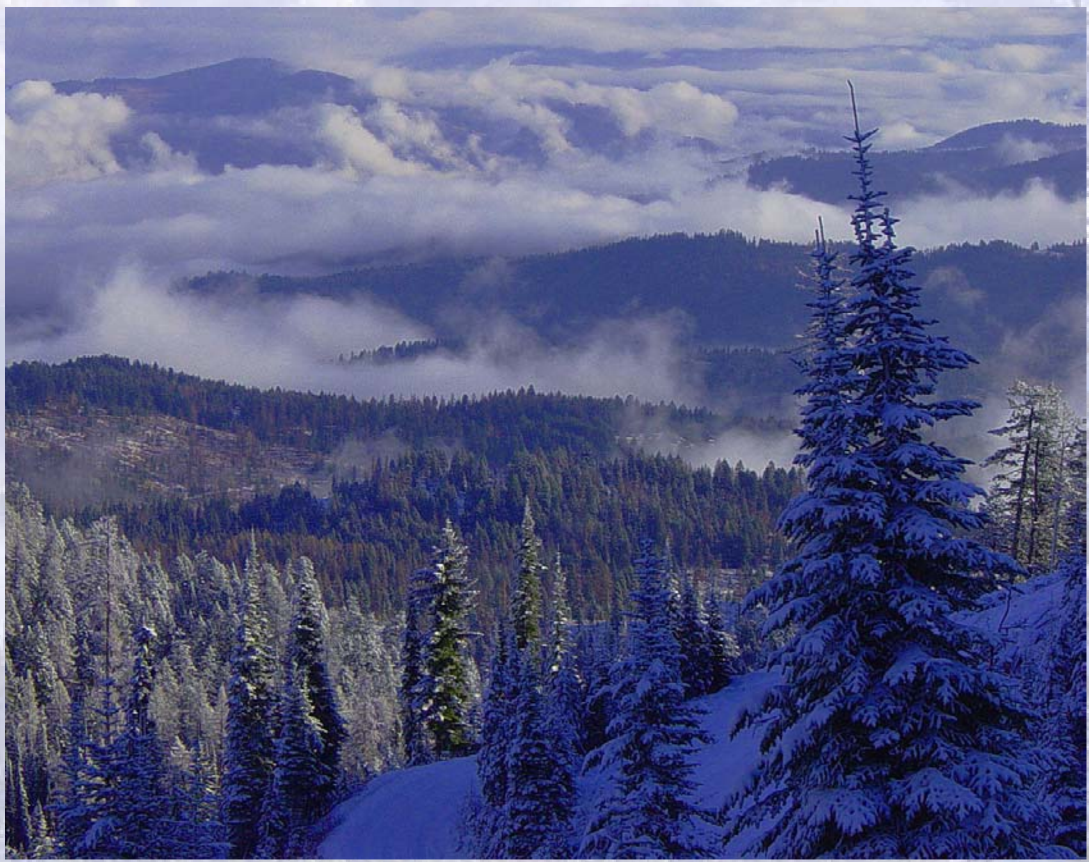
AMENDED PLAN OF OPERATIONS
BUCKHORN MT. PROJECT



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PREFACE

On July 31, 2003, Crown Resources Corporation (Crown) submitted a Plan of Operations (2003 Plan) for the Buckhorn Mt. Project in Okanogan County to the Washington Department of Ecology (DOE) and the USDA Forest Service, Tonasket Ranger District (USFS). This Amended Plan of Operations (Plan) revises and updates the 2003 Plan to reflect a new proposal to ship the ore from the Buckhorn Mt. mine for off-site processing at Echo Bay Minerals Corporation's (EBMC's) existing Kettle River processing facility (Mill) in Ferry County. This new project proposal modifies the 2003 Plan by eliminating the mill and tailings disposal facilities that were proposed for the Dry Gulch site near Chesaw in Okanogan County and capitalizing upon existing facilities in Ferry County that can be readily expanded. Under this Plan the Buckhorn Mountain Project will become the seventh mine in northeastern Washington to ship ore to the Kettle River Operations. The Kettle River milling facility has operated in this fashion since 1990, processing ore from satellite deposits located in the region.

This Plan also includes some minor changes in the layout of the surface facilities for the underground mine and presents a proposed haul route and haul route alternatives between the Buckhorn Mt. Mine Site and the Kettle River Mill. A new quarry site has been proposed at a location along the haul route.

Crown is able to make these revisions to the Plan of Operations for the Buckhorn Mt. Project pursuant to a new business arrangement with Kinross Gold Corporation (Kinross) and its wholly-owned subsidiary, EBMC. On November 20, 2003, Kinross announced it had entered into an agreement to acquire Crown and the Buckhorn Mt. gold deposit. Upon approval by regulatory authorities and completion of the merger Crown will become a wholly owned subsidiary of Kinross.

Crown also based the decision to change the Plan to eliminate on-site processing and tailings disposal in response to public comments received during the scoping period for the Supplemental Environmental Impact Statement (SEIS) that Ecology and the Forest Service are preparing. It was clear from these comments that some area residents had misgivings about the proposed tailings disposal site. The new business arrangement between Crown and EBMC/Kettle River Operations presents a unique opportunity that allows Crown to change its project proposal in order to accommodate these public concerns. Section 5.3 of the July 2003 Plan considered the alternative of off-site milling at the Kettle River Operations. However, at that time the off-site milling alternative was eliminated from detailed consideration because Crown and EBMC were unrelated companies and there was no business arrangement between the two.

During production, approximately 120 employees would work directly at the mine site and about 30 employees would be employed directly or under contract in the ore haul. Additionally, 40 employees currently working at the Kettle River Mill would continue to be employed during the 7-8 years of ore processing. Employment at the mine would occur at somewhat lower levels during the several years of the pre- and post-production periods.

1.0 INTRODUCTION

1.1 General Information

Crown Resources Corporation (Crown) proposes to develop an underground gold mine on Buckhorn Mountain in the Myers Creek mining district, Okanogan County, in north-central Washington (Figure 1). The ore from the Buckhorn Mt. Mine will be transported by road to the Echo Bay Minerals Corporation's existing Kettle River Operations processing facility (Mill) located near Republic in Ferry County. The mine will be similar in nature to six other mines which have operated in the vicinity and have shipped ore to the Kettle River Mill since its commissioning in 1990.

This proposal will be reviewed by regulatory agencies as described below and will be subject to an environmental impact analysis and study as part of the permitting process. The proposal described in this document in future tense is Crown's preferred project design based on information available at the time of submission. As part of the regulatory review the proposal will be one alternative for future action. However, any and all development on the part of the proponent is contingent upon regulatory approval.

The Buckhorn Mt. deposit was discovered by Crown exploration geologists in 1988 and further delineated by Battle Mountain Gold Corporation (BMG) during the period 1990 – 1992. An economic feasibility study, completed by BMG in 1992, indicated that the deposit was commercially viable as an open pit mine with an on-site milling facility. In 2000, BMG withdrew from its joint venture with Crown and the project assets reverted to 100 percent Crown ownership. Crown owns or controls unpatented mining and millsite claims in the Buckhorn Mountain area listed in Appendix A.

Crown proposes to develop the deposit as an underground gold mine on Buckhorn Mt. approximately 3.5 air miles east of Chesaw, Washington. The project will be developed on private, federal, and state land. The federal land is administered by the U.S. Forest Service (USFS) Okanogan and Wenatchee National Forests (Tonasket Ranger District).

Following the protocol of the National Environmental Policy Act (NEPA) and the Washington State Environmental Policy Act (SEPA), this Amended Plan of Operations (Plan) is submitted to the governing agencies for the purpose of review of the project proposal and preparation of environmental documents as required by law as a prerequisite to any application of permits necessary for operation.

This Plan presents details of the proposed new project. The document builds in part on the previous work developed by BMG relating to the Crown Jewel Project, a proposed open pit gold/silver mine at Buckhorn Mountain. BMG submitted a Plan of Operations pertaining to that proposal in 1992 and its subsequent revisions in 1993, 1997, and 1998. This Plan is also based in part on the extensive studies performed during the environmental review of the BMG proposal. It contains similar information relative to the location, access, topography, surface ownership, and site environmental characteristics. Compared with the previous BMG Crown Jewel Project, significant changes have been made in the proposed operations to address issues identified in the previous environmental analyses, including revisions and updates to operating facilities and reclamation, mitigation, and monitoring plans.

This Plan updates and revises the previous plan prepared and submitted by Crown on July 31, 2003, which proposed an underground mine at Buckhorn Mountain with a new ore processing and tailings facility on private land at Dry Gulch near Chesaw. This Plan eliminates the need for a new ore processing and tailings facility, and instead incorporates the existing and approved Kettle River Mill for the processing of the ore. This change greatly simplifies the project description and associated technical issues.

1.2 Summary of Previous Work

The Buckhorn Mt. area has a long history of mining. The town of Chesaw was initially developed to service mineral exploration and mining activities in the small mining districts of Myers Creek, Bodie, and Wauconda. Various other companies and individuals explored the Buckhorn Mountain area prior to the discovery of the Buckhorn Mt. deposit by Crown. Crown worked on the Buckhorn Mt. Project for two years defining parts of the mineralization contained within the deposit.

After forming a joint venture with Crown in 1990 and changing the name of the project to Crown Jewel, BMG performed numerous studies on the geologic, hydrogeologic, geotechnical, archeological, wildlife, air, vegetation, soils, visual resources, and threatened and endangered species conditions present at and near Buckhorn Mountain. These studies and previously projected impacts were evaluated by the USFS, United States Bureau of Land Management (BLM) and the Washington Department of Ecology (DOE). The existing environment at the various components of the Buckhorn

Mt. Project have been thoroughly described in the Final Environmental Impact Statement (FEIS) completed in 1997 by the DOE and the USFS as lead agencies and assembled by TerraMatrix Engineering and Environmental Services (TerraMatrix).

Substantial differences in the project plan exist between the current project proposal and all of the alternatives studied and assessed in the Crown Jewel permitting process. However, much of the technical information from the earlier studies is relevant for this project, particularly those relating to the existing environment. Extensive baseline work has been compiled and can be reviewed in the selected studies performed by BMG, its contractors and the agencies and contractors who assessed the project as part of the earlier EIS and permitting process. Additionally, new baseline data has been collected by Crown to augment previously collected data and new programs of monitoring are planned where appropriate. Finally, the extensive public record from the previous Crown Jewel project has been reviewed and considered in design of this Plan. The SEIS process will identify whether additional baseline data need to be collected in order to complete the environmental analysis process.

Table 1 (appended) is a reference list of pertinent major submittals associated with the Crown Jewel project. These documents provide an extensive database that is applicable for the environmental and regulatory review of this proposed underground mine.

1.3 Applicant Information

Crown Resources Corporation is incorporated in the State of Washington and is focused on developing the Buckhorn Mt. Project.

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1.4 Permits, Approvals, and Regulatory Requirements

In addition to receiving agency approval on the Plan, Crown must comply with other federal, state, and local laws and regulations. As part of the scoping process governmental agencies determine what permits will be required for operation of the mine and which existing or new environmental information will be necessary to review in order to determine any mitigation measures which must be undertaken to address identified impacts. Table 2 lists the likely permits, approvals, and authorizations currently identified as being necessary in connection with the construction, operation, and closure of the Buckhorn Mt. Project. This list may be revised based on final approved project design and consultation with regulatory agencies. The focus of this Plan are the new proposed facilities consisting of the underground mine, road upgrades, quarry, and other supporting mine infrastructure.

The Kettle River Mill is a permitted and operating facility. It is expected that Kettle River's existing operating dam safety permit may ultimately be modified to accommodate storage of the Buckhorn Mt. ore from the later years of production.

TABLE 2

PERMIT LIST

Federal Government	
U.S. Forest Service	Plan of Operations Special Use Permits (Rights-of-Ways, etc) Plan of Operations Record of Decision Utilities Easement
Environmental Protection Agency	Spill Prevention Control and Countermeasure (SPCC) Plan Notification of Hazardous Waste Activity (Review Only, No Permit Required)
Dept. of Homeland Security (Department of Alcohol, Tobacco, and Firearms)	Explosives User Permit
Mine Safety and Health Administration	Mine Identification Number (No permit Necessary) Miner Training Plan Approval Notice of Start of Operations

State of Washington	
Washington Department of Ecology	National Pollution Discharge Elimination System (NPDES)/Construction Activities Storm Water General Permit and Operational Permit Waste Water Discharge permit EPCRA Sara Title III compliance Notice of Construction Approval (Air Quality) Air Contaminant Source Operation Permit Water Rights/Change of Use
Washington Department of Fish and Wildlife	Hydraulic Project Approvals
Washington Department of Health	Public Water Supply Approval
Washington Department of Natural Resources	Road Maintenance and Improvement Mined Land Reclamation Permit Forest Practices Act Burning Permit Right of Way Utilities Easement Surface Mine Permit
Washington Department of Labor and Industries	Explosives License Safety Regulation Compliance (No Permit)
Wash., Dept of Community Development, Office of Archaeology and Historic Preservation	SHIPO/106 Review
Local Government	
Okanogan Planning Department	Conditional Use Permit/Zoning Requirements Building Permits Shoreline Management Permits Joint Aquatic Resource Permits Maximum Environmental Noise Levels (Compliance Item) Socioeconomic Impact Analysis Approval Growth Management Critical Areas Regulations
Okanogan County Health District	Solid Waste Handling
Okanogan Public Works Department	Road Construction and/or Realignment
Okanogan Public Utility District	Power Service Contract
Ferry County Planning Dept.	Quarry approval

2.0 PROJECT OVERVIEW

The proposed project area and facilities are located on private property, land partially within the boundaries of the Okanogan National Forest and certain lands belonging to the State of Washington, all in Okanogan and Ferry Counties, The proposed underground mine is located on the eastern flank of Buckhorn Mountain approximately 3.5 air miles or nine miles by road to the east of the town of Chesaw. The proposed mine site is accessible by paved and unpaved county and USFS roads as shown on Figure 1. The mineral deposit itself lies under both private and USFS land as shown on Figure 2.

The mined ore will be transported by road in highway-legal trucks from the mine to the Kettle River Mill and tailings disposal facility (TDF) near Republic in Ferry County. The majority of underground mined areas will be backfilled upon completion of mining in each area. The backfill will consist of mined development rock from the mine or gravel from a quarry located on private land west of the town of Curlew. Haul trucks returning from the Mill will transport the backfill gravel to the mine.

Figure 1 shows the proposed access route for employee and supply transportation from Oroville to the mine using county and USFS roads. Figure 1 also shows the transportation routes from the mine site to the backfill quarry and Kettle River Mill.

2.1 Project Area and Ownership

The mine site will consist of approximately 31 acres of disturbed area surrounding surface facilities located above the ore deposit. Parts of the surface facilities and of the ore deposit are located on private land with surface and mineral title belonging to Crown. The majority of the ore deposit is located under USFS surface rights. Since 1987, Crown has held the mineral rights to the area of the deposit through unpatented mining claims and fee land. A list of mining (lode) and mill site claims in the area of the mine that are owned or controlled by Crown are listed and shown on a map in Appendix A. In 1992 BMG filed applications in Crown's name for patent of ten lode claims overlying the ore deposit. Figure 2 shows the land ownership of the area surrounding the mine.

A transportation route for hauling ore from the mine to the Mill is proposed along a road alignment approximately forty-seven miles in length (Figure 1). Most of this route is comprised of paved County or State highway. However, there are some portions that will utilize the unpaved portions of an existing road alignment that Crown is proposing to upgrade in order to comply with road and traffic safety requirements. Additionally, Crown is proposing to construct an unpaved spur road from the existing road to the mine site.

2.2 Employee Access

The estimated number of employees at the mine site is about 100 at the peak of construction activities and 120 during full operation. Additional full-time contract employees will be likely used for ore hauling and quarry operations. Although some shift staggering may occur, it is anticipated that most mine employees will be assigned to one of two daily 10-hour shifts, three 8-hour shifts or two 12-hour shifts. Employees will be encouraged to car-pool. Most employees will likely access the mine site via the Pontiac Ridge/USFS 120 route, which will be improved as discussed in Section 4.12.

2.3 Project Schedule

After issuance of required permits, the construction of surface facilities at the mine site and collaring of development workings will commence. About eight months of underground development work is required prior to initial ore production. Initial development of access to the ore zones will continue for an additional six months. The development rock mined during this period will be temporarily staged on the surface until it is placed underground as backfill.

Construction required to upgrade existing roads to appropriate standards will also be initiated soon after permits are obtained. Transport of gravel for use in the mine as backfill will commence based upon scheduled backfill requirements but is not anticipated before the tenth month of operation.

Initially, development workings in the mine will be driven south and west of the main (lower) portal to establish a ventilation loop near the west end of the Southwest Zone of the deposit (Figure 3). Concurrently, the primary access will be advanced from a second portal located to the southwest of the main portal. Subsequently, test-mining areas (stopes) will be started to confirm grades and geotechnical rock characteristics. This test stoping will occur for several months with ore exiting the upper portal and hauled to the ore stockpile at the main surface facility located at the lower portal for transport to the Mill. After test stoping is complete and full scale production has begun, the majority of ore will be transported to the main surface facility through the lower portal.

Prior to development and commercial production detailed metallurgical testing will be completed. Results will determine detailed operational parameters for the milling process. A bulk sample of ore from the deposit may be necessary to complete this testing. This ore would necessarily be extracted and processed at the Kettle River Mill.

After initial access development has been started for the Southwest Zone, the access drifts to the Gold Bowl area will be driven. Prior to commercial production mining in the Gold Bowl area, underground ore definition drilling may be required from the development drifts to provide information necessary for mining of these ore bodies.

After the initial eight to ten month construction phase, commercial production is projected to continue for approximately 90 months (7.4 years). Active physical decommissioning of the site facilities will continue for approximately two additional years upon mining cessation, followed by three to five additional years of reclamation monitoring and final closure.

3.0 SITE CHARACTERISTICS

3.1 Topography and Physiography

The Buckhorn Mt. deposit is located in north-central Washington State several miles south of the Canadian (British Columbia) border in the northwestern portion of the Okanogan Highlands geomorphic province. The mine site area lies near the top of Buckhorn Mountain on portions of its eastern flank. The region consists of a group of north-south ridges with rounded tops and steeper-walled valleys. The terrain in the mine area commonly has slopes of 2 horizontal (H): 1 vertical (V). The intervening north-south valleys between the ranges are wide and gentle, reflecting their glacial origin. Steeper east-west tertiary drainages flow into the larger secondary drainages of Myers and Toroda Creeks.

Regional elevations range from just over 900 feet above mean sea level (amsl) in the Okanogan River Valley to the west to 5,598 feet amsl at the summit of Buckhorn Mountain. The proposed primary portal location lies at an elevation of approximately 5,000 feet amsl and the secondary portal location at an elevation of approximately 5,400 feet amsl.

Buckhorn Mountain and the mine area are drained to the east by Nicholson Creek and Marias Creek. These creeks are third order streams that ultimately drain to Kettle River via Toroda Creek.

Although Buckhorn Mountain has historically been covered in timber, much of the terrain immediately surrounding the local mine site area has been disturbed by earlier logging in the 1980's associated with part of the Buckhorn Timber Sale.

The Mill Site and tailings disposal facility (TDF) located northeast of the town of Republic is at an elevation of approximately 3,000 feet amsl.

3.2 Land Use

The mine area includes private land and public lands within the Okanogan National Forest (USFS 1989), managed by the Tonasket Ranger District. Current and past land uses include hunting, fishing, gathering, logging, mineral exploration and extraction, agriculture, residential development, timber sale, firewood gathering, grazing, and general recreation.

Logging has been one of the dominant land management uses in the vicinity of this project. Over the past 35 years, about 8,000 acres have been logged in and around the mine Site. Approximately 560 acres of timber were harvested during the 1979 USFS's Buckhorn Mountain Sale.

The State of Washington and BLM have also harvested their lands within the vicinity of Buckhorn Mt. using both shelterwood and overstory removal methods. Most private lands around the project area have been harvested at some time in the past.

The USFS Cedar Creek grazing allotment exists on Buckhorn Mountain and surrounding areas.

Historically native populations have used the land of the region for traditional uses and continue to reserve rights for hunting, fishing, and gathering on the traditional north half of the Colville Indian Reservation.

Management of the USFS land is guided by a land and resource management plan (RMP) developed by the USFS (USFS 1989). The proposed mine is consistent with the USFS RMP. Although there are no developed recreation facilities in the immediate vicinity of the project, recreation is another land use in the general area. USFS lands in the region are used for hunting, hiking, fishing, camping, sightseeing, and picnicking.

3.3 Geology/Seismicity

The mine is situated west of the western margin of the Eocene-aged Toroda Creek Graben and on the northern edge of the Okanogan Metamorphic Core Complex. The rocks within the mine area are comprised of Cretaceous- to Tertiary-aged intrusive rocks and Permian- to Triassic-aged, volcanics, and clastic sediments that have been variably metamorphosed.

Host rocks for the Buckhorn Mt. mineral deposit consist of a sequence of folded and faulted volcanic and volcaniclastic rocks, shallow to deep marine clastic rocks, and carbonate rocks. Locally the volcanic rocks overlie sedimentary, carbonate, and volcaniclastic rocks. The sequence has been intruded by numerous small diorite bodies and the larger Buckhorn Mountain granodiorite pluton. Figure 4 presents a geology map of the mine site area.

The Buckhorn Mt. deposit is a mineralized skarn formed by the hydrothermal interaction of hot silicate magmas and cooler sedimentary rocks. A skarn deposit that can be mined largely for its contained gold is classified as a gold skarn. In most cases gold skarns are of modest size and do not reach economic proportions.

Buckhorn Mt. gold mineralization is directly associated with the skarn alteration which mineralogically includes pyroxene-, garnet-, and magnetite-dominant skarn zones reflecting the varied hydrothermal fluid reaction in host rocks. Skarn fluid pathways included folds, faults, chemically reactive rocks, and permeable hosts. Most faulting and shearing in the area predated skarn development and mineralization. The overprint of early faulting and shearing by skarn minerals has healed the fractures and renders the structures, along with the enclosing host rocks relatively impermeable. Permeability within the rocks within and surrounding the deposits is now controlled by closely-spaced small fractures and by the broken rock within the North Lookout fault zone (Figure 4). This condition is termed secondary permeability. Gold occurs as fine-grained disseminations varying in grade within the skarn mineral assemblages. The geology of the deposit is understood based on surface mapping and detailed examination, analysis, and interpretation of approximately 280,000 feet of reverse circulation drilling and 100,000 feet of diamond drilling core.

Structurally, rocks in the Buckhorn Mt. area near the deposit average a strike of north-northwest and range in dip from 0-20 degrees to the northeast. Northeast trending, southeast dipping, and nearly horizontal sinuous shear zones locally cut all rock types. These sinuous shears have been healed by the overprint of skarn alteration.

Regionally, major faulting after the Jurassic or Cretaceous skarnification event was related to Tertiary volcanism. Geologic structural interpretation, historic seismic records and data on active faults in Washington indicate a lack of active faulting and the lack of moderate to strong seismic activity in the area in recent geologic time.

3.4 Geotechnical Characteristics

The geotechnical rock strength characteristics of the host rocks of the Buckhorn Mt. deposit are favorable for stability during underground mining. Uniaxial rock strengths are summarized below in Table 3 for the rock types that will be encountered in the workings. These strengths are typical of competent lithologies, particularly for the skarn, clastics, and andesite, which are the “hanging wall” rocks of the ore found directly above the most important planned mining stopes. Except in rare local cases, the weaker marble lithology typically comprises the "footwall" of the stopes so its strength is of lesser importance for stability in the workings. Garnet skarn is important only in the Gold Bowl area where large spans of exceptionally competent rock are not critical to ground stability.

TABLE 3

UNIAXIAL ROCK STRENGTHS PARAMETERS

Measured Unconfined Compressive Strengths	
Lithology	**Expected Uniaxial Compressive Strength (psi)**
Andesite	18,000
Clastics	28,000
Skarn	17,000
Marble	7,500
Garnet Skarn	9,600

Backfill placed into stope areas will facilitate stability in the underground workings. Additionally, backfill will support the rock mass as a whole and will minimize the amount of normally occurring fracturing, relaxation and subsidence in the rock immediately overlying the mined-out stopes. Surface disturbance caused by subsidence will be prevented by the use of backfill and the appropriate placement of pillars and ground support.

A detailed geotechnical assessment of each stoping area will be completed prior to final design of mining and backfilling. These studies will continue throughout the mine life. Design criteria for the stopes and for backfilling will be based on geotechnical information obtained from drill core and detailed data obtained in the mine workings. This underground information is acquired by mapping of fractures with particular emphasis placed on logging of orientation, spacing, planarity, roughness, alteration, and continuity. These data will be used in conjunction with measurements of uniaxial compressive strengths of the host rock to model the rock strength characteristics of the ore body. The objective for the design performance of the mine backfill specifications will be to achieve visually undetectable subsidence-related surface disturbance above the mined areas.

