Chapter 2 Alternatives

2.1 Introduction

An important part of the EIS process is developing options and alternatives to the Applicant's proposed project that address the issues identified by the public and agencies during scoping. This chapter explains how that was done.

It is important in reviewing this EIS to understand the relationship between the terms "component," "option," and "alternative."

- **Component.** A complete mining project such as the Pogo Mine has several components, each a necessary part of an entire viable project; for example, the mill process, the tailings disposal system, and how the project location is accessed.
- **Option.** For each component, there are one or more options, or choices; for example, for the access component there are all-season road options (Shaw Creek Hillside and South Ridge) and winter road/trail options (Shaw Creek Flats and the Goodpaster Valley).
- **Alternative.** An alternative is a set of options (one for each component) that constitutes an entire functioning project; for example, one mill process, one tailings disposal location, one airstrip location, and one surface access route.

Section 2.2 (No Action Alternative) describes what would happen in the project area if no action were taken and the Pogo Mine project did not go forward.

Section 2.3 (Applicant's Proposed Project) describes the Applicant's Proposed Project in relative detail so readers can understand what has been proposed.

Section 2.4 (Issues, Options, and Screening) describes the three-step process by which: the issues were identified; options other than those proposed by the Applicant were developed to address those issues; and how screening criteria were identified and the options screened.

Section 2.5 (Action Alternatives Identification) describes how the options and sub-options remaining after screening were grouped into full project alternatives to be assessed in detail in Chapter 4 (Environmental Consequences) to determine environmental impacts.

2.2 No Action Alternative

In the No Action Alternative, the Pogo Mine project would not be developed. This alternative may be used as a baseline for comparison with the action alternatives to determine impacts.

For many issues raised during scoping (e.g., water quality, air quality, and fish), the No Action Alternative likely would mean no changes from the present condition in the reasonably foreseeable future because none of the potential impacts from development of the Pogo Mine project would occur and because there are no other factors on the horizon that might affect these resources.

For other issues, however (e.g., socioeconomics and industrial and commercial uses), changes could occur because factors unrelated to the Pogo project development could influence them. For example, deployment of the National Missile Defense System (NMDS) definitely would change the present socioeconomic picture in the Delta Junction area with respect to population, jobs, and pressures on existing services, whether or not the Pogo mine were developed. Also, the 5-year harvesting plan of the Division of Forestry (DOF) likely would be implemented, and thus, the present status of timber access and logged areas would be affected. Therefore, in Chapter 4 (Environmental Consequences), there is a discussion of what the No Action Alternative would mean with respect to each resource.

The No Action Alternative would result from denial of at least one, or perhaps more, of the federal or state permits necessary for project development. It also could result if the Applicant chose not to develop the project because of a drop in the price of gold, or because the Applicant chose to direct its mine development resources elsewhere.

2.3 Applicant's Proposed Project

This section describes the Applicant's Proposed Project. A more detailed description may be found in the Applicant's *Pogo Project Plan of Operations* (Teck-Pogo Inc., 2002a), *Pogo Project Plan of Operations Supplement* (Teck-Pogo Inc., 2002i), and *Pogo Project Right-of-Way Application* (Teck-Pogo Inc., 2002j).

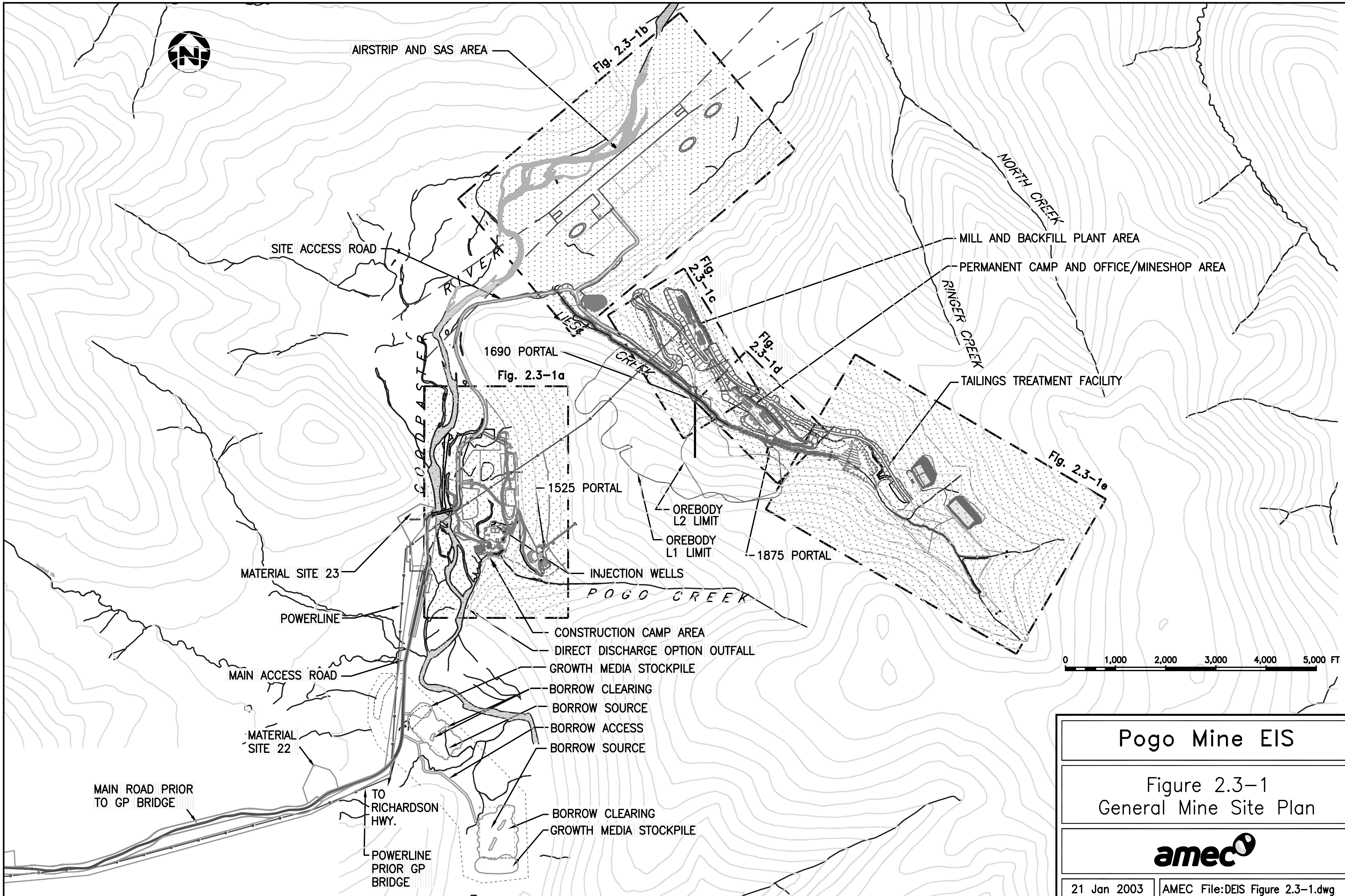
2.3.1 Project Design Criteria

The Pogo Mine project design criteria:

Operating period		24 hours per day; 365 days per year
Mining rate		Same as milling criteria
Milling rate:	Start-up production	Average 2,500 tpd
	Eventual production	Average 3,500 tpd
Milling process		Grinding, gravity separation, flotation concentration, and cyanide vat leaching
Tailings storage (surface and underground)		11 million tons
Development rock generated during mine life		1.9 million tons
Current projected mine life @ 2,500 tpd		11 years
Annual gold production		375,000 to 500,000 oz
Construction employees for start-up facilities		700
Operating employees		288 @ 2,500 tpd 360 @ 3,500 tpd
Energy requirements for mine operations		10 MW @ 2,500 tpd 14 MW @ 3,500 tpd
Annual operating fuel usage:	Diesel	786,000 gals @ 2,500 tpd 1,300,000 gals @ 3,500 tpd
	Propane	930,000 gals @ 2,500 tpd 1,850,000 gals @ 3,500 tpd
Annual operational non-fuel supplies		27,000 tons @ 2,500 tpd 42,000 tons @ 3,500 tpd

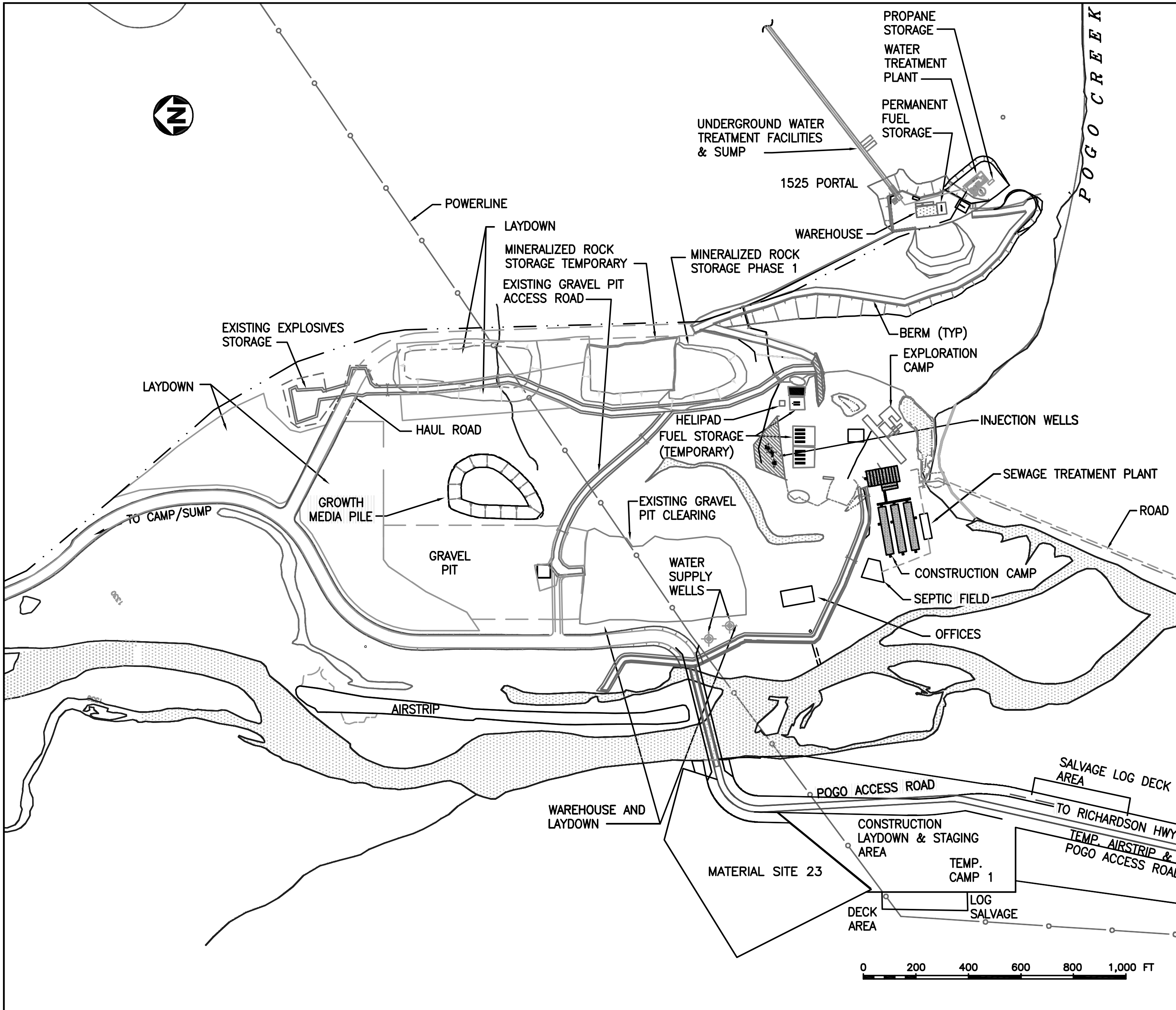
2.3.2 General Mine Site Plan

Figure 2.3-1 presents the general mine site plan for the Applicant's proposed all-season road option. Subsequent figures present the existing mine portal site plan (2.3-1 a), airstrip and associated facilities (2.3-1 b), Liese Creek Valley mill site plan (2.3-1 c), Liese Creek Valley camp and shop plan (2.3-1 d), and the Liese Creek Valley recycle tailings pond (RTP) and tailing treatment facility plan (2.3-1 e).



Pogo Mine EIS

Figure 2.3-1
General Mine Site Plan



Pogo Mine EIS

Figure 2.3-1a
1525 Portal Site Plan

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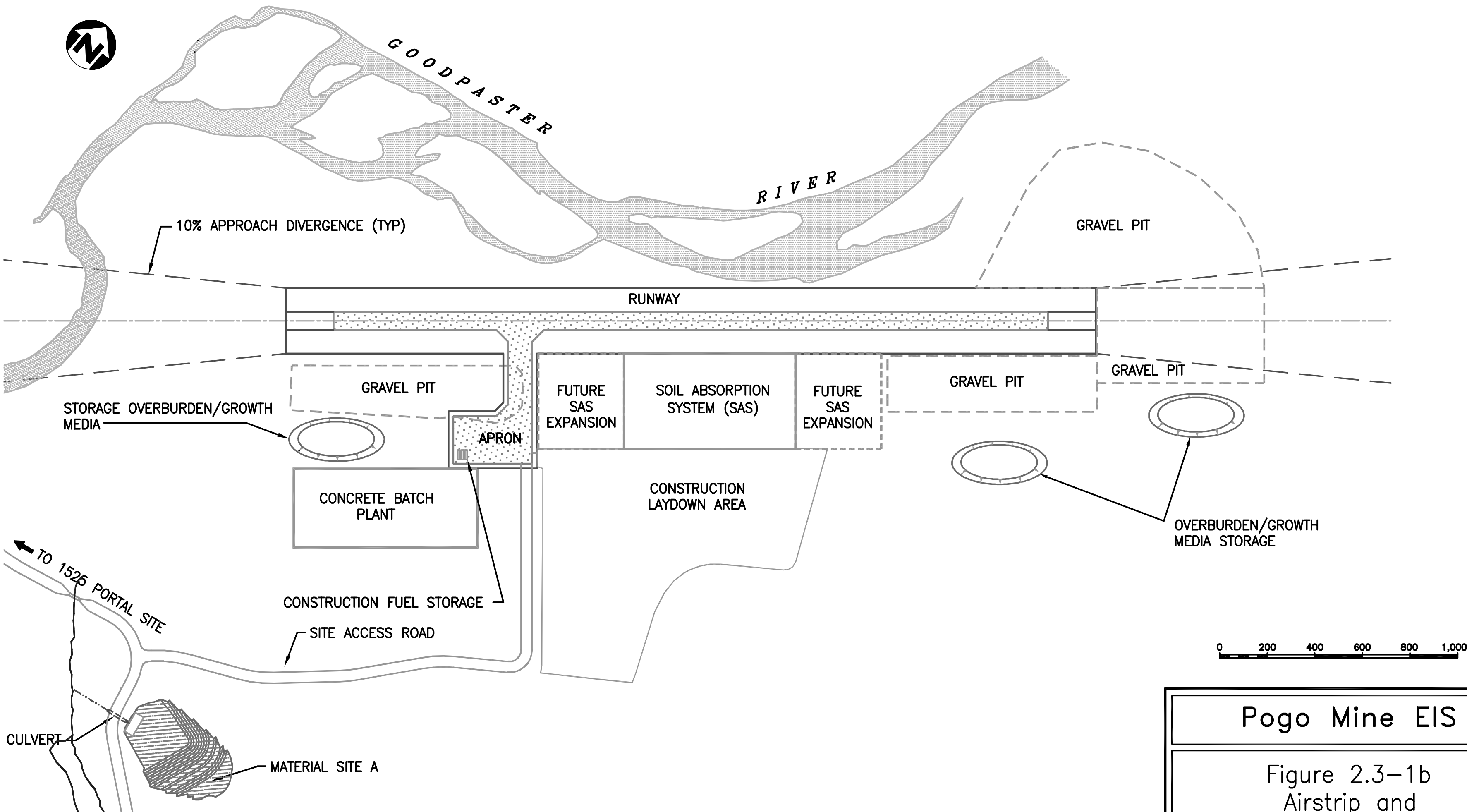

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Figure 2.3–1b
Airstrip and
Associated Facilities

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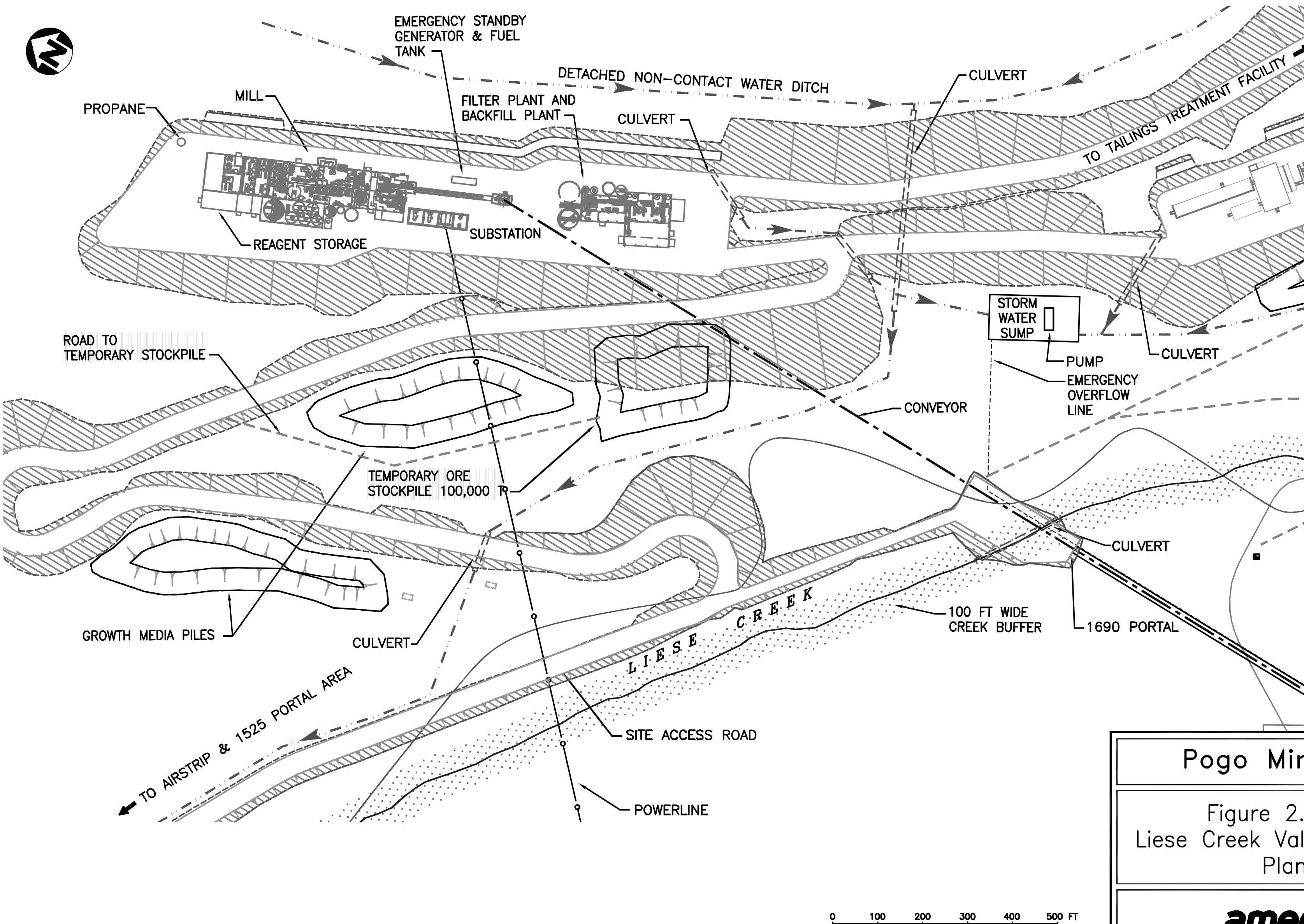

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Figure 2.3–1c
Liese Creek Valley Mill Site Plan

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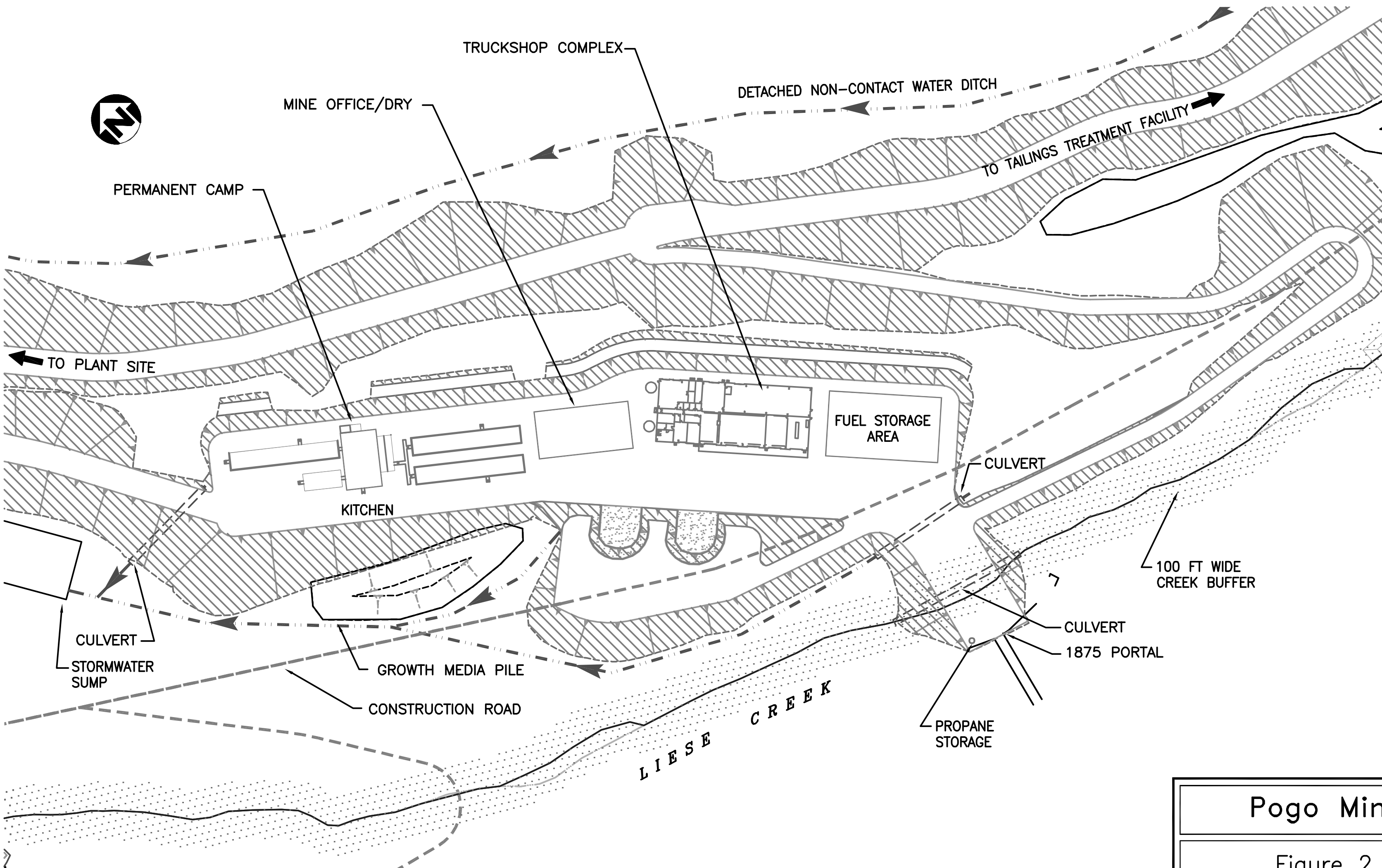

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Figure 2.3–1d
Liese Creek Valley Camp and Shop Plan

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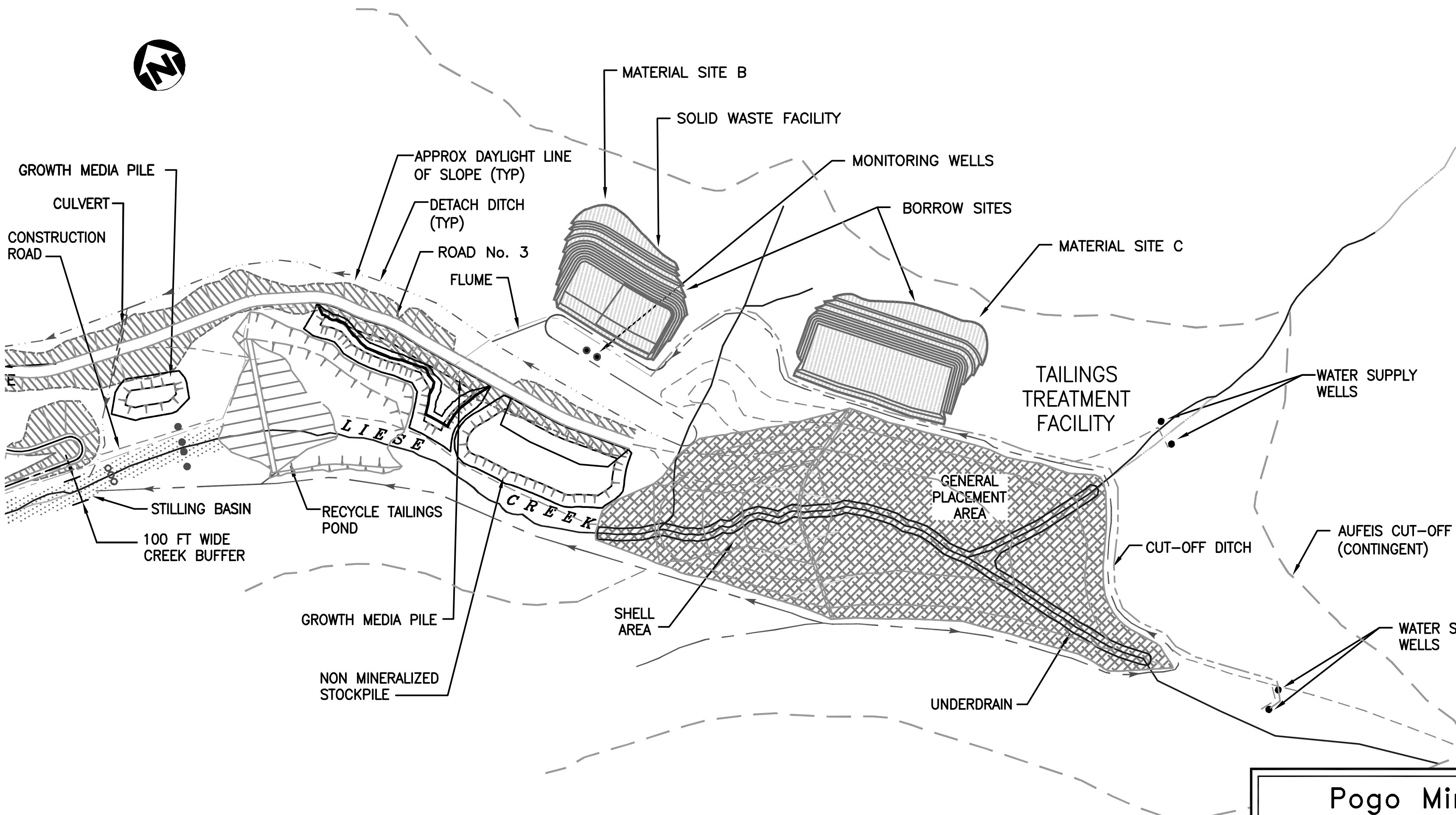

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Figure 2.3–1e
Liese Creek Valley RTP and Tailings Treatment Facility

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2.3.3 Access

The Applicant proposes two modes of access to the mine site: surface and air.

