Draft Environmental Assessment

Tintina Alaska Exploration, Inc.
Black Butte Copper Project, Meagher County, MT
Exploration License #00710

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL MANAGEMENT BUREAU

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Glossary of Terms

country rock: rock surrounding the ore body

decline: a downward-sloping underground opening for access to the workings

drift: horizontal tunnel, excavation, or cut parallel to the ore body

ephemeral drainage: a gulch or coulee that contains flowing water only part of the year or only during “wet” years; sometimes referred to as an intermittent drainage

facies: a distinctive rock unit that forms under certain conditions of sedimentation, reflecting a particular process or environment.

gabbro: dark, coarse-grained, intrusive mafic igneous rock chemically equivalent to basalt

gossan: intensely oxidized, weathered or decomposed rock, usually the upper and exposed part of an ore deposit or mineral vein

homogeneous: alike, consistent composition or structure; properties do not change throughout the unit

hydraulic conductivity: a property of soil or rock that describes the ease with which water can move thorough pore spaces or fractures.

hydrophytic vegetation: plant-life that thrives in wet conditions; used as an indicator of wetlands

igneous: rocks that have crystallized from magma (previously melted rock);

igneous intrusion: rocks that were previously melted, then squeezed into and between (intruded) older rocks before crystallizing; the heat and fluids from an igneous intrusion can cause country rock to become metamorphosed

lithic scatters: archaeological sites that consist solely of flaked stone artifacts

lithology or **lithologies:** rock type or types

massive: thick units of homogeneous (alike; consistent) material

mil: one/thousandth of an inch

ore: rock that contains an amount of mineralization that is sufficient to be produced at a profit

oxidation: alteration of a rock by the addition of oxygen

oxide: mineral group that contains oxygen

potentiometric surface map: a map that indicates the distribution of groundwater heads and direction of groundwater flow; useful for describing the effects of pumping on an aquifer; indicates where ground water recharges (water enters the subsurface) and discharges (groundwater leaves the subsurface)

pyrite: an iron sulfide mineral that, when exposed to the atmosphere, may be capable of generating acid

pyrrhotite: an iron sulfide mineral with varying iron content that, when exposed to the atmosphere, may be capable of generating acid

transmissivity: a measure of how much water can be transmitted through an aquifer and is a function of aquifer thickness and hydraulic conductivity

sedimentary rock: rocks formed from fragments of other rock (sediment) that are transported, deposited, and lithified (compressed and cemented or formed into rock); can also be rock that precipitates from sea water

subsidence: settling or collapse of the ground surface

sulfide: mineral group that contains sulfur; may include pyrite, pyrrhotite, or other potentially acid-generating minerals

List of Acronyms

ac: Acre; a land measure currently based on the U.S. survey foot, one acre is approximately 43,560 square feet or 4,046.873 square meters.

cfs: cubic foot per second is an Imperial unit/U.S. customary unit volumetric flow rate, which is equivalent to a volume of 1 cubic foot flowing every second.

DEQ: Department of Environmental Quality

gpm: gallons per minute.

ICP-MS: a type of analytical technique which is capable of detecting metals and some non metals at concentrations as low as one part in in one trillion

LAD: Land application disposal; refers to disposal method for produced water.

Ma: Millions of years before present (as a point in time). The term for millions of years as a unit of measure is Myr.

mg/L: milligram per liter; approximately equal to parts per million (ppm).

MSHA: Mine Safety and Health Administration

NAG: non acid-generating

NP:AP ratio: balance between the acid consumption potential and the acid production potential of a rock

PAG: potentially acid-generating

ppb: parts per billion; approximately equal to micrograms per liter (µg/L)

SAP: Sampling and Analysis Plan

SC: Specific conductance; an electrical measure of the amount of dissolved substances in water

SHPO: State Historic Preservation Office

TCLP: a soil sample extraction method for chemical analysis to simulate leaching through a material for hazardous contaminants

TDS: Total dissolved solids; a measure of the amount of dissolved substances in water

TKN: Total Kjeldahl nitrogen; an analytical test that measures all forms of reduced nitrogen (ammonia, ammonium ion, and organic amines/amides including proteins) in waste water. The Kjeldahl method cannot measure nitrate or nitrite nitrogen.

µg/L: micrograms per liter; approximately equal to parts per billion (ppb)

1.0 INTRODUCTION

On November 7, 2012 Tintina Alaska Exploration, Inc. (Tintina) submitted an exploration license amendment proposal to expand exploration activities on its Black Butte Copper Project property (Project) located about 15 miles north of White Sulphur Springs (Figure 1). DEQ reviewed the exploration license amendment application and issued deficiency letters on January 4h, and March 15th , 2013. Tintina responded to the agency's comments and submitted an amended final application in April 2013.

The Project site is in Meagher County, and is located on the Bar Z Ranch and Hanson properties in sections 23, 24, 25, 26, 28, 32, 33, 34, 35, and 36,Township 12 North, Range 6 East; sections 19, 29, 30, and 32, Township 12 North, Range 7 East; sections 1, 2, 6, and 7, Township 11 North, Range 6 East; sections 1 and 12, Township 11 North, Range 5 East (project location) and encompasses a proposed surface disturbance area of 46.5 acres.

The purpose of the project is to expand exploration activities by constructing an exploration decline into the Johnny Lee copper-cobalt-silver deposit zones. It is intended that the decline would be used as access from which to conduct an underground development drilling program that would provide a more thorough understanding of the geometry and grade of the mineable resource. The decline would also provide access for the collection of a 10,000 ton bulk sample for metallurgical testing. In addition, the decline would allow for other technical investigations such as hydrologic/aquifer, water quality, geochemical characterization, and geotechnical studies to be conducted in support of future mine planning and to minimize water quality and quantity impacts.

While the scope of this environmental assessment (EA) is limited to the impacts of the installation of an exploration decline and the subsequent reclamation of that decline, the purpose of the decline is to determine potential for future mining of the Black Butte Copper Project property.

DEQ has jurisdiction to approve and regulate the Black Butte Copper Project under the Metal Mine Reclamation Act (MMRA) Title 82, Chapter 4, Part 3 of the Montana Code Annotated (MCA). As part of DEQ's review of the exploration license, an environmental review of the Proposed Action is required under the Montana Environmental Policy Act (MEPA) Title 75, Chapter 1, Part 2, MCA. This EA analyzes impacts of allowing the Black Butte Copper Project exploration decline as the Proposed Action.

Exploration activities at the Black Butte Copper Project have been previously approved under Exploration License #00710. DEQ currently holds a bond for the currently approved disturbances and would recalculate a required bond amount if the amendment is approved.

1.1 Purpose and Need of the Proposed Action

Tintina proposes to conduct underground exploration operations at the Black Butte Copper Project north of White Sulphur Springs in Meagher County (Figure 1). The Proposed Action would produce a bulk sample for metallurgical testing. The exploration decline would provide access to the underground ore zone for an underground definition drilling program. Tintina would collect information to predict the environmental consequences of mining the ore deposit in the event that Tintina decides to apply for an operating permit.

1.2 Authorizing Actions

DEQ is responsible for issuing exploration licenses and approving amendments under the MMRA. The exploration license application must contain an exploration plan of operations stating the type of exploration techniques that would be used in disturbing the land. It also must include a reclamation plan in sufficient detail to allow DEQ to determine compliance with MMRA reclamation and performance requirements.

DEQ is also responsible for protecting air quality under the Clean Air Act of Montana, and water quality and quantity under the Montana Water Quality Act. The options that DEQ has for decision-making upon completion of the EA are (1) denying the application if the proposed operation would violate MMRA, the Clean Air Act, or the Water Quality Act; (2) approving Tintina's application as submitted; (3) approving the application with agency mitigations; or (4) determining the need for further environmental analysis to disclose and analyze potentially significant environmental impacts.

DEQ is responsible for calculating the amount of performance bond for reclamation of the Black Butte Copper Project exploration proposal. The purpose of the bond is to ensure the fulfillment of obligations under the MMRA and rules implementing MMRA by ensuring the availability of funds sufficient to perform reclamation in the event of default by the operator. The posting of the performance bond payable to the State of Montana is a precondition to approval of an exploration license amendment. The amount of the bond is based upon the estimated cost to the State to ensure compliance with the Clean Air Act of Montana, the Montana Water Quality Act, and the MMRA (including the reclamation plan set forth in the exploration license).

If an exploration license amendment is approved by DEQ, then the Black Butte Copper Project would be subject to safety regulations enforced by the Mine Safety and Health Administration (MSHA). MSHA regulates human health and safety practices under the Federal Mine Safety and Health Act of 1977. The purpose of these standards is the protection of life, promotion of health and safety, and prevention of accidents. MSHA regulations are codified under 30 CFR sub-chapter N, part 56.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes the alternatives (potential actions) considered by DEQ including the No Action Alternative, the Proposed Action, and the Agency-Mitigated Alternative. The Proposed Action has been separated into two timeframes; the first is the installation of the decline, and the second is the closure of the decline and post closure activities. Table 1 shows the potentially impacted resources by facility under the alternatives.

Table 1. Potentially Affected Resources by Facility

Facility	No Action Alternative	Proposed Action	Proposed Action during closure and post closure	Agency-Mitigated Alternative	Resource Potentially Impacted
Exploration Decline	Not a component of the currently approved exploration license	Installation of a decline with conventional underground mining methods	Backfilling the decline with PAG[1] waste rock below the water table. NAG[2] waste rock would be reclaimed in place.	Water Treatment of groundwater infiltrating into the decline prior to discharge	Groundwater
Support Facilities	A core shed exists and would remain for landowner use	Building roads, buildings, portal pad, sediment control structures, powder magazine, etc.	Removal of all structures not used by landowner. Reclamation of all sites using salvaged soils and then revegetation.		Vegetation, Soils
Surface Disturbance	Access roads, drill roads, and drill pads. Total disturbance to date is about 5 acres	46.5 acres of disturbance including stockpiling soils for reclamation	Reclamation of all sites using salvaged soils and then revegetation		Vegetation and Soils
Waste Rock Storage	Not a component of the currently approved exploration license	NAG and lined PAG pads constructed for waste rock storage	Backfilling waste rock from the PAG waste rock pad and some NAG waste rock into the decline	NAG waste rock pad would be lined. Water Treatment and/or disposal to LAD[3] sites	Groundwater
Seepage Collection	Not a component of the currently approved exploration license	Lined NAG and PAG ponds.	Remove lined ponds; restore topography.	Water Treatment and/or disposal to LAD sites	Low pH water storage in PAG pond with potential discharge to Groundwater
Land Application Disposal	Not a component of the currently	Surface LAD; Subsurface	Surface LAD and Subsurface LAD until PAG	Water Treatment and/or	Groundwater

Facility	No Action Alternative	Proposed Action	Proposed Action during closure and post closure	Agency-Mitigated Alternative	Resource Potentially Impacted
Area	approved exploration license	LAD	is moved below water table.	disposal to LAD sites	

[1]PAG = potential acid-generating
[2]NAG = non-acid-generating
[3]LAD = land application disposal

2.1 Existing Conditions

Land uses in the Project area are predominantly agricultural, with hay and livestock production the primary activities. Outfitters use the Sheep Creek drainage for big game hunting and fishing.

2.1.1 Previous Exploration Disturbance

Homestake Mining explored the property in 1973 and 1974. Cominco American, Inc. (Cominco) conducted exploration in 1976. Cominco joint ventured with BHP from 1985 through 1988. After reclaiming exploration disturbances, Cominco dropped the leases in the mid-1990s. Approximately 66 exploration core holes were completed by Cominco and BHP.

Beginning in September 2010, Tintina drilled a total of 109 exploration holes on private land at this site and has hydraulically plugged and reclaimed 89 of them. Twenty holes remain and have been completed as piezometers, monitoring wells, or pumping wells. Disturbances include 14,320 feet of drill access roads and pads. Disturbances to date have totaled 5.1 acres of which 4.7 acres have been reclaimed. The reclamation includes stockpiling of soil, hydraulic plugging of drill holes in accordance with ARM 17.24.106 to prevent aquifer cross contamination, placement of cuttings and other drilling materials down the holes, recontouring of drill sumps, replacing soil, and revegetation. All temporary disturbances attributable to the project have been recontoured and revegetated in accordance with State requirements and seeded with a native seed mixture provided by DEQ.

Exploration drill hole abandonment/completion methods have been adopted by Tintina for all exploration drill holes to prevent cross-contamination of multiple or stacked groundwater aquifers. Exploration drill holes are plugged and abandoned from the bottom up by pumping each hole almost completely full of a bentonite grouting material containing high-swelling sodium montmorillonite clay. The upper 5-10 feet of each hole are filled with concrete. Surface well casing is either removed from the hole or cut off below ground level. If water is encountered in an exploration drill hole, a hydraulic packer is set above the point of water inflow and the remaining upper portion of the hole is filled with the grouting material and completed with a cement cap.

In addition, between September 2010 and December 2012 Tintina drilled a total of seven groundwater monitoring wells and four pumping wells on the property to determine groundwater levels, and to collect samples and aquifer characteristics. These wells were drilled and completed by a licensed water well driller in accordance with State regulations.

2.2 Proposed Action

Tintina proposes to construct an exploration decline into the Johnny Lee copper-cobalt-silver deposit. The decline would be used as access from which to conduct an underground development drilling program that would provide a more thorough understanding of the geometry and grade of the mineable resource. The decline would also provide access for collection of a 10,000 ton bulk sample for metallurgical testing. The decline would allow for other technical investigations such as hydrologic/aquifer, water quality, geochemical characterization, and geotechnical studies to be conducted in support of future mine planning. These studies would be used to evaluate impacts to surface water and groundwater in the event Tintina submits an application for an operating permit. In addition to underground exploration drilling and bulk ore sampling, Tintina expects that surface exploration drilling and hydrologic studies would continue during the proposed underground drilling phase of the exploration program. Major components of the Proposed Action are described below.

2.2.1 Exploration Decline

Tintina proposes to drive an 18-foot wide by 18-foot high 5,200-foot long exploration decline to a location near the bottom of the Upper Johnny Lee mineralized deposit. Underground drill stations would be cut, and infill development drilling would be conducted from these locations. The schedule for project construction is dependent on several factors, including drill and mining crew availability. Construction could start in 2013. Development of the decline would commence immediately after site preparation and surface facilities construction activities are completed. It is anticipated that site preparation, driving the drift, and definition drilling would take from 8 to 16 months to complete.

The proposed exploration decline would be located about 8,500 feet east-southeast of Black Butte and about 3,000 feet southwest of Strawberry Butte (Figure 2). The proposed decline would be collared at an elevation of about 5,880 feet. The decline would be divided into two segments. The first 3,200-foot long segment would trend north-northwest and decrease in elevation at a grade of about 15 percent for a 480-foot elevation change. The second segment would trend more northwest, at a near-constant elevation for about 1,800 feet.

Decline construction would use conventional mining methods including drilling, blasting, rock bolting, mucking (using a loader) and underground truck haulage of mine waste to the waste rock storage areas located at the surface. Diesel powered equipment would use low emission engines complying with MSHA underground air quality regulations. The decline would be rock bolted to provide basic ground support. Shotcrete and screen mesh would be used as necessary to assist with support in areas with more intense fracturing or poor ground conditions.

If pilot hole drilling indicates the potential for large inflows of water from water-bearing faults and/or fractures, pressure grouting techniques would be used to control the flow of water while advancing the face. Grouting of water-bearing faults and/or fractures is planned as a primary means of minimizing and controlling the amount of water flowing into the decline from that predicted by aquifer testing.

Pressure grouting involves injecting a grout material into fractured rock. The grout may be a cementitious or solution chemical mixture and could extend into the wallrock up to 100 feet depending on fracturing. The purpose of grouting can be either to strengthen rock or reduce water flow through rock and is a widely accepted and standard practice in the mining industry.

If large amounts of water were encountered in a pilot hole, a packer would be installed to seal the hole followed by directional grouting prior to advancing the decline. A packer is an expandable plug used to isolate sections in a well or borehole.

2.2.2 Support Facilities and Surface Disturbance Areas

Surface disturbances associated with the proposed exploration decline include: access roads, a portal patio containing various support facilities, an explosives magazine, waste rock storage pads, lined waste rock seepage collection ponds, surface and subsurface land application disposal areas (LADs), a water supply well and pipeline, a water storage tank, a septic/drainfield system, soil/subsoil stockpiles, and stormwater control structures and ponds (best management practices or BMPs) (Figure 3).

Support facilities on the portal patio include: an office, dry/change house, warehouse, shop/maintenance facility, construction laydown area, employee parking, fuel and lubricant storage, and power supply with on-site backup power generation and transformers (Figure 4).

2.2.3 Waste Rock Storage and Seepage Collection Support Facilities

Temporary waste rock storage facilities would be constructed for placement of development rock generated during construction of the exploration decline. Two waste rock storage facilities are proposed, one for potentially acid-generating waste (PAG) and another for non acid-generating waste (NAG). The combined facilities are designed to hold approximately 115,400 cubic yards (CY) (163,000 tonnes) of waste rock (Figure 5)

The PAG waste rock storage facility would be constructed on a composite compacted subgrade/geotextile bottom liner, with an internal waste rock seepage collection system. The NAG waste rock storage facility would use a compacted subgrade base with an internal seepage collection system and no geotextile liner. Seepage would be gravity fed to lined seepage collection/evaporation ponds (Figure 5). The PAG pond would have the capacity to store 1.9 million gallons of water, and the NAG pond would have a capacity of 4.1 million gallons.

All waste rock pad and seepage pond liners and associated HDPE piping would be installed by a subcontracted liner or piping specialty company. The development of a quality assurance/quality control (QA/QC) testing program, and all liner installation inspections and testing protocols would be completed by an independent third-party engineering company. After all the liners and piping are installed, the third-party engineering contractor would provide DEQ with a QA/QC liner/piping installation report to ensure proper installation of these critical components of the exploration decline plan.

Evaporation rates at the project site (34 inches per year) are approximately twice the precipitation rate (17 inches per year). Seepage from both facilities would either be treated prior to discharge or directly discharged into a surface or underground LAD system depending on the water quality and season of the year. Diversion structures would channel surface water run-on away from the waste rock facilities and into a dispersion structure.

2.2.4 Water Treatment

As the decline trends deeper (about 280 vertical feet below the surface and 2,900 feet from the portal entrance) it would penetrate the ore body and encounter much lower permeability bedrock. Aquifer test results indicate bedrock hydraulic conductivity at this depth interval is approximately 0.015 ft/day. Calculated inflow to this lower section of the decline is about 10 to 12 gpm. The major ion chemistry of the water at the lower portion of the decline is similar to that of the shallow groundwater system, but there are several metals present at higher concentrations including arsenic, strontium, thallium and zinc, as shown in the deep aquifer water quality test data presented below in Section 3.2.3. The arsenic concentration of 0.067 mg/L exceeds the human health standard of 0.010 mg/L and the strontium concentration of 9.3 mg/L exceeds the human health standard of 4 mg/L. All of the remaining parameters meet applicable regulatory limits with most metals present at concentrations below detection limits including cadmium, chromium, copper, mercury, nickel, selenium, silver, and thallium.

Water treatment may be required for nitrogen and arsenic if grouting, mixing and dilution, and LAD are not sufficient to protect groundwater. Treatments being considered for decline water and for PAG waste rock seepage include lime treatment and co-precipitation of arsenic with iron, reverse osmosis (RO) with thermal evaporation of brine for off-site disposal, sulfide precipitation, ceramic microfiltration, and zero discharge strategies.

The contaminated water would be managed/stored/recirculated as follows until appropriate treatment systems are operational:

a. **<u>Dilution.</u>** Dilute 10-12 gpm of potentially arsenic contaminated water from the sulfide zone with up to 100 gpm of groundwater from the upper bedrock aquifer so that the mixed stream meets groundwater standards and can be discharged to an underground LAD system.

b. **<u>Seepage Collection Pond Storage.</u>** There would be storage capacity available in the seepage collection ponds during decline construction. The schedule for the exploration amendment would take up to 16 months to complete the decline, collect a bulk sample of the ore, and conduct the required underground development drilling.

   The first 1,700 lineal feet (36 percent) of decline development work is expected to be dry. The first15 feet of materials placed on the NAG waste rock pad (36 percent of the total volume, 35,000 tons) are likely to be dry. There would be no PAG waste rock generated in the first 1,700 lineal feet of the decline. All of the NAG waste rock (85,000 cubic yards, 42 feet deep) and PAG waste rock (30,000 cubic yards, 23 feet deep) would be loaded on the pads within 16 months. At the end of 16 months, there would no longer be any need to continue to dewater that decline, and the decline would not need to be used again unless Tintina applied for and received an operating permit. Therefore, decline dewatering could stop.

   There are 17 inches of annual precipitation and 34 inches of annual evaporation at the site. Tintina claims it would not be possible to saturate either of the waste rock piles during the short period of decline construction and operation or that a large volume of seepage would develop during this time period. A large portion of the seepage collection pond volumes should be available for storage during this period of time. Tintina assumes that there would be 5 million gallons of remaining storage capacity available in the two seepage collection ponds, providing about 35 days of storage.

c. **Recirculation.** Contaminated water can also be recirculated from the upper to lower sumps in the mine. This pumping can provide storage for a few days of inflow at 100 gpm.

d. **Mine Flooding.** The pumps in the underground workings can be shut off and the decline allowed to flood. Flooding of the decline would eventually reach the level of the water table but would never discharge from the decline.

A portable trailer-mounted reverse osmosis (RO) treatment system would be used to treat decline water if necessary. RO is capable of extracting nitrogen compounds and arsenic. RO can also effectively remove selenium, thallium, and strontium, the other possible contaminants. Trailer-mounted RO systems are capable of handling 100 to 200 gpm and multiple units can be operated in parallel to handle higher flow volumes. RO would meet groundwater quality standards for discharge to the underground LAD systems. RO treatment creates a brine that is about 6 to 7 times more concentrated and about 10 to 15 percent or less of the total volume treated, assuming 85 to 90 percent efficiency levels. At 100 gpm, the RO unit could generate as much as 20,000 gallons per day of brine. Brine water would be driven off by thermal evaporation and the remaining salts disposed off-site in an approved facility.

Tintina proposes to use an adsorptive medium removal system if necessary to treat the brine. The adsorptive medium would likely be a hydrous iron-oxide or alternatively a granular iron-oxide/titanium-oxide medium for the removal of arsenic. Various adsorptive media are available for the removal of multiple and/or selective constituents. Adsorption media when spent typically fall well below the threshold for a hazardous waste, but spent media would be toxicity characteristic leaching procedure (TCLP) tested prior to landfill disposal. A skid-mounted bag filtration system consisting of 25 Micron and 5 Micron prefilters would also be included as part of the brine treatment system. These filters provide prefiltration of solids and adsorbed metals prior to the adsorptive medium tanks to prevent premature fouling of the media.

Both the RO and absorptive medium treatment systems are readily available from commercial vendors and are capable of meeting discharge standards. RO systems are generally available for lease or purchase to be moved onto a site and operational within six weeks.

Tintina may modify the proposed treatment methodologies if other technologies appear to be more applicable based on actual water quality conditions. Treatment will also be implemented if necessary for NAG and PAG seepage collection water.

2.2.5 Land Application Disposal Areas

Surface and underground (infiltration) LADs are proposed for the disposal of decline inflow, NAG and PAG waste rock seepage, and storm water. Disposal of any decline water to surface LAD areas would occur via a surface drip emitter discharge system or traditional impact-type irrigation systems (e.g., Rain Bird ® brand). A major component of surface water disposal is through evapotranspiration, particularly during the spring, summer, and early fall seasons when vegetation growth and evaporation rates are high. Use of surface LAD systems would be most effective during initial dewatering when large volumes of water need to be disposed of, as opposed to smaller sustained decline-inflows later in the exploration program.

Because water needs to be disposed of on a year-round basis, large area underground drain field systems would be constructed to dispose of water below the frost level during winter months, returning water to the near surface colluvial and/or shallow fractured bedrock system. Tintina has conducted shallow and deep percolation testing to identify areas suitable for drain field disposal scenarios (Section 4.2.3.2).

Within these areas, Tintina would discharge to two surface and one underground LAD systems that have excess capacity for handling anticipated decline water. Tintina has applied for an underground injection control (UIC) permit from the Environmental Protection Agency (EPA). The EPA would determine if a UIC permit is required.

2.2.6 Monitoring and Mitigation Plans

Monitoring is necessary to verify potential environmental impacts that may result operationally and after closure from the proposed exploration decline activities. Monitoring during active exploration activities would be required in order to identify whether these activities are impacting the environment thereby necessitating operational changes and/or mitigation measures. Mitigation plans or procedures are designed to minimize or reduce possible or observed impacts to resources.

2.2.6.1 Dust Control and Air Monitoring

Tintina would implement dust control measures on high traffic areas along access roads that can create dust. Waste rock stockpiles would be watered to minimize dust while loading or unloading material. Monitoring by site personnel during each shift would minimize the effects of dust at the site.

The ambient air monitoring station west of the core shed would remain operational during the period of exploration decline construction and evaluation. The station was established to accurately characterize the local meteorology and collect baseline data.

An Air Quality Permit may not be required for the construction and operations of the Project's exploration decline. Detailed information for all emissions sources would be compiled for submittal to DEQ.