The North Lookout Fault crosses the northwestern part of the Southwest Zone of the Buckhorn Mt. Deposit and to the south of the majority of the Gold Bowl ore bodies. This fault is characterized by a zone of broken rock that dips, on average, 65 degrees from vertical to the southeast. Within the uppermost andesite this fault zone is estimated to average about 20 feet in width and is characterized by blocky to rubbly fracturing adjacent to the fault trace itself over variable widths. In the more competent skarn and adjacent mylonite and hornfels lithologies, the zone of broken rock is more confined and less broken. In either case, where workings intercept the North Lookout Fault zone ground support is anticipated to be required to maintain a high degree of safety in the mine workings. This support may take the form of rock bolts, shotcrete, or steel sets, as required.

3.5 Climate

The climate at the Buckhorn Mt. Project is influenced by the topography, elevation, its location relative to the Cascade Mountains and the Pacific Ocean, as well as latitude and longitude. The prevailing westerly winds and weather fronts generally have origins from the Pacific Ocean and the Artic Ocean.

Extensive climatic data was collected from near the top of Buckhorn Mt. from 1989 to 2000. BMG operated sensors for wind speed, wind direction, and temperature at the site beginning in 1991. Precipitation data was collected and analyzed starting in mid-1993. Total average annual precipitation near the summit of Buckhorn Mt. is provided in the Meteorological Data Set, Crown Jewel Project, Chesaw, Washington (ENSR 1996) and updated in the Prefiled Direct Testimony of James M. Wilder (Revised) before the Pollution Control Hearings Board (Wilder 1998). These data have been statistically correlated and corrected by the use of long-term averages from the nearby monitoring stations of Republic and Molson. Yearly average precipitation at the site is calculated to be 20.0-inches per year using data to 1996, which includes snowfall yielding 7.1 inches of water. Updated values calculated using data through 1998 indicated that yearly average precipitation to be 19.8-inches (Wilder 1998).

Most precipitation between mid-December and mid-February falls as snow, with some snow occurring before and after these dates. Rain can occur at any time, however, and occasionally may be mixed with snow. The months with the highest average precipitation are May and June with 2.3 inches and 2.4 inches, respectively. September and October are the months with the lowest average monthly precipitation at 1.2 inches of water. The estimated precipitation rates at the mine site for 24-hour storm events are presented on Table 4.

Monthly maximum, minimum, and average temperature data were collected continuously at 2.0 and 8.8-meter levels. Wind speed and direction were recorded at the 10-meter level. Average and maximum 1-hour average wind speeds (m/s) were compiled on a monthly and annual basis for both levels. Frequency of occurrence of wind speed by direction were developed graphically (windrose) and in tabular form for each quarter and annually. Relative humidity (2 meter), solar radiation (3 meter) and barometric pressure (1.8 meter) data were all collected on a continuous basis for the site. Monthly, quarterly, and annual evaluations were made for relative humidity (percent, monthly average, monthly 1-hour maximum and minimum), solar radiation (watts/m^2, monthly average, monthly 1-hour maximum) and barometric pressure (in Hg, monthly average, monthly 1-hour maximum, and minimum).

TABLE 4

PRECIPITATION DATA FOR 24-HOUR STORM EVENTS

Storm Recurrence Period (year)	Mine Site Precipitation (inches)
2	1.4
10	2.0
25	2.4
100	2.7

Pan evaporation rates for the Buckhorn Mt. mine site were calculated by adjusting historical data that were available from a National Weather Service station in Republic, Washington for the Buckhorn Mt. site (Golder 1996). The adjustments to the Republic evaporation data included modifications for temperature, wind speed, and humidity at the mine site. The estimated average annual pan evaporation for the Buckhorn Mt. mine site using the Priestly and Taylor model is about 38.6 inches (Golder 1996). The average monthly pan evaporation ranges from a maximum of about 7.3 inches in July to a minimum of 0.2 inches in January. Estimated average monthly potential evapotranspiration values for the site were developed by Golder (1996) and are summarized in Table 5, where the potential evapotranspiration is estimated at approximately 0.7 times the pan evaporation.

TABLE 5

ESTIMATED AVERAGE MONTHLY POTENTIAL EVAPOTRANSPIRATION VALUES FOR THE MINE SITE

Month	(in/month)	(mm/month)
January	0.08	2.03
February	0.12	3.05
March	0.61	15.5
April	1.66	42.2
May	3.17	80.5
June	4.22	107.2
July	5.44	138.2
August	4.39	111.5
September	2.69	68.3
October	1.03	26.2
November	0.00	0.00
December	0.00	0.00
Annual Total	23.41	594.68

3.6 Water Resources

Extensive baseline water resource characterization studies for surface water and groundwater were conducted at the mine site and analyzed during preparation of the FEIS and permit application for the Crown Jewel Project. These programs are summarized in the following sections; the previous studies shown on Table 1 are incorporated by reference.

In 2003 Crown Resources resumed monitoring in areas critical to the newly configured project. Currently 9 monitoring wells, 12 surface water stations and 8 springs and/or seeps are being sampled on a monthly basis. All 29 sites were previously established as baseline locations for the Crown Jewel permitting efforts and are being analyzed for a similar suite of parameters. Data from this latest round of baseline data collection may be used in conjunction with the existing extensive database for evaluation during the NEPA/SEPA and state permitting efforts.

3.6.1 Surface Water Hydrology

The Buckhorn Mt. mine site area is drained by Nicholson Creek and Marias Creek that generally flow east to Toroda Creek. On the western side of Buckhorn Mt., Ethel Creek, Thorp Creek, Bolster

Creek, and Gold Creek flow west to Myers Creek. Myers Creek is approximately three miles to the west of the proposed Buckhorn Project and flows north into Canada eventually discharging into the Kettle River. Toroda Creek is about six miles east of the project and flows northeast and then north and east to the Kettle River.

To characterize baseline surface water resources, monitoring stations were established in six principal drainages in or near the area of the mine and related facilities. The drainages were extensively monitored from 1990 to 1996 over a period of six years and included Nicholson Creek, Marias Creek, Bolster Creek, Gold Creek, Ethel Creek, and Myers Creek. A total of eighteen surface water sites were established as part of the baseline water quality characterization program and were sampled for an extensive suite of field and laboratory parameters. Not all eighteen sample sites were monitored the entire period as modifications to the operational program refocused monitoring on certain drainages and sites. However, from 1990 to 1996 the majority of these sites were sampled on a monthly basis. Samples were analyzed for as many as 138 different field and laboratory parameters including trace metals (total, total dissolved, dissolved & total recoverable), major cations and anions, nutrients, radionuclides and physical characteristics. In addition, pH, temperature, conductivity, flow rate, dissolved oxygen (DO) and ferrous iron ($Fe^{2}+$) were also recorded as field parameters at each station at the time of sample collection. Over this time period for the 18 different surface water sites approximately 32,000 individual analyses were performed.

3.6.2 Surface Water Quality

Due to similarities observed in water quality conditions, an overall summary of water quality characteristics on the project area is summarized here instead of a basin by basin description. Based on field analyses surface waters are alkaline and contain measurable oxygen, with field pH values ranging from 6.9 to 9.3. Dissolved oxygen (DO) ranges from 1.5 mg/l to 13.8 mg/l. Surface water temperatures vary seasonally, with measurements ranging from -0.7 ^{o}C (30.7 ^{o}F) during the winter to 16.9 ^{o}C (62.5 ^{o}F) during the summer. Field tests of ferrous iron in site surface waters were negative.

Laboratory analyses indicate that calcium and bicarbonate are the dominant cation and anion measured, respectively, in site surface waters. The pH range and the predominance of calcium and bicarbonate in solution indicate that the major-ion chemistry and the acid-base conditions of the surface waters at the site are due to dissolution of carbonate minerals. The bicarbonate alkalinity characteristic of the surface water indicates that the system has natural acid buffering capabilities.

One exception is the station located at the headwaters of Gold Creek. Sulfate instead of bicarbonate was the dominant anion.

At most stations the total dissolved solids (TDS) ranged from 62 mg/l to 324 mg/l. One station (SW 10) had the highest TDS measurements, ranging from 290 mg/l to 482 mg/l.

Dissolved trace metal concentrations were generally at or below analytical detection limits. Both arsenic and strontium were frequently detected at levels above detection limits. Arsenic concentrations ranged from less than 0.001 mg/l (detection limit) to 0.014 mg/, and averaged 0.002 mg/l. Strontium concentrations ranged from less than 0.01 mg/l (detection limit) to 0.77 mg/l, and averaged 0.3 mg/l. These metals are commonly detected at trace levels in natural waters as a result of the interaction with sediments and bedrock.

Total concentrations of iron and aluminum were higher in unfiltered samples than associated dissolved concentrations in filtered samples at several stations. This is not uncommon and is attributed to the occurrence of colloidal material and/or suspended solids in the water column.

Nutrient levels were low in most surface water samples. Ammonia concentrations ranged from below 0.05 mg/l (detection limit) to 0.27 mg/l. Average ammonia concentrations were less than 0.05 mg/l. Nitrate plus nitrite concentrations ranged from below 0.02 mg/l (detection limit) to 1.09 mg/l. Average nitrate/nitrite concentrations were 0.1 mg/l.

Analysis of gross alpha and gross beta activities indicates that background radioactivity is generally near detection limits.

Total and weak acid dissociable (WAD) cyanide concentrations were generally below analytical detection limit. The highest concentration of total cyanide was 0.029 mg/l. The highest concentration of WAD cyanide was 0.02 mg/l. Cyanide does occur naturally in the environment and its detection during baseline monitoring may indicate a natural source.

3.6.3 Groundwater Hydrogeology

The water resource data collected and evaluated for the Crown Jewel FEIS is extensive and directly applicable to this project. The regional groundwater system in the vicinity of the Buckhorn Mt.

project area occurs as three hydrogeologic systems; alluvial sediments, glacial deposits, and bedrock. Bedrock is the primary hydrogeologic unit in the immediate area of the proposed mine. In close proximity to the mine area significant thicknesses of alluvial materials are absent and groundwater flow is limited to thin glacial and colluvial deposits and bedrock systems.

Alluvial valley sediments have developed along the valley bottoms of the regional drainages and are generally saturated where the thickness of the sediments is more than approximately ten feet. Unconsolidated sediments along regional streams are typically comprised of clays, silts, sands, and gravel. The alluvial sediments are recharged by precipitation and snowmelt, by stream flow losses, and by discharge from the bedrock groundwater system. The regional surface and groundwater system is interdependent with groundwater contributing to stream baseflows in some areas.

Unconsolidated glacial deposits are saturated with groundwater near their bases in many areas near the project, particularly where the deposits are located in valleys. The glacial deposits exhibit permeability and porosity depending primarily on the gradation and clay content.

Groundwater is present in varying degrees in all bedrock in the mine area. Groundwater flow direction generally mimics topography; however preferential flow may occur on a small scale in the fractured bedrock. The small scale fracture systems occur in all of the bedrock and affect the ability of the bedrock to store and transmit groundwater.

To evaluate the baseline groundwater resources in the drainage basin potentially affected by mine development, nine monitoring wells were installed in 1992. The location of each well was selected in consultation with DOE and the USFS to provide water quality data within and downgradient of the proposed open pit mine and waste rock disposal areas of the Crown Jewel proposal. Wells were sampled for field and laboratory analytical parameters on a monthly basis, weather, and access permitting, from May 1992 to June 1995; sampling was then conducted on a semi-annual basis. . Selection of groundwater wells specific for this project will be in conjunction with the DOE and the USFS.

In 1999 seven additional wells were drilled and completed at the request of the state agencies to further evaluate groundwater quality specific to certain proposed facilities for the Crown Jewel project. These wells were sampled monthly for 13 consecutive months. In addition, the preexisting wells were also sampled on a quarterly basis to provide a comparative database for these seven new wells. Field parameters such as static water level were routinely recorded during sampling.

In addition to the groundwater monitoring wells and the Roosevelt adit (GW-1), a series of other historic adits located within the project area were sampled and analyses conducted. There are a total of four mine adits that make up this component of the overall historic groundwater monitoring efforts on site. Although the number of total analyses performed was much lower for these sites than that of the monitoring wells, the extensive parameter suite was similar (over 100 different parameters analyzed) and over 5,000 individual analyses were analyzed from the four sites from 1990 - 1996.

A number of groundwater hydrologic investigations in both bedrock and glacial systems have been completed at the site. Generally, these data indicate that groundwater fluctuates seasonally by about one to two feet in the glacial system. Seasonal fluctuations ranging from 50 to 200 feet locally occur within the bedrock groundwater system with lesser fluctuations observed near valley bottoms. Permeability and porosity are moderate to low within the mine area bedrock system, and groundwater flow is governed by secondary fractures and joints that are small but closely spaced, indicating that the flow is similar to that of a porous media on a moderate to large scale. Aquifer recharge is via infiltration of precipitation and snowmelt for the bedrock system plus direct infiltration from local streams and flow from bedrock groundwater in the case of glacial till formations. The groundwater flow in the vicinity of the deposit appears to be influenced on a small-scale by the North Lookout Fault, which crosses the site from southwest to northeast, dipping 60 to 70 degrees to the southeast. In the general project area, the fractured rock associated with the fault zone is approximately 70 to 200 feet wide at the surface.

A groundwater divide exists along the top of Buckhorn Mountain that separates the Toroda Creek groundwater basin to the east from the Myers Creek groundwater basin to the west. The general location of this divide has been estimated based on groundwater modeling (Hertzman 1996). Depths to groundwater are greatest on the ridge tops (generally between 100 and 300 feet below ground level (bgl)) and less in the valley bottoms (less than 50 feet bgl) depending on the season. Groundwater elevations in the bedrock range from 4,700 to over 5,200 feet amsl. Historic data indicate that groundwater levels rise rapidly in the spring in response to snowmelt and spring runoff. Groundwater elevations subsequently decline over a period of several weeks to months in late spring and early summer and then decline very slowly throughout the remainder of the year.

The principal (lower) decline portal will be situated at an elevation of approximately 5,030 feet amsl. At this location the elevation of the decline portal will be above the high water table elevation at that location. A second portal will be located at an elevation of approximately 5450 feet amsl and will also be above the high water table elevation. Most of the mine workings will extend below the water table, and as a consequence, groundwater will enter the workings as mining proceeds. During operations, this water will be collected and managed as described in Section 6.6. Upon mine closure cement bulkheads will be placed in the primary access to hydrologically isolate the workings in the Southwest Zone from the rest of the mine and prevent the possibility of discharge from the portal.

Because part of the mine workings in the Southwest Zone extends under the groundwater divide, the workings will intercept some of the upgradient recharge west of the groundwater divide during mining. Groundwater modeling work was conducted in 2003 in order to provide estimates of the potential impacts to the physical groundwater system associated with the proposed underground mining operation on Buckhorn Mountain. Specifically, modeling was conducted to determine the following:

- Estimated groundwater inflows to the underground workings during mining,
- Any change during operation in the location of the groundwater divide between the Myers Creek drainage and the Toroda Creek drainage basins, and
- Any final post-closure impacts to the hydrogeologic system.

The modeling results are presented in Appendix B. The results illustrate that the displacement of the groundwater divide associated with the proposed mining operation during and after mining will be minimal.

The estimated maximum groundwater inflows to the underground workings during the mine life range from an annual average of 15 to 42 gpm. Water collected within the mine and discharged will be returned to the local drainage after water quality treatment.

<u>Groundwater Quality</u>

Groundwater quality monitoring wells were completed in both the bedrock units and in glacial deposits. The bedrock units included andesite and/or basalt; clastics and granodiorite; and undifferentiated skarn, garnet skarn, and diorite. Groundwater quality was analyzed for both bedrock and glacial deposit wells and is discussed separately below. Similar to the surface water monitoring program, an extensive parameter suite was evaluated for each well over the period of 1990 - 2000. Over this time period over 113 different analytical parameters were evaluated totaling over 25,000 individual sample analyses. Groundwater was analyzed for trace metals (total, total dissolved, & dissolved), major cations and anions, nutrients, radionuclides, total petroleum hydrocarbons (TPH), total organic carbon (TOC) and physical characteristics. In addition pH, temperature, conductivity, flow rate, depth to water, dissolved oxygen (DO) and ferrous iron ($Fe^{2}+$) were also recorded as field parameters at each well at the time of sample collection. The average values as discussed below were calculated using one-half the detection limit value for all measurements identified as below the reported detection limit.

Bedrock Wells

Field analyses indicate that the groundwater is near neutral to moderately alkaline. Values of pH ranged from 6.2 to 9.2. Groundwater temperature ranged from 4.0° C (39° F) to 7.9° C (46° F). DO levels ranged from 3.1 mg/l to 12.3 mg/l. Ferrous iron was not detected in field measurements in groundwater.

Laboratory analyses indicated that, with the exception of one well, MW-1, calcium, and bicarbonate are the dominant cation and anion measured, respectively, measured in all wells, including the glacial wells. Sodium (rather than calcium) was the dominant cation measured in MW-1. TDS ranged from 92 mg/l to 250 mg/l in the bedrock wells. Average TDS in the glacial wells was 190 mg/l. TDS concentrations in the surface water averaged 235 mg/l. These similar TDS levels between surface water and groundwater suggest a close interrelationship between the two hydrologic systems and between the bedrock and glacial aquifers.

In general, dissolved trace metal concentrations in bedrock groundwater were generally at or below analytical detection limits. However, three trace metals (arsenic, barium, and strontium) were commonly detected at levels above detection limits. Dissolved arsenic concentrations ranged from less than 0.001 mg/l (detection limit) to 0.011 mg/l, and averaged 0.004 mg/l. Dissolved strontium concentrations ranged from less than 0.09 mg/l to 0.8 mg/, and averaged 0.3 mg/l. Dissolved barium concentrations ranged from less than 0.01 mg/l (detection limit) to 0.03 mg/, and averaged 0.01 mg/l.

Total trace metal concentrations in unfiltered samples were typically higher than associated dissolved concentrations in filtered samples in both bedrock and glacial deposit wells.

Nutrient levels in the bedrock wells were low. Ammonia concentrations ranged from below 0.05 mg/l (detection limit) to 0.12 mg/l. Average ammonia concentrations were less than 0.05 mg/l. Nitrate plus nitrite concentrations ranged from below 0.02 mg/l (detection limit) to 3.5 mg/l and averaged 0.94 mg/l.

TOC concentrations ranged from less than 1 mg/l to 53 mg/l and averaged 3 mg/l. These concentrations may indicate inputs related to organic matter. TPH concentrations were below detectable limits in both bedrock and glacial deposit wells.

Hydrogen sulfide concentrations ranged from less than 0.02 mg/l to 0.30 mg/l.

Total and WAD cyanide concentrations were generally below analytical detection limits. Cyanide was occasionally detected in both bedrock and glacial deposit wells. Total cyanide concentrations ranged from less than the detection limit to 0.03 mg/l. WAD cyanide concentrations ranged from less than the detection limit to 0.04 mg/l. Cyanide does occur naturally in the environment and its detection during baseline monitoring may indicate a natural source.

Analysis of gross alpha and gross beta activities indicates that background radioactivity is generally near detection limits.

Glacial Deposit Wells

Field analyses indicate that the groundwater is near neutral to slightly alkaline. Values of pH ranged from 6.0 to 8.3. Groundwater temperature ranged from 3.1 ^{o}C (38 ^{o}F) to 8.5 ^{o}C (47 ^{o}F). DO levels ranged from 2.3 mg/l to 13.3 mg/l. Field tests for presence of ferrous iron were negative.

Laboratory analyses indicated that calcium and bicarbonate are the dominant cation and anion measured, respectively, measured in all wells, including the glacial wells. TDS ranged from 76 mg/l to 344 mg/l in the bedrock wells. Average TDS was 190 mg/l.

The same trace metals were typically detected at levels above analytical detection limits in the glacial deposit and bedrock wells, except iron and manganese which were below detection limits in the bedrock wells. Iron and manganese concentrations in the glacial wells may be unique to the glacial materials.

Dissolved arsenic concentrations ranged from less than 0.001 mg/l (detection limit) to 0.44 mg/l, and averaged 0.006 mg/l. Dissolved strontium concentrations ranged from less than 0.13 mg/l to 0.54 mg/l, and averaged 0.29 mg/l. Dissolved barium concentrations ranged from less than 0.01 mg/l (detection limit) to 0.04 mg/, and averaged 0.01 mg/l. Iron concentrations ranged from less than 0.02 mg/l to 0.20 mg/l and averaged 0.02 mg/l. Manganese concentrations ranged from less than 0.01 mg/l to 0.70 mg/l and averaged 0.07 mg/l.

Nutrient levels in the glacial deposit wells were low. Ammonia concentrations ranged from below 0.05 mg/l (detection limit) to 0.49 mg/l. Average ammonia concentrations were 0.06 mg/l. Nitrate plus nitrite concentrations ranged from below 0.02 mg/l (detection limit) to 1.53 mg/l and averaged 0.15 mg/l.

TOC concentrations ranged from less than 1 mg/l to 77 mg/l and averaged 3 mg/l. These concentrations may indicate inputs related to organic matter. Tests for presence of TPH were negative in both bedrock and glacial deposit wells.

Hydrogen sulfide concentrations ranged from less than 0.02 mg/l to 0.80 mg/l.

Analysis of gross alpha and gross beta activities indicates that background radioactivity is generally near detection limits. Gross alpha activities measured in the glacial deposit wells ranged from less than 1 pCi/l to 17.4 pCi/l and averaged 4 pCi/l. Gross beta activities ranged from less than 3 pCi/l to 33 pCi/l and averaged 3 pCi/l.

Radium 226 was measured in both bedrock and glacial deposit wells when gross alpha activities exceeded 5 pCi/l. Radium activities ranged from less than 1 pCi/l (detection limit) to 8.6 pCi/l and averaged less than 1 pCi/l. Radium activities were above the detection limit in all but three wells.

Seasonal variations in TDS and temperature were the only trends noted in groundwater quality. There appeared to be little or no seasonal variability in the levels of nutrients, trace metals, or radionuclides.

Seeps and Springs

A series of springs (30) and seeps (18) were monitored as a component of the overall site groundwater monitoring program. A spring and seep survey was conducted over an area of approximately 10 square miles that was delineated by the Washington DOE and includes watersheds that would have been within and downgradient of development of the Crown Jewel open pit project and adjoining facilities. Groundwater in the glacial deposits discharges into springs and seeps and into the surface water streams in the lower reaches of the local drainages. Springs and seeps within the study area were identified by examining color aerial photographs, geologic maps, and topographic maps, and by physically walking the drainage areas. Springs and seeps were designated based on the presence of observable flow: sources with observable overland flow were classified as springs, while sources characterized as areas of very shallow standing water or saturated soil were classified as seeps. Samples from springs and seeps were analyzed for a wide spectrum of parameters (approximately 120), including trace metals, major cations and anions, nutrients, radionuclides, and physical characteristics. Where possible, flow, temperature, pH, conductivity, DO, and ferrous iron were measured and recorded as field parameters for each spring and seep.

3.7 Geochemistry Characteristics

The geochemical behavior of the rock to be mined and processed for the Buckhorn Mt. Project has been extensively characterized by BMG (Adrian Smith Consulting Inc. 1992, Kea Pacific 1993a, 1993b, 1993c, BMG 1993, BMG in association with Geochimica and Golder 1996, TerraMatrix 1995, and Geochimica 1996) and in the Crown Jewel FEIS (USFS and DOE 1997). The proposed underground mine will encounter the same materials that have been characterized previously, but at reduced volumes and without any permanent surface waste rock disposal facilities as compared to the Crown Jewel open pit proposal. The existing database of geochemical information and analysis can therefore be used to develop management strategies for the mine and temporary surface stockpile that will significantly reduces or eliminate any potential environmental issues related to the geochemistry of the materials. A three-dimensional study that specifically relates the distribution of lithologies to be mined and correlation with the geochemical alteration types already characterized is planned for 2004. This study, when complete, will be provided to the agencies developing the SEIS and will be appended to this Plan.

3.7.1 Materials Characterized

During the assessment of the Crown Jewel Project geochemical characterization programs were developed to be representative of the geologic materials encountered in the mine and to evaluate the environmental behavior of waste rock, ore and low grade ore, and tailings. Based on these studies the following waste rock groups were identified:

- Altered Andesite
- Unaltered Andesite
- Garnet Skarn
- Magnetite Skarn
- Undifferentiated Skarn
- Altered Clastics
- Unaltered Clastics
- Marble, and
- Intrusives

Ore and low grade ore included:

- Andesite/garnetite skarn
- Magnetite skarn, and
- Undifferentiated skarn
- Tailings developed by bench scale milling of the ore materials were also analyzed.