Surface Access

The Shaw Creek Hillside option would be a 49.5-mile, two-lane, all-season road (Figure 2.3-2). It would begin at the end of the existing approximately 2.1-mile-long Shaw Creek Road on the west side of Shaw Creek, and cross the TAPS approximately 4.5 miles from the Richardson Highway. It would proceed up the northwest side of the Shaw Creek Valley for a distance of approximately 26 miles. It then would cross Shaw Creek and climb 18 miles over the divide into the Goodpaster River Valley and cross the river to the mine site. The highest road elevation would be 3,300 feet (ft); the lowest 970 ft.

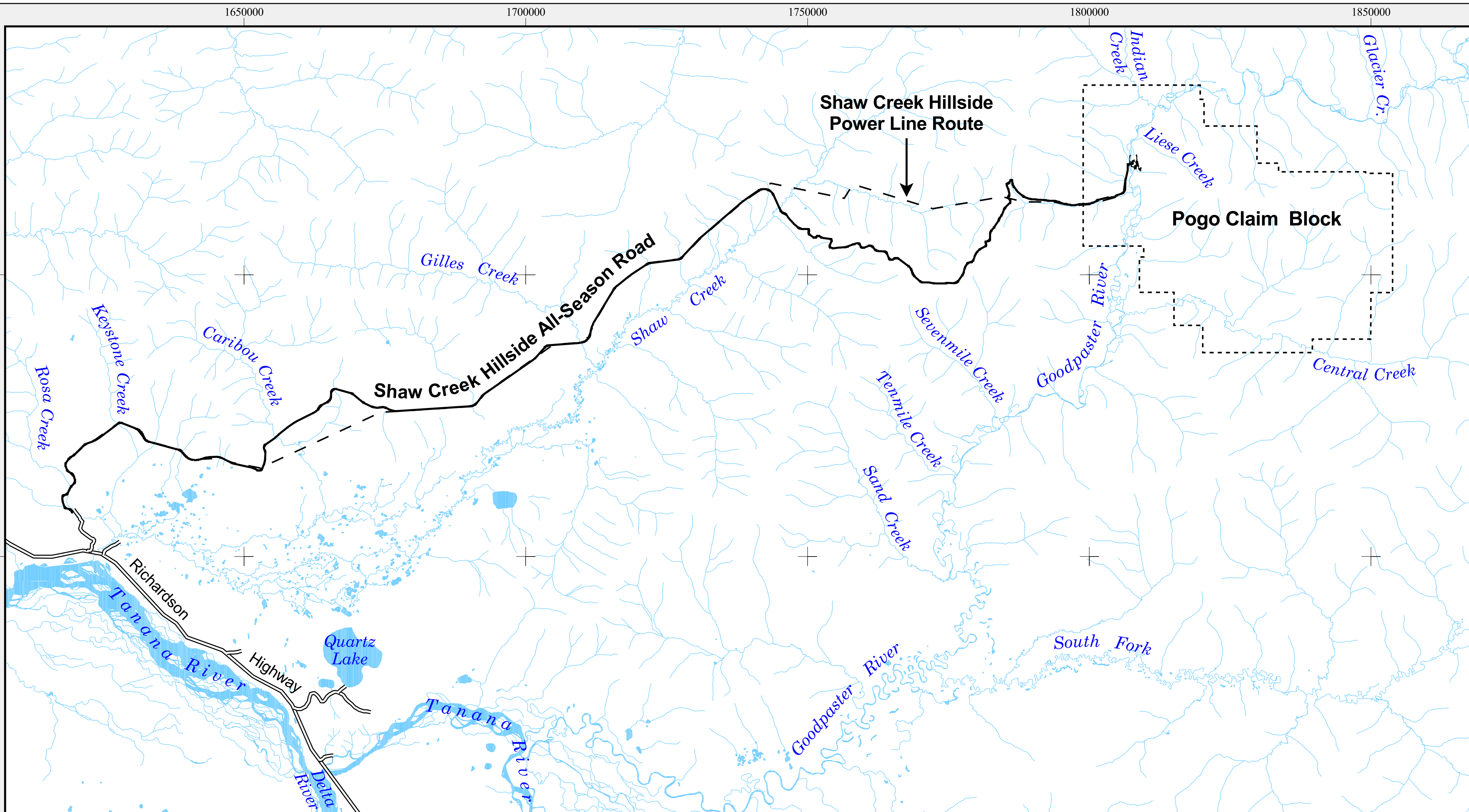
The road would meet or exceed American Association of State Highway and Transportation Officials (AASHTO) standards as a resource development road. Because the road would transect the TVSF, the design criteria have been developed to meet or exceed the proposed DOF northern region forest road standards for moderate-to-heavy, long-term, year-round use (Table 2.3-1).

The road would have either a 24-ft surface, or in steep areas an 18-ft surface with a safety berm. Conventional cut-and-fill road construction methods would be used on the majority of the road alignment. Limited areas traversing permafrost, wetlands, or both would use a thick (4 ft to 6 ft) fill section placed over geotextile fabric. Segments between Shaw Creek and the Goodpaster River would require blasting and/or ripping of bedrock.

The road surface would be gravel or crushed rock. Approximately 1.3 million cubic yards (cu yd) of material would be moved to complete road construction. An estimated 250,000 cu yd of classified material and 220,000 cu yd of rock for road surfacing would be required from 23 potential material sites.

The road would have a maximum grade of 7 percent, with limited short grades of 8 percent. There would be two long grades of 5 to 7 percent; one of approximately 4.3 miles climbing from Shaw Creek to the Shaw Creek and Goodpaster River divide, and one of approximately 3.2 miles descending to the Goodpaster River. There would be no turnouts, but there would be truck safety run-outs on the two major grades. Roadside berms would be installed at all bridges, at sharp curves on steep grades, and where the road passes bodies of water deeper than 3 ft. Corrugated metal pipe drainage culverts would be installed at all drainage crossings. The road would be designed for a speed of 35 miles per hour. Radio contact would be maintained between all vehicles and mine security, and traffic would be controlled to avoid interference at one-lane sections.

Six single-span, single-lane bridges between 60 and 85 ft long would be required across five creeks: Rosa (two crossings), Keystone, Caribou, Gilles, and Shaw. The Goodpaster River crossing would be a six-span, single-lane bridge, 390 ft long. Bridges would have a design capacity of approximately 100 tons, with a maximum axle load rating of 60 tons.



Base map: USGS 1:63,360 digital line graph mosaic
Projection: Alaska State Plane Zone 3 (units ft.)
Datum: NAD 83
Grid: 50,000 feet

Pogo Mine EIS

Figure 2.3-2 Applicant's Proposed Shaw Creek Hillside All-Season Road and Power Line Routes

ABR inc. map prepared by: environmental research & services

24 July 2002 | ABR File: Pogo_PDEIS_Chapter2.apr

Table 2.3-1 DOF and Applicant Access Road Design Criteria Comparison

Criterion	DOF Criteria[1]	Applicant's Proposed Criteria
Design speed	None given.	35 mph.
Horizontal curve radius	300 ft normal & 100 ft min.	500 ft normal & 300 ft min.
Vertical curve sight distance	None given.	500 ft normal & 350 ft min.
Grade	8% normal & 10% max.	7% maximum except for limited short grades of up to 8%.
Drivable surface	16 ft to 20 ft with rock surface.	24 ft with rock surface, 18 ft with safety berm, single lane as required.
Turnouts	Not required if width is 18 ft+	Not typically required.
Cut & fill	Fill castings 1.5:1 max. Cut slopes at 1:1 max.	Fill 1.5:1 max. 2:1 typical. Cut 1.5:1 max. 2:1 typical. Except bedrock to 0.5:1.
Clearing	5 ft beyond cuts or fills, or min. 35 ft width. Merchantable timber cut and decked ahead of construction.	5 ft beyond cuts or fills, except to toe of fill in wetland areas. Merchantable timber cut and decked ahead of construction.
Grubbing	All debris outside of ditches unless top of stumps under 2 ft of fill.	All debris outside of ditches unless top of stumps under 2 ft of fill. No grubbing in marshy areas.
Debris disposal	If at least 2 ft beyond ditches may be buried under 1 ft of fill or windrowed. If not at least 2 ft beyond ditches, buried under 3 ft of fill.	If at least 2 ft beyond ditches may be buried under 1 ft of fill or windrowed. If not at least 2 ft beyond ditches, buried under 3 ft of fill.
Ditches	1 ft min. depth. 2 ft minimum width. Block ditch on downhill side of culvert inlet where needed.	2 ft min. depth with 3 ft typical. No ditch on down slope side of road where possible. Block ditch on downhill side of culvert inlet where needed.
Culverts[2]	Min. 12 in. dia. installed at or below natural ground line. Installed at natural drainage gradient.	Min. 15 in. dia. installed at or below natural ground line. Installed at natural drainage gradient. Culverts serving major drainage areas are designed appropriately. Cross culverts as needed.

[1] ADNR (2000)
[2] ADOT/PF (2000)

Road construction would proceed from four headings: one at the Goodpaster (east) end; one at the Shaw Creek (west) end; and two in the middle (central). The Goodpaster Winter Trail would be used to stage construction equipment for the east heading. The winter trail in Shaw Creek would be used to establish the two central headings. The TAPS work pad or the existing Shaw Creek Road would be used to establish the west heading. Temporary camps would be established at both the east and central headings. Temporary airstrips would be constructed as wider areas on the road alignment at the east and central headings. Construction would be supported by air until the pioneer all-season road was serviceable.

During mine operations, there would be an estimated annual transport of 30,000 to 40,000 tons of freight to the mine, with negligible tonnage of backhaul. Mine-related large truck traffic would average approximately 5 to 10 round trips per day, 7 days per week, during the day or at night. In addition, there would be an average of approximately eight other daily round trips: periodic personnel change-outs by bus (two per day), Teck-Pogo administrative personnel (three per day), maintenance equipment (two per day), and state and federal agency vehicles (one per day). Overall, mine-related vehicle use would average between 10 and 20 round trips per day.

Depending on the project's particular needs, the number of trucks or other vehicles on a given day could be substantially higher than the average, while on other days there might be few or no trucks or other vehicles. After the road were built, during intense periods of mine construction, traffic would average approximately 50 round trips per day, roughly split between semi-tractor trailers and light vehicles.

For safety reasons, the Applicant proposes that the road be a controlled-access industrial road with traffic restricted to Pogo-related vehicles. There would be a security gate near the end of Shaw Creek Road and another approximately 1 mile east of the TAPS crossing. These gates would be operated and monitored by mine security personnel with the use of remote-controlled video cameras.

A maintenance and staging facility would be developed at material site 3, approximately 2.4 miles from the end of the existing Shaw Creek Road and approximately 750 ft southwest of the TAPS crossing (Figure 2.4-4). The site would be used as a staging area during construction, and then a maintenance shop and a separate employee bus station would be constructed for shift changes. Employees would leave personal vehicles in a fenced, secured area and would be transported to and from the mine by bus.

Shift changes would occur every 4 days, and could be at any time of the day or night. Because of the distance to the mine site, it would take approximately 4 hours from the time buses left the TAPS crossing parking area/bus station with the incoming shift until the buses returned to the parking area/bus station with the outgoing shift. Thus, there would be two peak periods of shift-change traffic on Shaw Creek Road approximately 4 hours apart. During shift changes, up to 180 personal incoming shift vehicles could arrive at the TAPS parking area/bus station, and up to the same number could depart the parking area/bus station approximately 4 hours later.

The proposed Goodpaster River Bridge would be located adjacent to the mine site approximately 68 miles above the mouth of the river (Figure 2.3-1a). The bridge would have six, 65-foot unbroken steel girder sections, for a total length of 390 feet, supported on steel tube piles driven into the unfrozen alluvial gravel. The vertical opening between the proposed bridge and the normal high water level would be 11.2 feet. The horizontal opening would be 65 feet. This design would allow use of pre-fabricated steel girder sections that could be transported over the Goodpaster Winter Trail.

In the preferred winter construction scenario, bridge pile driving and structure erection would take place using equipment set on a grounded ice workpad constructed outward from the west bank. Ice workpad development would be done to allow continued flow under the ice in the main channel. A conventional ice bridge would be constructed at the traditional Goodpaster Winter Trail crossing location, approximately 800 feet downstream from the proposed bridge site, with access to the bridge along the west bank of the river.

If the project approval date would not allow for winter construction, the bridge would be installed by fording the river with appropriate equipment and driving piling in the active river channel. Given past active channel location and normal river levels, two sets of piling would be required in the active channel. Bridge construction activities that would take place in the flowing waters of the river would be completed prior to July 15.

Air Access

For complementary air access to the mine site, the Applicant proposes to construct a 3,000-ft-long by 75-ft-wide gravel airstrip in the Goodpaster Valley just north of the mouth of Liese Creek (Figure 2.3-1). This airstrip would be capable of handling SkyVan, Caribou, DC3, CASA 212, Caravan, and King Air aircraft. Approximately 100 flights per year, or approximately two per week, would be required to support the mine area facilities during operations. Air freight would be flown out of Fairbanks, the public DC6 airstrip near Delta Junction, or a private airstrip 14 miles east of Delta Junction. The airstrip would be maintained for the life of the operation and would be available to provide access for post-closure monitoring.

During initial construction, the airstrip would support operations during the period when Goodpaster Winter Trail access would not be available and the permanent all-season access road not yet completed. Depending on when appropriate permits were received, this period could range from 6 to 12 months. Also during this period, heavy-lift helicopters might be used to transport time-sensitive items that could not be transported by fixed-wing aircraft as discussed below.

Personnel changes during this initial construction period would require transport of up to 130 workers in each direction weekly, needing up to 15 Twin Otter and Cessna Caravan flights per week. Smaller aircraft such as the Cessna 206 and Cessna 207 also would be used and would average approximately ten flights per week. Personnel would be transported from the City of Delta Junction airstrip (D66) and from Fairbanks International Airport.

Fuel and supplies would be transported by DC-3, C-46, Caribou, and SkyVan aircraft. The SkyVan likely would be flown out of an existing private airstrip 14 miles east of Delta Junction; the DC-3 and C-46 would operate out of Fairbanks; and the Caribou would operate out of D66.

Fuel requirements were estimated up to 15,000 gallons per week. If this fuel were flown by the SkyVan, it would require approximately 30 trips per week. Flying out of Fairbanks or D66 with a larger aircraft would require approximately only 15 trips per week. Air freight requirements were estimated at up to 50 tons per week, requiring approximately 15 trips per week with various aircraft.

Thus, aircraft trips during initial construction could total up to between 55 and 70 flights per week, or 8 to 10 per day.

2.3.4 Mining Method

Conventional underground mining techniques would be used to excavate ore from the Pogo deposit. The mine facilities would be designed to extract 2,500 tpd, with the possibility of expansion to 3,500. Three portals would be used to access the mine as listed below (Figure 2.3-1). The number used to refer to each portal represents its elevation above sea level in feet.

- The existing 1525 Portal that was constructed in the Goodpaster Valley during the advanced exploration phase would be used to transport bulk materials underground and would provide intake ventilation.
- A new 1875 Portal in the Liese Creek Valley would provide primary access for men and equipment and also would provide intake ventilation.

- A new 1690 Portal in the Liese Creek Valley would be used primarily for conveyor access to the mine and for exhaust ventilation.

A combination of underground mining methods likely would be used, but most mining would be done by a technique called cut-and-fill mining. This procedure would involve drilling a series of holes in the rock, loading them with explosives, and blasting. The broken rock would be moved out with LHD (load-haul-dump) units, similar to a front-end loader, and 50-ton haul trucks, and taken to ore storage bins. The bins would be fitted with a grizzly (large stationary screen for sorting rock by size) and hydraulic rock breakers to reduce oversize material. From the grizzly, the rock would fall to one of two underground ore bins, which would feed a 42-inch- (in.-) wide, 2,000-ft conveyor that would take the ore to the mill through the 1690 Portal.

After ore removal, the excavated section would be filled with paste backfill, a mixture of cement and tailings material from the milling process. Backfill would provide support so that the adjacent sections of ore could be removed safely. The mining cycle would then repeat.

Air would be provided by intakes at the 1525 and 1875 portals, which would supply approximately 500,000 cubic feet per minute (cfm) of air. Propane units would heat the air in winter. Air would circulate through the mine workings and be exhausted through raises at the 1425 and 2175 levels as well as through the 1690 Portal.

2.3.5 Milling Process

Gold would be recovered from the mined ore in the mill situated in Liese Creek Valley (Figure 2.3-1 and 2.3-1 c). The milling process would consist of grinding the ore to a fine particle size (similar to fine sand), gold recovery through gravity separation, concentrating the remaining gold and sulfide minerals by flotation, and then recovering the gold from the flotation concentrate by cyanide vat leaching. The gravity concentration process would account for approximately 60 percent of gold recovery, with the flotation and cyanide vat leaching process accounting for approximately 40 percent. The gold from both processes would be combined and then melted to produce gold bars.

The milling process for Pogo would isolate the cyanide process from any contact outside the mill. Free cyanide and metallocyanide complexes in the thickened tailings would be oxidized in a cyanide destruction tank by means of a sulfur dioxide (SO_2)/air process. This process would reduce cyanide concentrations in the tailings pore water to less than 2 milligrams per liter (mg/L) of total cyanide (Teck-Pogo Inc., 2002b). Any residual cyanide-bearing tailings material would be placed underground in the mine in a paste (cemented) backfill. Although it would result in 1 to 2 percent lower gold recovery, the gravity/flotation/cyanide vat leach method was selected over the more conventional whole-ore cyanidation approach to minimize the environmental impact. Specifically, the Applicant chose not to use whole-ore cyanidation for the following reasons:

- Whole-ore cyanidation would result in treatment of all the tailings with cyanide. After cyanide destruction these tailings would contain low levels of residual cyanide (less than 2 parts per million [ppm]). Even low levels, however, would present an environmental management issue. Thus, conventional milling was not selected.
- The flotation process selected would concentrate the sulfide- and arsenic-bearing minerals into the gold concentrate. Only this concentrate would be leached for gold recovery and become cyanidation tailings, which then would be incorporated into the

mine paste backfill. As such, the sulfide and arsenic would be returned to their original underground location.

- The flotation and vat leach method would reduce the size of the cyanidation circuit and the quantity of cyanide required on site or present in solution.

The operation of a small cyanidation circuit processing only 250 to 350 tpd of flotation concentrate would allow the separate production and handling of two types of tailings: the tailings from the flotation circuit and tailings from the cyanidation circuit. Flotation tailings would make up approximately 90 percent of the total tailings produced. This material would contain no cyanide and low levels of sulfide. (Sulfides are potentially acid-generating minerals contained in the rock.) About half of these tailings would be filtered and trucked to the surface site for dry-stack storage. The other half would be used to make the paste backfill for the mine, along with the cyanidation tailings.

Tailings from the cyanidation circuit would make up only 10 percent of the total tailings flow. These “carbon-in-pulp” (CIP) tailings would contain approximately 90 percent of the sulfides released in the process. These tailings would be submitted to a cyanide destruction process, then mixed with roughly 50 percent of the flotation tailings and cement to make the paste backfill for mine support.

2.3.6 Tailings Disposal

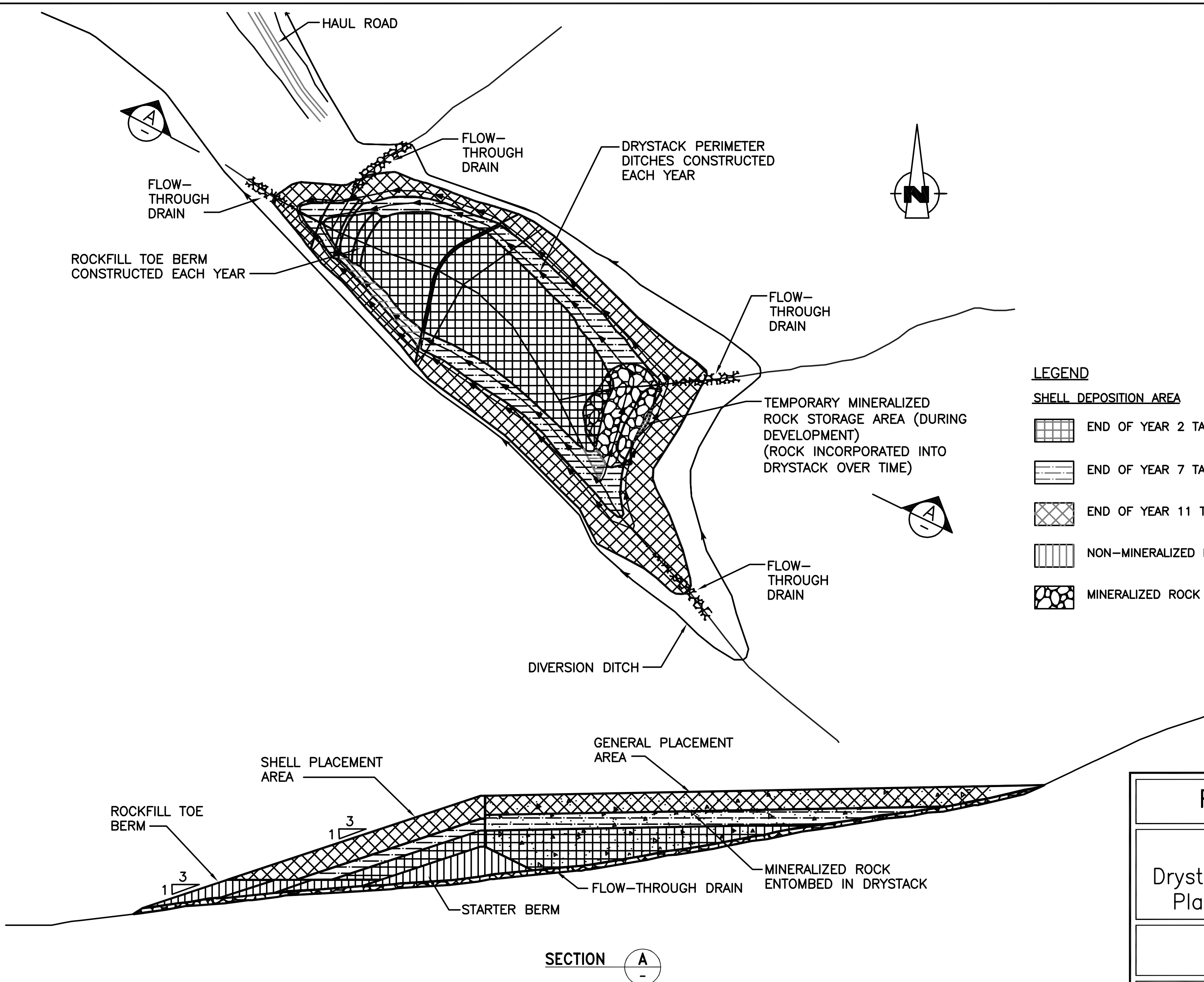
The Pogo mine would produce at least 11 million tons of tailings during its projected life. Approximately half of the tailings would be returned to the underground workings as cemented-paste backfill. The other half would be filtered to remove most of the water. The filtered material then would be delivered by truck to a dry-stack storage site at the head of Liese Creek, above the recycle tailings pond, where it would be spread and compacted as a solid earthen mass (Figure 2.3-1).

Paste Backfill

The CIP tailings from the cyanidation circuit would make up 10 percent of the total tailings flow, but would contain 90 percent of all sulfides originating in the ore. Following cyanide destruction, the CIP tailings would be mixed with flotation tailings and with approximately 2 percent cement in the paste backfill plant and pumped underground via pipeline. This combined material would harden into a relatively impermeable and stable mass when placed in the mined-out underground stopes. The hardened backfill would support the roof in mined-out areas and provide a working face and surface for mining equipment.

Dry-Stack Tailings Storage

The remaining half of the flotation tailings would be filtered to reduce the moisture content to between 12 and 15 percent, and then trucked to the dry-stack storage area on the surface of upper Liese Creek Valley (Figure 2.3-1 and 2.3-1 e). Figure 2.3-3 presents plan and section views of the dry-stack placement facility. The filtered tailings would be essentially inert, unsaturated silt and should form a seismically stable, non-acid generating and low permeability mass when placed and compacted in the stack. Development rock from the mine also would be placed within the dry stack. When the existing ore reserves were mined out, the dry-stack tailings facility is expected to contain approximately 5.4 million tons of tailings and approximately 1.9 million tons of development rock, for a total of 7.3 million tons. The site would have adequate capacity to hold a total of 20 million tons of material.



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Pogo Mine EIS

Figure 2.3-3
Drystack Placement Facility
Plan and Section Views

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18 July 2002 | AMEC File:PDEIS Figure 2.3-3.dwg

Both mineralized and nonmineralized development rock produced during mine operation would be blended with tailings material and entombed in the dry-stack storage pile. Encapsulating this rock within the solid tailings mass would minimize the oxidation of any sulfide minerals present, resist creation of seepage paths through the stack, and minimize the potential for leachate from the rock to enter the groundwater system.