2.2.6.2 Surface and Groundwater Monitoring

Tintina continues to monitor water resources for the proposed exploration decline under the existing water monitoring plan (Table 2). Eleven surface water stations have been established as baseline monitoring sites (Figure 6). Flow, stage, and field parameters (temperature, pH, and specific conductance [SC]) are monitored quarterly at these sites. Water quality samples are collected quarterly at six of the surface water stations and seven groundwater monitoring wells. Thirteen seeps and springs are monitored annually.

Table 2. Proposed and Agency-Mitigated Water Monitoring Plans

Surface Water			
Site:	Parameter suite* (F, L,WL)	Monitoring Frequency	Agency-Mitigated
SW-1	F, L	quarterly	
SW-2	F, L	quarterly	
SW-3	F, L	quarterly	
SW-4	F	quarterly	
SW-5	F, L	quarterly	
SW-6	F, L	quarterly	monthly
SW-7	F	quarterly	
SW-8	F	quarterly	
SW-9	F	quarterly	
SW-10	F	quarterly	
SW-11	F, L	quarterly	
Springs, Seeps, Gossan			
SP-1	F, L	annually	Flow monthly
SP-2	F, L	annually	Flow monthly
SP-3	F, L	annually	Flow monthly
SP-4	F, L	annually	Flow monthly
SP-5	F	annually	
SP-6	F, L	annually	Flow monthly
SP-7	F	annually	
DS-1	F	annually	
DS-2	F, L	annually	
DS-3	F	annually	Flow monthly
DS-4	F, L	annually	Flow monthly
DS-5	F	annually	
DS-6	F	annually	
G-1	F	annually	
G-2	F	annually	
Groundwater – monitoring wells			
MW-1A	WL, F, L,	quarterly	WL monthly
MW-1B	WL, F, L	quarterly	WL monthly
MW-2A	WL, F, L	quarterly	WL monthly
MW-2B	WL, F, L	quarterly	WL monthly
MW-3	WL, F, L	quarterly	WL monthly
MW-4A	WL, F, L	quarterly	WL monthly
MW-4B	WL, F, L	quarterly	WL monthly
MW-5A (proposed)	WL, F, L	quarterly	
MW-5B (proposed)	WL, F, L	quarterly	
MW-6 (agency proposed)			WL, F, L quarterly
MW-7 (agency proposed)			WL, F, L quarterly
MW-8 (agency proposed)			WL, F,L quarterly
Groundwater Pumping or Observation wells – Hydrologic testing			

PW-1 (pumping well)	Not currently sampling		F, L quarterly; WL monthly
PW-2 (pumping well)	Not currently sampling		F, L quarterly; WL monthly
PW-3 (pumping well)	Not currently sampling		F, L quarterly; WL monthly
PW-4 (pumping well)	Not currently sampling		F, L quarterly; WL monthly
SC11-032 (Observation)	Not currently sampling		WL monthly
SC11- 09 (Observation)	Not currently sampling		WL monthly
SC11-031 (Observation)	Not currently sampling		WL monthly
SC12-116 (Observation)	Not currently sampling		WL monthly
Groundwater - Piezometers			
PZ-1	WL	quarterly	
PZ-2	WL	quarterly	
PZ-3	WL	quarterly	
PZ-4	WL	quarterly	
PZ-5	WL	quarterly	
PZ-6	WL		Replaced by MW-6
PZ-7	WL		Replaced by MW-7
UG LAD piezometers (8 total)	WL +/- L	Weekly water levels (initially)	
Surface LAD piezometers (3)	WL	Weekly water levels (initially when in use)	
Mine Water			
Decline Water	F, L	Monthly (quarterly eventually)	
NAG pond water	F, L	Monthly (quarterly eventually)	
PAG pond water	F, L	Monthly (quarterly eventually)	
Discharge to LAD			F, L weekly

Table 2: Proposed and Agency-Mitigated Water Monitoring Plans
*Parameter Suites:
F = field parameters (stream flow or stage, water temperature, dissolved oxygen, pH, SC)
L = Laboratory Analyses (See Table 3-1)
WL = water level

The parameter list, detection limits and analytical methods are included in Table 3. Monitoring would continue through development of the exploration decline and evaluation of the mineral deposits from underground including any temporary closure intervals.

Table 3. Parameters, Methods, and Detection Limits for Baseline Environmental Assessment

Parameter	Analytical Method[1]	Required Detection Limit(mg/L)
Physical Parameters		
Total Dissolved Solids (TDS)	SM 2540C	10
Common Ions		
Alkalinity	SM 2320B	4
Sulfate	300.0	1
Chloride	300.0/SM 4500CL-B	1
Fluoride	A4500-F C	0.1
Calcium	215.1/200.7	1
Magnesium	242.1/200.7	1
Sodium	273.1/200.7	1
Potassium	258.1/200.7	1
Nutrients		
Nitrate+nitrite as Nitrogen (N)	353.2	0.01
Trace Constituents (SW - Total Recoverable except Aluminum [Dissolved], GW - Dissolved)[2, 3]		
Aluminum (Al)	200.7/200.8	0.03
Antimony (Sb)	200.7/200.8	0.003
Arsenic (As)	200.8/SM 3114B	0.003
Barium (Ba)	200.7/200.8	0.005
Beryllium (Be)	200.7/200.8	0.001
Cadmium (Cd)	200.7/200.8	0.00008
Chromium (Cr)	200.7/200.8	0.001
Cobalt (Co)	200.7/200.8	0.01
Copper (Cu)	200.7/200.8	0.001
Iron (Fe)	200.7/200.8	0.03
Lead (Pb)	200.7/200.8	0.0005
Manganese (Mn)	200.7/200.8	0.005
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.00001
Molybdenum (Mo)	200.7/200.8	0.005
Nickel (Ni)	200.7/200.8	0.01
Selenium (Se)	200.7/200.8/SM 3114B	0.001
Silver (Ag)	200.7/200.8	0.0005
Strontium (Sr)	200.7/200.8	0.1
Thallium (Tl)	200.7/200.8	0.0002
Uranium (U)	200.7/200.8	0.0003
Zinc (Zn)	200.7/200.8	0.01
Field Parameters		
Stream Flow	HF-SOP-37/-44/-46	NA
Water Temperature	HF-SOP-20	0.1 °C
Dissolved Oxygen (DO)	HF-SOP-22	0.1 mg/L
pH	HF-SOP-20	0.1 s.u.
Specific Conductance (SC)	HF-SOP-79	1 µmhos/cm

[1] Analytical methods are from *Standard Methods for the Examination of Water and Wastewater* (SM) or EPA's *Methods for Chemical Analysis of Water and Waste* (1983).
[2] Samples analyzed for dissolved constituents field-filtered through a 0.45 µm filter.
[3] Samples collected after October 2012 will use updated DEQ-7 required reporting values (DEQ 2012a).

Tintina would initially monitor water quality monthly for the decline water, seepage from the waste rock pads, and seepage collection ponds. The frequency of sampling may be adjusted depending on results. Daily records of LAD discharge volumes and locations would be maintained. Three piezometers would be installed in the two surface LAD areas and eight in the underground LAD cells. In addition to collecting baseline water level data, piezometers would be monitored weekly for measurement of saturation levels within individual LAD cells. Weekly monitoring would continue until trends are established that may suggest a change in the required frequency of sampling. Tintina would complete the piezometers with well head protection and collect samples for water quality from at least five of the piezometers on a quarterly basis. A greater frequency of sampling would be conducted if deemed necessary by DEQ.

Samples would be analyzed for the groundwater suite (Table 3). In addition, two new piezometers would be installed in seeps located downgradient of the underground LAD areas. Tintina believes the proposed underground LAD system would have a four-fold capacity to accommodate the maximum estimated 500-gpm flow from the underground workings. Flows could be reduced to 100-gpm by an aggressive underground grouting program. A pair of downgradient wells would be monitored for potential impacts to shallow alluvial or deeper bedrock groundwater. Weekly inspections would be conducted to document potential saturation of soils and prevent surface ponding or downslope seepage.

Results of monitoring during exploration would be used to select monitoring sites, analytical parameters, and frequency of monitoring during the post-exploration period with DEQ approval.

2.2.6.3 Ore and Waste Rock Testing

Acid drainage results when acid-forming minerals such as pyrite react with oxygen and water to generate more acid than the other minerals in the rock can neutralize.

Static Test

Static testing methods were used to evaluate both acid generation and metal release potential. Static testing, which refers to analysis at a fixed point in time, differs from kinetic testing which measures changes in oxidation and solute release over time. The Acid Base Accounting (ABA) and Net Acid Generation (NAG) pH methods were used to evaluate potential for acid generation. Multi-element tests of rock composition using inductively coupled plasma mass spectrometry (ICP-MS) were used to evaluate whole rock metal content. The EPA method 1312 Synthetic Precipitation Leach Procedure (SPLP) was used to evaluate potential metal mobility.

Kinetic Test

Kinetic testing is used to supplement static testing of ore and waste rock. The most common form of kinetic testing uses a humidity cell. Humidity cell tests are designed to mimic weathering at the laboratory scale in a controlled fashion. The test determines the rate of acid generation, the variation over time in leachate water quality and thus allows development of mitigating strategies.

The standard humidity cell test is conducted at the bench scale. The sample is subjected to alternating cycles of dry and moist air to simulate precipitation cycles. The sample is soaked for a specific length of time with deionized water. The water percolates through the sample and is then collected. This leachate is analyzed for a number of parameters including pH, sulfate, acidity, alkalinity, conductivity and metals (including Ca and Mg).

Humidity cells test results are reviewed monthly to check progress and determine if extended leaching is required. Tests typically run from 16 to 24 weeks. As the acid rock drainage generating and neutralizing minerals leach away, the mineralogy of the leach sample will change.

Acid Base Accounting Test

The determination of sulfur content is necessary to classify ore for metallurgical processing. Sulfur content is used to classify waste materials from the mining and processing of ore such as leach residues, waste rock, and tailings according to their potential to generate acid in the environment. This information is useful during mine development to assist in mining and mineral processing operations and for proper disposal of waste materials. These test methods are also used to speciate carbon and sulfur contents of metal-bearing ore and related materials so that acid-base accounting can be performed. Tintina determined sulfur content using a LECO sulfur analyzer.

Sulfide minerals in waste rock, particularly pyrite, react with water and oxygen to produce sulfuric acid (H_2SO_4), which can be neutralized by minerals capable of consuming acid, such as calcite. The ABA test measures the relative acid production and neutralization properties of a mine waste material based on the conservative assumption that all sulfide present in a rock will oxidize, releasing acidity. The acid base accounting test quantifies the acid production potential (AP) and neutralization potential (NP) of a sample in units of tons $CaCO_3$ / kiloton of rock (Sobek et al. 1978), allowing calculation of the net neutralization potential (NNP) as NP less AP and the neutralization potential ratio (NPR) as NP divided by AP (INAP, 2012). The ABA test uses a relatively complete digestion of finely ground rock, and therefore conservatively estimates the reactivity of available sulfide minerals.

To determine neutralization potential, a sample is treated with excess standardized hydrochloric acid (HCl) at ambient temperatures for 24 hours. The remaining acid is titrated with a standardized base to pH of 8.3 after the test is complete to allow the calculation of calcium carbonate equivalent for acid consumed. This study used the modified Sobek method of ABA analysis, which uses a fizz test to adjust the amount of acid used in alkalinity titration.

Review of the sulfur-bearing minerals in Table 1-1 indicates that both sulfide and sulfate minerals occur within the Black Butte Copper deposit. Sulfur was therefore fractionated to identify the sulfide, acid soluble and insoluble sulfate, and residual sulfur fractions. Total sulfur was determined by LECO S, and total sulfate sulfur was measured by analysis of the carbonate soluble sulfur fraction. Sulfide was then calculated by subtracting total sulfate from total sulfur. Acid insoluble sulfate was calculated by subtracting the HCl-soluble sulfate from the total sulfate. Barium determined by x-ray diffraction was used to calculate the amount of barite present. Potential acidity (AP) was calculated based on sulfide sulfur for this study.

The NNP and NPR are used by regulatory agencies to assess acid generation potential of rock samples based on the criteria shown in Table 4-1. Samples falling in the “uncertain” category require kinetic testing using humidity cells to evaluate whether they would generate acidic leachate over an extended period of weathering.

Table 4-2. Criteria for Classifying Acid Generation Potential of Rock Samples

Classification	ABA Criteria[1]	NAG Criteria[2]
Potentially Acid-Generating	NP:AP < 1 and NNP < -20 tons/kton	Final NAG pH < 4.5
Uncertain Acid Generation Potential	NP:AP between 1 and 3 and/or NNP between -20 and +20 tons/kton	
Unlikely to Generate Acid	NP:AP > 3 and NNP > +20 tons/kton	Final NAG pH > 4.5

[1] *From BLM (1996) and USEPA (1994).*
[2] *INAP (2012) GARD Guide*

Results of the baseline geochemistry study for the 2012 decline suggest that 70 to 80 percent of the 135,000 tonnes of rock to be removed during construction would be non acid-generating with a low potential to release metals. The rock from the decline would be selectively handled and placed into waste rock facilities based on NAG and PAG designations.

Initial geochemical testing indicated four rock units (two sulfide zones, igneous intrusives, and minor potentially acid-generating portions of the Lower Newland Formation [*Ynl*]) would be acid-generating and should be handled as PAG (Tintina 2013). One *Ynl* sample in the original testing was potentially acid producing. Because of this outlier Tintina analyzed 20 additional *Ynl* samples. Review of these results, and comparison of the findings with recent revisions of the stratigraphic model for the geologic contact between the Upper Sulfide Zone (*USZ*) and the *Ynl*, resulted in the reclassification of two of the samples, which were originally designated as *Ynl*, to the *USZ*. This revised stratigraphic model has subtly altered the original conclusions of the baseline study, which had indicated that a small portion of the *Ynl* waste rock, like the *USZ*, had potential to be acid generating. The results presented here indicate that the *Ynl* is unlikely to be acid generating (Enviromin, Inc. 2013a).

Net Acid Generation pH Test
The net acid generation pH (NAG pH) test is designed to avoid the potential bias built into the assumptions that the ABA method relies on. The ABA method assumes that all sulfides generate acid and that carbonate is the only acid-neutralizing agent in rock. Neither of these assumptions is strictly true. In the NAG pH test, a sample of rock is ground and oxidized with hydrogen peroxide. The resulting pH indicates whether the rock is potentially acid-generating or not. A pH value less than 4.5 indicates that the rock is potentially acid-generating. (INAP, 2012)

Geochemical analyses suggest that a final NAG pH greater than 4.5 and/or a NP:AP ratio above 3 would indicate non acid-generating (NAG) material and would distinguish NAG from potentially acid-generating (PAG) material for selective handling purposes.

Additional sampling and analyses would be conducted prior to and during the decline construction and exploration program. Baseline results to date are based on limited analysis of a small number of drill samples and would be validated through analysis of an additional 20 samples of Lower Newland Formation (*Ynl)* using ABA and NAG pH methods prior to initiation of work in the exploration decline. Kinetic testing of the lithologies that could release metals or acidity is ongoing to confirm the results of the static testing.

During installation of the decline geochemical sampling and analysis would be conducted to confirm the NAG classifications of lithotypes based on drill samples. This sampling would guide placement of waste rock during decline development and guide the overall geochemical baseline study for a potential future mining operation. The selective handling criteria in Table 4 were developed to identify waste rock to be placed on the unlined NAG facility and to provide information for future geochemical studies for the potential future mining operation. The waste rock characterization and management program has three levels of additional analyses during the exploration decline program:

Table 4. Selective Handling Criteria Black Butte Copper 2012 Johnny Lee Decline

Lithotype*	% tonnage	Designation	Criteria	Justification	Add. Data[1]
Ynl 0 (Lower Newland Unit 0)	6	NAG	lithology	NAG pH > 4.5, NP:AP > 3, low metals	Confirmation sampling
Ynl B (Lower Newland Unit B)	26	NAG	lithology	NAG pH > 4.5, NP:AP > 3, low metals	Confirmation sampling
Ynl (Lower Newland Formation)	41	NAG	Operational NAG > 4.5	NAG pH > 4.5, NP:AP > 3, low metals	Mapping, static analyses, kinetics
Ynl sulfide[3] *(Lower Newland sulfide)*	Unknown % of *Ynl*	NAG	Operational NAG pH < 4.5	NAG pH < 4.5, NP:AP < 3	Mapping, static analyses, kinetics
0/1 SZ (Sulfide zone at the top of Lower Newland Formation)	5	PAG	lithology	nd[2]	none
IG (Igneous intrusives)	<1	PAG	lithology	Elevated SPLP metals	Confirmation sampling
USZ (Upper Sulfide Zone)	11	PAG	lithology	NAG pH < 4.5 NP:AP < 3	none
Copper Ore	10	PAG	lithology	nd	none

1 See detailed testing plan below
2 nd – not determined
3 Subsequent tests indicate that the Ynl is unlikely to be acid generating (Enviromin, Inc. 2013a).
Note: Sub 0 SZ and Copper Ore were not included in the baseline geochemistry study for the decline
**All lithologies listed in the table, with the exception of IG, are units within the Lower Newland Formation.*

NAG Confirmation Sampling. Tintina would confirm baseline results through collection of additional samples for static analyses during construction of the decline. Samples would be collected from each lithology and subjected to further analyses including NAG pH and additional metal mobility and kinetic testing.

1. Testing of the Lower Newland Formation *(Ynl)* to identify the PAG fraction

    a. Detailed geologic mapping of the *Ynl* would be performed to define sulfide distribution and locate zones of sulfide enrichment, relative to stratigraphic markers of relevance to potential future mining operations. Sedimentary or structural features controlling sulfide occurrence would be identified to guide selective handling. *Ynl* samples would be collected for static and kinetic analyses to represent the observed variation in lithotype.

    b. These samples would be screened initially, with all rock having visual sulfides sent for handling as PAG. Any rock not identified as PAG would be subjected to further testing using NAG pH test method.

    c. Onsite NAG testing during construction would be used to differentiate between NAG and PAG rock within the *Ynl* which passed the initial visual screening tests. Materials with final NAG pH less than 4.5 would be placed in the lined PAG repository. Materials with NAG pH above 4.5 would be designated as non acid-generating material. Splits for ABA as well as confirmation NAG pH testing, would be collected for independent offsite analysis, to allow correlation with baseline data**,** and onsite analyses.

    d. One composite each of delineated NAG and PAG *Ynl* would be archived for both metal mobility and kinetic humidity cell testing.

2. In-situ monitoring of water quality in decline and on NAG/PAG waste rock pads

    Water quality would be monitored on or near the waste rock pads and in the decline, over a period of years, to evaluate changes in chemistry due to weathering of exposed and blasted rock. Also, analysis of mineral products of weathering would be performed for both run of mine NAG and PAG. Results of this *in situ* work would be used to scale future kinetic test results that would be conducted during the baseline geochemistry program for a future potential mine.

    Results of the exploration decline geochemical sampling and static testing program would be submitted in quarterly reports to the agencies during construction, and in an annual report following construction for any longer term water quality monitoring. A separate report would be prepared describing the selective handling, metal mobility, and kinetic testing of the *Ynl* NAG and PAG materials.

    Data collected as a part of the decline sampling program would be considered as part of the site-wide geochemistry baseline study for a future potential mine.

2.2.6.4 Soil Testing

Stockpiled soil would be tested before respreading to identify what, if any, deficiencies or limitations in soil physical and chemical properties that affect plant growth. Appropriate fertilizer, liming, organic matter, and other amendments would be determined prior to use for reclamation.

2.2.6.5 Weed Control

Tintina has a weed control program in place for its exploration activities. The program would need to be expanded to include new areas of activity and surface disturbance. Tintina shall make reasonable and conscientious efforts to identify, control and suppress all weeds which its operations introduce, or are likely to have introduced. The plan would be developed between the landowners, Meagher County weed control officials, DEQ, and Tintina.

2.2.6.6 Cultural Resources Protection

Cultural resources were surveyed in areas likely to be within the area of influence or surface disturbances related to exploration decline operations. One cultural resource site lies within the proposed disturbance area. It was recommended that an archaeologist be present during road construction in the vicinity of this site if construction were approved. Future areas proposed for disturbance would be surveyed for cultural resources prior to disturbance.

2.2.6.7 Wetland Delineation

A baseline wetland survey delineated wetland areas in the Project area. Tintina has a surface water and groundwater monitoring network in place that would be used to monitor drawdown effects and verify that wetlands are not impacted. Tintina would implement mitigation if necessary to prevent adverse impacts to wetlands in these areas. Mitigation can be implemented either through grouting controls to reduce exploration decline inflows, or through re-infiltration of groundwater to the shallow bedrock aquifer in an intervening area to limit the extent of drawdown effects.

2.2.6.8 Sediment Mitigation

Sediment would be generated from non-vegetated disturbance areas, including the exploration decline portal patio or access roads during periods of high rainfall or snowmelt. Sediment transport into area streams would be minimized by maintaining BMPs consisting of berms and/or silt fences along the perimeter of the water supply pond and along the access road. All storm water controls would be constructed prior to or in conjunction with soil stockpiling.

2.2.7 Reclamation Plan

After the exploration decline and drilling are completed, either temporary or permanent closure plans would be implemented. Temporary closure may be necessary if Tintina applies for an operating permit for a mine. The following description of site reclamation is focused on final reclamation of the exploration decline site, its support facilities, and other disturbance. At the end of the exploration decline project, Tintina would meet with DEQ and review the approved closure plan. Any proposed revisions to the plan would be submitted to DEQ in writing for its review and approval. Tintina would initiate closure and reclamation activities within four years of the completion of the exploration decline. An extension of the four-year time frame could be requested from the DEQ if needed.

Land and Road Use After Exploration
Land uses at the decline site would remain primarily grazing, recreation, and wildlife habitat. Tintina would reclaim the disturbances to these land uses. Reclamation activities would stabilize the site, minimize erosion, and provide a self-sustaining plant community.

The Sheep Creek and Black Butte roads would remain for public access, while roads such as the access road to the decline (Figure 15 and Figure 17) on private property would either be reclaimed or left open at the request of the landowner. Reclamation of private exploration roads would recontour the road to blend with existing topography followed by soil placement and reseeding.

Solid Waste and Facility Disposal and Decline Closure
Should a decision be made that the project would not be advanced after exploration work is completed, all buildings except the core shed along Sheep Creek Road would be removed. All infrastructure at the decline site not needed for use by the landowner would be dismantled and removed. Building materials, aboveground piping and other infrastructure would be recycled or disposed of at an approved facility. Concrete foundations would be broken up, leveled, and buried on the portal patio site. All exposed rebar would be cut off. The concrete would be buried with a minimum of three feet of fill material.

Following removal and/or salvage of facilities, any remaining solid waste would be disposed of in accordance with Montana and Meagher County laws and regulations. Valuable inert waste such as steel, plastic, or wood would be sold to scrap dealers for recycling. The regraded fill would be covered with 15 inches of subsoil and 6 inches of topsoil and seeded.

Decline and Portal Pad Closure
All mobile equipment and utilities (air, ventilation, and electrical lines) would be removed from the underground workings. The PAG and some of the NAG waste rock would be backfilled in the decline below the water table including the area under Coon Creek. The surface of the portal patio would be stripped of potentially contaminated PAG material from hauling between the portal and the PAG pile. This material would be placed underground, below the projected water table at closure. Pumps would be turned off and removed with any underground pipelines. The mine would be allowed to flood. The decline is not anticipated to make or discharge water at or post-closure.

A geotechnical engineer would evaluate the rock quality data for the first 250 feet of the decline to determine the risk of collapse of the underground workings that might result in surface subsidence. If there is risk of subsidence, additional ground support at closure would be installed to eliminate the risk. Alternatively, a longer section of workings could be backfilled with NAG waste rock until stable conditions are reached. It is proposed to close the portal with a cemented NAG waste rock backfill for at least the first 25 feet of the underground workings to prevent access to the underground workings and limit surface subsidence.

The portal patio fill slope material would be used to backfill the cut at the back of the patio. Excess material would be blended to a final reclamation slope of 2.5 to 3:1. The perimeter of the reclaimed site would be graded to blend with surrounding topography. A stabilized drainage would be re-established. Stockpiled soil would be placed over the regraded surfaces and the area seeded.

2.3 Agency-Mitigated Alternative

Components of the Agency-Mitigated Alternative are summarized below and discussed at length in Section 4.2. In order to minimize potential impacts to groundwater, additional mitigations and monitoring would be required. The Agency-Mitigated Alternative does not involve any major changes to facility location or design.

In addition to Tintina's proposed monitoring of decline water and waste rock seepage, DEQ would require weekly sampling of water discharged to the LAD system to confirm that discharged water meets applicable water quality standards (Table 2).

Water treatment prior to land application may be required to meet groundwater standards. DEQ would not require that a specific method of water treatment be used, but would require that all water discharged meet groundwater quality standards prior to land application disposal. Tintina would stop dewatering the decline if water pumped from the exploration decline exceeds groundwater quality standards, until an on-site water treatment plant is operational. Water collected in the waste rock seepage collection ponds would be blended with water pumped from the decline. Cessation of LAD until a treatment system is in place would also be required if this blended water does not comply with groundwater quality standards.