All of these materials were evaluated by whole rock chemistry (XRF), leachability tests (US EPA Method 1312), acid base accounting (ABA), and humidity cell tests (HCT). Additionally, the tailings had pore water extraction and testing and waste classification testing. These test procedures are consistent with standard of care currently used for the characterization of mine waste materials and are considered appropriate for the analysis of this project.

3.7.2 Geochemical Characterization Results

As summarized in the Crown Jewel FEIS (USFS and DOE 1997), the following key conclusions were reached:

1. Whole rock chemistry identified the presence of trace metals in the ore and surrounding rocks including arsenic, chromium, cobalt, copper, lead, molybdenum, nickel, strontium, thorium, tin, vanadium, and zinc.

2. However, US EPA Method 1312 tests indicated a low potential for short-term leaching of these metals. Due to the nature of this test, the results do not provide specific predictive information for the water quality but merely indicate that the following metals may be leachable: arsenic, iron, and aluminum. The leachability of metals would be facilitated if acidic conditions exist.

3. Acid Base Accounting testing indicated that the overall geologic materials from the mine will not be acid generating due to the availability of net acid neutralizing potential. A portion of two individual rock types (magnetite skarn and altered clastics) were identified to be marginally potentially acid generating based on the ABA testing. Likewise a portion of two ore rock types were also identified to be potentially acid generating on the basis of the ABA testing. Tailings were found to have a low potential for acid generation.

4. Humidity Cell Test results for the ore and tailings indicated that these materials are not acid generating.

Management of the temporary ore and development rock stockpiles is discussed below in Section 4.10. Based on the geochemical characterization and the proposed storm water management plans in Section 4.9, no environmental impacts related to the geochemistry of the rock are expected. The small quantities of rock to be stored in the stockpiles, the short duration of the surface exposure and the neutralizing potential of the material minimize the potential for oxidation of the minerals contained. In contrast to the open pit mine plan the marginally acid generating lithologies will not be stored on the surface.

Materials encountered in the underground mine will be exposed to geochemical interaction with groundwater. Based on the studies completed to date, the mine waters are expected to be neutral during operation and post-closure. The backfill, particularly the cemented backfill, will be neutralizing.

The existing geochemical database is extensive and provides suitable background to support the further analysis required during environmental analysis.

4.0 PROJECT DESCRIPTION

The Buckhorn Mt. Project proposes to mine and process gold ore from the Buckhorn Mt. deposit located in Okanogan County, Washington approximately 20 miles east of the town of Oroville. During operation the project will employ about 120 people at the mine site; an additional 30 will be involved in the ore haul. Additional contractors will be hired on an as-needed basis to perform road maintenance, mechanical repair and maintenance, engineering, special mining projects etc. At the Kettle River Mill/TDF approximately 40 people will continue to be employed by EBMC as a result of production from the Buckhorn Mt. Project. The mine and the Mill will operate on a 24-hour basis with transportation limited to a shorter daily schedule.

The proposed project consists of an underground mine, a quarry for backfill, and roads that will connect the mine to the Kettle River Mill and provide access to the Okanogan Valley. Most of the road network to be used currently exists but some new alignments will require construction and some existing alignments will require upgrading. Site maps of the mine are shown on Figures 5 and 6 and of the quarry on Figure 7. Cross-sections through the mine workings and surface facilities site are presented on Figures 8 and 9. Key Project components at each of the site are introduced below.

Mine Site

- Mine Portals, Ventilation Raises and Underground Workings
- Mine Ventilation Equipment
- Office, Shop and Change Room Building
- Substation
- Fuel Storage
- Explosives Storage
- Development Rock and Ore Temporary Storage
- Backfill Stockpile and Batch Plant
- Topsoil Stockpile

- Water Tank/Well
- Water Treatment Plant
- Stormwater Diversion, Capture and Infiltration Structures
- Security Fencing
- Parking

Quarry Site

- Quarry and rock stockpile
- Fencing
- Topsoil storage area
- Fuel tank

4.1 Site Construction Methods

Much of the mine site area was logged in the 1980's and will require little clearing of timber for site construction. To the extent possible, existing timbered areas will be left intact. The mine site layout is shown in Figures 5 and 6. The facilities in the vicinity of the lower portal are arranged to allow for one way traffic on the site eliminating the need for two lane roads, minimizing traffic congestion and surface disturbance. The location of building foundations may vary slightly from the layout indicated in order to accommodate local irregularities in the configuration of the bedrock. Most or all of construction at the site will be possible using cut and fill of overburden.

The proposed construction, widening and realignment of access and haul routes will require some tree cutting. Generally, Crown will propose a detailed design for the access and haulage routes that addresses safety concerns, while at the same time minimizing impacts to vegetation, wildlife, and water quality. All road upgrades and new construction will conform to county and/or USFS/DNR standards and regulations as required including the proper construction of ditches and water control structures. Only minor stretches of blasting of road cuts will be required.

Prior to construction at the site, diversion ditches and stormwater catchment structures will be constructed so as to control sedimentation from the beginning of construction activities. Concurrent with road construction, water control structures will be installed. A Construction Stormwater Pollution Prevention/Erosion Sediment Control Plan will be developed as discussed in Section 4.9.

Most of the area of the proposed site is located on a small part of previously disturbed ground related to logging and exploration drilling. The majority of the site has been reclaimed by recontouring and revegetation. However, only small quantities of mature timber will require removal as part of the mine site construction and operation.

Topsoil and subsoil will be removed from within the proposed disturbance footprints at the mine and quarry sites prior to construction of facilities. This soil will be stockpiled for use in reclamation at the end of the mine life. The soil stockpiles will be seeded and revegetated as soon as practical after placement in order to prevent erosion during the period they reside in stockpile and to maintain nutrient capabilities of the soil.

4.2 Underground Mining

Ore production at the Buckhorn Mt. Project will primarily use room and pillar and drift and fill underground mining methods combined with extensive use of backfill for ground support. Access to mining areas and drifting (tunneling) in ore will be accomplished by the use of drill jumbos and conventional blasting techniques. A jumbo is a rubber-tire mining machine that drills near-horizontal holes in a mining face to be blasted. The method results in openings that can be driven on the level or on an incline, either up or down, of up to 15 percent grade. These drifts will be designed to measure up to 14 by 16 feet in size. Most of the development and mining activities will be accomplished by this method.

A lesser quantity of ore will be extracted by longhole methods. The primary machine used for preparing blast holes is the longhole drill that drills vertical or near vertical holes to excavate vertical slices of rock.

Prior to commercial mining development, drifting will be done to provide access to the areas for production. A primary access ramp will be developed to the south of the mine portal which will split to access the Southwest Zone and the Gold Bowl mining areas (Figure 3). A secondary portal will also be developed concurrently to access the southwestern part of the ore deposit (Figure 5). Development access off the primary and secondary portals will continue throughout the mine life as new areas are selected for mining.

Certain mining practices will always be followed regardless of the specific mining method used. The use of water or water mist is necessary during drilling of the blast holes to cool the drill bit, suppress dust and to wash the drilled rock from the blast hole. This water will be obtained from sumps located throughout the mine. No drilling additives will be used with this water.

The holes will be loaded with an ammonium nitrate-based blasting agent such as ANFO and/or emulsion or explosives such as water gel. It is anticipated that ANFO will be the most appropriate primary blasting agent based on existing ground conditions and the relatively dry rock conditions anticipated. Approximately 1.2 lb of ANFO per ton of ore will be required for mining. Non-electric blasting caps will be the primary detonation devices for the explosives. Safety and security precautions will be taken in the handling and storage of explosive materials and blasting agents to ensure the safety of workers and minimize spillage of bulk materials.

After blasting and prior to reentry, the mining area will be ventilated to meet air standards prescribed by the Mining Safety and Health Administration (MSHA). Water spray will be applied to the ore pile after blasting to control dust in the mine air.

Cross-sections through the orebody illustrating pre-mining topography, pre-mining groundwater elevations, post-mining topography, and post-mining groundwater elevations are presented on Figure 8. Figure 9 shows cross-sections through mine site area that illustrate the pre-mining, mine operations, and post-reclamation topography for facilities and underground access are shown on Figure 9.

4.2.1 Underground Mining Method in Near-Horizontal Bodies

Mining in near-horizontal ore zones such as in most of the Southwest Zone will be done with a room-and-rib-pillar, cut, and fill technique or by long hole open stoping. Once an initial drift (tunnel) of up to 14 x 16 feet is established through the ore zone, extraction of the walls of the drift will be facilitated using a drill jumbo to achieve a full maximum stope width of up to 32 feet. Commonly, however, the design width of the stope will not exceed 16 feet. Further definition drilling will then be completed both up and down to determine the full height of the ore zone. Extraction of ore below the drift level (if necessary) will be followed by filling of the opening by cemented backfill which will provide a solid floor on which to mine additional ore above the initial drift level, if present. Cemented backfill will ultimately be placed in the mined out stope as tightly as feasible to provide rock support to the overlying rock mass.

When complete, another stope will be mined parallel to the initial stope leaving a pillar of ore between these two primary stopes. When the cemented backfill in these stopes has fully hardened, the extraction of the pillar will be done in the same manner as previously described and filled as before but with unconsolidated (uncemented) fill to provide ground support in the secondary stope.

Where vertical ore thicknesses exceed about sixty feet the ore may be removed by a longhole open stoping technique. This method utilizes blast holes collared in one drift in the ore (sublevel) and drilled upwards or downwards toward the adjacent sublevel. These holes are loaded with explosives and the ore between the levels is blasted and falls into the lower level of the active stope where it is removed.

Filling of stopes by cemented backfill will be accomplished in a similar manner to thinner zones and intervening secondary stopes will be filled by unconsolidated fill where required.

In some areas it may be possible to fill the primary stopes with a core of uncemented fill armored with cemented fill on either side and above.

4.2.2 Underground Mining Method in Inclined Ore Zones

Mining in steeply dipping bodies is accomplished in much the same way as described above. Initial drifts of up to 14 x 16 feet will be established through the ore and drilling will be done to locate the limit of the ore laterally. Slashing (ore extraction) to the maximum full ore width of thirty feet will be followed by stoping of the ore above the drift and by filling where needed. Where vertical ore thicknesses are sufficient, longhole open stoping can be used to more efficiently extract the ore. In all cases, filling of the open stopes will be done where appropriate to minimize natural stoping (or caving) resulting in surface subsidence.

Production drill hole configuration in the longhole method is determined by stope width. In narrower stopes, parallel longhole drilling and blasting will be completed. In wider stopes where spans are too great for full width sublevels, ring drilling patterns may be designed.

It is anticipated that stope boundaries in the majority of the inclined ore zones of the Gold Bowl area will be determined and engineered prior to initial cuts in the ore. This definition of ore boundaries can be accomplished by close spaced drilling of the body from a development drift outside of the ore. While this is more expensive and time consuming than boundary definition drilling from the interior of the stope, this method gives the highest degree of confidence in the stope engineering and layout for more complex geometries of individual ore bodies.

4.2.3 Ore and Development Rock Transfer Procedures

Broken development rock and ore will be loaded into low profile diesel powered underground haul trucks at or near the face (end) of the working stopes or at draw points designed for this purpose. Low profile diesel powered front-end loaders will load the rock into the mine trucks. Development rock will be transported to the surface and deposited into the development rock temporary storage areas near the mine as shown on Figure 6. Construction design of the storage areas is discussed in Section 4.10. All of the development rock will ultimately be transported underground and used as backfill material as described in Section 4.2.4.

Mined ore by the longhole method will be loaded and hauled from the ore face or at draw points at the lowest level of an active longhole stope. The ore will then be transported to the temporary ore stockpile area on the surface as shown on Figure 6. Where required, underground loading of blasted mine rock will be done using remote controlled equipment to reduce human exposure to falling rock.

Transportation of ore from the stockpile to the Mill is described in Section 4.12.

4.2.4 Backfilling

The voids produced during mining will be selectively backfilled after stoping is completed. Backfilling will promote rock stability and prevent surface disturbance by minimizing subsidence of the rock immediately overlying the stopes. Backfill will consist of either development rock from other parts of the mine or of gravel transported from the backfill storage site. Some of the backfill will contain up to 6 percent (average 5 percent) cement that will bind the unconsolidated rock and provide additional strength to support load. Cement will be added as slurry directly to the truck transporting the rock. Uncemented development rock used as backfill may be brought directly from another working area within the mine or from the development rock storage area on the surface.

In the case of cemented gravel backfill, underground trucks will load the backfill at the underground backfill facility by an automated system as shown on Figure 10. The unconsolidated gravels for cemented backfill will be transported from the backfill quarry site to the mine site by the haul trucks when they return to the mine from the Kettle River Mill. The gravel will be stored on the surface at the temporary backfill storage location shown on Figure 6. The gravel will be dumped by a loader into the backfill pass where it will fall by gravity onto a conveyor underground. Cement and mine water will be added directly as a slurry into the truck from a screw feed mechanism fed from cement storage silos located on the surface. The gravel with cement will be conveyed directly to underground trucks as required and is hauled to a mined area.

The need for cemented backfill will be determined based on the requirement for stope stability depending on stope geometry, size, depth from surface, and mine sequencing.

Approximately 1.6 million yd^3 of total backfill will be required during the mine life. Of this amount, about 900,000 yd^3 will be uncemented fill and 700,000 yd^3 will require cement additive.

4.3 Equipment Requirements/Consumables

Table 6 lists the mine site mobile equipment requirements for the Buckhorn Mt. Project during production. Some substitutions for comparable items may occur based on availability. During preproduction development of the underground workings, the mine equipment requirements will be less. The fleet will gradually be augmented as additional headings are commenced to ultimately achieve the full complement shown in Table 6.

TABLE 6

MINE SITE MOBIL EQUIPMENT LIST

Mobile Equipment List	
Mine Site	
40 ton Underground Haul Trucks	5
30 ton Underground Haul Trucks	2
8 yd Scoop (underground loader)	5
4 yd Scoop	1
Jumbo 2 Booms	4
Jumbo 1 Booms	1
Scissor lift	1
Bolter	1
D4 Dozer UG and surface	1
UG Light Trucks	4
Light Surface Vehicles	2
Cat 966 Surface Loaders	2
Quarry Site (Contract)	
Cat 966 Loader	1
D8 Dozer	1
Transportation	
Haul Trucks (contract)	14 average
Road Maintenance (contract)	As needed

During construction of the surface facilities at the mine Site, and quarry, all mobile construction equipment will most likely be contracted. The contractor will determine exact fleet requirements at that time.

Table 7 lists typical quantities of major consumable materials delivered by truck and consumed by the Buckhorn Mt. Project during full operation. Table 8 presents the estimated project consumable usage on an annual basis and anticipated maximum storage requirements at the mine and Mill sites. The Material Safety Data Sheets (MSDS's) are provided for those consumables requiring MSDS's in Appendix C.

TABLE 7

MAJOR CONSUMABLES DELIVERY ESTIMATE

Consumables Delivery Estimate	
Mine Site	
Material	**Trucks per Month**
Explosives	4
Cement	0-75 (depending on usage)
Fuel	15
Miscellaneous Supplies	Daily

Areas containing consumables will require security clearance for entry. Explosives will be stored at the mine site and stored as required by federal regulations with security controlled access as discussed in Section 4.5. No unauthorized personnel will be given access to restricted areas containing potentially dangerous materials.

TABLE 8

CONSUMABLE USAGE AND SITE STORAGE REQUIREMENTS

Reagent/Substance	Buckhorn Mt Est. Annual Use	Buckhorn Mt. Est. Maximum Storage Requirements	Use
Cement	10,000 Tons	250 Tons	Mine Backfill
Diesel Fuel	630,000 gal	5,000 gal	Mine Equipment
Gasoline	4000 gal	1000 gal	Surface Vehicles
Motor Oil	3000 gal	400 gal	Mine/Surface Vehicles
Transmission Fluid	1000 gal	200 gal	Mine/Surface Vehicles
Anti Freeze	400 gal	200 gal	Mine/Surface Vehicles
Ammonium Nitrate	330 Tons	30 Tons	Mine Explosive

4.4 Mine Ventilation

Electric fans will provide the principal ventilation of the mine. The fans will draw air into the primary portal and will exhaust air from the upper ventilation portal and ventilation raises. The difference in elevation of the primary portal and the exhaust ventilation openings will aid air movement by natural effects. The ventilation portal and raises will be located as shown on Figures 5 and 6. The two portal areas will be surrounded by security fencing. Ventilation raises will be enclosed in locked structures. Road access to the secondary portal and raises will provide the ability to service electric fans.

The routing of air to specific areas underground is facilitated by the use of strategically placed barriers to direct airflow. Moveable 60 to 125 horsepower (hp) fans will blow air through ventilation tubing or bag to working areas. As the configuration of the underground workings changes, so does the configuration of the airflow. The Mining Safety and Health Administration (MSHA) regulates the air quality in underground workings and requires an updated ventilation design and layout at all times. Periodic inspections of the mine by MSHA inspectors address the adequacy of the ventilation plan along with measured air quality and safety issues. An updated mine ventilation map will be posted at the mine site office at all times.

4.5 Explosives Storage and Handling

Explosives are to be stored in a locked magazine approved by and permitted by MSHA and the Department of Homeland Security. All personnel who handle explosives or are involved in blasting will do so in accordance with the rules, regulations, and guidelines stipulated by MSHA, the Department of Homeland Securities (ATF), and the State of Washington. Weekly and monthly safety meetings will be held with all operations personnel. Safety in explosives handling is a regular topic of these meetings. Also covered in these meetings are the best management procedures for handling explosives so as to prevent spillage at the working face.

Access to the explosives magazine will be strictly regulated by the safety and security department. The magazine itself will be located underground and locked and secured under separate key, in accordance with MSHA regulations. Only security personnel and mining personnel with security clearance and training will have access to the keys to the magazine.

4.6 Fire Fighting Equipment/Emergency Response

All light vehicles on site will be equipped with an axe, shovel, bucket, and fire extinguisher during fire season as required by the USFS. In addition, all vehicles and other internal combustion engines will have adequate spark arresters. There will be telephone service at the mine and Mill sites for communication in case of fire or other emergencies.

Phones will also be located underground for communication with the surface. All underground personnel are awareness trained in the location of these phones and of emergency escape-way locations. A map showing emergency escape routes, refuge chambers, and telephones is posted at the sites and routes are clearly marked underground.

Ore haul trucks and mine light vehicles will be equipped with radio equipment for emergency communication in the case of accident or fire.

Crown will promptly comply with any emergency directives by the USFS or the State and will obey any fire precautions imposed on operations during the summer fire season. Also, existing water sources at the mine site will be available to fire fighting efforts in the area.

An emergency medical transfer vehicle will be present on site at the mine during production. Trained emergency medical technicians employed by Crown will be available to respond to emergencies at any time.

A trained mine rescue team is on call at all times to respond to underground mine emergencies. Trained emergency medical technicians are members of this team.

4.7 Mine Site Power Requirements

It is currently anticipated that electrical power will be purchased from the Public Utilities District of Okanogan County (PUD). Power required at the mine site can be strung along existing easements and construction to the end of the current service near the junction of County Road 4895 and USFS easements (USFS 120). In order to minimize surface disturbance, the new line to the mine is proposed to be buried along the road easements.

Power requirement at the mine site is projected to be approximately 2.1 megawatts (Mw) of installed capacity averaging 1.4 Mw usage.

During construction generators will be used to provide power until grid service is available. Power requirements during that time are expected to be less than half of full production needs.

4.8 Mine Site Water Requirements

Water will be needed at the mine site for mining and for potable uses. Uses in the mine will include drilling water, ore washing water for particulate suppression, and water for general cleaning of equipment (Table 9). The water entering the mine through natural seepage will be used for these purposes. All use will occur underground prior to any treatment and discharge. After initial startup, excess water entering the underground workings will be collected in sumps, pre-treated by settling and organics removal, and subsequently discharged to a water treatment plant for treatment of elevated nitrates as required. The treated water will be infiltrated in engineered infiltration structures returning the water to the groundwater system (Figure 5).

Potable water will be required for showers, toilets, and human consumption. Potable water is proposed to be obtained from an on-site water supply well. Containerized water for human consumption will be brought on site.

Additionally, water may be needed at the mine site and along the access and haulage routes from time to time to augment dust suppression on the roads. It is planned to use water from existing water rights located in the Myers Creek and Toroda Creek drainage basins for this purpose.

TABLE 9

PROJECT MINE WATER USE

Project Water Use	
Mine Site	
Use	**Average Amount**
Potable	6 gpm
Drilling	4 gpm*
Ore Wetting	2 gpm*
Cement Addition	4 gpm*
Miscellaneous Washing	1 gpm*
Contingency	
Road Watering	
Fire Fighting	

*Note: All water used for these underground purposes will come from natural seepage into the mine.

Water requirements during the six months of site construction will come from the on-site well. Two gallons per minute during this period will be needed for dust suppression and general construction requirements. During this period lower operational needs will offset construction requirements.

A detailed Water Supply Plan detailing water handling and consumption for the project will be prepared in conjunction with water rights and change applications. The Water Supply Plan will further refine water usage calculations and incorporate proposed water conservation measures.

4.9 Stormwater and Sediment Control

Through best management practices Crown will minimize and, where possible, eliminate any impact to area streams from stormwater runoff entering or originating within the mine and quarry site boundaries and along road alignments. Stormwater control will be implemented primarily through construction of channels to divert flow around facilities. Culverts will be used to convey flow beneath access roads. Catchment ditches will control stormwater flow originating on the sites themselves. Stormwater will be directed through sediment control structures and traps that will be designed to detain flows originating from disturbed surfaces to allow sedimentation to occur behind the structures prior to or during proposed infiltration into specially designed infiltration structures. Sediment controls and diversions will be constructed and made fully operational prior to beginning mine construction or other surface disturbance activities.

Figure 5 show the location of diversion ditches, sediment traps, and the flow direction of diverted waters at the mine site. Water caught on the mine site will be routed to the sedimentation/infiltration structure east of the site. Storm water at the quarry will be captured for infiltration within the excavation and no runoff from the disturbed area will be allowed to flow offsite.

A detailed Stormwater Pollution and Prevention/Erosion and Sediment Control Plan utilizing Best Management Practices will be developed for the project construction and operation phases as required by the Clean Water Act, in conjunction with and to be approved by the DOE.

4.10 Development Rock Temporary Storage Areas

Prior to use as backfill, some of the mined rock from development workings will be stored temporarily on the surface at the mine site as shown on Figure 6. The development rock stockpile will locally be stacked against the topsoil stockpile. To segregate the two materials types a liner as shown on Figure 6 will be placed on top of the topsoil stockpile. The exact layout of the development rock stockpiles may vary slightly from that shown based on site conditions of the bedrock surface.

Development rock is mined to gain access to the ore. The primary access to the Southwest Zone is the largest individual contributor to the development rock storage area. Additionally, rock from shorter accesses to some of the early stopes in the Southwest Zone and local development in the Gold Bowl area may be stored on the surface. As discussed Section 4.2.4, approximately 1,600,000 yd^3 of backfill will be required during mining. Whenever possible, as development rock is mined, it will be placed as backfill in another part of the mine. When no development rock is being generated, then development rock fill will be sourced from the temporary surface stockpile for use as backfill. When all the development rock has been consumed as backfill, gravel from the quarry site will be stockpiled and used.

A preliminary mine sequencing plan has been prepared that outlines the quantity and lithologies of the development rock that will be generated early in the mine life. This plan will be adjusted as conditions require

The lithologies of the development rock to be stored on the surface are classified as andesite, undifferentiated skarn, clastics, and marble. All the rocks to be stored on the surface have low acid generating potential and excess neutralizing potential. Although the rock will be exposed to atmospheric conditions for only a short time frame, consideration is given to development rock handling and stormwater management methods to minimize the potential for acid rock drainage (ARD) and leaching of metals.

Table 10 presents a summary of the development rock volumes projected to be temporarily stockpiled at the upper and lower portals Table 11 presents a summary of their geochemical characteristics determined by TerraMatrix in the EIS (USFS and DOE 1997) for waste rock acid generation potential (AGP) and acid neutralization potential (ANP) for each major lithology. These results were developed as part of the verification program conducted by the third-party EIS contractor. Each of these lithologies corresponds to materials expected in the stockpile. As can be seen from these data, all of the rock types have excess neutralizing capability based on the mean expected values. The marble and andesite rock will be the predominant rock types expected during the early development phase.

All development rock that is initially stored in the temporary stockpiles will be placed underground within the first two and one-half to three years of the mine life. Based on the short resident time of rock on the pile, the low overall AGP of all rock types and the high ANP of the lower and admixed andesite and marble lithologies, the ARD potential for the storage piles is extremely low and no impacts are expected. However, appropriate storm water controls will be constructed to minimize contact of surface water with the stockpile to the degree possible.