The tailings would have a moisture content between 12 to 15 percent. However, because tailings have the potential to create dust, especially when they have been frozen or desiccated by the sun, procedures would be in place to control dust during drystack operations. The drystack area in the Liese Basin is not overly exposed to sun, and wind velocities are much lower than on adjacent ridges. Compacting the tailings would control dust substantially, as would controlling traffic on the drystack and limiting the use of equipment to active placement area(s) only. Summer rainfall should assist in keeping the surface moisture content within the acceptable range, although prolonged periods of warm weather with low humidity could make it necessary to build silt fences around non-active placement areas. In winter, silt fences might be required if the shell were exposed. During this time, natural or artificial snow coverings would provide cover for the shell area.

2.3.7 Laydown Areas

Construction laydown areas would be built on the Goodpaster Valley floor. Near the 1525 Portal, the existing 4-acre temporary nonmineralized development rock pile would be spread out to a total of 8 acres. Two smaller laydown areas would be developed near the existing gravel pit for a total of 4 additional acres. Another approximately 18-acre laydown area would be located adjacent to the new airstrip.

After construction, the laydown areas on the valley floor would be reduced in size, but still would be needed because of the steep nature of Liese Creek Valley, which would preclude a large laydown area at the mill.

2.3.8 Development Rock Storage

Approximately 1.92 million tons of development rock would be produced over the course of mine exploration, development, and operation (Teck-Pogo Inc., 2002i). This rock quantity includes approximately 126,000 tons already produced from the underground exploration program, and another approximately 410,000 tons to be excavated during the two-year mine development (pre-production) phase. An additional approximately 1.4 million tons of development rock would be produced from ongoing mining operations during the first 6 years of production. After 6 years, the flow of development rock would diminish because most of the underground facilities required for extraction of the ore deposit would be completed.

Development rock would result from various underground excavations, including ventilation raises, the ramp system, ore haulage system, ore passes, and ore access drifts. Development rock can be either mineralized or nonmineralized (more technically described as “weakly mineralized”). Development rock containing greater than 0.5 percent sulfur *or* 600 ppm arsenic is considered “mineralized” development rock, and rock with concentrations less than *both* of those values is considered “nonmineralized” development rock. To date, development rock produced by exploration activities has been segregated into stockpiles located on the valley floor below the existing 1525 Portal of the exploration adit (Figure 2.3-1 a).

During the mine development phase, development rock would be segregated as mineralized or nonmineralized; however, during the more time-critical operations phase, segregation on a round-by-round basis might no longer be feasible because of the bulk handling method to be employed. Thus, during operations, all development rock would be handled as mineralized rock unless otherwise analyzed and segregated on a round-by-round basis.

Nonmineralized development rock During the course of the entire project, approximately 411,000 tons of nonmineralized development rock would be placed underground, and approximately 840,000 tons of nonmineralized development rock would be placed on the surface. Test data shows that acid rock drainage and metals leaching should not be an issue for segregated nonmineralized rock stored on the surface. Nonmineralized development rock would be used as bulk fill on roads and pads, for construction of the RTP and toe berm of the dry stack, and as riprap. Up to 350,000 tons of nonmineralized rock not required for construction would be stored near the toe of the dry stack (Figure 2.3-1 e). Any rock not used to cover the dry stack after closure would be reclaimed in place.

Alternatively, if nonmineralized rock were not segregated on a round-by-round basis during operations, it would be handled as if it were mineralized, rock and therefore up to 493,000 tons of nonmineralized development rock could be placed in the dry stack.

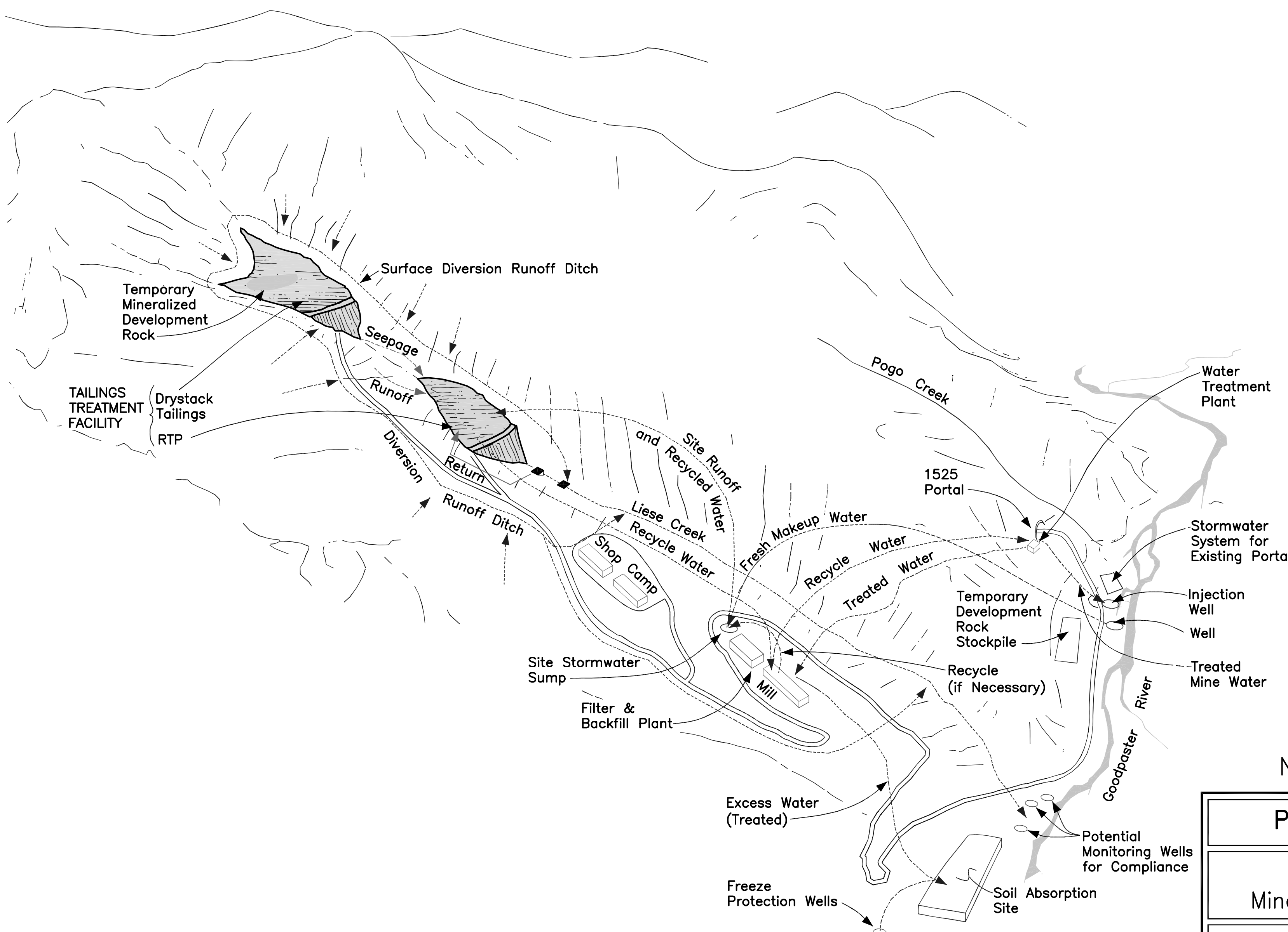
Mineralized development rock During the course of the entire project, approximately 436,000 tons of mineralized development rock would be placed underground, and 237,000 tons would be placed on the surface in the tailings dry stack. All mineralized rock ultimately brought to the surface would be disposed of in the tailings dry stack. During development, mineralized rock from the 1525 Portal would continue to be stored near the portal. Mineralized rock from the 1690 and 1875 portals would be hauled to a temporary stockpile within the overall footprint of the dry stack to minimize potential for oxidation and seepage. This rock, as well as the mineralized rock from the 1525 Portal temporary storage pile, ultimately would be encapsulated in the dry stack. Any development rock not brought to surface would be entombed underground in the backfill.

1525 Portal area storage The nonmineralized development rock that is presently stockpiled at the site below the existing 1525 Portal would be used as fill material in the laydown area and for road construction. This would free up the existing engineered polypropylene lined pad and allow placement of additional mineralized development rock on the existing lined pad as temporary storage. If there were more mineralized rock than could fit on the existing lined pad, the excess mineralized rock would be temporarily stored immediately to the north of the existing lined pad and would be moved to the temporary stockpile within the overall footprint of the dry stack in upper Liese Creek within 2 years. New nonmineralized development rock would be placed near the north end of the rock storage area over the existing vegetative mat.

2.3.9 Water Management

Geographical water flows in the mine area are shown in Figure 2.3-4. Figure 2.3-5 is a conceptual flow diagram for water management of the same mine area water flows.

The water management plan is based on maximum water recycle, minimal use of fresh water, and careful control of all site runoff. Recycled process water, mine drainage water, and surface runoff from the development area would meet mill process water requirements in most operating years. Fresh water would be needed for potable supply and would be used for processing when all other sources were inadequate. Fresh water would be obtained from groundwater wells.



Not to Scale

Pogo Mine EIS

Figure 2.3–4
Mine Area Water Flows

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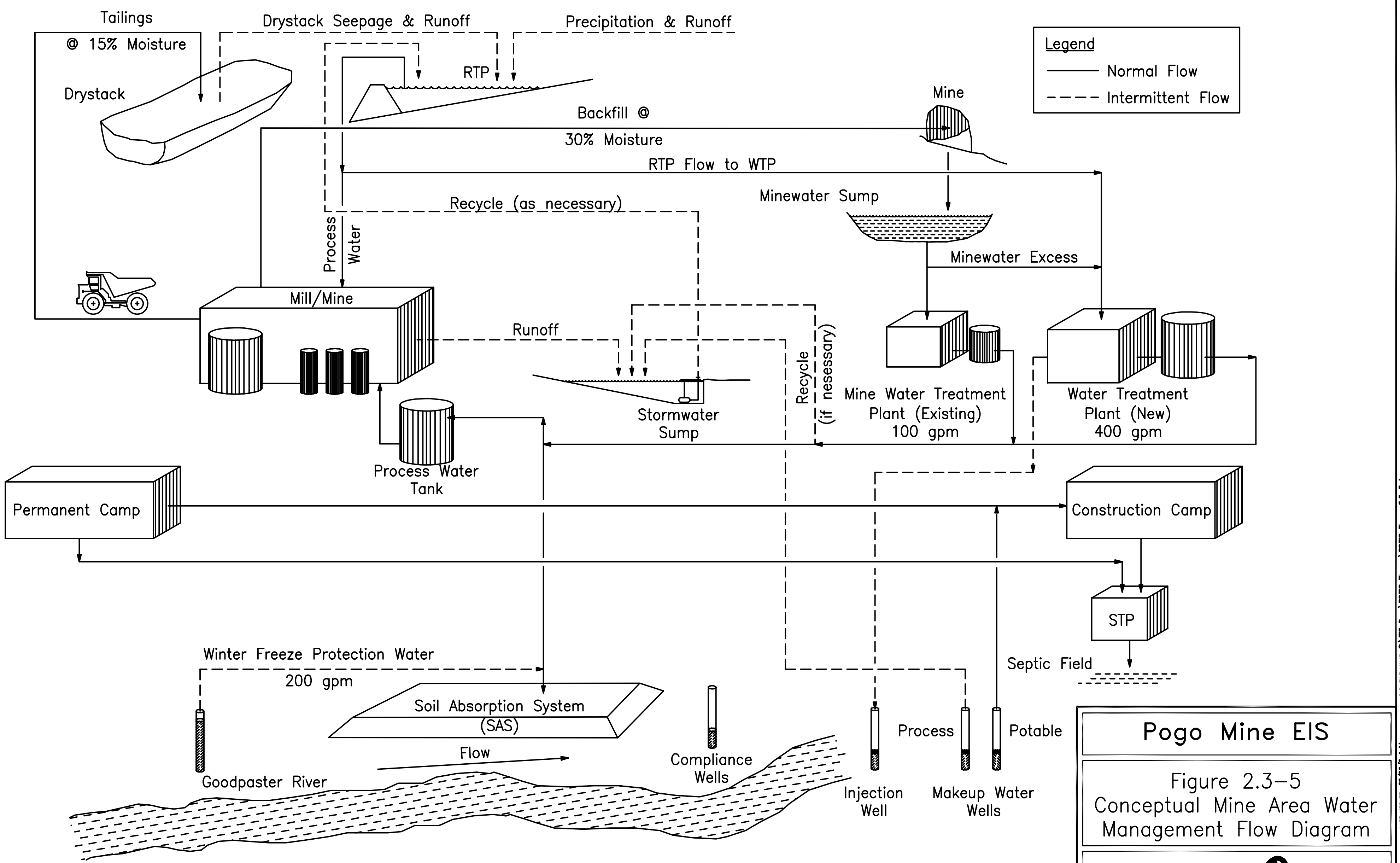

Pogo Mine EIS

Figure 2.3–5
Conceptual Mine Area Water Management Flow Diagram

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Surface Water and Runoff

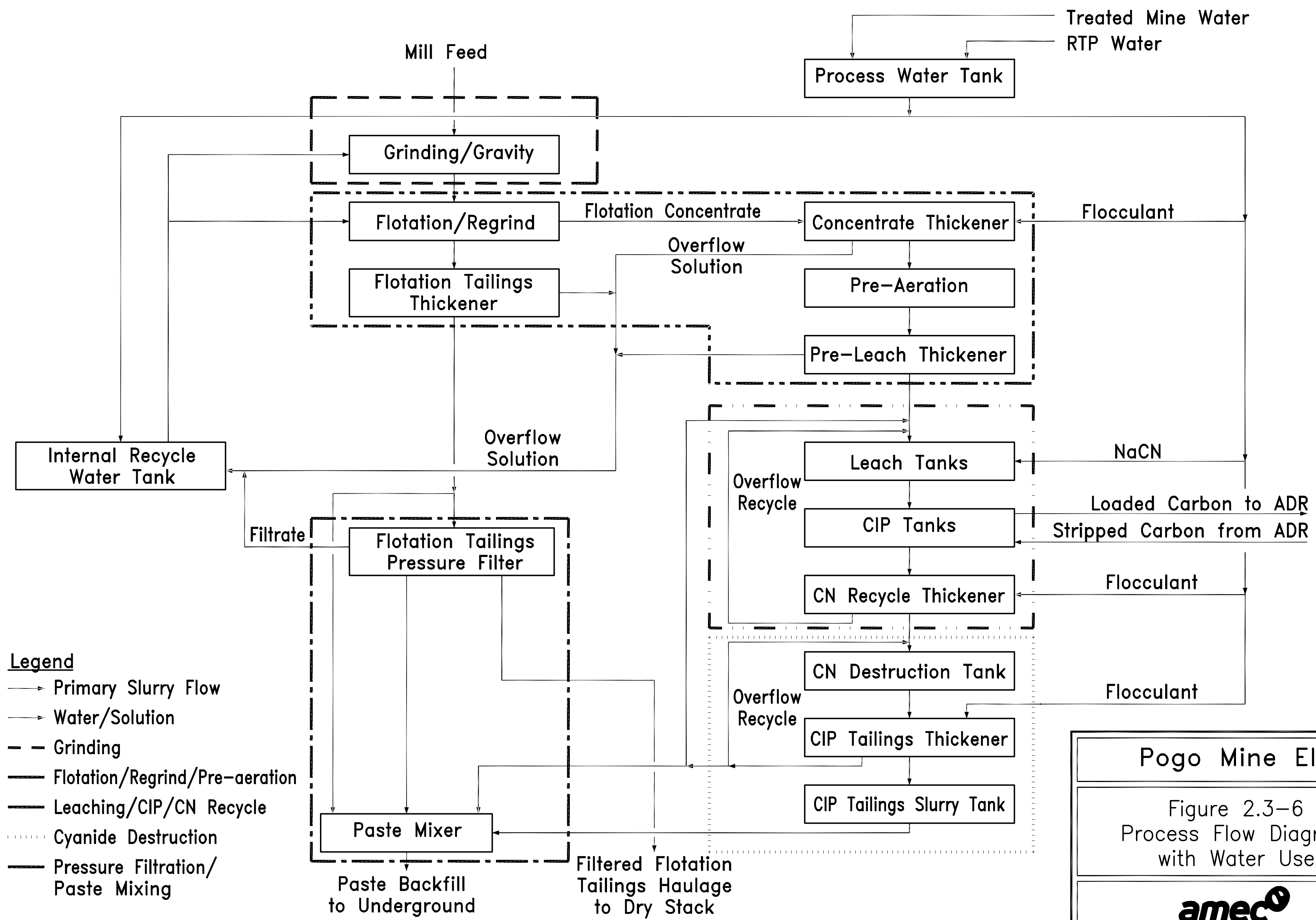
A central feature of the surface water control system would be a major diversion ditch on the hillside above and around the dry-stack tailings treatment facility and the RTP in upper Liese Creek Valley (Figure 2.3-4). The ditch also would run the length of Liese Creek uphill of, and parallel to, the dry-stack tailings and RTP access road on the north side of the valley. The diversion system would capture surface waters flowing into the Liese Creek drainage from above the site access road and would divert these waters around the dry-stack tailings facility. This would be “non-contact water,” i.e., water that had not come into contact with project facilities or mineralized/chemically processed rock. It would be routed into material site A at the mouth of Liese Creek (Figure 2.3-1 b), which would be developed into a stormwater sedimentation pond after the development phase. Overflow from the pond would be directed through an outlet works back to Liese Creek without chemical treatment throughout the life of the mine and during decommissioning.

The diversion ditch would be a “detached” ditch, which is different from the roadside ditch adjacent to the dry-stack access road (Figures. 2.3-1 c, 2.3-1 d, and 2.3-1 e). The runoff from the roadside ditch along the access road to the dry-stack facility from the mill/backfill plant would be collected and directed to the stormwater sump near the mill site, where it subsequently would be pumped to the RTP.

Mill Process

The mill has been designed to operate with maximum recycle of water. A process flow diagram with water use is presented in Figure 2.5-6. Water would be recycled from the flotation and thickening circuits, stored in an internal recycle water tank, and pumped to the grinding and flotation circuits. The cyanide vat leach section of the process also would operate in closed circuit. All water affected by cyanide in this circuit would either be recycled to the head of the cyanide circuit in the mill for reuse, or remain in the filtered CIP tailings after cyanide destruction. Therefore, all water that would be exposed to cyanide in the mill and leave the cyanide circuit would be contained in the cemented-paste backfill for the mine. The only water released from the process would be to the tailings themselves as either part of the cemented-paste backfill (cyanide and flotation tailings), or as residual moisture in the surface dry stack (flotation tailings only).

An estimated 1,174 gallons per minute (gpm) of water at 2,500 tpd, and 1,622 gpm at 3,500 tpd, would be required for processing, primarily for slurry preparation with the ground ore, for mixing reagents, and for flotation. Approximately 107 gpm of makeup water at 2,500 tpd (149 gpm at 3,500 tpd) would be needed to replace water retained in the tailings material. Water would be obtained from three sources (listed in order of priority) to satisfy the makeup requirement. mine drainage water, RTP water, and fresh water from wells. Mine drainage water likely would satisfy all the process water requirements under most circumstances for the project. A conceptual site water balance for an average case at 2,500 tpd is shown in Figure 2.3-7.



Pogo Mine EIS

Figure 2.3-6
Process Flow Diagram
with Water Use

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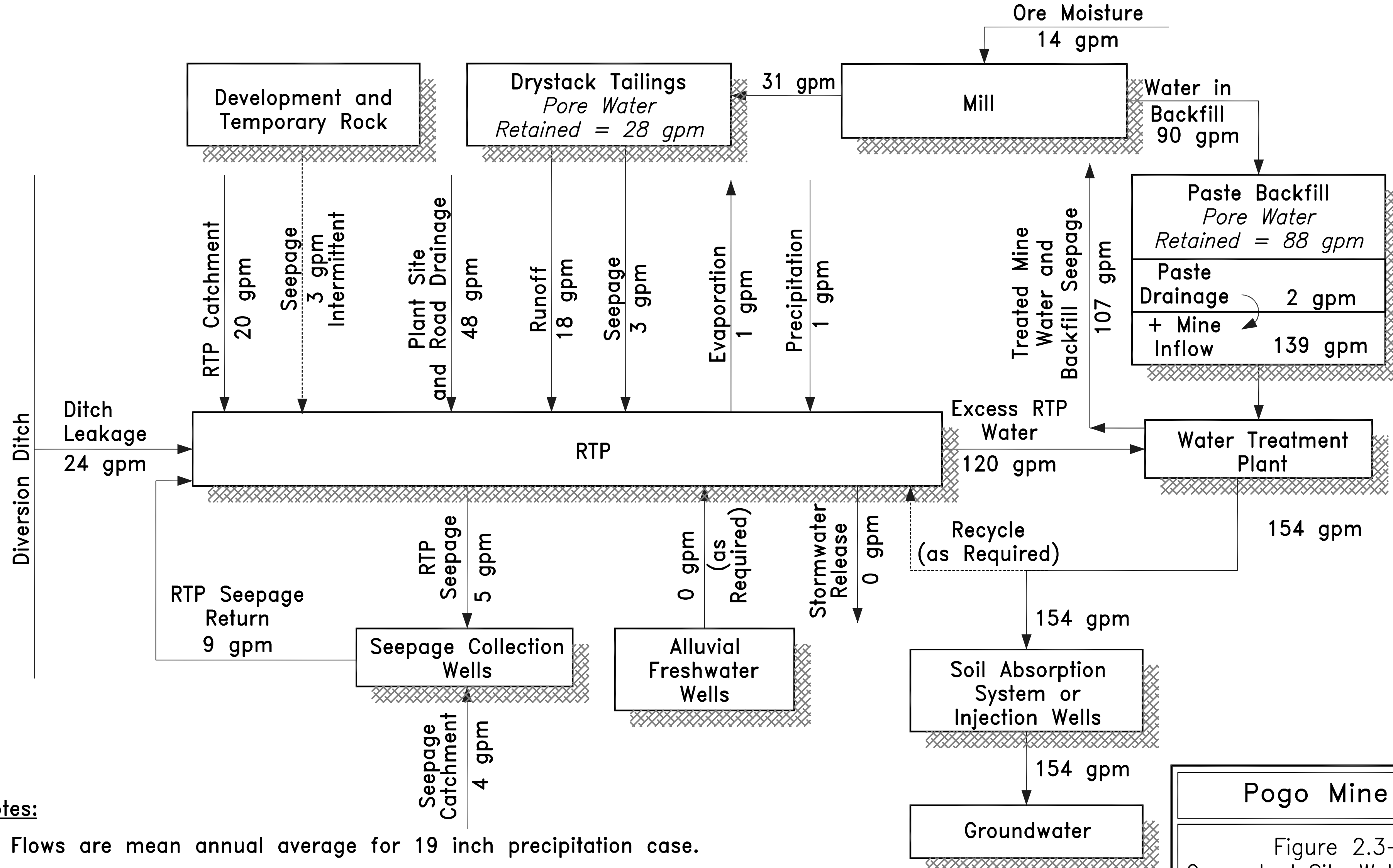

Notes:

1. Flows are mean annual average for 19 inch precipitation case.
2. Average mine inflow.
3. All development rock is incorporated in the drystack by year 6.
4. Up to 200 gpm of freeze-protection water would be pumped from the alluvial freshwater wells to the SAS.

Pogo Mine EIS

Figure 2.3-7
Conceptual Site Water Balance at 2,500 tpd – Average Case

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Mine Water

Mine water inflows are expected to average approximately 139 gpm, with a peak annual inflow of approximately 205 gpm. The mine drainage water is expected to have low but measurable levels of cyanide and other metals. All available mine water would be used in the mill process before any additional makeup water were obtained from the RTP to ensure that the residual cyanide and metals in the mine water would be entrained in the tailings solids sent either to the underground as cemented backfill or to the dry stack. Mine water likely would satisfy all the process water requirements under most circumstances for the project. Mine drainage water would be collected in a large sump in the mine and pumped to treatment facilities either in the mine or near the mouth of the existing 1525 Portal in the Goodpaster Valley, from which it would be discharged to the injection wells or soil absorption system (SAS), sent to the mill as process water, or recycled to the RTP.

Recycle Tailings Pond

Water would accumulate in the RTP from snowmelt, stormwater runoff from the mill, camp and associated roads, seepage from the dry-stack tailings, and fresh water pumped to the RTP to provide water during dry periods when precipitation and mine water inflows were insufficient for process plant needs. RTP water would be used for process makeup requirements to fill demand not met by mine water flow.

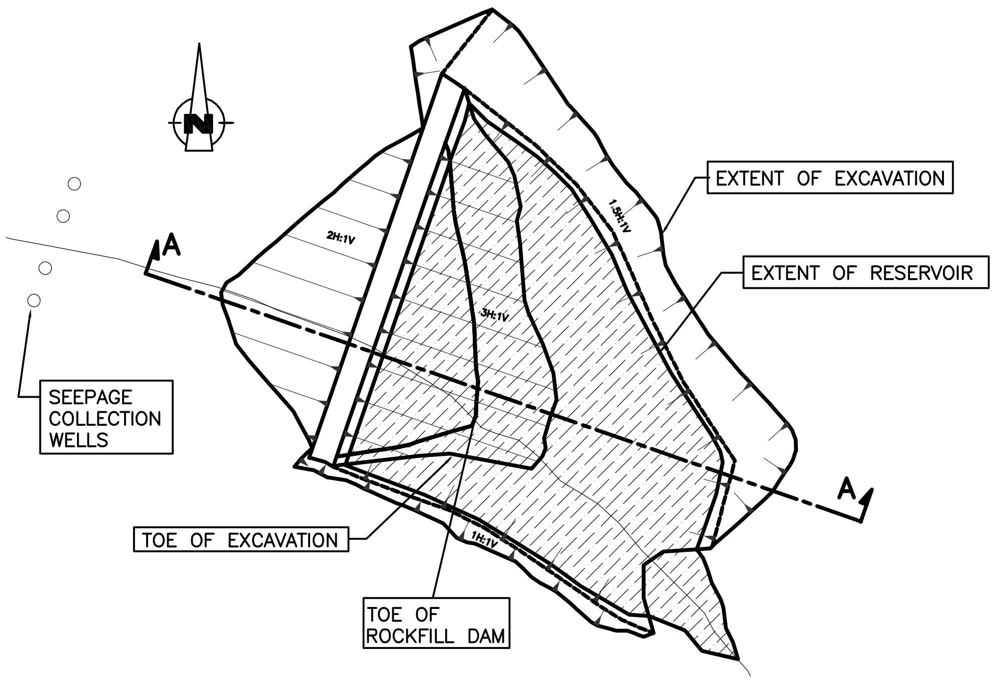
The RTP would be built by constructing a dam downstream of the dry-stack tailings facility in Liese Creek Valley. A cross-section view of the 40-million-gallon RTP is shown in Figure 2.3-8. Although the bottom of the RTP would be unlined, the dam itself would be a lined, rock-fill structure with expansion capability. The RTP would provide storage for snowmelt runoff and the 100-year, 24-hour-intensity storm event. Summer season operating water levels in the dam would be kept below the 100-year, 24-hour-storm volume requirement. The RTP would provide a total of 40 million gallons of water storage. Modeling showed the RTP would overtop and discharge without treatment only infrequently (22 times in 1,000 years) during major storm or runoff events.