Tintina proposed 10 piezometers in the subsurface LAD area for the purpose of tracking groundwater mounding due to water disposal and to avoid soil saturation. DEQ would require that three monitoring wells be installed downgradient of the LAD area but upgradient of the wetlands along the unnamed tributary to Little Sheep Creek. Two of these wells would take the place of the proposed piezometers PZ-6 and PZ-7. The other monitoring well would be installed south of the underground LAD area (Figure 7). These monitoring wells would verify that groundwater quality standards are not exceeded as a result of land application disposal. DEQ also recommends a minimum of two monitoring wells along the Volcano Valley Fault to document baseline groundwater conditions prior to a potential future mine (Figure 7).

DEQ would require that the NAG waste rock stockpile be lined with a 60-mil geotextile. This would minimize leakage and provide additional assurance that seepage from the stockpile would not discharge to groundwater beneath the pad but would be collected and routed to the seepage collection pond. This would provide an additional level of groundwater protection in the event that NAG waste rock produces seepage that exceeds any groundwater standards.

2.4 Alternatives Considered But Dismissed

Two other decline portal locations were evaluated. One was located in the NE/4, NE/4 of Section 24 and the other was in the center of the N/2 of Section 25. Although these declines were shorter in length, they intercepted higher amounts of sulfide-bearing rock, would cause support facilities to be spread out over a greater geographic area, and have greater visual impacts than the Proposed Alternative. In addition, the two other portal locations did not have suitable LAD areas nearby. The two other portal locations, therefore, were not carried forward for detailed analysis.

The footprint of the disturbance area has been minimized by placing the support facilities and waste rock pads and seepage collection ponds as physically close as possible to the decline portal. Because alternative locations would have resulted in more widespread disturbance, they were not considered in detail.

3.0 AFFECTED ENVIRONMENT

3.1 Geological Resources

The copper-cobalt-silver (Cu-Co-Ag) deposits of Black Butte occur in middle Proterozoic sediments of the Belt Supergroup in central Montana (Zieg and Leitch, 1993). During this period, a deep water basin, the Helena Embayment, was formed. Calcareous shale facies (Newland Formation) were deposited in this trough-like basin. The northern boundary of the Helena Embayment is located along the southern flank of the Little Belt Mountains north of White Sulphur Springs, Montana.

The Newland Shale hosts the Black Butte Copper massive sulfide deposits, and consists of a lower shale-dominated section, which measures approximately 2,500 feet in thickness and an upper carbonate-dominated section which measures approximately 1,150 feet thick.

3.1.1 Deposit Type

The Black Butte Copper bedded sulfide accumulations are shale-hosted, subaqueous massive sulfide deposits. These sulfide deposits are concentrated as several discrete, continuous, and laterally extensive stratigraphic layers.

The sulfide deposits are associated with hydrothermal vent fields that were present during deposition of the host shale. The hydrothermal vent fields are localized at structural intersections developed during prolonged extensional faulting along the northern margin of the Helena Embayment.

3.1.2 Mineralization

Copper-cobalt ore is located in bedded layers within the calcareous shale of the Lower Newland Formation. In the Project area north of the Black Butte fault, four separate beds of massive sulfide deposits occur within the Upper Sulfide Zone (*USZ*). *USZ* stratigraphic horizons are separated by conglomerate lenses or cut into separate structural blocks by northeast trending, down-to-the-southeast normal faults. One of the massive sulfide deposits, the Johnny Lee Upper Zone (*JL-UZ*), is the target for additional underground exploration drilling and sampling. With the exception of its higher copper ore content, the overall structure of the Johnny Lee Upper Zone is typical of the *USZ* throughout the Black Butte Copper Project area.

The JL-UZ consists of several beds of fine-grained pyrite as much as 285 feet thick. These beds contain as many as three different copper-bearing horizons. These beds may also contain cobalt (Co), nickel (Ni), and arsenic (As)-rich material. In the southern part of the *USZ*, copper zones may contain cobalt minerals as well.

While most of the waste rock to be removed would be non-acid producing, the sulfide rock containing the copper ore would be acid generating. The amount of acid generating waste rock is estimated at 20-30 percent of the total amount to be removed. In addition to the acid generating waste rock, there would be a small percentage of igneous intrusive waste rock that may have the potential to leach heavy metals.

3.1.3 Geochemistry

The ore bodies to be explored would be the Johnny Lee Upper and Lower Zones. These zones contain copper and smaller amounts of silver and cobalt. The Johnny Lee Upper Zone copper mineralization lies in the *USZ*, which is hosted by the Proterozoic Lower Newland Formation in calcareous shale. The *USZ* is overlain by shale and dolostone and underlain by the Lower Newland Formation footwall shale and conglomerate. Above the *USZ* are thin, locally discontinuous beds of massive sulfide. At various locations in the Newland Formation there are thin, discontinuous stringers and irregular-shaped masses of intrusive igneous rock.

The exploration decline would have the following purposes:

- Facilitate underground drilling of the ore bodies,
- Extract a bulk sample of up to 10,000 tons for metallurgical testing, and
- Collect hydrogeological, geochemical, and geotechnical data in support of potential mine plans.

The decline location and routing were chosen to intercept a minimum of potentially acid-generating sulfide rock. A total of 115,400 CY of waste rock is expected to be produced. Out of this total 70 percent is anticipated to be non acid-generating with a low potential to release metals. The rock from the decline would be selectively handled and placed into waste rock facilities based on NAG and PAG designations.

A total of 318 drill holes samples were analyzed for total metals and statistically analyzed to select samples for static acid-base accounting tests. Eight samples from each lithology were tested for acid generating potential. Eight composite samples were then tested for metal leaching using the EPA Synthetic Precipitation Leaching Procedure (SPLP) and for asbestiform minerals using polarized light microscopy (PLM). No asbestiform minerals were found. Humidity cell testing, (test designed to simulate accelerated weathering in a laboratory) is underway on composite samples of all the lithologies. These tests would identify classes of rock that have the potential for metal mobility and long-term acid production.

Except for the rock in the Upper Sulfide Zone and one rock sample of the Lower Newland Formation calcareous shale, all tested samples were non-acid forming. Waste rock sampling and testing would continue during construction of the decline, to identify any rock that may have the potential to form acid or leach metals.

The proposed plan includes storage of PAG in a lined storage areas and NAG waste rock in an unlined storage area. About 30 percent of the waste rock is projected to be PAG, with the other 70 percent being NAG. If a bulk sample is removed for metallurgical testing, the ore would be temporarily stored in the PAG area until it is hauled to the testing facilities.

Four rock units (two sulfide zones, igneous intrusives, and minor potentially acid-generating portions of the Lower Newland Formation [*Ynl*]) would be acid-generating and should be handled as PAG. Rock from other units would be placed as NAG. Subsequent tests indicate that the *Ynl* is unlikely to be acid generating (Enviromin, Inc. 2013a).

Acid drainage results when acid-forming minerals such as pyrite react with oxygen and water to generate more acid than the other minerals in the rock can neutralize.

3.1.4 Climate

The Western Regional Climate Center maintained two weather stations in the vicinity of the Project area beginning in the late 1940s and mid-1960s until the early to mid-1980s. More recent data are available from a station located in White Sulphur Springs from1978 through 2005. Average annual temperatures for these datasets are similar and range from about 25 degrees Fahrenheit (F) to 55 degrees F. Recent monthly data from the station located in White Sulphur Springs ranges from an average low of 12 degrees F in January to an average monthly high of 81 degrees F in July. Temperatures could be expected to be somewhat lower at the Project area due to its greater elevation compared to the weather stations.

Precipitation data from the station nearest to the project area (6.5 miles southeast and about 700 feet lower in elevation) show an average annual precipitation of about 16 inches from 1949 through 1981. Further away at White Sulphur Springs annual precipitation averaged about 13 inches between 1978 and 2005. The annual snowfall is considerably different at these two stations with 83 inches historically falling at the station closest to the Project area while only 37 inches was measured in White Sulphur Springs. It is difficult to determine whether the apparent difference in snowfall is due to the different location (Black Butte area is much closer to the Little Belt Mountains) and/or the different period of record for each of the weather stations. Annual snowfall at the Project area likely falls within the reported range for the two weather stations. Annual evaporation rates for the Project area are believed to be between 35 and 40 inches per year as reported by the two stations closest to the site that have evaporation measuring capability; Canyon Ferry Lake (40 miles away) and Montana State University in Bozeman (80 miles away).

3.2 Hydrological Resources

3.2.2 Surface Water

The Project area is in the Sheep Creek watershed, a tributary to the Smith River, which is in turn a tributary of the Missouri River. The site elevation ranges from approximately 5,600 feet to 6,800 feet atop Black Butte. To the west of Black Butte is Butte Creek, which is a tributary to Sheep Creek. Sheep Creek is a fifth order stream draining a total of approximately 194 square miles (NRIS, 2011). The Project area is located in the approximate upper third of the drainage. There are no gaging stations on Sheep Creek or its tributaries. The nearest gaging station is located on the Smith River just below the confluence with Sheep Creek. Base flows at the gaging station range from approximately 90 cubic feet per second (cfs) to peak flows on the order of 1,500 cfs (US Geological Survey [USGS] Station No. 06077200).

Baseline surface water monitoring was conducted for the Black Butte Copper Project during the second quarter of 2011, and for surface and groundwater during the third and fourth quarters of 2011 as well as the first, second, and third quarters of 2012. These data were included in the exploration license amendment application for the Project. Quarterly baseline data collection is ongoing. Water quality samples were submitted for analyses of physical parameters, common constituents, nutrients, and a comprehensive suite of trace constituents as listed in Table 3. With the exception of aluminum, trace constituents were analyzed for the total recoverable fraction for surface water samples; aluminum was analyzed for the dissolved fraction. All trace constituents for groundwater samples were analyzed for the dissolved fraction. This report summarizes the results of groundwater and surface water monitoring conducted in 2011 and 2012.

Sheep Creek originates in the Little Belt Mountains at an elevation of about 7,600 feet and discharges to the Smith River approximately 34 river miles to the west at an elevation of 4,380 feet. The Project area is approximately 17 miles above the confluence with the Smith River which is a popular destination for recreational fishermen, rafters, and boaters. Sheep Creek is a high quality stream that flows in a meandering channel through a broad alluvial valley upstream of the Project site but enters a constricted bedrock canyon just downstream. Sheep Creek is used principally for stock water, irrigation, and fishing (RMI, 2010).

Primary tributaries to Sheep Creek in the immediate Project area are Little Sheep Creek, and Coon Creek (Figure 6). Little Sheep Creek is located to the southeast of the Project area and converges with an unnamed tributary approximately half a mile south of Strawberry Butte before converging with Sheep Creek at the southern terminus of Strawberry Butte. Coon Creek follows Butte Creek Road east of Black Butte and joins Sheep Creek at the head of a canyon located almost one mile northwest of Strawberry Butte. To the west of Black Butte is Butte Creek, also a tributary to Sheep Creek. Another unnamed tributary flows westward from the northern side of Black Butte into Butte Creek. Flows in the tributary drainages are only perennial on their lower reaches and are ephemeral upstream.

Eleven surface water stations have been established as baseline monitoring sites (Figure 6). Flow, stage, and field parameters (temperature, pH, and specific conductivity (SC)) are monitored quarterly at all of these sites. Water quality samples are collected at six of the sites during quarterly monitoring. Monitoring was initiated at these sites in May of 2011 with subsequent quarterly monitoring events scheduled in the months of August, November, March, and May of each year.

During the first year of the baseline study from May to November 2011, discharge in Sheep Creek ranged from approximately 21 to 250 cfs at the upstream site (SW-2) and 21 to 612 cfs at the downstream site (SW-1). During the second year of monitoring, there was a decrease in peak flows in the month of May with the upstream Sheep Creek monitoring site (SW-2) decreasing from approximately 250 cfs in 2011 to 103 cfs in 2012 and the downstream monitoring site (SW-1) ranging from approximately 612 cfs in 2011 to 111 cfs in 2012.

Flows decreased at all surface water sites from the spring of 2011 to the spring of 2012. This decrease was due to unusually high runoff conditions in the spring of 2011 versus more typical conditions in 2012.

Surface water results show neutral to slightly alkaline pH values (6.8 to 8.6), and low to moderate specific conductance (49 to 443 µmhos/cm). Major ion chemistry is dominated by calcium and bicarbonate. Metals data show some infrequent excursions above DEQ-7 water quality standards for selected metals (aluminum and iron) during high runoff events. Surface water standard exceedances were observed for the following constituents:

- Total recoverable iron at all sites during peak runoff periods except SW-6 and SW-11 (2011) and SW-3 (2012);
- Dissolved aluminum during peak runoff season (2011 only) at SW-1, SW-2, SW-5, and SW-11; and
- The human health surface water standard for thallium of 0.00024 mg/L was exceeded at SW-3 during three separate monitoring events in 2011.

Total Maximum Daily Load

Montana has established water quality standards to protect designated beneficial uses of its waters (e.g., aquatic life, drinking water, recreation, agriculture and industrial uses). A waterbody that does not meet one or more standards is called an impaired water. Every two years, the Montana Department of Environmental Quality (DEQ) prepares a Water Quality Integrated Report that lists all impaired waterbodies and their identified impairment causes. The 303(d) list portion of the Integrated Report includes all waterbody segments impaired by a pollutant (e.g., a metal, a nutrient, pathogens, temperature).

Montana's Water Quality Act (Section 75-5-701, MCA) requires the development of total maximum daily loads (TMDLs) for waterbodies impaired by a pollutant. A TMDL is the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. TMDLs provide an approach to improve water quality so that streams and lakes can support and maintain their state-designated uses. Sheep Creek, which flows into the Smith River, is identified on the "2012 Water Quality Integrated Report" (DEQ 2012b.) as not supporting its uses of aquatic life and primary contact recreation due to impairments of aluminum, iron, and E. coli. TMDL development for Sheep Creek will most likely not occur until after 2014, and a schedule has not been established.

It is worth noting that Sheep Creek was previously identified as impaired for mercury. In 2011, Tintina collected water quality data for the purpose of a baseline water quality study for the Black Butte Copper Project, and none of the collected samples exceeded Montana's water quality standard for mercury. The data was submitted to DEQ with a request to remove the mercury impairment for Sheep Creek. DEQ conducted a reassessment of Sheep Creek using the new data and concluded that Sheep Creek was not impaired for mercury, and removed the impairment.

3.2.3 Groundwater

The proposed exploration decline would penetrate dolomitic and silicic shales of the Newland Formation. The shale bedrock formations have a thin colluvial cover over most upland areas, but are overlain by thicker Tertiary deposits along the flanks of the major drainages. Quaternary alluvial deposits are present beneath the stream channels and along the axis of the drainages. Limited historical information on the hydrogeology of the decline area is available; however artesian flow from drill holes does occur in the Sheep Creek Valley (RMI, 2010).

An initial set of paired monitoring wells (MW-1A and MW-1B) was installed for baseline groundwater monitoring in June 2011 (Figure 6 and 7). These wells were completed immediately upgradient of the Sheep Creek hay meadows in the unconsolidated Tertiary clayey gravel deposits and in the underlying shallow bedrock groundwater system. A second set of paired monitoring wells (MW-2A and MW-2B) was completed in November 2011 near Coon Creek in unconsolidated clayey gravels and underlying shallow bedrock. Monitoring well MW-3 was completed in November 2011 near the proposed terminus of the exploration decline within the sulfide ore body. A third set of paired monitoring wells (MW-4A and MW-4B) was completed in May 2012 in the hay meadow field north of the proposed decline area and near Sheep Creek. The wells were installed in the shallow alluvial gravels and shallow bedrock to provide baseline data between the Project area and Sheep Creek.

In addition to the monitoring wells, four test wells have been installed to provide information on the hydrologic characteristics of the bedrock. Two of the test wells (PW-1 and PW-2) were installed in November 2011 and two additional test wells (PW-3 and PW-4) were installed in March 2012. Water level and water quality data were collected at these locations during testing; however, these wells are not routinely monitored during quarterly baseline monitoring events. Water level data have also been collected from various exploration boreholes during hydrologic testing at PW-1, PW-2, PW-3, and PW-4.

Potentiometric water level data from May 2012 were compiled and show an eastward trending groundwater flow direction in the bedrock groundwater system which is consistent with earlier exploration testing results (Chen-Northern, 1989). The potentiometric contours indicate an average hydraulic gradient of approximately 0.08 feet/feet. Paired wells MW-1A and MW-1B have a strong downward gradient during all monitoring events with a head differential between the two wells of 15 to 18 feet. All of the other paired wells show upward gradients with head differences between the paired wells of 0.26 to 0.48 feet.

An analytical model was developed to provide a preliminary assessment of drawdown effects from the evaluation decline. The methodology and results are documented in Appendix D and Appendix I of Tintina's proposal. The model was used to generate a potentiometric map of initial water level conditions and a steady-state drawdown map showing the expected effect of the adit on groundwater levels assuming unrestricted inflow into the exploration decline (no grouting) of 500 gpm (Figure 8). A separate simulation was also generated in which grouting is assumed to limit the inflow to 100 gpm (Figure 9). The results represent steady-state (long-term) drawdown effects and are provided as an initial assessment to identify areas where drawdown effects are likely to be most pronounced.

Groundwater in the shallow alluvial wells and in shallow bedrock wells is calcium/magnesium bicarbonate type water with near neutral pH and moderately low dissolved solids. One exception is well MW-1B, which has a calcium/magnesium sulfate type water with a lower pH range (6.2 to 6.5) and moderate dissolved solids (338 to 401 mg/L). The water quality at MW-1B is similar to MW-3 and test well PW-4, both of which are completed in the sulfide zone.

Wells completed in shallow unconsolidated overburden deposits include MW-1A, MW-2A, and MW-4A. These wells have neutral pH water (7.2-7.4) with low to non-detectable concentrations of dissolved metals. MW-1A periodically exhibits variable water quality with some excursions of arsenic, barium, iron, lead, manganese, and thallium above the human health standards. Well MW-1A is screened in fine-grained sediments and has high turbidity present in the water during sampling events. Monitoring events where metals are detected at higher concentrations at this well may reflect breakthrough of particulate through the filters due to the high turbidity.

Wells completed in shallow bedrock above the Upper Sulfide Zone include MW-2B, MW-4B, and test wells PW-1, PW-2, and PW-3. Dissolved trace constituents that are present at detectable concentrations in the shallow bedrock wells include arsenic, barium, iron, manganese, strontium, thallium, and uranium. Water quality at test wells PW-1, PW-2, and PW-3 exceeds the secondary drinking water standards for iron (0.3 mg/L) and manganese (0.05 mg/L). Neither of these secondary standards is currently listed in Montana's October 2012 Circular DEQ-7. The concentration of thallium at MW-2B (0.0031-0.0036 mg/L) exceeds the human health standard of 0.002 mg/L. Thallium concentrations at the other shallow bedrock wells do not exceed regulatory limits. All other parameters in the shallow aquifer meet applicable regulatory limits.

While thallium is also present at detectable concentrations in MW-3 and PW-4, it does not exceed the human health standard. All of the sulfide zone wells exceed the secondary drinking water standard for iron, and MW-1B and PW-4 also exceed the secondary drinking water standard for manganese (neither of these secondary standards are currently listed numeric water quality standards in Montana's October 2012 Circular DEQ-7).

Wells completed in the Upper Sulfide Zone (MW-3 and PW-4) have the highest concentrations of dissolved solids and sulfate compared to the other wells. As previously discussed MW-1B has similar water quality to these sulfide zone wells. The pH of water at these sulfide zone wells ranges from 6.2 to 7.1 which is slightly lower than other wells. Dissolved trace constituents that are present at detectable concentrations in the sulfide zone wells include arsenic, barium, cobalt (MW-1B only), iron, manganese, mercury, nickel, strontium, thallium, and uranium. Strontium concentrations are elevated (9.3 to 16.2 mg/L) at MW-3 and PW-4 and exceed the human health standard of 4 mg/L. Arsenic concentrations at MW-1B, MW-3 and PW-4 range from 0.054 mg/L to 0.067 mg/L and exceed the human health standard of 0.010 mg/L. Arsenic speciation of samples from MW-1B and MW-3 indicate that the majority of the arsenic is present in reduced form as As (III). Concentrations of thallium at MW-1B (0.013 mg/L) also exceed the human health groundwater standard of 0.002 mg/L.

3.2.4 Wetlands Delineation

A wetland survey identified 28 wetland sites comprising approximately 268 acres associated with perennial streams (including Coon Creek, Little Sheep Creek, and Sheep Creek), Sheep Creek Meadow, ephemeral drainages, and springs and seeps in the Project study area (Figure 7) (Hydrometrics, Inc., 2011). Vegetation observed in the wetland sites included hydrophytic grasses, grass-like plants (e.g., sedges), shrubs, and trees. Hydrologic indicators observed at these sites included perennial stream flow, evidence of ephemeral stream flow, standing water, saturated soils, and evidence of early-growing season saturation. The most typical character of Project area wetlands is hydrophytic vegetation growing in linear riparian corridors on saturated soils along perennial and ephemeral drainages. These wetlands generally transition to wider, dry channels and swales in upper drainage reaches where wetland features (hydrophytic vegetation and supporting hydrology) become isolated and absent.

Localized wetlands were noted in the immediate area of all upper drainage springs, seeps, and springs/seeps developed to support livestock watering. These wetlands are characterized by hydrophytic vegetation stabilizing lower-gradient riparian sites on saturated soils that are subject to trampling by livestock.

Larger wetland complexes are present at upper Coon Creek and lower perennial drainage locations on Coon Creek, Little Sheep Creek, and Sheep Creek Meadow in the Project study area. These wetland complexes are characterized by hydrophytic vegetation growing in broader, less-incised riparian sites on saturated soils in perennial drainages. These sites generally provide high quality habitat and buffer site stability. Some wetlands in the Project area are isolated without a direct connection to perennial drainages. These isolated sites support grass and forested wetlands that provide high quality habitat.

Although wetlands, seeps, and springs are present in various places throughout the Project area, the proposed portal location, and related support facility sites required for the construction of the exploration decline have avoided disturbance of all wetland areas.

3.2.5 Seeps and Springs Delineation

As a part of the initial water resource evaluation, nine seeps and 13 springs in the Project area have been identified, mapped, and some sampled for water quality and flow as a part of an inventory completed in 2011. A second series of flow and water quality samples of seeps and springs was collected during July 2012 (Figure 7). A number of springs discharge along the Volcano Valley Fault where the Flathead Quartzite is in contact with the Newland Formation.

Observed flow rates at the springs ranged from 1 gallon per minute (gpm) to as much as approximately 50 gpm. Water samples were collected at five of the primary spring sites (SP-1, SP-2, SP-3, SP-4, and SP-6) that surround the proposed exploration decline area, and two surface water locations (G-1 and G-2 on Figure 7) where gossan (an iron oxide deposit) is exposed in outcrop in the streambed. The springs generally exhibit neutral to slightly alkaline pHs (6.8-8.0) with moderate to high alkalinities (61-240 mg/L). Background nitrate concentrations were low (<0.1 - 0.68 mg/L) at all of the spring sites. Metals concentrations were within regulatory limits. Manganese at springs SP-1 and SP-2, slightly exceeded the recommended secondary standard for drinking water of 0.05 mg/L. Iron at SP-3 exceeded the recommended secondary drinking water standard of 0.3 mg/L. SP-3 had slightly higher concentrations of some dissolved metals (Al, Cu, and Cr) but all were well below regulatory standards. Other samples from springs originating from gossan sites showed similar water quality to the spring samples with no major differences in dissolved metals concentrations. Total metals concentrations at one of the gossan sites (G-2) exceeded the secondary drinking water standard for iron and the numeric drinking water standard for thallium.

3.2.6 Aquifer Testing

An initial aquifer test was completed for the project which used open core holes to conduct preliminary tests (Tetra Tech 2011a). The test was designed to provide, for planning purposes, a rough estimate of water volumes that might be expected during development of the ore deposit in a future permitting action. The values obtained from this suggest, as a preliminary estimate, that water volumes as large as 400 to 600 (gpm) might be expected to be produced from the mined deposit zone during production, but are inconclusive due to the limited quantity of the holes for this testing purpose.

A more rigorous aquifer testing program was designed to refine the earlier estimate of the likely water production (Hydrometrics 2012b). This testing utilized the previously installed well pair MW-1A and MW-1B as observation wells and MW-2A, MW-2B, and MW-3 that were installed in conjunction with the aquifer test program. Pumping wells PW-1 and PW-2 were also installed for the aquifer test. Based on the pump test wells, steady state decline inflows between 160 and 500 gpm were predicted for the exploration decline.

The most recent aquifer assessment for the proposed decline location was completed in 2012 and included installation of two new wells (PW-3 and PW-4) (Hydrometrics 2013). In addition two existing exploration holes (SC12-116 and SC12-117) were also used as observation wells (Figure 7). Forty-eight hour pumping tests were conducted at test wells PW-3 and PW-4 to establish aquifer characteristics for the bedrock units that would be encountered along the path of the proposed exploration decline. Aquifer test results were analyzed using AQTESOLV (v.4.01) to calculate aquifer transmissivities, hydraulic conductivities, and storage coefficients. Analyses were performed using several analytical solutions including the Theis (1935) solution for confined aquifers, the Theis recovery solution, the Hantush-Jacob (1955) solution for leaky confined aquifers and the Moench (1984) dual porosity solution for fractured rock systems.