TABLE 10

SEQUENCE OF INITIAL DEVELOPMENT ROCK FOR TEMPORARY STORAGE

Rock Type	Tons Placed
Lower Development Rock Storage	
Andesite - Unaltered	36,000
Undifferentiated Skarn	83,000
Andesite - Unaltered	3,000
Undifferentiated Skarn	68,000
Upper Development Rock Storage	
Undifferentiated Skarn	65,000
Marble	31,000
Clastics	7,000

TABLE 11

SUMMARY OF ACID GENERATION POTENTIAL FOR DEVELOPMENT ROCK

Rock Type	Mean Values of Total Sulfur by Wt. %	Mean Acid Generation Potential (Ton CaCO3/Ktons)	Mean Acid Neutralizing Potential (Ton CaCO3/Ktons)
Andesite - Altered	0.45	14.0	72.4
Andesite – Unaltered	0.32	10.1	38.6
Undifferentiated Skarn	0.97	30.4	86.4
Marble	0.19	5.87	667.2
Clastics	0.38	12.0	60.2

4.11 Backfill

Backfill for the mine openings will consist of both development rock and glacial gravel. Backfill will contain, in part, cement additive to enhance its support characteristics. The glacial gravel will be sourced from the backfill quarry located on private land along the ore haulage route (Figure 1). The gravel will be loaded into the trucks by front end loader after excavation (Figure 7), and will be transported directly to the mine site backfill storage site (Figure 6). Detailed engineering of the quarry will be developed in accordance with DNR requirements as specified in a surface mining permit. Trucks which transport ore from the mine to the Mill will transport backfill on the return trip, as required.

4.12 Project Transportation Plan

Ore Haulage

Ore stockpiled at the mine will be loaded into highway-legal haul trucks by a front-end loader for transportation to EBMC's Kettle River Mill. As required, the backfill will be transported from the backfill quarry to the mine site by the same trucks which transport ore to the Mill. The ore hauling procedures and equipment will be similar to the ore hauling operations used for the past 13 years by the Kettle River Operations.

The ore transportation will likely be contracted to a company specializing in highway haulage. The trucks will probably be rated at a twenty- or twenty five-ton capacity and will likely trail a ten-ton or fifteen-ton tandem trailer. Alternatively, side-dump trucks of similar capacity may be used. The actual payload is expected to be between 30 and 32 tons. The number of round trips will therefore average about fifty per day. However, during some periods such as immediately before and after spring breakup the average trips per day will increase in order to compensate for those times during which hauling is not permitted or feasible. Haulage rates may also vary based on operational and weather considerations. All trucks and trucking procedures will conform to requirements of the Washington State Dept. of Transportation, the Okanogan and Ferry County Road Departments, the DNR and the USFS and will be permitted by the agencies as required. The contractor will have latitude to select the equipment based on seasonal conditions so long as permitted requirements and agency regulations are followed. Ore transport is proposed to be limited to a daily schedule of 6:00 a.m. to 6:00 p.m.

Several routes exist which could be used for ore haulage from the mine site to the Mill as shown on Figure 11. The Marias Creek-Toroda Creek-Kettle River-Highway 21 route is proposed as the optimal route for the reasons discussed in Section 5.2. New road construction and upgrading will be required in order to improve the Marias Creek Road to safe operational standards as shown on Figure 12. Approximately 8,000 feet of new road construction is proposed in the upper parts of the Marias Creek drainage approaching the mine site. Most of the route from the mine site to the Toroda Creek Road is located on USFS land and road construction specifications have been recommended by that agency. These preliminary specifications indicate a crowned double lane graded road of a 24-foot travel way width with shoulders and ditching to control stormwater runoff. Crown will work with the title holding agencies in the development of the engineered design in order to meet operational and environmental objectives.

Mine Access

The proposed access route to the mine for deliveries incorporates the shortest possible alignment from highway 97 in the Okanogan Valley using existing roads (Figure 1). Certain portions of the existing route will require realignment and the entire USFS route will require widening to provide an appropriate margin of safety and to facilitate adequate stormwater control and proper maintenance. The route following existing roads is identical to one reviewed in the Crown Jewel EIS. Figure 12 shows the land status and alignment of the proposed routes in the vicinity of the mine to the Mill illustrating those portions of the alignment that require new construction or upgrading. That part of the route using County Road 4895 will require minimal widening and upgrading. All of the upgraded portions of the proposed alignment along 4895 USFS road 120 will conform to plans previously submitted and reviewed by Okanogan County and the USFS under the Crown Jewel proposal.

4.13 Ore Processing

Ore from the Buckhorn Mt. Project will be processed at the permitted and currently operating Kettle River Mill located near Republic in Ferry County. The Mill at the Kettle River Facility has been used to process ore from six other ore bodies, including ores with metallurgy similar to Buckhorn Mountain ore. The existing process includes crushing, grinding, leaching, and cyanide detoxification circuits. The existing gravity concentration circuit will be used.

As has historically been the case for processing of ores from the other mines, EBMC may need to make minor adjustments in the existing mill processing circuit to accommodate the specific characteristics of the Buckhorn Mt. ore. However, no changes will be made that will affect the nature of the tailings treatment compared to other ores currently and historically processed at the facility. A simplified flow sheet of the mill process is shown on Figure 13.

The estimated head (mined) grade is an average of approximately 0.32 ounces per ton. Currently defined reserves total 3.1 million tons not including some "inferred resources" that have a lower level of confidence. Based on currently prevailing gold prices and knowledge of the mineralized system the resource to be mined is estimated to total 4 million tons. Detailed mine planning will refine the mine life and scheduled grade to be delivered to the Mill. Ultimately, reserves will be determined by gold price, operating costs and conditions encountered in mining.

Ore will be transported by truck from the temporary ore storage located at the mine (Figure 6) to the Mill. Generally the storage site will contain from 0 to 20,000 tons of ore. However, during the spring thaw period when road conditions might restrict truck traffic, the mine site ore stockpile will be allowed to expand up to 50,000 tons.

4.13.1 Process Flowsheet

As presented on Figure 13, the Kettle River ore processing flowsheet consists of the following key steps:

- Crushing and Grinding
- Carbon-in-leach precious metal extraction
- Detoxification and tailing disposal
- Gold and Silver Recovery

Each of these processing steps is briefly reviewed below.

Crushing and Grinding

The particle size of the ore is reduced for precious metal extraction in a three step process that starts with crushing in a jaw crusher/cone crusher circuit followed by grinding in one or more rod mills. The final step is further processing by ball mills for further size reduction. Water is added to the milling circuit to assist in grinding. A gravity separation circuit following grinding may be used to concentrate some of the gold into a heavy fraction which may then be subjected to further grinding to better facilitate gold extraction in the carbon-in-leach process.

Carbon-in-Leach Process

The finely ground ore is pumped as a thickened slurry through the leach circuit. The leach circuit utilizes a conventional process known as carbon-in-leach or CIL. The CIL process includes using a dilute sodium cyanide solution to dissolve the gold and silver from the ground ore followed by adsorption of the precious metals on to granular carbon particles. The gravity concentrate may be initially leached in a separate tank at a somewhat higher cyanide concentration for more efficient recovery of gold. From the CIL circuit, carbon is screened and transferred to the acid wash system for further processing. The barren slurry (tailings) from the CIL tanks report to the cyanide detoxification system.

Cyanide Detoxification

The Mill uses the INCO/SO_2/O_2 (INCO) process to neutralize the cyanide contained in the tailings. This process employs a sulfur dioxide (SO_2) and air or oxygen injection system for neutralization. The cyanide destruction step takes place prior to discharging the tailings to the lined tailings disposal facility. The process has a well-documented and proven track record of neutralization in cyanide bearing tailings for similar ores at Kettle River Operations and numerous other mine facilities.

The Washington State Waste Discharge Permit for the Kettle River Mill requires EBMC to collect samples from the tailings pond five days per week and daily from the underdrain sump to check cyanide concentration levels when the mill is operating. This monitoring program verifies that the cyanide detoxification and containment systems are working properly. The INCO process at the Kettle River Mill routinely reduces cyanide discharge of the tailings to less than an average of

10 mg/L WAD cyanide. The Waste Discharge Permit for discharge into the tailings facility specifies an average WAD cyanide limit of 40 ppm.

Following detoxification, the tailing slurry is pumped to the TDF for disposal. At the TDF, solids settle from the slurry and the liquid fraction is recycled to the mill for reuse.

Gold and Silver Recovery

The gold and silver is stripped from the loaded carbon from the CIL circuit using a dilute sodium cyanide solution. This resulting gold- and silver-bearing solution (pregnant solution) is passed through an electrowinning cell, which plates the metals onto cathodes through an electrolysis procedure. Periodically, gold and silver are removed from the cathodes in the electrowinning circuit and smelted in a furnace. Most impurities are removed in the smelting process, and dore bullion is produced containing gold and silver and minor amounts of other trace metals. Dore bullion is shipped offsite for further refining.

The final step in this process is to reactivate the carbon by passing it through a heated kiln for thermal reactivation. The reactivated carbon is recycled to the leach tanks.

4.13.2 Kettle River Tailings Management Overview

EBMC's Kettle River Operation utilizes a geomembrane-lined TDF for permanent disposal of the detoxified mill tailings. This facility is operated under Washington State permit approvals for the Kettle River Operations including a Waste Discharge Permit and Dam Safety Permit. As of year end 2003, approximately 1.5 million tons of tailings storage capacity remains in the TDF, which currently has an ultimate total capacity of 8.6 million tons of placed tailings. Based on current reserves and production schedule at Kettle River Operations and including Buckhorn Mt. ore, a future expansion of disposal capacity at the TDF will be required to accommodate approximately 3 million tons or more, depending on ongoing exploration programs that may be developed prior to or concurrently with the production from Buckhorn Mt. EMBC will submit applications to the Eastern Regional Office of the DOE for an expansion of the Kettle River tailings disposal facility to accommodate the 3 million tons of Buckhorn Mt. ore that exceed the current storage capacity.

The planned expansion would include one or more upstream raise(s) and will incrementally have minimal effects on the impoundment footprint. The proposed expansion would use upstream construction methods similar to those used for the most recent lift constructed in 2001. Preliminary engineering already completed has indicated that upstream raises can be constructed that will provide for more than the required capacity. Detailed confirmatory engineering studies will be completed prior to dam safety permit application. The project will require permit approvals from the DOE which will be supported by detailed geotechnical investigations and engineering plans to be developed in support of permit applications. EBMC will conduct detailed geotechnical investigations at the site to characterize the dam raise foundation conditions and support future permit submittals.

5.0 ALTERNATIVES

As part of the Crown Jewel Project permitting process a detailed analysis of project alternatives was made and presented in the Crown Jewel FEIS (USFS and DOE 1997). These alternatives were developed utilizing engineering, reclamation, and environmental studies performed specifically for the alternatives analysis or in association with the Crown Jewel permitting process. Seven alternatives were evaluated in detail. These alternatives comprised variations in project components such as mining methods, waste rock disposal, tailings disposal, ore processing, reclamation, etc.

During Crown's development of this Plan and the 2003 Plan, various project components, options, and alternatives were considered for the proposed Buckhorn Mt. project. These variations were analyzed to select the combination of practical project alternatives that best fit Crown's objective of minimizing project-related impacts. The following presents several of the most important proposed project components that have been considered for the Buckhorn Mt. Project as compared with earlier studied alternatives. More detailed analysis of alternatives will be completed as part of the environmental impact analysis. Supporting technical data will be supplied by Crown on an ongoing basis to the agencies in response to requests for background information required for analysis of identified alternatives.

5.1 Underground Mining

The underground mining plan proposed by Crown will greatly reduce mine related impacts in comparison to impacts associated with previously evaluated open pit mining alternatives (Crown Jewel Alternatives B, D, E, F, and G). The open pit mining alternatives analyzed would have resulted in:

1. Larger areas of surface disturbance from the mine pit and waste rock areas;
2. Permanent reconfiguration of the topography at the mine site related to the open pit and waste rock disposal areas;
3. The requirement for long-term monitoring of surface and groundwater downgradient from permanent waste rock disposal areas;
4. Monitoring of pit lake chemistry and discharge;

5. Potential for long-term remediation of water quality relating to 3 and 4 above;

6. Relatively large water usage due to larger amounts of ore treated, the requirement for an on-site mill and the necessary use of extensive water for dust suppression; and

7. A permanent reconfiguration of groundwater system in the vicinity of the pit which was to be mitigated by conveyance of pit water from the Toroda Creek drainage to the Myers Creek drainage.

All of the issues above are addressed by the current Plan proposed by Crown for underground mining.

Crown's proposed Plan also differs substantially from the previously evaluated underground Alternative C in the Crown Jewel FEIS. Alternative C, like the open pit alternatives, proposed surface waste rock disposal, permanent mine discharge and the resultant changes in groundwater flow. Alternative C also was judged to have resulted in possible surface disturbance related to subsidence, as no structural backfilling was included in the plan. The backfilling proposed in the Buckhorn Mt. plan addresses the issue of subsidence. The underground mining alternative C was the USFS preferred alternative from the standpoint of environmental impacts among those analyzed in the Crown Jewel EIS.

An alternative considered but rejected in the Crown Jewel FEIS was proposed by the EPA in comments to the draft EIS. This plan would have mined the deposit by a combination of open pit and underground techniques and would have used development rock as backfill for the underground workings. Thirty million tons of waste rock from the open pit would be used to backfill the surface mine on completion.

In comparison to either of the above underground alternatives Crown's proposed Plan will significantly reduce the surface disturbance during operations by temporarily placing limited amounts of development rock on the surface; ultimately transporting all of it to underground workings to avoid surface disturbance due to subsidence. Final reclamation will recontour and revegetate the mine site in its entirety.

Crown believes that this proposed Plan of Operations for an underground mine addresses the environmental concerns raised during the Crown Jewel EIS relating to surface disturbance, land ownership, habitat conservation, wetlands preservation and water quality and usage.

5.2 Ore Transportation Routes

EBMC's Kettle River Operations, located east of Republic, Washington is the proposed Mill site. There are a number of alternative ore transportation routes from the mine to the Mill site as shown on Figure 11. From the mine, State Highways 20 and 21 could be used to access Kettle River Operations. Highway 21 was selected as the preferred state highway route because Highway 20 has a larger vertical climb, more adverse weather conditions and would result in increased truck traffic through the town of Republic. Therefore, this ore transportation discussion focuses on the potential routes from the mine to State Highway 21.

As shown on Figure 11, there are four potential alternatives to from USFS Road 120 to Toroda Creek Road including:

- Beaver Lakes Road
- Pontiac Ridge / Beaver Lakes Road
- Marias Creek Road
- Nicholson Creek Road

The Beaver Lakes and Pontiac Ridge/Beaver Lakes routes were rejected due to a relatively high level of local and recreational traffic, especially during the summer months and the close proximity of the roadbed to residences and environmentally sensitive waterways. The Nicholson Creek route and Marias Creek routes are similar in road distance and grade but the Marias Creek Road has no residences and much less traffic. Based on this analysis the Marias Creek route is judged to be the best alternative. Figure 12 presents the proposed road upgrades and areas of new construction required for use of the Marias Creek route.

A portion of the uppermost part of the existing Marias Creek Road alignment (Alternative 1, Figure 14) has excessively steep grades and sharp switchbacks that do not meet USFS recommended specifications. Three other alternative alignments meet the design requirements as shown on Figure 14. Alternative 2 is the shortest and is the preferred route if wetlands are not impacted by construction (Figure 14). In 2004, further evaluation of these road alignment alternatives will be completed in coordination with the USFS and DNR, the results of which will be appended to this Plan.

5.3 Tailings Disposal Facility Siting

A number of Alternatives for mill site location and tailings disposal were evaluated and presented in the Crown Jewel FEIS including off-site upland and side-hill sites analyzed by TerraMatrix as part of the Crown Jewel permitting process (TerraMatrix 1996). Options were evaluated for environmental suitability, social impacts, and economics. While these studies provided insights into many of the local and regional options, Crown's substantially reduced tailings disposal volumes in relation to the Crown Jewel Open Pit mining alternatives afforded additional options to Crown for assessment.

Prior to submitting the 2003 Plan, Crown evaluated potential TDF sites within a reasonable transportation distance of the Buckhorn Mt. ore deposit. Based on a review of land status, topography, upgradient, and downgradient catchments, availability of construction materials, access, and surrounding land uses, Crown identified two favorable nearby locations for the mill and tailings disposal: the Dry Gulch site south of Chesaw; and the Lost Creek site north of Chesaw.

Within short haulage distance from the mine the Dry Gulch site, south of Chesaw, was identified as the most desirable and technically appropriate location in the 2003 Plan. The Dry Gulch site differs from all of the Alternatives evaluated in the Crown Jewel FEIS in the following important ways:

- The Dry Gulch site would not require construction on an active stream course or wetlands. Minimal upgradient catchment area exists at the site eliminating the need for extensive stormwater management and facilitating reclamation.
- The Dry Gulch site would require lesser impact to timbered forest lands thereby reducing impact to prime habitat.
- The Dry Gulch site is on private land rather than public land.
- The volume of tailings contained in the proposed TDF is less than half of the volume proposed in the open pit alternatives, minimizing area of disturbance, water consumption, and closure requirements.

The Lost Creek site, located two miles north of Chesaw, was also identified as a superior mill/TDF location in relation to the Alternatives analyzed in the EIS. As is the case with the Dry Gulch site, the

Lost Creek site would not have accommodated the larger storage capacity required for the open pit reserves considered in the EIS. All of the advantages listed above for the Dry Gulch Site apply to the Lost Creek site. However, the Dry Gulch site would have less visual impacts and the construction would not intercept groundwater. Further, the Dry Gulch site would involve lesser amounts of surface disturbance.

The proposed Mill/TDF in this Plan utilizes the existing facilities at the Kettle River Operations (KRO) located in Ferry County. In comparison to alternatives addressed in the 2003 Plan this alternative eliminates the environmental impact related to the construction, operation, and closure of a new mill and associated tailings disposal facility at or near Buckhorn Mountain or Chesaw. As discussed above the ore would be hauled by highway trucks to the existing KRO Mill site for processing. The environmental advantages of using the existing Mill and TDF include:

- Elimination of new surface disturbance at a mill site associated with parking lots, buildings and a new tailings impoundment.
- Elimination of consumptive uses of water associated with a new ore processing facility.
- Restriction of the management and closure of a tailing storage facility to one existing location.
- Elimination of potential noise and visual impacts associated with a new mill/TDF location.
- Reduced impacts resulting from traffic along the Pontiac Ridge Rd.

5.4 Gravel Backfill

Crown proposes to use gravel sourced from a quarry to be located on private land for the underground mine backfilling operation. The underground mining alternative analyzed in the Crown Jewel EIS considered a surface rock quarry near the top of Buckhorn Mt. to provide rock needed for partial backfill during mine operations. The rock quarry would have also included a crushing and screening operation for sizing the backfill material.

6.0 MANAGEMENT AND MITIGATION OF AFFECTED ENVIRONMENT

Management and mitigation practices at the mine site and its surrounding environs are based on Crown's policy to minimize environmental impacts and are guided by the requirements of local, state, and federal laws and regulations, best management practices (BMP)s, and current technology.

The mining and environmental control activities also are designed such that the site will be reclaimed to a productive use following closure and decommissioning. Implementation of the measures discussed in this section has been developed to allow the Project to operate in an environmentally responsible manner. The management and mitigations measures proposed or to be developed by Crown in all cases either exceed or meet requirements of state or federal regulations.

6.1 Air Quality

As part of the DOE air quality permit, Crown will be required to meet all applicable state and federal air quality standards. The use of Best Available Control Technology (BACT) is required to meet these standards. The following practices and design features will be employed during construction and operations to control fugitive dust emissions and mitigate impacts to air quality:

- Dust-inhibiting agents approved by the appropriate agencies will be used to control fugitive dust on the haulage and access roads. These agents are the first line of defense for dust suppression. The selection of the dust suppressant will be coordinated with state, local and federal agencies consistent with climatic and road use considerations as well as other environmental factors. Watering of mine-related roads will be conducted to reduce fugitive dust at such times as are necessary when dust suppressants are not effective.

- Vehicle speed on the access roads will be restricted as necessary to reduce the amount of fugitive dust caused by traffic.

- Mining underground will eliminate dust emissions from blasting.

- Burning of slash during land clearing operations will adhere to DNR burning permit restrictions.

EBMC has extensive experience in controlling dust on the haul routes used by the Kettle River Operations. Similar measures will be used for the Buckhorn Mountain Project.

6.2 Topography/Physiography

The mine site will be constructed so as to minimize surface disturbance. Upon mine closure, the site will be recontoured to pre-mining condition and revegetated as described in Section 7, Reclamation Plan. All of the project facilities at the mine site are temporary and will be removed during reclamation and closure.

The access route to the mine will be constructed using existing alignments wherever practical. Any widening or improvements will be done to address safety issues and as directed by the agencies but will also be designed to minimize surface disturbance and impact to vegetation.

Estimated Summary of Areas of Disturbance	
Mine Site	31 acres
Haul and Access Road Improvement/Construction	57 acres
Backfill Quarry	24 acres
Other (Monitoring Wells, Diversions etc.)	5 acres

Road realignment and new construction will provide access to public lands in areas where access currently exists but is unsuitable for the proposed action. Crown proposes to reclaim those existing accesses on the direction of the responsible agencies when the new alignments have been completed thereby reducing the net areas of disturbance through reclamation. Ultimately, all new disturbances will be fully reclaimed as directed by the agencies and as described in Section 7, Reclamation.

6.3 Geology and Geotechnical Considerations

All facilities involved with construction and operations of the project will be constructed and maintained to be geotechnically stable during operations and in the long-term following decommissioning and reclamation of the project. Facility design and engineering plans will be submitted to the USFS as part of the Plan approval process, and to the DNR and DOE as part of the permitting process.

6.4 Soils

Crown recognizes that soil resources, particularly topsoil materials, are a valuable resource at the site. To the extent practical, soil horizons will be removed from facility sites prior to construction and stockpiled using methods that promote microbial activity upon redistribution. Temporary soil stockpiles will be reseeded with noxious weed-free mixed cover vegetation containing native species and with an emphasis on the ability to root quickly.

6.5 Water Management

Surface water control and management and protection of groundwater resources are critical elements of the operation. Controls include control of sediment and erosion and diversion and entrapment of surface runoff flows from disturbed areas.

6.5.1 Storm Water Management and Sedimentation Controls

Storm water management will be completed in accordance with the approved storm water pollution prevention/erosion control plan. This plan will be part of the site wide water management plan and fall under the jurisdiction of the DOE. Minimization of erosion and sedimentation of disturbed areas may include the following techniques:

- Vegetation will be removed only from those areas to be directly disturbed
- Cut and fill slopes for service and access roads will be designed to prevent soil erosion. Drainage ditches with cross drains will be constructed where necessary.
- Road embankment slopes will be graded and revegetated as practicable.
- Runoff from roads, buildings, and other structures will be handled through BMPs.
- Stream crossings will be minimized.
- Diversions will be constructed around affected areas during construction and operation of the mine site.
- Normal incidental precipitation falling on disturbed areas at the mine Site will be collected in basins or traps and infiltrated.
- Management practices such as check dams, dispersion terraces, and filter fences will be used during construction and operations.

- Permanent diversion channels, if required, will be designed for long-term stability.

- Reclamation will be implemented as soon as practical.

The design events (i.e., peak flows) for storm water management and sedimentation control will vary according to the size of the facility and possible consequences of failure, in general accordance with standard engineering practice. Other storm water management structures will sized according to the potential consequence of failure and likely range from a 24-hr, 100-year reoccurrence storm events for medium risk structures such as settlement basins above wetland areas to 6-hr, 2-year reoccurrence storm events for non-critical structures. Culverts will sized to meet Okanogan County, DNR and USFS road requirements with consultation from the Washington Department of Fish and Wildlife.

Surface water channels. Channels will be located on natural ground where possible and will not be lined for infiltration control. Channels with velocities above prescribed limiting velocities will be protected with riprap.

6.6 Mine Water Quantity/Quality

Water will be encountered in the subsurface workings of the mine. Modeled estimates of mine water inflow have been prepared and are summarized in Appendix B. Assuming the maximum estimated recharge rate of 5.4 in/yr (Hertzman 1996); total maximum estimated annualized inflows to the Southwest Zone workings are calculated at 7.25 gpm at the end of mining and maximum extent of ore extraction. Including the Gold Bowl, total annualized inflows into the entire workings at the end of mining are expected to be from 15 to 42 gpm, based on the range of estimated recharge values (1.9 inches/year minimum; 5.4 inches /year maximum). Seasonal changes in recharge and local rock permeability conditions will affect inflows.