The dam would be constructed with nonmineralized development rock and local borrow materials from within the water storage basin. Because of the absence of adequate fine-grained soils in the vicinity for developing a dam core of high integrity, a composite synthetic liner system would be placed on the upstream face of the dam. This liner system would be tied into a vertical seepage cutoff trench and/or extended in a sloping trench at the upstream toe. Selection of the actual method of seepage cutoff would depend on the preferred technical alternative.

A seepage collection well and pump-back system would be incorporated into the downstream toe of the dam. The seepage wells would be installed through all overburden and into the bedrock beyond the immediate downstream toe of the 40-million-gallon dam. This system would allow for dam raising downstream, providing an appropriate degree of flexibility at this stage of design. A system of monitoring wells would be developed downstream of the seepage collection wells to monitor the performance of the seepage collection system.

Fresh Makeup Water

Fresh water would be added to the RTP for makeup water when the other water sources were inadequate for process requirements. This water would come from wells in a suitable area of alluvial sediments in the Goodpaster Valley and in upper Liese Creek Valley above the dry



GENERAL LAYOUT PLAN

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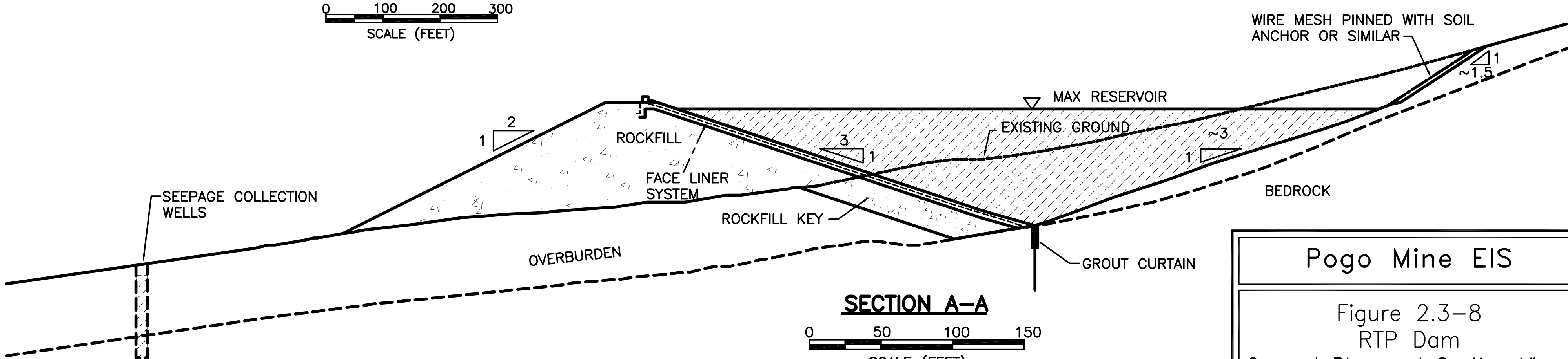

SECTION A–A

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Pogo Mine EIS

Figure 2.3–8
RTP Dam
General Plan and Section Views

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stack, to supply at least 150 gpm of fresh water. A fresh water supply pipeline would be routed from the wells to the RTP and to the plant site for potable water supply.

Potable Water

There would be three potable water supply sources. The first would be wells drilled into the alluvial gravels of the Goodpaster Valley near the 1525 Portal to supply the construction camp (Figure 2.3-1 a). The second would be wells drilled into the colluvium in upper Liese Creek Valley above the dry stack (Figure 2.3-1 e). These wells would have two purposes: water supply and dewatering of the colluvium to reduce winter water flows in the diversion ditches.

The third possible source would be the wells drilled in the Goodpaster Valley upstream of the off-river treatment works (Figure 2.3-1 b). If the upper Liese Creek wells were inadequate, the wells in the Goodpaster Valley, either near the 1525 Portal or near the off-river treatment works, would be used.

A treatment facility would filter and chlorinate the potable water before use. An average of approximately 100 gallons per day (gpd) of potable water would be required for each camp resident.

2.3.10 Water Discharge

Treatment

All water from the RTP and the mine drainage would be treated at one of two treatment plants before discharge. The existing 100-gpm plant would remain underground, and the new 400-gpm plant would be built on the surface near the existing 1525 Portal. Both plants would be capable of discharging to both the SAS and the underground injection wells, and could provide process water to the mill and recycle water to the RTP.

The water treatment plants would use two processes to remove contaminants from the water before discharge. A high-density sludge process would enhance co-precipitation of metals, including arsenic. A lime-softening and recarbonation process would remove calcium and magnesium and thereby reduce total dissolved solids (TDS). Sulfide precipitation, which would precipitate heavy metals such as lead, cadmium, and copper to the sludge, would be available as a contingent measure if additional treatment were necessary.

The final treatment stage would use a multi-media pressure filter to polish the treated water for removal of residual suspended solids prior to discharge to the SAS. Excess sludge generated by the process would be dewatered by using a filter press to produce a cake for underground disposal with tailings paste backfill.

The flexibility would exist to discharge directly to the injection wells on an as-needed basis if the treated water were of sufficient quality to meet the injection well influent criteria.

Soil Absorption System

The SAS would consist of a distribution pipe network placed above an approximately 4.4-acre engineered soil column adjacent to the airstrip (Figure 2.3-1 b). The system would deliver water at up to 400 gpm from the water treatment plant. Water would flow down through the absorption system and into the near-surface alluvium material of the Goodpaster floodplain. Figure 2.3-9 shows a cross section and details of the SAS.

The absorption field would use perforated pipe and a mixed soil consisting of medium sands and silts with some organic component. During passage through the soil, residual metals would be removed through adsorption onto the soil particles. Cyanide metal complexes would be removed through adsorption and biological degradation. Ammonia would be removed by biological degradation in a manner analogous to a septic leach field. Diffusion and travel time would result in the attenuation and dispersion of the treated water. Modeling showed approximately 1 year of travel time between the SAS and the Goodpaster River (AMEC, 2001b; Teck-Pogo Inc., 2002f, Appendix C). [Uncertainty in these predictions may be considered moderate, given the reasonably good knowledge of the alluvial groundwater flow system hydraulics. The choice of conservative input values tended to skew model inaccuracies toward the conservative side, thus providing a model that yielded results that may reflect a conservative estimate.]

Industrial Wastewater

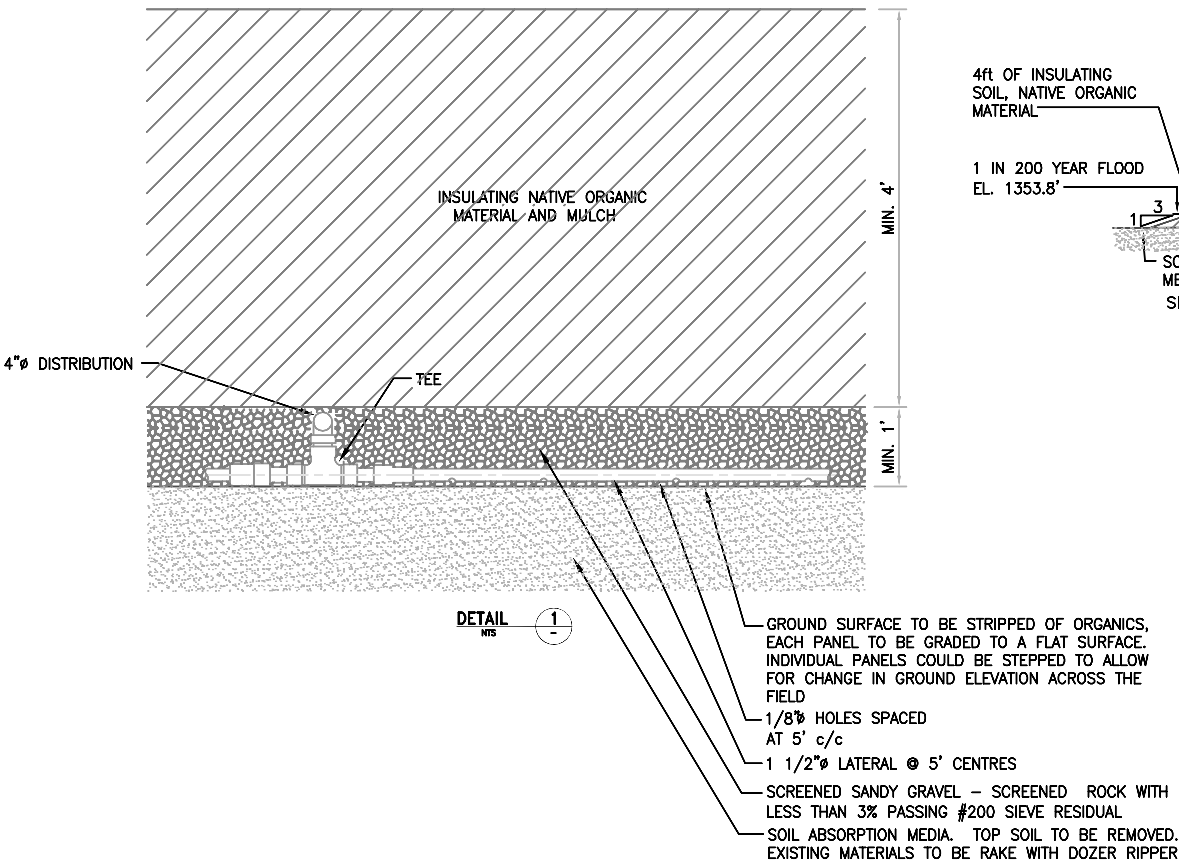
Precipitation and other water reaching the RTP in excess of the project's water recycle needs would be treated near the existing 1525 Portal as necessary and discharged via the SAS. Discharge would not exceed the net allowable discharge, defined as the net precipitation in excess of evaporation plus mine drainage. Excess precipitation and other water that would collect in the RTP under normal operating conditions is expected to have relatively low contaminant levels. Still, treatment to achieve water quality standards before discharge would be necessary. As the mill process is designed, minimal cyanide should reach the RTP; however, the soil absorption system would be capable of treating cyanide (Teck-Pogo Inc., 2002b).

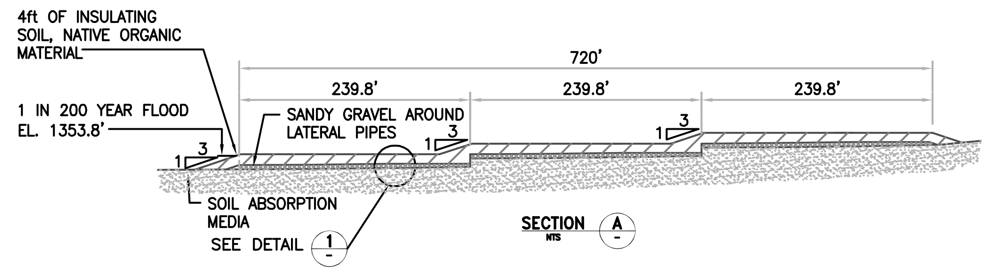
Domestic Wastewater

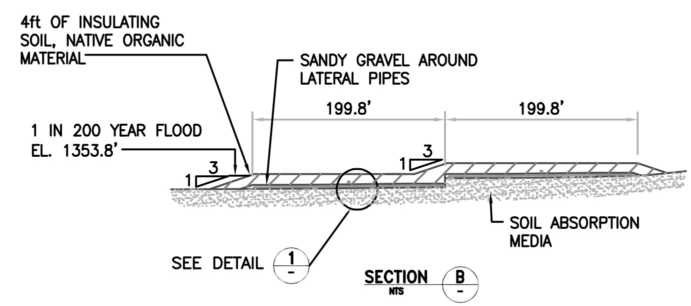
For the initial development phase, a package treatment plant at the construction camp below the 1525 Portal would discharge to an underground drain field at the camp. Once the mill and camp complex was constructed, lift stations would be located in each of the main buildings to pump sanitary sewage to a package treatment plant within the camp complex. During the remainder of the development phase, treated effluent from this plant would be discharged to a temporary underground drain field on the south-facing side slope below the camp in Liese Creek Valley. During operations, treated effluent would be piped through the mine to the permanent underground discharge field at the construction camp. Sludge from the package treatment plant would be periodically removed and disposed of in accordance with ADEC-approved procedures.

2.3.11 Power Supply

The maximum power demand for the mine, mill, camp complex, and other facilities is estimated to be 10 MW at 2,500 tpd throughput and 14 MW at 3,500 tpd. To meet this demand, the Applicant would construct a 138-kilovolt (kV), three-phase power line, from the Golden Valley Electric Association (GVEA) Fairbanks to Delta Junction power line near the Richardson Highway to the mine site (Figure 2.3-2). The power line would originate from a new, approximately half-acre substation at the existing transmission line near TAPS north of Shaw Creek Road (Figure 2.4-4).







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Pogo Mine EIS

Figure 2.3-9
Soil Absorption System
Sections and Details

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The power line generally would closely follow the Shaw Creek Hillside all-season road, with approximately 40 percent of its route being a single, combined corridor cleared for both components. The route would be up Shaw Creek Valley and over the Shaw Creek and Goodpaster River divide to the mine site. The power line would deviate in a major way from the road in two places, however. The first would be in the vicinity of Caribou Creek. The second would extend an additional two miles up Shaw Creek Valley and then turn east up Sutton Creek Valley. This would avoid exposure to wind and icing which likely would occur along the all-season road route following the ridge crest.

The "H-frame" power pole configuration would consist of two tapered wood poles, a wooden cross arm, and a wooden cross brace if needed for strength purposes, similar to the existing GVEA transmission line between Fairbanks and Delta Junction. Structures would be anchored using stranded steel guy wire and soil or rock anchors. Typical structures would be approximately 70-ft tall. Spans would range from 400 ft to 1,200 ft, with most spans ranging from 600 ft to 800 ft. All wood members would be pressure treated to reduce decay. A 30-ft minimum vertical clearance for the wires above ground would be maintained where the line crossed roads and areas likely to be accessed by snow machines; a 26-ft minimum vertical clearance for wires would be maintained elsewhere. At the Goodpaster River Bridge, the line would be suspended directly from towers on both sides of the river, independent of the bridge. No power line structures would be placed in the Goodpaster River bed.

Where the power line followed the road across wetlands, power poles would be placed as close to the road as possible to minimize disturbance of wetlands. Where the power line was not adjacent to the road, some clearing and spur trail development from the road would be necessary for equipment access for pole installation and stringing line. At these spur trails, fill would be placed as needed to create ramps extending 20 ft to 40 ft beyond the toe of the road embankment. Spur trails would be sited to minimize disturbance to wetlands. Most wetland access would occur with low-ground-pressure vehicles. The portion of the power line between upper Shaw Creek Valley and the Shaw Creek and Goodpaster River divide above Wolverine Creek would be accessed by helicopter or in winter over a winter road constructed along the power line alignment.

Poles typically would be embedded by auguring an approximately 30-in.-diameter, 10-ft-deep hole, and then back filling. In areas with poor soil conditions such as wetlands, driven pipe pile foundations (approximately 30 in. diameter) and anchors (approximately 8 in. diameter) could be needed to support the structures. These sites would be accessed by low-ground-pressure vehicles in winter or by helicopter.

The approximately 43-mile power line ROW would be 125 ft wide. Vegetation would be cleared near ground level by hand, hydro-ax, or other mechanical means. The vegetative mat would be left intact where feasible. There would be no blading of ground vegetation in flat-lying wetland areas. Vegetation more than 10 ft tall generally would be cleared, but it could be left intact in such areas as depressions, gullies, swales, or over low-vegetation wetlands were it was determined to be sufficiently below the power line conductors. At a minimum, any tree with the potential to fall and contact the wire or pole structures would be removed, even outside the ROW. The ROW width would be periodically cleared with the intent of protecting the line from forest fires.

Step-down transformers (138 kV/4.16 kV) would be installed at the mine site. Site distribution voltage would be 4,160 volts. On-site backup power would be supplied by two 750-kilowatt (kW) generators at the mill, two 500 kW generators at the camp, and a 250-kW generator at the water treatment plant. This backup power capacity would be sufficient to power key motors, pumps, water treatment, and lighting both underground and on the surface. These items would draw from the same fuel storage facilities as would the mobile equipment.

2.3.12 Fuel Supply

During construction, the existing facility for diesel fuel storage at the exploration camp near the 1525 Portal, consisting of eight 20,000-gallon tanks, would continue to be used on a temporary basis. An additional fifteen 20,000-gallon diesel tanks would be placed temporarily on the apron at the new airstrip. These tanks would be filled during operation of the winter road; they would continue to be supplied by air as necessary until the all-season road was completed. All tanks would be located within a bermed and lined containment area with a capacity of at least 110 percent of the largest tank. Once construction was completed, all diesel storage tanks at the construction camp and the new airstrip would be removed from the valley floor.

During operations, main permanent diesel storage would consist of two 20,000-gallon tanks located near the maintenance shop in Liese Creek Valley, with a 5,000-gallon tank at the mouth of the 1525 Portal 200 ft above and 1,400 ft from the Goodpaster River. A fuel truck would transfer fuel from the main storage tanks for delivery to remote equipment and smaller storage tanks.

Smaller diesel tanks with secondary containment would be located at the mill building and the camp. These tanks would be used for fuelling heaters, backup generators, and the incinerator. The total on-site capacity for diesel fuel storage during operations would be approximately 50,000 gallons.

A 5,000-gallon tank would be located permanently near the new airstrip for storing Jet-A fuel.

Up to 50,000 gallons of propane storage would be provided near each of the 1525 Portal and the 1875 Portal. These tanks would supply the mine air heaters and would typically be full only in the winter months. An additional 5,000 gallons of propane storage would be placed near the mill to fire the carbon-stripping water heater. A total of approximately 105,000 gallons of propane storage would be provided on site.

Diesel and propane would be transported to the site over the initial Goodpaster Winter Trail in 5,000-gallon tanker trucks. The tanks then would be refilled as necessary by 8,000-gallon tanker trucks using the all-season road for the life of the project.

Near the maintenance shop in Liese Creek, up to 5,000 gallons of used oil would be stored. This oil would be dewatered, filtered, and burned for shop heat. Records would be kept to document whether the oil was on or off specification.

2.3.13 Material Sites

Approximately 1.1 million cu yd of gravel and rock materials would be excavated, and approximately 955,000 cu yd would be placed to construct the mine site facilities. Cuts and fills would be balanced throughout the project wherever possible.

Three material sites would be developed in the Liese Creek Valley to support project development. Material site A, located near the mouth of Liese Creek (Figure 2.3-1 b), would be required for initial construction and would be used to provide fill for the road in Liese Creek Valley.

Material site B would be developed to produce coarse rock for construction of the rock-fill RTP dam (Figure 2.3-1 e) This site also would be used for riprap and other rock-fill requirements as needed. After initial construction, portions of this site would be used as a surface solid waste facility for disposal of general wastes.

Material site C, adjacent to site B, would be developed to produce riprap and other bulk fill needed for project closure, including the riprap required to armor the dry-stack perimeter channels.

Approximately 140,000 cu yd of gravel would be required from borrow pits in the Goodpaster Valley alluvial gravels. Approximately 870,000 cu yd of rock would be excavated. Rock material sources would be developed in conjunction with construction of the major facilities for the project (i.e., at the 1525 Portal, mill site, campsite, and RTP area).

Gravel mining would be conducted according to the following design criteria:

- Larger timber, more than 8 in. in diameter, on the borrow sites would be sawed and used for construction or support activities or would be cut, decked, and removed for sale off site or otherwise disposed of pursuant to DOF regulations.
- Smaller timber, slash, and brush would either be chipped or mulched and would be added to the topsoil as an amendment.
- Organic material consisting of surface vegetation, stumps, and root wads would be segregated and stockpiled. Silt and sand overburden would be segregated and would be stockpiled and maintained in a manner to minimize wind and water erosion and compaction until required for reclamation purposes.
- Excavation would be limited to within 10 ft of the outer perimeter of the cleared area.
- In thawed areas, gravel mining would be conducted by dragline to increase digging depths and reduce the surface disturbance required. In frozen areas, gravel mining would be conducted by drilling and blasting. Expected pit depths would be approximately 25 ft, with side slopes of 1.5 to 1.
- Shoreline length and diversity would be maximized to the extent practicable. Consideration would be given to maintain appropriate pit slopes to ensure stability and avoid wildlife entrapment.
- The gravel pit locations would provide appropriate setback distances from the Goodpaster River.

2.3.14 Organic and Growth Media Management

Organic material such as surface vegetation, root wads, and growth media from certain areas of the project, would be segregated and stockpiled for future use. Growth media is the near-surface soil, silt, and sand that could be respread in the future to support revegetation.

An estimated 185,000 cu yd of growth media would be salvaged, stockpiled, and protected from erosion due to wind and water through Best Management Practices (BMPs). The stockpiles also would be seeded which, in addition to helping prevent erosion, would enhance the growth media's biological properties that aid in nutrient absorption.

What is a BMP?

A Best Management Practice (BMP) is a way of doing something to meet an objective, often to minimize a particular impact. As an example, in the context of preventing soil erosion from construction-related ground surface disturbance activities, BMPs could include:

Spruce bough barrier – spruce tree sections, including fully needled boughs and limbs salvaged from clearing operations, may be placed in road ditches or at the toe of slopes to reduce flow velocity and encourage sediment dropout.

Natural vegetative filter – natural vegetation will be left in as close proximity to the construction disturbance as possible in order to trap silt or sediments before they reach a watercourse.

Check dams – a small device constructed of rock, sandbags, or fiber rolls, placed across a natural or man-made channel or drainage ditch. Check dams reduce scour and channel erosion by reducing flow velocity and encouraging sediment dropout

Desilting basin – a temporary basin formed by excavation and/or construction of an embankment so that sediment-laden runoff is temporarily detained under quiet conditions, allowing sediment to settle out before the runoff is discharged.

Straw bale barrier – a temporary linear barrier consisting of straw bales, designed to intercept and slow sediment-laden sheet flow runoff to allow sediment to settle before water leaves the construction site.

2.3.15 Refuse Disposal

All on-site refuse would be disposed of as authorized under the mill site permit. After initial construction, portions of material site B adjacent to the surface dry stack in upper Liese Creek Valley would be used as a surface solid waste facility for disposal of general wastes (Figure 2.3-1 e). The facility would be developed as a series of cells that would be kept to a manageable size to allow progressive reclamation. Cells would be covered with a layer of soil or nonmineralized development rock to minimize water percolation and ensure that buried refuse would not attract wildlife such as bears. The surface surrounding the facility would be graded to prevent precipitation from ponding or draining into it, and surface water runoff would be collected and routed to the RTP. Two monitoring wells would be placed in the bedrock downgradient of the surface facility.

This solid waste facility would receive nonhazardous waste products such as dewatered sewage sludge, incinerator ash and residue, iron (e.g., drill steel, balls, and empty cans), tires, empty plastic and glass containers, empty triple-rinsed chemical containers, contaminated soils, spill boom, liners used for the containment of spilled materials, chemicals used in the cleanup of spills or other spill cleanup wastes, and construction debris.

Clean general mine refuse (such as pallets, cardboard packaging, nonrecyclable containers, and nonputrescible refuse) either would be first burned in diesel-fired incinerators or burned in open pits and then placed in the facility. Putrescible wastes would be stored indoors, or would be stored outdoors in closed containers in a fenced area to prevent access by wildlife. All putrescible refuse would be incinerated before being buried in permitted, on-site trenches. The incinerator would operate under a permit from the ADEC and would comply with all state air-quality regulations.

Materials not designated for disposal on the site would be sorted and shipped to Delta Junction or Fairbanks for recycling or disposal. All waste material either listed as, or meeting the characteristics of, hazardous waste would be shipped off the site and disposed of according to applicable state and federal regulations. All used oil filters would be drained and disposed of in an approved manner or recycled for scrap metal. Waste petroleum oils would be stored on the site for reuse as fuel for space heaters or would be transported off the site for recycling.

2.3.16 Commodities Transport

Delivery of major commodities to the mine site would be as follows:

- Cement would be transported in 27-ton capacity bulk trucks.
- Grinding balls would be transported on trailers.
- Process consumables and spare parts would be transported primarily in containers.
- Food would be transported in containers.
- Highway truck-trailers would carry two containers per trip and would be limited to a payload of 10.5 tons of cargo per container, totaling 21 tons of cargo.

Table 2.3.2 and Table 2.3-3 show the materials quantities that would be transported to the site during construction and operation, respectively.

