Buckhorn Access Project
Chapter III
Affected Environment and Environmental Consequences

INTRODUCTION

This chapter presents information about the environment that would be affected by the Buckhorn Access Project, and the direct, indirect and cumulative effects of implementing the alternatives for the Buckhorn Access Project. These effects are the scientific and analytic basis for the comparison of alternatives. The information presented in this chapter summarizes and cites the specialist's reports that are found in the project analysis file. Full versions of these specialist's reports are available at the Tonasket Ranger District office in Tonasket, Washington.

Each resource area discloses the direct, indirect and cumulative effects for that resource area. The National Environmental Policy Act defines these as:

> **Direct** – effects which are caused by the action and occur at the same time and place
> **Indirect** – effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable
> **Cumulative** – impacts that result from the incremental impact of the action, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions

Direct and indirect effects are limited to those effects caused by the Forest Service project on NFS lands and adjacent to NFS rights-of-way. So, for example, Alternative D's direct and indirect effects do not discuss the longer route resulting from the use of that route, although this information is discussed as applicable in the cumulative effects section for that alternative.

The project interdisciplinary team (IDT) identified past, present, and reasonably foreseeable future actions that might have cumulative impacts with the proposed action early in the analysis process. Those actions listed below were developed from a much larger list of past actions which is contained in the project file. Only the past actions that the IDT considered to still be having impacts on resources affected by the Buckhorn Access project are included in this analysis. Each resource area considered different mixes of these actions, depending on the cumulative effects boundary for the resource area and the resource affected. For example, the cumulative effects analysis for deer considers the Forest Plan management areas as the cumulative effects boundary, whereas hydrology considers the analysis watersheds as the cumulative effect boundary. Only those past, present and reasonably foreseeable actions that overlap the geographic analysis area boundary for each particular resource are considered, and only if those other actions have or are expected to have overlapping effects with the Buckhorn Access Project. Some past projects may still be having effects on one resource, but not another.

The suite of past, present and reasonably foreseeable future actions developed by the project team, and examined for overlapping effects with each resource in the Buckhorn Access Project are[24]:

Past Actions (those with * are also ongoing and reasonably foreseeable)

- Crown Resources/Battle Mountain Gold/Newmont/Kinross Exploration and Pre-development Activities* (Crown/Kinross has on-going exploration activities on their patented land)
- Battle Mountain Gold/Newmont Reclamation
- Historic Mining
- Firewood cutting and hauling, and user created roads to access firewood*
- Noxious weed treatments*
- Livestock grazing on Ethel, Gold, and Cedar allotments, and Washington State Department of Natural Resources (DNR), Bureau of Land Management (BLM) and private lands*
- Hunting, fishing and gathering by members of the Confederated Tribes of the Colville Reservation*
- Patenting of Crown Resource's claims
- Construction of the existing road system
- Past road closures on the Crown Jewel Mine project and three Nicholson Timber Sales
- Nicholson Creek culvert replacements

Past actions are analyzed consistent with current case law and guidance developed in 2005 by the Council on Environmental Quality (CEQ). As noted by CEQ, the National Environmental Policy Act (NEPA) is forward looking, but requires a review of past actions to the extent that the review informs agency decisionmaking regarding the proposed action. According to CEQ, agencies should look at the present effects of past actions that are, in the judgment of the agency, relevant and useful because they have significant cause-and-effect relationships with the direct and indirect effects of the proposal. Agencies are not required to list or analyze the effects of individual past actions unless such information is necessary to describe the cumulative effect of all past actions combined. Generally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions, without delving into the historical details of individual past actions (CEQ, 2005). In this EIS, where the past actions listed above may have cumulative effects on the specific resource under discussion, the effects of those actions are described as part of the affected environment information for each resource, and summarized in the cumulative effects analysis. Some resources, like transportation, analyze the past actions, such as past road construction, as part of the overall depiction of the direct and indirect effects analysis.

Ongoing actions (in addition to those listed above with stars; those with stars below are also all reasonably foreseeable):

- Wauconda Quarry (transportation overlap with supply route during operations)*
- Ongoing recreation and road use for snowmobiling, hunting, fishing, hiking, camping (including at Beth and Beaver Lake Campgrounds - overlaps potentially with Alternative D for people accessing campgrounds on CR 9480), sightseeing and OHV use*
- Little Nicky Timber Sale (232 acres of harvest on DNR land, S22,27, T40N, R31E – haul out 3575-040 and 3575 road with one mile of road construction, plus riprap and

[24] Many other past projects have happened in the project area, but were determined to not have overlapping cumulative effects with the Buckhorn Access Project.

ditching). The road was constructed in 2005, and tractor yarded ground has already been hauled. Most other activities and haul from Little Nicky are expected to be complete in 2007
- Reconstruction of Toroda Creek road
- Deferred road maintenance and use of the 3575-120 and 3575-140 roads for the Buckhorn Mountain Project*

Reasonably Foreseeable Future Actions[25]:
- Buckhorn Mountain Project (non-NFS components, including conceptual mitigation that would occur on non-NFS lands)[26]
- Replacement of culvert where Toroda Creek road crosses Marias Creek with an arch that provides for fish passage
- Future road maintenance to reclose non-system roads that were previously closed, but breached for firewood gathering or recreational activities
- Air Quality only: many timber sales and fuels reduction projects with potential for air quality overlaps where prescribed burning has not yet been completed
- Noise only: haul of the remaining ore from the K2 mine on County Road 501 to the Kettle River mill.

The cumulative effects analysis for the Buckhorn Mountain (Mining) Project presented herein is based on effects disclosed in the Department of Ecology's final supplemental Environmental Impact Statement (DSEIS) for that project published in September 2006. That FSEIS is incorporated by reference, and cited where appropriate. NEPA encourages agencies to reduce excessive paperwork by incorporating other documents by reference [40 CFR 1500.4(j)].

The Washington State Department of Fish and Wildlife (WDFW) is concerned about the effects to deer in deer winter range for this project. As analyzed in the wildlife section later in the chapter, the Forest Service does expect that deer would avoid the area adjacent to the road, but some deer may be injured or killed in vehicle accidents. The primary effect is expected to be avoidance of habitat near the ore haul route and restriction of movement across the haul route. However, as noted in the transportation and wildlife sections, the preferred alternative would substantially reduce existing road density in one of the deer winter range management areas affected by the ore haul route, and moderately reduce it in another, by requiring closure of other roads in the management area (although road density in another deer winter range management area would be increased because of its very small size). In addition, the project is requiring a lower speed limit than County regulations to limit mortality. As such, adequate mitigation is in place for deer. The Forest Service is committing to looking at the potential to create habitat for deer in the deer winter range portion of the 2010 Cache project, located in the Bonaparte Block of National Forest System lands, several miles south of the Buckhorn Access Project area. No proposal for the Cache project has been developed, and this should in no way be construed as a proposed action; no specifics have been developed for this project other than to identify a potential project

[25] preliminary EA included the "Ventana Resort", but the only resources that discussed this indicated there would be no cumulative effects from this project, so this project was dropped from consideration in cumulative effects. The only overlap is with the transportation route during the short window of construction, and only for a 2 mile segment over paved roads, so no cumulative effects are expected.

[26] The DEIS analyzed the cumulative effects of a proposal to "daylight" Marias Creek to try and re-establish continuity with Toroda Creek where Marias Creek goes subsurface. The proponent has dropped this proposal at the request of the State of Washington, Department of Ecology, and references to it have been deleted from this FEIS.

area boundary on a map, and therefore this project is not analyzed in the cumulative effects sections of this EIS.

Transportation

The section below summarizes the affected environment information, along with the direct, indirect and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Transportation Report, by Engineering Technician Dave McCormack dated January 8, 2007 in the analysis file. Additional information is also located in the Buckhorn Access Project Roads Analysis and Transportation Management Plan document in the analysis file.

AFFECTED ENVIRONMENT

Forest Road 3550 Marias Creek road is a Forest Service collector road that provides access to remote areas in the Marias Creek drainage and to Forest Road (FR) 3575-120 from Toroda Creek Road, Okanogan County Road (OCR) 9495. This road provides service for logging, mining and recreation activities. This road is used mainly for mixed recreation use and is suitable for commercial use. The road was originally built to a 16 foot width with turnouts and over time with continued maintenance blading the road now has an average width of 18 feet.

Forest Road 3575 Nicholson Creek road is a Forest collector road which provides access from OCR 4883 (Bolster road) on Myers Creek to OCR 9495 on Toroda Creek. This road provides service for logging, mining and recreation activities, and access to residences near its east and west ends. This road is suitable for commercial use. The road is approximately 13.6 miles in length.

Forest Road 3575-120 Cow Camp road forks north off of Pontiac Ridge road (OCR 4895) approximately two miles east of OCR 9480. The Forest Service controls access and use of the Cow Camp road, which provides access to the immediate project area from the south, and several residences are found along this road.

Local roads include Forest Roads 3575-100, 3550-130, 3575-140 and 3575-150. The Forest Service controls access and use of these roads, with the exception of a stretch of approximately 1.5 miles at the west end of Forest Road 3550-130 managed by the Washington Department of Natural Resources as route 1400. These roads provide access to the immediate project area from the north, east and south. Some of sections of these roads, have been closed in the winter for winter wildlife habitat (Okanogan National Forest Travel Plan, 2003). Others are “closed” by virtue of the fact that they are snowed in during winter.

A roads analysis was done for roads potentially needed for the project. This analysis provides a scientific approach to evaluate current conditions and recommending road management objectives. It provides an opportunity to assess the needs, assets and liabilities of each road, and to identify road closure opportunities as well as which unclassified roads, if any, should become part of the transportation system. Additionally a transportation management plan was prepared that gives information about road design, maintenance levels and reclamation.

Table III-1: Summary of Existing Conditions for Project Access Routes

Roadway Name	Road standard	Condition	Traffic loads	Proximity to houses	Maintenance
Marias Creek Road 3550	Gravel road w/ 1 to 1.5 lanes; grades of 12%	Fair	Traffic is highly seasonal w/highest volume during hunting season	Two residences. Closest structure is 300 ft from the road	Forest Service level 3 maintenance
Nicholson Creek Road 3575	Gravel road w/ 1 to 1.5 lanes; grades of 4-6% on the west end and up to 10% on the east end	Fair to good	Traffic is highly seasonal, with highest volume during hunting season	Residences, cabins or ranches on east & west ends; closest structure is 90 ft from the road	Forest Service level 3 maintenance
Cow Camp Road 3575-120	Narrow 1 lane primitive dirt road max grade - 10%	Fair	Traffic is highly seasonal, with highest volume in hunting season	6 residences; none within 100ft of roadway	Forest Service level 2 maintenance
Forest Road 3575-100	Narrow 1 lane primitive dirt road; grade of 9%	Fair	Traffic is highly seasonal, with highest volume in hunting season	No developed areas	Forest Service level 2 maintenance
Forest Road 3550-130	Narrow 1 lane primitive dirt road; grades of 9%	Fair	Traffic is highly seasonal, with highest volume in hunting season	No developed areas	Forest Service level 2 maintenance
Forest Road 3575-140	Narrow 1 lane primitive dirt road; grade of 9%	Fair	Traffic is highly seasonal, with highest volume in hunting season	No developed areas	Forest Service level 2 maintenance
Forest Road 3575-150	Narrow 1 lane primitive dirt road; grade of 9%	Fair	Traffic is highly seasonal, with highest volume in hunting season	No developed areas	Forest Service level 2 maintenance

Through the 1950's to 1990's several roads were built to access timber sales and kept open for post sale activities such as fuels treatment or fire protection. Once a road is established it becomes used for other activities such as firewood gathering or access to other parts of the Forest. There are also several user created roads within the project area.

The Buckhorn Access Project area includes parts of five discrete management areas (MAs) that have open road density standards established in the Okanogan National Forest Land and Resource Management Plan (1989) (see Management Area map, EIS Chapter I). Table III-2 displays the current open road densities for each MA that has a standard.

Table III-2: Current Open Road Density

Management Area	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	3.5	3.8	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	44.2	1.8	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	7.5	1.4	1.0

Table III-3 displays the current open road density on NFS lands in the Buckhorn Block.

Table III-3: Current Total Road Density on NFS lands by Project Area

	Square Miles	Road Miles	Road Density Miles per Sq. Mi.
Total	**47.26**	**115.9**	**2.5**

Current maintenance costs are approximately $79,281 per year.

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Alternative A - No Action

The No Action alternative is a baseline against which effects associated with the action alternatives will be compared. The No Action Alternative would preclude development of the ore-haul routes. Construction of the new roadway segments or upgrades to the existing roadways, as described under the action alternatives, would not occur unless these improvements were implemented future capital improvement decisions by the Forest Service. Current condition information is displayed in the affected environment section above.

Effects Common to All Action Alternatives

This section describes the potential environmental consequences (impacts) associated with each of the action alternatives under study. Potential impacts to the existing transportation network could result from an increase in daily traffic volume due to employee related traffic or other site visits by light duty vehicles, from timber removal or gravel truck traffic during construction, from the transportation of supplies to or from project worksites, and from the transport of ore from the mine to the mill and backfill from the borrow pit to the mine. For each action alternative, traffic would be generated by project activities during each phase (the operational, construction, and reclamation phases). The following operational features are common to project activities under each action alternative:

Trucks delivering supplies would have a capacity of up to 25-32 tons of cargo. Under the action alternatives, the ore haul contractor would ultimately determine the equipment used to haul ore. The proponent anticipates the use of 30 to 32 ton haul trucks, most likely single semi tractor-trailer units or double dump truck units with tandem axles front and back. Mitigation measures described in Chapter II would be employed to ensure that high safety standards are maintained throughout the ore hauling process and impacts from project-related traffic on the surrounding environment are minimized.

Road design criteria for all new or improved roads in the project area would adhere to Forest Service and highway safety standards. Based on tests of the gravel planned for use, the gravel used for the road surface would not be acid producing or contain any contaminates. The Forest Service design criteria were provided to Crown Resources in a letter dated December 19, 2003 (Okanogan National Forest, 2003).

Facilities
The infiltration gallery is located outside of RHCAs consistent with MM-2. Solid waste and sanitary facilities may be located within RHCAs but these would be entirely contained, and pumped regularly with waste transported off-site. This would avoid impacts to inland native fish and is consistent with INFISH standard and guideline MM-3.