Both PW-3 and SC12-116 yield similar hydraulic conductivity estimates for the PW-3 pumping test, with estimated hydraulic conductivity values ranging from 1.1 to 2.2 feet/day. The analysis of PW-4 drawdown yielded hydraulic conductivity estimates of approximately 0.01 to 0.02 feet/day.

3.3 Soils Resources

The Natural Resources Conservation Service (NRCS) has completed a Meagher County soil survey in the vicinity of the proposed exploration decline and in other portions of the Project area (NRCS, 2011). Soil surveys are complete in all areas proposed for surface disturbance associated with the exploration decline (Figure 10).

The soil survey data show that soils near the decline location and in areas under consideration for land application disposal areas (LADs) primarily consist of loamy mollisols. Two soil mapping units, 340D (Burnette-Lymanson-Adel loams) and 1175D (Stubbs-Copenhaver complex) along with a smaller area of map unit 38E (Woodhall-Woodhurst complex) would be disturbed. Additional mapped soils are present within the broader Project area. Soils within the area are rated as being either poor or fair for use as a topsoil source or as reclamation material according to the NRCS soil survey due to shallow depths to bedrock, and/or a high percentage of rock fragments within the soil. Area soils are rated as having a high potential for subsequent reclamation if disturbed in place and then revegetated. Exploration decline related disturbance areas and the LAD system layouts are also shown on Figure 10.

Field verification of the County soil survey was completed in the Project area to confirm soil classifications, and to determine the depth of salvageable soil for reclamation uses in areas likely to be disturbed during construction of the exploration decline and associated facilities. Physical data collected during the field survey include horizon depths, texture, structure, color, and reaction (pH) with hydrochloric acid. Samples were submitted to an analytical laboratory for determination of saturated paste pH, electrical conductivity, nutrient content (nitrogen as nitrate, phosphorus, potassium, and organic matter content), sodium adsorption ratio (SAR), and gradation including coarse fragment content. Chemical parameters were measured in the A (surface) and B (subsoil) horizons from each sampled location.

Composite samples representing the A and B horizons from soil mapping units 340D and 1175D were submitted for analysis of 16 saturated paste extractable metals. Discrete samples from two unmapped units were submitted for analysis of saturated paste extractable arsenic, iron, manganese, and selenium concentrations. Field and lab data were provided along with the Meagher County soil survey descriptions for the mapping units 38E, 340D, and 1175D which are the soil units selected as potential LAD sites.

Field verification confirmed the accuracy of soil descriptions and boundaries provided by the Meagher County soil survey in the vicinity of the decline portal and proposed LAD areas except for several minor discrepancies. Soil samples collected across the Project area were fine textured with clay-loam surface horizons and clay-loam or silty clay-loam subsoil horizons. Coarse fragment content ranged from 7 to 27 percent in surface horizons (17 percent average) and from 10 to 52 percent in subsoil (28 percent average). Soil pH was slightly acidic, ranging from 5.3 to 7.7 (average of 5.8). Electrical conductivity and SAR values were low, and along with pH data, show that these soils are not saline or sodic. Organic matter concentrations ranged from 3.3 to 6.4 percent in the surface horizons and from 0.9 to 3.2 percent in subsoil horizons. Average nitrogen, phosphorus, and potassium were respectively <1, 2.7, and 296 mg/kg.

3.4 Vegetation Resources

Baseline vegetation studies were conducted in the area during the summer of 2011 (Elliot 2011). The following habitat based communities were identified.

3.4.1 Wetlands and Riparian Areas

A large wetland complex, charged by both surface and groundwater flows, is present on the floodplain of Sheep Creek and Little Sheep Creek on the eastern side of the Project area. Other linear wetlands, originating from springs, dissect upland habitats and occur along stream courses along valley bottoms that ultimately flow into Sheep Creek and Little Sheep Creek. The sub-irrigated meadows are dominated by introduced and native grasses, sedges, and forbs including: meadow foxtail, beaked sedge, Nebraska sedge, yellow monkey flower, berula, marsh aster, Baltic rush, redtop, smallfruited bulrush, and tufted hairgrass. On dryer microsites in the meadows, agronomic naturalized and introduced species (e.g., Kentucky bluegrass, smooth brome, and timothy) are present.

3.4.2 Shrub Communities

Shrub communities along Sheep Creek originate from springs on upland sites, and consist mainly of Bebb's willow and Booth's willow, with understory species including: large-leaf avens, beaked sedge, Nebraska sedge, Baltic rush, willow-herb, shrubby cinquefoil, marsh butterweed, and tufted hairgrass. Scattered aspens often are present along the linear drainages dissecting upland sites. One tree-dominated wetland, charged by springs, is present in the southern part of Section 24 at the base of a forested slope. Engelmann spruce, horsetail, mannagrass, brook saxifrage, baneberry, and colt's-foot dominate this wetland.

3.4.3 Coniferous Forest

Upland forest communities in the project area are dominated by an overstory of Douglas-fir with lesser amounts of lodgepole pine. In open Douglas-fir stands on dryer sites, Idaho fescue and big sagebrush are common understory plants. On moist, north-facing slopes understory species include common juniper, birch-leaf spirea, showy aster, Oregon-grape, twinberry, and bearberry.

3.4.4 Big Sagebrush\Grassland

Non-forested uplands support big sagebrush\grassland communities with common species including: big sagebrush, Idaho fescue, rough fescue, Sandberg's bluegrass, western needlegrass, Junegrass, sticky geranium, and silky lupine.

3.4.5 Species of Concern

No plant Species of Concern (SOC) are listed in the vicinity of the project area, however, nine SOC are known to exist in other areas of Meagher County (Elliot, 2011). These species were not identified in the Project area during baseline studies and have a low to moderate likelihood of occurring in or near the project area.

3.4.6 Noxious Weeds

Noxious weeds observed in the project area include Canada thistle, musk thistle, and houndstongue.

3.5 Wildlife

Reconnaissance level baseline wildlife studies were conducted in 2011 to characterize wildlife habitat and assess the potential for animal species of concern to be present within the proposed project area (Elliot 2011). Databases maintained by the Montana Natural Heritage Program and Montana Department of Fish, Wildlife & Parks (FWP) were also queried to obtain natural resources information relevant to the project area.

3.5.1 Wildlife Observed

Wildlife species or their sign (tracks, scats, skeletal remains, nests, beds, or calls) observed during field studies include white-tailed deer, mule deer, elk, coyote, beaver, Richardson's ground squirrel, pocket gopher, red-tailed hawk, Swainson's hawk, northern harrier, kestrel, Canada goose, Clark's nutcracker, eastern kingbird, barn swallow, tree swallow, savannah sparrow, lark sparrow, gold finch, rock dove, northern flicker, yellow-rumped warbler, mourning dove, raven, American robin, ruffed grouse, magpie, and red-winged blackbird.

3.5.2 Species of Concern

Wildlife SOC were not observed during the 2011 survey and are not recorded as present within the project area, but SOC have been identified in Meagher County (MNHP, 2011). The only species of concern observed on the site to date includes the Clark's nutcracker. The habitat types frequented by some of these SOC are associated with habitats that are present within the Project area (i.e., conifer forests, grasslands, streams/riparian areas) suggesting that SOC could also be present within the Project's area of influence. In the case of far-ranging wildlife, it is likely that the Project area comprises only a relatively small proportion of the total range used by such wildlife during the year. Other SOC found in Meagher County that have a high potential of occurring in the project include northern goshawk, Brewer's sparrow, Cassin's finch, golden eagle, hoary bat, fringed myotis, western toad, and westslope cutthroat trout.

3.5.3 Fisheries and Aquatic Resources

Sheep Creek and Little Sheep Creek are perennial streams that meander through a broad floodplain of sub-irrigated meadows and shrub-dominated wetlands. Sheep Creek has riffles and pools with cobble and gravel substrates. There is evidence of abandoned beaver dams, and oxbows are a prominent feature of the broad floodplain area. Table 5 shows the distribution of fish for Sheep Creek from the FWP's website Montana Fisheries Information System (MFISH). It is likely that brook trout, rainbow trout, westslope cutthroat trout, and hybrids of rainbow and westslope cutthroat trout are present in waters of the Project area. No critical fishery habitat locations have been identified at this time.

Table 3. Sheep Creek Fish Distribution[1]

Begin Mile	End Mile	Species	Abun-dance	Use Type	Life History	Origin	Genetic Status	Data Rating	Data Source
0	30.4	Brook Trout	Rare	Year-round resident	Not applicable	Introduced	Not Applicable	Extrapolated from multiple surveys/ observations	FWP
30.4	36.6	Brook Trout	Common	Year-round resident	Not applicable	Introduced	Not Applicable	Extrapolated from a single survey/observation	FWP
0	36.6	Brown Trout	Rare	Both resident and Fluvial/ Adfluvial populations	Not applicable	Introduced	Not Applicable	Extrapolated from a single survey/observation	FWP
0	36.6	Mottled Sculpin	Common	Year-round resident	Not applicable	Native	Not Applicable	No Survey, Professional judgment	FWP
0	14.5	Mountain Whitefish	Common	Year-round resident	Not applicable	Native	Not Applicable	Extrapolated from a single survey/observation	FWP
Begin Mile	**End Mile**	**Species**	**Abun-dance**	**Use Type**	**Life History**	**Origin**	**Genetic Status**	**Data Rating**	**Data Source**
0	30.4	Rainbow Trout	Common	Both resident and Fluvial/ Adfluvial populations	Not applicable	Introduced	Not Applicable	Extrapolated from multiple surveys/ observations	FWP
30.4	36.6	Rainbow Trout	Rare	Both resident and Fluvial/ Adfluvial populations	Not applicable	Introduced	Not Applicable	Extrapolated from a single survey/observation	FWP
5.5	24.8	Westslope Cutthroat Trout	Rare	Year-round resident	Resident	Native	Potentially hybridized with records of contamin-ating species	No Survey, Professional judgment	FS

[1] Sheep Creek tributary of Smith River (10030103), Region 4, Meagher County, MT; River Miles Inventoried: 0 to 36.6 of a total stream length of 36.6 miles. Data source: http://fwp.mt.gov/fishing/mFish/

Benthic invertebrate communities in the project area were not quantitatively analyzed. Tintina did not provide aquatic studies for the exploration decline program.

3.6 Cultural Resources

The proposed Project area is entirely on private land and cultural resource inventories are not required under State and Federal laws. DEQ recommended that Tintina conduct a cultural resource inventory prior to filing the exploration license amendment application to construct the exploration decline. Tintina conducted an intensive pedestrian inventory of 970 acres of private land within the Project area (Tetra Tech, 2013). This area also covers the central portion of the lease block, most of the plan view of the Johnny Lee mineral deposit, the proposed decline portal, portal pad, temporary waste rock storage facilities and the temporary access road. This area also includes all of the proposed facilities identified during conceptual planning for the exploration decline.

The pedestrian inventory recorded seven prehistoric sites, three historic sites, and two prospect pits. Additionally, a previously recorded road was identified. All seven prehistoric sites are lithic scatters that if they are to be disturbed, require further work to determine their eligibility to the National Register. The three historic sites and the previously recorded historic road are recommended not eligible to the National Register of Historic Places (NRHP) and no further work is recommended prior to exploration activities. The prospect pits were recorded as isolated finds. Evaluation of National Register eligibility was not conducted as isolated finds usually do not have the ability to contribute information important to prehistory or history.

One of the identified prehistoric sites occurs in an area proposed for surface disturbance associated with one of the exploration decline's related facilities. Because this identified prehistoric site falls within an area of proposed future surface disturbance it was more thoroughly re-evaluated to determine its potential eligibility for recommendation to the NRHP. A detailed report for the cultural resources at the site was prepared and submitted to the State Historical Preservation Office (SHPO) for a ruling on their eligibility for the National Register. Avoidance was recommended for all potentially NRHP eligible sites.

Tintina would upgrade an existing two-track road into a decline portal access road. Site 24ME163, a potentially NRHP eligible prehistoric site, was identified on the proposed access road during the 2011 cultural inventory. At the recommendation of DEQ, Tintina conducted NRHP eligibility testing of the site on November 7, 2012 (Tetra Tech, 2013). Testing indicated that the site contains intact buried cultural deposits that may be capable of addressing important archaeological research questions (Criterion D).

3.7 Socio-Economics

Meagher County is sparsely populated by Montana and US standards with a 2010 population of 1,891 and a land area of 2,392 square miles (Table 6). The population density is 0.8 people per square mile, while the average for Montana in 2010 was 6.8 people per square mile. The population in Meagher County has decreased slightly since 2000, but it is higher than the 1990 population of 1,824. The US Census Bureau reports that migration out of the county is greater than migration into the county (loss is 2.1 percent), and the number of births has also decreased, which are the primary causes of the population decline. Meagher County has a significantly higher proportion of its population over the age of 65 (21.2 percent) compared to Montana (14.6 percent) and the US (12.9 percent) (Table 7). In addition the percentage of the population under the age of 5 is 5.6 percent in Meagher County, 6.4 percent in Montana and 6.9 percent in the US.

Table 6. Meagher County, MT, and US Current Population Trend

Year	Meagher County	Montana	US
2010	1,891	989,415	308,745,538
2000	1,932	902,190	281,424,602
2000 to 2010	-2.1%	9.7%	9.7%

Source: US Census 2011

Table 7. Age Groups in Meagher County, MT, and US Current Population

	Meagher County	Montana	US
Under 5 years old, percent, 2009	5.6%	6.4%	6.9%
Under 18 years old, percent, 2009	20.1%	22.5%	24.3%
65 years old and over, percent, 2009	21.2%	14.6%	12.9%

Source: US Census 2011

Meagher County is rural and the main industries of farming and ranching employ 173 people or 16.9 percent of the population. Other major industries that employ people include: retail trade (9.5 percent); arts, entertainment and recreation (5 percent); accommodation and food services (6.7 percent); other services (6.7 percent); and government (14.1 percent). Growth industries for jobs include: retail trade (+34 percent since 2001); real estate (+142.3 percent); education (+12 percent); arts, entertainment and recreation (+4.8 percent); and other services (+5.9 percent). Industries showing a loss of jobs include: farming/ranching (-23.8 percent since 2001); accommodation and food services (-7.5 percent); and government (-16.1 percent).

The unemployment rate is an indication of the potential number of available employees for Tintina's project. Considering nationwide economic conditions, both Meagher County and Montana reported lower than average unemployment rates for August 2011, with 65 people or 7.8 percent and 36,014 people and 7.1 percent, respectively. Meagher County and Montana "per capita" incomes are $18,866 and $22,881 respectively. The median household incomes for Meagher County and the State of Montana are $32,409 and $42,222 respectively. The percentages of populations in Meagher County and the State of Montana considered below the poverty level as defined by the US Census are 19 percent and 15 percent respectively.

3.8 Land Use

Land uses in the Project area are predominantly agricultural, with hay and livestock production the primary activities. In addition, outfitters use the Sheep Creek drainage for big game hunting and fishing.

The decline site and related facilities fall entirely within two tracts of private property owned by the Bar Z Ranch, three members of the Hanson family, and/or Rose Holmstrom who together control 100 percent of the surface and mineral rights. Tintina has lease agreements with each of these owners (RMI, 2010). The leases stipulate that only underground mining would be practiced. Post mining land uses are expected to revert to farming, ranching, outfitting/guide services, and recreational access.

4.0 Resources Status and Possible Effects Analysis

The Proposed Action may affect the physical environment and the human population in the area. Table 8 lists the resources of the human environment and their presence in the project area. The potential of being affected by the Proposed Action is listed for each resource.

Table 8. Summary Comparison of Resource Impacts by Alternatives

Resources Evaluated	No Action Alternative	Proposed Action	Agency-Mitigated Alternative	Impact Analysis
RESOURCES ELIMINATED FROM FURTHER STUDY				
Air Quality	Existing quality is good due to lack of emission sources in the area. Air quality is unimpaired by exploration activities to date.	Potential emissions are expected to be less than levels that trigger Prevention of Significant Deterioration (PSD) review. Tintina would apply for an air quality permit if needed.	Same as Proposed Action.	No significant impacts predicted.
Surface Water	The existing impairment of Sheep Creek for elevated levels of fecal coliform bacteria, which is possibly related to livestock grazing, would remain. Water quality standards are infrequently exceeded for iron, aluminum, manganese, and thallium during high runoff events. Existing conditions are unimpaired by exploration activities.	There are no predicted impacts to existing surface water quality and quantity from dewatering of the exploration decline. Tintina would use best management practices (BMPs) to control runoff and limit erosion.	Same as Proposed Action.	No significant impacts predicted.
Wetlands	Wetlands have been impacted by historic grazing, and dewatering for producing hay. Wetlands are unimpaired by exploration activities to date.	No additional direct impacts to wetlands are proposed. No indirect impacts to wetlands are predicted.	Same as Proposed Action.	No significant impacts predicted.
Wildlife, Fisheries, and Aquatic Resources	Wildlife habitat and fisheries have been impacted by historic grazing. Minimal impacts have occurred from exploration activities on 5.1 acres of disturbance.	Exploration activities would displace some wildlife species. No long-term impacts predicted. If surface water quality and quantity are not impacted, fisheries and Aquatic resources would not be impacted.	Same as Proposed Action.	No significant impacts predicted.
Socio-Economics	Meagher County is suffering from lack of a diverse economy. Median household income is 35 percent below the national average.	Potential positive economic effects of the Project on local communities from the 45 people temporarily employed during the exploration program.	Same as Proposed Action.	Potential positive effects.
RESOURCES FURTHER EVALUATED IN THIS EA				
Geochemistry	The area is a mineralized zone with natural geochemical weathering and release of metals.	Rates of geochemical weathering would increase from exposure of sulfide-rich ore and/or other rock lithologies. To minimize geochemical weathering, PAG would be backfilled into the decline below the water table, as well as any NAG waste that is shown by humidity cell testing to leach metals under near-neutral conditions.	Hydraulic plugging of the exploration decline between the NAG and sulfide zones would be required at closure based on hydrogeological and geochemical data collected during the installation of the decline. If NAG waste rock leaches metals under near-neutral conditions, it would be stored on the PAG waste rock pad. All PAG contaminated surface disturbance areas would be removed and stored underground below the water table at closure. Rapid flooding of the decline at closure would limit geochemical weathering while the water table rebounds.	Impacts are reduced below the level of significance due to mitigation measures.

Table 8. Summary Comparison of Resource Impacts by Alternatives continued

Resources Evaluated	No Action Alternative	Proposed Action	Agency-Mitigated Alternative	Impact Analysis
RESOURCES FURTHER EVALUATED IN THIS EA				
Soil	Licensed exploration activities have disturbed 5.1 acres.	An additional 46.5 acres would be disturbed. Soil salvage and replacement would minimize soil impacts. Development of the portal pad and LAD would increase the potential for soil slumping. LAD would increase the potential for soil contamination and leaching of contaminants to surface water and groundwater.	Tintina would have to map and isolate the subsoil cell stored in the portal pad to prevent contamination.	Impacts are reduced below the level of significance due to mitigation measures.
Vegetation	Vegetation has been affected by historic grazing. Licensed exploration activities have disturbed 5.1 acres.	An additional 46.5 acres would be disturbed. Soil salvage and replacement would minimize vegetation impacts. Locally, many native species dominated communities would lose species reducing long term diversity. Noxious weeds may increase.	Same as Proposed Action.	No significant impacts predicted.
Groundwater	Groundwater in some wells naturally exceeds drinking water standards including arsenic, iron, strontium, and thallium. Impacts to groundwater from licensed exploration to date have been minimal due to Tintina's drill hole hydraulic plugging program.	Potential impacts would occur to groundwater near the decline from weathering of sulfide-rich ore and/or other rock lithologies. Potential impact to shallow groundwater from NAG seepage. Decline dewatering would lower the bedrock potentiometric surface. Potential impact of aquifer cross-contamination from decline development. During decline development Tintina would grout to limit inflows. If necessary, Tintina would treat water with a reverse osmosis system prior to discharge in the LAD areas.	Installation of additional monitoring wells and increased monitoring of groundwater resources would document cone of depression and water quality from dewatering the decline. Lining the NAG pad would minimize leakage to shallow groundwater. Potential installation of decline hydraulic plug would minimize aquifer cross contamination.	Impacts are reduced below the level of significance due to mitigation measures.
Historical/ Cultural	Historic mining sites in the area.	Potential impacts to one NRHP eligible site.	One agency mitigation is recommended.	No significant impacts predicted.

4.1 Resources Eliminated from Further Study

The DEQ has assessed the presence of and evaluated the possible impacts on the resources from the Proposed Action, and has determined the Proposed Action would not affect the following resources. The rationale for dismissing further evaluation follows in this section.

4.1.1 Air Quality Resources

4.1.1.1 Air Quality No Action Alternative

Existing air quality is good because of lack of emission sources in the area other than occasional forest fires. Existing air quality has been unimpaired by exploration activities to date.

4.1.1.2 Air Quality Proposed Action

Potential emissions are expected to be less than levels that trigger Prevention of Significant Deterioration (PSD) review. Detailed information for all emissions sources would be compiled for submittal to DEQ's Air Resources Management Bureau for review and final determination of potential permitting needs once specific pieces of equipment have been selected for the exploration decline. Tintina would apply for an air quality permit if required. Tintina would have to comply with conditions in its air quality permit under the Air Quality Act. Air quality will not be evaluated further as part of this EA.

4.1.1.3. Air Quality Agency-Mitigated Alternative

Same as Proposed Action.

4.1.2 Surface Water Resources

4.1.2.1 Surface Water No Action Alternative

The existing impairment of Sheep Creek for elevated levels of fecal coliform bacteria, which is possibly related to livestock grazing, would remain. Water quality standards are infrequently exceeded for iron, aluminum, manganese, and thallium during high runoff events. Under the No Action Alternative no exploration decline would be constructed. Thus, there would be no impacts from decline construction, removal of waste rock and a bulk sample, or discharge of groundwater to the surface due to the lowering of the groundwater table. Other exploration activities could continue. More core drilling might occur from the surface.

4.1.2.2 Surface Water Proposed Action

There are no predicted impacts to existing surface water quality and quantity from dewatering associated with construction of the exploration decline assuming that grouting can limit inflows to 100 gpm or less during a short duration exploration project. Water flowing into the decline would be primarily derived from the shallow bedrock aquifer. This water would be pumped out of the adit, treated if necessary, and disposed of via LAD. The dewatering associated with the construction of the exploration decline would result in the drawdown of the ground water table.

Drawdown analysis indicates that at a pumping rate of 100 gpm, the cone of depression associated with dewatering the decline would not extend beyond the shallow bedrock aquifer and would not impact the Sheep Creek alluvial aquifer. Even if the cone of depression extended to the Sheep Creek alluvial aquifer, the high permeability of the Sheep Creek alluvial aquifer and the large volume of water contained within the aquifer would limit the extent of drawdown in the direction of Sheep Creek. Thus the impact on Sheep Creek would be below the level of significance.

Drawdown effects are most likely to occur where the exploration decline would pass beneath Coon Creek, a tributary of Sheep Creek, and its associated wetlands. The exploration adit would pass approximately 90 feet below Coon Creek about 2,400 feet from the portal (Figure 7). Aquifer tests, however, indicate that there is no direct hydrologic connection between Coon Creek and the shallow bedrock aquifer in the area. PW-3, a well located immediately adjacent to Coon Creek, indicates the primary water producing zones in the shallow bedrock are at depth and separated from the surface by a sequence of lower permeability bedrock which is dry near the surface. PW-3 encountered minimal groundwater in the upper 75 feet of the borehole.

Furthermore, there was no observed decrease in water levels or flow in Coon Creek during a 72-hour aquifer test conducted on PW-3. The water quality sample collected at the end of the 72-hour aquifer test did not show evidence that Coon Creek was a source of recharge. The unsaturated zone in the shallow bedrock beneath the Coon Creek alluvium and the pump test results indicate the lack of connection between the shallow bedrock and Coon Creek alluvial aquifers. Therefore, there is a low risk that construction of the decline would decrease flows in Coon Creek.

The Proposed Action also includes operational elements that mitigate impacts to surface water below the level of significance. Tintina would use standard mining techniques such as controlled blasting, grouting, and ground support to reduce the potential for impacts to Coon Creek. Wallrock integrity is essential in mining from an operational, environmental, safety, and regulatory standpoint. The integrity of the wallrock can be ensured by using controlled blasting to minimize over-break (excavation/fragmentation outside the planned 18' by 18' dimension of the decline), reduce ground vibrations, and fractures within wallrock. Minimal fractures and over-break, less ground support, and safety can be achieved by selecting and employing proper blast design, and precise/accurate timing delays of the charges. These standard mining practices would provide maximum protection of the wallrock and preserve its original strength, thereby reducing the potential for impacts to Coon Creek.

In addition, Tintina would grout both naturally occurring bedrock fractures and fractures from blasting at the decline level beneath Coon Creek to minimize inflows into the underground workings and potential impacts to surface water. Fractures due to blasting are not likely to extend more than 2 to 3 feet beyond the decline wall. Pressure grouting would seal fractures tens of feet beyond the decline wall. For these reasons, grouting would reduce groundwater inflow into the decline.

Finally, Tintina would use "ground support" to stabilize areas with more intense fracturing or poor ground conditions. Ground support techniques would include the use of rock bolts, shotcrete, and screen meshes to assure structural integrity of the decline. While the primary purpose of ground support is to protect workers from rock fall, a secondary benefit is limiting fracturing of wallrock during operations.