Table 2.3-2 Commodities Transport Quantities During Construction (tons)

Commodity	Year 1	Year 2	Total Freight
Mining equipment	2,000	5,000	7,000
Mining consumables	2,000	3,000	5,000
Concrete materials	1,100	-	1,100
Structural steel	1,400	-	1,400
Architectural	-	2,400	2,400
Mechanical equipment	-	3,400	3,400
Instruments	-	300	300
Construction equipment	900	-	900
Temporary facilities	400	-	400
Fuel	5,000	4,000	9,000
Food & camp supplies	400	400	800
Miscellaneous	2,850	2,850	5,700
Total	**14,050**	**21,350**	**37,400**

Source: Teck-Pogo Inc. (2002a)

Table 2.3-3 Annual Commodities Transport Quantities During Operations (tons)

	Commodity		2,500 tpd Scenario	3,500 tpd Scenario
Mine	Cement		14,000	21,000
	Propane		2,000	4,000
	Consumables		4,000	6,000
	Explosives		1,000	1,500
		Subtotal	21,000	32,500
Mill	Grinding Media & Liners		2,000	3,000
Mill Reagents	Lime		1,000	1,500
	Sodium cyanide		1,000	1,500
	Potassium amyl xanthate		41	57
	Aero Promoter 208		68	96
	MIBC		64	89
	Flocculant		55	77
	Sulfuric acid		500	750
	Sodium metabisulfite		1,000	1,500
	Copper sulfate		50	75
	Activated carbon		5	10
	Nitric acid		20	30
	Sodium hydroxide		30	45
		Subtotal	3,833	5,729
Fuel	Gallons		786,000	1,300,000
	Tons		2,800	4,620
Spare Parts			250	400
Food & Camp Supplies			290	500
		Total (tons)	30,173	46,749
Personnel			10,000	14,700
Bus Round Trips			330	490

Source: Teck-Pogo Inc. (2002i)

2.3.17 Reagent Handling

Reagents typically would be purchased in normal commercial bulk containers or packaging, such as tote bins, barrels, palletized sacks, and Super Sacks, and would be loaded into shipping containers at the point of origin and shipped to the mine site. Cyanide would be transported only as dry pellets inside plastic bags inside wooden boxes inside metal shipping containers in conformance with all federal and state hazardous materials transportation regulations. Reagents would be stored in a covered building adjacent to the mill. All storage areas would be diked for collection of spillage and cleanup to prevent loss to the environment. Reagents would be mixed in steel or other tanks inside the mill building and be pumped to their addition points in the process. Any spills would be contained within the concrete dikes of the reagent area and collected in a sump for disposal or for return to the process tanks.

A spill response plan for shipment of hazardous materials, including cyanide, would be required as an ADEC permit condition.

2.3.18 Explosives Handling and Controlled Firing Area

Explosives would be transported to site by means of conventional truck haulage, and would be used on site, in accordance with U.S. Bureau of Alcohol, Tobacco, and Firearms regulations.

Explosives would be stored underground in an explosives magazine. Locked storage magazines would be provided for caps, detonating cord, primers, and boosters. Secure storage would be provided for blasting agents such as emulsion, and bagged ammonium nitrate or ammonium nitrate/fuel oil. Any spills would be collected in a containment area and disposed of in accordance with applicable federal and state standards and regulations.

A controlled firing area (CFA) would be established in which explosive activities would be conducted in a controlled manner to prevent any hazard or impact on aircraft. Within the CFA, the Applicant would keep watch for passing aircraft and immediately terminate the hazardous activity if an aircraft approached the area. Also, certain visibility conditions would be adhered to. There would be two controlled firing areas, one with horizontal boundaries which would approximate the millsite lease boundaries, the other which would approximate the road construction corridor, with a vertical distance between ground level and 500 feet above ground level. Blasting activities within the CFA could potentially occur 24 hours per day throughout the project life.

2.3.19 Spill Containment

The plant site would be designed with levels of containment for spills. Any reagent spills would be contained within the concrete dikes of the reagent area and collected in a sump for disposal or for return to the process tanks. Any spills of cyanide leach solutions or other process materials would be contained within concrete diked areas within the mill building or around outside process tanks. In the unlikely event that a spill were to escape the building, all surface drainage would flow to sumps on the plant site. Such collected internal or external spills would be returned to the mill process.

2.3.20 Mine Equipment

Table 2.3-4 contains a preliminary list of mine site equipment.

Table 2.3-4 Preliminary Mine Large Equipment List

Equipment Item	No.	Equipment Item	No.
Two-boom electric hydraulic jumbo	4	Explosive loading vehicles	2
One-boom electric hydraulic jumbo	1	Mechanic’s vehicle	1
Rock bolters	2	Fuel truck	1
Load haul dump truck – 8 cu yd	4	Lube vehicle	1
Load haul dump truck – 6 cu yd	2	Personnel carrier	5
Load haul dump truck – 3 cu yd	1	Electrician’s vehicle	1
Load haul dump truck – utility with forks	1	Water pumping truck	1
50-ton diesel haulage trucks	4	Service scissors lift	2
Dozer	1	Grader	1

Source: Teck-Pogo Inc. (2002a)

2.3.21 Worker Accommodations

Workers would be housed in a permanent camp uphill of the mill site in Liese Creek Valley (Figure 2.3-1 and 2.3-1 d In addition to sleeping quarters, the camp would include facilities for a kitchen; dining, lounge, television, recreation, games, and laundry rooms; and storage. The complex also would have a first-aid and medical facility. The preconstructed modules would be double-stacked and meet the appropriate State of Alaska fire, safety, and occupancy requirements. They would be placed on concrete foundations, overlying cut-in weathered bedrock or compacted fill, and would be insulated to preserve the permafrost, if present.

Each dormitory room would contain two beds and be double-occupancy during the construction phase, giving a total camp capacity of approximately 500 persons during construction and 250 during operations. Washrooms and showers would be centrally located. Enclosed walkways would connect the accommodation complex to the dining facilities and to the worker’s drying shed, offices, shops, and warehouse building.

The existing exploration camp near the 1525 exploration portal in the Goodpaster Valley would be expanded to accommodate approximately 200 workers during the construction period. This camp would be removed after startup.

2.3.22 Communications

The primary methods of communication in the mine, mill, shops, and camp would be on-site telephone systems, intercoms, and radios. All radio and telephone communications would be coordinated through the main security office. Responses to emergency situations and routine warnings for conditions such as blasting and hazardous materials transportation would be communicated through the security department.

2.3.23 Workforce

The mine and mill would be staffed and operated 24 hours per day, 365 days per year. The 2,500-tpd operation would require approximately 288 employees, of whom 172 would work in the mine department, 23 in management and administration, 70 in the mill and maintenance departments, and 23 as contract employees. At 3,500 tpd, the project would employ approximately 360 employees, of whom 215 would work in the mine department, 29 in management and administration, 86 in the mill and maintenance departments, and 30 as contract employees.

Operations and mining personnel are expected to be recruited from the workforce that lives in the Delta Junction and Fairbanks areas. Managerial and technical personnel necessarily would be recruited more widely. Table 2.3-5 presents the preliminary annual operations staffing for both the 2,500- and 3,500-tpd scenarios.

Because the relatively remote project site would make daily commuting impractical, a permanent camp would be constructed on site, and employees would rotate in and out on buses or aircraft in accordance with their shift schedules. Mill, maintenance, and underground staff likely would work a 4-day-on and 4-day-off rotation. Supervisory staff would generally be assigned to a 4-day-on and 3-day-off rotation. Personnel on rotations would share rooms with employees on the opposite rotation. Additional rooms would be allocated for contract and other personnel temporarily on site.

Table 2.3-5 Preliminary Annual Operations Staffing

	Classification	2,500 tpd	3,500 tpd
Process Plant	Supervision	10	12
	Technical labor	4	7
	Operating labor & trainees	16	22
	Maintenance labor	10	12
	Subtotal Process Plant	**40**	**53**
Mining	Production & development	31	44
	Haulage	8	10
	Construction	2	2
	Mining services & trainees	21	25
	Maintenance services	25	27
	Subtotal mining	**87**	**108**
	General & administration	17	21
	Engineering and Geology	15	19
	Total on-site employees	**159**	**201**
On-site contractors (including catering, housekeeping, underground drilling, security)		12	17
	Total on-site personnel	**171**	**218**
	Employees on rotation	117	142
	Total employment	**288**	**360**

2.3.24 Surface Disturbance

The project footprint, as shown in Figures 2.3-1 through 2.3-1 e for the mine site, and Figure 2.3-2 for the access route, may be defined as that area on which surface disturbance would occur during the project's life. The overall project footprint would be composed of several individual project components. Although this Section 2.3 describes only the Applicant's Proposed Project, Table 2.3-6 presents the acreage of estimated surface disturbance, grouped by project component and option, associated with all three of the action alternatives (Alternatives 2, 3, and 4). This presentation has been made here for clarity because it would be confusing to show the Alternatives 3 and 4 (which are not the Applicant's Proposed Project) disturbance figures in separate tables in other sections of the document.

The Applicant's Proposed Project site plan, shown in Figures 2.3-1 through 2.3-1 e, and Figure 2.3-2 for the access route, was used to generate the estimated acreages of surface disturbance for Alternative 2 as shown in Table 2.3-6. The acreages shown in Table 2.3-6 for Alternatives 2, 3, and 4 are the same as those that were shown in the DEIS. Since that time, however, based on the agencies' Preferred Alternative as presented in the DEIS, public comments on the DEIS, further engineering refinements and more detailed design, and on-going discussions with the agencies, the project that the Applicant actually expects to construct, if it receives the necessary authorizations, has changed slightly. Therefore, to present the most likely up-to-date acreage disturbance figures, the last column in Table 2.3-6 contains the estimated surface disturbance that would occur from construction of the agencies' Preferred Alternative.

Table 2.3-6 Approximate Existing and Expected Surface Disturbance for Each Alternative

Component / Option / Sub-option	*Existing Disturbance*	*Expected Disturbance (Alternative)*			
		2	*3*	*4*	*Preferred*
Mill and Camp (Liese Creek)					
► Basic mill, shop, camp, laydown, rock storage, solid waste, and growth media stockpiles	0	79.7	79.7	79.7	75.2
► Gravel source (including rock quarries)	0	11.6	11.6	11.6	13.9
► Power line Bridge to Mill	0	12.0	12.0	0.0	13.4
► Power[1]	0	0.1	0.1	0.1	0.1
Subtotal	*0*	*103.4*	*103.4*	*91.4*	*102.5*
1525 Portal Area (Goodpaster Valley)					
► Advanced Exploration Camp, construction facilities, fuel storage	22.4	33.7	33.7	33.7	27.7
► Gravel source (including Valley Borrow Area)	4.3	32.0	32.0	32.0	32.4
► Laydown area	0	15.9	15.9	15.9	11.0
Subtotal	*26.7*	*81.6*	*81.6*	*81.6*	*71.0*
Airstrip Facility (Goodpaster Valley)					
► Airstrip, batch plant, aviation fuel, growth media, and access	0	55.5	55.6	58.9	76.6
► Gravel source[2]	0	22.3	22.3	9.2	3.9
► Laydown area[3]	0	23.9	28.3	40.5	20.6
► Fuel storage[4]	0	0	1.6	6.1	1.6
Subtotal	*0*	*101.7*	*107.8*	*114.7*	*102.8*
Tailings Treatment Facility (Liese Creek)					
► Dry stack tailings pile, RTP, ditches, and related facilities	0	108.5	108.5	108.5	107.8
Subtotal	*0*	*108.5*	*108.5*	*108.5*	*107.8*
Treated Wastewater Discharge (Goodpaster Valley)					
► Soil absorption system	0	4.4	0	0	0
► Direct discharge to Goodpaster River	0	0	0.5	0	0
► Off-river treatment works[5]	0	0	0	13.1	13.1
Subtotal	0	*4.4*	*0.5*	*13.1*	*13.1*
All Mine Site Facilities *Subtotal*[6]		*426.3*	*428.5*	*436.0*	*423.9*
Surface Access					
► All-season road ROW from Shaw Creek and Goodpaster River divide to Goodpaster River Bridge (common to all alternatives)	0.3	71.9	71.9	71.9	81.7
✦ Material Sites for this common segment	0	17.3	17.3	17.3	17.2
► Shaw Creek Hillside all-season road ROW, camps, airstrips	2.3	429.7	0	0	444.1
✦ Material Sites for Alternative 2	22.9	225.6			201.3
► South Ridge all-season road ROW, camps, airstrips	0.4	0	554.7	0	0
✦ Material Sites for Alternative 3	1.2	0	121.8		0
► Shaw Creek Flats perennial winter trail ROW, camps, airstrips	56.1	0	0	330.3	31.0
✦ Material Sites for Alternative 4	0	0	0	118.1	0
Surface Access *Subtotal*[6]		*770.0*	*767.6*	*594.0*	*777.9*
Power Line					
► Shaw Creek and Goodpaster River divide to Goodpaster River Bridge ROW (common to Alternatives 2 and 3)	0.6	62.1	62.1	0	80.6
► Shaw Creek Hillside ROW (with all-season road)	0.5	539.2	0	0	505.8
► South Ridge ROW (with all-season road)	2.4	0	460.0	0	0
Power Line Subtotal[6]		*602.4*	*525.1*	*0.0*	*587.5*
Mine Facilities / Surface Access / Power Line Total[6]		***1,798.7***	***1,721.2***	***1,030.0***	***1,789.3***
► Tenderfoot Richardson Highway egress option	0	43.0	0	0	0
► Shaw Creek Hillside power line ROW (with winter only access)[7]	0.2	0	0	599.7	0
► Goodpaster Winter Road[8]		31.7	31.7	31.7	31.7
Grand Total[6]		***1,873.4***	***1,752.9***	***1,661.4***	***1,821.0***

1 Transformer (power line option) or generators (on-site generation option) require same area.
2 Alternative 4 value reflects 13.1 fewer acres of gravel extraction because same volume of gravel would be excavated for development of the off-river treatment works (see footnote 5).
3 Alternative 4 value reflects winter only access option need to store a year's materials and supplies.
4 Alternative 3 value reflects on-site power generation option with all-season road. Alternative 4 value reflects winter only access and need to store a year's fuel supply.
5 This option would disturb approximately 13.1 acres, and its excavation would produce gravel (see footnote 2)
6 Includes existing disturbed acreage from column 2.
7 Although Alternative 4 by definition has on-site power generation, the winter only access option could be paired with a power line as the Preferred Alternative. In that case, the Shaw Creek Hillside power line route would be used.
8 Used during first two winters of project development for all alternatives.

Because the Preferred Alternatives' disturbance acreage figures in Table 2.3-6 are very close to those shown for Alternative 2, and generally somewhat lower, this FEIS uses the same acreage values in its impacts discussions as were used in the DEIS for two reasons. First, the function of an EIS is to analyze the relative impacts between alternatives, and the small difference between Alternative 2 and the Preferred Alternative would not materially affect any of the analyses. Second, the Preferred Alternative acreage disturbance figures in Table 2.3-6 are based on the detailed COE Section 404 (wetlands) public notice which is contained in Appendix B of this FEIS. Therefore, the public notice drawings and disturbance acreages present the most detailed picture of what would actually be constructed if the Applicant receives the necessary authorizations.

In reviewing the COE Section 404 public notice in Appendix B it will become obvious that some acreage figures are substantially less than those shown in Table 2.3-6. This is because by its nature Section 404 and the public notice are concerned only with wetlands that fall under the COE's restricted jurisdiction, which results in differences between disturbance acreages shown in Table 2.3-6 and the Section 404 pubic notice. For example, clearing trees and brush for the power line across wetlands that would not actually break the ground surface does not fall under Section 404 jurisdiction because a “fill” would not occur. This FEIS, however, has used a more expansive definition of disturbance, and such clearing is included in Table 2.3-6 to give the reader a complete view of all impacts that would occur.

Because some project components would be constructed on or would partially cover existing disturbed areas, Table 2.3-6 also shows the existing disturbed acreage that would be occupied by a particular component. At the bottom of the table, the additional acreage that would be disturbed if the Tenderfoot Richardson Highway egress sub-option were selected for the Shaw Creek Hillside all-season road option is shown. Also shown there are the 31.7 acres of disturbance that would occur for all alternatives from construction of the Goodpaster Winter Road during the first two winters of project development.

2.3.25 Mine Safety

The mine area roads and power line clearing over Pogo Ridge would serve as wildfire breaks. The heavy equipment listed in Table 2.3-4 would be available for fire control and suppression, and would be able to quickly construct firebreaks. Automatic fire-suppression systems would be installed on all heavy equipment, and manual fire extinguishers would be installed in all small vehicles. Buildings would have sprinkler systems installed where appropriate, and all buildings would have fire extinguishers mounted on the walls.

The federal Mine Safety and Health Administration (MSHA) is the regulatory agency with oversight authority for underground and surface mining. The federal metal and nonmetallic mine safety and health regulations and the Applicant's corporate practices and policy require mandatory training for all full-time employees. In addition to training full-time employees, the project's operators would require that all visitors, vendors, and contractors review a "hazard recognition" information bulletin and sign a form acknowledging that they have read and understand the hazards associated with mining.

New-hire underground mine employees would be required to complete a 40-hour mine-safety and hazard-recognition training program before reporting to their assigned work areas. New-hire surface employees would receive a 24-hour mine-safety training program. All full-time employees also would be required to attend an 8-hour annual refresher course.

Fire brigade and mine emergency response teams would be trained and certified to respond to emergency situations, including forest fires that might threaten the project site. The Applicant would provide training opportunities for certification of employees in mine rescue and advanced technical training for hazardous material incidents, and as medical first responders, emergency medical technicians, and hazardous material incident first responders.

2.3.26 Fish and Wildlife Protection

Applicant and contractor employees transported to project facilities during construction or operation for purposes of work and individuals otherwise on site would not be permitted to hunt, trap, or fish in the area. Employees wishing to hunt or fish would have to return to their point of origin after their shift and return to the area by their own means. They would not be permitted to return via either the all-season access road or the airstrip. No hunting at all would be permitted by *anyone* in the immediate vicinity of project facilities, including the public, for worker safety reasons. Employees on duty or commuting to or from the mine site would not be permitted to operate non-company all-terrain vehicles (ATVs), snow machines, watercraft, or aircraft to, from, or within the mine site facilities.

The following policies would be included in an employee education program that would be implemented:

- Feeding animals would be strictly prohibited.
- Employees would be instructed in proper food handling and garbage disposal techniques, the personal dangers involved in feeding animals, and the fact that animals often end up being shot when they lose their fear of people and become dangerous.
- Every employee would receive formal instruction on how to avoid attracting and confronting bears. This instruction would include:
  - Reading a handout that spells out the Applicant's bear policies and specifically lists forbidden activities (e.g., feeding wildlife, tossing out lunch wrappings and juice cans, and harassing wildlife), and the risks of engaging in those activities (mauling and rabies).
  - Watching a video on how to avoid and react to bear encounters.
  - Reading the ADFG *Bear Facts* pamphlet.
- Employees would be instructed that if a bear is shot for reasons attributed to feeding of animals or the improper disposal of food away from camp, and the individual(s) can be identified, they would be disciplined.
- Employees would be instructed that any bear not shot in defense of life and property would be considered a violation of the Applicant's no hunting policy, the individual(s) would be disciplined, and the matter would be turned over to the Alaska State Troopers for investigation.
- Employees would be required to sign a statement affirming the employee understands the Applicant's animal feeding and bear policies and the consequences of violating those policies, including possible dismissal.

The Applicant would develop and maintain human-wildlife contact protocols addressing:

- How to react to the presence of a bear that remains in the project area, whether attracted by food, garbage, or for some other reason.

- When specific actions are needed, what actions should be taken, by whom, with what equipment, where it is stored, and what role (if any) agency personnel should play (e.g., ADFG).
- Applicant and agency personnel to be contacted for assistance or to report an incident.

2.3.27 Mine Closure and Reclamation

The goal of the closure and reclamation plan would be to return disturbed land to the designated post-mining land use, defined by the State's TBAP as public recreation and wildlife habitat (ADNR, 1991). The goal of reclamation would be to re-establish wildlife habitat within 5 to 15 years by stimulating the growth of early successional vegetation. This vegetation would provide willow and shrub browse for moose and other game; young aspen stands for ruffed grouse habitat; and grass areas that would provide forage, diversity, and cover for voles and food for raptors.

The primary objective of the closure part of the plan would be to ensure that water quality would not be strongly affected after mine closure. To accomplish this objective, materials that potentially could cause degradation to the lands and waters of the state would be stabilized, removed, or mitigated.

The primary objective of the reclamation part of the plan would be to stabilize disturbed mined-land surfaces against erosion. This stabilization would be accomplished by improving plant growth conditions and encouraging the succession of self-sustaining native and naturalized plant communities. Inactive areas not anticipated to be disturbed would be closed and reclaimed concurrently with mining.

A summary of the proposed closure and reclamation plans for project facilities is presented below. Specific mining and reclamation plans are presented in the *Pogo Project Reclamation and Closure Plan* (Teck-Pogo Inc., 2002c).

Mill and Camp Complex

The following closure activities would be performed upon completion of mill operations and termination of mining and production activity:

- All process liquids would be treated and sent to the recycle tailings pond. Any wastewater would be treated and discharged in a manner permitted by the regulatory agencies.
- Hazardous and toxic materials such as reagents, petroleum products, acids, and solvents would be moved off site by licensed transporters for return to vendors or disposal at licensed facilities.
- Process equipment and structures would be removed from site and sold as salvage.
- Remaining structures such as the mill, camp site, and ancillary facilities and foundations not removed off site would be disposed of in accordance with ADEC solid waste regulations. For example, depending on the item, it might be burned, crushed, or dismantled and buried on site.
- The ground surface of the mill site and other ancillary sites would be ripped where the surface were compacted, recontoured, and stabilized as required for the post-mining land use of the site.

Tailings Dry Stack

After appropriate contouring to control runoff, the tailings dry stack would be capped with an engineered soil cover system to provide a medium for establishing a sustainable vegetation cover that would be consistent with the post-mining land use designation

Runoff water from upstream in the watershed would be diverted around the tailings dry stack in permanent diversion channels. Any long-term discharge from the dry stack would be monitored and treated as necessary in consultation with the regulatory agencies.

Adit, Shaft, and Underground Workings

The three adits and two ventilation raises would be permanently stabilized and sealed with concrete. The mine workings would be allowed to flood and groundwater levels to recover toward pre-operational levels. The mineralized wall areas and the cemented backfill would be below the water table, thereby reducing or eliminating the oxidation of sulfides.

Rock and Overburden Storage Piles

Preliminary characterization of waste rock indicates there is no net acid generation potential from the nonmineralized material that would be placed in storage piles (Teck-Pogo Inc., 2002b; Appendix C, p. 16 and Table 5). Stabilization of the nonmineralized piles would follow BMPs to minimize water runon and runoff while providing adequate growth medium to establish a vegetative cover.

Routine characterization of material produced during mine life and at closure would determine final stabilization methods. Materials that could result in the potential for net acid generation would be classified as mineralized material and buried within the tailings dry stack.

Any material that would be disturbed and that had the potential to be classified as growth medium, such as overburden and topsoil, would be stockpiled for future use. These stockpiles would be seeded to prevent erosion and preserve the plant growth conditions.

It is proposed to amend some of the overburden material by mixing with downed brush and trees from clearing activities. This amended material would be expected to have several advantages: provide nitrogen and nutrients as decomposition products; supply seeds, roots, and micro-organisms needed to re-establish native vegetation; and contribute woody debris for habitat enhancement.

After cessation of active mining, material from the overburden stockpiles would be used as a growth medium where necessary. Overburden stockpiles of material not designated to be used as growth medium in other areas would be seeded and stabilized during mining.

RTP Dam

Upon cessation of mining and milling, the RTP water storage dam constructed in the upper Liese Creek would be reclaimed after it was no longer required for water treatment. The cut-and-fill slopes would be graded to blend with the surrounding topography. Small areas of depression would be created to hold snow and precipitation, and willow or alder thickets would be established.

Access and Site Roads

All bridges would be removed from the main access road and the roadway would be reclaimed. On-site access and service roads not specifically required for post-closure and reclamation monitoring would be reclaimed. Roads necessary for monitoring would be sloped and water-barred to minimize erosion and prevent the formation of rills.

Power Transmission Lines

Power transmission lines to the project site and distribution lines to the mine, mill, and ancillary facilities would be dismantled when no longer necessary for closure operations. Electric cables, poles, supports, insulators, transformers, and other equipment and materials would be removed and sold for salvage.

Airstrip

Once the bridge across the Goodpaster River was completed, the existing gravel bar airstrip in the valley bottom would become unusable, and would be reclaimed by removing airstrip markers and spreading woody debris such as logs and stumps to ensure it would not be functional.

The 3,000-ft airstrip would not be reclaimed immediately after project shutdown because it would be used for post-closure and reclamation monitoring. Once monitoring was completed, the airstrip would be either reclaimed or left as is, depending on direction from the landowner, the State of Alaska.

Water and Monitoring Wells

After final closure, water pump-back and production wells would be abandoned and plugged in an approved manner. All sumps, ponds, and drains associated with pump-back wells would be filled, contoured, seeded, or stabilized to meet the requirements of the designated post-mining land use.

Monitoring wells not used for post-closure compliance monitoring would be abandoned and plugged in an approved manner. Compliance monitoring wells would be maintained and secured to prevent tampering until the monitoring requirements were satisfied. They then would be abandoned and plugged.

2.3.28 Monitoring

Ultimate monitoring plans for post-closure would be developed in conjunction with state and federal agencies. The principal objective of water quality monitoring, however, would be to protect water quality in the Goodpaster River. The three major components of the water quality monitoring plan would be to monitor the:

- Operating performance of the SAS
- Water that is near, but has not yet reached, the Goodpaster River
- Water in the Goodpaster River

This monitoring would involve sampling wells on the perimeter of the SAS to monitor its performance to provide early feedback, enabling response and mitigation as needed before there was a compliance problem at downgradient wells. Monitoring wells downgradient of the SAS would be monitored on a monthly basis to determine water quality and elevation trends and to sample the water before it reaches the river. A groundwater well located upgradient of the SAS field also would be monitored. Background sampling is currently under way at these sites and would continue after discharge to the SAS commences.

Test procedures would follow EPA or other approved methods. The quality assurance and quality control program currently in place for the advanced exploration program would be continued and expanded as necessary. A more detailed water monitoring plan would be included with the State of Alaska solid waste application for the dry-stack tailings area, RTP pond, and SAS.

The results from compliance monitoring would be reported to the appropriate agencies on a monthly basis following discharge to the SAS. If there were an anomalous value of concern, it would be addressed as outlined in the monitoring plan. Quarterly data reports would include electronic data and graphical presentation for trend detection.

2.3.29 Contingency Planning

If the conditions encountered during mine operations were to vary substantially from those predicted, alternative plans might have to be implemented. Although developing detailed plans to address every conceivable potential problem would be impractical, developing certain plans makes sense, e.g., mine inflow contingency plan (Teck-Pogo Inc., 2002b). In addition, the Applicant has incorporated certain design features and management strategies in planned facilities that would improve the flexibility of the systems to respond to different or changing conditions. These include:

- Bleed stream treatment and management for the mill process
- Design features of the water treatment plant that improve flexibility
- Instrumentation, control, and upset management for water treatment
- Water treatment plant changes to meet reduced arsenic limits of 10 parts per billion (ppb)

2.3.30 Project Shutdowns

At some point during the life of the mine, project operations likely would be shut down for one or more short periods (less than 3 months). Short-term shutdowns occur due to events such as major equipment breakdowns or weather-related interruptions. Long-term, but still temporary (between 3 months and 3 years) shutdowns usually only occur in response to economic changes, such as a prolonged decline in the price of gold. Long-term shutdowns are much less likely to occur. Permanent shutdown would occur at the end of the mine life.