Nearly all of this groundwater entering the mine would be from recharge intercepted within the Toroda Creek drainage during mining. The use of backfill during operations and installation of permanent bulkheads/plugs at closure will promote and ensure long-term hydrogeologic conditions will return to near pre-mining conditions. After mine flooding, the regional groundwater divide in the area of the mine is modeled to move slightly eastward to near the pre-mining divide location, potentially resulting in a minimal net reduction in recharge to the Myers Creek basin on the order of

0.5 gpm (Appendix B). Crown will work with the agencies to develop mitigation in the mine to address the post closure hydrologic environment.

Water used underground during operation for drilling, wetting of ore, cleaning of equipment and other uses underground will be drawn from sumps designed to temporarily store mine inflow of water. Excess water will need to be discharged from the mine during operation to facilitate mining activities. This water will be treated to ensure that nitrate derived from explosives is reduced to standards required by the DOE. Treated water will be infiltrated in the infiltration pond, the proposed location of which is shown on Figure 5. The exact final location and engineering of the infiltration structure(s) will be determined in consultation with the DOE and USFS.

Water will be collected in sumps in the mine prior to discharge. These sumps will be inspected for any petroleum residues which will be collected by skimming and removed as required. Settling of particulates in the sumps will minimize suspended solids. Should other potential pollutants be encountered in the mine discharge, water handling or the treatment plant will be modified as necessary. The water treatment method and detailed plant design will be determined by the DOE in consultation with other agencies.

As discussed in Section 3.7 development rock stored on the surface will have a net neutralizing character thereby minimizing the potential for acid generation and metals leaching while temporarily present on the surface. Nevertheless, development rock storage will be constructed in a manner as if there were potential for acid generation within the storage area. Temporary development rock storage will be constructed on a compacted pad of net neutralizing material. Storm water draining these temporary storage areas will be managed in sediment control structures for infiltration. Storm water will be managed in accordance with the approved storm water pollution protection plan.

Ore stored on the surface will temporarily reside in the ore storage area for only days or, at the most, weeks. Consequently, there will be no opportunity for oxidation, acid generation, or metals leaching prior to shipment to the Mill.

The development rock stored on the surface will ultimately be placed underground as backfill in stopes along with other development rock that was generated underground but which never reported to the temporary surface stockpile. Any acid generation potential of this placed development rock in the underground workings is effectively eliminated by:

- The relatively small proportion of placed development rock fill in relation to the encapsulating neutralizing mine rocks.

- The interlayering of the development rock fill with much larger quantities of inert to neutralizing glacial gravels and, more importantly, cemented backfill having very high neutralizing potential.

- Inundation of most backfilled areas effectively diminishing the oxidation of rock-forming minerals.

6.7 Water Supply Resources and Water Rights

Water use will occur at the mine site. It is the policy of Crown to minimize the use of water in Project operations to the degree practical. Water rights controlled by Crown are adequate to provide resources for the minor but necessary water consumption at the mine site. However, a change of use and point of diversion will be required to utilize these rights at the mine Site. Crown will work with DOE and local authorities to ensure that the consumptive use of water in no way impairs the water rights of others.

Application for water appropriation has been filed with DOE for the site consumptive uses shown in Table 9. The majority of the requested appropriation relates to the groundwater removed from the mine to permit underground work. However, it is currently assumed that the discharge of mine waters from the mine will require a waste water discharge permit rather than a water right. Excess water discharged from the mine is proposed to be treated and returned to the groundwater by infiltration and will therefore not result in a net loss of water in the groundwater system of the Toroda Creek drainage. Some consumptive use in the mine during mining will result in a small net loss to the groundwater system. Water will be lost from the mine through ore transported to the Mill for processing.

Water will also be used for potable/domestic uses in toilets, showers and for human consumption. This water is proposed to come from an on-site water well for which water rights have been applied.

A water supply plan will be prepared and submitted to the DOE in support of the review of the water rights applications. This plan will detail uses and mitigations of any water appropriated and used in both the Myers Creek and Toroda Creek drainage basins.

6.8 Vegetation

Mitigation and management issues regarding vegetation resources include avoidance of surface impacts, timber salvage, and sales, noxious weed control, use of noxious weed-free mulch and seed in reclamation, and interim revegetation. These are discussed in the Reclamation Plan in Section 7.0.

The project design is tailored to minimize the amount of timber that is required for removal. Timber on areas scheduled for disturbance by the Project will be sold and cleared in accordance with the USFS and DNR management requirements for timber harvesting. Negotiated contracts for timber harvest will be entered into with the appropriate agency where appropriate. Timber to be removed will be designated by agency representatives prior to removal.

As applicable to the surface ownership, plans for clearing and disposal of vegetation will be submitted prior to beginning operations. The areas to be cleared will be delineated on the ground to facilitate USFS and DNR review, as appropriate in order to specify the measures that will be needed to ensure proper utilization of the timber, disposal of slash, and protection of surface resources.

6.9 Wetlands

It is the objective of the project design to result in no net loss of wetlands and no part of the proposed action is designed to result in wetland loss. Should analysis of the Plan identify associated wetland loss then modifications will be proposed. However, if existing wetland resources are affected or filled by mandated changes in the proposed development of the project, permits would necessarily be obtained from the DOE and/or United States Army Corps of Engineers (USACE). Final mitigation measures would be detailed in these permits. Final wetland mitigation measures on USFS administered land must be agreed to by the USFS prior to their implementation though none are expected based on the current plan.

Water intercepted in the underground workings of the mine will be infiltrated or released as directed by the DOE and USFS. It is anticipated that this infiltration or release will accommodate local groundwater conditions in the protection of wetlands and surface waters in the area surrounding the mine. Crown will work with these agencies to ensure that ground and surface water quality and quantity are protected through conditions in permits as issued.

6.10 Wildlife

The project is designed to avoid impacts to wildlife resources. By minimizing surface disturbance, the use of existing access roads where possible and reclamation of the mine site and Mill/TDF sites, impacts to wildlife resources are mitigated. The goals of the project design are:

- Avoid impacts to wildlife and sensitive habitats.
- Minimize impacts to wildlife when impacts cannot be avoided.

The following specific wildlife management and mitigation steps will be employed by Crown.

- Perimeter fencing at the mine Site will exclude cattle but allow for deer movement.
- At least 15 percent of the species mix selected to provide for accelerated soil stabilization during reclamation will be species with higher palatability to wildlife.
- Any required new power poles will be designed to eliminate risk of electrocution of raptors.
- Wildlife run-outs will be created along both sides of access roads during winter when snow banks exceed two feet in height.
- Speed limits will be instituted in areas of high wildlife density to minimize wildlife injuries or mortalities from vehicles.

A Biological Assessment (B.A.) (Cedar Creek 1996) was completed for the area of the Crown Jewel mine site and transportation corridor as required under the Endangered Species Act of 1973. A determination of effects was developed for the Gray Wolf, Grizzly Bear, Northern Bald Eagle, and American Peregrine Falcon.

The B.A. determined that the previously proposed Crown Jewel Project would not adversely affect existing populations of Gray Wolves or Lynx primarily because no viable populations occurs in the area.

The study area of the B.A. was found to be unsuitable critical habitat for the establishment of Grizzly Bears though occasional travels through the area are possible. Population centers exist in Canada within forty miles.

No suitable breeding or wintering habitat exists for Bald Eagles and the Project was judged to have no adverse affect on Peregrine Falcons.

6.11 Noise

Noise generated at the mine will consist of several elements. Local traffic, including ore transport trucks and underground mobile mine equipment entering and exiting the portal will contribute to noise at the site. Given the location of the mine in the Gold Bowl drainage basin, the prime direction of noise will be upward and to the east. It is unlikely that any operational noise from the site could be heard within populated areas. A possible exception may be during the initial several blasts in the development of the adit. These noise impacts detected from the local sparsely populated areas will be very low given the distance. In any case the impacts would be of very short duration.

The fans at the portal and the other ventilation openings will also contribute to local noise levels. In all cases, fans will be used which minimize noise by design. Existing vegetation near the ventilation raises and secondary ventilation ramp, will be left in place to the extent possible to shield noise. At these sites the direction of the highest noise will be engineered so that the peak direction is upward and away from the population centers. It is highly unlikely that ventilation fan noise will be heard from populated areas under even the most adverse wind and climatic conditions. However, testing of detectable noise at different locations will be done subsequent to installation of the fans.

Increased noise will occur along the access and ore haul routes as a result of increased traffic associated with ore transport, employee traffic, and deliveries. All company or contractor vehicles will observe the following noise reduction measures:

- Deliveries by truck are proposed to be limited to a schedule of 8 a.m. to 5 p.m.
- Contractor and company owned vehicles will have maintained exhaust systems in good condition.

- Company vehicle operators will observe company instituted speed limits on the haul and mine access routes.

The use of a loader and dozer at the backfill quarry site will increase the background noise in that area. The loader and dozer are also proposed for use on a schedule to correspond with ore haulage times.

Both Washington State and MSHA regulate noise on construction and operational sites. Crown will comply with all State of Washington, MSHA, and Okanogan County health and safety requirements relative to noise generation.

6.12 Scenic Resources

Crown will employ several general measures to minimize the visual intrusion of the project. As discussed previously, vegetation will be left undisturbed where feasible as a screening element. Construction cuts and fills will be rounded and blended with the surrounding topography to the degree possible. Exterior lighting will be reduced to the minimum required for safe operations and to maintain site security. Such exterior lights will be directed inward and down toward the center of the area to be illuminated to minimize views from offsite. Permanently mounted lights will be sodium or a similar type of spectrum and intensity.

The mine site is not known to be visible from any population centers nor from public roads.

6.13 Heritage Resources

Various cultural resource studies were conducted from 1993 to 1995 as part of the Crown Jewel permitting process. Within the immediate area of the mine site, significant or potentially significant heritage and cultural resources were identified. Four intact structures of the old Gold Axe mining camp remain. Crown believes that these structures represent a valuable resource to be preserved. All four occur within the area of proposed site construction. Of these, three occur on USFS land and the fourth on private property owned by Crown. Crown intends to isolate these resources within the site so that they will be left undisturbed and preserved. Crown will consult with agencies and interested parties regarding the enhancement of these historic sites and their preservation during and after operation

No other sites previously identified as culturally significant will be impacted by Crown's proposed operations. However, if newly undiscovered cultural resources are identified during the course of operations the site will be documented and protected. The USFS, or DNR or other appropriate agencies will be notified for determination of future action, if any. If cultural sites of importance to native cultures are located, tribal authorities of the Colville Indian Reservation will be contacted and coordination of the disposition of the site will be made.

6.14 Tribal Rights

The Colville Confederated Tribes retain hunting, fishing, and gathering rights to the region surrounding the Buckhorn Mt. Project as part of the traditional north half of the Colville Reservation. Many of the impact avoidance strategies that address general environmental issues similarly protect tribal rights in the area. The minimization of impacts to surface water quality and quantity ensures protection of existing aquatic habitat in the surrounding streams. The minimization of the area of disturbance on Buckhorn Mt., reduces impacts to wildlife habitat. The fact that the site is situated to a large degree on previously disturbed areas further minimizes new impacts.

Approximately 16 acres of USFS land within the fence of the mine site is proposed to be withdrawn from hunting during the operating life of the mine. For security reasons, hunting is not a compatible activity within the portal and office area at the mine site.

No known Native American archeological sites within the area of disturbance were located in previous surveys. However, if resources are identified appropriate action will be coordinated with the Colville Confederated Tribe.

6.15 Transportation

Issues pertaining to transportation have been discussed in Section 4.13. Additional details, regarding road maintenance, winter road maintenance, supply delivery, a USFS Road Use Permit, road closures, and other issues relating to transportation will be identified in a proposed joint agreement between the County Road Department, USFS and DNR.

Crown understands that it must obtain agency approval for road improvements on existing USFS routes, DNR routes and along county easements. New road construction must also be permitted through the appropriate landholding agency.

EBMC at their Kettle River Operations have been hauling ore on public roads from satellite mines to the Mill since 1990. During that time, hauling contractors have had an excellent safety record. EBMC and the contractors have worked closely in instituting safety programs and guidelines including scheduling of regular meetings and workshops to raise safety awareness.

6.16 Land Use/Reclamation

Land use considerations include land and vegetation disturbances, existing livestock leases and water sources, fencing, and noxious weed control during construction operations. Additionally, the federal land at the mine site impacted during the mine life will be fenced and entry will be limited for safety and security purposes to those with business at the mine site. This area of approximately 16 acres will therefore be withdrawn temporarily from recreational purposes such as hunting and hiking.

Crown will minimize land and vegetation disturbances by maintaining a compact operation. Timber and vegetation will be left where feasible to serve as facility screening and for wildlife habitat. Erosion will be controlled at all times during construction and operation.

As discussed previously, the site will be fenced to exclude livestock using standard USFS four strand barbed wire fence enclosing a total area of 32 acres during the mine life. Sixteen acres of USFS land within the Cedar Allotment will fall within the fence line. All stock fencing will be maintained by Crown during operations and until reclamation and successful revegetation of the site is established (up to five years from closure).

It is important to prevent the establishment or spread of noxious weeds. All earth-moving and other mobile equipment entering the site for the first time will be cleaned (washed) of soil and noxious weed seeds with particular attention to the undercarriage area. While spraying or biological control programs will be used to control noxious weeds on site and on the access road as necessary, preventative measures of vehicle cleaning are an important defense against the spread of noxious weeds. Company vehicles that have traveled off of paved highways in areas of noxious weed infestations will be cleaned prior to traveling on the accesses to the site and on the haul road.

Spraying of areas on or adjacent to federal or state land will be conducted only as approved by the jurisdictional agency. All spraying will be conducted in accordance with county guidelines.

6.17 Socioeconomics

Crown's corporate philosophy will be to employ personnel from the local communities surrounding its mine Site when feasible. Every effort will be made to maximize local hires. Such local hiring practices include use of local contractors and contract personnel whenever practical. New worker training will be available, particularly to support local hiring practices. The mine construction, operations, and reclamation will provide a beneficial revenue and tax base increase for the counties and state for a minimum of ten years. Socioeconomic impacts related to the mine construction are expected to be both beneficial and adverse in relation to housing a temporary workforce consisting of local and outside contractors.

Local expenditures made directly by the mine and by mine personnel will result in an increased demand for goods and services in the project area. Some of this demand will be met by existing residents working in stores, real estate offices, and other businesses. However, the new demands generated by the mine would be expected to create new jobs in the service, retail, or other non-mine sectors of the economy to support the project and its employees.

The socioeconomic impacts will be more fully evaluated as part of the Counties' project review, analysis, and approval process.

6.18 Solid Waste (Garbage and Trash) Management

Solid refuse, trash, and general garbage generated during construction of the facility will be consolidated, contained and transported offsite to the county land fill or other disposal sites as appropriate. Portable toilet facilities will be used during construction and during operations at certain locations. Solid wastes such as wood debris and concrete may be buried onsite during the reclamation phase contingent upon approval by the appropriate authorities and land management agencies. Should burial not be approved, solid waste will be transported to appropriate landfill disposal locations. Spills of oil, fuel, grease, and other materials will be cleaned up immediately and disposed of appropriately. An emergency spill and response plan will be developed as required prior to construction and operation.

The handling of human waste during operation and the closure will be coordinated with the State of Washington and the counties at the mine and quarry sites.

6.19 Hazardous Substances

At the mine site explosives will be handled and stored for blasting use in mining of ore and development rock. It is anticipated that most or all of the primary explosives used will be ammonium nitrate fuel oil (ANFO). This blasting agent is particularly safe to handle and poses less risk of danger or theft than other dynamite-based explosives. Nevertheless dynamite-based blasting agents may be stored on site as will detonation cord and other explosive devices requiring high security measures. Storage of explosives is discussed in Section 4.6 and the security of explosives on site and in transit will be subject to a security plan which will be approved by MSHA and prepared in coordination with the County and other appropriate agencies. The transportation of potentially hazardous or dangerous substances to the site by contractors will be in accordance with the provisions of 49 CFR Part 107a. A list of substances to be consumed on site is shown in Table 8.

7.0 RECLAMATION PLAN

This section presents an overview of the key components of the reclamation planning for the Buckhorn Mt. Project. Details of the reclamation plan are presented in Appendix D. The Kettle River Mill/TDF site already has an approved Reclamation Plan.

Historic and current land uses include hunting, fishing, gathering, mineral exploration and extraction, logging, agriculture, residential development, timber sale, firewood gathering, grazing, and recreation. Management of the USFS land in the vicinity of the project is guided by a land and resource management plan (RMP) developed by the USFS (USFS 1989). The RMP states that all operations associated with mining development shall adhere to National Forest Management Act, which requires reclamation of all mining operations and compliance to air and water quality state and federal standards. Reclamation plans presented here are, to the extent applicable and appropriate, based on recommendations contained in the BLM Solid Minerals Reclamation Handbook (BLM 1992). Additionally, reclamation will conform to WA DNR Title 78 governing mines, minerals and petroleum.

The goal of reclamation is to return the site to a productive post-mining condition following closure and decommissioning. Reclamation will be completed on both private and public lands. Key facilities to be reclaimed include:

- Mine portal area
- Ventilation openings
- Access roads
- Water supply well
- Monitor wells

Reclamation activities will be scheduled to occur as soon as practical after the mining activities are completed, thus minimizing erosion and sedimentation problems. In general, reclamation will be timed to take advantage of optimal climatic conditions. Final grading, drainage, and sediment control establishment will occur over the late spring and summer months. Seedbeds will be prepared in later summer or early fall just prior to seeding. Seeding will be completed in mid-late fall in order to take advantage of winter and spring moisture.

Many of the reclamation activities can not occur until near the time of final mine closure. Areas such as the underground workings and surface facilities will remain active until mine closure. However, during the anticipated life of the project, interim and concurrent reclamation will occur to reduce erosion and the potential for off-site degradation.

Interim reclamation refers to reclamation efforts on lands disturbed and reclaimed during the course of a project. To reduce erosion and sedimentation during the life of the operations, disturbed areas will be temporarily revegetated. Topsoil will not be applied to temporarily revegetated areas. Topsoil will generally be conserved for final reclamation activities. These temporarily vegetated areas will be broadcast seeded with an interim seed mixture. Mulch and fertilizer may be added if initial seeding is unsuccessful. The topsoil stockpiles, tailings pipeline berm, and access road embankment will require interim reclamation.

Concurrent reclamation refers to reclamation activities which can be carried on at the same time as ongoing mining activities. Concurrent reclamation can be advantageously employed on disturbed areas that have served their purpose and are ready to be graded to final reclamation contours. Such areas will include disturbances associated with diversion ditches, exploration drill pads, and any access roads that will not be needed for future activities. Reclamation of temporary development rock staging areas will occur upon final use as interim reclamation. Where possible during the life of the project, disturbed lands will be reclaimed with ongoing mining operations.

Extensive reclamation has already been completed at the mine Site. Exploration drilling roads constructed by Crown and, more extensively by BMG, have been reclaimed by BMG (now Newmont Mining) in 2002 and 2003.

Most reclamation activities will take place at the time of mine closure and will be considered “final” reclamation. The areas to undergo reclamation at mine closure include underground workings, the portal and general mine area, the sediment control ponds, and access roads. Final reclamation will be implemented upon the completion of mining and exploration. Detailed final reclamation procedures are discussed in Appendix D.

Reclamation of the Kettle River facilities is described and covered under separate documentation and permits, and may or may not occur at the end of the Buckhorn Mtn. mine life, depending on whether additional ore sources are identified as part of on-going exploration programs.

8.0 MONITORING MEASURES

Monitoring programs will be developed by Crown through discussions with and input from Okanogan County, DOE and DNR, and the USFS and required by permit conditions. These programs will be designed to detect and quantify any environmental impacts from construction through post-closure reclamation activities at the site. All monitoring programs will comply with any required local, state, and federal permit and approval stipulations.

Extensive monitoring data exists as documented in the Crown Jewel Project FEIS and subsequent monitoring activities conducted by BMG and Crown. These baseline data provide background for the proposed Buckhorn Mt. Project. It is anticipated that much of the existing monitoring data and baseline studies will be utilized during the future regulatory analysis of the Buckhorn Mt. Project. Based on Crown's current understanding of the existing data and where data gaps may exist for the new project, the following table (Table 12) summarizes the expected monitoring programs.

TABLE 12

MONITORING MEASURES

Resource Area	Baseline Monitoring Measures	Operational Monitoring Measures	Post-Closure Monitoring
Water Resources	Use existing data and augment existing mine site data	Select appropriate stations from baseline program	Reduced number of stations
Air Quality	Use existing data	Use existing data and select appropriate stations	None or to be determined
Geochemistry	Use existing data and continue monitoring program in place	Develop operational sampling and testing program to verify baseline results	To be determined
Reclamation	Use existing data	Use existing data and develop operational monitoring program	Develop post-closure monitoring program

Water resource monitoring is believed to be the most critical resource area for characterizing baseline and establishing appropriate monitoring for the operational conditions. Extensive baseline monitoring of groundwater and surface water geochemistry and of surface water flows in the vicinity of the mine site has been completed for the Crown Jewel project and has provided the basis and starting point for the ongoing Buckhorn Mt. Project monitoring. Continued baseline water quality monitoring of surface and ground waters at and near the mine site was reinitiated in 2003. Continued surface water flow and ground water level data is currently being collected.

Monitoring parameters and locations during operation and post-closure may be different from initial baseline studies as information is gathered and assessed. The monitoring programs, whether baseline, operational or post-closure will be developed in cooperation with appropriate regulatory agencies. It is anticipated that specific programs will be modified as the project moves forward to meet identified needs.

