mixing system.

Sodium Metabisulfite – Sodium metabisulfite is delivered in 2,000 lb supersacks for use in the cyanide detoxification circuit. It is mixed and stored in tanks in the reagent mixing area.

Copper Sulfate – Copper sulfate is used as a catalyst in cyanide detoxification. It is received in 2,000 lb supersacks and dissolved in the copper sulfate tank as a 25% solution. The solution is metered from this tank to the SO_2/air cyanide destruction tanks.

Fluxes – Fluxes are used in the gold refining process. Anhydrous borax, sodium nitrate, soda ash, manganese dioxide, and graded silica sand are received in 50 to 100 lb bags or drums. These fluxing agents are used directly from their containers to refine gold concentrates into bullion. The containers are stored in the gold refinery.

Water Softening & Anti-scalant Agents – Water softening and anti-scalant agents are used in the mill to treat process water and prevent scaling in pipes. These chemicals are received as prepared concentrated solutions in drums and used as required via liquid metering pumps.

9.2.2 Grinding Media

Grinding balls are delivered in open containers and emptied into ball bunkers situated near the grinding mills. SAG mill grinding balls are loaded to a ball feeder situated over the mill feed conveyor.

9.2.3 Fuel & Propane

Fuel is trucked to site from various suppliers on an as needed basis. Fuel piping is above ground as much as practical, and all piping is either in lined containment or underground inside secondary piping. Buried piping on-site is from Above Ground Storage Tank (AST)-1 containment to the permanent camp facility (1 inch carbon steel line inside 3 inch HDPE) and to the maintenance shop (2 inch carbon steel line inside 8 inch HDPE). The other buried piping on-site is from AST-2 containment to the mill facility (1 inch carbon steel line inside 3 inch HDPE).

The site has three stationary fueling areas; helicopter, main containment area (MCA) and 1875 portal area. They have all been constructed of earthen berms with impermeable liners providing tertiary containment at least 110% of the volume of the largest tank.

A fuel truck is used to deliver fuel from the main storage tanks to remote equipment and smaller storage tanks on the site. Fuel is pumped for delivery with appropriate automatic shutoff devices.

Smaller tanks with secondary containment are located at the mill building and the camp. These tanks are filled by the fuel truck and are used for fueling heaters, backup generators and the incinerator. The total above ground diesel fuel storage capacity is 265,340 gallons.

Up to 60,000 gallons of propane storage is provided near both the 1525 Portal and the 1875 Portal. These tanks supply the mine air heaters and typically are full only in the winter months. The upper camp has 15,000 gallons of propane storage for the kitchen facilities. The new lower camp has one 1,000 gallon tank which is used to heat the mine dry. A total of 137,000 gallons of propane storage is provided on site.

10.0 MONITORING PLAN OUTLINE

10.1 Quality Assurance Project Plan or QAPP

The Quality Assurance Project Plan (QAPP) was developed using Environmental Protection Agency (EPA) guidance documents such as: EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5 (EPA, 2001) and Guidance for Quality Assurance Project Plans, EPA QA/G-5 (EPA, 2002b). The primary purpose for the Plan is to assure the quality and integrity of all collected samples, the representativeness of the results, the precision and accuracy of the analyses, and the completeness of the data. The Plan describes the sample methods, sample designs, compliance goals, measurement objectives, and quality assurance and quality control measures utilized by the staff. The Plan was submitted to the EPA and the ADEC in support of Pogo‟s permits.

10.2 Pogo Mine Monitoring Plan

The principle objective of the Pogo Mine Monitoring Plan is to protect the water quality of the Goodpaster River. Through the use of a "Monitoring Plan," Pogo ensures this objective is achieved. The foundation of the plan is to monitor:

- Outfall of the off-river treatment system;
- Groundwater downstream of the RTP;
- Effluent of the domestic water treatment plant;
- Surface water in the Goodpaster River;
- Geotechnical stability of drystack tailings facility; and
- Geochemistry of the drystack tailings and mineralized waste rock.

The details of Pogo‟s Monitoring Plan were developed in consultation with State and Federal regulatory agencies. Monitoring results are reported to the appropriate agencies on a quarterly basis. The quarterly reports include data tables and graphs.

11.0 TEMPORARY SHUTDOWN

Planning for potential shutdowns is an integral part of good mine management. At some point, the operation may shut down for a short period (less than three months) during the life of the mine. Short-term shutdowns occur due to events such as major equipment breakdowns or weather related interruptions. Long-term, but still temporary (between three months and three years) shutdowns usually only occur in response to economic changes, such as a prolonged decline in the price of gold. These types of events are much less likely to occur, but Pogo has also been designed to accommodate such eventualities. Permanent shutdown occurs at the end of the mine life.

11.1 Short-term Shutdown Plan

During a short-term shutdown, the following activities are carried out:

- Continue to treat and discharge water;
- Continue all monitoring requirements;
- Continue maintenance of stormwater ditches;
- Shut down mill and filter plant and prepare to resume operations as soon as mining recommences; and
- Shape stockpiles to minimize erosion.

These and other maintenance activities keep the facility in good operating order for when the interruption is remedied and operations are ready to resume.