Short-Term Shutdown Plan

During a short-term shutdown, the following activities and other maintenance procedures would keep the facility in good operating order until the interruption(s) were remedied and operations were ready to resume:

- Continue to treat and discharge water as normal
- Continue normal maintenance of ditches

- Shut down mill and filter plant and prepare to resume operations as soon as mining recommences
- Shape stockpiles to minimize erosion

Long-Term Shutdown Plan

In the event of a long-term shutdown, a minimum staff would continue to maintain and preserve the facility until it could be restarted. Long-term shutdown practices would allow the mine and plant to be restarted after a commissioning period during which equipment would be reassembled and restarted, reagents reintroduced, electrical and control systems re-energized, and production activities resumed. A long-term shutdown of the Pogo project would involve 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 its mechanical condition
- Flush and clean all process lines and instrumentation, and protect all electronics and sensitive equipment
- Secure the mill, filtration plant, and mine, and continue to treat water as necessary
- Implement contingency plans to limit mine water inflows to below 150 gpm
- Install erosion protection on all stockpiles, dumps, and site areas

2.3.31 Development Schedule

Based on current timelines, the Pogo project would be constructed during a 2-year period beginning soon after permits were received, possibly in the latter half of 2003. The timing and sequence of construction would depend on the date of project approval. The main construction philosophy for the project would to mobilize camp facilities, surface earthmoving equipment, underground equipment, and supplies to the site as soon as possible over the Goodpaster Winter Trail. This mobilization activity would allow the site surface and underground work to be started prior to completion of the all-season access road. It also would allow the access road to be constructed from both ends.

Two construction camps would be built on site, and temporary camps would be installed along the access road and power line. Construction would proceed year-round as follows, with production commencing approximately the end of 2005:

- Major construction equipment and materials would be staged at the Richardson Highway and Delta Junction.
- As soon as possible after project approval, the site road from the 1525 Portal to the plant site in Liese Creek and to the new airstrip would be constructed with equipment currently on site.
- The 3,000-ft airstrip would be built as soon as possible after project approval.
- A winter road would be built on the Goodpaster Winter Trail in December 2003 to permit construction equipment, materials, and road-building equipment to be transported to the site.

- When the winter road access would become available, the existing exploration camp below the 1525 Portal would be expanded to accommodate 200 people, and temporary construction facilities would be established.
- Aggregate gravel pits would be opened and production would start as soon as possible. The off-river treatment works would be constructed in some of the borrow pits and would be completed within 12 months of project startup.
- Construction on the Shaw Creek Hillside all-season access road would begin as soon as possible after project approval. A second construction heading would be established at the Pogo Mine site end after completion of the winter road. If permit approval were received in time for the Shaw Creek Flats winter road/trail to be used, an additional double construction heading would be established near Gilles Creek. The access road likely would take 8 to 12 months from start of construction to final completion.
- Construction on the 138-kV power line would lag behind road construction to ease congestion and limit the size of working areas.
- Underground development would begin as soon as possible, using the existing exploration adit for access. The 1690 and 1875 adits, the underground ore handling system, and the delivery conveyor would be developed and installed during the subsequent 18 months.
- Site preparation and concrete work would begin in the summer of 2004. The main construction/operations camp in Liese Creek Valley would be built during this period to provide accommodation at the site for the construction workforce.
- The major buildings would be erected by the winter of 2004-2005 so that work could continue within a protected shell.
- Assuming timely construction of the pioneer all-season road, additional materials and equipment would begin arriving on site in late 2004. If road construction were delayed, these materials could be transported over a second winter road on the Goodpaster Winter Trail beginning in December 2004.
- The RTP dam and other earthworks would be constructed during the spring, summer, and fall of 2005.
- The remaining mechanical, piping, electrical, and instrumentation work would be done in sequence throughout 2005, with mill completion and startup planned for late 2005.

2.3.32 Changes Following DEIS Comments

As a result of public and agency comments on the DEIS, two relatively small changes in project configuration have been considered in this EIS. While all of the preceding information in this Section 2.3 presents the Applicant’s original Proposed Project, this subsection describes these two changes because this is the logical location to present such material.

Tailings Dry Stack

In the Applicant’s Proposed Project, the only organic material to be removed prior to depositing tailings in the dry stack footprint is from the area of the flow-through drains. The structural stability analysis indicated the toe berm of the structural shell would provide sufficient confinement to preclude any potential for dry-stack instability, and that further clearing of organic matter from the dry stack footprint was unnecessary. Thus, in the Pogo Reclamation Plan (Teck-

Pogo Inc.,2002C), the Applicant did not assume any growth media would be salvaged from the dry-stack area.

In reviewing the reclamation plan, the State raised two issues with respect to the topsoil and growth media in the dry-stack area. The first suggested the Applicant show that the dry-stack facility would be geotechnically stable without topsoil removal. The second suggested the overall growth media balance might turn out to be negative under certain circumstances, and questioned if there were sufficient contingency areas from which to obtain adequate volumes. In response to these concerns, a slightly modified construction approach for the dry-stack facility has been considered. The only substantive changes would be to clear, grub, and stockpile approximately 1 foot of organics and mineral soil from the entire dry-stack footprint, totaling approximately 40,000 cubic yards, and subsequently place an approximately 1.5 feet deep nonmineralized rock erosion control/drainage blanket (approximately 87,500 tons) of over the entire dry-stack facility footprint.

Power Line Route

In the Applicant's Proposed Project, the power line would cross the Shaw Creek / Goodpaster divide via Sutton Creek (Figure 2.3-2), to the north and away from the road corridor. As a result of public comments on the DEIS, a new sub-option has been considered with the power line following the road corridor over the divide.

2.4 Issues, Options, and Screening

This section describes the issues identification, options development, and options screening processes for the Pogo Mine project. It includes three subsections, each describing one process.

Section 2.4.1 (Issues Identification) discusses how scoping comments were analyzed to determine the 17 scoping issues raised by the public and agencies, and identifies those issues.

Section 2.4.2 (Options Development) identifies the component options that were considered to address those scoping issues, and then describes them.

Section 2.4.3 (Options Screening Process) summarizes the process by which the options identified in Section 2.4.2 were screened against the options evaluation criteria. As a result of this process, those options best suited to address the scoping issues were retained for detailed impacts analysis in Chapter 4, and the other options were dropped from further consideration.

2.4.1 Issues Identification

An important first step in preparing the EIS is "scoping." Scoping is a public participation process intended to have all interested parties assist EPA and cooperating agencies in identifying issues of concern associated with the proposed Pogo Mine project. The process is designed to help ensure that all potentially significant issues are properly identified and fully addressed during the course of the EIS process.

The main objectives of the scoping process are to:

- Provide the public, Tribes, and regulatory agencies with a basic understanding of the proposed Pogo Mine project

- Explain where to find additional information about the project
- Provide a framework for the public to ask questions, raise concerns, identify specific issues, and recommend options other than those proposed by the Applicant
- Ensure that those concerns are included within the scope of the EIS review process

How Scoping Proceeded

On August 11, 2000, EPA distributed the *Scoping Document for Pogo Mine Project Environmental Impact Statement*. That document:

- Presented a schedule for the scoping process
- Described the scoping open houses held in September 2000
- Identified where additional information about the proposed project could be obtained
- Explained the roles of EPA, COE, and ADNR in the EIS and permitting processes
- Described the EIS process after scoping and presented a tentative EIS schedule
- Presented a brief summary of the Applicant's proposed project as well as more specific details for each component of the proposed project
- Described other component options and issues that were already identified by the public and agencies that will be considered during the EIS process

Distribution of the scoping document began a 60-day public and agency review and comment period that ended on October 10, 2000. EPA hosted two scoping open houses during that period. The first was held on September 26, 2000, in Delta Junction at the Delta Junction Community Center, and the second was held on September 27, 2000, in Fairbanks at the Noel Wien Library. Attendance was 46 and 50, respectively.

The scoping open houses served two purposes. One was to listen to and record the public's comments about the proposed project as described in the scoping document. The second was to respond to the public's requests for the background information and hands-on technical assistance they might need to fully understand the project description and proposed scope of the EIS analysis before commenting. EPA project staff and members of the third-party contractor, Michael Baker, Jr., were available to answer questions and explain methodologies.

A "town meeting" format at each evening's end provided an opportunity for individuals to comment and promoted group interaction. All comments made during the open houses, whether oral or written on comment sheets or flipcharts, were documented as part of the official record. While people were welcome to make comments and suggestions during the open houses, the record was specifically left open for an additional 13 days to accommodate anyone needing additional time to formulate comments.

Government-to-Government Consultations

In addition to the EIS scoping effort, pursuant to Executive Order 13084 (Consultation and Coordination with Indian Tribal Governments) EPA has undertaken a concerted government-to-government consultation effort on the Pogo EIS project with the 13 Tribes listed below that are considered to be potentially affected by the proposed Pogo Gold Mine by virtue of their location (1) within a 125-mile radius of the proposed Pogo Mine site or (2) within the potentially affected Tanana River watershed.

Under EPA's government-to-government consultation plan, the first consultation was held in the village of Healy Lake between EPA and the Healy Lake Tribal Council on September 25, 2000. Then, all 13 Tribes were invited to attend in person or by teleconference the first in a proposed series of government-to-government consultations on the subject of the Pogo EIS on September 26, 2000, in Delta Junction. A telephonic government-to-government consultation also was convened on November 9, 2000.

- Circle Native Community
- Dot Lake Village Council
- Healy Lake Tribal Council
- Manley Village Tribal Council
- Mentasta Traditional Council
- Native Village of Eagle
- Native Village of Minto
- Native Village of Tanana
- Nenana Native Village
- Northway Traditional Council
- Tanacross Village Council
- Tetlin Village Council
- Tok Traditional Council

Scoping Comments

All comments received during the scoping process, whether written in letters, on comment sheets, on flipcharts at the open houses, transcribed from oral testimony at the open houses, or received during government-to-government consultations, were read and categorized into the issues discussed below. Many commenters raised several issues, and each was considered.

Sixty-two sets of comments were received, excluding those received during government-to-government tribal consultations. In five of these cases, individuals gave very similar comments on two or more occasions, usually orally and in writing. Thus, 57 individual sets of non-tribal comments were received. Because some written comments were signed by more than one individual or organization, 64 entities actually commented. An approximate breakdown by general non-tribal commenter group is shown below.

Individual members of the public	48
Municipal governments	1
Non-government organizations	8
State and federal agencies	7
Total	64

During the government-to-government consultations described above, comments were solicited from 13 Tribes and two regional Native non-profit organizations during the scoping process. All comments received are considered in this EIS.

A fully representative selection of tribal, agency, and public comments, as well as a comprehensive listing of all issue-related comments raised in government-to-government tribal consultations, were distributed to all interested parties in the *Pogo Mine EIS Responsiveness Summary* on January 30, 2001 (EPA, 2001a).

The majority of comments related to issues predominantly associated with access to the mine. They included the type of access (all-season road versus a winter road/trail), the access route, how a road should be managed when in use, and what a road's disposition should be after mine closure. A substantial number of other issue comments also were related directly or indirectly to access. Thus, the type of access, the route, issues associated with management and disposition of a road, and a road's effects on surrounding land uses and resources were of overwhelming concern to commenters.

Other issues of particular concern that were identified include water (water quality and water management), wildlife, fish, wetlands, subsistence, cultural resources, and employment. Many of these comments concerned access-related impacts on these resources. Many comments fell into the category of land use changes that could occur if an all-season road were to be constructed. These land use changes included increases in timber harvesting, recreational use, and competition for subsistence resources.

Other issues, while still important, were not the subject of as many comments as the issues cited above. Several of the issues, however, were considered important enough to become formal scoping issues (e.g., cumulative impacts, air quality, noise, and safety).

Identification of Issues and Evaluation Criteria

Issues identification is the process by which the key concerns raised during scoping were determined. These issues then were turned into specific criteria that were used to evaluate the various options and sub-options for each component of the proposed project. Analysis of the comments received during the Pogo Mine EIS scoping process was the important first step in this identification process. The comments received during the scoping process were individually analyzed and fell roughly into three groups.

- **Informative.** These comments provided information to be considered during the EIS process. Examples included agencies stating their authority or jurisdiction over certain regulatory functions and making suggestions about how certain technical analyses might be approached as well as individual members of the public and tribal councils who provided resource and use information based on their experiences in the area. Information contained in these comments has been evaluated and is reflected in data reports, this EIS document, or during other aspects of the EIS process as appropriate.
- **Inquisitive.** These comments asked questions about the proposed project or about how the EIS process would proceed. Examples included specific technical queries (e.g., *Will individual mine workers be allowed to fly their own planes to work?*) and more broad process questions (e.g., *Is the State of Alaska proposing any changes in any of its current management plans or options to address these [timber harvesting] impacts?*). These comments were used as a checklist to ensure that these questions were addressed in this EIS.
- **Expressive.** This group contained the majority of comments, and, through statements or questions, expressed a wide range of project-related concerns. These comments are of particular importance to the scoping process because they document the public, agency, and tribal concerns about the project and form the basis for identifying the issues and developing the specific evaluation criteria that were used to screen the various project options, select the alternatives, evaluate the consequences, and identify a preferred alternative.

Issues and Evaluation Criteria

The scoping comments provided the basis for identifying the major issues of concern during construction, operation, and closure of the proposed project. The 17 issues identified from public scoping comments are listed below. Each issue (e.g., water quality, wildlife, and socioeconomics) was turned into a specific “evaluation criterion” that, in combination with the other criteria, was used to screen the various project component options and identify the alternatives to be considered for detailed analysis in the EIS. Each criterion is shown below under its corresponding issue heading.

Note: Because “impacts” can be both positive and negative, in this document the term “impacts” is construed to mean negative impacts while the term “benefits” is construed to mean positive impacts.

Issue 1. Surface and Groundwater Quality

Criterion: Maintenance of existing water quality in the affected drainages to fully protect all designated uses (such as aquatic life, drinking water, and industrial use).

Issue 2. Wetlands

Criterion: Siting, construction, and management of components to avoid, minimize, and mitigate impacts on wetlands.

Issue 3. Fish and Aquatic Habitat

Criterion: Minimization of impacts to fish and aquatic habitat.

Issue 4. Wildlife

Criterion: Minimization of impacts to wildlife and habitat.

Issue 5. Air Quality

Criterion: Minimization of impacts to existing air quality.

Issue 6. Noise

Criterion: Minimization of noise impacts to residents, recreationists, wildlife, and others.

Issue 7. Safety

Criterion: Minimization of safety issues for workers and members of the public.

Issue 8. Reclamation

Criterion: Components designed and sited to promote successful reclamation.

Issue 9. New Industrial and Commercial Uses

Criterion: Infrastructure for new industrial/commercial uses, such as logging, consistent with the management intent, guidelines, and land use designations of the adopted TBAP and the TVSF Management Plan.

Issue 10. Recreational Resources and Uses

Criterion: Access for recreational uses consistent with the management intent, guidelines, and land use designations of the adopted TBAP and the TVSF Management Plan.

Issue 11. Existing Privately Owned Lands and Existing Recreational and Commercial Uses

Criterion: Minimization of impacts to existing privately owned lands and existing recreational and commercial uses consistent with the management intent, guidelines, and land use designations of the TBAP and the TVSF Management Plan.

Issue 12. Subsistence and Traditional Uses

Criterion: Minimization of impacts to subsistence and traditional resource uses currently occurring within the affected area.

Issue 13. Cultural Resources

Criterion: Avoidance of impacts to cultural resources.

Issue 14. Socioeconomics

Criterion: Minimization of social and quality of life impacts and maximization of economic benefits to potentially affected communities.

Issue 15. Cumulative Impacts

Criterion: Assessment of the cumulative impacts from this and other past, present, and potential developments in the area.

Issue 16. Technical Feasibility

Criterion: Minimization of chances of system failure by incorporating technically feasible and operationally efficient component design, siting, and mitigating measures.

Issue 17. Economic Feasibility

Criterion: Consideration of the cost-effectiveness of technically feasible and operationally efficient component design, siting, and reclamation.

2.4.2 Options Development

Once the scoping issues identification process was completed, as described in Section 2.4.1 above, project component options were developed to provide an array of options that could address the specific concerns raised by the scoping issues. Subsection # 1 below presents, in outline format, the component options and sub-options that are considered in this EIS, and Subsection # 2 describes these options in greater detail.

Options Considered

In developing its proposed project, the Applicant considered several options for different components. In its *Pogo Project Conceptual Project Description* (Teck-Pogo Inc., 2000e), *Pogo Project Access Alternatives Study* (Teck-Pogo Inc., 2000b), *Pogo Project Description* (Teck-Pogo Inc., 2000a), and *Pogo Project Plan of Operations* (Teck-Pogo, Inc., 2002a), the Applicant discussed why it ultimately selected or rejected specific options to arrive at its proposed project. In addition to these options considered by the Applicant, other component options were suggested during scoping by the public, the agencies, the Tribes, and the third-party contractor. Still other options were identified by the agencies following review of the Preliminary Draft EIS (PDEIS).

From these sources, and based on the project's design criteria, Table 2.4-1 presents the 14 project components (shown in bold), 15 subcomponents (bold, italics), and more than 100 options and sub-options that were developed. An underline signifies the Applicant's proposed option or sub-option for a given component. Each option and sub-option listed immediately below is described in the following section (Section 2.4.2 Options Description). Each has been addressed in this EIS.

Table 2.4-1 Components, Options, and Sub-Options Considered in this EIS

An <u>underline</u> signifies the Applicant's proposed option or sub-option for a given component

Project Component	*Sub-components*	▶ Options	✦ Sub-options / ▸▸ Sub-options
Milling Process			
		Whole ore cyanidation	
		<u>Gravity/flotation/cyanide vat leach</u>	
		Gravity/flotation/ship concentrate off site	
Tailings Disposal	*Type*		
		<u>Underground paste backfill</u>	
		<u>Surface dry stack/recycle tailings pond (RTP)</u>	
			Lined dry stack
			Lined RTP
			<u>Unlined dry stack</u>
			<u>Unlined RTP</u>
		Traditional surface wet tailings placement	
	Location		
		West side of Goodpaster River	
			# 2 Traditional wet tailings
			# 3 Traditional wet tailings
			# 4A Dry stack
			# 4B Dry stack
			# 5 Dry stack
			# 7 Traditional wet tailings
			# 8 Traditional wet tailings
		West side of Goodpaster River via tunnel	
		East side of Goodpaster River	
			<u># 1 Liese Creek dry stack</u>
			# 6A Lower West Creek wet tailings
			# 6B Upper West Creek wet tailings
			# 6C West Creek dry stack
			# 9 Sonora Creek wet tailings
			# 10 Tabletop dry stack
		Off site (outside the project area)	
Mill and Camp Location			
		# 1 Near existing 1525 Portal in Goodpaster Valley	
		# 3 Upper Pogo Ridge	
		# 4 Pogo Ridge	
		# 5 West side of Goodpaster River	
		<u># 6 Liese Creek Valley</u>	
		Off site (outside the project area)	
Development Rock Disposal			
		<u>Mineralized rock encapsulated in dry stack</u>	
		<u>Nonmineralized rock in dry stack, in RTP dam, and for other construction</u>	
Gravel Source			
		<u>Expand existing gravel pits and develop new pits in Goodpaster and Liese Creek valleys</u>	
		Crush nonmineralized development rock	
Construction Camp Location			
		<u>Below existing 1525 Portal in Goodpaster Valley</u>	

Table 2.4-1 Components, Options, and Sub-Options Considered in this EIS

Project Component	*Sub-components*	► Options	✦ Sub-options	⏩ Sub-options
				An underline signifies the Applicant's proposed option or sub-option for a given component
Laydown Areas				
		Permanent near existing 1525 Portal, adjacent to airstrip, and at mill		
		Temporary near existing 1525 Portal and adjacent to airstrip; permanent at mill		
Power Supply				
		On-site generation		
		Power line		
Water Supply				
	Industrial			
		Mine drainage		
		RTP		
		Wells		
		Goodpaster River		
	Domestic			
		Wells		
		Goodpaster River		
Water Discharge				
	Development Phase			
		Underground injection wells		
		Direct discharge to Goodpaster River		
		Off-river treatment works		
	Operations Phase			
		Industrial wastewater (RTP)		
			Constructed wetlands at borrow pit in Goodpaster River Valley	
			Soil absorption system	
				Goodpaster River Valley adjacent to airstrip
				Middle Liese Creek Valley
				Saddle above and southeast of Pogo Ridge
			Underground injection wells	
			Direct discharge to Goodpaster River	
			Off-river treatment works	
		Domestic wastewater		
			Underground drain field	
				Permanent in Goodpaster Valley near mouth of Liese Creek
				Temporary Liese Creek Valley; permanent below 1525 Portal
			Direct discharge to Goodpaster River	
Fuel Supply and Storage				
	Supply Route			
		All-season road		
			Shaw Creek Hillside	
			South Ridge	
		Winter-only access		
			Shaw Creek Flats	
			Goodpaster River Valley	
		Air-only supply		

Table 2.4-1 Components, Options, and Sub-Options Considered in this EIS

Project Component — ***Sub-components*** — ▶ **Options** — ✦ **Sub-options** — ⏩ **Sub-options**

An <u>underline</u> signifies the Applicant's proposed option or sub-option for a given component

Storage Location
- ▶ <u>Temporary below 1525 Portal and at airstrip; permanent at 1525 Portal mouth and mill</u>
- ▶ Temporary below 1525 Portal and at airstrip; permanent only at the mill

Surface Access

Type
- ▶ <u>All-season road</u>
- ▶ Winter-only access
- ▶ Railroad

Route
- ▶ All-season road
  - ✦ <u>Shaw Creek Hillside</u> (Initial egress from Richardson Highway)
    - ⏩ <u>Existing Shaw Creek/Rosa Road</u>
    - ⏩ Pipeline
    - ⏩ Keystone
    - ⏩ Tenderfoot
  - ✦ South Ridge
  - ✦ Dean Cummings Crossing
- ▶ Winter-only access
  - ✦ Shaw Creek Flats
    - ⏩ To head of Shaw Creek Valley
    - ⏩ To south of Gilles Creek
  - ✦ Goodpaster River Valley
- ▶ Railroad
  - ✦ Goodpaster River Valley

Management
- ▶ Design
  - ✦ All-season road
    - ⏩ One lane with periodic turnouts
    - ⏩ <u>Two lanes</u>
  - ✦ Winter-only access
    - ⏩ Traditional winter road construction standards
    - ⏩ Perennial winter trail construction standards
- ▶ Use (during Pogo mine operations) – Road open (versus closed) to:
  - ✦ <u>Pogo project only</u>
  - ✦ Pogo and other industrial/commercial users only
  - ✦ Everyone
- ▶ Security gate location
  - ✦ <u>Near end of Shaw Creek Road</u>
  - ✦ At Gilles Creek

Disposition
- ▶ <u>Remove and reclaim</u>
- ▶ Convert to recreational trail
- ▶ Leave road open (versus closed) to:
  - ✦ Industrial/commercial users
  - ✦ Everyone

Table 2.4-1 Components, Options, and Sub-Options Considered in this EIS

Project Component	*Sub-components*	▶ Options	✦ Sub-options
			▸▸ Sub-options
Air Access			
	Type		
		Air-only access	
		As complement to surface access	
			3,000-ft airstrip in Goodpaster River Valley
			5,000-ft airstrip at Tabletop (above and east of Liese Creek Valley)
		No air complement to surface access	
	Management		
		Airstrip open (versus closed) to:	
			Pogo project only
			Pogo and other industrial/commercial users
			Everyone
	Disposition		
		Remove and reclaim after mine reclamation	
		Leave airstrip open (versus closed) to:	
			Industrial/commercial resources
			Everyone
Power Line Route			
		All-season road	
			Shaw Creek Hillside
			South Ridge
		Winter-only access	
			Shaw Creek Hillside
			Goodpaster River Valley

An underline signifies the Applicant's proposed option or sub-option for a given component

Note: An underline signifies the Applicant's proposed option or sub-option for a given component.

Options Description

The options and sub-options for each of the 14 project components identified in Table 2.4-1 (above) are described below. The reader is strongly encouraged to frequently refer to the list of options and sub-options in Table 2.4-1 immediately above for context when reading the following descriptions.

Milling Process

Three mill process options were considered. In two options, cyanide would be used to leach gold from the flotation concentrate inside the mill, while the third option would not use cyanide on site.

- Whole ore cyanidation In this option, all the ore would be leached with cyanide. All the tailings would undergo a cyanide destruction process, but any tailings deposited in either a traditional surface disposal impoundment or in a dry tailings stack would have been exposed to cyanide.

- Gravity/flotation/cyanide vat leach In this option, after gravity separation, flotation would be used to produce a concentrate that would be 10 percent of the total ore weight.

The concentrate would be leached in cyanide vats to recover the gold, and all of the leach tailings would be placed underground as paste backfill after cyanide detoxification. The flotation tailings deposited on surface in the dry-stack facility would not have been exposed to cyanide.

- Gravity/flotation/ship concentrate off site This option would be the same as immediately above, but cyanide would not be used on site. The ore concentrate would be shipped outside the project area for processing.