Road Standards
A "frost-free" road template would be utilized. Adequate drainage is essential to providing a frost-free roadway. By diverting water away from the road the effects of frost are reduced. The road template would exhibit the following components: aggregate surfacing, road inslope, ditches, and ditch relief culverts. The aggregate surfacing would act as a filter to remove water from the road surface and discourage puddling. An inslope road template would divert water off the roadway to the side ditch. Although INFISH recommends outsloped roads, an insloped road was used to minimize sediment deliver to creeks. This would divert water from the roadway into the roadside ditch, and through a series of sediment control structures that would capture 80-99% of the sediment, depending on the alternative. This would meet the RF-2(d) INFISH objective to avoid sediment deliver to streams from the road surface (see details in the Hydrology section). Outsloping would have increased sediment delivery by causing erosion from runoff across fill slopes. Although road widening would occur in RHCAs, it would be entirely upslope from streams to minimize sediment delivery to streams. Building an entirely new road outside of RHCAs, rather than widening the existing road would cause much more disturbance over a much wider area, and is probably not even technically feasible because road design standards could not be met, and grades would be too steep. All new road construction is outside of RHCAs. The purpose of the ditch is to carry water from the roadway and reduce damage to the road surface. The water that is collected and carried in the ditch would be directed away from the roadway at frequent intervals, in this case, using culvert pipe. Ditch relief culverts would be placed at frequent intervals to control the flow of water and slow it down to reduce erosion and debris build-up in the culverts. Culverts and ditches would be kept clean to provide maximum flow through each structure.

Alternative B and B1

The Buckhorn Access Project would result in road management decisions for those roads that would be used by the project. Two new road segments would be constructed to access the mine site: the new lower portal road would be 0.6 mile in length across National Forest System (NFS) lands, and the portion that would be constructed in Township 40 North, Range 31 East, Section 31 would be 0.7 miles in length across NFS lands (two segments). Open road densities by management area are displayed below.

Table III-4: Alternative B During Project Open Road Density

Management Area	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	3.8	4.2	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	45.3	1.9	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	7.5	1.4	1.0

Under Alternative B there would not be any additional road closures.

Table III-5: Alternative B1 During Project Open Road Density

Management Area	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	1.6	1.5	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	43.9	1.8	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	6.0	1.1	1.0

Post project open road density in the Management Areas would stay the same as during the project. Table III-6 shows the roads and lengths that would be closed under Alternative B1 in MA14-18 and MA26-16 to meet or more closely meet the open road density standard, and as compensatory mitigation for impacts from the increased use on the Marias Creek road. These closures are already incorporated into the figures in Table III-5. No amendment is needed for MA26-15 because road densities in this management area are not affected by this alternative, or MA26-16 because the project is moving road density toward the desired condition and no new road construction is occurring in this management area.

Table III-6: Alternative B1 Road Closures in MA14-18 and MA26-16

Route Number MA14-18	Road Miles	System/ Non-system
3550122	0.4	System
3550123	0.2	System
3550000 (mp 4.5)	1.3	System
35500122-1.00L-1	0.3	Non-system
35500125-0.04L-1	0.02	Non-system
Total Miles	**2.2**	
Route Number MA26-16	**Road Miles**	**System/ Non-system**
3550122	1.1	System
3550122-0.27L-1	0.06	Non-system
3550122-1.00L-1	0.27	Non-system
3550125-0.04L-1	0.06	Non-system
Total Miles	**1.5**	
Route Number MA25-18	**Road Miles**	**System/Non-system**
3550	1.4	System

mp = mile post

The intersection at the junction of Forest Roads 3550 and 3550-120 would be reconstructed to a perpendicular alignment to provide for sufficient safe sight and stopping distance. As a general rule, the alignment and grade at, or near, the intersection are more critical than on the main road, so the sight distance should exceed the minimum. The site distance along the main road as viewed from the main road or from the intersecting road should be at least equal to the stopping distance for the design speed of the main road. Roads intersecting at acute angles tend to limit and restrict traffic flow to one direction. The smallest angle formed by the intersecting road should not be less than 60 degrees. Right angles are desirable.

Alternative B – Marias Creek Haul Route

Operational Impacts
Alternative B would have a total of 8.4 miles of road to the patented land boundary, 1.5 miles constructed on National Forest System or National Forest System rights-of-way and 5.2 miles of reconstruction on National Forest System lands or rights-of-way. All construction would be away from Marias Creek. Alternative B would result in 50-70 round trips of ore haul per day mostly Monday thru Friday with possible reduced haul on Saturdays and Sundays depending on mill supply. Employee traffic of about 169 one-way trips per day would be in addition to ore haul (other employees would likely take other routes). An exception to the haul volume is a 3 week period before and a three week period after spring breakup. During these six weeks the haul could increase by 25 truck loads/day, which would increase disturbance of residents up to 50% during that time. Spring breakup is generally the months of February, March, and/or April, with the exact dates varying year to year. The operating schedule for ore haul traffic would be from 6 AM to 6 PM Monday through Friday with the possibility of Saturday and Sunday for catch up work. Also there may be the some unloaded ore trucks traveling outside of these hours. Supply traffic would average 4 to 6 trucks per day Mondays through Friday, but some traffic can be expected seven days a week. Some supply traffic may also operate outside of the 6 AM to 6 PM schedule. The newly improved Marias Creek Road would serve as the primary access route for ore hauling and supply shipments as well as much of the employee traffic. Approximately 50 to 70 round-trip ore hauls would be completed per day, an average of one truck passing by a fixed point along the route every 5 to 7 minutes over the 12-hour period. Short-term spring break-up increases would result in one truck passing a fix point along the route every 3 to 5 minutes over a 12-hour period.

Impacts on FR 3575 (Nicholson Creek / Gold Creek Road) west of FR 3575-150, FR 3575-140, and OCR 4895 (Pontiac Ridge Road) east of FR 3575-120 would be limited to minimal employee traffic. Project activities would have limited impact on those roads. Impacts would be limited to access to the water tower and water quality monitoring points.

Construction Impacts
FR 3550 (Marias Creek Road) would be substantially improved during this phase, and the new lower portal access road would be built. The Forest Service design criteria, and all other applicable roadway design standards, have been incorporated in the evaluation phase of the haul and access road alternatives. The supply haul route during this period would be from OCR 9480 to OCR 4895 to FR 3575-120 and 3575-140. Until road upgrades are completed, public access and through traffic would not be allowed and access to the mine site would be via the existing road network.

Road Standards
The Marias road would be improved to a 28 foot two-lane road including shoulders (24 foot running surface). The benefits of this road would include the following:

- Improved traffic flow. Traffic would be less congested.
- Fewer delays. The increased road width would accommodate the increased traffic volume.
- Increased safety to passenger cars and trucks. By allowing two-way traffic to travel in separate lanes, drivers would have more room to react to hazards, substantially reducing the risk of head-on collisions and other accidents.

The improvements and extension of project roads would provide an 8.4-mile long, two-lane wide, 30 mph design speed, high-grade gravel road built by project proponents to Forest Service standards. Gravel would be brought in from the Beal borrow pit site off National

Forest System lands. All culverts at haul road crossings of Marias Creek would be upgraded to pass all aquatic life forms and to pass the 100-year, 24-hour storm event including debris passage. This would lessen the potential of the road washing out under a high flow event. Also under this alternative the culverts on the Nicholson Creek road 3550 at mile post 0.2, and the culvert at Forest Road 3550-080 crossing of Marias Creek would be replaced and would meet these same standards. During the construction of the Nicholson Creek culvert there would need to be a temporary bypass around the construction site so that the residents living above the culvert can still get to their residences. The design and construction would require review and approval by the Forest Service and Washington State Department of Fish and Wildlife. Additionally, a culvert on a non-system road near the junction of Forest Road 3575 and 3575-100 would be replaced with a culvert that would also allow for passage by all aquatic life forms, also lessening the chance of washout.

Traffic Loads and Public Safety
The existing traffic is seasonally based (recreational and timber related). The road upgrade, with design features including two lanes, and maintenance and the enforcement of the 30 mph speed limit would be expected to improve public safety.

The anticipated project generated traffic would be year-round seven days per week. The improvements of a two lane road could increase public traffic, especially during hunting season; although regular project traffic through the operational phase could discourage recreational use. Because the road currently has little use, and project use would result in a greatly improved road, the likely number of traffic accidents would be lower than if the existing single lane road with turnouts was used for haul. For example, haul truck drivers would be making repeat trips on the same road several times a day for the next eight years possibly reducing their responsiveness, alertness, and awareness to other traffic, particularly residential and passenger vehicles which may also be traveling on the road. Drivers traveling on a two-lane road would have more time and room to react decisively, especially during winter months when snowy and icy road conditions increases stopping distances due to slick conditions. The possibility of fog and sun glare also increases during winter months making driving much more difficult and dangerous. Because the transition from gravel to pavement would occur at the County road junction, dirt and dust may be tracked onto the Country road, although this is minimized by use of dust abatement on the gavel road.

Proximity to houses
There is one home at the mouth of Marias creek drainage, and one home along with Forest Service rights-of-way across private lands at Cow Camp. Impacts to these homes would be intermittent construction impacts, including a greater amount of dust would be generated, although much of it would be blocked by vegetation or slopes or settle out before reaching households since they are both so far from the road. There would be an improved road surface, and further increase in truck and employee traffic and dust after construction is completed.

Road Maintenance
Project proponents would be responsible for on-going maintenance and snow plowing necessary to maintain year-around heavy truck access. Dust controls would be employed during dry periods to the entire road segment. Dust levels would likely increase along the roadway, although measures described in Chapter II, mitigation, would minimize those impacts (see Air Quality section of this chapter). Because of the high quality of gravel to be placed on the road surface, it is anticipated that re-graveling would only be needed once a year on the ore haul route.

Alternative B1 – Marias Creek Haul Route

Impacts under Alternative B1 would differ from Alternative B only in that no ore haul traffic, loaded and unloaded would be outside of the 6 AM and 6 PM time frame, but haul would still be seven days a week with most haul occurring Monday through Friday. Only infrequent, unplanned supply truck traffic could deliver outside of the 6 AM and 6 PM time frame. The speed limit would be reduced to 25 mph to increase safety for all forest users. Alternative B1 would require approximately 0.5 mile of pavement from the intersection with OCR 9480 to mile post 0.5. This would help with dust from entering into the stream and improve safety by minimizing the amount of dirt/dust tracked onto the county road. All other features are as described under Alternative B. Track-on dust from the transition from gravel to paved surface would be away from residence at the bottom of Marias Creek and would not result in increased dust impacts to that residence.

Alternatives C and D

Only one road segment would need to be constructed to access the mine site under these two alternatives. The lower portal road would be 0.6 mile in length. Paving would occur under these two alternatives. Alternative C would require 2.4 miles of pavement and Alternative D would require 1.3 miles of pavement. Both paved sections are National Forest System rights-of-way past private residences. Open road densities by management area are displayed below:

Table III-7: Alternatives C and D During Project Open Road Density

Management Areas	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	3.5	3.8	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	44.8	1.9	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	7.5	1.4	1.0

Post project open road density in the Management Areas would stay the same as during the project, because no roads would be closed. No amendment is needed for MA14-18, MA26-15 or MA26-16 because road density is not affected by these alternatives.

Alternative C – Nicholson Creek Haul Route

Operational Impacts

Impacts under Alternative C would differ from Alternative B and B1 in that the 13.3 miles of Nicholson Creek haul route (FR 3575 – FR 3575-150 – FR 3575-100 -FR 3575-120) would be upgraded to serve as the primary mine access and only 0.6 mile of new road construction on National Forest System land would be needed (12.4 miles or reconstruction would be on NFS lands and rights-of-way). Also paving would occur on FR 3575 from the junction of Okanogan County road 9495 to approximately mile post 2.4. Alternative C would average 60 round trips per day Monday through Saturday with no haul allowed on Sunday. Employee traffic of about 169 one-way trips per day would be in addition to ore haul (other employees would likely take other routes). An exception to the haul volume would be the 3-week period before and a 3-week period after spring breakup. During these six weeks the haul could increase by 30 truck loads/day, which would increase disturbance to residents from ore haul

by 50% during that time. Spring breakup is generally the months of February, March, and/or April, with the exact dates varying year to year. The operating schedule for ore haul traffic would be from 6 AM to 6 PM, six days a week with supply traffic generally from 8 AM to 5 PM, five days a week. Supply traffic would average two to four trucks per day Monday through Friday with the exception of infrequent, unplanned supply traffic outside of those hours. Truck traffic would be concentrated along the ore haul route, and the supply route would enter the area by way of 3575, 3575-150, 3575-100, 3575-120 and the new road to the lower portal. While existing access routes to the mine site would be retained, the newly improved Nicholson Creek Road would serve as the only access route for ore hauling and supply shipments as well as much of the employee traffic. This route also includes nine residences within about 500 feet of Nicholson Creek Road. These residents would have noticeable increases in traffic noise. Approximately 60 round-trip ore trips would be completed per day, an average of one truck passing by a fixed point along the route every 6 to 7 minutes over the 12-our period. Short-term spring break-up increases would result in one truck passing a fix point along the route every 4 to 5 minutes over a 12-hour period.

Impacts on FR 3550 Marias Creek Road east of FR 3575-125, FR 3575-130, and OCR 4895 (Pontiac Ridge Road) east of FR 3575-120 would be limited to minimal employee traffic. Project activities would have no impact on those roads.

Construction Impacts

FR 3575 (Nicholson Creek Road) would be greatly improved during this phase, and the new lower portal access road would be built. The USFS design criteria, and all other applicable roadway design standards, have been incorporated in the evaluation phase of the haul and access road alternatives. The supply haul route during this period would be from OCR 9480 to OCR 4895 to FR 3575-120 and 3575-140. Until those road upgrades are completed, only local resident traffic would be allowed and access to the mine site would be via the existing road network.

The intersection at the junction of Forest Roads 3550 and 3550-120 would be reconstructed to a perpendicular alignment to provide for sufficient safe sight and stopping distance. As a general rule, the alignment and grade at, or near, the intersection are more critical than on the main road, so the sight distance should exceed the minimum. The site distance along the main road as viewed from the main road or from the intersecting road should be at least equal to the stopping distance for the design speed of the main road. Roads intersecting at acute angles tend to limit and restrict traffic flow to one direction. The smallest angle formed by the intersecting road should not be less than 60 degrees. Right angles are desirable.