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TABLES

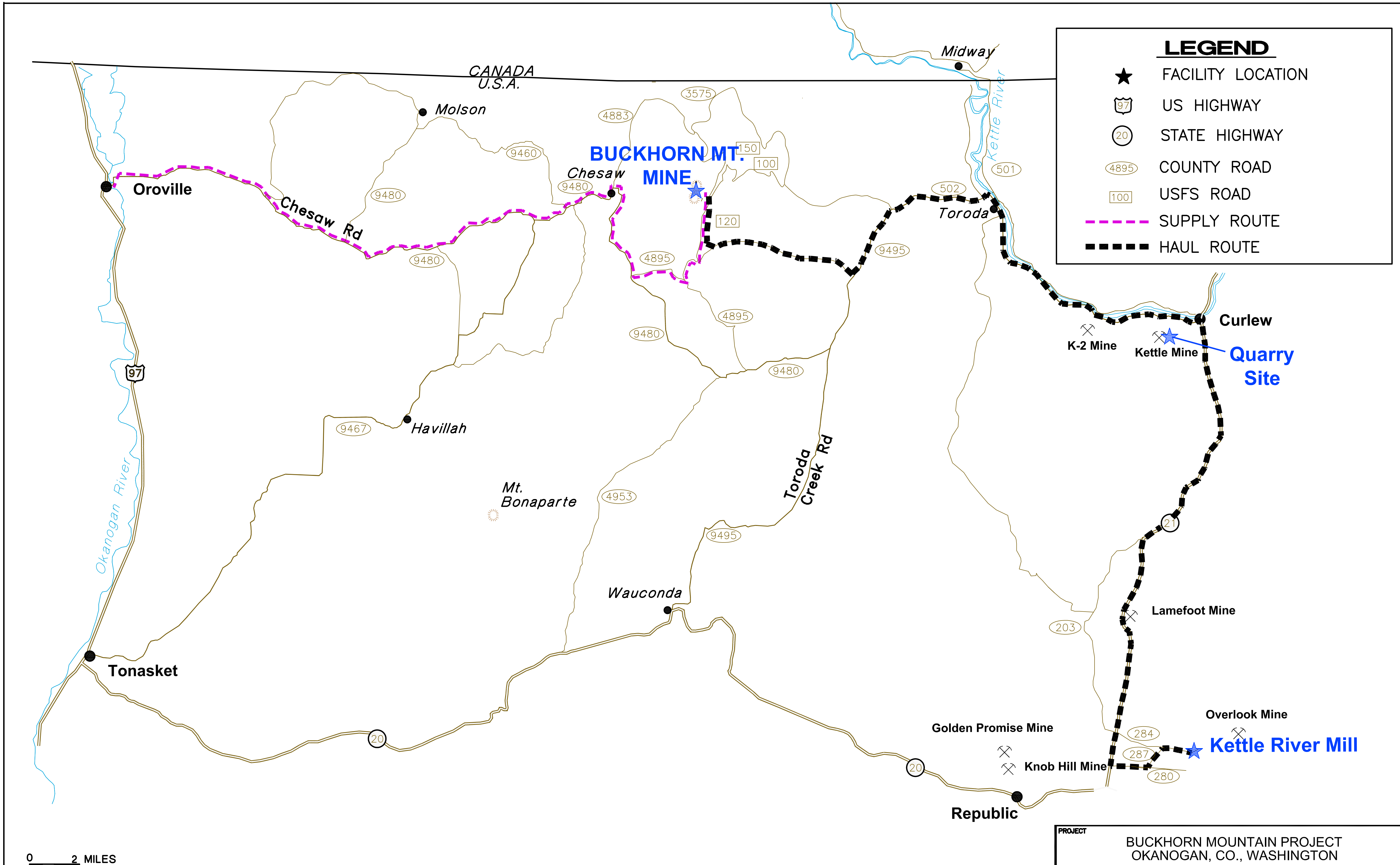
TABLE 1

PERTINENT MAJOR STUDIES/SUBMITTALS PERFORMED FOR THE PROJECT

Year	Subject	Author
1990	A Cultural Resources Survey of the Crown Jewel Exploration Project, Okanogan County, Washington	Archaeological and Historical Services
1992	Plan of Operations	Battle Mountain Gold
1992	Soils Technical Memorandum, Crown Jewel Project	Cedar Creek Assoc.
1992	Report on the Waste Rock Geochemical Testing Program: Crown Jewel Project, Chesaw, WA.	Adrian Smith Consulting Inc.
1992	Supplements to the Plan of Operations	Battle Mountain Gold
1993	Integrated Plan of Operation	Battle Mountain Gold
1993	Reclamation Plan.	Battle Mountain Gold
1993	Report on Geochemical Testing of Ore and Low Grade Ore Crown Jewel Project	Battle Mountain Gold
1993	Baseline Noise Monitoring Report. Proposed Crown Jewel Mine Site. Chesaw, Washington	Hart Crowser
1993	Report on the Waste Rock Geochemical Testing Program, Crown Jewel Project	Kea Pacific Holdings Inc. and Golder Associates Inc.
1993	Report on the Waste Rock Geochemical Testing Program, Crown Jewel Project, Responses to Agency Comments	Kea Pacific Holdings Inc. and Golder Associates Inc
1993	Report on Geochemical Testing of: Ore and Low Grade Ore, Crown Jewel Project	Kea Pacific Holdings Inc. and Golder Associates Inc
1993	Aquatic Resources for Sections of Myers, Gold, Nicholson, and Marias Creeks in the Okanogan National Forest	Pentec Environmental Inc.
1993	Aquatic Resources for Sections of Myers, Gold, Nicholson, and Marias Creeks in the Okanogan National Forest	Pentec Environmental, Inc.
1993	Wetland Delineation, Crown Jewel Project, Okanogan County, Washington	Pentec Environmental, Inc.
1993	All Known Available and Reasonable Technology (AKART) Evaluation for Cyanide Detoxification, Battle Mountain Gold Company, Crown Jewel Project, Okanogan County WA.	Knight Piesold & Company
1994	Cultural Resources Investigations of the Crown Jewel Mine Project, Okanogan County, Washington	Archaeological and Historical Services
1994	Summary Report Confirmation Geochemistry Program, Crown Jewel Project	Terra Matrix Inc.
1994	Technical Memorandum on Groundwater Supply Evaluation of Lost Creek Ranch Irrigation Well	Golder Associates Inc.
1995	Crown Jewel Project, Wildlife Technical Report	Beak Consultants, Limited
1995	*Draft Environmental Impact Statement: Crown Jewel Mine, Okanagon County Washington*, assembled by TerraMatrix	U.S. Forest Service
1995	National Register of Historic Places Registration Form determination of Eligibility: Buckhorn Mountain Mining Properties	Eastern Washington University

Year	Subject	Author
1995	Crown Jewel Project Economic and Fiscal Impact Analysis	Huckell / Weinmam Assoc.
1996	Tailings Geochemical Testing Program, Crown Jewel Project, Okanogan County, Washington, Addendum 1	Battle Mountain Gold
1996	Reclamation Plan	Battle Mountain Gold
1996	Biological Assessment for the Crown Jewel Mine Project	Cedar Creek Associates, Inc. and Beak Consultants Inc.
1996	Affected Socioeconomic Environmental Background Report (1996 Update) Crown Jewel Project	E.D. Hovee and Company
1996	Existing Socioeconomic Environmental Conditions Baseline Report (1996 Update) Crown Jewel Project	E.D. Hovee and Company
1996	Report on Waste Rock Geochemical Testing Program, Crown Jewel Project, Phase IV, Additional Humidity Cell Tests	Geochimica, Inc.
1996	Final Report: Tailings Disposal Facility, Final Design Report	Golder Associates Inc.
1996	Crown Jewel Project Conceptual Wetland Mitigation Plan.	Parametrix, Inc.
1996	Noxious Weed Management Plan, Crown Jewel Mine	Parametrix, Inc
1996	All Known Available and Reasonable Technology (AKART) Evaluation for Cyanide Detoxification, Battle Mountain Gold Company, Crown Jewel Project	Knight Piesold LLC
1996	Report on Packer Injection Tests at the Proposed Crown Jewel Mine, Okanogan County, WA.	Golder Associates Inc.
1996	Meteorological Data Set, Crown Jewel Project, Chesaw WA	ENSR
1996	Myers Creek Project Fisheries & Instream Flow Studies, Final Report	Cascade Environmental Services Inc. & Caldwell & Assoc.
1997	*Final Environmental Impact Statement: Crown Jewel Mine, Okanagon County Washington*, assembled by TerraMatrix	U.S. Forest Service
1997	Crown Jewel Mine Plan of Operations, Battle Mountain Gold Company	Battle Mountain Gold Company
1997	Results of Static Acute Fish Toxicity Testing for Designation of Dangerous Waste	Battle Mountain Gold Company
1997	Engineering Report INCO SO2/O2 Wastewater Treatment Unit	AGRA Earth and Environmental Inc.
2000	Crown Jewel Surface Water and Groundwater Data Validation and Preliminary Analysis	Shepherd Miller Inc.

FIGURES



PROJECT

BUCKHORN MOUNTAIN PROJECT
OKANOGAN, CO., WASHINGTON

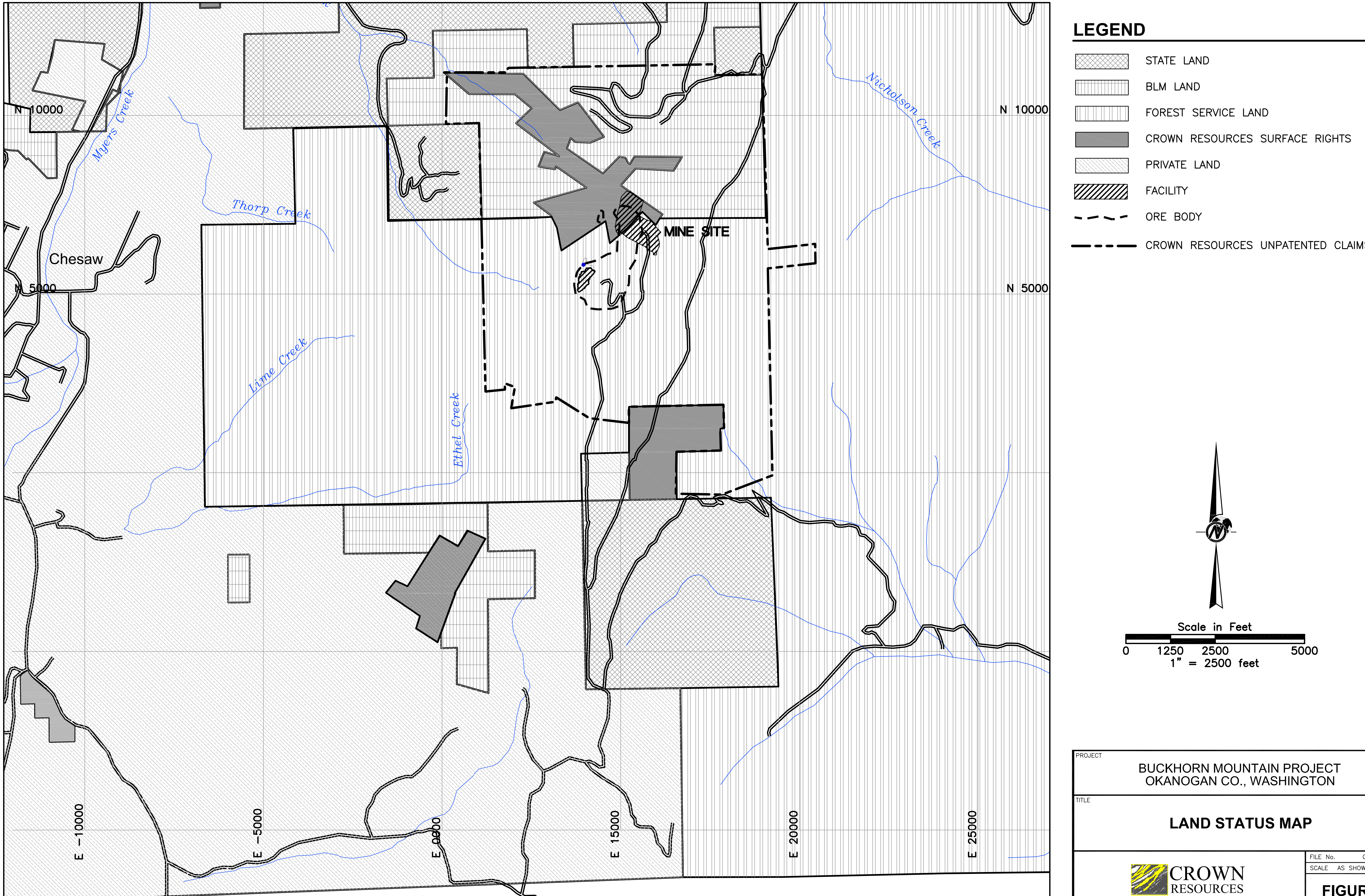
TITLE

PROJECT LOCATION MAP

CROWN RESOURCES

FILE No.	0232002A042		
SCALE	AS SHOWN	REV.	B

FIGURE 1



PROJECT
BUCKHORN MOUNTAIN PROJECT
OKANOGAN CO., WASHINGTON

TITLE
LAND STATUS MAP

CROWN RESOURCES

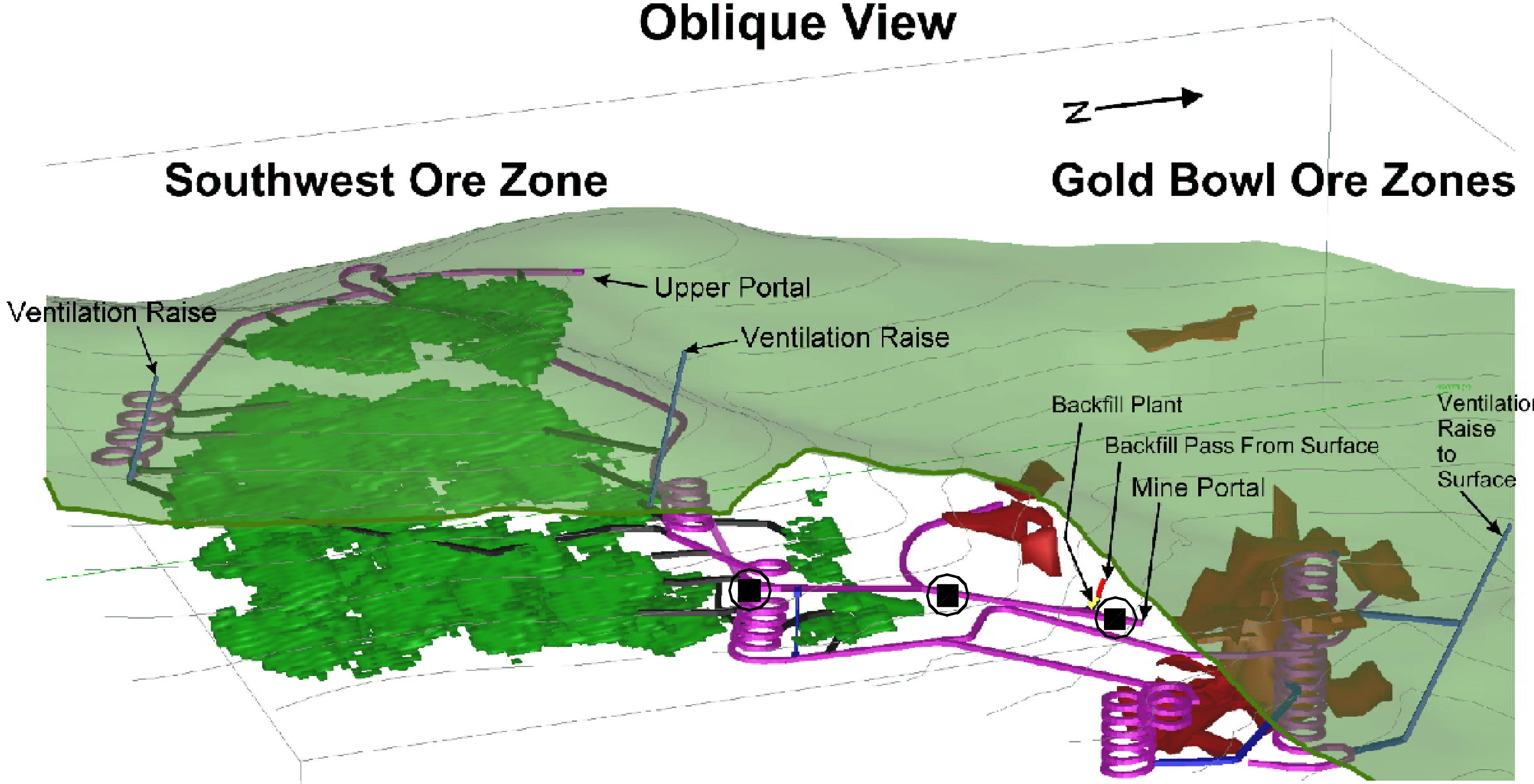
FILE No. 0232002A012
SCALE AS SHOWN REV. B

FIGURE 2

Dwg Name: N:\023-2002\0232002A012.dwg
Last Update: Feb 04, 2004 16:22 By:
Last Plot: Feb 04, 2004 16:50 By: jroberts
Machine: NOT SET

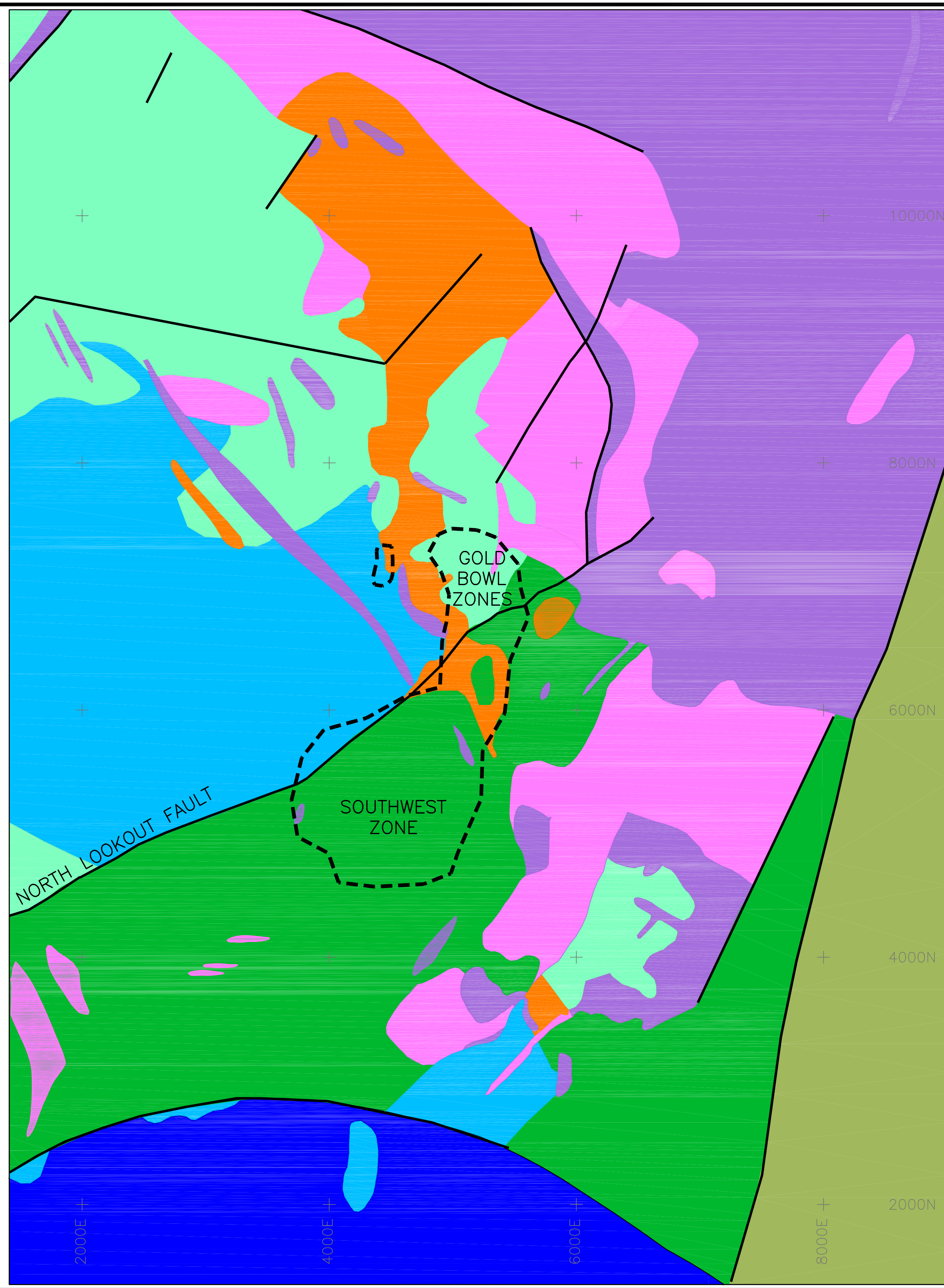
Dwg Name: N:\023-2002\0232002A048.dwg
Last Update: Feb 04, 2004 17:03 By:
Last Plot: Feb 04, 2004 17:03 By: mjuneau
Machine: CAD_Juneau

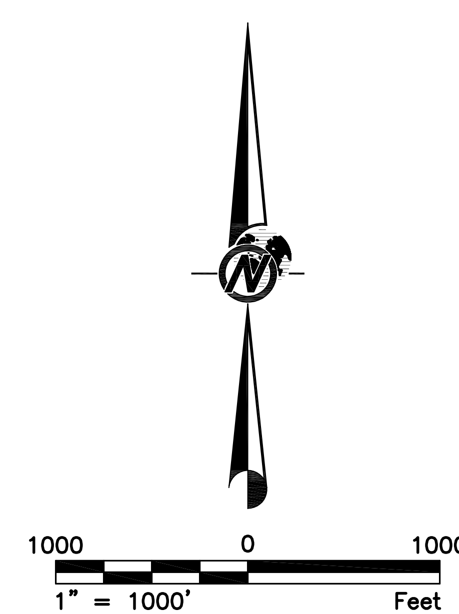
Buckhorn Mt. Mine Plan
Oblique View



Legend
- Southwest Ore Zone
- Gold Bowl Ore Zone
- Primary Mine Development
- Secondary Mine Development
- Ventilation passes
- Bulkhead Location

PROJECT	BUCKHORN MOUNTAIN PROJECT OKANOGAN CO., WASHINGTON
TITLE	**MINE PLAN OBLIQUE VIEW**
CROWN RESOURCES	FILE No. 0232002A048 SCALE N.T.S. REV. A **FIGURE 3**





LEGEND

Fault

Approximate Surface Projection of Outer Boundary of Ore Bodies

LITHOLOGY

- Eocene Volcaniclastics
- Skarn
- Andesite
- Diorite
- Other Intrusives
- Clastics/Volcaniclastics
- Marble
- Clastics

PROJECT
BUCKHORN MOUNTAIN PROJECT
OKANOGAN CO., WASHINGTON

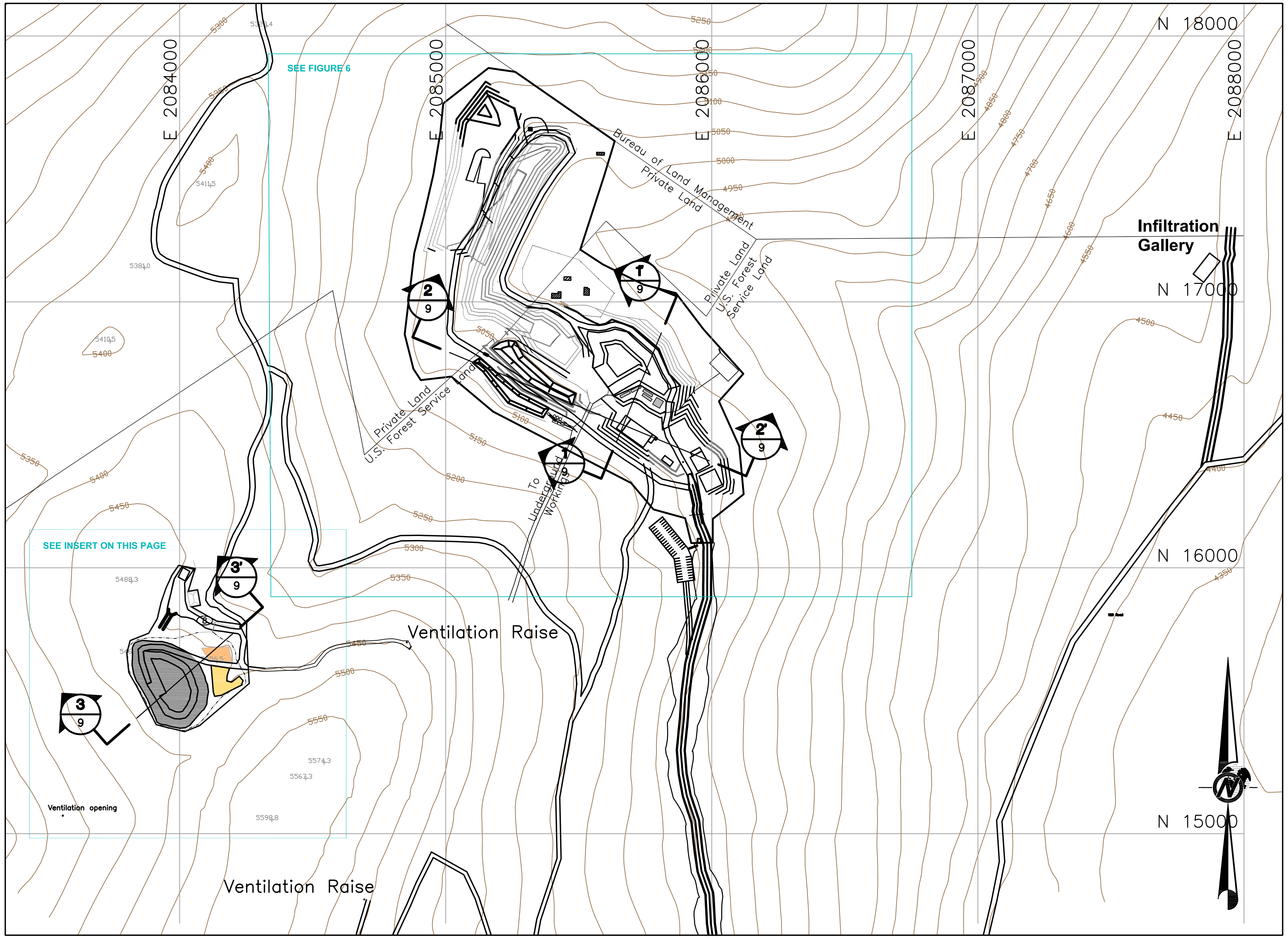
TITLE
SITE GEOLOGY MAP

CROWN RESOURCES

FILE No.	0232002A007
SCALE AS SHOWN	REV. B

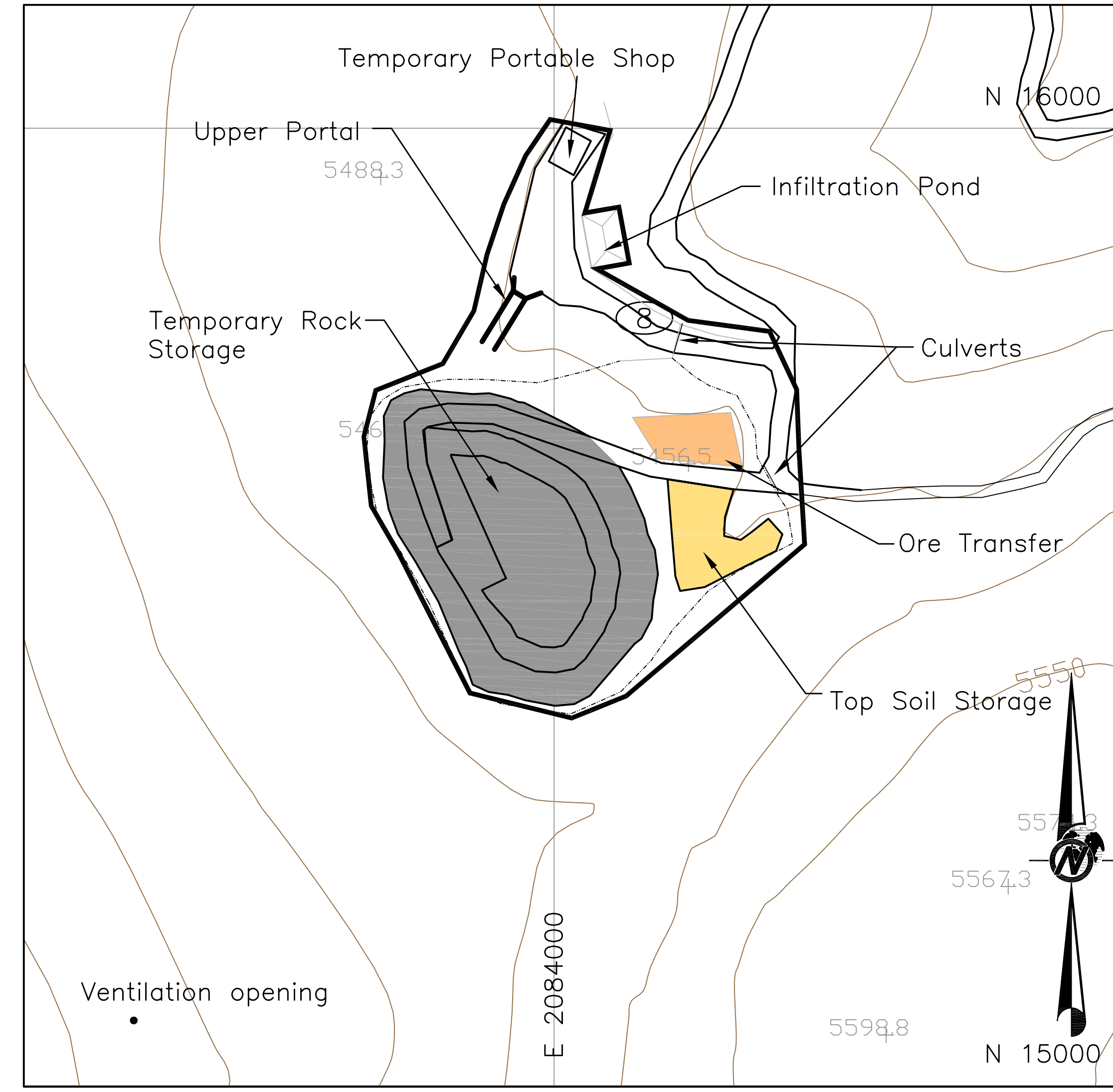
FIGURE 4

Dwg Name: N:\023-2002\0232002A007.dwg
Last Update: Feb 04, 2004 14:11 By:
Last Plot: Feb 04, 2004 17:04 By: jroberts
Machine: NOT SET