Tailings Disposal

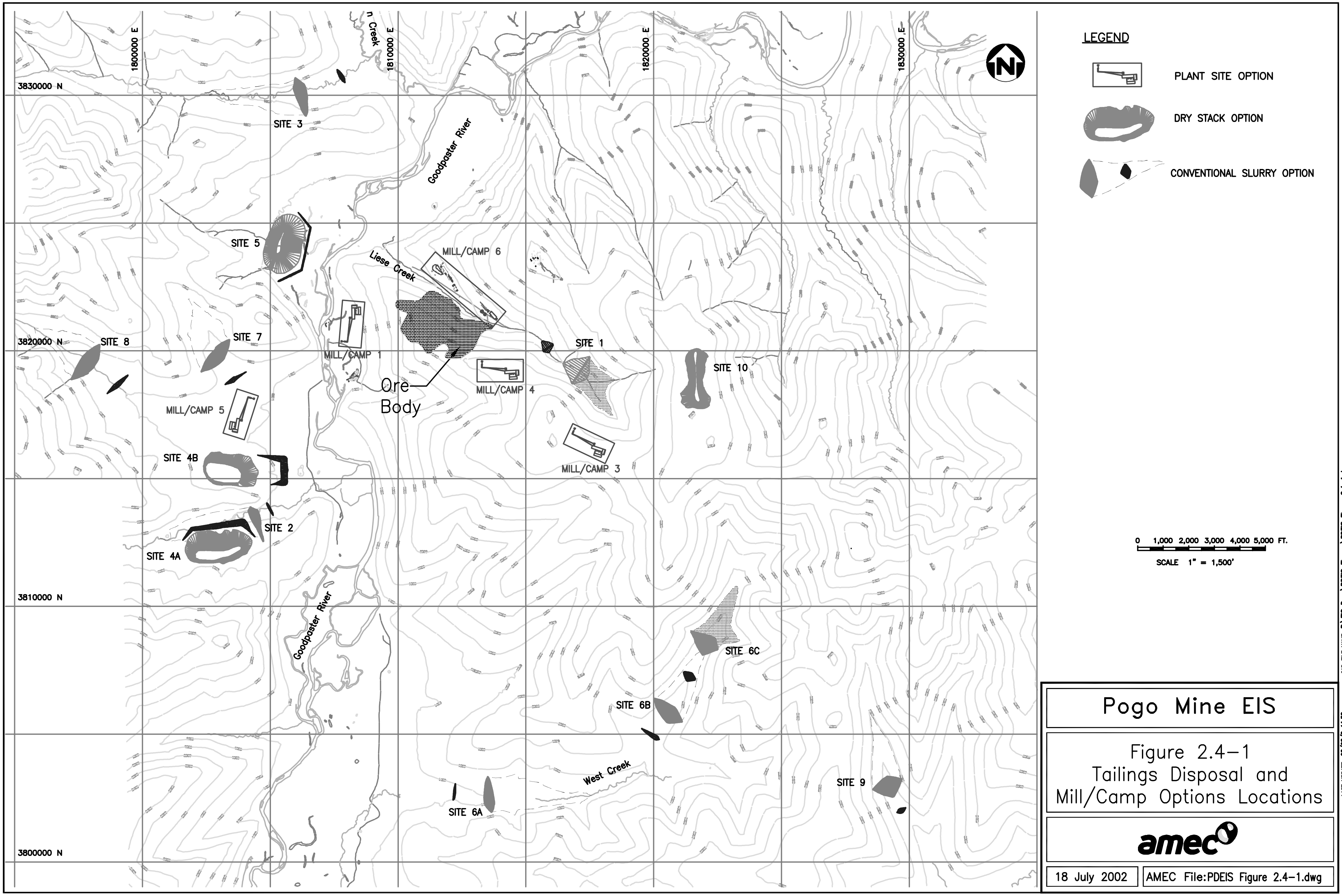
This component had two subcomponents: type of disposal and location of the disposal.

Type Three tailings disposal options were considered: underground in the mine as a paste backfill, stacked dry on the surface, and traditional placement in a surface pond for settlement behind a dam.

- Underground paste backfill In this option, approximately half the tailings would be returned underground. These tailings would be mixed with 2 to 5 percent cement and would harden into a relatively impermeable and stable mass when placed in the mined-out underground mine stopes. The hardened backfill would support the roof in mined-out areas and provide a working face and surface for mining equipment.
- Surface dry-stack and RTP This option would filter the flotation tailings to reduce the moisture content to between 12 and 15 percent. This filtered material then would be delivered by truck to a dry-stack storage site on the surface. This option would require development of a tailings pond (RTP) behind a dam to provide storage for stormwater.
  - Tailings facility liner There were two sub-options for the dry stack and RTP: a lined or unlined dry stack, and a lined or unlined RTP. Either or both facilities could be lined or unlined.
- Traditional surface wet placement In this option, flotation tailings would be pumped from the mill in a slurry pipeline to a surface impoundment where they would be deposited in a pond created by a dam. The tailings would settle out, allowing the water to be recycled.

Location Thirteen disposal sites in two general locations in the mine area were considered for the two types of surface tailings disposal (Figure 2.4-1). Seven locations were considered for traditional wet surface disposal in a tailings pond, and six locations were considered for dry surface stacking. The paste backfill disposal option would, of course, be located underground in the mine itself.

- West side of Goodpaster River Seven locations, four traditional wet disposal and three dry-stack disposal, were located west of the Goodpaster River.
- East side of Goodpaster River Six locations (three traditional wet disposal and three dry-stack disposal) were located east of the Goodpaster River.



Pogo Mine EIS

Figure 2.4-1
Tailings Disposal and Mill/Camp Options Locations

amec

18 July 2002 | AMEC File:PDEIS Figure 2.4-1.dwg

A separate option indirectly related to tailings disposal location also was identified. It was a separate tunnel option under the Goodpaster River that might address concerns with surface tailings transfer to a tailings disposal site on the west side of the river.

- Off site (outside the project area) A fourteenth location, located at some unidentified point outside the project area, also was considered.

Mill and Camp Location

Six options for this component were identified (Figure 2.4-1):

- The Goodpaster River Valley floor immediately west of the ore body near the existing 1525 Portal (Site # 1)
- In the saddle on Upper Pogo Ridge southeast of the ore body (Site # 3) (There was no Site # 2.)
- On Pogo Ridge almost immediately above the ore body (Site # 4)
- On the west side of the Goodpaster River somewhat over 1 mile southwest of the ore body (Site # 5)
- In Liese Creek Valley (Site # 6)
- A generic location off site, somewhere outside the project area

Development Rock Disposal

Two options for this component were identified:

- Encapsulate mineralized development rock in the dry-stack tailings pile in upper Liese Creek Valley.
- Use nonmineralized development rock as construction material for roads, pads, and the RPT dam, as well as encapsulate some in the dry tailings stack.

Gravel Source

Two options for this component were identified:

- Expand the existing gravel pit below the 1525 Portal (Figure 2.3-1 a), develop new pits adjacent to the 3,000-ft airstrip (Figure 2.3-1 b) as well as adjacent to the access road on the west side of the Goodpaster River (Figure 2.3-1), and develop a pit at the mouth of Liese Creek Valley (Figure 2.3-1 b) and two pits adjacent to the Liese Creek tailings disposal facility (Figure 2.3-1 e).
- Gravel would not be extracted. Nonmineralized development rock that otherwise would be encapsulated in the dry tailings stack would be crushed to produce gravel.

Construction Camp Location

One option for this component was considered. A 200-person construction camp would be built at the site of the existing exploration camp below the existing 1525 Portal on the Goodpaster Valley floor (Figure 2.3-1 a). It would be used for the approximately 2 years necessary to construct a permanent camp in Liese Creek Valley. Once construction were finished, this camp would be dismantled.

Laydown Areas

Two options for this component were considered:

- Permanent laydown areas would be built on the Goodpaster Valley floor below the 1525 Portal (Figure 2.3-1 a) and adjacent to the airstrip (Figure 2.3-1 b). A smaller permanent laydown area also would be built at the mill site in Liese Creek Valley. After construction, the valley floor site below the 1525 Portal and airstrip laydown site would be reduced in size to accommodate operational phase needs.
- An expanded laydown area for operations would be built at the mill site in Liese Creek Valley, and the 1525 Portal and airstrip laydown areas on the Goodpaster Valley floor would be reclaimed after construction.

Power Supply

Two options for this component were considered:.

- Produce power on site by using diesel generators that would require an additional approximately 4.2 million gallons of fuel to be trucked to and stored at the mine site.
- Bring power to the mine site via a power line from the existing GVEA power line that parallels the Richardson Highway from Fairbanks to Delta Junction.

Water Supply

This component had two subcomponents: an industrial water source and a domestic water source.

Industrial water source Four options were considered:

- Ground water infiltrating the underground mine shaft and tunnels
- Water from the RTP in Liese Creek Valley
- Wells in the Goodpaster Valley and in upper Liese Creek Valley above the dry stack
- Water pumped directly from the Goodpaster River.

Domestic water source Two options were considered:

- Wells in the Goodpaster Valley
- Water pumped directly from the Goodpaster River.

Water Discharge

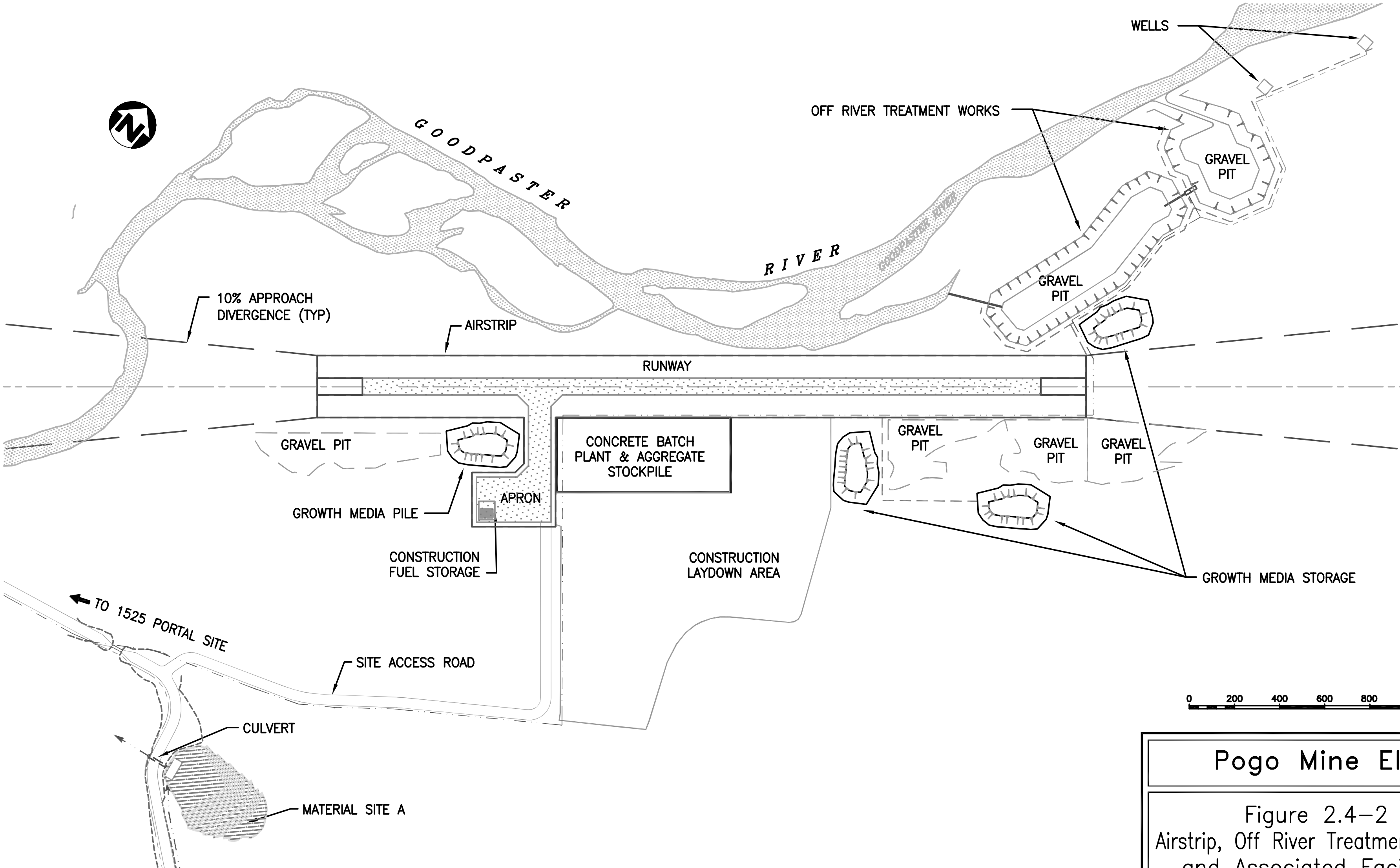
This component had two subcomponents: discharge during the mine development phase, and discharge during the operational phase.

Development phase For this phase, during which the various permanent project facilities would be constructed, three options were considered:

- Use of the same borehole/cased underground injection wells used for water discharge during the exploration phase
- Treatment and direct discharge to the Goodpaster River
- Off-river treatment works.

Operations phase For this phase, two types of discharge were addressed: industrial excess water discharge from the RTP, and domestic discharge from the mill and camp.

- Industrial wastewater (RTP) Five excess water discharge options from the RTP were considered. For all options, wastewater would be treated before discharge.
  - Discharge to an artificial wetlands constructed in an existing borrow pit below the existing 1525 Portal on the floor of the Goodpaster Valley (Figure 2.3-1 a).
  - Injection into an engineered SAS. This option had three location sub-options: near the airstrip in the Goodpaster Valley (Figure 2.3-1 b), in middle Liese Creek Valley, and in the saddle above and southeast of Pogo Ridge to be accessed by a spur road.
  - Inject water into bored/cased wells below the existing 1525 Portal, as has occurred during the exploration phase (Figure 2.3-1 a).
  - Direct discharge to the Goodpaster River (Figure 2.3-1 a).
  - Discharge through an off-river treatment works (Figure 2.4-2) that would use two ponds created in excavated gravel pits: a primary pond with an intake channel from the Goodpaster River and a separate secondary pond. Water would be pumped from the primary pond, mixed with treated process water, and discharged to the secondary treatment pond for mixing. Water from the secondary pond would be discharged via gravity flow through a screened pipe into a channel leading back to the river. Residence time in the second pond would be approximately 24 hours, which would provide ample time to respond to potential upset conditions at the water treatment plant by closing the shutoff valve in the pond's outlet works. When river ice or other restrictions limit intake flow, water would be pumped from two wells upstream of the ponds (Figure 2.4-2) to the mixing chamber (Teck-Pogo Inc., 2002i). With this option, modeling showed the RTP would overtop and discharge without treatment approximately 45 times in 1,000 years during major storm or runoff events. Note that the modeling conducted to determine this frequency of overtopping did not include use of supplemental groundwater from wells for dilution water in the mixing; therefore, this frequency is conservative.
- Domestic wastewater Two options were considered for domestic wastewater. Both options would use package treatment plants that would produce an effluent that would be discharged directly without further treatment.
  - Underground to a drain field. The first option had two sub-options for location of the discharge field.
    - Discharge from a Liese Creek camp and mill treatment plant to a permanent discharge field on the Goodpaster River Valley floor near the mouth of Liese Creek.



Pogo Mine EIS

Figure 2.4–2
Airstrip, Off River Treatment Works and Associated Facilities

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  - During the development phase, treated effluent would be discharged to a temporary discharge field on the south-facing side slope below the camp in Liese Creek Valley. Then, during operations, treated effluent would be piped through the mine to a permanent discharge field on the Goodpaster Valley floor originally built for use by the temporary construction camp during the development phase.

- Directly to the Goodpaster River. A permanent package water treatment plant would be constructed below the 1525 Portal (Figure 2.3-1 a) and would serve both the nearby temporary construction camp and the Liese Creek construction/permanent camp.

  During early operation of the construction/permanent camp in Liese Creek, sewage either would be trucked or pumped through a pipeline that would run adjacent to the site access road to the permanent treatment plant below the 1525 Portal. During operations, sewage would flow from the camp by gravity through the mine to the treatment plant. Treated effluent would be discharged directly to the Goodpaster River at a maximum rate of approximately 50 gpm during construction, and at an average rate of approximately 20 gpm during operations.

Fuel Supply and Storage

This component has two subcomponents: a fuel supply route and a storage location.

Supply route Three fuel supply route options were considered:

- An all-season road, with two route sub-options:
  - Shaw Creek Hillside route
  - South Ridge route
- Winter-only access, also with two route sub-options (which are described in more detail below under surface access routes):
  - Shaw Creek Flats route
  - Goodpaster Valley route
- An air-only supply route.

Storage location Two options for locations of diesel fuel storage were considered:

- First, construction of temporary diesel storage tanks on the Goodpaster Valley floor below the existing 1525 Portal (Figure 2.3-1 a) and adjacent to the airstrip (Figure 2.3-1 b). Smaller, permanent storage would be built at the mill in Liese Creek Valley (Figure 2.3-1 d) and at the mouth of the 1525 Portal (Figure 2.3-1 a) above the valley floor. After the construction phase, all diesel storage would be removed from the Goodpaster Valley floor.
- The second option would be the same, except there would be no permanent diesel storage at the mouth of the 1525 Portal above the valley floor. There would be a permanent 5,000-gallon Jet-A tank at the airstrip with either option.

Surface Access

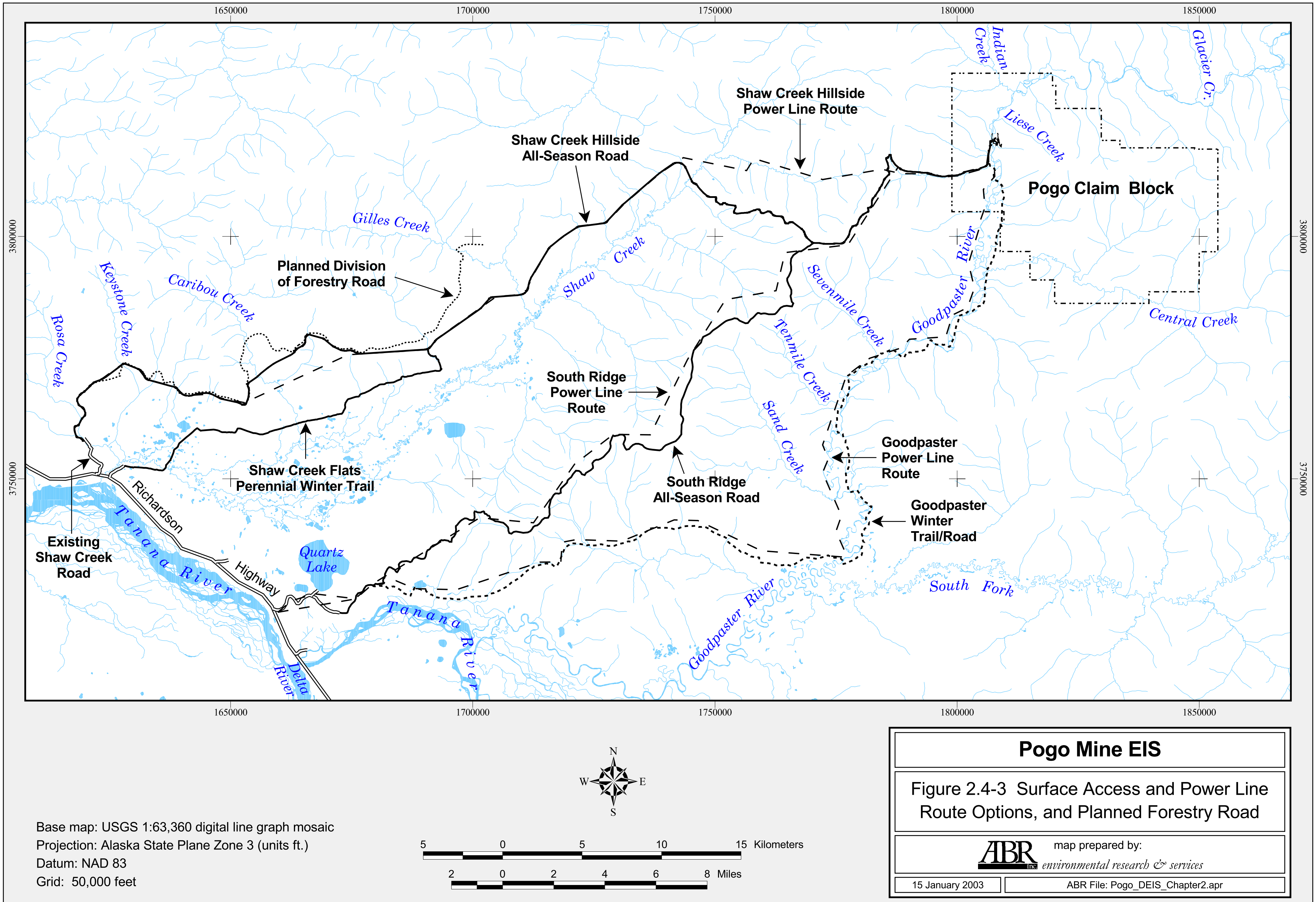
This component had four subcomponents: type of access, access route, management of that access, and ultimate disposition of the access system at mine closure.

Access type This subcomponent had three options for the type of surface access: an all-season road, winter-only access, and a railroad.

- All-season road An all-season gravel road would be constructed between the Richardson Highway and the mine site. After the road was built, during intense periods of mine construction, traffic would average approximately 50 vehicles per day, roughly split between semi-tractor trailers and light vehicles. Mine-related large truck traffic would average approximately 5 to 10 per day, 7 days per week, during the day or at night. In addition, there would be an average of approximately eight other daily vehicles. Overall, mine-related vehicle use would average between 10 and 20 round trips per day. Depending on the project's particular needs, the number of trucks on a given day could be substantially higher than the average, while on other days there might be no trucks.
- Winter-only access Two winter-only access type sub-options were considered: a traditional winter road and a perennial winter trail. How these sub-options would be constructed is described later under access design.
  - Traditional winter road A traditional winter road would be constructed every year of the project's life, beginning in late November or early December. It was expected the road would be useable for approximately 8 weeks each year. Traffic would consist of approximately 30 to 35 large trucks per day, 7 days per week, day and night.
  - Perennial winter trail A perennial winter trail also would be constructed every year of the project's life, beginning in late November or early December. It was expected the trail would be useable for approximately 10 weeks each year, 2 weeks longer than would a traditional winter road. Traffic would be similar to that for the traditional winter road, but somewhat lower on a daily basis because of the longer period of operation.
- Railroad A small-gauge railroad would be built between the Richardson Highway and the mine. It would make several round trips per week carrying freight and passengers year-round.

Access route This subcomponent had three options for type of access route: those for an all-season road, those for winter-only access, and that for a railroad.

- All-season road For the all-season road option, three route sub-options were considered.
  - Shaw Creek Hillside This 49-mile route would begin at the Richardson Highway in the vicinity of Shaw Creek (Figure 2.4-3). It would proceed up the northwest side of the Shaw Creek Valley for a distance of approximately 25 miles. It then would cross Shaw Creek and climb 18 miles over the divide to the Goodpaster River and the mine site. Seven single-lane bridges would be required across six waterways: Rosa (two), Keystone, Caribou, Gilles and Shaw creeks, and the Goodpaster River.



Base map: USGS 1:63,360 digital line graph mosaic
Projection: Alaska State Plane Zone 3 (units ft.)
Datum: NAD 83
Grid: 50,000 feet

Pogo Mine EIS

Figure 2.4-3 Surface Access and Power Line Route Options, and Planned Forestry Road

ABR map prepared by: environmental research & services

15 January 2003 | ABR File: Pogo_DEIS_Chapter2.apr

For the Shaw Creek Hillside route sub-option only, four sub-options were considered for the initial egress from the Richardson Highway to a point near the end of the existing 2.1-mile long Shaw Creek Road (Figure 2.4-4).

- Shaw Creek/Rosa, would use the existing Shaw Creek Road.
- Pipeline, would exit the Richardson Highway on a TAPS access road approximately one-half mile east of Shaw Creek Road. After reaching the TAPS pipeline, it would turn northwest and follow the TAPS work pad immediately adjacent to the elevated pipeline until it intersected with the Shaw Creek/Rosa sub-option route after approximately 4 miles.
- Keystone, would follow the same route to the TAPS pipeline as the Pipeline sub-option, but then would head directly north-northeast across Shaw Creek Flats until it intersected the Shaw Creek Hillside route.
- Tenderfoot, would leave the Richardson approximately 3 miles west-northwest of Shaw Creek Road (toward Fairbanks) and proceed approximately 3.5 miles over a hill until it intersected the existing Shaw Creek Road/Rosa sub-option route near the end of the existing Shaw Creek Road.

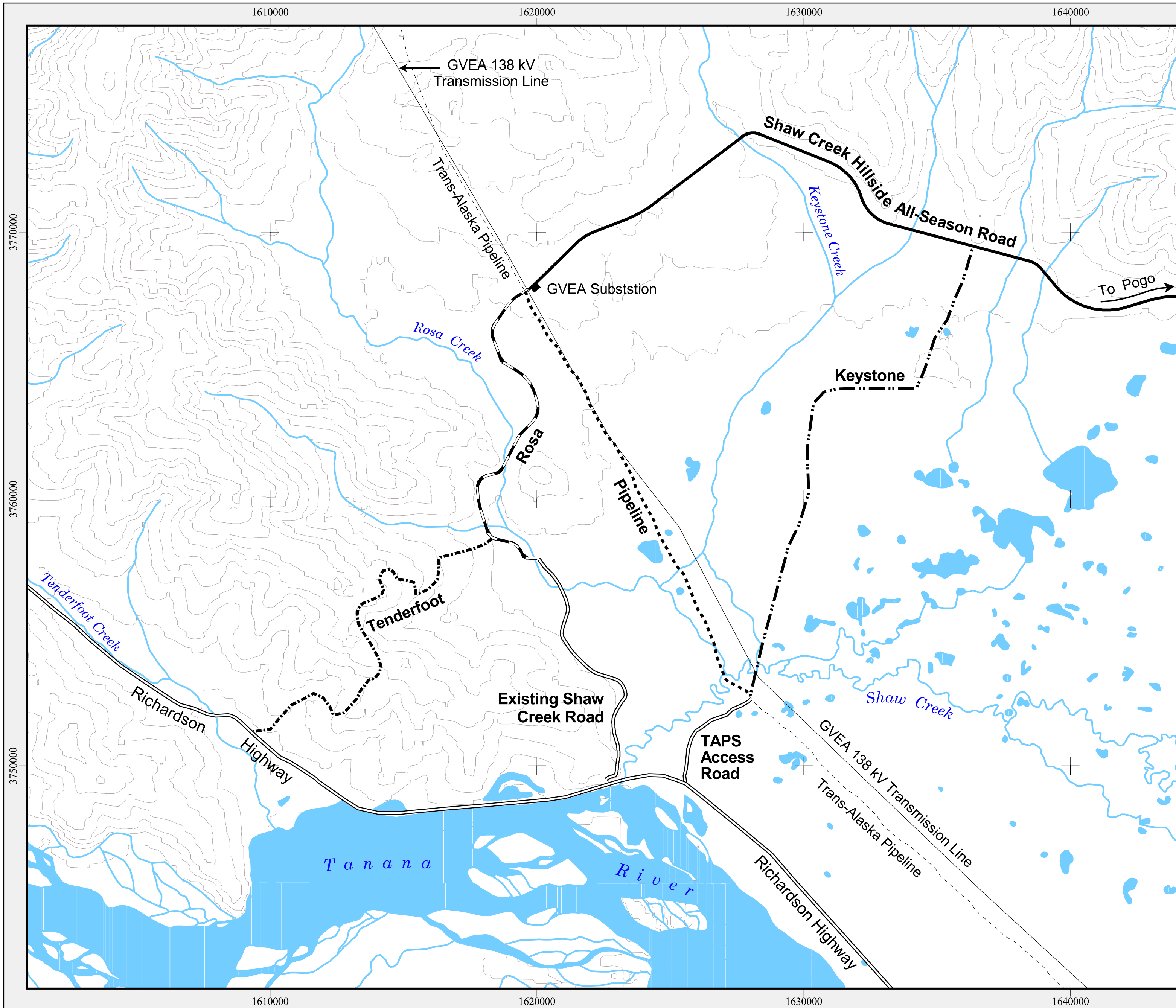
- South Ridge This 46-mile route would generally follow the ridge northwest of the Goodpaster River Valley, between that valley and Shaw Creek Valley (Figure 2.4-3). It would begin approximately 2.1 miles from the Richardson Highway at the intersection of Quartz Lake Road and the existing DOF forestry road near the public recreation area on Quartz Lake, and then travel northeast, crossing the divide between Rapid and Indian creeks. It then would climb the ridge, generally following the ridge line to the northeast, and descend to the Goodpaster Valley in the vicinity of the mine. This route would require only one bridge, across the Goodpaster at the mine site.