Road Standards

The Nicholson road would be improved to a 28-foot two-lane road, including shoulders (24 foot running surface) which would result in the following benefits:

- Improved traffic flow. Traffic would be less congested.
- Fewer delays. The increased road width would accommodate the increased traffic volume.
- Increased safety to passenger cars and trucks. By allowing two-way traffic to travel in separate lanes, drivers would have more room to react to hazards, substantially reducing the risk of head-on collisions and other accidents.

The improvements and extension would provide a 13.3 mile long (including BLM managed lands), two-lane wide, paved surface for approximately 2.4 miles, high-grade gravel road built by project proponents to USFS standards. The improvements of a two lane road could

increase public traffic, especially during hunting season; although regular project traffic through the operational phase could discourage recreational use. Because the road currently has little use, and project use would result in a greatly improved road, the likely number of traffic accidents would be lower than if the existing single lane road with turnouts was used for haul. Drivers traveling on a two-lane road would have more time and room to react decisively, especially during winter months when snowy and icy road conditions increases stopping distances due to slick conditions. The possibility of fog and sun glare also increases during winter months making driving much more difficult and dangerous.

All culverts that are at haul road crossings of Nicholson Creek and the culvert at Forest Road 3550-080 crossing of Marias Creek would be upgraded to pass all aquatic life forms and to pass the 100-year, 24-hour storm event. Additionally, a culvert on a non-system road near the junction of Forest Road 3575 and 3575-100 would be replaced with a culvert that would also allow for passage by all aquatic life forms. These would lessen the potential of the road washing out under a high flow event. During the reconstruction of the lower Nicholson Creek road, access for local residents would be maintained. The design and construction would require review and approval of the Forest Service. Because the gravel from the Beal borrow site is high quality, it is estimated that gravel would only need to be refreshed once a year on the ore haul route.

Traffic Loads and Public Safety

The existing traffic is seasonally based (recreational and timber related) with some residential traffic. The road upgrade, with design features such as two-lane, and regular maintenance and the enforcement of a 25 mph speed limit would be expected to have a positive effect on public safety. Upgrading to a two-lane road would allow for traffic to travel in both directions simultaneously and would substantially reduce the likelihood of traffic accidents.

The anticipated project generated heavy truck traffic would be year-round six days per week. The improvements of a two-lane road could increase public traffic, especially during hunting season; although regular project traffic through the operational phase could discourage recreational use. Because the road currently sees little use, project use would result in a substantially improved road over the existing conditions. For example, haul truck drivers would be making repeat trips on the same road several times a day for the next eight years possibly reducing their responsiveness, alertness, and awareness to other traffic, particularly residential and passenger vehicles which may also be traveling on the road. Drivers traveling on a two-lane road would have more time and room to react decisively. Travel during winter months poses other risks. Driving in snowy and icy road conditions increases stopping distances due to slick conditions. The possibility of fog and sun glare also increases during winter months making driving much more difficult and dangerous. These risks are all mitigated by the requirement for a two lane road.

Proximity to houses

There are nine residences, cabins, or ranches along this route with the closest structure approximately 90 feet from the road. The residents along this route would notice intermittent construction impacts, including a greater amount of dust would be generated, though much of it would be blocked by vegetation or slopes or settle out before reaching the households. There would be an improved road surface, and further increase in truck and employee traffic after construction is completed. With the paved portion constructed on the road segments in front of the residences, dust during the life of the project would be almost eliminated. Track-on dust from the transition from gravel to paved surface would be away from residences and

would not result in increased dust impacts to residences. Traffic levels could increase driving risks for those residents, though the improved road surface and two-lanes could enhance safety.

Road Maintenance
Project proponents would be responsible for on-going maintenance and snow plowing necessary to maintain year-round heavy truck traffic. Dust controls would be employed during dry periods to the entire road segment that is not paved. Dust levels would likely increase along the unpaved sections of roadway, although measures described in Chapter II, mitigation, would minimize those impacts. Because of the high quality of gravel to be placed on the road surface, it is anticipated that re-graveling would only be needed once a year on the ore haul route.

Alternative D – Cow Camp to Pontiac Ridge Haul Route

Operational Impacts
Alternative D would have an average haul of 70 round trips per day mostly Monday through Friday with no ore or supply haul on weekends, in addition to employee traffic of about 169 one way trips per day (other employees would likely take other routes). An exception to the haul volume is a 3-week period before and a 3-week period after spring breakup. During these six weeks the haul could increase by 35 truck loads/day, increasing disturbance to residents from ore haul by 50% during that time.. Spring breakup is generally the months of February, March, and/or April, with the exact dates varying year to year. The operating schedule for ore and supply haul traffic would be from 6am to 6pm 5 days a week with the exception of infrequent, unplanned supply traffic outside of that window. Supply traffic would consist of 2 to 4 trucks per day with most of the traffic Mondays through Fridays. Truck traffic would be concentrated along the ore haul route, and the supply route would enter the area by way of 3575-120, 3575-140, and the new road to the lower portal. While existing access routes to the mine site would be retained, the newly improved Cow Camp to Pontiac Ridge Road would serve as the primary access route for ore hauling and supply shipments as well as much of the employee traffic. Approximately 70 round-trip ore hauls would be completed per day, an average of one truck passing by a fixed point along the route every 5 to 6 minutes over the 12 hour period. Short-term spring break-up increases would result in one truck passing a fix point along the route every 3 to 4 minutes over a 12-hour period.

Construction Impacts
The Cow Camp to Pontiac Ridge Haul Route would be substantially improved during this phase, and the new lower portal access road would be built. The USFS design criteria, and all other applicable roadway design standards, have been incorporated in the evaluation phase of the haul and access road alternatives. The supply haul route during this period would be from OCR 9480 to OCR 4895 to FR 3575-120 and 3575-140. Until those road upgrades are completed, only local resident traffic would be allowed and access to the mine site would be via the existing road network. Because there would be no snow plowing of the 3550 Marias Creek road from December 1 to march 31 and 3575 Nicholson Creek road, employees would likely access the mine via the Cow Camp to Pontiac Ridge road.

Road Standards
The Cow Camp road would be improved to a 28 foot two-lane road including shoulders (24 foot running surface) which would result in the following benefits:

- Improved traffic flow. Traffic would be less congested.
- Fewer delays. The increased road width would accommodate the increased traffic volume.
- Increased safety to passenger cars and trucks. By allowing two-way traffic to travel in separate lanes, drivers would have more room to react to hazards, substantially reducing the risk of head-on collisions and other accidents.

The improvements and extension would provide a 4.1-mile long, two-lane wide, 25 mph design speed, 1.3 miles of pavement along residential areas, and high-grade gravel road built by project proponents to USFS standards (2.1 of these miles would be reconstructed on NFS lands and rights-of-way, and 0.6 miles of new road would be constructed). The design and construction would require review and approval of the Forest Service. The improvements of a two lane road could increase public traffic, especially during hunting season; although regular project traffic through the operational phase could discourage recreational use. Because the road currently has little use, and project use would result in a greatly improved road, the likely number of traffic accidents would be lower than if the existing single lane road with turnouts was used for haul. Drivers traveling on a two-lane road would have more time and room to react decisively, especially during winter months when snowy and icy road conditions increases stopping distances due to slick conditions. The possibility of fog and sun glare also increases during winter months making driving much more difficult and dangerous.

Also under this alternative the culverts on the Nicholson Creek road 3550 at mile post 0.2 and Forest Road 3550-080 crossing of Marias Creek would be replaced and would meet 100-year, all aquatic life standard. During the construction of the Nicholson creek culvert there would need to be a temporary bypass around the construction site so that the residents living above the culvert can still get to their residence. The design and construction would require review and approval by the Forest Service and Washington State Department of Fish and Wildlife. Additionally, a culvert on a non-system road near the junction of Forest Road 3575 and 3575-100 would be replaced with a culvert that would also allow for passage by all aquatic life forms, also lessening the chance of washout.

Traffic Loads and Public Safety

The existing traffic is seasonally based (recreational and timber related) with some residential traffic. The road upgrade, with design features including two-lanes, and maintenance and the enforcement of a 25 mph speed limit would be expected to have a substantial positive effect on public safety. Upgrading to a two-lane road would allow for traffic to travel in both directions simultaneously and would substantially reduce the likelihood of traffic accidents.

The anticipated project generated traffic would be year-round 5 days per week. The improvements could increase public use of the road, especially during hunting season on weekends when mine traffic does not occur; regular project traffic through the operational phase could discourage recreational use except on weekends. Because the road currently sees little use, project use would result in a greatly improved road over the existing conditions. For example, haul truck drivers would be making repeat trips on the same road several times a day for the next eight years possibly reducing their responsiveness, alertness, and awareness to other traffic, particularly residential and passenger vehicles which may also be traveling on the road. Drivers traveling on a two-lane road would have more time and room to react decisively. Travel during winter months poses other risks. Driving in snowy and icy road conditions increases stopping distances due to slick

conditions. The possibility of fog and sun glare also increases during winter months making driving much more difficult and dangerous.

Proximity to houses
There are seven cabins or ranches along this route none within 100 feet from the road. The residents along this route would notice intermittent construction impacts, including an improved road surface, and then see a further increase in truck and employee traffic after construction is completed. With the paved portion constructed on the road segments in front of the residences dust during the life of the project would not be an issue. A greater amount of dust would be generated during the construction phase, though much of it would be blocked by vegetation or slopes or settle out before reaching the households. Track-out dust from the transition from gravel to paved surface would be well away from the residence at Cow Camp and would not result in increased dust impacts to that residence. Traffic levels could increase driving risks for those residents, though the improved road surface and two-lanes could enhance safety.

Road Maintenance
Project proponents would be responsible for on-going maintenance and snow plowing necessary to maintain year-around heavy truck traffic. Dust controls would be employed during dry periods to the road segment that is not paved. Dust levels would likely increase along the roadway, although measures described in Chapter II, mitigation, would minimize those impacts. Because the gravel from the Beal rock pit is high quality, it is estimated that gravel would only need to be refreshed once a year.

Road Density Effects Common to All Alternatives

The patenting of the Buckhorn Mountain area in December of 2004 resulted in those lands leaving Federal ownership. As a result discrete MA14-19 is left as only three slivers of land totaling 68 acres between the newly private land and other management areas. The information presented above maintains MA14-19 to show the effects of the project without a Forest Plan amendment. However, for the purposes of future management, MA14-19 is now too small and disjointed to manage as a discrete management area, and all alternatives include a Forest Plan amendment to combine the slivers with their adjoining management areas. Most of the acres (66) would be joined with MA26-15; both MA14 and MA26 are designed to emphasize deer winter range, although MA26 has more restrictive standards and guidelines. Both management areas currently exceed open road density standards and MA26-15 would continue to exceed standards, although its overall open road density would remain 1.2 miles per square mile. Two acres of MA14-19 would be joined with MA25-18 which would not change the overall road density in MA25-18. The result of the combination of these management areas is as follows:

Table III-8: Open Road Density from Elimination of MA14-19

Management Areas (Alt)	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 25-18 (B/B1)	24.0	46.1	1.9	3.0
MA 25-18 (C/D)	24.0	44.3	1.8	3.0
MA 26-15	2.4	2.8	1.2	1.0

Combining the small amount of acres in MA14-19 with MA26-15 would result in a combined management area that was easier to manage and the combination would not affect Forest Plan goals, outputs or objectives, and the emphasis on deer winter range would remain. The

combination of 2 acres of MA14-19 with MA25-15 is so incidental that no changes are expected to goals, outputs or objectives.

Cumulative Effects

This cumulative effects analysis considers the effects to the transportation system within the project area to approximately 15-18 years into the future, the time when all project work, except long-term monitoring, from the Buckhorn Mine project would be completed and operational road impacts would return to pre-project levels.

The existing road system was constructed over the past 90 years, starting with mining access up the Lost Creek drainage and access from Canada up the Cedar and Jackson Creek drainages. Access for timber harvest began in the 1950s. The only recent road constructed was under the Nicholson Salvage II Timber Sale, which built several short spur roads north and south of the 3575-100 road. User created roads, primarily for firewood access, have added to the road network, although these roads are not part of the transportation system. Additionally, some roads that were closed by previous projects have been breached in the project area, and these roads would be re-closed as they are discovered during regular road maintenance activities. All past road construction is calculated into the open road density analysis above, as are past road closures, including those done under the Crown Jewel Mine project and Nicholson Timber Sale. The table below displays the road density for all open roads on NFS lands in the project area, which incorporates all past actions in the aggregate. Knowing specific details about the construction or past use of each of these roads is not relevant to the Buckhorn Access Project transportation effects since only the roads actually used for the project would be impacted. Information on current use and the direct and indirect effects on each of the affected roads is presented above in the affected environment and direct and indirect environmental consequences sections.

Table III-9: Total Road Density by Alternative on NFS lands in Project Area

Alternative	Square Miles	Road Miles	Road Density Miles per Sq. Mile
Alternative A	47.26	115.9	2.5
Alternative B	47.26	117.2	2.5
Alternative B1	47.26	117.2	2.5
Alternatives C and D	47.26	116.5	2.5

Although total road mileage would increase under the action alternatives, maintenance costs would decrease in Alternative B1, because fewer roads would be open to public travel (see below).

In September 2006, a road use permit was issued to Crown/Kinross to use Forest Roads 3575-120 and 3575-140. As part of this permit, before heavy haul traffic could commence to the mine site on private lands, the proponent was required to perform deferred maintenance on these roads. The substantially improved the road condition of these roads, and required continual maintenance would keep these roads in good condition. Required watering of the road has been adequate to minimize dust creation. These roads would be used by Crown/Kinross to access the mine site until the new haul route is finished in the spring/summer of 2007. After that this route would only be used incidentally for supply deliveries and by employees. Actual construction at the mine site began in September 2006, but does not have any other cumulative effects with the transportation system.

Trucks using the Wauconda Quarry may overlap with supply trucks during operations but any impacts to the Toroda Creek road would be minimal, especially since this road can accommodate this traffic and only the first few miles of the Toroda Creek road would overlap.