The combination of the hydrogeologic conditions described above plus the proposed operational elements would result in potential impacts to wetlands and flows in Coon Creek during operations that are below the level of significance.

Tintina has a surface water and groundwater monitoring plan in place that would be used to monitor water quality and drawdown effects during exploration activities (Figure 6). Monitoring would verify the extent of the cone of depression between the decline and Coon Creek, and the flow in Coon Creek.

Tintina would use BMPs to control runoff and limit sediment discharge to surface water to a level below significance. Typical BMPs such as silt fences, rock check dams, settling ponds, and straw wattles reduce runoff velocity and sediment transport. BMPs are proven techniques to control erosion from sediment sources.

Closure after Exploration

Tintina proposes to backfill the PAG and some NAG waste rock in the decline below the water table, including the segment of the decline beneath Coon Creek. Backfilling would reduce the potential for subsidence by filling the void space in the decline. There would be no long term impacts to surface water quantity or wetlands.

Recharge to wetland features in upper Coon Creek and surrounding drainages is derived from bedrock strata at higher elevations than the shallow groundwater system associated with the decline. There will be no impacts in these more distal wetland areas.

4.1.2.3 Surface Water Agency-Mitigated Alternative

Same as Proposed Action.

4.1.3 Wetlands and Riparian Area Resources

4.1.3.1 Wetlands and Riparian Areas No Action Alternative

Wetlands in the Project area are described in Section 3.4.1 and are shown in Figure 7. Wetlands have been impacted by historic grazing, and dewatering for producing hay. Wetlands are unimpaired by exploration activities to date.

4.1.3.2 Wetlands and Riparian Areas Water Proposed Action

An assessment of drawdown effects from the proposed exploration decline shows minimal potential for impacts to existing wetlands if grouting would reduce inflows to 100 gpm or less. Aquifer testing indicated drawdown would be isolated to the area immediately above the decline (Figure 9). Surface water monitoring during the aquifer test showed no connection between the shallow bedrock aquifer and surface water.

The exploration decline would pass approximately 90 feet below the Coon Creek tributary of Sheep Creek about 2,400 feet in from the portal (Figure 9). Shallow bedrock at test well PW-3, which is located along the decline trend adjacent to Coon Creek, encountered minimal groundwater in the upper 75 feet of the borehole suggesting that dewatering of the deeper decline would have minimal impact on Coon Creek flow, and that there would be low risks of dewatering its associated wetlands. Fractures at the decline level in this area would be grouted to further minimize the potential for inflow into the underground workings and further reduce or eliminate the potential for impact to surface water flow or wetlands near Coon Creek. Tintina would implement mitigation if necessary to prevent any adverse impacts to wetlands in these areas. Mitigation can be implemented either through grouting controls to reduce exploration decline inflows, or through re-infiltration of treated groundwater to the shallow bedrock aquifer in intervening areas.

In Sections 4.1.2.2 and 4.2.2.2, DEQ concluded that surface water and groundwater resources in wetlands would not be impacted by the proposed exploration program. Tintina has surface water monitoring networks in place that would be used to monitor drawdown effects during exploration activities. DEQ would require additional groundwater monitoring requirements between the proposed decline and the closest wetlands that would verify drawdown conditions between the decline and wetlands (Section 4.2.2.3).

Tintina contends no US Army Corps of Engineers or DEQ permits for wetland disturbance are needed. The monitoring data generated during the exploration program would be used to predict impacts to wetlands from future exploration and/or mining plans. This issue will not be evaluated further because no wetlands are to be directly or indirectly impacted by the Proposed Action.

4.1.4 Wildlife and Fisheries

4.1.4.1 Wildlife and Fisheries

Existing wildlife resources are described in Section 3.5. No threatened and endangered animal species were found in the Project area. Animal species of concern have been observed in Meagher County. As Tintina would disturb less than 50 acres in the Project area, there are no predicted impacts to species of concern. As such, wildlife resources will not be evaluated further in this EA.

Fishery resources are described in Section 3.5.3. No critical fishery habitat locations have been identified. Surface water resources and wetlands would not be affected by the proposed exploration program (Section 4.1.2.2).

4.1.5 Socio-Economic Resources

4.1.5.1 Socio-Economics No Action Alternative

Under the No Action Alternative the exploration decline would not be constructed. There would be no additional impacts from decline construction, removal of waste rock, or discharge of water. Other exploration activities could continue. More core drilling might occur from the surface.

4.1.5.2 Socio-Economics Proposed Action

Average quarterly employment for the decline construction and development drilling period is shown in Table 9. Mining crews would nominally consist of 5 to 6 miners per shift and underground drilling crews would consist of 2 people per drill per shift and typically require assistance from the miners for moves and material handling. Additional personnel would include the project engineer, site superintendent, chief geologist, field geologists, environmental technician, head mechanic, head electrician, drillers, and surface laborers. The maximum number of employees would be about 45 people.

Potential short-term positive effects of the proposed Project development include:

- reduction of unemployment in the region,
- job opportunities for younger people and encouragement to retain younger people in the county,
- increased tax base for local, state and federal government,
- economic stimulus for existing local businesses,
- economic development and contract opportunities for existing and new businesses, and
- community infrastructure improvements.

4.1.5.3 Socio-Economic Agency-Mitigated Alternative

Same as Proposed Action.

Table 9. Average Quarterly Employment and Principal Tasks

Employees	Quarter							
	1	**2**	**3**	**4**	**5**	**6**	**Awaiting Permitting**	
Admin/Supervision	3	6	6	6	6	6	2	2
Hourly[1]	14	24	24	24	39	39	2	2
Total	**17**	**30**	**30**	**30**	**45**	**45**	**4**	**4**
Principal Tasks	Mobil-ization	Decline Construction.			Decline Construction, Development, Drilling/Bulk Sampling, and Temporary or Permanent Closure and Monitoring		Care and Maintenance while awaiting Permitting, and Monitoring	

[1] Miners, drillers, and laborers

4.2 Resources Evaluated in this EA

The following resources have been identified by the DEQ as being possibly affected by the Proposed Action.

4.2.1 Environmental Geochemical Resources

When sulfide-bearing deposits are exposed to air and water, oxidation of some metal sulfides within the deposit may occur, even at near-neutral pH, and release metals. This geochemical reaction is sometimes referred to as the creation of acid rock drainage. Sulfide-bearing geological deposits in the exploration decline would oxidize as a result of dewatering the decline during the proposed exploration program. After being exposed to air and water, oxidation of some metal sulfides within the PAG waste rock, the 10,000 ton bulk sample, and the wall rock around the decline may generate geochemical reactions even at near-neutral pH, and release metals. Even if waste rock is classified as NAG, there is a potential that metals could leach out of it at near neutral pH levels. The primary impacts to geochemistry at the Tintina project would be as follows:

- Upon being exposed to air and water, some metal sulfides in the NAG and PAG waste rock stockpiles would oxidize and release metals,
- Upon being exposed to air and water, the wall rock in the exploration decline would release metals in acidic or even in near-neutral pH conditions. These oxidation byproducts could be mobilized by inflows during the exploration program and from rising groundwater levels after the exploration program is completed as the groundwater table rebounds, and
- Sulfide-bearing material may inadvertently be brought to the surface on equipment tires and spread along the portal patio and road surfaces.

4.2.1.1 Geochemistry No Action Alternative

Under the No Action Alternative the exploration decline would not be constructed. There would be no geochemical impacts from decline construction. Other exploration activities would continue as permitted. Geochemical impacts would not occur.

4.2.1.2 Geochemistry Proposed Action

Geochemical impacts associated with the PAG waste rock would be mitigated below the level of significance by operational design. The PAG waste rock would be stored on the surface in an area that would have surface runon diverted away from the PAG waste rock storage area. This diversion would prevent surface runon from interacting with the PAG waste rock and creating acid mine drainage.

The subgrade upon which the PAG waste rock storage facility is to be located would be compacted. In addition, a 60-mil HDPE textured geosynthetic liner would be placed beneath the PAG waste rock storage facility. Compaction and liner installation would be completed by a third-party engineering firm. Compaction of the subgrade and installation of the geosynthetic liner would prevent seepage of contaminants to groundwater.

The PAG waste rock storage facility would be constructed with an internal waste rock seepage collection system. The seepage collection system would direct seepage into a pipeline that would route the water into a 60-mil lined PAG storage pond. Water in the PAG pond would be treated as necessary for compliance with groundwater standards prior to land application disposal. Thus, there will be no impacts from seepage of contaminated water from the PAG waste rock storage facility.

At closure, the PAG waste rock would be placed underground below the water table and prevent further oxidation of the PAG waste rock (Section 4.2.2.2). Once the decline is flooded, continued geochemical reactions would not occur because the sulfide in the waste rock and decline wallrock would not be exposed to oxygen.

Geochemical impacts associated with the NAG waste rock would be mitigated below the level of significance by operational design. The NAG waste rock would be stored on the surface in an area that would have surface runon diverted away from the NAG waste rock storage area. This diversion would prevent surface runon from interacting with the NAG waste rock and creating acid mine drainage.

The subgrade upon which the NAG waste rock storage facility is to be located would be compacted but no geosynthetic liner would be installed. The NAG waste rock storage facility would be constructed with an internal waste rock seepage collection system. The seepage collection system would direct seepage into a pipeline that would route the water into a 60-mil lined NAG storage pond. Water in the NAG pond would be treated as necessary for compliance with groundwater standards prior to land application disposal.

At closure, some of the NAG waste rock would be placed underground. The NAG waste rock remaining on the NAG waste rock facility would be covered with salvaged soil and revegetated. Placement of a soil cap and revegetation would reduce infiltration of rain and snowmelt and would reduce the release of any metals or other geochemical byproducts. Impacts from the reclaimed NAG waste rock would be reduced below the level of significance.

4.2.1.3 Geochemistry Agency-Mitigated Alternative

Tintina would line the NAG waste rock stockpile with a 60-mil liner to minimize release of geochemical byproducts and nitrogen compounds. Covering the NAG waste rock stockpile with salvaged soil and revegetation would minimize any future seepage from the NAG waste rock pad.

Tintina would sample all road and other disturbance area surfaces to identify areas contaminated with PAG materials during construction of the exploration decline. These contaminated materials would be removed and stored underground at closure. All waste rock lithologies needing disposal would fit back into the underground workings below the water table.

At closure, the exploration decline would be closed with a hydraulic plug above the sulfide zone to minimize cross-contamination of bedrock aquifers. DEQ would require rapid flooding of the decline by pumping treated PAG and NAG pond water into the decline. This would shorten the duration of geochemical weathering while the water table rebounds. These mitigations will reduce long term geochemical weathering to below the level of significance.

4.2.2 Groundwater Resources

4.2.2.1 Groundwater No Action Alternative

Groundwater in some wells naturally exceeds drinking water standards including arsenic, iron, strontium, and thallium. Impacts to groundwater from licensed exploration to date have been minimal due to Tintina's drill hole hydraulic plugging program. Under the No Action Alternative, the exploration decline would not be constructed. There would be no additional impacts from decline construction, removal of waste rock, or discharge of water. Other exploration activities could continue. More core drilling might occur from the surface.

4.2.2.2 Groundwater Proposed Action

Potential groundwater impacts are discussed separately for development of the exploration decline, flooding of the exploration decline after closure, operation of the waste rock storage pads and seepage ponds, and operation of the LAD system.

Potential Impacts of the Decline Development on Groundwater

The Proposed Action would produce conditions that could degrade groundwater quality and quantity during decline development and after completion of the exploration program.

Dewatering the decline would lower the groundwater table, causing the decline to act as a groundwater sink (Figures 8 and 9). Development of the decline would first encounter the shallow bedrock aquifer. Inflows could range up to 500 gpm from the shallow bedrock aquifer (Figure 8). Tintina would grout to control inflows to less than 100 gpm during the exploration program (Figure 9). The water in the shallow bedrock aquifer is generally of good quality and meets all ground water quality standards except thallium levels in one well.

As the decline extends into deeper bedrock (about 280 feet below the surface and 2,900 feet from the portal), it would penetrate the ore body and encounter lower permeability bedrock, less inflows, and groundwater that is of lower quality than the shallow bedrock aquifer. The major ion chemistry of the water in the sulfide zone is similar to the shallow bedrock aquifer system, but there are metals present at detectable concentrations. Arsenic, strontium, and thallium exceed groundwater standards in some wells. Aquifer test results indicate bedrock hydraulic conductivity at this depth interval would be approximately 0.015 feet/day. Calculated inflow to this section of the exploration decline is 10-12 gpm.

The 10-12 gpm inflow from the sulfide zone would mix in the underground collection sumps with up to 100 gpm from the shallow bedrock aquifer, resulting in the cross-contamination of the two semi-isolated aquifers. The mixed water may meet groundwater quality standards for metals such that discharge to the LAD system is acceptable without treatment.

Dewatering and decline development would expose waste rock and ore in the decline to oxygen, resulting in the production of geochemical byproducts. The geochemical processes are discussed in Section 4.2.1. Nitrogen residues from blasting compounds and arsenic from geochemical reactions in decline water could eventually exceed groundwater quality standards, requiring water treatment prior to land application disposal.

Potential Impacts of the Decline Flooding at Closure on Groundwater

Tintina would place PAG and some NAG waste rock with a potential to release metals back in the sulfide zone of the decline after exploration is completed. Tintina estimates it would take about 30 days to place the waste rock back in the decline. After the waste rock has been placed underground, the pumps in the underground workings would be shut off and the decline would be allowed to flood. The time required to flood the sulfide zone would be minimized. It would take about 60 days for the decline to flood.

Potential impacts to groundwater quality would occur from the weathered PAG and NAG waste rock that have been placed underground. As the water table rebounds, geochemical byproducts exposed on weathered waste rock as well as the decline wallrock would dissolve, impacting water quality. Generation of additional geochemical byproducts would be short-lived. Once the sulfide zone within the decline is flooded, continued geochemical reactions would not occur because the sulfide in the waste rock and decline wallrock would not be exposed to oxygen.

There is a potential to increase metals and nitrogen compounds in groundwater in the immediate vicinity of the decline as the water table rebounds. Initially, up to 100 gpm from the upper portion of the decline, derived from the upper bedrock aquifer, would mix with 10-12 gpm inflows from the sulfide zone, derived from the lower bedrock aquifer. The water quality in the upper bedrock aquifer is of better quality than the water in the lower bedrock aquifer as discussed in Section 3.2.3. The decline would connect these two aquifers and may result in cross-contamination. As the water table rebounds, the rate of groundwater flow into and around the decline would decrease compared with inflow rates during dewatering, and would return to baseline flow rates.

Once the decline floods, it would no longer be a groundwater sink. Groundwater would reestablish its pre-existing flow path except where the decline wallrock has been grouted. Grouting would slow the flow of groundwater in the area of the decline, resulting in the majority of groundwater flowing around the decline. This would dilute any seepage of potentially impacted water from within the decline and entering the surrounding bedrock aquifer.

The majority of seepage out of the decline would occur where bedrock is most permeable, within the shallow bedrock system beneath and south of Coon Creek. This seepage would mix with bedrock groundwater and flow northeast toward the Sheep Creek alluvial aquifer. The seepage would be further diluted upon mixing with alluvial groundwater. The flow of groundwater through the Sheep Creek alluvium is much greater than through the local bedrock aquifer in the area of the decline. As the groundwater flows from the bedrock to the alluvial aquifer, changes in geochemical conditions are likely to cause metals to precipitate out of the groundwater and adsorb to clay minerals in sediments.

Kinetic testing of rock from the Lower Newland Formation indicates low potential for acid generation and metal release except for materials from the *USZ* (Enviromin, Inc. 2013b). The potential for metals and nitrates to impact the shallow bedrock aquifer beyond the drawdown area shown in Figure 9 would be short in duration and below the level of significance.

Flooding of the underground workings would never reach a level that would discharge from the portal because the portal elevation is above the naturally occurring water table.

Potential Impacts of Waste Rock Storage Pads and Seepage Ponds on Groundwater

1. Tintina does not apply for an operating permit.

If Tintina decides not to apply for an operating permit, Tintina would place the PAG waste rock in the sulfide zone of the decline below the water table. As discussed above, placing the PAG waste rock below the water table would prevent the generation of acidic water. Placement of the PAG waste rock below the water table would reduce the impacts to groundwater below the level of significance.

After the PAG waste rock is placed in the decline, the liner and seepage collection pipes in the PAG waste rock pad area would be removed. The pad area would be regraded, soiled, and revegetated.

Waste rock storage in an unlined NAG waste rock pad may allow leakage of contaminants of concern into groundwater during installation of the decline and after the decline is closed. If Tintina does not decide to apply for an operating permit the NAG waste rock pad would be regraded, soiled, and revegetated. Revegetation with 21 inches of soil would minimize seepage long-term. Reclamation would reduce the impacts to groundwater below the level of significance. The groundwater table is approximately 100 feet below the NAG waste rock pad.

2. Tintina applies for an operating permit

Tintina may decide to apply to DEQ for an operating permit based on information obtained during development of the exploration decline and associated exploration activities. If Tintina applies for an operating permit, it is likely that PAG and NAG waste rock would be left at the surface during the operating permit application process and for the duration of mining activity if an operating permit is issued.

Waste rock left on the PAG waste rock pad would weather and may generate acid mine drainage. Seepage from the PAG waste rock pad would need to be collected and treated until the PAG waste rock is placed in the exploration decline below the water table. Although the PAG waste rock pad is lined, there is a minimal potential for liner leaks allowing contaminants of concern to escape. Although the leakage could escape, impacts to groundwater are unlikely because the groundwater table is approximately 100 feet below the PAG waste rock pad.
Waste rock left on the NAG waste rock pad would weather and there is a minimal potential for contaminants of concern to escape. Although the seepage could escape, impacts to groundwater are unlikely because the groundwater table is approximately 100 feet below the NAG waste rock pad.

Potential Impacts of Land Application Disposal on Groundwater

Water collected in the seepage ponds and pumped out of the decline would be piped to a LAD area south of the decline portal (Figure 7). Tintina has proposed to land apply the water without treatment if it meets groundwater standards. Nitrogen residues from blasting compounds and arsenic from geochemical reactions may exceed groundwater quality standards and water treatment may be necessary prior to land application disposal.

Tintina would install a reverse osmosis (RO) water treatment plant if water quality standards are exceeded. The RO system is capable of extracting nitrates and arsenic, the likely constituents that may exceed groundwater standards. In addition, RO can also effectively remove selenium, thallium, and strontium, the other possible contaminants. The RO system would be able to meet groundwater quality standards for discharge to the underground LAD systems except for nitrogen compounds.

An anaerobic biological treatment system may be needed at the site to treat for elevated nitrogen compounds. A biological treatment system would effectively remove nitrogen compounds and has been successfully employed at other mine sites in Montana.

The LAD system would be installed in soils that exhibited extractable metals in a saturated paste. Surface and subsurface application of water may leach metals from these soils and carry them to groundwater. Tintina would install one pair of monitoring wells (shallow and deep) in the down-gradient area below the portal pad, waste rock storage seepage collection ponds and the LAD areas (see proposed site MW-5). Piezometers proposed for installation in the LAD areas include three in the surface LAD sites, and eight among the underground LAD cells. In addition to collecting baseline water level data from the piezometers, piezometers will initially be monitored weekly for measurement of water levels with respect to saturation within individual zones within the LAD cells, until trends are established that may suggest a change in the required frequency of sampling. Tintina will complete the piezometers with well-head protection, and proposes to collect samples for water quality from at least half (five) of the installed piezometers on a quarterly basis.

4.2.2.3 Groundwater Agency-Mitigated Alternative

Although the Proposed Action would lower the groundwater level in the area near the decline, there is a low risk that area springs would have decreased flows and that groundwater quality would be impaired. DEQ mitigations would ensure that these impacts remain below the level of significance.

Agency mitigations also would require Tintina to obtain additional baseline data for use in the event that it applies for an operating permit.

Additional Monitoring of Potential Impacts on Groundwater

Additional groundwater monitoring under the Agency Mitigated Alternative would document baseline flow and quality and measure potential impacts from construction of the decline. The additional groundwater monitoring would begin immediately and continue until further written notice from DEQ. Tintina would be required to report hydrogeologic data to DEQ quarterly.

The Agency Mitigated Alternative requires additional monitoring of flow at seven springs near the proposed decline (Table 2). The frequency of monitoring water levels at natural springs (SP-1, SP-2, SP-3, SP-4 and SP-6) and two developed springs (DS-3 and DS-4) would be increased from annually to monthly. The purpose of the increased monitoring frequency is to detect any impacts of dewatering the decline on the area springs. If impacts to water rights are documented Tintina would be required to replace the water supply as required by Section 82-4-355, MCA.

The Agency Mitigated Alternative requires additional water level monitoring at seven wells near the proposed decline (Table 2). The frequency of monitoring water levels at wells MW-1A, MW-1B, MW-2A, MW2-B, MW-3, MW-4A, and MW-4B, would be increased from quarterly to monthly. The purpose of this increased monitoring frequency is to measure the amount that the local groundwater table is depressed as a result of dewatering the decline. If this impact is different than the projected impact from the dewatering model, then Tintina would use the data to recalibrate the model (Figure 9) in the event that it applies for an operating permit. Because the proposed exploration activity is of such short duration, impacts would be below the level of significance even if there is a difference between the observed and projected drawdown.

The Agency Mitigated Alternative requires additional monitoring at groundwater pumping and observation wells in the project area (Table 2). Water levels at pumping wells PW-1, PW-2, PW-3, and PW-4 and at observation wells, SC11-032, SC11-09, SC11-031, and SC12-116, would be required monthly. Field parameters and water samples for analytical laboratory analysis would be required quarterly from pumping wells PW-1, PW-2, PW-3, and PW-4. The purpose of this increased monitoring is to document baseline and operational chemistry and groundwater levels for use in the event that Tintina applies for an operating permit.

Mitigating Potential Impacts of the Decline Flooding on Groundwater

DEQ analyzed three scenarios for managing water in the decline after Tintina's proposed exploration project is completed. The first scenario assumes that Tintina does not apply for an operating permit and permanently closes the exploration decline. The second scenario assumes that Tintina indefinitely defers closure of the decline and continues to pump and treat the decline water. The third scenario assumes that Tintina indefinitely defers closure of the decline and allows it to flood.

1. Tintina does not apply for an operating permit and closes the exploration adit.

If Tintina decides not to apply for an operating permit, Tintina proposes to place the PAG waste rock in the sulfide zone of the decline. As previously discussed, the decline would connect the upper and lower bedrock aquifers, resulting in the possible cross contamination of the two aquifers. The Agency Mitigated Alternative requires Tintina to install a hydraulic plug in the decline between the upper decline and the sulfide zone. The hydraulic plug would consist of a steel rebar frame set into the wallrock with concrete poured into the frame.

Due to the low permeability of the concrete and surrounding grout, the hydraulic plug would form a barrier between the upper bedrock aquifer, which flows through non acid-generating rock, and the lower bedrock aquifer, which flows through potentially acid-generating sulfide rock. Cross-contamination between these semi-isolated water bearing units after the decline is flooded would be reduced to below the level of significance.

The Agency Mitigated Alternative would require Tintina to dispose of treated water below the hydraulic plug in the decline after closure rather than in the LAD system. Disposing of the treated water below the hydraulic plug would speed flooding of the sulfide zone. In turn, this would minimize the length of time that the sulfide bearing wallrock and the waste rock placed in the sulfide zone is in contact with oxygen and acid-generating, improving water quality.

Finally, the Agency Mitigated Alternative would require Tintina to install two wells to monitor water quality in the decline. One of the wells would be placed above the hydraulic plug and the other well below the hydraulic plug. In addition to measuring water quality, the well placed below the hydraulic plug would be used to pump water from the lowest point in the decline for treatment, if necessary, until water quality in the decline meets background water quality in the surrounding deep bedrock aquifer.

In the event that Tintina does not apply for an operating permit and closes the exploration decline permanently, the impacts on groundwater would be below the level of significance.

2. Tintina indefinitely defers closure of the decline and continues to pump and treat the decline water.

Tintina proposed backfilling the PAG and some NAG waste rock below the water table and then allowing the decline to flood. However, Tintina may defer placing the waste rock underground if it applies for an operating permit.

If Tintina applies for an operating permit, the Agency-Mitigated Alternative would allow the PAG and NAG waste rock to be left on the respective storage pads. This would allow Tintina continued access to the decline. Tintina would continue to dewater, treat, and land apply water from the decline to continue exploration or apply for an operating permit.

Continued dewatering during this period would increase the length of time water needs treatment. The rate of water flow through the treatment plant would essentially remain unchanged, however, and no change to the treatment system would be required. No additional impacts to groundwater would occur during this period.

Continued dewatering would also allow sulfide material in the sulfide zone and the PAG waste rock to weather for longer period of time. As a result, it may take longer for the water quality to return to background conditions after the decline is flooded. At final closure, the decline would be backfilled and closed as discussed above. Water may have to be pumped from the flooded decline and treated for a longer period of time. No additional impacts to groundwater would occur during this period.

In the event that Tintina does apply for an operating permit and continues to dewater the exploration decline, the impacts on groundwater would be below the level of significance.

3. Tintina indefinitely defers closure of the decline and allows it to flood

Tintina proposed backfilling the PAG and some NAG below the water table and then allowing the decline to flood. However, this action may be deferred if Tintina applies for an operating permit.