- Dean Cummings Crossing This approximately 64- to 70-mile route would begin approximately 28 miles east of Delta Junction where the Alaska Highway crosses the Gerstle River. The route would follow New Cummings Road northwest to the vicinity of Dean Cummings Junction where it would cross the Tanana River. From this point, the route was not well defined, but it would pass close to Healy Lake and then up the Healy River and into the Goodpaster drainage. It would require a major bridge across the Tanana, and between five and eight other bridges, depending on the route.

- Winter-only access For the winter-only access option, two route sub-options were considered: Shaw Creek Flats and the Goodpaster River Valley.

  - Shaw Creek Flats This approximately 46-mile sub-option had two sub-options, both of which would begin at the TAPS Pipeline access road off the Richardson Highway, half a mile east of Shaw Creek (Figure 2.4-3).

    - To head of Shaw Creek Valley This sub-option would follow the existing winter trail in the lower Shaw Creek Valley, and then proceed up the bottom of the upper valley for a distance of approximately 25 miles, making two crossings of Shaw Creek and three crossings of other major creeks. Because of the mountainous topography between the Goodpaster and Shaw Creek valleys, an approximately 18-mile all-season road would be constructed over the Shaw Creek and Goodpaster River divide to the mine site.



Pogo Mine EIS

Figure 2.4-4
Richardson Highway
Egress Route
Suboptions

map prepared by:
ABR Inc.
environmental research & services

14 Jan 2003 | File: Pogo_DEIS_Chapter2.apr

        - To south of Gilles Creek This shorter sub-option would follow the existing winter trail in the lower Shaw Creek Valley to a point between Caribou and Gilles creeks, and then would turn north and intersect the Shaw Creek Hillside all-season road route, a distance of approximately 15 miles. It then would follow the all-season route approximately 30.5 miles to the mine site.

    - Goodpaster River Valley This 49-mile route would follow the existing winter trail up the Goodpaster Valley (Figure 2.4-3). Like the South Ridge all-season route, it would begin at the intersection of Quartz Lake Road and the existing DOF road near the public recreation area on Quartz Lake. It would require nine crossings of the Goodpaster River and several other minor crossings. The Applicant used this road during the winter of 1997-1998 to haul in equipment, supplies, and fuel for its exploration program.

- Railroad Railroads by their nature have severe grade limitations. Therefore, for this option, the Goodpaster River Valley would be the only practicable route. The route logically would follow closely the existing winter trail, beginning at the intersection of Quartz Lake Road and the existing DOF road near the public recreation area on Quartz Lake. It would require approximately six to nine crossings of the Goodpaster River and several other minor crossings.

Access management This subcomponent had thee types of access management: that for design of the access system, that for managing actual use of the access system, and that for location of a security gate for an all-season road.

- Access design Two design issues were considered: that for an all-season road and that for winter-only access.

    - Two all-season road designs were considered.

        - One-lane road The road surface would be approximately 15 ft wide with approximately three additional 15-ft-wide by 300-ft-long turnouts per mile to allow traffic to pass. It would have single lane bridges and a maximum grade of 10 percent, and would be designed for a speed of 35 miles per hour.

        - Two-lane road The road surface would be 24 ft wide, with single-lane bridges and a maximum grade of 10 percent, and would be designed for a speed of 35 miles per hour. There would be no turnouts.

    - Two winter-only access designs were considered.

        - Traditional winter road The road surface would be composed of snow and ice built on top of the organic layer. Construction would involve grooming the snow to promote freeze-up of the trail, hauling snow and water and icing the trail surface where necessary, installing temporary bridge structures at select stream and river crossings, and constructing ice bridges and snow and ice ramps. There would be little clipping of tussocks or blading into the mineral soil.

        - Perennial winter trail This option would be similar to the traditional winter road, except the trail surface would be bladed flat and would require small cuts and fills and limited removal of some surface organics, including clipping off tussocks. This flatter micro-topography would allow a drivable snow and ice surface to be constructed more quickly each winter, thus providing a longer winter operating window than a traditional winter road.

- Access use Three road or trail use options were considered during the life of the Pogo project. The first would allow use for Pogo project-related purposes only. Second would be for Pogo project-related purposes as well as for other industrial/commercial users. The third option would allow road use by everyone.

- Security gate location Two locations for a security gate for the Shaw Creek Hillside all-season road route option were considered: near the end of the existing Shaw Creek Road and at Gilles Creek approximately 23 miles up the Shaw Creek Valley from the end of the existing Shaw Creek Road.

Access disposition This subcomponent had three options for access system disposition after mine closure:

- Remove and reclaim the road at the end of the Pogo project

- Convert the road to a recreational hiking trail

- Leave the road in place

  If an all-season road were to be left in place, two sub-options for its continued use were considered:

  - Restrict use to industrial and commercial resource users

  - Leave the road open for use by everyone

Air Access

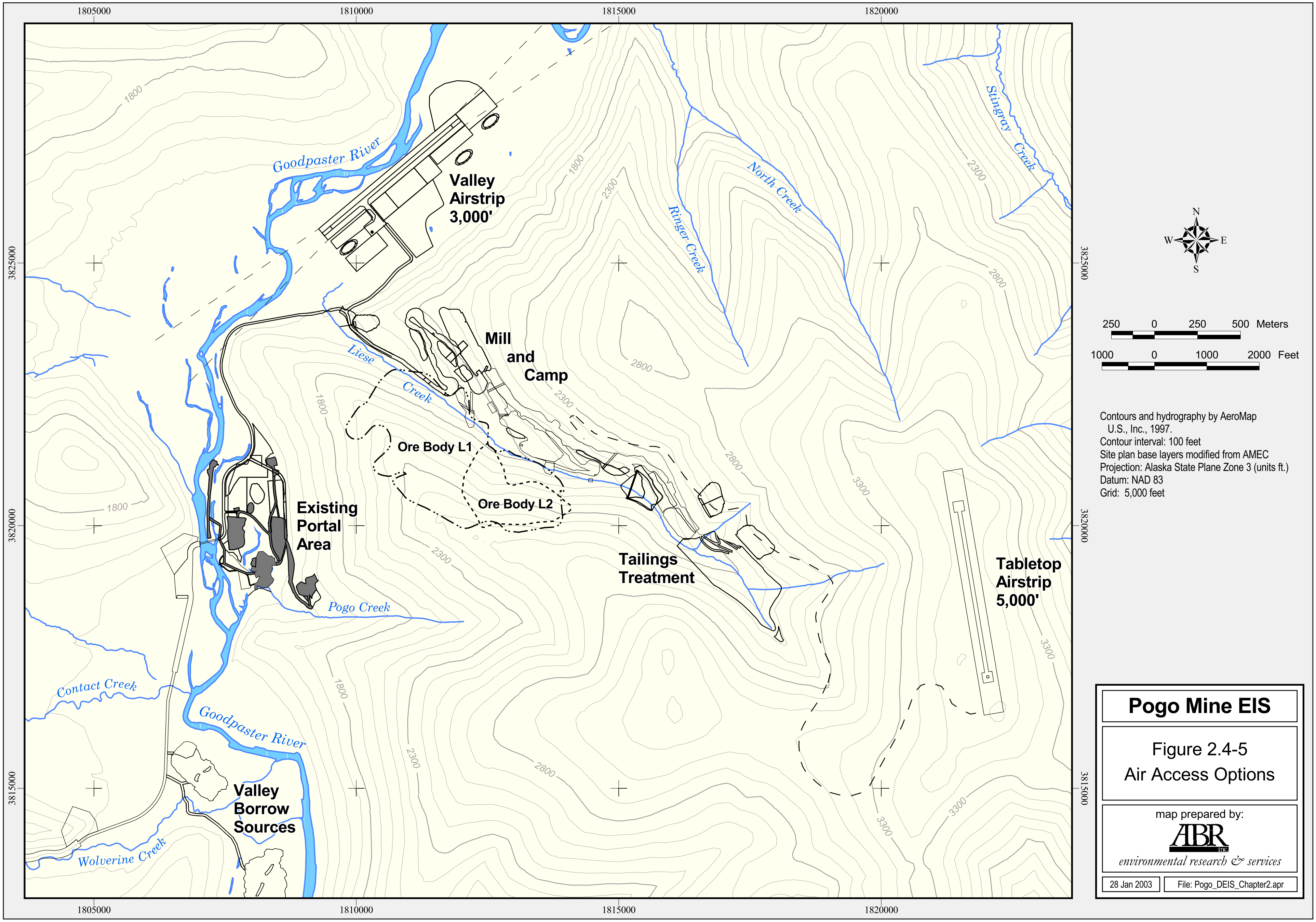
This component had three subcomponents: type of air access, management of that access, and ultimate disposition of the access system at mine closure.

Access type This subcomponent had three options: an air-only access option, air access as a complement to surface access, and no air access complement to surface access.

- Air-only access Under this option, almost all movement of personnel and supplies would be by air, with no all-season road or regular annual winter-only access. A winter road still would have to be constructed up the Goodpaster Winter Trail for the first two or three consecutive seasons in order to mobilize and demobilize the equipment and supplies necessary to construct an airstrip and the other mine facilities, and to supply the initial inventory. Winter-only access, however, still would have to be used periodically for items too large to be transported by air.

- Complement to surface access Two complementary air sub-options for surface access were considered (Figure 2.4-5).

  - 3,000-ft airstrip This airstrip would be located in the Goodpaster Valley just north of the mouth of Liese Creek in conjunction with the all-season road option. This strip would be capable of handling SkyVan, Caribou, DC3, CASA 212, Caravan, and King Air aircraft. Approximately two flights per week would be required to transport supplies and personnel during mine operations.


Goodpaster River
Valley Airstrip 3,000'
Mill and Camp
Liese Creek
Ringer Creek
North Creek
Stingray Creek
Ore Body L1
Ore Body L2
Existing Portal Area
Tailings Treatment
Tabletop Airstrip 5,000'
Pogo Creek
Contact Creek
Goodpaster River
Valley Borrow Sources
Wolverine Creek
1805000
1810000
1815000
1820000
3825000
3820000
3815000
250 0 250 500 Meters
1000 0 1000 2000 Feet
Contours and hydrography by AeroMap U.S., Inc., 1997.
Contour interval: 100 feet
Site plan base layers modified from AMEC
Projection: Alaska State Plane Zone 3 (units ft.)
Datum: NAD 83
Grid: 5,000 feet
Pogo Mine EIS
Figure 2.4-5
Air Access Options
map prepared by:
ABR inc.
environmental research & services
28 Jan 2003
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- ✦ 5,000-ft airstrip This airstrip would be located at the Tabletop site above and east of Liese Creek Valley in conjunction with the winter-only access option. This strip would be capable of handling large DC-6 and Hercules C-130 aircraft. Approximately 500 flights per year would be required to transport supplies and personnel during mine operations.

- No air complement to surface access There would be no air access to the mine site, only surface access.

Access management This subcomponent had three options for managing air access use during the life of the Pogo project:

- Pogo project-related purposes only
- Pogo project-related purposes as well as for other industrial and commercial resource purposes
- Open to use by everyone

Access disposition This subcomponent had two options for airstrip disposition after mine closure and reclamation:

- Remove and reclaim the airstrip
- Leave the airstrip in place

  If the airstrip were to be left in place, two sub-options for its continued use were considered:

  - ✦ Restrict use to industrial and commercial resource users
  - ✦ Leave the airstrip open for use by everyone

Power Line Route

Three route options were considered for this component, each relatively closely paralleling a surface access route option (Figure 2.4-3):

- All-season road:
  - ✦ Shaw Creek Hillside
  - ✦ South Ridge
- Winter-only access:
  - ✦ Shaw Creek Hillside
  - ✦ Goodpaster River Valley

Note that for the Shaw Creek Flats winter-only surface access option, the power line in the lower Shaw Creek drainage would follow the power line route for the Shaw Creek Hillside all-season road option and would not be located in the flats near the winter road or perennial winter trail in the valley bottom. These routes are described in more detail above under ground access routes.

2.4.3 Options Screening Process

Once all the options that addressed the scoping issues had been identified in Section 2.4.2, it was necessary to screen them to reduce the more than 100 options and sub-options initially identified to a more manageable number that still provided a reasonable range from which to identify full project alternatives.

This process was conducted by the third-Party EIS team and agency representatives. First, it involved developing objective evaluation criteria for each scoping issue. Then, each option was screened against those criteria to determine which options best addressed the scoping issues. These options then were retained for detailed impacts analysis in Chapter 4, and the other options were dropped from further consideration. This process was comprehensive and time consuming, and readers are referred to Appendix A.1 in which each step in the process is described.

Following the options screening process, the remaining options and sub-options were grouped to form alternatives to the Applicant's proposed project. How this was done is described next in Section 2.5 (Action Alternatives Identification).

2.5 Action Alternatives Identification

Section 2.2 above described Alternative 1, the No Action Alternative. Alternative 1 considers what would happen in the project area if no action were taken and the Pogo Mine project did not go forward. All other alternatives addressed in this EIS are called “action alternatives.”

An **action alternative** is one that if the agencies took the actions to implement it by issuing the necessary permits, a change would occur in the project area from the situation described in the No Action Alternative.

The first action alternative is Alternative 2, the Applicant’s Proposed Project. This alternative was described in detail in Section 2.3 to provide an understanding of what the Applicant’s proposed Project would entail. NEPA, however, requires that an EIS consider feasible alternatives to the Applicant’s Proposed Project that address issues raised during the scoping process. The previous section, 1.1, described how the scoping issues were identified, how options and sub-options were developed to address those issues, and how those options and sub-options were screened to determine which ones best addressed the scoping issues, and which should be dropped from further consideration. This section, 2.5, describes how the remaining options and sub-options were grouped to form two additional action alternatives; that is, alternatives to the Applicant’s Proposed Project (Alternative 2).

To present these options and sub-options as part of the three action alternatives in the most understandable manner, they have been divided into the following three groups of components, which are described and presented in tabular format in the following subsections.

1. Options and sub-options that are common to all three action alternatives
2. Options and sub-options that vary among the alternatives, but that are not related to surface access
3. Options and sub-options that vary among the alternatives, and that are related to surface access

Alternatives Construction

An action alternative contains an option for each project component so that if the alternative were constructed it would produce a functioning project. How options are assigned to a particular alternative, however, depends on such factors as the nature of the project, the issues identified during scoping, and expected impacts. Because of the large number of Pogo project components, options, and sub-options, the number of permutations and combinations was very high. Without careful alternative construction, a substantial number of confusing alternatives could have resulted. Therefore, it was important to assign options to alternatives in a way that would reduce the number of action alternatives to the minimum necessary to provide a structure that could accurately describe and compare environmental impacts in Chapter 4 in an understandable manner.

To best accomplish the description and comparison of environmental impacts, in a few instances the action alternatives in this EIS present more than one option or sub-option for a particular component. Doing so eliminated the need to identify an entirely new alternative that would differ for only that single component. An example is the Richardson Highway egress sub-option. The two route choices for this sub-option that were carried forward for detailed analysis in Chapter 4, the existing Shaw Creek Road/Rosa route and the Tenderfoot route, were both assigned to Alternative 2 for impact analysis because they were specific only to the Shaw Creek Hillside all-season road route, which is found only in Alternative 2. Although Alternative 2 is the Applicant’s Proposed Project, and the Applicant did not propose the Tenderfoot route, the discussion of Alternative 2 was the logical place to discuss and compare its impacts with the Shaw Creek Road/Rosa route, and doing so eliminated the need to identify an entirely new alternative that would differ only in this small route segment specific to only one alternative.

Another example concerned the fuel storage subcomponent related to the on-site power generation option. With on-site power generation, additional diesel fuel storage at the mine site would be needed. If surface access were provided by an all-season road, only an additional 1.6 acres of fuel storage would be needed. If surface access were provided by winter only access, however, an additional 6.1 acres of fuel storage would be needed (because fuel would have to be stored for an entire year). Thus, to allow these two options to be compared without identifying an entirely new alternative, they are discussed where applicable under existing alternatives.

2.5.1 Options Common to All Action Alternatives

The first component group consists of 11 project components, with 23 options, that are common to all three action alternatives (Table 2.5-1). That is, these options would be the same regardless of the alternative ultimately selected. Because they are common to all action alternatives, their impacts are discussed separately as a group in Chapter 4 (Environmental Consequences).

Table 2.5-1 Component Options and Sub-Options <u>Common</u> to All Action Alternatives

Milling Process
- <u>Gravity/flotation/cyanide vat leach[1]</u>

Tailings Disposal
- <u>Underground paste backfill</u>
- <u>Surface dry stack and RTP in Liese Creek Valley</u>

Mill and Camp Location
- <u>Liese Creek Valley</u>

Development Rock Disposal
- <u>Mineralized rock encapsulated in dry stack</u>
- <u>Nonmineralized rock in dry stack, for RTP dam, and for other construction</u>

Gravel Source
- <u>Expand existing pits; develop new pits in Goodpaster and Liese Creek valleys</u>
- Crush nonmineralized development rock

Construction Camp
- <u>At existing exploration camp below 1525 Portal in Goodpaster Valley</u>

Laydown Area
- <u>Permanent below existing 1525 Portal, adjacent to airstrip, and at mill</u>

Water Supply

Industrial
- <u>Mine drainage</u>
- <u>RTP</u>
- <u>Wells</u>

Domestic
- <u>Wells</u>

Water Discharge

Operations Phase
- Domestic wastewater
  - ✦ <u>Package treatment plant and direct discharge to Goodpaster River</u>

Fuel Storage Location
- <u>Temporary below 1525 Portal and airstrip; permanent at portal mouth and mill</u>

Air Access
- <u>3,000-ft airstrip in Goodpaster Valley</u>

Use
- <u>Pogo project only</u>
- Pogo and other industrial/commercial users only
- Everyone

Disposition
- <u>Remove and reclaim following mine reclamation</u>
- Open for Industrial/commercial resource users only
- Open for everyone

[1] <u>Underline</u> – Applicant's proposed option or sub-option

2.5.2 Nonsurface Access-Related Options Specific to Action Alternatives

The second group consists of 3 project components, with 13 options and 2 sub-options that are specific to certain action alternatives, but that are not related to the issue of surface access (Table 2.5-2). An "X" indicates that a particular option or sub-option is contained in a given alternative. Because they are all unrelated to surface access issues, their impacts are discussed separately as a group for each resource in Chapter 4.

Because these options and sub-options were independent of the type and route of surface access, they were assigned to an action alternative in a manner that best allowed for a comparison between related options and sub-options.

Table 2.5-2 Component Options and Sub-Options that are Specific to Certain Action Alternatives, but Not Related to Surface Access

	Alternative		
Component/Option/Sub-option	**2**	**3**	**4**
Tailings Facility Liner			
▶ Surface dry stack and RTP in Liese Creek[1]			
✦ Lined dry stack		X	X
✦ Lined RTP		X	X
✦ Unlined dry stack	X		
✦ Unlined RTP	X		
Power Supply			
▶ Power line	X	X	
▶ On-site generation			X
Water Discharge			
Development Phase			
▶ Underground injection wells	X		
▶ Direct discharge to Goodpaster River		X	
▶ Off-river treatment works			X
Operations Phase			
▶ Soil absorption system (SAS)	X		
✦ Goodpaster River Valley adjacent to airstrip	X		
✦ Saddle above and southeast of Pogo Ridge	X		
▶ Underground injection wells	X		
▶ Direct discharge to Goodpaster River		X	
▶ Off-river treatment works			X

[1] Underline – Applicant's proposed option or sub-option

2.5.3 Surface Access Related Options Specific to Action Alternatives

The third group consists of 2 project components, with 10 options and 8 sub-options, that vary among action alternatives, and that are directly related to surface access (Table 2.5-3). An “X” indicates that a particular option or sub-option is contained in a given alternative. Because they are all directly related to the surface access issue, their impacts are discussed separately as a group for each resource in Chapter 4.

The biggest difference between the three action alternatives in this group concerned surface access to the mine site, both by type and route. Alternative 2 (Applicant’s Proposed Project) contains the Shaw Creek Hillside all-season road option; Alternative 3 contains the South Ridge all-season road option; and Alternative 4 contains the Shaw Creek Flats winter-only access option.

The primary thrust of Alternative 3 was to define an alternative that offered an all-season road option other than the Applicant’s proposed Shaw Creek Hillside all-season route. The primary purpose of Alternative 4 was to define a surface access option specifically designed to avoid all-season access so that there would be a physical barrier to public access rather than only a management decision about whether public use would be permitted.

The allocation of some options and sub-options to specific alternatives depended on the particular surface access option. For example, whether the initial all-season road egress from the Richardson Highway would be via the existing Shaw Creek Road or the Tenderfoot route was specific only to the Shaw Creek Hillside route; therefore, both were assigned to Alternative 2. In a similar manner, the two power line route options were specific to the surface access route they would parallel; therefore, each was assigned to the alternative containing its corresponding access route. Also, how use of an all-season road would be managed, and whether it would be removed at the end of the Pogo project, were applicable only to the all-season road options in Alternatives 2 and 3, and not to the winter-only access option.

Figure 2.5-1 graphically presents all the options that differ among the action alternatives (Tables 2.5-2 and 2.5-3). Those on the left side of the figure are not related to surface access, and those on the right side of the figure are related to surface access. Note that Figure 2.5-1 does not contain those options that would be common to all alternatives (Table 2.5-1) because, by definition, there would be no difference in impacts among the alternatives.

Table 2.5-3 Component Options and Sub-Options that are Related to Surface Access

Component/Option/Sub-option	Alternative 2	Alternative 3	Alternative 4
Surface Access			
Route			
▶ Shaw Creek Hillside all-season road[1]	X		
✦ Shaw Creek Road/Rosa egress from Richardson Highway	X		
✦ New Tenderfoot egress from Richardson Highway	X		
▶ South Ridge all-season road		X	
▶ Shaw Creek Flats winter-only access			X
✦ Traditional winter road construction standards			X
✦ Perennial winter trail construction standards			X
Use			
▶ Pogo project only	X	X	
▶ Pogo and other industrial/commercial users only	X	X	
▶ Everyone	X	X	
✦ Security gate near end of Shaw Creek Road	X		
✦ Security gate at Gilles Creek	X		
Disposition			
▶ Remove and reclaim	X	X	
▶ Leave road open (versus closed) to:			
✦ Industrial/commercial users	X	X	
✦ Everyone	X	X	
Power Line Route			
▶ Shaw Creek Hillside	X		
▶ South Ridge		X	

[1] Underline – Applicant's proposed option or sub-option

ALTERNATIVES ANALYZED IN THIS EIS

AN ALTERNATIVE TO BE ANALYZED IN THIS EIS[1] =	TAILINGS FACILITY LINER +	POWER SUPPLY +	DEVELOPMENT PHASE +	OPERATIONS PHASE +	TYPE +	ROUTE +	USE +	DISPOSITION +	POWER LINE ROUTE
	COMPONENTS NOT SURFACE ACCESS RELATED		WATER DISCHARGE	WATER DISCHARGE	COMPONENTS SURFACE ACCESS RELATED: ACCESS	ACCESS	ACCESS	ACCESS	COMPONENTS SURFACE ACCESS RELATED
	Options	Options	Options	Options	Options	Options	Options	Options	Options
ALTERNATIVE 1 **NO ACTION**	Under the **No Action Alternative,** the project would not be developed and none of the options below would be implemented.								
ALTERNATIVE 2 Applicant's Proposed Project	Unlined	Power Line	Injection Wells	▪ Injection Wells, and ▪ SAS ◆ At airstrip ◆ Above Pogo Ridge	All-Season Road	▪ Shaw Creek Hillside, Richardson Egress ◆ Shaw Creek Road ◆ Tenderfoot	▪ Pogo Project Only, or ▪ Pogo and: ◆ Industrial/ Commercial ◆ Everyone	▪ Remove/Reclaim, or ▪ Road Left Open to: ◆ Industrial/ Commercial ◆ Everyone	Shaw Creek Hillside
ALTERNATIVE 3 South Ridge Route Direct Discharge	Lined	"	Direct Discharge to Goodpaster River	Direct Discharge to Goodpaster River	"	South Ridge	"	"	South Ridge
ALTERNATIVE 4 Winter Only Access Off-River Treatment Works	"	On-Site Generation	Off-River Treatment Works	Off-River Treatment Works	Winter Access Only ▪ Traditional Road ▪ Perennial Trail	Shaw Creek Flats	N/A[2]	N/A	N/A
Major Options Eliminated From Further Consideration[3]			Constructed Wetlands		Railroad Air Only (5,000-ft Airstrip)	Richardson Egress: ▪ Pipeline ▪ Keystone Dean Cummings Crossing Goodpaster Valley		Convert to Recreational Trail	

[1] Excludes those components/options common to all alternatives (Table 2.5-1).
[2] Not applicable to this alternative.
[3] See Appendix A.1.

Figure 2.5-1