No ongoing or reasonably foreseeable future actions would construct roads on National Forest System land, although the Little Nicky Sale on DNR managed lands in the Nicholson Creek drainage constructed approximately one mile of new road in 2005. This road does not affect road densities on NFS lands or the NFS transportation system. Although no new road construction is planned on NFS land, a roads analysis was completed for this project which identified additional roads for future closures that are not planned for use in the Buckhorn Access Project. Although no closures have actually been proposed under other projects, these potential road closures would have the effect of reducing road density further. Road closures under the Buckhorn Access Project, in conjunction with potential future road closures would result in further reductions in road density than displayed above and additional reductions in road maintenance costs. Additionally, during road maintenance, unauthorized roads that previously had been closed, but are now open, would be closed further reducing open road density and maintenance costs.

Timber harvest is anticipated to continue across the undeveloped sections of the project area, with the emphasis shifting from federal projects being completed to on-going state projects. No future timber harvest is currently planned on NFS lands. Mining interest is anticipated to remain strong. Recreation, hunting, and firewood gathering activities would be supported by project improvement to the forest road system, though project activity sites would be closed to the public until reclamation is underway. Public activities in the undeveloped sections of the project area include recreation, firewood gathering, and hunting. Currently, climate and weather conditions generally prevent access to the affected Forest Service road network from late fall through approximately mid spring. Hunting and firewood gathering peak in the fall. As a result, traffic may increase substantially on access roads and the affected Forest Service road network although its likely hunters and firewood gathers would avoid the areas near the haul route because of the decreased recreational experience (see Recreation section in this chapter). Project construction would upgrade the road network from the lower portal of the mine east toward Toroda creek road via Marias Creek road under Alternative B and B1, or via FR 3575-120, FR 3575-100, FR 3575-150, and Nicholson Creek road under Alternative C and via Cow Camp (FR 3575-120) to Pontiac Ridge road (OCR 4895) under Alternative D. The improved roadway could provide better and safer access for those activities along and in the few areas accessible beyond the road corridor. Reconstruction of the Toroda Creek road and culvert replacement won't have any cumulative effects with the transportation system on NFS lands, although the road reconstruction would improve traffic conditions for all road users, including trucking between the mine and mill.

The choice of different haul routes on National Forest System lands affects the total miles of haul, and road grades along the routes to the Kettle River Mill. Under Alternative D, the proponent would have the choice of hauling north on the Toroda Road, adding 6.8 miles one way to the Alternative B/B1 haul route off National Forest System lands. Alternately the proponent could haul south on the Toroda Road to Highway 20, adding 2.7 miles one way to the Alternative B/B1 haul route off National Forest System lands, and ultimately hauling through the Town of Republic to reach the mill. Table III-10 below gives the total number of miles by haul route when considering both Forest Service and non-Forest Service haul.

Adverse grades for the different haul routes are displayed in terms of total vertical feet of climbing road grades.

Table III-10: Haul Routes on All Lands from Mine to Mill by Alternative

Alternative	B	B1	C	D (Curlew)	D (Republic)
Haul Route Miles (one-way)	46.8	46.8	49.3	53.6	49.5
Life of Mine Total Haul in Million Miles	9.4	9.4	9.9	10.7	9.9
Adverse grade – Mine to Mill (vertical feet)	1,430	1,430	1,430	1,430	2,800

As can be seen above, when considering the Buckhorn Access Project along with the larger Buckhorn Mountain (Mining) project, Alternatives B and B1 have the shortest haul route and least amount of adverse haul grades. Alternative D, with its longer haul route and longer adverse grades (Republic) would substantially increase the amount of energy used for haul and increase costs for the proponent. In addition, Alternative D (Republic) would require haul through the Town of Republic, which would substantially increase safety concerns to pedestrians, school children and normal vehicle traffic.

Table III-11 below indicates the annual cost of maintaining the transportation system by alternative within the Buckhorn Access Project area. The no-action alternative has the least expensive maintenance costs. Of the action alternatives, Alternative B1 is the least expensive because this alternative has more road closures and after project completion the usable road surface would be reclaimed to pre-project width (hence less maintenance) than Alternative B. Alternative D is the next cheapest because it has the least amount of road upgraded to double lane. Alternative C is the most expensive because it has the most mileage of road upgraded to double lane.

Table III-11: Estimated Annual Maintenance Cost for Roads in the Buckhorn Project Area by Alternative

Alternative	A	B	B1	C (Nicholson)	D (Cow Camp)
Annual Cost	$79,281	$141,508	$108,162	$184,183	$121,395

Soils

The section below summarizes the affected environment information, along with the direct, indirect and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Soils Report, by Soil Scientist Annie Greene dated October 27, 2006 and additional field information in the analysis file.

This direct and indirect analysis covers only National Forest System lands and rights-of-way used for construction or haul in the alternatives or other activities. Discussion of existing environments covers the areas of disturbance along the haul/utility routes, construction supply route, and infiltration gallery and conveyance pipeline areas. The water monitoring well, piezometers, staff gauges, and surface water monitoring sites would only incur minimal short-term erosion and are not an issue. Fence construction for livestock would also incur minimal short-term erosion. Compaction along the fence line would occur if livestock concentration occurs. Only those soils disturbed by activities within these areas are discussed.

AFFECTED ENVIRONMENT

Geology/Geomorphology

The analysis area includes areas of proposed and alternative construction activities on the east flank of Buckhorn Mountain. Bedrock in these areas consists primarily of Cenozoic volcanics and Cretaceous or older intrusive and metasedimentary units (Stoffel and others, 1991). Typical lithologies include andesite and dacite extrusive and intrusive rocks, argillites and granodiorite.

These rock units are hard and resistant to weathering, forming prominent ridges. Soil weathering products are normally quite coarse and lack fine silt and clay fractions. Volcanic ash and pumice typically form a veneer over most of the terrain in the analysis area. Volcanic ash deposits are normally deeper on northern aspects and shallow on southern exposures or ridge tops. The depth of ash deposits has been strongly influenced by differential erosion processes and by the amount of canopy closure existing during the time of fallout.

The Cordilleran Ice Sheet over rode the analysis area as late as 12- to 14-thousand years ago and has strongly influenced topographic expression (Waitt, 1972). This massive ice sheet filled all valleys and over-rode many of the ridges within the analysis area. All major ridge complexes have a rounded appearance caused by ice scour from the continental ice sheet.

Topographic expression in the project area has been described in the in-service publication *Landtype Associations of Central Washington* (USDA, 2004 Landtype Associations). Continental glacial processes have shaped all landforms within the project area. This process also helps to explain soil properties and the occurrence of soils across the landscape.

Soil Development and Occurrence

Soil development and occurrence is in direct response to landforms developed by glacial scour (*Scoured Glaciated Mountain Slopes),* glacial deposition *(Glaciated Mountain slopes*), and subsequent volcanic ash fall. Areas of glacial scour typically influenced the development of shallow, coarse textured soils on very steep slopes associated with abundant bedrock exposures. *Glaciated Mountain Slopes* contain areas of glacial deposition and soils can occur on gentle benches or undulating rounded ridges and are often characterized by thick surfaces of light colored volcanic ash overlying cobbly glacial till.

Soil Classification

Soils occur in rather predictable patterns, which have been verified by field assessments completed by Forest Service Soil Scientists. Field notes are stored in the analysis file. A soil survey has been completed within the analysis area (USDA-NRCS, Okanogan-Methow Highland Area, 2005). The Natural Resource Conservation Service conducted this soil survey. The tables below indicate the soils and their classifications found within the areas of disturbance along the construction supply route, the haul/utility route, and the infiltration gallery/conveyance pipeline.

Table III-12: Existing Soils

Map Unit	Soil Name
234	Nevine-Louploup Complex, 3-15% slopes
235	Nevine-Louploup Complex, 15-35% slopes
236	Nevine-Wilma Complex, 35-65% slopes
237	Nevine-Wilma Complex, 15-35% slopes
238	Oxerine-Nevine Complex, 35-65% slopes
250	Borgeau-Nicmar-Johnton Complex, 15-35% south slopes
251	Nicmar ashy loam, 15-35% slopes
252	Oxerine-Lithic Haploxerepts-Rock outcrop Complex, 35-65% slopes
254	Johnton-Thout-Nicmar complex, 15-65% slopes

Table III-13: Soil Classification

Soil Name	Family or Higher Classification
Borgeau	Loamy-skeletal, mixed superactive, mesic Vitrandic Haploxerolls
Johnton	Loamy-skeletal, mixed superactive, mesic Lithic Haploxerolls
Louploup	Ashy over loamy, glassy over isotic, frigid Typic Vitrixerands
Nevine	Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands
Nicmar	Loamy-skeletal, isotic, frigid Vitrandic Haplxeralfs
Thout	Loamy-skeletal, isotic, Vitrandic Haploxerepts
Oxerine	Loamy-skeletal, isotic, frigid Andic Haploxerepts
Wilma	Loamy-skeletal, isotic, frigid Andic Haploxerepts

Soil Properties

The *Borgeau* and *Johnton* soil series are *Haploxerolls*, which are Mollisols, or grassland soils that occur in warm dry climates. These soils occur on landforms that have been scoured by ice and usually occupy southern exposures or low elevations. These soils often occur associated with bedrock outcroppings. This group of soils often contains more than 25% rock cobbles in soil profiles and has shallow ash caps. *Johnton* soils are shallow (lithic) to bedrock.

The *Louploup* and *Nevine* soil series are *Andisols* with relatively thick volcanic ash surfaces. These Andisol soils typically occur on northern or protected exposures and normally have 17-23 inches of light colored volcanic ash forming soil surfaces. The depth of volcanic ash overlies bouldery glacial till or fractured bedrock. These Andisol soils can occur in complexes with other soils that have thin volcanic ash surfaces or rock outcrop.

The *Oxerine, Thout* and *Wilma* representative soil series are *Inceptisols*, which are weakly developed soils occurring in warm, dry climates. These soils have thin dark colored “ashy” surfaces with very coarse textured regoliths (sandy textures). There is subrounded glacial till cobbles or angular rock fragments contained in more than 25% of soil regoliths.

The *Nicmar* soil series are *Alfisols*, which are well developed with an accumulation of clay. These soils have thin dark colored “ashy” surfaces with loam to clay loam textures and more than 35% rock in soil horizons overlying glacial till.

Soil Interpretations

Soil Erosion/Displacement

Most soils in the analysis have “ashy” surfaces with fine sandy loam textures and friable or weak structure. This textural characteristic can result in erosive conditions if site features are

not limiting hydrologic processes. Surface rock fragments, vegetation recovery, timing/duration of precipitation, and slope gradient can either limit hydrologic processes linked with erosion risk or accelerate the risk of erosion.

Bedrock exposures or rock fragments tend to affect hydrologic function by reducing the effects of water runoff and in turn can lower natural erosion processes. If understory or surface vegetation does not provide continuous ground cover, then the effects of rock fragments are not totally effective at armoring soils and concentrated runoff can lead to erosion.

Adits and waste rock piles of the Roosevelt mine were developed prior to 1920. These disturbances are largely re-vegetated and the soils are stabilized.

The Nicholson, Nicholson Salvage 1 and 2 Timber Sales occurred from 1994 to 1998 and resulted in tree removal causing soil disturbance. Vegetation has become established stabilizing soils.

Livestock grazing occurs within the analysis area in the Ethel, Gold and Cedar allotments. Stock trails are evident, but soil effects are localized.

Existing Road Conditions

Field observations indicate that vegetation has been established on the majority of the cutbanks on Marias, Nicholson and Cow Camp Routes. A road log was taken for Marias and Nicholson routes and indicates by stakes (Marias) or mileage (Nicholson) steep banks, rock outcrops, talus, vegetated cutbanks and slumps. No road log was recorded for Cow camp road, only observations were taken. These road logs and observations are part of the project analysis file.

The vegetation on cutbanks and adjacent to the roads was dominated by orchard grass, wheatgrass, needle grass and some cheat grass. Native needle and thread grass was also abundant. One obvious slump was noted on Marias Creek at stake 312. Steep cutbanks at Marias Creek Route stakes 303, 280 and 270 have potential for slumping if over steepened during road construction. INFISH standard and guideline RF-2d2 has an objective of avoiding sediment delivery to streams from road surfaces by routing road drainage away from potentially unstable streams, fills and hillslopes. Because the Marias Road is already in place in this location, this area cannot be avoided. These areas lack vegetation as a result of active soil movement. Areas of rock outcrop and talus occurred on both routes.

Existing road surfaces have very little gravel. Road maintenance has not included any ditch or shoulder cleaning because vegetation including conifers are present.

ENVIRONMENTAL CONSEQUENCES

Alternative A - No Action Alternative

Direct and Indirect Effects

No new road construction or road expansion would occur with this alternative. No infiltration gallery or pipelines would be constructed. Current rates of soil erosion would occur from the existing roads and no road improvements would occur. Road maintenance would continue.

The WEPP model included runs for existing road conditions including the current relief culvert spacing. This provided baseline data to run other WEPP runs against. Additional discussion on relief culverts is provided in the Hydrologist section later in the chapter and Chapter II of this EIS.

Direct and Indirect Effects Common to All Action Alternatives

Infiltration gallery, conveyance pipeline, augmentation water line, fencing

These effects would be common to all action alternatives. A more complete description of the conveyance pipe and infiltration gallery is included in the analysis file (McInnis, 2005).

Field investigations noted ash to mixed ash over glacial till occurs in this area. The infiltration gallery would be constructed on soil map unit 234, Nevine-Louploup Complex, 3-15% slope. The soils have thick ash caps overlying rounded glacial cobbles and stones. Water would pass through the coarse sands and rounded rock freely. Soils are well to excessively drained with high permeability.

The conveyance pipeline occurs on soil map unit 238, Oxerine-Nevine Complex 35-65% slope and connects to the infiltration gallery on soil map unit 234, Nevine-Louploup Complex, 3-15% slope. All these soils contain ash or mixed ash cap over glacial till.

The connecting rights-of-way road to the pipeline occurs on soil map units 252, Nicmar-Johnton-Rock Outcrop Complex, 35-65% slope and 238, Oxerine-Nevine Complex, 35-65% slope.

Permeability for soils is moderately rapid in upper depths and is moderate to moderately slow if densic massive glacial till layers are present (USDA-NRCS 2002) (USDA-NRCS, Okanogan-Methow Highland Area, 2005). Field observations noted loose unconsolidated material in the upper 20 feet overlying denser glacio-lacustrine sediments layers which are less permeable to water movement.