500 0 500 1000

1" = 500' Feet



UPPER PORTAL

200 0 200 400

1" = 200' Feet

LEGEND

Symbol	Description
Thin line	PROPERTY LINES
Triple line	PROPOSED ROADS
Double line	EXISTING ROADS
Hatched box	CULTURAL RESOURCE
Line	SECURITY FENCE
2 (upper number)	SECTION DESIGNATION
9 (lower number)	FIGURE DESIGNATION

PROJECT	BUCKHORN MOUNTAIN PROJECT OKANOGAN CO., WASHINGTON
TITLE	**MINE SITE LAYOUT**
CROWN RESOURCES	FILE No. 0232002A044 SCALE AS SHOWN REV. A **FIGURE 5**

Dwg Name: N:\023-2002\0232002A044.dwg
Last Update: Feb 03, 2004 12:12 By:
Last Plot: Feb 03, 2004 12:13 By: jroberts
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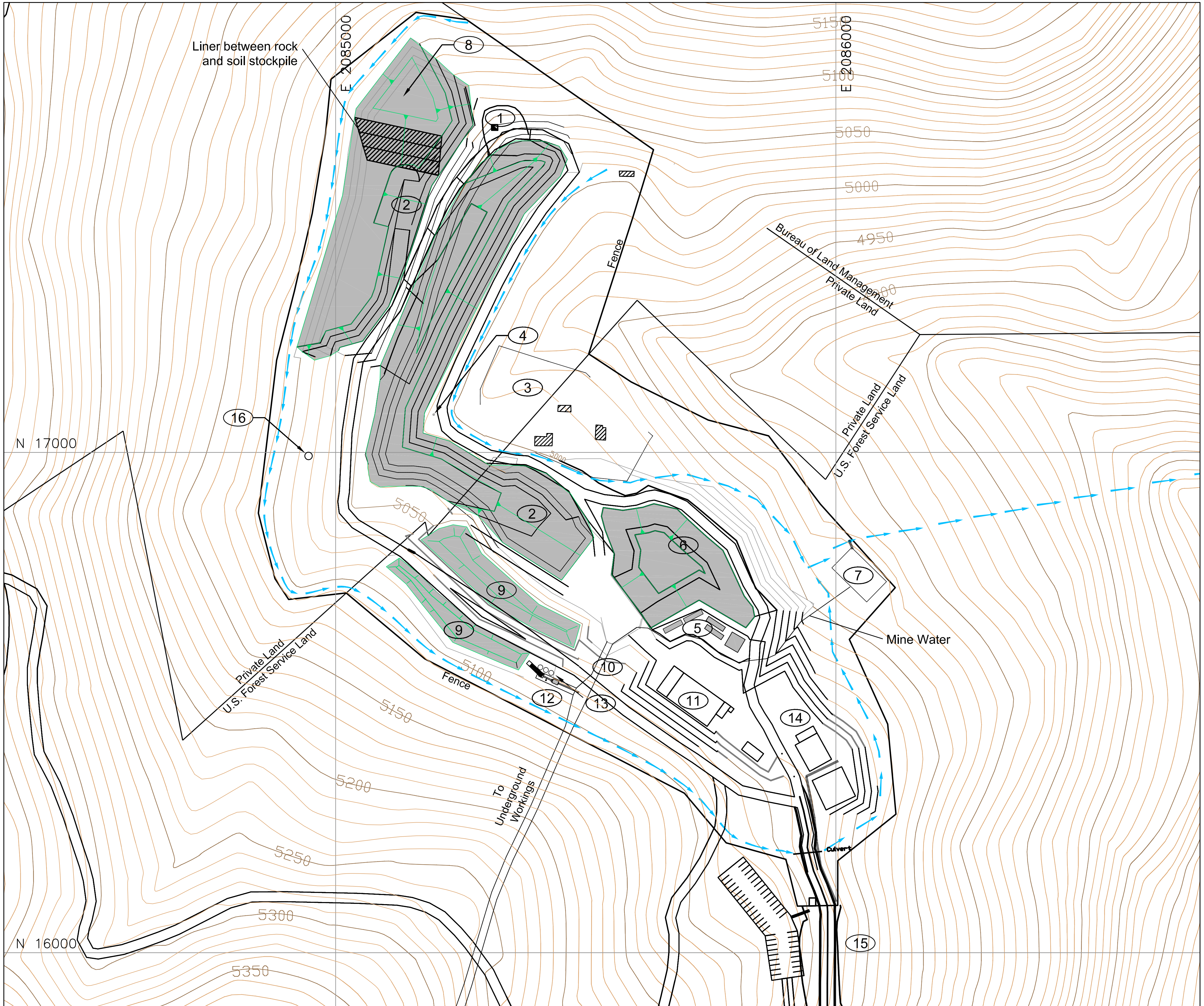


LEGEND

PROPERTY LINES
PROPOSED ROADS
EXISTING ROADS
STORMWATER DIVERSION FLOW
CULTURAL RESOURCE
SECURITY FENCE

ID. NUMBER	FACILITY
1	Ventilation Raise
2	Temporary Development Rock Storage Area
3	Gold Axe Heritage Conservation Area
4	Water Well
5	Compressor / Fuel Storage
6	Temporary Ore Stockpile
7	Mine Effluent Water Treatment
8	Topsoil Stockpile
9	Backfill Storage
10	Main Portal
11	Shop
12	Backfill Plant
13	Cement Storage
14	Mine Offices/Facilities
15	Parking Lot and Security Gates
16	Water Tank

Note: Surface cross sections shown on Figure 9.

200 0 200 400
1" = 200' Feet

PROJECT
BUCKHORN MOUNTAIN PROJECT
OKANOGAN CO., WASHINGTON

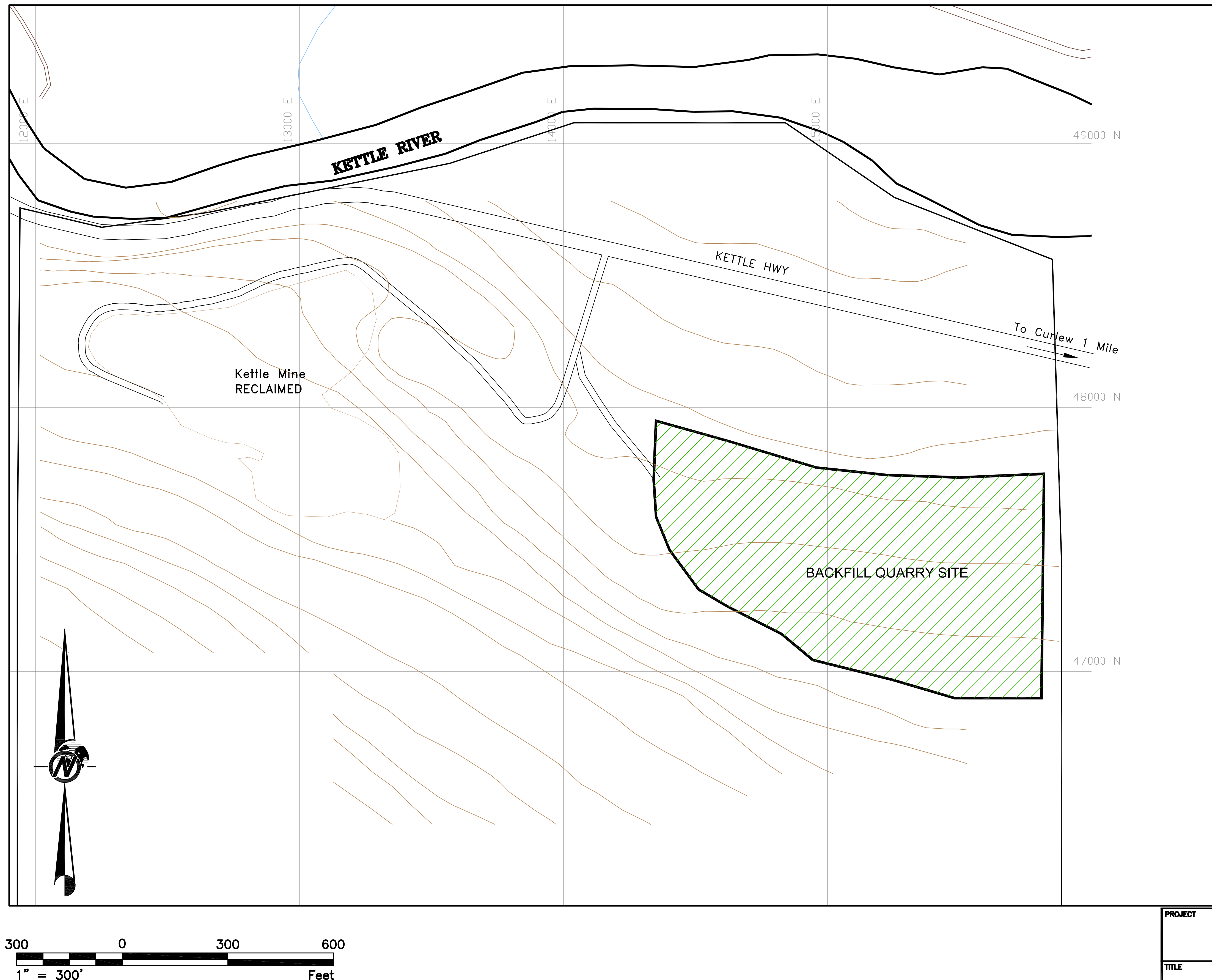
TITLE
MINE SITE DETAIL

CROWN RESOURCES

FILE No. 0232002A043
SCALE AS SHOWN REV. A

FIGURE 6

Dwg Name: N:\023-2002\0232002A043.dwg
Last Update: Feb 04, 2004 14:26 By:
Last Plot: Feb 04, 2004 17:04 By: jroberts
Machine: NOT SET



LEGEND

PROPOSED LIMITS OF BACKFILL QUARRY

PROJECT: BUCKHORN MOUNTAIN PROJECT
OKANOGAN, CO., WASHINGTON

TITLE: BACKFILL QUARRY SITE MAP

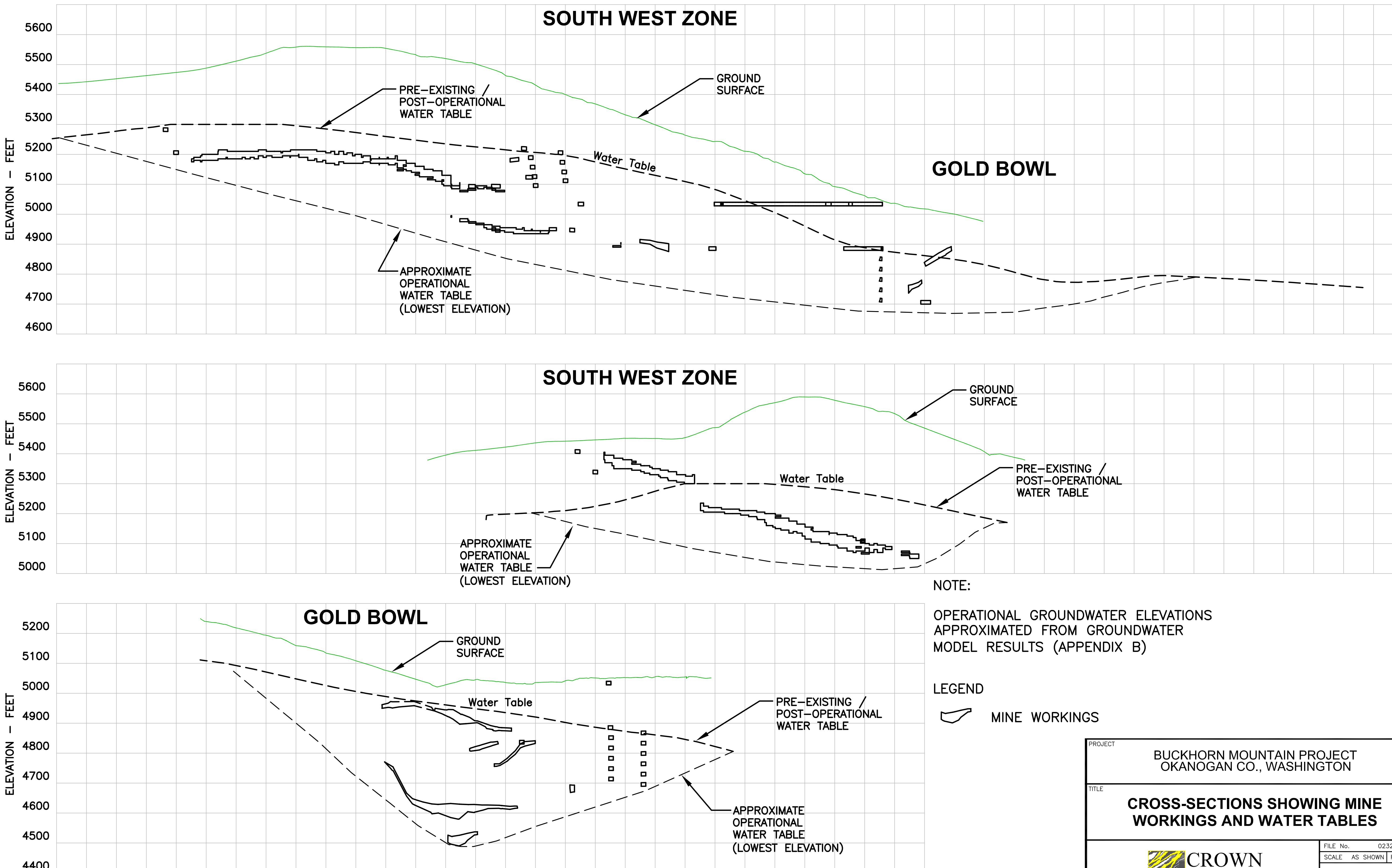
CROWN RESOURCES

023–2002

FILE No. 0232002A045

SCALE AS SHOWN | REV. B

FIGURE 7



NOTE:

OPERATIONAL GROUNDWATER ELEVATIONS APPROXIMATED FROM GROUNDWATER MODEL RESULTS (APPENDIX B)

LEGEND

MINE WORKINGS

PROJECT
BUCKHORN MOUNTAIN PROJECT
OKANOGAN CO., WASHINGTON

TITLE
CROSS-SECTIONS SHOWING MINE WORKINGS AND WATER TABLES

CROWN RESOURCES

FILE No.	0232002A031
SCALE AS SHOWN	REV. A

FIGURE 8

Dwg Name: N:\023-2002\0232002A031.dwg
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Last Plot: Feb 02, 2004 17:01 By: jroberts
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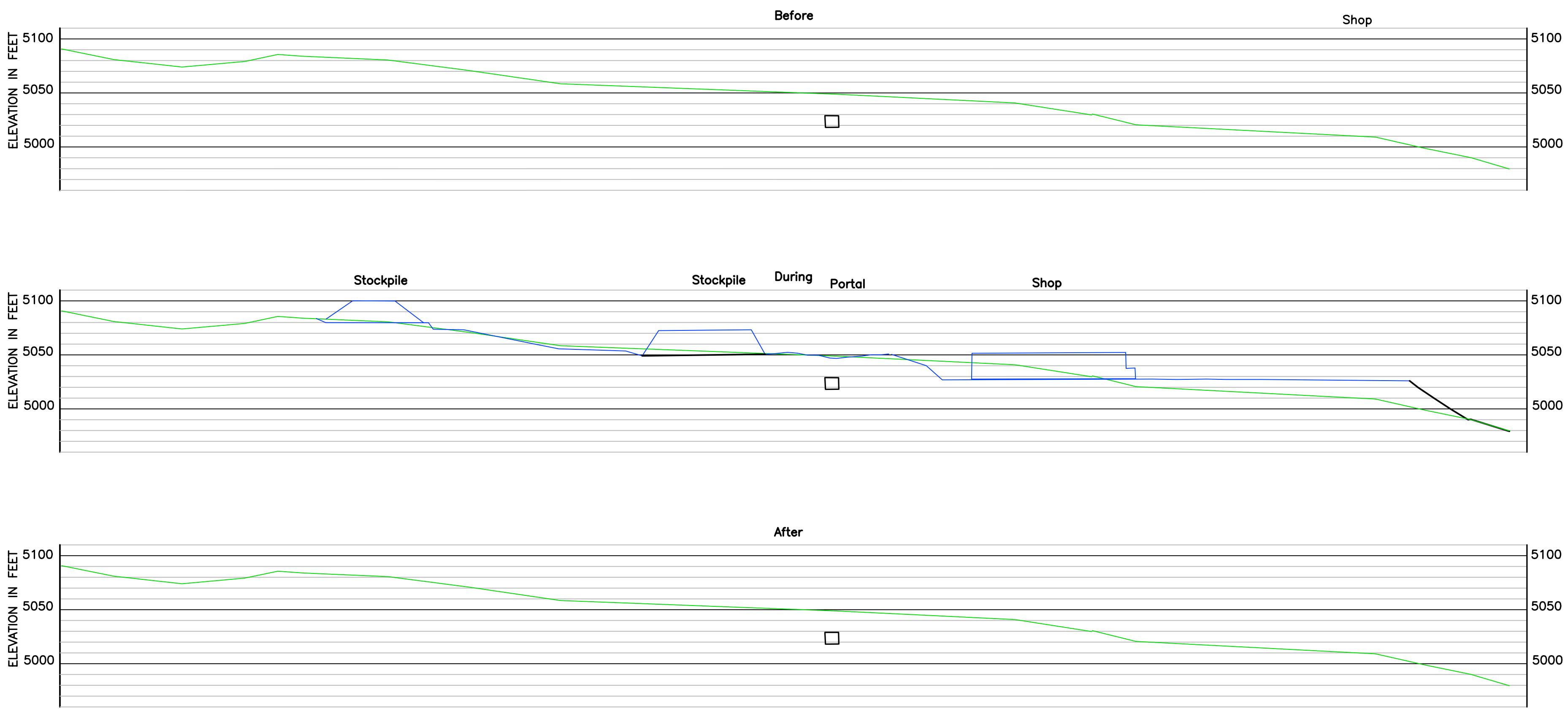
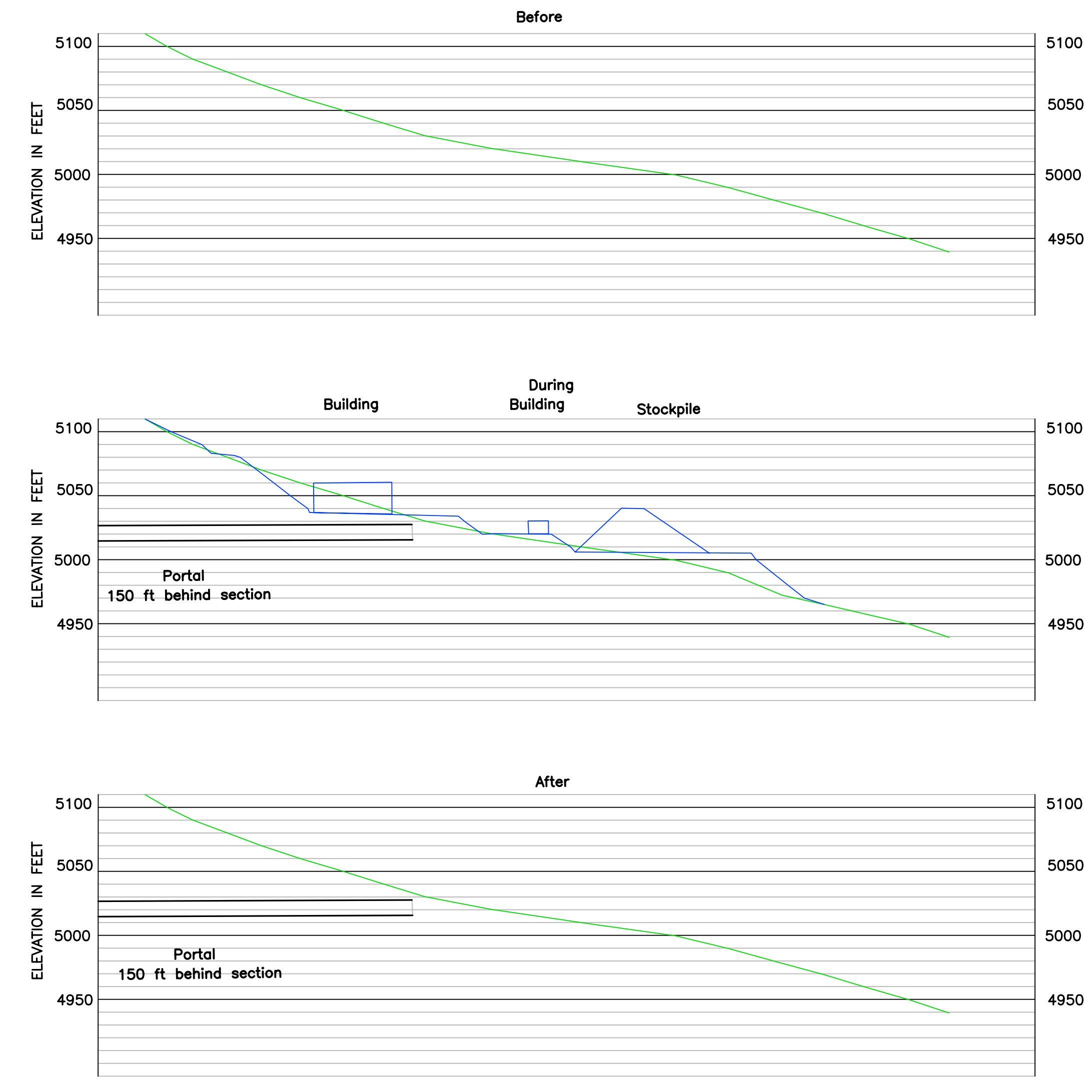
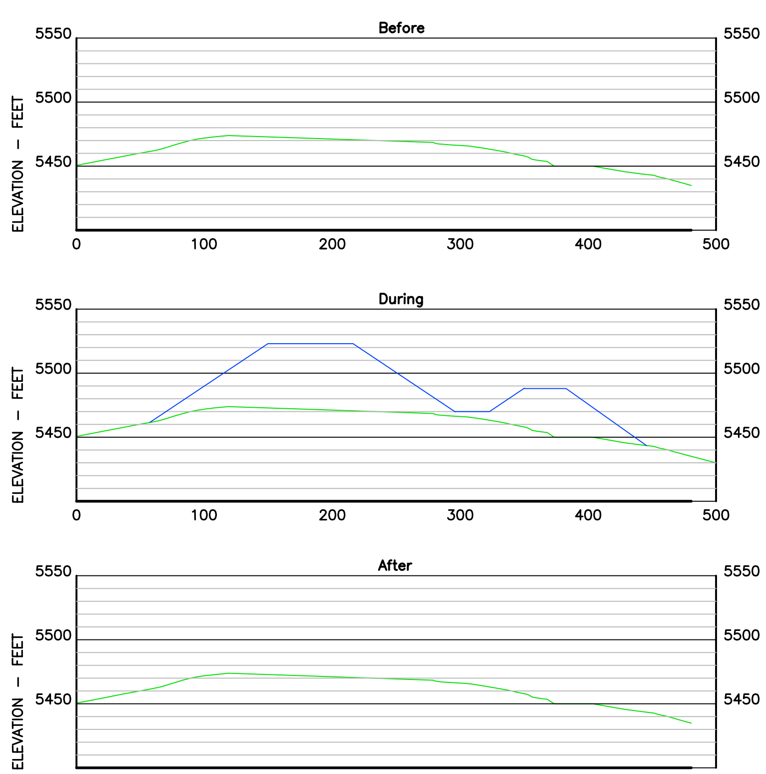