11.2 Long-term Shutdown Plan

In the event of a long-term shutdown, a minimum staff continues to maintain and preserve the facility until it can be restarted. The long-term shutdown plan for the Pogo project involves the following activities:

- Draw down the RTP to a minimum volume;
- Treat and eliminate all process solutions;
- Shut down the mill and filter plant, draw down all process tanks and vessels, and mothball major equipment to preserve their mechanical condition;

- Flush and clean all process lines and instrumentation, protect all electronics and sensitive equipment;
- Secure the mill, filtration plant and mine and continue to treat water as necessary;
- Continue to maintain stormwater system including diversion ditch;
- Implement possible mitigation measures such as grouting and paste backfilling of mining stopes to minimize mine water inflows; and
- Install erosion protection on all stockpiles, dumps, site areas, etc.

Long-term shutdown practices would allow the mine and plant to be restarted after a commissioning period, wherein equipment is reassembled and restarted, reagents reintroduced, electrical and control systems re-energized, and production activities resumed.

All monitoring and reporting requirements required under the various project permits will be met unless otherwise agreed to by the appropriate agencies.

12.0 RECLAMATION

Detailed reclamation plans are provided in Pogo‟s *Reclamation & Closure Plan* (2011). The financial bond amount is $44.43 Mil for the project area and $4.81 Mil for the access road and transmission line. Details are in the Reclamation Cost Model reviewed and approved by ADEC and ADNR.

Reclamation and closure are an integral part of the mining operations plan, providing guidance during the operational life of the mine to ensure that post-mining land use goals are achieved and that the waters of the state are protected. This plan describes a conceptual model for post-mining land use and provides the basis for reclamation and closure activities throughout the life of the project.

There are three critical reclamation and closure issues for the Pogo project:

- Successful stabilization and erosion control on steeply dipping slopes;
- Closure of the tailings drystack facility; and
- Closure of the underground workings.

Reclamation of the project site focuses on establishing post-mining land use in the area. This involves re-grading, surface amendment, re-establishing surface water drainage and re-vegetating. Closure of the project site focuses on stabilizing all development rock, tailings and underground workings in order to control or mitigate any seepage and prevent degradation of surface or groundwater.

12.1 Reclamation and Closure Phases

The reclamation activities are separated into the following five phases:

- Phase I Reclamation of construction disturbance;
- Phase II Reclamation with concurrent mining;
- Phase III Final reclamation and closure of mine site;
- Phase IV Water treatment and post-closure reclamation; and
- Phase V Post-closure monitoring.

12.1.1 Phase I Reclamation of construction disturbance

The old airstrip on the sandbank of Goodpaster River was reclaimed.

12.1.2 Phase II Reclamation with concurrent mining

The old lower camp (former exploration camp) was demolished in 2010. The abandoned old surface exploration camp on the Pogo Ridge will be demolished and reclaimed. The mineralized rock stockpiled at the lower laydown area during the advanced exploration will be hauled to the Drystack Tailing Facility.

12.1.3 Phase III Final reclamation of mine site

Phase III will consist of the major closure activities required to decommission the mine, remove all facilities and structures not needed to support Phase IV activities from the property, and place the site in a stable condition. The facilities removed will include Mill facilities, Upper Camp, office, and shop. The mined-out stopes in underground will be paste filled and concrete plugs will be installed in all mine portals. An engineered soil cover will be installed on the surface of Drystack Tailings Facilities.

12.1.4 Phase IV Water treatment and post-closure reclamation

After completion of Phase III activities, the water of RTP will be treated and discharged until the water quality of RTP water will match the water quality standards. When appropriate, RTP will be breached and the remaining facilities such as water treatment plant and off-river treatment works, site access road, and 3,000 ft airstrip will be demolished and all of disturbed area will be reclaimed. The private portion of Pogo access road and the entire portion of transmission line will also be reclaimed. It is anticipated that the Phase IV water treatment will last 10 years.

12.1.5 Phase V Post-closure monitoring

The water quality of surface water and ground water will be monitored at the designated locations in 1, 2, 5, 10, 15, 20, and 30 years after the completion of Phase IV post-closure reclamation.

12.2 Post-mining Land Use

The Tanana Basin Area Plan states that traditional land use in the area is wildlife habitat and recreation (TBAP, 1991). The goal of reclamation is to re-establish wildlife habitat within five to fifteen years by stimulating the growth of early successional vegetation. This vegetation provides willow and shrub browse for moose and other game; young aspen stands for Ruffed Grouse habitat; and grass areas that provide forage, diversity and cover for voles and food for raptors.

13.0 REFERENCES

- Teck-Pogo, February 2002, Water Management Plan;
- Teck-Pogo, 2003 Plan of Operations;
- Teck-Pogo, 2003 Solid Waste Monitoring Plan;
- Teck-Pogo, 2003 Reclamation and Closure Plan;
- SRK, Sobek Acid-Base Accounting Test Results, November 5, 2008;
- AMEC, Pogo Mine Dry Stack Geotechnical Considerations, August 20, 2008;
- AMEC, Pogo Precipitation Review, November 20, 2008;
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- Engineering and Maintenance Associates, Water Treatment Plant Upgrades-Phase II, 2009;
- SRK, Review of Arsenic Concentrations in Dry Stack Tailings, January 10, 2009;
- Teck-Pogo, Pogo Stormwater Pollution Prevention Plan, June 2009; and
- Teck-Pogo, Pogo Quality Assurance Project Plan, March 2009.