Initial construction of the infiltration gallery, pipeline road, and placement of the pipelines would result in short term soil displacement and erosion. Soil would be replaced over the pipelines and as needed for the infiltration gallery. No soil movement would occur in the gallery area due to low relief topography. Pipeline placement on the steeper slopes over 35% may initially result in soil displacement and erosion. Once vegetation is established soil erosion would be limited. Vegetation would initiate the first growing season after construction is completed.

Infiltration trench design would allow for pipe placement in the coarse glacial till. This till is evident in adjacent road cuts. Surface soils (topsoil) would be stored during construction and reused when burying the pipes, then seeding would occur. This would allow the area to re-vegetate, except where road access is allowed.

A water augmentation pipeline would carry excess water from the infiltration pipeline to the Roosevelt adit area and then to a water trough in upper Marias Creek. Upslope this pipeline would lie on the surface and would be covered with soil due to high underlying rock content. The lower end would be excavated into waste rock in the Roosevelt adit area and then would be trenched into the ground to the water trough. Trenching would incur minimal soil disturbance.

Wildlife Guzzlers

Wildlife guzzlers would be constructed at the headwaters of Ethel and Bolster Creek. Both would be placed on hardened surfaces, either old landings or adjacent road surfaces, and would be fenced to keep cattle out. Since these are already compacted sites and heavy use is expected, soil productivity is not an issue. Erosion off these areas would be trapped by adjacent vegetation and would be minimal due to low relief slopes.

Surface Water Monitoring Sites and Culvert Replacements

These would occur on both Marias and Nicholson Creeks and are discussed in the Hydrology and Fishery Specialist Reports. No effects on soils are expected from these activities.

Monitoring Wells, Piezometers and Staff Gauges

One new water monitoring well, many piezometers, and staff gauges would be installed in addition to the eight existing water monitoring wells, seven on National Forest System lands that are already installed under the existing NEPA decisions. Minimal soil disturbance would occur with installation of these facilities and the approximately 400 feet of temporary road needed to access the well.

Road Design

Common to all alternatives would be the road design and the road width. Road design would include an insloped ditch, 24-foot travel surface with two 2-foot shoulder, and a 3-foot insloped ditch for a total width of 31 feet. Road surface design would avoid sediment delivery to streams by insloping and routing road away from potentially unstable stream channels, fills and hillslopes. Sidecasting of soils would be avoided. Both these measures would adhere to INFISH requirements.

WEPP Model Analysis

Erosion and sedimentation rates resulting from potential road construction and reconstruction activities were estimated with the WEPP (Water Erosion Prediction Project computer model). Values used in the modeling were developed from information supplied through GIS covers describing the proposed activity and corporate GIS covers for the Okanogan National Forest. FS WEPP is a program that allows users to quickly evaluate erosion and sediment delivery potential from forest roads. The erosion rates and sediment delivery are predicted using input values for forest conditions developed by scientists at the Rocky Mountain Research Station. The accuracy of the predicted values from “WEPP:Road” are, at best, within plus or minus fifty percent. True erosion rates are highly variable due to large variations in local topography, climate, soil properties, and vegetative properties, so predicted values are only a single estimate of a highly variable process. Outputs vary for a variety of reasons, including weather changes from year to year, time since last major climatic and runoff event, amount and age of management activities, bedrock lithology and weathering, soil and vegetation development and geomorphic processes. This analysis considered "average" conditions.

WEPP runs are used comparatively only and not as absolute numbers. Input constants were annual precipitation (20 inches)[27]. Wider road widths were constant (33 feet) including shoulders and inslope ditch were used for WEPP analysis Inslope ditches could be input into the model as bare or vegetated/rocked. Distance between relief culverts, road gradients and paving were also considered. A 50-foot fill slope was also used to account for both cut and fill slopes.

Supporting documentation for the WEPP model is in a separate document in the analysis file. Input variables and derivation are contained in the Hydrology Specialist Report. Individual WEPP runs and combination road log are contained separately in the project analysis file. Summaries and conclusions are contained in this report.

WEPP Model Summaries and Conclusions

Inslope WEPP erosion model was used for Alternatives B and B1, Marias Creek Road (3550, 3550-125); Alternative C, Nicholson Creek Road (36575, 3575-150, 3575-100, 3575-120); and Alternative D Cow Camp Road (3575-120) proposed haul routes (Forest Service roads only). Baseline WEPP runs were also run for current road conditions.

WEPP runs for Alternative D, Cow Camp route, did not indicate a substantial increase in erosion where it crosses National Forest System lands and rights-of-way. This route is over 2000 feet from a perennial stream. Low to no gradient roads lengths are present. Sediment would not be a concern on this proposed route.

The dominant soils have sandy coarse textures and are void of rocks in the upper surface. Sandy texture was a constant WEPP input. Use of a relief culvert spacing would be much closer than the maximum length of 1000 feet allowed in the WEPP model and substantially decreased erosion and sediment delivery amounts.

The required inslope ditches with vegetation rather than leaving the ditches bare resulted in a decrease of erosion and sediment delivery by three times.

Pavement increased erosion and sediment delivery. The highest erosion and sediment delivery yields were with a combination of pavement, bare ditches, no relief culverts and high road gradients. The least erosion and sediment delivery yields were with a combination of graveled roads, vegetated ditches, adequate relief culvert placing and low road gradients.

Ditches would be vegetated during road construction. Streambank wheatgrass would work well as ditch vegetation. This would decrease sediment (according to WEPP model runs) delivered from the roadbed and to the adjacent creeks. Vegetation works as sediment traps. Road maintenance would only remove large debris and would be done to avoid disturbance of vegetation in ditches, which would reduce the potential for road maintenance to introduce sediment in the ditches that might eventually wind up in the creeks. To facilitate the vegetation growth the first year and also act as an additional sediment trap, straw bales or wattles would be placed in road ditches between each culvert.

Additional discussion on WEPP results are contained in the Hydrologist section later in this chapter and the Hydrology Specialist Report in the analysis file.

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[27] A sensitivity analysis was run for more and less precipitation and showed minimal differences (see Hydrology section later in this chapter).

Road Construction

Non-paved portions of roads would be surfaced with adequate gravel. This would minimize surface soil erosion. Rutting would not occur in the roads with this surface and road maintenance would be required to maintain this surface. Paving would occur in Alternatives B1, C and D for dust control near home locations, and to allow track-on of dust onto the Forest Service, not County, road.

Dust abatements would be applied to the gravel roads to keep dust conditions to a minimum. The ash dominated soils have very fine sand size particles that are prone to wind erosion when dry conditions prevail.

The proponent has proposed using $MgCl_2$ (Magnesium Chloride) for dust control during ore hauling operations. $MgCl_2$ is soluble in water and not adsorbed by soils (Rao, et al., n.d.)

Initial road construction would result in short term soil erosion and displacement. Soils have ash to mixed ash caps on the surface. These surfaces would easily erode and be displaced. The largest concern would be the cutslopes occurring on steeper sections adjacent to the road. Road widening would also impact current cutslopes. Cutslopes would be stabilized after construction and monitored for excess erosion and displacement.

Cutbanks would be stabilized after road construction and road widening. Dry seeding alone provides minimal soil stabilization until plant growth initiates. Hydro mulch is easily detached on steeper slopes by surface runoff unless tackifiers are used (Burroughs and King 1989). Hydro mulch would be applied in two steps. Seed, designated by the Forest Ecologist would initially be applied. Slope aspects would determine the seed mix. Mulch would be applied after the seed has been place (Edwards, 2005). This would press the seed into the surface soil and ensure a better germination.

Long cutslopes and harsh south aspects are difficult to re-vegetate and may require tackifiers. Burroughs and King (1989) tested various erosion controls on cutslopes and found that hydro mulching is ineffective on short steep slopes. Straw mulch with added tackifiers proved more effective than just straw mulch.

Reclamation

Post mine operations would result in reclamation of the infiltration pipeline and gallery and is common to all alternatives. Most of the pipe would remain under the road. The area would be re-contoured where necessary and seeded to re-establish vegetation. A seed mix would be designated by the Forest Ecologist. These measures would reduce potential for erosion.

Alternative B and B1

Direct and Indirect Effects

This would be the Marias Creek (FS Road 3550, 3550-125) route including new road construction to mine site with 1.5 mile of new construction on NFS lands and 5.2 miles reconstruction to a double lane on NFS lands. Effects for Alternatives B and B1 are similar for soils.

This route would have the most miles of new road construction of the three proposed routes on Forest Service roads, less reconstruction than Alternative C, and more than Alternative D. Only Alternative B1 has proposed pavement of 0.5 mile on this route and would decrease dust for home owners but increase erosion and sediment delivery, as indicated by WEPP runs.

Compaction would not be an issue for road construction as soil productivity is only a concern for cutslopes and re-vegetation. The road log and field observations indicated that approximately two miles of the road had steep cutslopes, greater than 40% and contained intermittent rock outcrops. These rock outcrops would have to be ripped or blasted for road widening and monitored for rock debris in ditches. A slump occurs at Stake 312 on the Marias Creek route and would need stabilization during construction by gabions or other physical structures. As noted above these slumps are along the existing road that cannot be avoided.

Cutslope re-vegetation would be done as addressed in Chapter II mitigations. Existing vegetation indicates that re-vegetation would occur within 1-2 growing seasons following construction.

The new construction on Road 3550-125 would be contoured with low relief and would result in less erosion than the lower part of the Marias Creek route. Re-vegetation would be similar as cutslopes for the lower part of Marias Creek.

Buffer lengths, or distance between the stream and the road are greater for Marias Creek than for Nicholson Creek. Erosion and sediment reaching Nicholson Creek has twice the potential than Marias Creek, according to WEPP runs.

The main stem road 3550 would be partially reclaimed, post mine operation, to an 18 foot width by scraping gravel from the streamside of the road to the ditch side of the road and ripping and re-vegetating the scraped surface, which would stabilize the soils. The new road connecting the patented claims with Cow Camp would be reclaimed to a single lane road by ripping in Alternative B or re-contouring, re-vegetation and soil stabilization under Alternatives B1, C and D.

Approximately 5 miles of range fence construction would occur with two of these miles following close to the road (Figure II-2 shows all new fence construction). This would decrease cattle access to the ore haul route and some of Marias Creek. Short-term soil erosion would occur with the fence construction. Compaction would occur if cattle congregate next to the fence.

A corral, water gaps, gates and cattle guards are proposed in the lower Marias Creek area. This would take a minimum amount of ground out of production and the corral would create an area of high livestock concentration use. Minimum soil disturbance would initially occur during construction.

There would be no changes for the Nicholson Creek road and the Cow Camp road routes.

Alternative C

Direct and Indirect Effects

This would be the Nicholson Creek route (FS Road 3575, 3575-150, 3575-100, 3575-120) including 0.6 miles of construction on NFS lands and 12.4 miles of reconstruction on NFS lands and rights-of-way.

This route would have the least amount of construction on NFS lands and the most miles of road reconstruction, resulting in the most soil disturbance of the action alternatives.

Moister vegetation occurs along the Nicholson Creek route indicating the potential for re-vegetation on cutslopes is greater than on the Marias Creek or Cow Camp Routes.

The 2.4 miles of proposed pavement on this route would decrease dust for home owners but increase erosion and sediment delivery, as indicated by WEPP runs. There would be three times more erosion and sediment delivery in this section than a similar unpaved section according to WEPP runs.

Buffer lengths, or distance between the stream and the road are greater for the Marias Creek route than for this route. The potential for erosion and sediment reaching Nicholson Creek is twice that of the Marias Creek route, according to WEPP runs.

No road fencing would occur in this alternative to exclude cattle. Only 0.8 miles of fencing would occur for livestock around Grass Lake in Section 17. Less erosion from fencing would occur than Alternatives B/B1, although cattle may congregate along the fence line and cause compaction.

A corral is proposed in Nicholson Salvage 1, Unit 11. This would take a minimum amount of ground out of production and create an area of high livestock concentration use. Minimum soil disturbance would initially occur during construction.

The road section from Cow Camp to the patented land would return back to a single lane. Re-contouring, re-vegetation and soil stabilization would have to occur on this section of road.

Post mine operations would maintain this route as two lanes to the junction with the new road to the patented lands at Cow Camp. The road from Cow Camp to the patented lands would be reduced to a single lane road with intervisible turnouts. Little additional soil disturbance is anticipated.

There would be no changes for Marias Creek or Cow Camp Road.

Alternative D

Direct and Indirect Effects

This would be the Cow Camp to Pontiac Ridge Road route (FS Road 3575-120) including 0.6 miles of construction and 2.1 miles of reconstruction on NFS lands to the mine site.

The majority of this proposed haul route to the Toroda Road occurs on OCR 4895, Pontiac Ridge Road, which is outside of the Forest Service decision authority. This alternative would require the least amount of road widening of Forest Service Roads and would result in the least soil disturbance of the action alternatives.

Paving would occur on 1.2 miles of this proposed route and decrease dust for homeowners. Erosion would be high off this section, according to WEPP runs, but would not be within reach of a perennial stream, so no sediment delivery to streams would occur.

Buffer lengths, or distance between the stream and the road are the longest for this alternative and would result in no sediment delivery to streams, according to WEPP runs. Perennial streams are not located adjacent to the road as in the Marias and Nicholson routes, Alternative B, B1 and C respectively.

The road section from Cow Camp to the patented land would be returned to single lane road with intervisible turnouts. Re-contouring, re-vegetation and soil stabilization would occur on this section of road.

No livestock fencing would occur in this alternative, which would result in less soil disturbance than Alternatives B/B1 and C.

There would be no changes in the Marias Creek or Nicholson Creek Roads or routes

Cumulative Effects

Cumulative Effects analysis covers the haul routes on National Forest System lands and associated activities including infiltration gallery, pipelines, utility lines, fencing and water troughs. The effects on soils covers past actions dating back 10 years, ongoing actions and reasonably foreseeable future actions that have been proposed at this point in time. A complete list of past, present and reasonable foreseeable future actions are listed at the beginning of this chapter. Only those activities that have affected or would affect soils are considered in this cumulative effects analysis. Because effects on soils are localized, this cumulative effects analysis is limited to the immediate area surrounding disturbance areas.

Details regarding impacts of past activities have already been discussed in the affected environment information presented at the beginning of this soils section.

Past Activities

Past actions that have affected soils that would have overlapping impacts with proposed haul routes and accompanying actions are included in the following discussion.