SURFACE SECTION 1
1/9



SURFACE SECTION 2
2/9



SURFACE SECTION 3
3/9

Dwg Name: N:\023-2002\0232002A032.dwg
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Last Plot: Feb 03, 2004 09:51 By: jroberts
Machine: NOT SET

PROJECT
BUCKHORN MOUNTAIN PROJECT
OKANOGAN CO., WASHINGTON

TITLE
MINE SITE CROSS-SECTIONS

CROWN RESOURCES

FILE No. 0232002A032
SCALE AS SHOWN REV. A

FIGURE 9

Dwg Name: N:\023-2002\0232002A037.dwg
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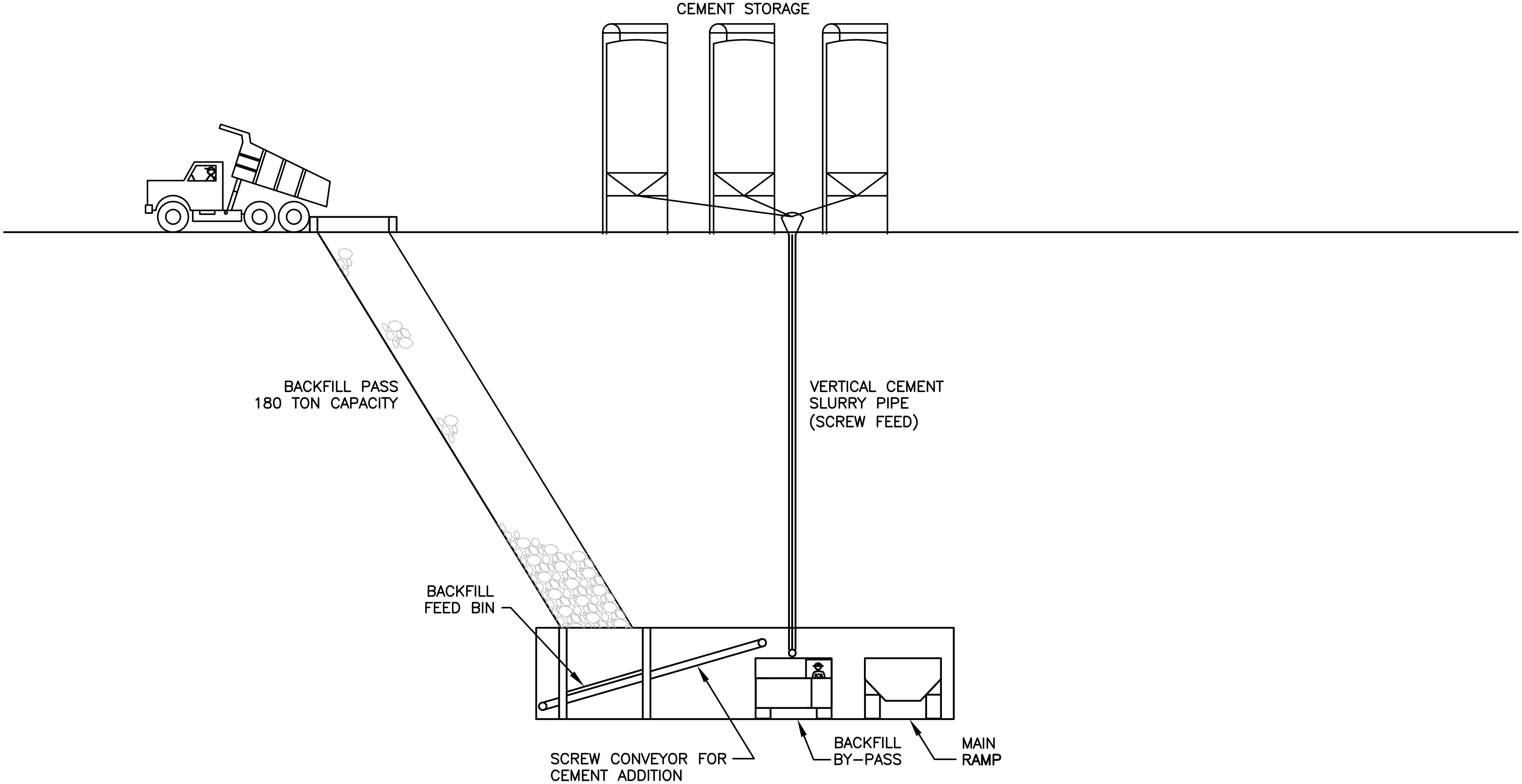
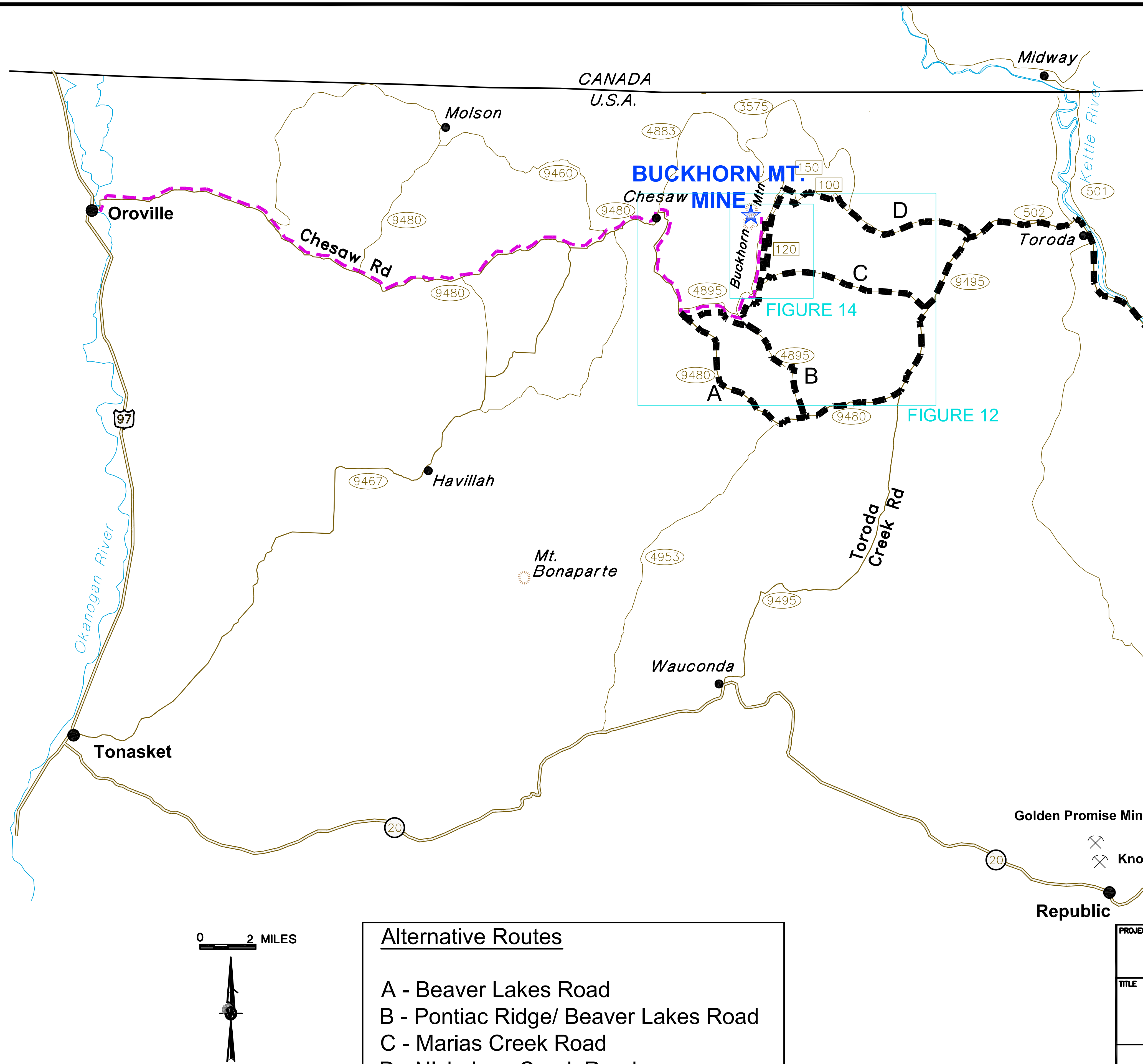
Last Plot: Feb 02, 2004 17:06 By: jroberts
Machine: NOT SET



PROJECT	BUCKHORN MOUNTAIN PROJECT OKANOGAN CO., WASHINGTON
TITLE	**UNDERGROUND BACKFILL FACILITY**
CROWN RESOURCES	FILE No. 0232002A037 SCALE AS SHOWN REV. B **FIGURE 10**



LEGEND

- ★ FACILITY LOCATION
- US HIGHWAY
- STATE HIGHWAY
- COUNTY ROAD
- USFS ROAD
- SUPPLY ROUTE
- HAUL ROUTE

Alternative Routes

A - Beaver Lakes Road
B - Pontiac Ridge/ Beaver Lakes Road
C - Marias Creek Road
D - Nicholson Creek Road

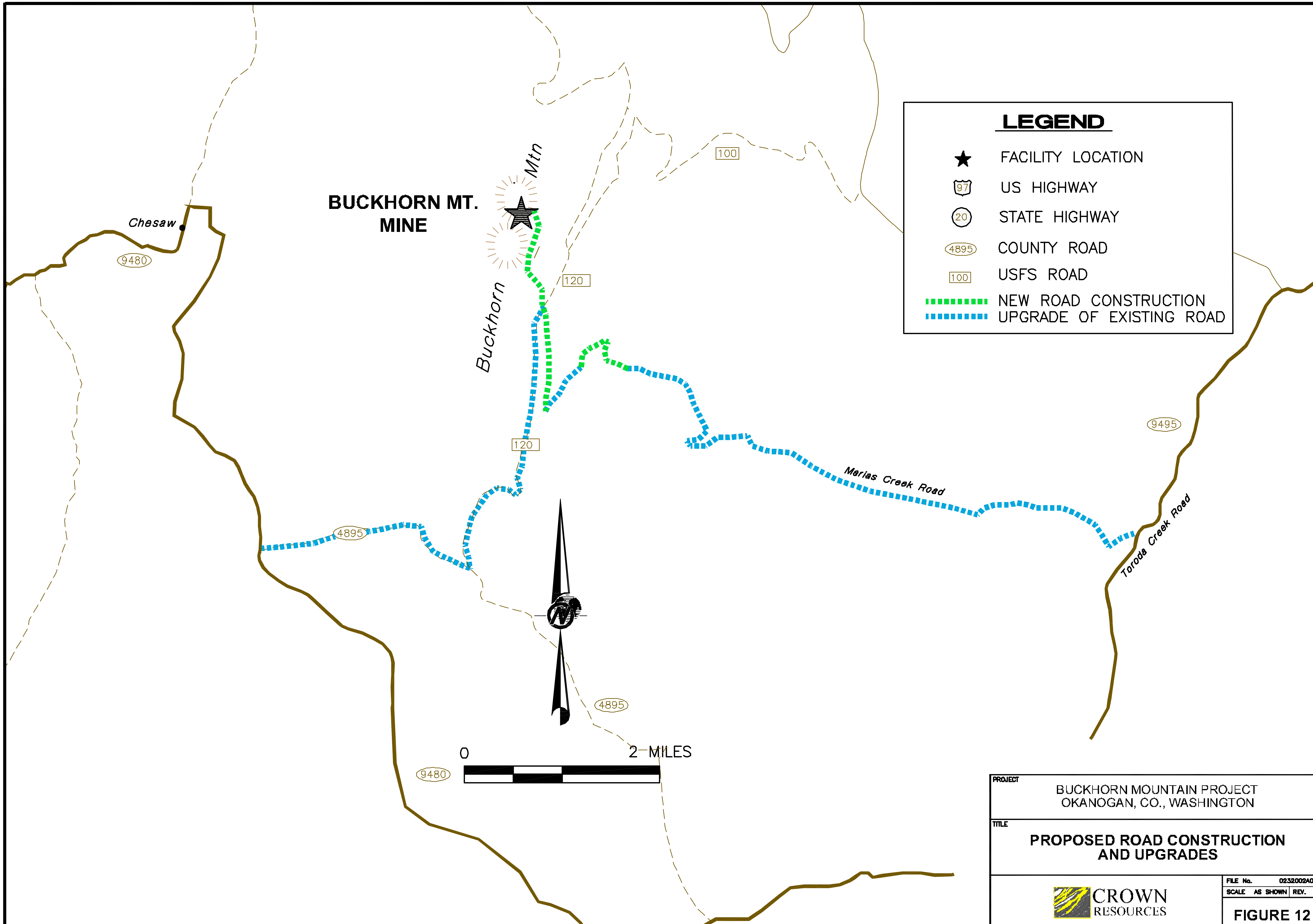
PROJECT: BUCKHORN MOUNTAIN PROJECT
OKANOGAN, CO., WASHINGTON

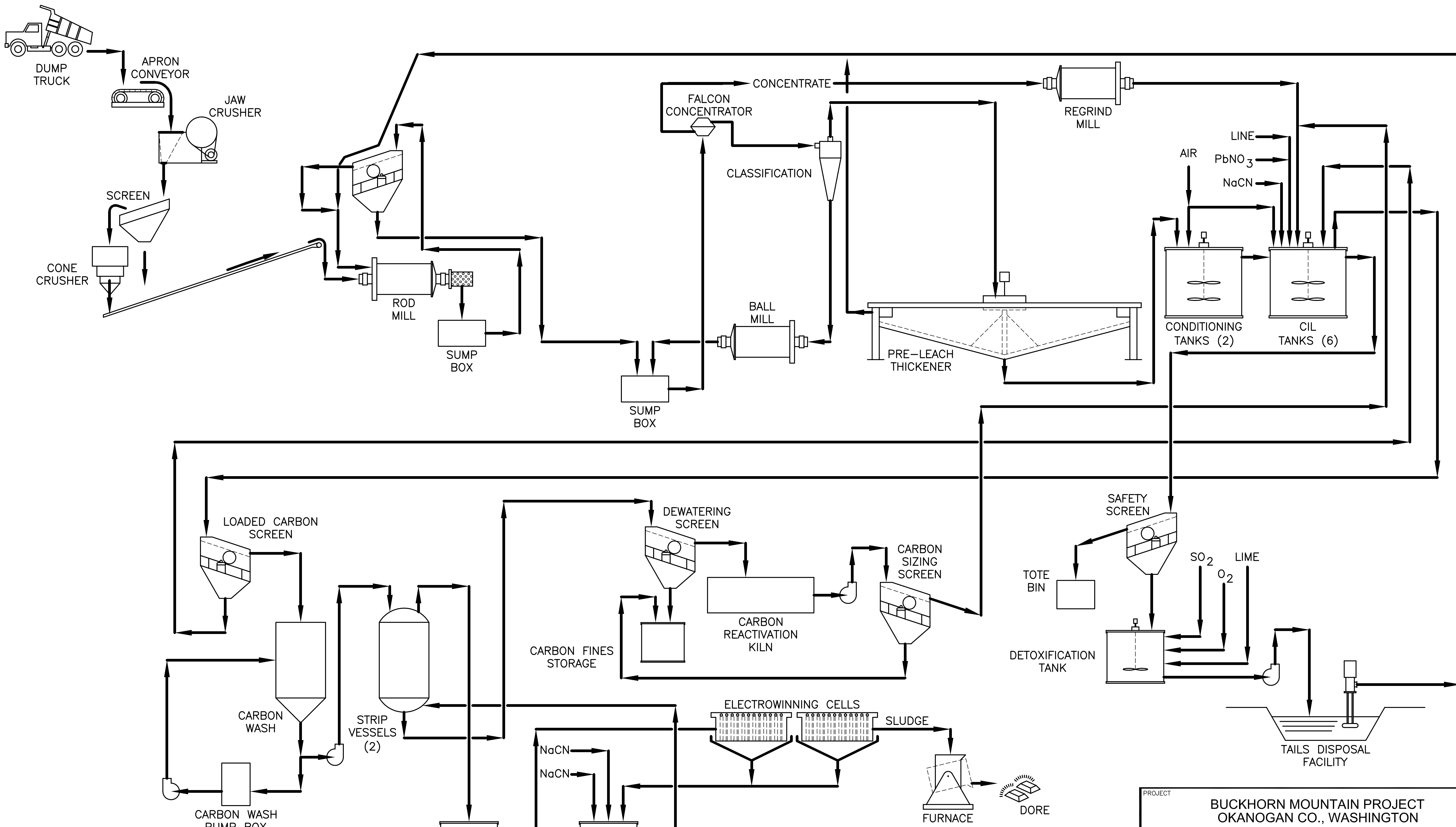
TITLE: **BUCKHORN MINE ACCESS AND HAUL ROUTE ALTERNATIVES**

CROWN RESOURCES

FILE No.	0232002A041
SCALE AS SHOWN	REV. B

FIGURE 11


BUCKHORN MT.
MINE
Buckhorn Mtn
Chesaw
9480
120
100
4895
9495
Marias Creek Road
Toroda Creek Road
0
2 MILES
LEGEND
FACILITY LOCATION
US HIGHWAY
STATE HIGHWAY
COUNTY ROAD
USFS ROAD
NEW ROAD CONSTRUCTION
UPGRADE OF EXISTING ROAD
PROJECT
BUCKHORN MOUNTAIN PROJECT
OKANOGAN, CO., WASHINGTON
TITLE
PROPOSED ROAD CONSTRUCTION
AND UPGRADES
CROWN
RESOURCES
FILE No. 0232002A046
SCALE AS SHOWN
REV. B
FIGURE 12



PROJECT

BUCKHORN MOUNTAIN PROJECT
OKANOGAN CO., WASHINGTON

TITLE

SIMPLIFIED MILL PROCESS FLOWSHEET

CROWN RESOURCES

FILE No. 0232002A038
SCALE AS SHOWN REV. A

FIGURE 13

Dwg Name: N:\023-2002\0232002A038.dwg
Last Update: Feb 02, 2004 16:45 By:
Last Plot: Feb 02, 2004 17:07 By: jroberts
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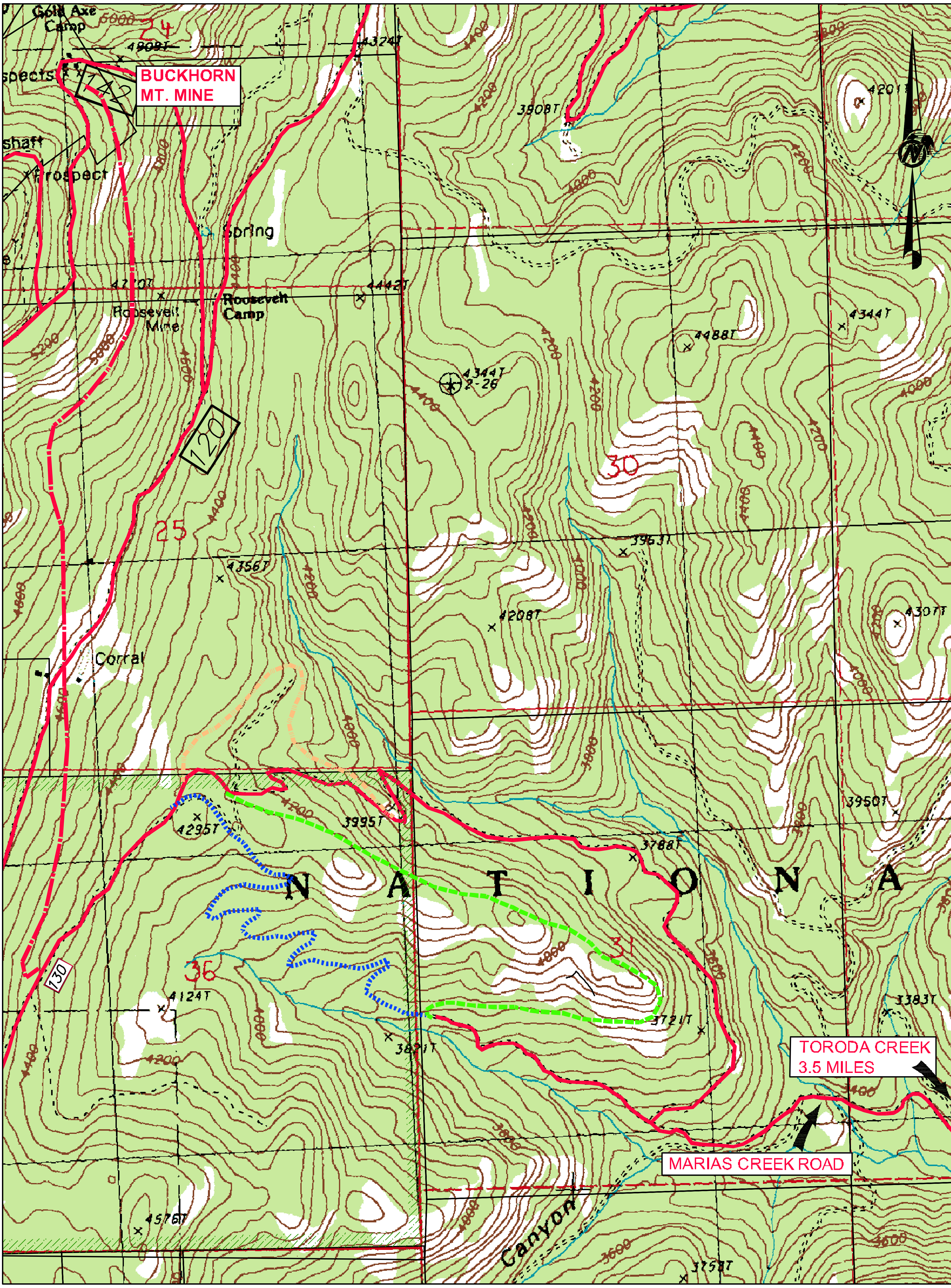

1000 0 1000 2000

1" = 1,000' Feet

LEGEND

- EXISTING GRAVEL OR PAVED ROAD
- 130 U.S.F.S. ROAD NUMBER
- BOUNDARY OF D.N.R. (STATE) LAND
- ALTERNATIVE ROUTE 1 (EXISTING ROAD)
- ALTERNATIVE 2 (NEW)
- ALTERNATIVE 3 (UPGRADE)
- ALTERNATIVE 4 (NEW)
- PLANNED CONSTRUCTION

PROJECT
BUCKHORN MOUNTAIN PROJECT
OKANOGAN, CO., WASHINGTON

TITLE
MARIAS CREEK ROAD ALTERNATIVES

CROWN RESOURCES

FILE No.	0232002A047		
SCALE	AS SHOWN	REV.	B

FIGURE 14