If Tintina applies for an operating permit, the Agency-Mitigated Alternative would allow the PAG and NAG waste rock to be left on the respective storage pads. Instead of continuing to dewater, treat, and land apply water from the decline, Tintina could allow the decline to flood while it applies for an operating permit. Flooding of the decline during this period would minimize the amount of water needing treatment and minimize weathering of exposed sulfide materials. The Agency Mitigated Alternative would require the installation of a hydraulic plug between the upper non-acid generating and lower potentially acid-generating sulfide bedrock aquifers. The hydraulic plug would minimize cross-contamination between these semi-isolated water bearing units after the decline is flooded.

The Agency Mitigated Alternative would require Tintina to install two wells to monitor water quality in the decline. One of the wells would be placed above the hydraulic plug and the other well below the hydraulic plug. In addition to measuring water quality, the well placed below the hydraulic plug could be used to pump water from the lowest point in the decline for treatment, if necessary, until water quality in the decline meets background water quality in the surrounding deep bedrock aquifer.

At final closure, the decline would be backfilled and closed as discussed above. DEQ would require water stored in the PAG and NAG storage ponds to be treated and used to flood the decline rather than being pumped to the LAD system. Flooding the sulfide zone with this treated water would limit oxidation of the wallrock and backfilled waste rock, improving water quality.

In the event that Tintina does apply for an operating permit and allows the exploration decline to flood, the impacts on groundwater would be below the level of significance.

Mitigating Potential Impacts of Waste Rock Storage Pads and Seepage Ponds on Groundwater

The Agency Mitigated Alternative would require Tintina to include installation of a 60-mil liner in the NAG waste rock pad as is required in the PAG waste rock pad under the Proposed Alternative. This would minimize seepage to groundwater from the NAG waste rock pile, ensuring that any impacts to groundwater would remain below the level of significance.

If Tintina defers closure, the PAG waste rock would be left on the PAG pad. The Agency Mitigated Alternative would require Tintina to cover the PAG waste rock pad with a geotextile material to shed the bulk of precipitation that would otherwise infiltrate into the waste rock. This would minimize seepage from the facility. Covering the PAG waste rock pad with a geotextile material would minimize the amount of water that would need to be treated during the period of inactivity.

Mitigating Potential Impacts of Land Application Discharge on Groundwater

Tintina would treat water to meet ground water standards prior to discharging water to the LAD area. LAD could increase metal leaching from mineralized soils in the area. The Agency Mitigated Alternative would require Tintina to install three additional monitoring wells in the LAD area to detect any impacts from LAD. One new monitoring well (MW-6) would be installed south of the LAD area (Figure 7). The other two monitoring wells (MW-7 and MW-8) would be installed in place of the proposed wetland piezometers (PZ-6 and PZ-7). These monitoring wells would document groundwater quality downgradient of the sub-surface LAD and upgradient of the nearest wetlands. If contaminants are detected in monitoring wells, Tintina would be required to modify the LAD system to reduce or limit the impacts below the level of significance.

Additionally, DEQ would require one surface water monitoring site (SW-6) to have an increased monitoring frequency from quarterly to monthly (Table 2). The purpose of this increased monitoring is to document surface water quality at the closest surface water sampling point downgradient to the LAD system. If contaminants are detected in surface water, Tintina would be required to modify the LAD system to prevent discharge to surface water. This would ensure impacts remain below the level of significance.

Finally, DEQ would require additional monitoring of water discharged to the LAD system after treatment. Tintina would measure field parameters and collect water samples on a weekly basis for analytical laboratory analysis at the entry point to the LAD system. If Tintina receives a preliminary laboratory report showing that a contaminant has exceeded standards, it would be required to notify DEQ within 3 working days and submit a corrective action plan for addressing the exceedances. For example, the corrective action plan may consist of resampling to confirm the exceedance, cessation of the discharge to the LAD, and/or modifications to the treatment system. This would ensure that impacts to groundwater would remain below the level of significance.

4.2.3 Soil Resources

4.2.3.1 Soils No Action Alternative

Under the No Action Alternative no exploration decline would be constructed. There would be no additional impacts from decline construction, removal of waste rock and a bulk sample, or discharge of water. Other exploration activities could continue. More core drilling might occur on the surface as well as additional roads. All exploration activities would have to be reclaimed by replacing stockpiled soils and seeding except the core shed area which would be left for use by the rancher. Soil impacts on the 5.1 acres of exploration disturbances include the typical loss of soil development, destruction of the soil profile, increased compaction, loss of soil structure, reduction in organic matter content, reduction in soil productivity, and reduction in soil biological communities. Salvage and replacement of soil would reduce these impacts. This is an unavoidable impact of allowing soil disturbance. Revegetation to date of reclaimed exploration soil disturbances indicates the disturbed soils can be successfully revegetated to control erosion.

4.2.3.2 Soils Proposed Action

Soil impacts on the additional 46.5 acres of exploration disturbances would be the same as those on existing disturbances. All of the proposed surface disturbances associated with the exploration license amendment would occur within the Copenhaver soil type, mapping unit 1175D. This is a shallow soil with a clay-loam surface horizon to a depth of about 7 inches below ground surface. Subsoil textures range from clay-loam to sandy clay-loam with about 16 percent coarse fragments to depths of around 20 inches. Bedrock is encountered below this depth. Salvageable soil volumes are limited mostly by the shallow depth to bedrock. The fine textured surface horizons may require amelioration with mulch or other organic amendments and fertilizer to enhance successful revegetation.

Undisturbed soils in the Project area may be contributing to metal concentrations measured in surface water or groundwater. Aluminum, barium, copper, iron, and manganese can be mobilized from area soils. Metal mobilization from area soils, however, will not be significant during the Proposed Action because:

- the water disposal in the LAD area would be of relatively short duration;
- the volume of water expected to be disposed is only 100-200 gpm;
- the LAD areas are designed to handle over 6,000 gpm. Given the low volume of water to be disposed, there are multiple possible configurations to spread water over the LAD areas, which is about 65.6 acres; and
- a portion of the water would be disposed through evapotranspiration instead of discharging to area soils.

Soil sampling to date is adequate for the evaluation of the proposed exploration license amendment. Tintina has agreed to conduct additional acid-base testing of soils in 2013. In the event that Tintina applies for an operating permit, this testing would help identify potential leaching of metals from area soils during long-term mining operations.

Proposed BMPs to control erosion would limit concentrations exceeding standards in runoff from stockpiled soil, LAD areas, or reclaimed areas.

Soil Slumping

Development of the portal pad and LAD would increase the potential for soil slumping. Observations were made on the location, size, and nature of areas of naturally occurring surface slumping throughout the project area. In general, surface slumping is restricted to areas underlain by Paleozoic sedimentary rocks to the north of the Project area proper (Jerry Zieg and Vince Scartozzi, personal communication, 2012).

Surface soil and subsoil down to bedrock would be removed from the roadbed and portal pad areas prior to construction of the portal pad. The portal pad would be excavated into bedrock, and constructed of excavated bedrock fill material, supplemented by subsoil and imported fill material (gravel) and/or select net-neutralizing NAG waste rock, if this material is proven to be suitable for construction with respect to metal mobility.

The potential for slumping as a result of LAD is discussed below in the LAD Section 4.2.2.2.4.

Soil Salvage and Replacement

Soil salvage and replacement would minimize soil impacts. Topsoil and subsoil would be stripped from all areas to be disturbed prior to land disturbance (i.e., waste rock storage areas, roads, ponds, soil stockpile areas). Salvaged topsoil and subsoil would be stockpiled separately and BMPs would be installed to control erosion. Soil stockpiles would be revegetated to limit weed invasion and water/wind erosion until they are scheduled for use in closure. Snow fencing would be used to minimize snow accumulations on the soil piles. Soil stockpiles would be marked and constructed with 2.5H:1V side slopes, 3H:1V access ramps, and incrementally stabilized to minimize erosion. Broadcast seeding would be conducted during the first appropriate season following stockpiling. Fertilizer and mulch would be applied to the piles as necessary. The estimated life of each stockpile is the life of the decline.

Soil salvage quantities would be limited by slope, shallow depth to bedrock, and limited areas of exposed bedrock at the decline site. Subsoils containing coarse fragments in excess of 50 percent by volume would be salvaged for use in reclamation to insure that no offsite soil would be required.

Topsoil stockpiles would be strategically located to ensure that topsoil derived from areas of similar slope to the original topographic slope angle would be used to reclaim the sites in closure. Subsoil from the portal patio construction area would be placed downgradient of the disturbance in berms for sediment and erosion and rock roll control. Topsoil and subsoil from the seepage collection ponds would be stored in parallel berms downgradient of the facilities for similar reasons. Subsoil from the waste rock pads would be stored in a pile to the northwest of the waste rock pads. The access road topsoil would be stored in windrows above the road, and subsoils would be stored in berms below the road or used to provide fill for the slope material for the roads.

Soil Testing and Redistribution

Prior to soil redistribution, compacted areas (especially the access roads) would be ripped to relieve compaction. This would eliminate potential slippage on layer contacts and promote a hospitable root zone. Soil materials would be applied in lifts as thick as possible to decrease compaction.

Stockpiled soil would be tested before respreading to identify what, if any, deficiencies or limitations in soil physical and chemical properties exist that might affect plant growth. Appropriate fertilizer, liming, organic matter, and other amendments would be determined prior to use for reclamation.

Soils would be redistributed to achieve a uniform thickness, reduce compaction, and minimize deterioration of chemical and physical soil properties. Subsoil would be redistributed evenly over the disturbed area, allowing an average redistribution depth of approximately 15 inches of subsoil. Six inches of topsoil would be placed on top of the subsoil in a second lift providing roughly 21 inches of plant growth medium. Reclamation of exploration disturbances to date on the site shows the suitability of area soils for reclamation of the site. Impacts to areas soils would be the same as the No Action Alternative but additional acres would be disturbed.

There is a material balance issue related to the construction of the portal patio. The portal patio requires 64,700 cubic yards of fill and only 19,900 cubic yards can be obtained from cuts on the portal pad. Therefore, there is a 44,800 cubic yard difference or deficit of material. Tintina proposes to take the 16,900 cubic yards of subsoil stripped from the waste rock pads and use it to construct the portal pad, to bring the deficit amount of material to 28,900 cubic yards that would have to be imported from offsite. In closure, Tintina would place a 3-foot lift of clean fill on top of the remaining portion of the 3.8 acre NAG pile. This requires about 18,500 cubic yards of additional material that would need to be derived from the excess previously placed on the portal patio. This leaves an excess of material on the portal patio of about 10,400 cubic yards.

Tintina would reclaim the site to its original topographic configuration, except the excess material from the portal pad (28,900 cubic yards) would modify the post-closure topography slightly in two areas.

Soil Suitability for Land Application of Water

LAD would increase the potential for soil slumping, soil contamination, and leaching of contaminants to surface and groundwater. Ten areas were evaluated for potential operation of LAD systems based on soil type, landscape position, and hydraulic properties (Figure 11). These areas are located in the vicinity of the decline.

Constant head tests were conducted using double-ring infiltrometers (ASTM D 3385-88) to measure saturated hydraulic conductivity of surface soil and shallow subsoil. These data were used to evaluate the suitability of different locations for construction and operation of surface and shallow subsurface LAD systems such as sprinkler irrigation systems or shallow underground drain fields to dispose of excess water. Approximately 12 feet below ground surface falling head percolation test pits were also used to measure hydraulic conductivity of underlying geologic materials to evaluate the suitability for deeper LAD systems.

The conceptual maximum LAD application rates that can be expected based on LAD system discharge area and site-specific infiltration rate/saturated hydraulic conductivity values were evaluated. Potential soil stability, changes to downgradient water quality, and other factors were also considered. These factors would be monitored during LAD operations and discharge volumes would be adjusted to avoid adverse impacts.

The water to be land applied in the surface system may include decline groundwater inflows influenced by one or more bedrock units; water collected in the NAG seepage pond; drill sump water following removal of suspended solids; and any water from treatment systems. Because kinetic humidity cell tests are ongoing, and water treatment systems are under design, Tintina cannot quantitatively predict the chemistry of water that would be land applied using the surface LAD system. By mid-2013, Tintina would conduct a series of batch attenuation tests, using representative samples of surface soils developed within the proposed surface LAD areas F and J. A synthetic discharge solution representative of the major ion chemistry of the water would be created for the test, to which varied concentrations of key metals and nutrients of concern would be added, in order to develop isotherms describing the attenuation potential of the soils within the LAD areas. A plan for this laboratory test work would be prepared for discussion with the regulatory agency prior to its implementation. This work would be completed prior to any discharge of water to the surface LAD areas.

In general, surface soil horizons have limited ability to infiltrate water, hydraulic conductivities decrease with depth within the soil profile due to higher clay concentrations that increase with depth. Surface LAD would not be optimal in these areas and would only be possible on a seasonal basis and of limited duration due to surface soil saturation. This is consistent with NRCS data which rate these soils' ability to infiltrate water as "very limited" due to slow water movement based on modeled results (NRCS, 2011). Soil at location J is sandy and infiltrated water more quickly compared to other area soils. This location is preferred for surface LAD.

At locations F, H, and I, the shallow Copenhaver soil type 1175D overlies highly fractured Precambrian shale. The shale has relatively high hydraulic conductivities and locations F, H, and I are preferred to construct subsurface LAD systems particularly given their proximity to the portal area. Location K was not investigated during field activities but is inferred to have similar soil and parent material properties as locations H and I based on its location, vegetation, and landscape position.

Slope angles in the proposed subsurface drain field's areas range from 1 percent in location F, 3 percent in areas K and I, to 6 percent in location H. These slope angles would minimize risk of slumping in these areas from shallow (4-6 feet deep) saturated conditions in underlying fractured bedrock. In addition, the shale in these areas strikes about N15^{o}E and dips about 6^{o} N. These bedrock dip directions are orientated directly opposite to the slope direction in area H. Areas K and I are at an angle of 90^{o} to the slope direction, which would limit the formation of near surface slumps. These locations (H, I, and K) would also be favorable for operation of a subsurface LAD system.

The average hydraulic conductivity calculated for the two deep percolation test pits in location F is 22 ft/day. Location F has the capacity to percolate about 4,887 gpm per acre of LAD system trenching two feet deep at the surface of or within the fractured shale parent material. A LAD system could be located near the top of the broad ridge at location F and designed to dispose of the actual volume of water to be discharged.

It is not technically possible to discharge water evenly across the entire LAD area using a subsurface piping system unless pressure compensating valves are used for water flow controls in the lateral lines and careful monitoring tracks soil saturation throughout the LAD field. Tintina would monitor mounding effects from LAD through a series of piezometers installed in the LAD infiltration areas and would route water to alternate areas if monitoring shows evidence of excessive mounding or soil instability. The discharge rates described for such a system should be considered the maximum volume possible per unit LAD trenching area and not the amount possible per total unit land surface area.

Similar percolation rates were measured for locations H and I located to the southeast and on the opposite side of the surface water divide from location F. Percolation rates measured at location H ranged from 32 ft/day to 450 ft/day. Percolation at location I was 26 ft/day. It is likely that the high percolation rate of 450 ft/day measured at the eastern end of location H is due to isolated fracture conditions in the underlying bedrock. The conservative rate of 32 ft/day would be used to represent this location during calculation of likely water disposal rates. Based on these data the water disposal capacities of locations H and I per acre of LAD system trenching are 7,241 GPM and 5,924 gpm, respectively. Instability related impacts to downgradient wetlands are not anticipated because these are low gradient wetlands and show no evidence of slumping or soil instabilities. Since the infiltration capacity of the soils in the LAD area greatly exceeds disposal demands, oversaturation of the soils is unlikely. Soil saturation would be monitored through a series of piezometers in LAD area I. If the active areas show evidence of excessive mounding, water would be rerouted to alternate areas as needed to avoid oversaturation of the soils.

Using the average water disposal capacities determined for locations F, H, and I gives an overall capacity of 6,000 gpm per acre of LAD trenching for the area of soil mapping unit 1175D located south of the decline portal along the broad ridge separating Little Sheep Creek and Coon Creek. Additional water disposal capacity would be available by operating a subsurface LAD system in locations K and J. Geochemical testing of the gabbro that underlies location E would be warranted should this site be selected for installation of a subsurface LAD system in the future, to evaluate its potential to contribute to metal loading during LAD operations prior to discharging water in this area.

It would also be possible to discharge water using surface drip emitters or a surface wheel-line sprinkler irrigation-type LAD system on a limited seasonal basis. The preferred locations for such systems are F and J due to the highly transmissive sandy soil that is present in these locations. The soil in area J overlies fractured igneous rock which percolates water at a rapid rate. Water applied to the soil surface would infiltrate and percolate at a rate limited by the most restrictive soil or lithic horizon encountered along the flow path. At location J, the soil surface and the underlying bedrock have similar hydraulic conductivities, about 10.3 feet/day. This equates to a water disposal capacity of about 2,300 gpm per acre of land surface for the 9 acre site.

Additional locations that could be considered for surface irrigation-type LAD systems are locations A and F (depending on whether a subsurface LAD system was operating at location F). Location A could be considered for irrigation due to the size and relative flatness of this area as well as its distance from seeps/springs. Operation of such a system at location F would also be possible due to shallow soil thickness and high conductivity of the underlying shale. At location A, the average saturated hydraulic conductivity is restricted by the underlying paralithic material (0.07 ft/day) which equates to a continuous infiltration rate of 15 gpm per acre. Using the same calculations and data for location F gives a range of infiltration rate of 270 gpm per acre.

The predicted inflow into the decline during aquifer tests is over 500 gpm. Tintina has committed to grout the decline to reduce flows to 100 gpm or less. The LAD system is designed for up to 1,800 gpm. Tintina would only discharge water that meets groundwater standards. No surface water or wetland impacts are predicted. The LAD system is designed to limit the potential for soil contamination and leaching of contaminants into groundwater. Tintina would monitor LAD area usage using piezometers located in the LAD areas (Figure 7). No soil monitoring is proposed to quantify soil contaminant levels from LAD during the exploration program.

4.2.3.3 Soils Agency-Mitigated Alternative

DEQ would require Tintina to map and isolate the subsoil cell stored in the portal pad. The subsoil would be located such that it would not be impacted by PAG materials that may be brought out of the decline on vehicles or from spillage during decline development.

Applying water to the surface and subsurface of the LAD areas has the potential to mobilize naturally occurring metals. DEQ would require groundwater monitoring to verify that impacts from applying treated water to the LAD area soils are below the level of significance.

4.2.4 Vegetation Resources

4.2.4.1 Vegetation No Action Alternative

Vegetation has been affected by historic grazing. Licensed exploration activities have disturbed 5.1 acres. No exploration decline would be constructed. There would be no additional impacts from decline construction, removal of waste rock and a bulk sample, or discharge of water. Other exploration activities could continue. More core drilling might occur on the surface including road construction. All exploration activities would have to be reclaimed by replacing stockpiled soils and revegetation with a native seed mix, except the core shed area which would be left for use by the rancher. Vegetation impacts on the 5.1 acres of exploration disturbances include the loss of native plant communities, temporary loss of vegetation productivity and canopy cover, reduction in species diversity, and increased potential for invasive species including noxious weeds. Salvage and replacement of soil and seeding with native species would reduce some of these impacts but the diverse native vegetation communities would not return. This is an unavoidable impact of allowing soil disturbance.

4.2.4.2 Vegetation Proposed Action

The decline site occurs primarily within montane sagebrush steppes and montane grassland habitat types, and also includes a small area of conifer dominated woodlands. Native vegetation seed mixes would be tailored to the soils, climate, environmental setting, proposed land use, and plant community desired on the site. The seed mix would be reviewed and approved by DEQ prior to application.

An additional 46.5 acres would be disturbed. Impacts would be the same as listed in the No Action Alternative. Soil salvage and replacement would minimize vegetation impacts. The decline site, waste rock pads, and seepage ponds cut and fill slopes would be revegetated as soon as practical following initial construction. In closure, the decline site and its associated facilities and the access road from the Black Butte Road to the decline would be revegetated to stabilize disturbance areas and restore wildlife habitat, watershed characteristics, soil productivity, and visual resources to be consistent with post-operation land use objectives. If required by the landowner, private access roads constructed in support of mine operations would be recontoured prior to revegetation.

Seedbed preparation would be conducted immediately after grading, spreading soil, and, if used, fertilizer application. On slopes less than 33 percent, the seedbed would be tilled and harrowed along the contour to break up large clods. On slopes exceeding 33 percent, on sites too narrow to negotiate with equipment, or on sites where organic debris has been respread, the soil surface would be left in a roughened condition. Seed and mulch would be applied during reclamation and closure, but also applied to fresh road cuts and fills as soon after construction as possible to ensure coverage by natural sloughing.

Cultural treatments would be practiced to ensure successful revegetation and include fertilizing, mulching, and respreading woody debris. Ripping would be conducted prior to soil application to reduce compaction of the top of the waste rock dump, building sites, and the portion of road surfaces that would be reclaimed. Reapplied soils would be cultivated to reduce compaction to improve water and air movement.

The decision to use fertilizer would be based on cover soil tests; application rates would be formulated to achieve soil macronutrient levels capable of promoting plant growth and productivity.

Tintina would make reasonable and conscientious efforts to identify, control, and suppress all weeds which its operations introduce or are likely to introduce. Noxious weeds would be controlled using appropriate mechanical, biological, and chemical treatments which meet the requirements of Montana laws. Tintina's weed control program has been developed in cooperation with the Meagher County Weed District for advice on identification of noxious weeds, appropriate treatment methods, and application rates.

Tintina has consulted with landowners and the County Conservation District on what seed types and mixes to use for reseeding disturbed areas. Tintina's lease agreements with underlying ranch owners require weed control programs for disturbances created by Tintina and this plan has been presented to DEQ in various exploration drilling program plans. A more formal weed control plan would be developed between the landowners, County weed control officials, and Tintina prior to completion of the decline permitting process.

4.2.4.3 Vegetation Agency-Mitigated Alternative

Same as Proposed Action.

4.2.5 Cultural Resources

4.2.5.1 Cultural Resources No Action Alternative

Under the No Action Alternative the exploration decline would not be constructed. There would be no additional impacts from decline construction, removal of waste rock, or discharge of water. Other exploration activities could continue. More core drilling might occur on the surface.

4.2.5.2 Cultural Resources Proposed Action

Cultural resources were summarized in Section 3.6. Tintina would upgrade an existing two-track road into an exploration decline portal access road. Site 24ME163, a potentially NRHP eligible prehistoric site, was identified on the proposed access road during the 2011 cultural inventory. Due to the location of the site in a slightly lower elevation area, Tintina indicated that only fill work would occur within the site boundaries. After consultation with SHPO and DEQ, it was agreed that burial of the site would be sufficient to achieve 'No Adverse Effect' to the site since this would result in minimal ground disturbance and protection of the resource. SHPO recommends an archaeologist be present during road construction in the vicinity of the site. No other cultural resources identified within the Project area would be impacted by the proposed exploration activities.

4.2.5.3 Cultural Resources Agency-Mitigated Alternative

DEQ recommends an archaeologist be present during road construction in the vicinity of the site.

5.0 CUMULATIVE IMPACTS

Cumulative impacts are the combined, incremental effects of human activity in the Project Area. One active mine is in this region.

(1) The existing Holcim Black Butte iron ore mine is about a mile from the proposed decline. That mine produces hematite ore for use at the Holcim Trident cement plant. The ore from that mine is not acid-producing and is not known to produce any geochemical environmental impacts. The cumulative impact would be an increase in traffic on the access road and highway.

6.0 REGULATORY RESTRICTIONS ANALYSIS

State agencies are required to evaluate in their MEPA documents any regulatory restrictions proposed to be imposed on the use of private property. The Proposed Action would allow Tintina to conduct mineral exploration activity on private property. The No Action Alternative would prevent Tintina from conducting any mineral exploration activity on private property. The Agency-Mitigated Alternative would alter and restrict the way Tintina conducts exploration and reclamation on private property.

Governmental entities generally have the authority and responsibility to protect the public health, safety and welfare. Under this "police power," governmental entities may limit the use of real property through land use planning, zoning ordinances, set back requirements, and environmental regulations. Normally, a governmental entity's exercise of its police powers does not involve a taking of private property. Nevertheless, at some point government regulations may go too far and constitute a taking of property.

The No Action Alternative would prohibit Tintina from conducting exploration activities, precluding it from ascertaining the extent and value of its mineral ownership and, potentially, from deriving economic benefit from its mineral ownership. This alternative is extremely restrictive of Tintina's private property and may lead to Tintina's initiation of a legal takings action.

The mitigation measures required under the Agency Mitigated Alternative are designed to ensure compliance with the regulatory requirements of the Metal Mine Reclamation Act and the Montana Water Quality Act. The mitigation measures do not result in a physical occupation of private property, do not deprive Tintina of all economically viable uses of its property, deny Tintina a fundamental attribute of property ownership, require Tintina to dedicate a portion of its property or grant an easement, have a severe impact on the value of Tintina's property, or cause physical disturbance with respect to Tintina's property that is in excess of that sustained by the public generally. Therefore, there are no takings implications.

7.0 PUBLIC NOTIFICATION AND PREPARATION

A Legal Notice and Press Release would be issued upon availability of a Draft Environmental Assessment for this Project.