The existing road network was built over the last half century, including the Marias, Nicholson and Cow Camp roads, creating irretrievable compacted surfaces along those roads, to which an additional 36, 52 or 14 acres would be added under the Buckhorn Access Project, under Alternatives B/B1, C and D respectively. Historic mining dating back to the 1890's and earlier is not considered part of Crown Resources/Kinross/Battle Mountain Gold/Newmont exploration and pre-development activities dating back to 1988. Most of these exploration activities on NFS lands have been reclaimed through seeding and planting. Vegetation has become established stabilizing soils.

Reasonably Foreseeable Future and Ongoing Actions

These include the Little Nicky Timber Sale presently being conducted on DNR managed lands in the Nicholson Creek drainage. Forest Roads 3575 and 3575-040 are being used for hauling. Additional sediment from the road would occur during hauling, which may overlap road construction in Alternative C, although it's likely sediment from Little Nicky would have partially or mostly stabilized by the time road construction occurred. Overlapping sediment is described in the Hydrology cumulative effects section later in this chapter.

The Toroda Creek road construction and culvert replacement on Marias Creek would cause some soil disturbance, and sediment generated may overlap with sediment generation from road construction under Alternatives B and B1 (see Hydrology section).

Ongoing and future livestock grazing would occur in the Cedar, Ethel and Gold allotments. Soil compaction would continue on traveled stock trails and driveways. There would also be continued soil compaction in areas of livestock concentrations along riparian areas, water troughs (existing and new), and new fence constructed under this project.

Noxious weed control would continue along NFS roads. Controlling noxious weeds would allow native vegetation to remain and continue to stabilize soils.

Future closure of unauthorized roads during road maintenance would minimize the potential to displace soils, although because firewood cutters generally use pickup trucks that don't cause substantial soil disturbance, firewood cutting would create minimal soil disturbance.

Deferred maintenance was performed on Forest Roads 3575-120 and 3575-140 in fall of 2006, and supply haul up to the mine site is ongoing Adequate gravel was placed to ensure minimal soil displacement from these roads.

Hydrology

The section below summarizes the affected environment information, along with direct, indirect, and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Hydrology Report by Forest Hydrologist Mel Bennett dated January 10, 2007, and other background data in the analysis file. Information presented in WADOE's FSEIS was used throughout this analysis.

AFFECTED ENVIRONMENT

Climate

The climate of the Okanogan Highlands has characteristics of mountain and continental climate along with a maritime climate. Most weather is related to easterly flow from the Pacific Ocean. The average annual precipitation for Buckhorn Mountain area is about 20 inches[28]. Precipitation distribution by month is shown below (in inches): Banton, (2004) has used average precipitation of 21.3 inches per year. This is slightly higher than shown here,

[28] A sensitivity analysis for sedimentation was performed during modeling and only showed slight difference of about 5% difference in sedimentation per inch of precipitation. That change would be expected to range equally across all alternatives, so the relative difference between alternatives would remain constant.

but when sedimentation estimates based on annual precipitation were made, the WEPP model used about 20 inches, so the differences that could occur in the modeling are small. There have been differences of opinion on what the actual annual average precipitation over the past several years as the Buckhorn project has been studied, but the estimates have been close to the 20 inches per year level. The Washington State Department of Ecology FSEIS (2006 Page 3.7-34) used 20 inches per year, and that is what is used here.

Table III- 14: Average Monthly Precipitation at Buckhorn Mountain

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2.14	1.45	1.56	1.32	2.00	2.08	1.30	1.47	0.99	1.24	2.13	2.13	20.00

The majority of annual precipitation falls during the late fall, winter and spring. The driest time of the year is July-September. Snow fall precipitation is about 50% of the annual precipitation. Minimum annual precipitation is estimated to be about 14 inches, while maximum annual precipitation is estimated to be near 30 inches.

The mean temperature in the project area varies from 21° F in January to about 61° F in August (Pentec Environmental, 2004).

Surface Water Hydrology

The road routes are located in the Okanogan Highlands, which are characterized by moderately steep topography. The overall area is drained by the Kettle River. The project area drains from Marias Creek or Nicholson Creek into Toroda Creek which drains into the Kettle River. The west side of the project area drains into Myers Creek, which also drains into the Kettle River. Slopes are relatively steep, ranging up to 70%.

The streamflow in the Kettle River and its tributaries of Toroda Creek, Nicholson Creek and Marias Creek is dominated by high flows during snowmelt-related runoff during the spring and early summer. Stream flow is normally the lowest in September or early October. Intense summer thunderstorm related precipitation may increase streamflow locally, above annual snowmelt peak flows. Rain-on-snow floods (November through February) may occur but are relatively rare. Peak flow records for several USGS stations near Republic, Chesaw, Ferry, Laurier and Tonasket show that one station experienced peak flows in the winter in 1974. Another station had winter-time peak flows in 1973, 1974 and 1981. Rain-on-snow floods are relatively rare because the air masses stay at or below freezing during winter storms, so accelerated snow melt along with rain usually doesn't occur.

Stream flow distribution (%) by month is listed below for Nicholson and Marias Creeks (taken from measurements by Frank (1995) at SW-7 and SW-8).

Table III-15: Nicholson Creek Stream Flow Distribution (%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
4%	4%	4%	11%	28%	14%	10%	7%	6%	4%	4%	4%	100%

Table III-16: Marias Creek Stream Flow Distribution (%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
3%	3%	3%	9%	26%	20%	9%	8%	8%	5%	3%	3%	100%

Golder's Engineering Report (2006b) shows the following distribution of baseflow and surface water flows for Nicholson and Marias Creeks:

Table III-17: Nicholson Creek (SW-7) Monthly Baseflow and Surface Water Runoff (%)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseflow	5%	5%	6%	13%	20%	16%	10%	6%	5%	4%	5%	4%	100%
Surface Runoff	0%	0%	0%	30%	53%	9%	5%	0%	0%	0%	3%	0%	100%

Table III-18: Marias Creek (SW-8) Monthly Baseflow and Surface Water Runoff (%)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseflow	3%	4%	7%	14%	15%	17%	10%	8%	7%	6%	5%	4%	100%
Surface Runoff	0%	0%	0%	30%	53%	9%	5%	0%	0%	0%	3%	0%	100%

Water routing on Buckhorn Mountain has been affected by adits used for past mining. Detailed information is provided in the cumulative effects of this Hydrology section.

There are wetlands present, including a 9-acre wetland in Nicholson and Marias Creeks, partially fed by surface and subsurface flow from the Roosevelt Mine adit. Another well known wetland is the *Frog Pond*. This pond fills from snowmelt and overflows into Nicholson Creek. During the year the water is reduced by evapotranspiration, seepage, and cattle and wildlife usage. In the summer and fall, only a small amount of water remains.

Some of the subsurface streamflow in Marias Creek is flow from the Roosevelt Mine adit. This contributes to late season flow. There are about 8 acres of wetlands in the uppermost reaches of the Marias drainage (Shaw, 2004).

Marias Creek and Nicholson Creeks are classified as a *Rosgen* B4 stream type (Jackson, 2004). The stream type is influenced by local constrictions, scour pools and minor sediment storage. Streams are slightly entrenched and only have minor flood plains or flood-prone areas. These streams have a gravel-sized substrate and generally do not have the stream power to move larger material.

There are no creeks adjacent to the Cow Camp Road section on National Forest System lands or where the Okanogan and Wenatchee National Forests have rights-of-way over private lands, although southern part of Cow Camp road approaches Millard Creek. This route is discussed Alternative D environmental effects below.

Executive Order 11988 of May 24, 1977 requires each agency to provide leadership and take action to minimize adverse impacts associated with the occupancy and modification of floodplains and reduce risks of flood loss, minimize impacts to floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values served by floodplains.

Wetlands[29]

Wetlands are lands where water saturation is a dominant factor in determining the nature of soil development and the types of plant and animal communities. Other common names for wetlands are sloughs, ponds, and marshes. Wetlands are important because they are a key part of the hydrologic cycle which is storage and release of water in the watersheds. Water is stored during the spring runoff period and released during the lower flow periods. The Washington State DOE FSEIS (2006 Page 3.9-9) also discusses the wetland functions in Marias Creek and Nicholson Creek:

> *The wetlands in the Nicholson Creek drainage provide a high potential and a low opportunity for improving water quality and decreasing downstream floods and erosive flows. The low opportunity function value results from the limited existing human use and development of the upper Nicholson Creek watershed. The Nicholson Creek wetlands generally provide a high opportunity and potential for the habitat quality functions* (FSEIS, page 3.9-9)…*The Marias Creek wetlands provide a high potential and a low opportunity for improving water quality and decreasing downstream floods and erosive flows. The low opportunity function value results from the limited existing human use and development of the upper Marias Creek watershed… Two wetlands* (SS-1a,b and SS-2 on the FSDEIS Figure 3.9-2) *may have a have a higher potential and moderate opportunity for improving water quality and decreasing floods and erosive flows because of their proximately to a road, private residence and fenced grazing livestock* (FSEIS, page 3.9-10).

Ground water discharges occur in the Nicholson Creek, Marias Creek and Upper Myers Creek (Cow Camp Road/Pontiac Ridge) watersheds, and are generally located in topographic lows, especially near stream courses where the water table reaches the ground surface. Seeps and springs also occur in depressions near ephemeral drainage ways, intermittent streams or at isolated locations where ground water in bedrock fractures and is diverted to the surface. Except where the topographic conditions are definite, it is very difficult to determine the exact source area for specific wet areas.

Wetlands have been mapped in the project area by several sources including the consultants working on the original Crown Jewel proposal (1990s), the Washington State Department of Ecology (by Shaw Environmental in 2004), and ENSR International, for Crown Resource Corporation (2005). Buckhorn Mountain had about 6.4 acres of wetlands mapped in the general vicinity of the project (ENSR, 2005). About 1.5 acres of wetlands were mapped by Shaw (2004) in Marias Creek, 22.75 acres in Nicholson Creek and about 1.2 acres in the vicinity of Pontiac Ridge.

The wetlands mapped by ENSR are listed below for Marias Creek where they are affected by Buckhorn Access Project activities. These wetlands are mapped and described in more

[29] The United States Supreme Court recently ruled that the Corps of Engineers (COE) was using too liberal of an interpretation in defining wetlands under the Clean Water Act. The Forest Service recognizes that the wetlands discussed in this section may not be wetlands (waters of the U.S.) under the Clean Water Act, but this information is being presented in the interest of full disclosure about these areas and impacts to them caused by the project in accordance with INFISH requirements, and because these areas are still likely to be treated as wetlands under the State's regulations. According to Tim Erkel of the COE (10/19/2006), specific new guidance for including the wetlands has not been received by his office, so the current direction is for the COE to make a local determination of whether to take jurisdiction, and in this case, COE will not be taking jurisdiction of the wetlands not in surface continuity with Marias Creek.

detail in ENSR (2005). The wetlands found along the haul route are displayed on the map on the next page. This map only depicts wetlands that could potentially be affected by road construction, reconstruction or other Buckhorn Access Project activities, and not all the wetlands in the Buckhorn area.

Table III-19: Area and Category Ratings of Wetlands Affected by Marias Creek Route (WADOE FSEIS, 2006 page 3.9-6)

Wetland Name	Estimated Area (square feet)	Dept of Ecology Rating System for Wetlands in Eastern Washington*
MR1	1,935	III
MR2	4199	IV
MR3	1,231	IV
MR4	719	IV
MR5	3817	IV
MR6	142	IV
MR7	1,079	IV
MR8	3,939	III

Wetland category classification is determined by water quality functions, hydrologic functions and habitat functions of the wetlands. The "rating" categories are intended to be used as the basis for developing standards for protecting and managing the wetlands to reduce further loss of their value as a resource. Some decisions that can be made based on the rating include the width of buffers needed to protect the wetland from adjacent development; the ratios needed to compensate for impacts to the wetland, and permitted uses in the wetland. The Department of Ecology has developed recommendations for such protective standards and these are available on the web at:

http://www.ecy.wa.gov/programs/sea/bas_wetlands/index.html.

The rating system is primarily intended for use with vegetated, freshwater, wetlands as identified using the State of Washington delineation method (WAC 173-22-035). The rating system, however, does not characterize many streambeds, riparian areas, and other valuable aquatic resources.

Category I wetlands are those that 1) represent a unique or rare wetland type; or 2) are more sensitive to disturbance than most wetlands; or 3) are relatively undisturbed and contain ecological attributes that are impossible to replace within a human lifetime; or 4) provide a high level of functions. Their functions and values are difficult to replace. Generally, these wetlands are not common and make up a small percentage of the wetlands.

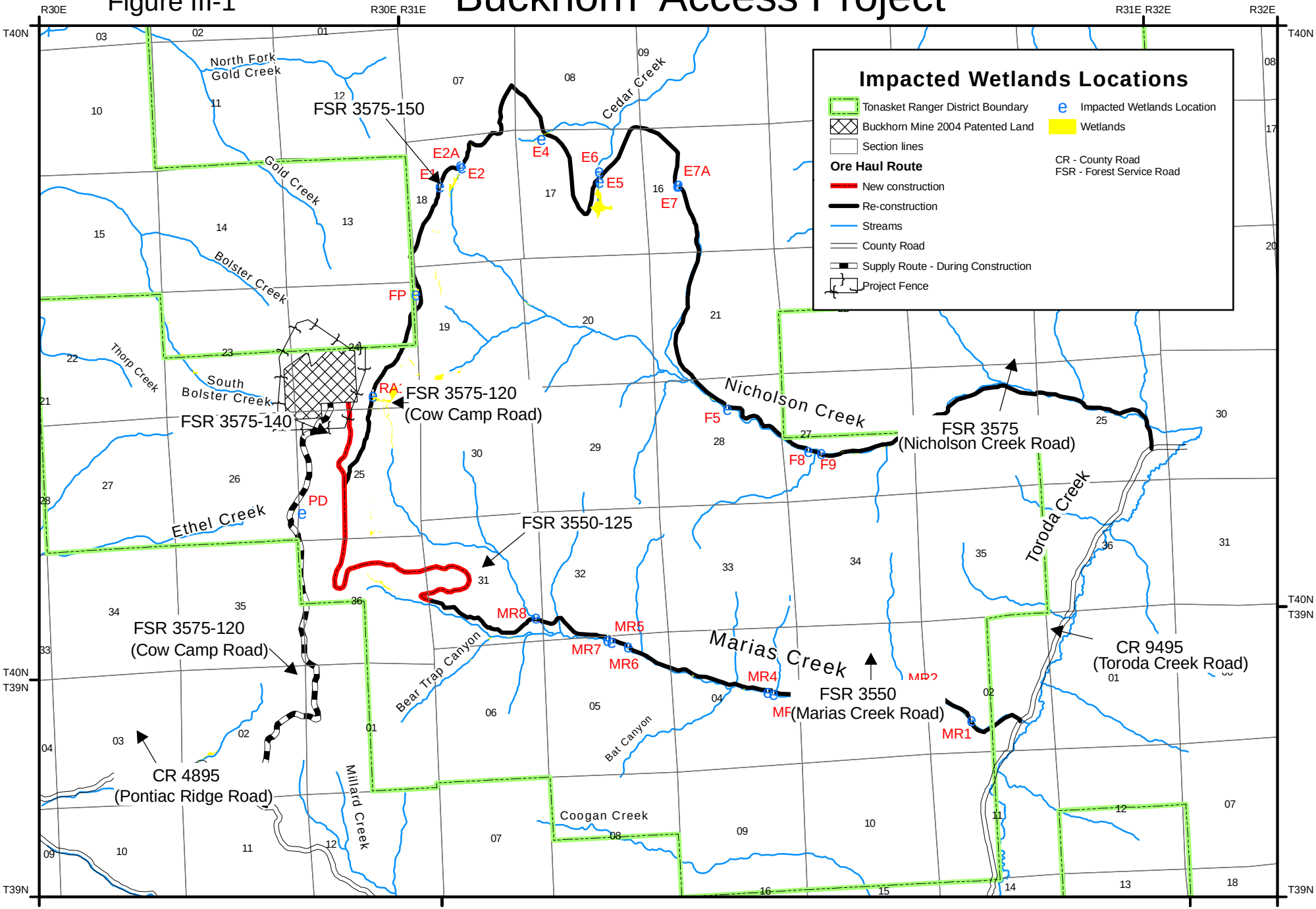
Category II wetlands are difficult, though not impossible, to replace, and provide high levels of some functions. These wetlands occur more commonly than Category I wetlands, but still need a relatively high level of protection.

Category III wetlands are 1) vernal pools that are isolated, and 2) wetlands with a moderate level of functions. Wetlands generally have been disturbed in some ways, and are often smaller, less diverse and/or more isolated from other natural resources in the landscape than Category II wetlands.

Category IV wetlands have the lowest levels of functions and are often heavily disturbed. These are wetlands that can be replaced, and in some cases be improved. However, replacement cannot be guaranteed in any specific case. These wetlands may provide some important functions, and also need to be protected.

Figure III-1

Buckhorn Access Project



Tonasket Ranger District
Okanogan-Wenatchee National Forests

Map by JRainford

1 inch equals 1.00 miles Absolute Scale = 1:63,478

0 0.25 0.5 1 1.5 2 Miles

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Wetlands mapped and described by Shaw (2004) for the Nicholson Creek drainage, and affected by Buckhorn Access Project activities, are listed below:

Table III-20: Area and Category Ratings of Wetlands in Nicholson Creek Route, Summarized by Shaw (2004)

Wetland Name	Areas (Acres)	Area (square feet)	Dept of Ecology Rating System for Wetlands in Eastern Washington*
E1	0.105	4,586	IV
E2	2.274	99,058	II
E2A	0.005	209	II
E4	0.812	35,349	III
E4A	0.20	8,745	III
E5	8.431	36,7271	II
E6	0.215	9,353	IV
E7	0.08	3,465	IV
E7A	0.039	1,681	IV
F5	0.34	14,697	III
F8	0.016	681	III

One wetland is found along the Cow Camp road, but it is not affected by road construction/reconstruction or other Buckhorn Access Project activities in any alternative.

Table III-21: Area of Wetlands and Category Rating Near Cow Camp Road, Summarized by Shaw (2004)

Wetland Name	Areas (Acres)	Area (square feet)	Dept of Ecology Rating System for Wetlands in Eastern Washington*
PD	0.05	1960	IV

Riparian Habitat Conservation Areas (RHCAs) are mapped as part of the Okanogan National Forest Geographic Information System. These are administratively delineated areas along streams based on water uses and flow regimes. The widths (on each side of the stream) vary from 300 feet for perennial, fish-bearing streams to 50 feet for intermittent streams. The RHCAs normally have at least seasonally elevated ground water tables and also include the stream beds. Areas outside the RHCAs may have elevated ground water levels and associated riparian vegetation. Many of these areas would be included in the mapped wetlands from the Crown Jewel consultants, WA Department of Ecology consultants, and the US Fish and Wildlife Service maps. In watersheds with proposed haul roads, the RHCA area is about 480 acres in Nicholson Creek watershed and 550 acres in Marias Creek watershed considering only National Forest System lands and rights-of-way. There are no RHCAs intersecting the Cow Camp road, proposed in Alternative D. However there are about 690 acres of RHCAs in the Upper Myers analysis watershed.

Executive Order 11990 of May 24, 1977 requires each agency to take action to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

Soil Permeability

An infiltration gallery is proposed on National Forest System lands at the headwaters of Nicholson Creek. The area proposed for infiltration is underlain by a sequence of glacial deposits. The upper-most permeable materials (outwash sand and gravel) targeted for infiltration is about 5 to 15 feet thick. During the investigation, these materials were unsaturated with the depth to groundwater about 20 feet (located in the center of the area proposed for infiltration). Minor groundwater was found at the contact between the sand and gravel and the underlying till and/or glacio-lacustrine sediments under confined conditions (Golder, 2004). The drain field for the infiltration gallery is about one-third of an acre. A more complete description of the conveyance pipe and infiltration gallery is included in the analysis file (McInnis, 2005). Soil infiltration rates for the coarse textured glacial till soils (see soil resource section) is high. A maximum of 20 gallons per minute (gpm) would drain into the infiltration gallery when the water treatment plant is operating[30]. The actual discharge would depend on the amount of water consumed during mining operations, and the amount diverted to water augmentation sites. Treated water would be discharged into the infiltration gallery in Alternatives B, B1, C and D.

Water Quality

Buckhorn Mountain surface waters are slightly alkaline with an average pH of 8.1. Dissolved constituents are dominated by bicarbonate (alkalinity, averaging 168 mg/L) and calcium ions (averaging 88 mg/L), indicating that water quality is controlled by reactions with carbonate minerals. Sulfate is low, typically averaging less than 37 mg/L. Most trace metal concentrations were below reportable detection limits, however cadmium, lead and ammonia were detected in exceedence of Washington State surface water quality criteria. Surface waters were found to be very similar chemically to ground waters in the area (Ecology FSEIS, 2006 Page 3.7-21; Ecology & FS, 1997).

Water quality parameters considered key for this analysis are shown in Table III-22. Analytical data are from samples collected in 1990 into 1992. These parameters are most likely to be affected by the road construction, reconstruction, and salt use. Total suspended solids represent low suspended sediment levels, while the low chloride and sodium background levels reflect that salting of these roads is not currently done in the winter.

[30] Thee infiltration gallery is designed for 40 gpm, and could potentially handle more than 20 gpm without adverse consequences. WADOE's adaptive management strategy may allow additional infiltration at this site, but additionally flows would not be permitted when bankfull discharge may be approached to eliminate possible erosion, undercutting or deposition.

Table III-22: Water Quality Parameters Marias and Nicholson Creeks

1990-1992	Monthly AVERAGE	Range	1990-1992	Monthly AVERAGE	Range	Standard or Criteria
Nicholson Creek (SW-1)			Marias Creek(SW-2)			
Chloride (ppm)	3	1-26	Chloride	3	1-20	230 ppm (WAC 173-201A)
Conductivity (millimohs)	367	286-476	Conductivity	407	296-492	None
Turbidity (NTU)[31]	4.6	0.1-29.8	Turbidity	Not Available	Not Available	5 NTU over background when the background is 50 NTU or less; or a 10 percent increase in turbidity when the background turbidity is more than 50 NTU. (WAC 173-201A-200)
pH (Std. Units)	8.4	8.1-9.2	pH	8.3	7.5-8.6	6.5-8.5 (WAC 172-201A)
Sodium, (ppm dissolved)	9	7-14	Sodium, dissolved	11	8-13	
Magnesium (ppm)	9.5	8-14	Magnesium	13.3	9-17	
Total suspended solids (ppm)_	4	2-14	Total suspended solids	4	2-10	

According to the data collected during the early 1990s (above) the current levels of Chloride (Cl) are within criteria listed above. There is no standard for magnesium.

All waters on the Okanogan National Forest lands are classified by the Washington State Department of Ecology in WAC 173-201-080 as a Class AA waters.

Golder gathered more recent information for the Buckhorn Mountain Project (Golder, 2006c), higher in the Nicholson and Marias Creek watersheds. Data was also gathered for turbidity:

Table III-23: Water Quality Parameters in Marias and Nicholson Creeks at SW-7 and SW-8

	SW-7 Nicholson Creek		SW-8 Marias Creek	
	Average	Range	Average	Range
Chloride (mg/L)[32]	0.7	0.5-1.0	1.1	0.5-2.0
Conductivity (Field (uS/cm)	327	4.2-434	381	0.34-454
Turbidity (Field) (NTU)	2.4	0-17	4.2	0-33
pH (Field)	7.9	7.0-8.6	7.3	6.0-9.3
Sodium total (mg/L)	5.2	4.4-5.8	8.0	7.3-9.7
Magnesium total (mg/L)	6.9	1-8	9.1	8.6-10
Suspended Solids (mg/L)	6.6	1-33	4.0	0.05-24

[31] Turbidity data collected during 1979-1982 at the mouth of Nicholson Creek (not collected at the SW-1 site).
[32] Chloride values used for effects analysis used the higher figure in WADOEs FSEIS. Lower background values would result in lower overall chloride values.

The Kettle River is listed as exceeding the State of Washington water quality criteria on the 2002-2004 303(d) list for dissolved oxygen and water temperature near Barstow, Washington, 50 miles downstream from the project area. This is a Category 5 designation which means that the segment is included on the 303(d) list, and a TMDL is required. A TMDL (total maximum daily load) is an allocation for a pollutant (water temperature or dissolved oxygen) in a watershed among all potential contributors so the total amount is less than a defined level for the waterbody. The 303(d) listings are for reaches over 50 miles below the proposed Buckhorn haul road areas.

Magnesium chloride is planned for dust abatement. A back-up method for magnesium chloride dust control in the project area is to use lignin sulfonate which has the potential to affect dissolved oxygen.

> *Lignosulfonates have a long history of use on roads as a method for dust control and surface stabilization. Lignosulfonates have a natural adhesive property when moist. When applied to gravel roads, the lignin sulfonate solution coats individual road particles with a thin adhesive-like film that binds the particles together. By attaching to the particle surface, it keeps the particle from being attracted to other particles and reduces the amount of water needed to use the product effectively. This allows the particles to pack closer together for a stronger surface. Consequently, water uptake by the roadbed surface is greatly reduced and the binder is less likely to be washed away by rain..*
>
> *Lignosulfonates encompasses a complex group of high-molecular-weight polymers. As a group lignins are second only to cellulose in abundance as natural polymers. Since very few biological agents can degrade the lignin molecule, it is extremely environmentally stable. In fact the Food and Drug Administration (FDA) currently allows for the use of ammonium-, calcium-, magnesium-, and sodium-lignosulfonates in animal feeds. They are commonly used in pelleted feeds for fish at a level of 2 to 2.5 percent, to increase water stability. There can be issues associated with increased oxygen demand in a stream when lignosulfonates are introduced directly into a stream from pulping plants. Receiving water near pulping plants experiences an increased oxygen demand and the water takes on a yellowish-brown tint (Schwenderman, 1981). Effluent from pulping plants is often up to 55% lignosulfonates so it is at a much higher concentration than would be achieved from its application as a dust palliative. There has not been any research that shows significant impacts to water quality as a result of lignosulfonates applied as a dust palliative* (Oregon Association of County Engineers and Surveyors, 1995).

The overall water quality trend for the Kettle River is shown in the **Kettle River Overall WQI** (Water Quality Index) **Trend for Water-Years** figure below. The trend is mixed, although the overall level in 2001 was slightly lower than in 1999 and 2000. Washington's draft Water Quality Index (WQI) is an attempt by the Washington State Department of Ecology to answer non-technical questions about water quality. It is a unitless number ranging from 10 to 100. A higher number is indicative of better water quality relative to expectations. For temperature, pH, fecal coliform bacteria and dissolved oxygen, the index expresses results relative to levels required to maintain beneficial uses (based on criteria in Washington's Water Quality Standards, WAC 173-201A). For nutrient and sediment measures, where criteria are not specific, results are expressed relative to expected conditions in a given region. Multiple constituents are combined and results aggregated over time to produce a

single score for each sample station. In general, stations scoring 80 and above met expectations for water quality and are of "lowest concern," scores 40 to 80 indicate "marginal concern," and water quality at stations with scores below 40 did not meet expectations and are of "highest concern."

Table III-24: Kettle River Overall WQI Trend for Water-Years 1994 to 2001

1994		1995		1996		1997		1998		1999		2000		2001	
66	53*	64	48*	62	62*	65	61*	55	46*	71	69*	70	64*	63	51*

*Second value has been adjusted for flow.

Sediment Estimates

Sediment production is primarily from geologic erosion and existing roads. Livestock grazing and some past timber harvest units continue to add to the overall stream sediment levels, especially in localized areas of livestock congregation along easily accessed stream reaches. Some on-site erosion may be occurring in the upper reaches of both Nicholson and Marias Creek from past logging activities. Roads represent the most likely and prevalent source of impacts to streams of all the past and on-going activities. Sediment estimates of the current situation were estimated using the Water Erosion Prediction Project (WEPP) model (Elliot, et al., 1999). Roads within the RHCAs are evaluated for erosion and sedimentation into the streams. Ketcheson and Megahan (1996) determined that eroded material may move over 800 feet from the road to a stream. Since the RHCA is 300 feet or less on each side of streams, it is reasonable to expect some eroded soil would get to the stream. The WEPP model routes the sediment to the stream, depending on the slope gradient between the road and the stream and distance of the road to the stream. The existing estimated sedimentation conditions are listed in the table below by subwatersheds.