The Proposed Action Application is on the DEQ website at http://deq.mt.gov/ea.mcpx

EA Reviewers and Preparers

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8.0 NEED FOR FURTHER ANALYSIS, MAGNITUDE AND SIGNFICANCE OF POTENTIAL IMPACTS AND PROPOSED DECISION

DEQ has determined that all of the impacts of Tintina's proposed exploration project have been identified and are discussed above. As indicated above, the impacts of the proposed exploration project will be mitigated below the level of significance and no significant impact is likely to occur.

DEQ proposes to approve the Agency-Mitigated Alternative. This decision could change after consideration of any substantive comments received on the Draft EA.

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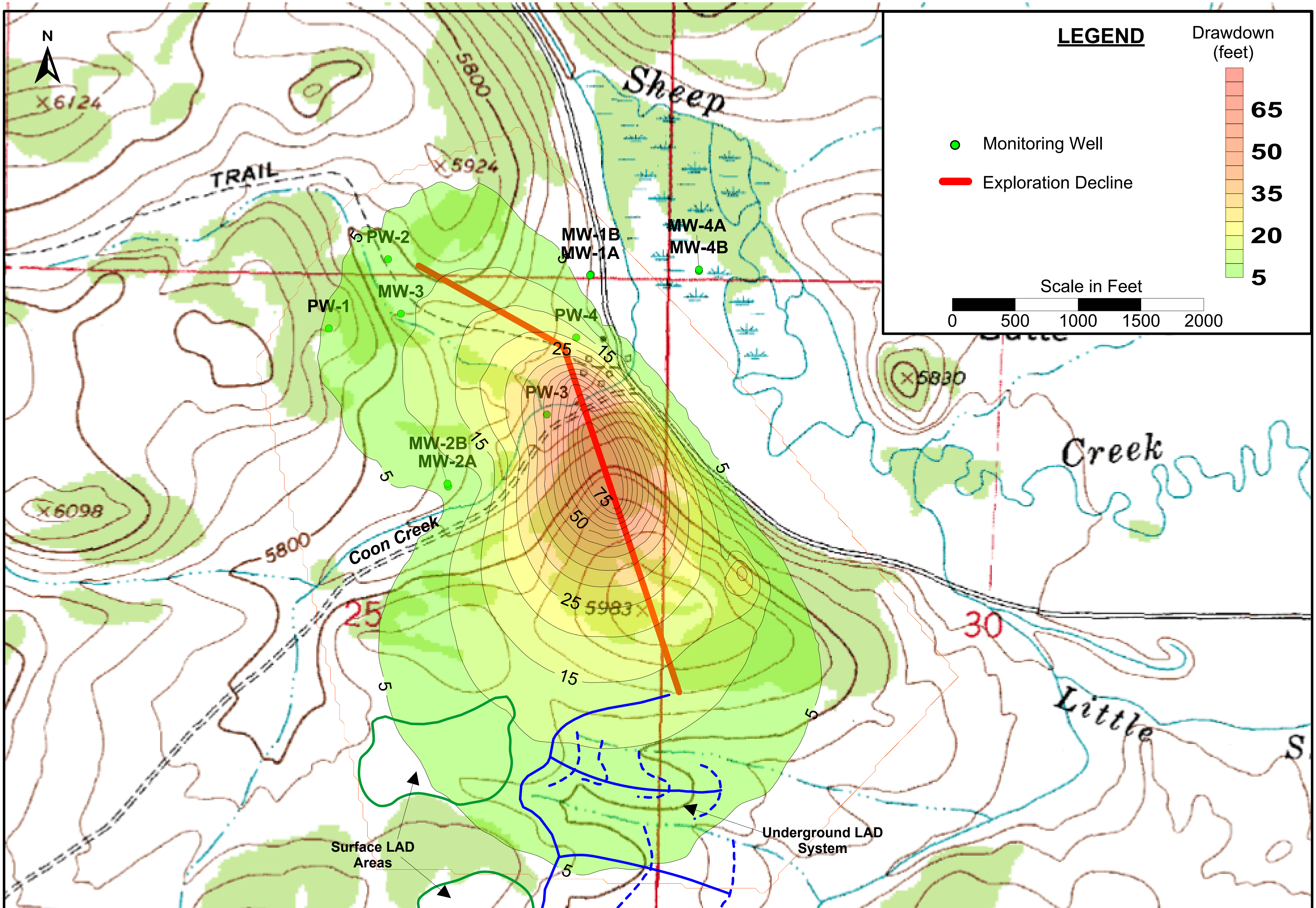

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Consulting Scientists and Engineers

Tintina Alaska Exploration Inc.
Black Butte Project
Meagher County, Montana

SIMULATED DRAWDOWN
ADIT DISCHARGE 500 GPM

FIGURE
8

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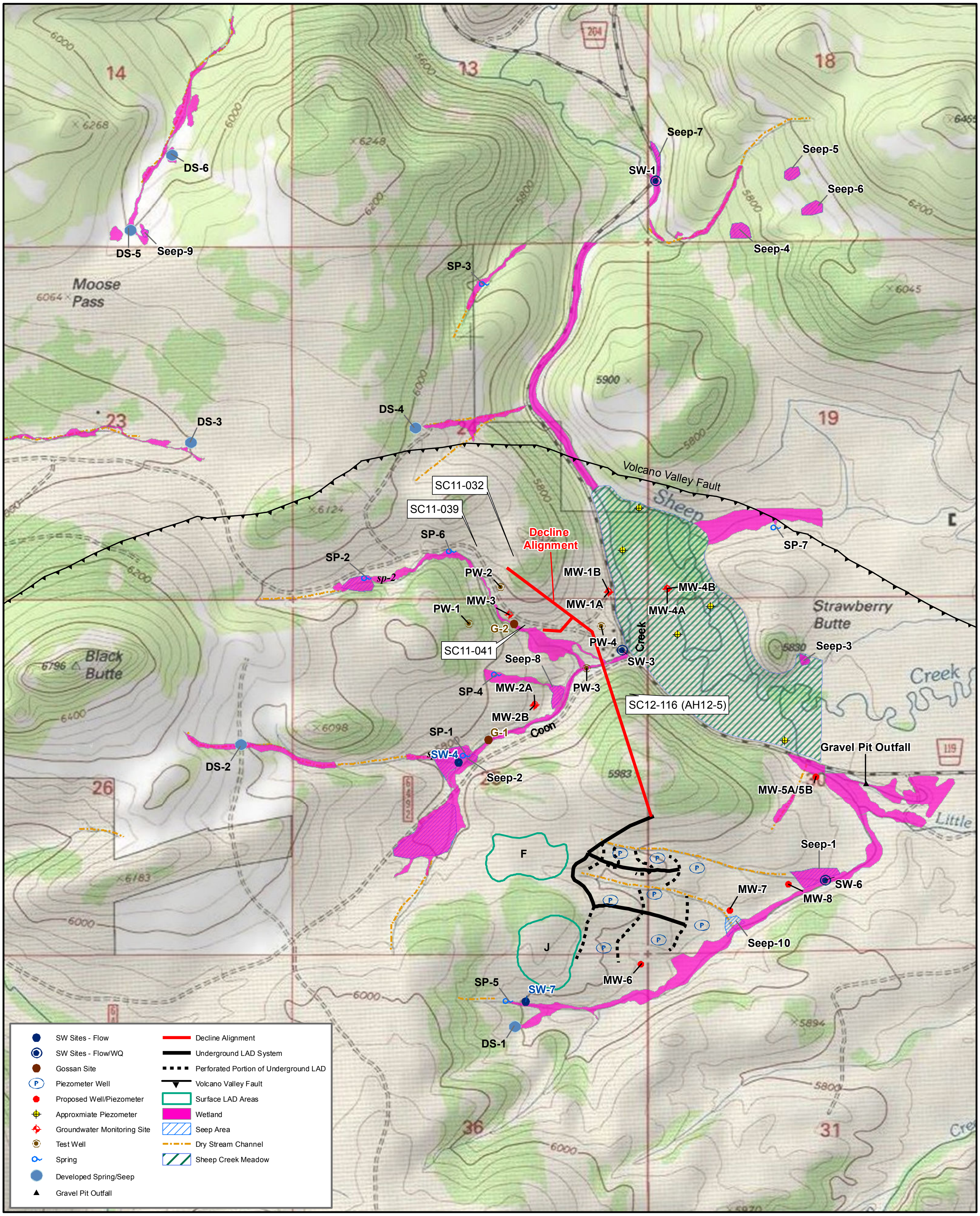
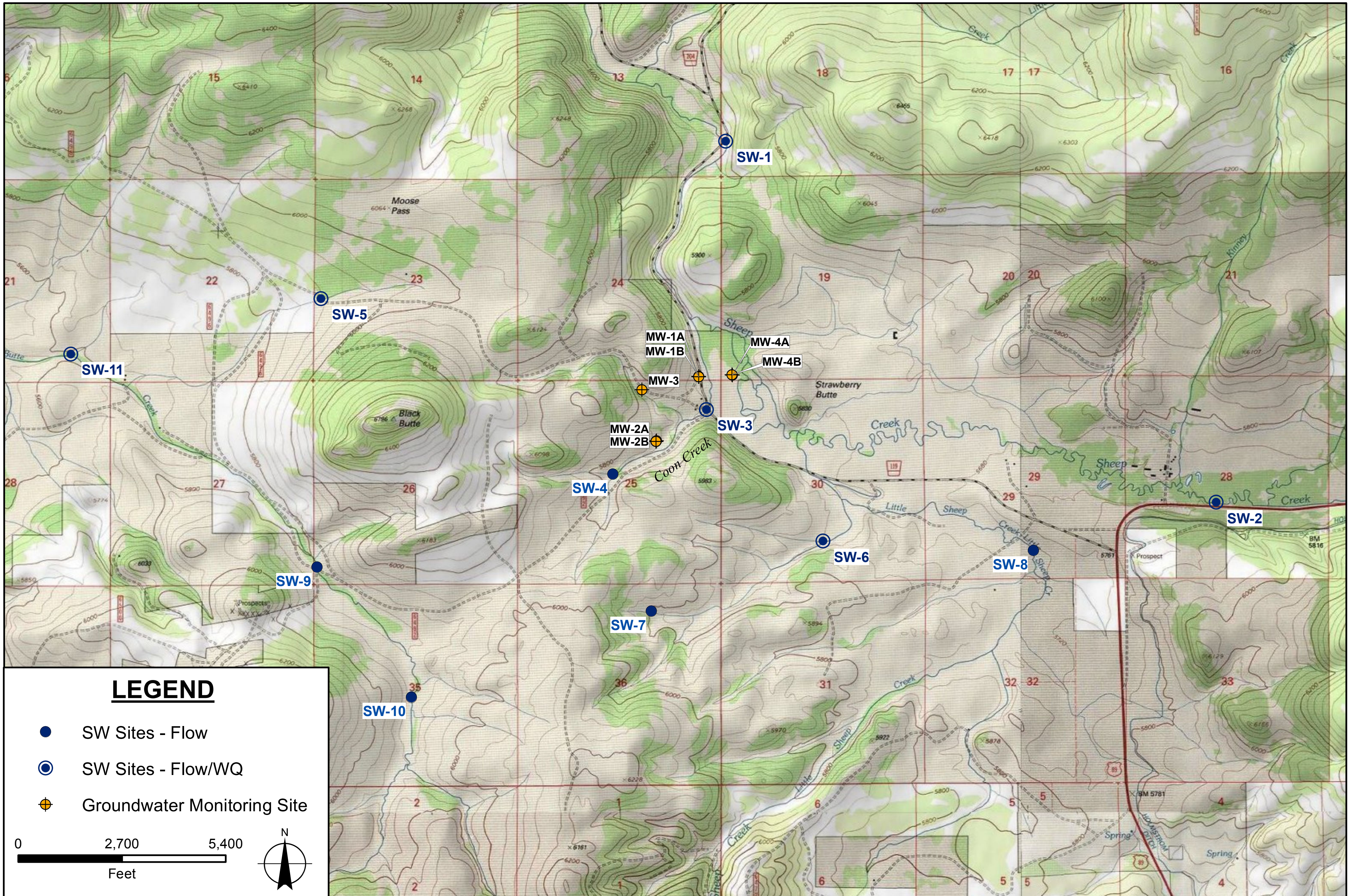


Figure 7

Surface Water and Groundwater Monitoring Sites and Wetlands

Black Butte Copper Project



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Consulting Scientists and Engineers

Tintina Alaska Exploration Inc.
Black Butte Project
Meagher County, Montana

GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

FIGURE 6

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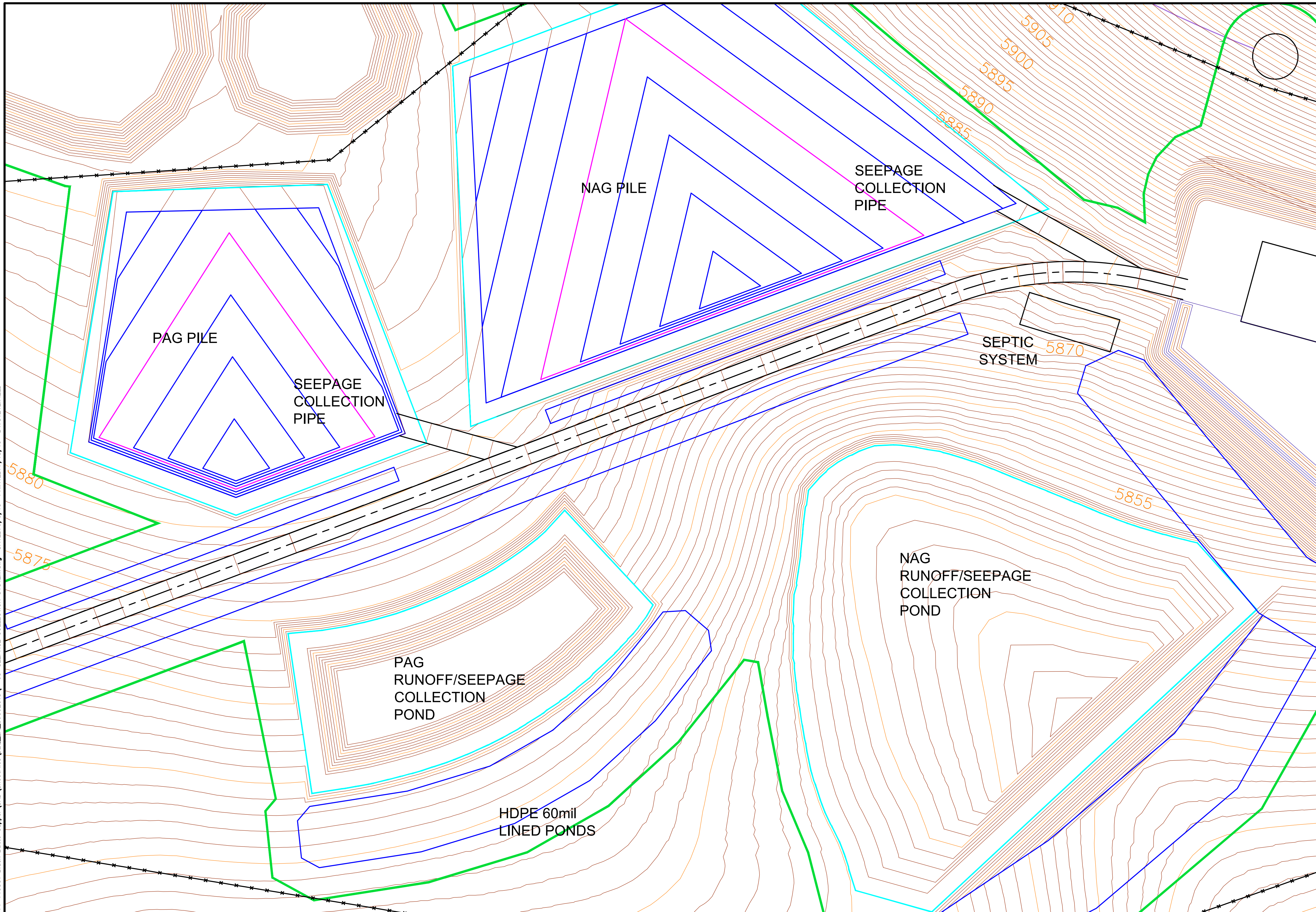

GENERAL NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN FEET.

LEGEND:

MAJOR CONTOURS.................................... 5890

MINOR CONTOURS....................................

PAD MAJOR CONTOURS............................

PAD MINOR CONTOURS.............................

LINER..

N

SCALE

100' 0 100' 200'

CONTOUR INTERVAL 1'

TINTINA RESOURCES

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REFERENCE	ENGINEER'S SEAL	Rev	Description	BY	Date
	DRAFT	A			

REVISIONS

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Drawn by: MRH
Checked by: TLM
Approved by: TLM

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Issued by:

TETRA TECH

120 West Park Drive, Stuite 204
Grand Junction, Colorado 81505
(970) 986-3566 (970) 241-3120 fax

Title:

SEEPAGE COLLECTION SYSTEM

A REVISION

Project: TINTINA GOLD

Project no.: 114-710301

Figure no. 05

Location: MEAGHER COUNTY, MONTANA

Date: 08/12

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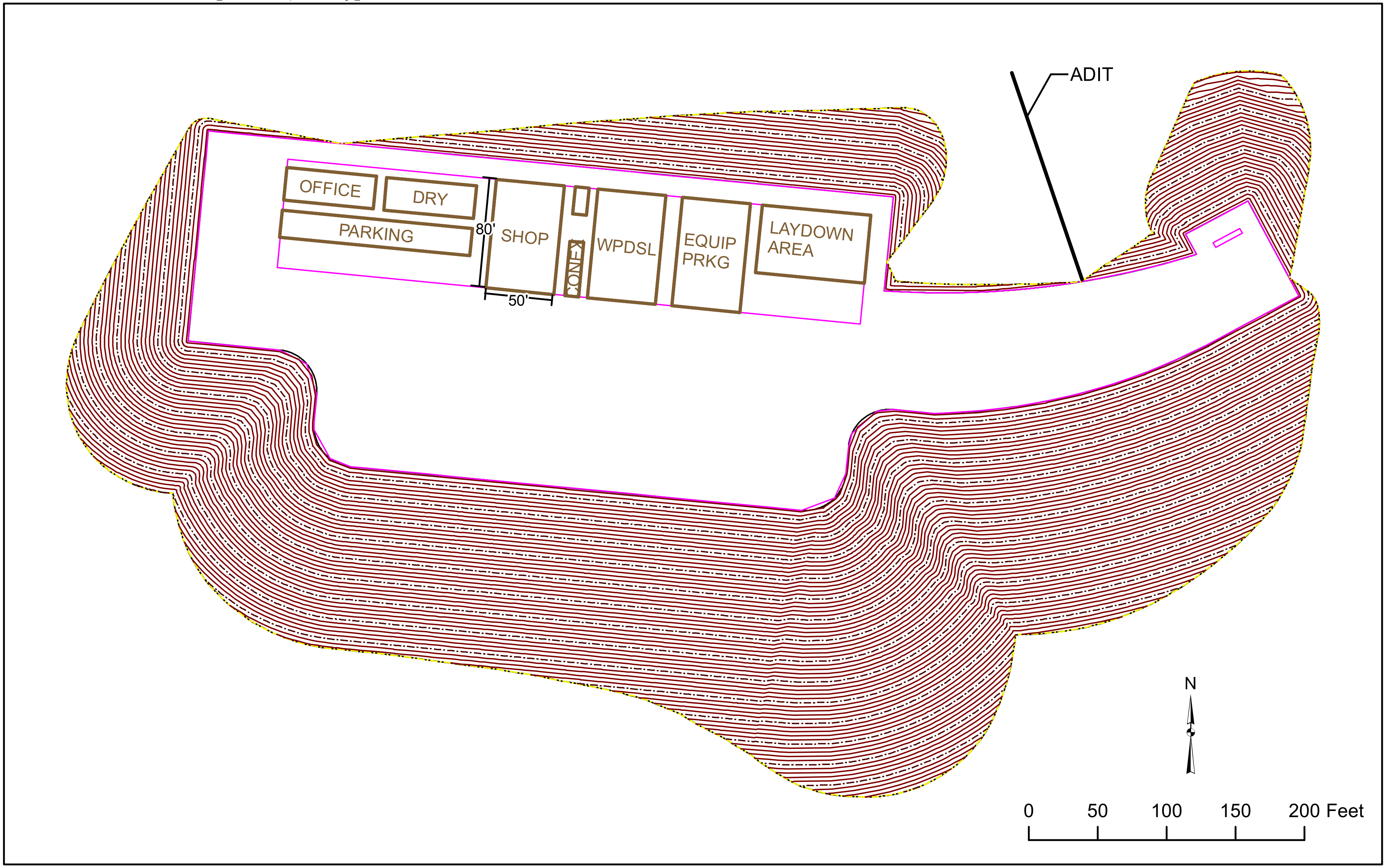
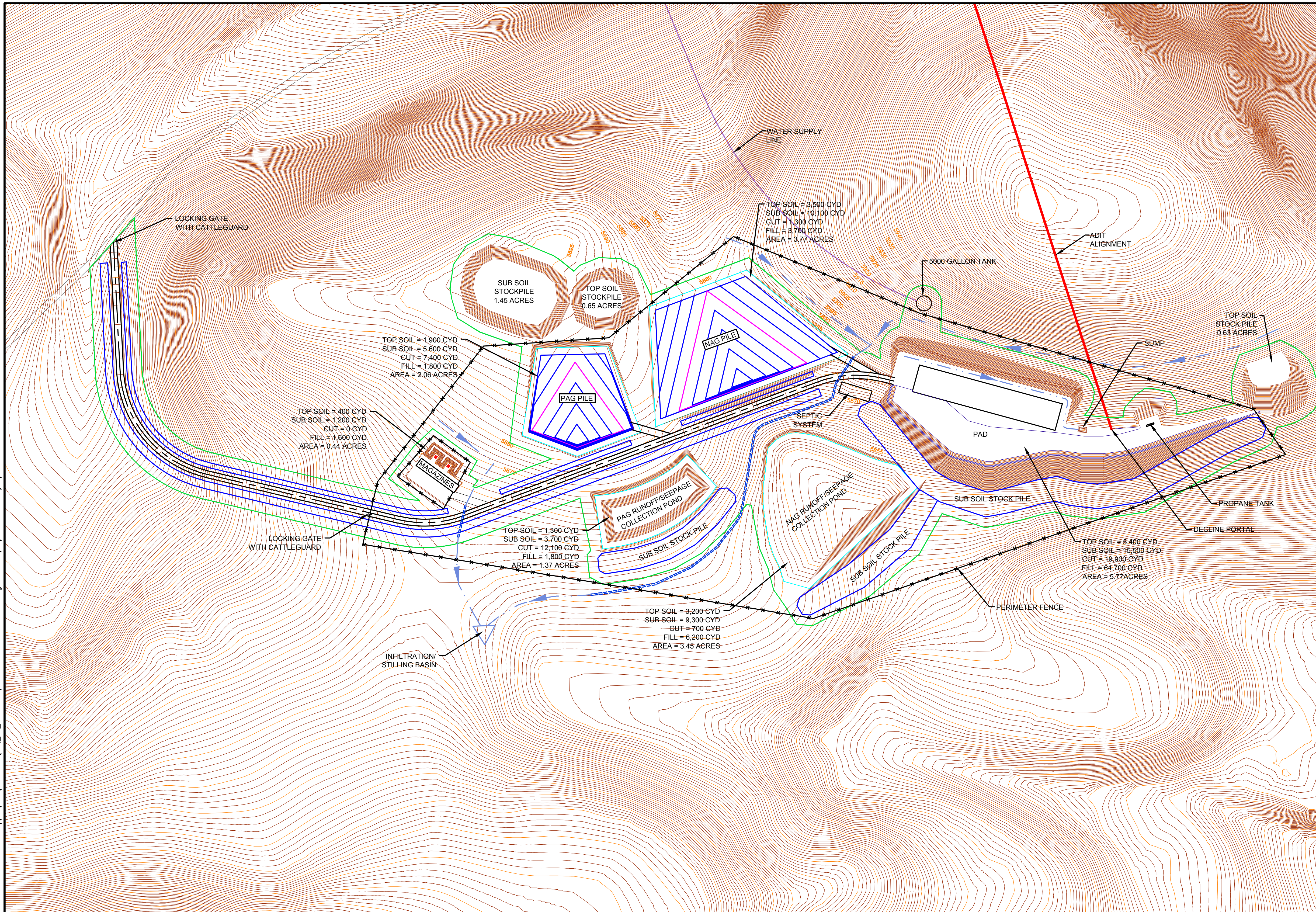


Figure 4
Portal Patio Site Plan
Black Butte Copper Project
Meagher County, Montana

TINTINA RESOURCES



GENERAL NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN FEET.

LEGEND:

EXISTING

- MAJOR CONTOURS (5920)
- MINOR CONTOURS
- STORMWATER DIVERSION
- SOIL STOCK PILE
- LINER
- LIMITS OF DISTURBANCE
- CULVERT
- RUN OFF CONTROL DITCH
- RUN ON CONTROL DITCH
- WATER SUPPLY LINE
- FENCE

N

SCALE

150' 0 150' 300'

CONTOUR INTERVAL 1'

TINTINA RESOURCES

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REFERENCE	ENGINEER'S SEAL	Rev	Description	BY	Date
	DRAFT	A			

REVISIONS

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120 West Park Drive, Stuite 204
Grand Junction, Colorado 81505
(970) 986-3566 (970) 241-3120 fax

Title:

MID-SCALE SITE PLAN MAP

A REVISION

Project: TINTINA GOLD
Project no.: 114-710301
Figure no. 03
Location: MEAGHER COUNTY, MONTANA
Date: 08/12

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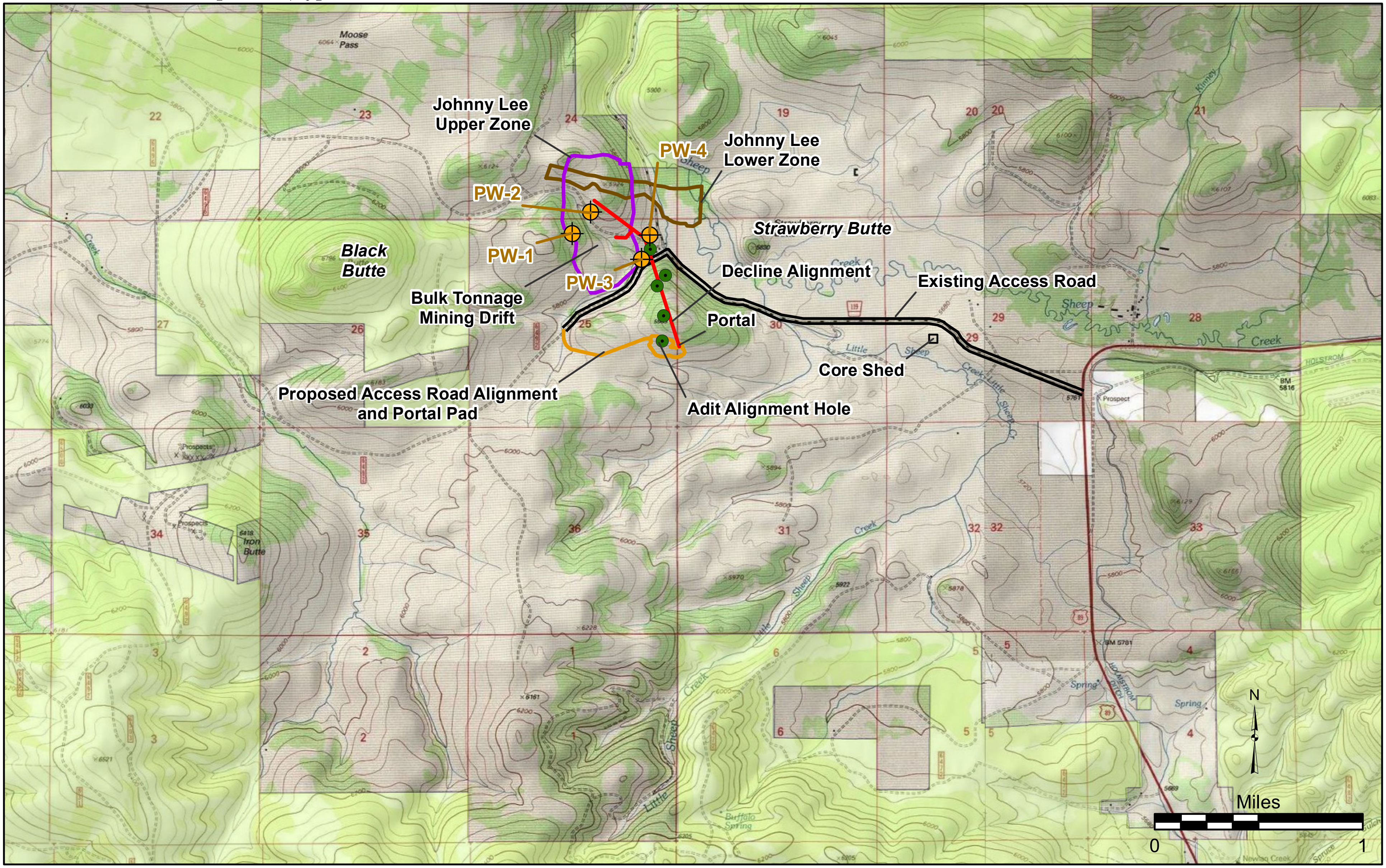


Prepared by Tetra Tech, Inc. 2012

Pumping Wells
Adit Alignment Holes
Decline Alignment
Existing Access Road
Proposed Access Road Alignment and Portal Pad
Core Shed
Johnny Lee Lower Zone
Johnny Lee Upper Zone
US Forest Service

TINTINA RESOURCES

Figure 2

Site Vicinity Map, Exploration Decline and Access Roads

Black Butte Copper Project

Meagher County, Montana

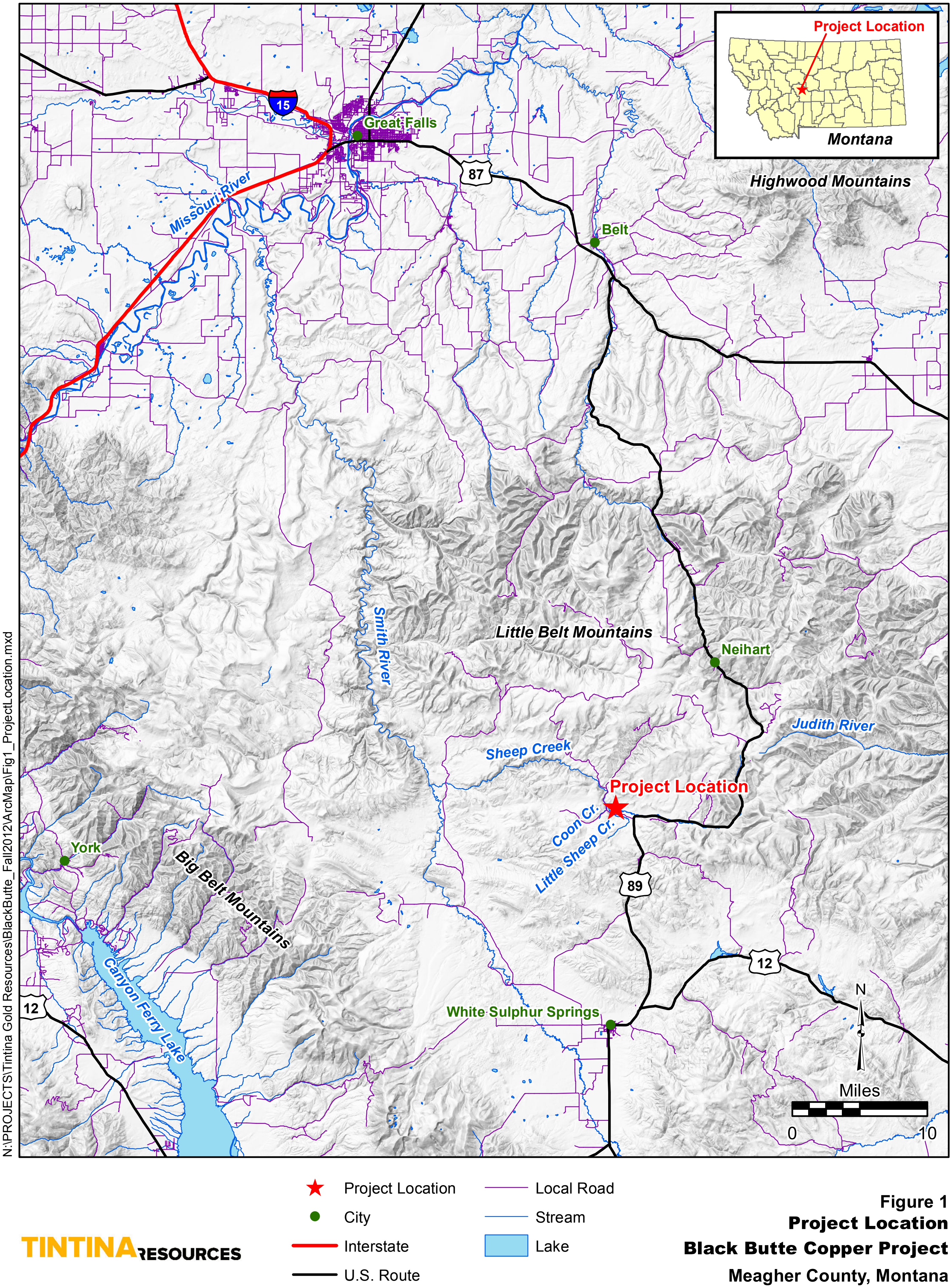
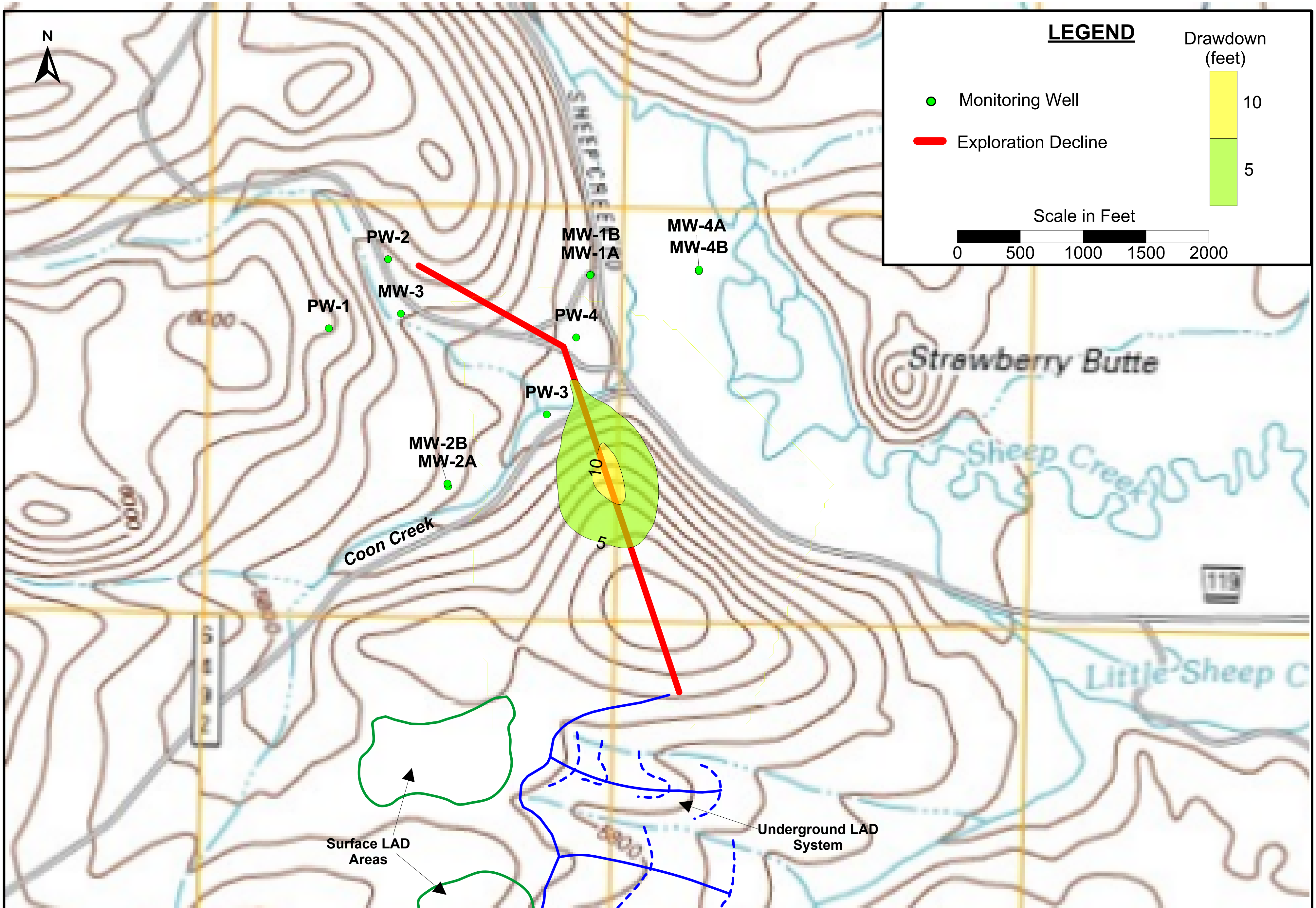
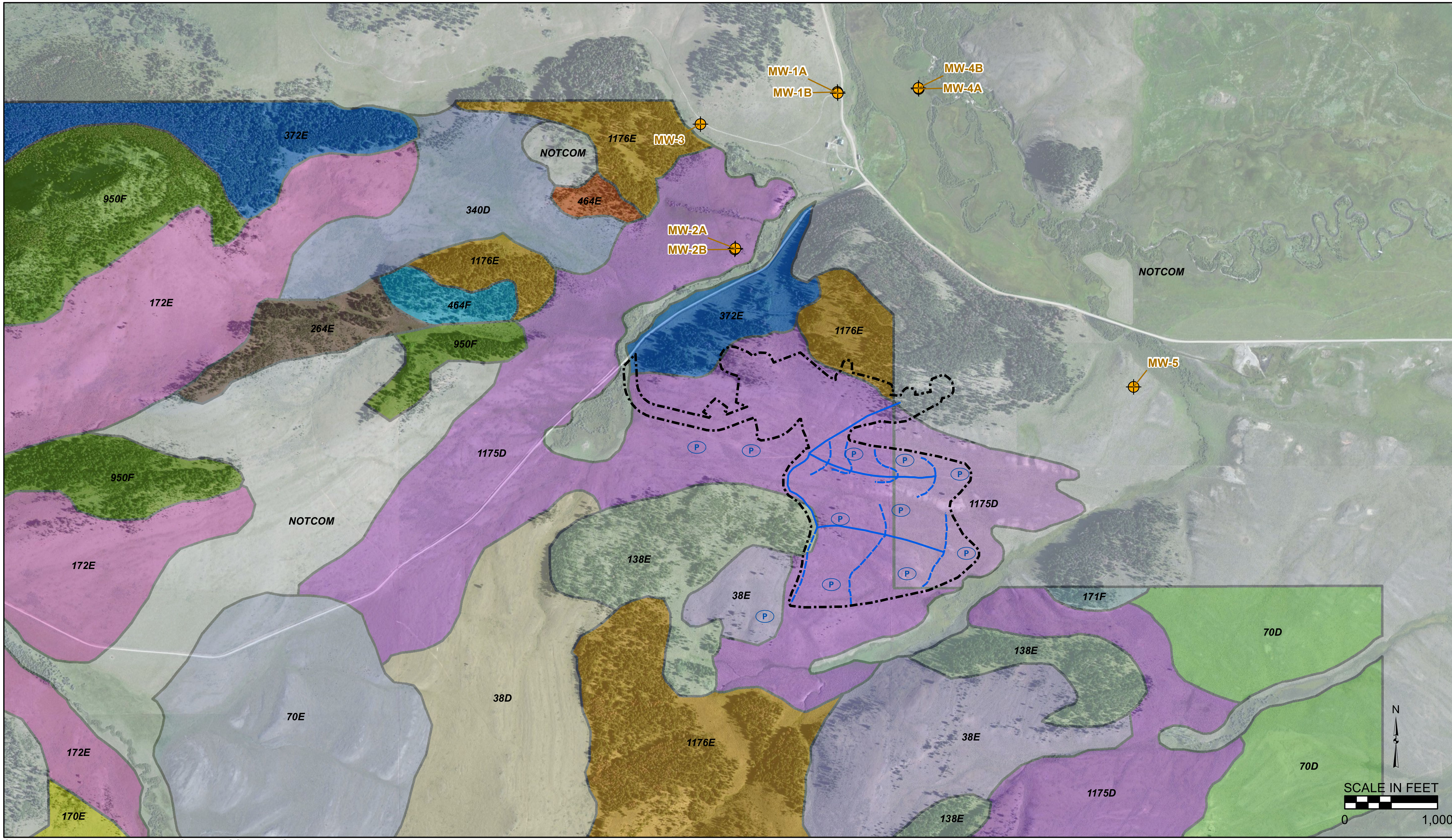


Figure 1
Project Location
Black Butte Copper Project
Meagher County, Montana



Hydrometrics, Inc. Consulting Scientists and Engineers	Tintina Alaska Exploration Inc. Black Butte Project Meagher County, Montana	SIMULATED DRAWDOWN ADIT DISCHARGE 100 GPM	FIGURE 9

K:\Project\11048\Maps\Fig-9_AditDrawdownAnalysis (Steady State-100).srf



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Soil Map Units: 38E, 1175D etc. refer to NRCS (2011) Soil Mapping Units. See Table 1.
NOTCOM - NRCS soil survey not completed in this area.

Piezometer Well
Groundwater Monitoring Wells
Disturbance Area
Perforated Portion of Underground LAD
Underground LAD System

TINTINA RESOURCES

Figure 10
Soils Map
Black Butte Copper Project
Meagher County, Montana

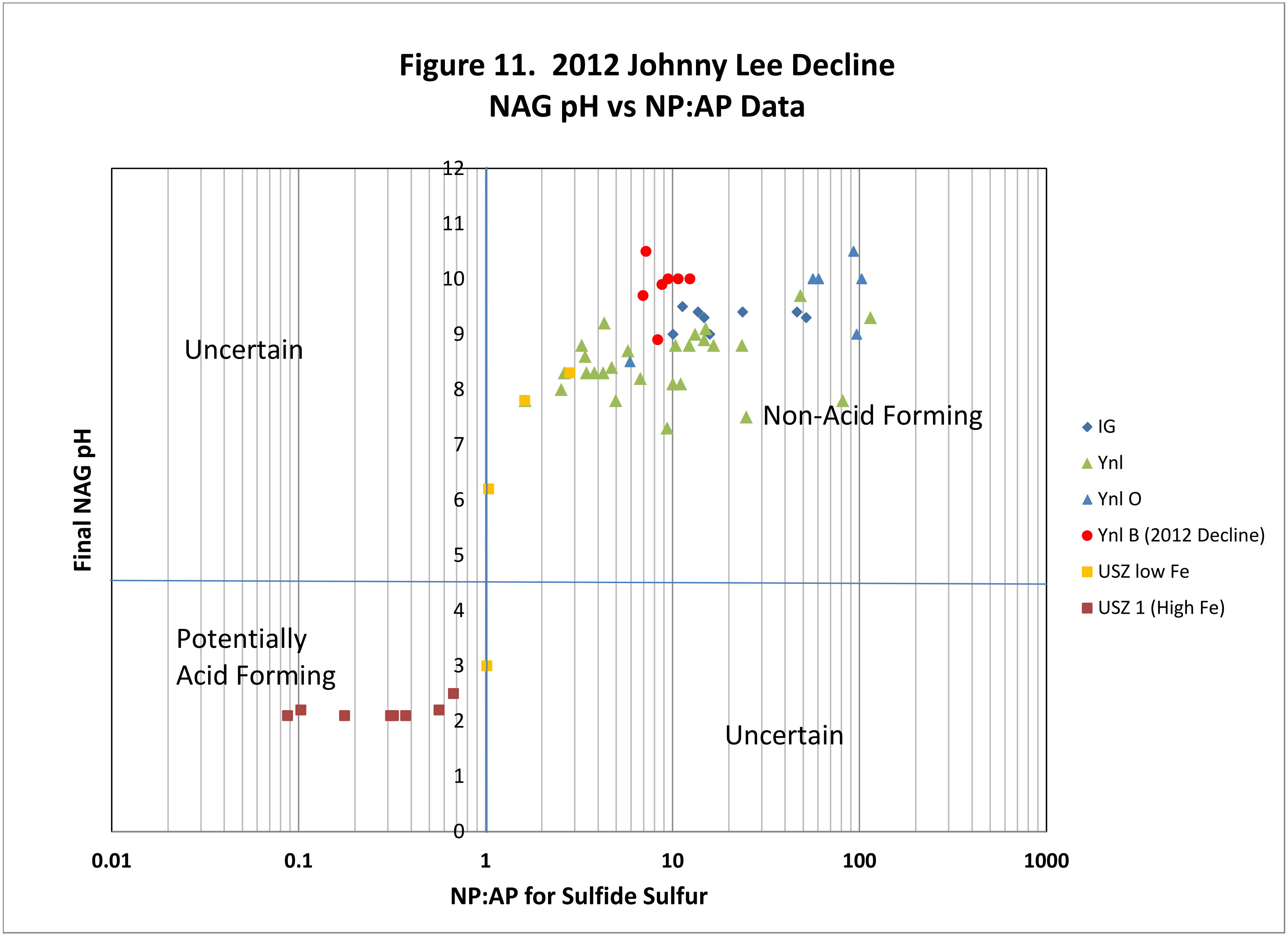
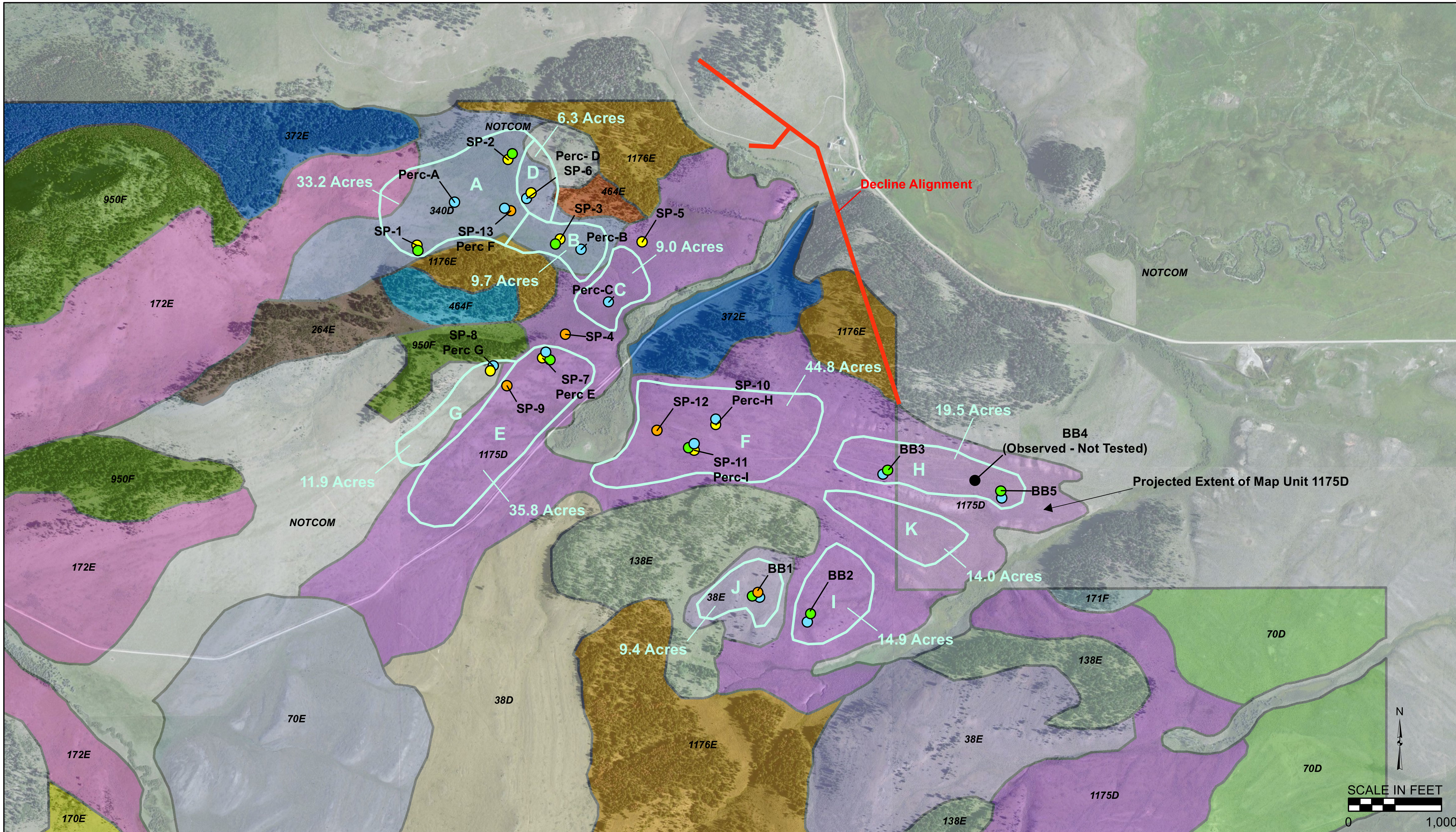


Figure 11. 2012 Johnny Lee Decline
NAG pH vs NP:AP Data
Final NAG pH
NP:AP for Sulfide Sulfur
0.01
0.1
1
10
100
1000
0
1
2
3
4
5
6
7
8
9
10
11
12
Uncertain
Non-Acid Forming
Potentially
Acid Forming
Uncertain
IG
Ynl
Ynl O
Ynl B (2012 Decline)
USZ low Fe
USZ 1 (High Fe)



Soil Map Units: 38E, 1175D etc. refer to NRCS (2011) Soil Mapping Units. See Table 1.
NOTCOM - NRCS soil survey not completed in this area.
Figure prepared by Tetra Tech, Inc. 2012

TINTINA RESOURCES

Deep Percolation Test Site
Infiltrometer Test Site
Soil Profile (Described)
Soil Profile (Described and Sampled)
Decline Alignment
Sampling Areas

Figure 12
Soil Infiltration Testing Map
Black Butte Copper Project
Meagher County, Montana