Table III-25: Existing Condition Stream Sedimentation (tons/year)

Subwatershed	Background	Existing Roads	Total Existing Condition
Marias Creek	926	99	1025
Nicholson Creek	1302	146	1448
Upper Myers Creek	771	222	993

Existing roads were assumed to be about 18 feet wide. Total existing road width values used, including shoulders and ditch, was 25 feet in the WEPP modeling (proposed constructed and reconstructed roads were 33 feet in the WEPP modeling as shown below in Direct and Indirect Effects sections for each alternative). This included a 3 feet wide shoulder and 4 feet for the ditch. Fill slopes were also analyzed and increased to account for cut slopes. At one time, existing roads had a graveled surface, but most of the gravel has been pushed off the road by traffic and road maintenance. Relief culverts were estimated to be about 500 feet apart. The figure at left shows a typical existing road in these subwatersheds.

Figure III-2. The haul roads for each alternative including the current situation were modeled using the WEPP model. The current roads (Marias Creek road at left), for the WEPP modeling are 25 feet wide, have unpaved dirt road surface, with a vegetated ditch and relief drains about 500 feet apart. Current traffic levels are low.

Most sediment moves through the streams at high stream flows. During some low stream flow years, peak flows may not be sufficient to move sediment through the system. Heavy stream sediment levels in stream reaches less than 3% gradient may remain in place for several years, and may even be covered with vegetation. Very little sediment is expected to move from the subwatersheds during declining or base stream flows. Sediment estimates for current conditions are disclosed under Alternative A (no-action) below.

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Analysis Procedure

Erosion and sedimentation rates resulting from potential road construction and reconstruction activities were estimated with the WEPP model. Values used in the modeling were developed from information supplied through GIS covers describing the proposed activity and corporate GIS covers for the Okanogan National Forest. FS WEPP is an interactive program available through the internet that allows users to quickly evaluate erosion and sediment delivery potential from forest roads. The erosion rates and sediment delivery are predicted using input values for forest conditions developed by scientists at the Forest Service Rocky Mountain Research Station. The accuracy of the predicted values from WEPP:Road are, at best, within plus or minus fifty percent, but the figures shown should be considered to show *magnitudes* of differences, rather than *absolute* differences. True erosion rates are highly variable due to large variations in local topography, climate, soil properties, and vegetative properties, so predicted values are only a single estimate of a highly variable process. Outputs vary for a variety of reasons, including weather changes from year to year, time since last major climatic and runoff event, amount and age of management activities, bedrock lithology and weathering, soil and vegetation development and geomorphic processes. The WEPP model analysis used "average" conditions of precipitation at 20 inches per year, road width of 33 feet (includes road shoulder of 3 feet and ditch-to-cut slope of 5 feet and road surface of 25 feet), a fill slope 50 feet long (at 67% gradient), varying road gradients (based on GIS analysis of road segments), varying relief culvert spacing (based on road gradient), rock or vegetation lined ditch on an insloped road, graveled road surface and high traffic loads.

Marias Creek, Nicholson Creek and Upper Myers Creek are analyzed for direct, indirect and cumulative effects for estimated sediment changes. Several alternatives are considered (A, B, B1, C, and D). Alternative A is the *no action* alternative and provides a basis for comparison of the other alternatives. The time period for cumulative effects is through the expected life of the project (about 13 years in the future including reclamation monitoring and water augmentation, but not long term water monitoring). Past road construction is included as well as effects of the proposed Buckhorn mining operation.

Chloride levels were estimated for Marias Creek and Nicholson Creek subwatersheds, using provided information on the amount of magnesium-chloride likely to be used for dust abatement. Water concentrations were based on base flows listed in the Washington State Department of Ecology's Buckhorn Mountain project FSEIS (2006 Page 3.7-64).

Stream Sedimentation For All Action Alternatives

Increased stream sedimentation is the most obvious effect on water resources from management activities, which disturb vegetative cover or freshly expose soil. Road construction activities increase surface erosion rates and influence the delivery of sediment to surface water, and may change the erosion and/or deposition processes in stream channels. The intended use of the sediment analysis is to show the relative differences of sediment production between alternatives. Sedimentation levels were estimated for the three years following construction and reconstruction, the timeframe when most increased sedimentation normally occurs, using time trend analysis for surface erosion from roads as described by Megahan (1974). The road construction practices include *point-to-point construction* that would not have the sediment control structures installed for a period of about 10 days. The road related sediment estimates include an increased level of about 4 tons per year to account for the unprotected road surface, fill and cut slopes and lag in installing relief culverts and protection of the road ditch. Sediment estimates increased when paving was used because of increased runoff from the road surface, increasing erosion in the roadside ditches. The increased sedimentation was calculated using information in Megahan (1974).

INFISH Standards and Guidelines apply to Alternatives B, B1 and C. There are no RHCAs in Alternative D so INFISH Standards and Guidelines do not apply. INFISH standard and guideline RF-2, d1 says "*avoid sediment delivery to streams from the road surface [by] Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is infeasible or unsafe*" The constructed and reconstructed roads on National Forest System lands would be insloped to direct water runoff to structures designed to collect and store sediment in the storm water runoff. The stored sediment would be collected periodically and would be kept from discharging into the streams. As noted below in the Direct and Indirect Effects section for Alternatives B, B1 and C, the efficiency of these management practices, such as silt fences or hydro-mulching, is quite high, especially when used in combination with other practices. Controlling storm runoff by insloping the road surface towards a ditch also minimizes the amount of surface runoff that can run over the road fill and cause rills and gullies, which eventually introduce sediment into surface water.

INFISH standard and guideline RF-2, d2 says "*Route road drainage away from potentially unstable stream channels, fills and hillslopes*." Collected road surface water from the road ditch is routed though the ditch and eventually is discharged in the RHCA through road fills (toward the streams) into silt fences, backed by straw bales. The relief culvert spills onto a

rock apron which is designed to slow the flow velocity and eliminate any rills or gullies below the relief culvert outflow. Structure maintenance requires accumulated sediment be removed periodically so the erosion control structures remain efficient at collecting sediment.

INFISH standard and guideline RF-2 e says "*avoid disruption of natural hydrologic flow paths*." Road-stream crossings are designed to maintain the stream channel (stream simulation) form and hydrologic characteristics at all perennial stream crossings. In addition road-intercepted ground water collected in the road ditches and routed though relief culverts would infiltrate back into the ground after it passes through relief culverts.

INFISH standard and guideline RF-4 says "*Construct new and improve existing culverts, bridges, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those improvements would pose a substantial risk to riparian conditions*." All new culverts installed on perennial or intermittent streams in Alternatives B, B1, and C would be able to accommodate a 100 year flood.

Sanding the roads for winter use would also add sediment to the road surface and most sand would eventually collect in the road ditch from the insloped road surface. Approximately 200 tons of sand would be applied to the roads each year in Marias Creek (Alternative B/B1), Nicholson Creek (Alternative C). Sand spread on the Cow Camp road in Alternative D would not get to a stream (Millard Creek) because vegetation between the road and creek would intercept any sediment since the creek is so far from the road. 200 tons per year has been added to the total sediment production for each alternative.

303(d) List Implications For All Action Alternatives

Stream sedimentation is the most likely impact from the road construction and reconstruction activities in the Upper Toroda drainages. Stream sedimentation results are in the ***Delivered Sediment Tables*** for each alternative, but the sediment would not likely affect the 303(d) listing for water temperature or dissolved oxygen in the Kettle River near Barstow, WA. The distance from the project area to Barstow is over 50 miles downstream, and the flow of Marias or Nicholson Creeks is small relative to the Kettle River, so the project would not affect the listed parameters (water temperature and dissolved oxygen). Associated with the road work is road widening in the RHCAs. This may slightly reduce the overall shading of Marias or Nicholson Creeks where the road is within 10-20 feet of the stream, but tree removal is so minimal that water temperatures are not expected to change, and therefore water temperature in the Kettle River would not increase because of the road widening. Although the temperature of water infiltrated or augmented may be warmer or cooler than background levels, depending on the time of year, the water would be required to meet State water quality standards set by the NPDES operating permit which would require that water temperature to be at or below the State criteria.

Turbidity Implications For All Action Alternatives

The Washington State Water quality parameter criterion most likely impacted by increased stream sedimentation is turbidity. The Washington State criterion allows for a 5 nephelometric turbidity units (NTU) increase over background conditions (WAC 173-201A-200). The estimated increased sediment would increase turbidity the greatest during the first year following construction. Water monitoring would occur during and immediately following construction and reconstruction so follow-up measures can be implemented to stop or slow the movement of sedimentation into the creek if turbidity levels exceed state criteria.

Turbidity changes were estimated using the relationship between collected turbidity and suspended sediment levels collected from Nicholson Creek. Collected turbidity values on Nicholson Creek varied from 1 to 29 NTUs in 1980-1982 and between 0-17 in Upper Nicholson and 0-33 in Upper Marias in 2006 (Golder, 2006c). The draft (WA Department of Ecology, 11/15/2006) limits the maximum turbidity values to be 22 NTUs. Turbidity, a measure of sediment delivery, is expected to increase by less than 1 NTU in any alternative, well within standard of less than 5 NTU increase. Even with a 50% or 100% increase over the modeled amounts, the increase would be less than 2 NTU, again well with the standard.

Water Temperature Implications for All Action Alternatives

No new created openings are planned in riparian areas. The minimal amount of rights-of-way clearing in the RHCAs is not expected to change water temperatures in Marias or Nicholson Creeks. No rights-of-way clearing would occur in the RHCA for Millard Creek so no water temperature changes would occur. According to WADOE's draft NPDES and Fact Sheet, treated mine water temperature was determined based on Golder's 2006 engineering report not to exceed state surface water criteria.

Water Infiltration Gallery and Water Augmentation Effects for All Action Alternatives

The water infiltration gallery and water augmentation sites are located in the same position for all action alternatives. Treated water would be discharged into the infiltration gallery at a maximum of 20 gallons per minute over the life of the project, although it is possible additional water would be sent to the infiltration gallery if the gallery can handle more volume without any adverse erosional impacts down gradient. Excess water would be diverted to storage ponds on the mining site, be routed to the Roosevelt adit (up to 13[33] gallons per minute flow augmentation during July through September), the head of Gold Bowl (up to 24 gallons per minute-or in extreme conditions up to 64 gallons per minute in Nicholson Creek) or wetlands in Marias Creek (up to 3.5 gallons per minute flow augmentation during July through September[34]) to supplement surface water flows in those basins. Flow augmentation would begin the first year of mining, after the ground water levels have dropped from mine dewatering and are affecting surface water flow in Nicholson and Marias Creeks. While this analysis uses 20 gallons per minute as the flow to the infiltration gallery, there is some information to suggest the gallery has a capacity of 40 gallons per minute. If the discharge to the infiltration gallery is near 40 gallons per minute during the peak runoff period, it may increase the peak flow average and would likely increase the length of time stream flow is at bankfull stage or higher for a few to several days. Bankfull stage or higher is when most channel forming processes of erosion and deposition occur. This would cause more channel scouring and/or sediment deposition in Nicholson Creek. For this reason, a

[33] Golder, 2006a states that up to 6 gpm would be added at the Roosevelt adit augmentation site. The larger number used in WADOEs FSEIS was used to account for the higher chloride values when comparing to the standard and the potential for additional water to be augmented at this site. Any additional water augmented at this site or the infiltration gallery would have the tendency to raise chloride levels above those predicted in this FEIS, but in no case would the total exceed the chlorides predicted for the water with the highest levels of chlorides, the treated mine water at 230 ppm.

[34] Golder, 2006a states that up to 1 gpm would be added at the Marias Creek augmentation site. The larger number used in WADOEs FSEIS was used to account for the higher chloride values when comparing to the standard, and the potential for additional water to be augmented at this site. Any additional water augmented at this site would have the tendency to raise chloride levels above those predicted in this FEIS, but in no case would the total exceed the water with the highest levels of chlorides, the treated mine water at 230 ppm.

mitigation measure has been added in Chapter 2 to require that any additional discharges in streams or to the infiltration gallery above flows needed to replace flows lost due to mine dewatering would be made so that resulting stream flows remain below bank full conditions. The overall affect on Toroda Creek would be minor because Nicholson Creek's broad alluvial fan would trap any increased stream sedimentation where Nicholson Creek flows into Toroda Creek. Nicholson Creek may have short reaches where past accumulations of sediment are cleaned out and some scouring may occur; and there would be short reaches where increased stream sediment deposition occurs.

Water discharged at the infiltration gallery and any other ground water infiltration sites would be required to meet State ground water quality standards. Limits would be set by the NPDES operating permit issued by the Washington State Department of Ecology (see permit at http://www.ecy.wa.gov/programs/wq/permits/central_permits.html). Water quality would be required to meet the most restrictive of State or Federal standards for surface or ground water quality, whichever is the most restrictive.

Water discharged from the infiltration gallery would move downslope towards the cut-slope of an existing road. Some water would probably seep out of this road cut during the wet times of the year and would be most evident when the infiltration gallery is taking the maximum inflow of 20 gallons per minute. McKenzie-Johnson and Banton (2004) determined "*Flow within the unsaturated/partially saturated groundwater system is capable of conveying the infiltrated treated mine water effluent without causing adverse environmental effects such as mounding at the infiltration site or emergence at ground surface*". In the event there would be a failure of the old cut-bank, the failed material would likely remain just below the failed slope and the slope is likely to become re-vegetated. It is highly unlikely the failed material would be a detectable source of stream sedimentation and turbidity in Nicholson Creek because the relatively low and sometimes intermittent water flow from the infiltration gallery water would not have sufficient volume and velocity to carry sediment over downslope vegetation and other ground cover to surface flow in Nicholson Creek.

Associated with the infiltration gallery would be the extension of a two-inch, water augmentation pipeline to the Roosevelt Adit and wetlands in Upper Marias Creek. The purpose of the pipe would be to carry supplemental water to augment flows in Nicholson and Marias Creeks. Without augmentation, flows from the adit would decrease during and immediately following mining from mine dewatering. The supplemental flow would augment the ground water discharge from the adit. Additional water would be diverted to a stock watering trough in the upper Marias Creek headwaters. Stock water tank overflow would then be diverted to a nearby wetland. The result would be slightly more water than normal during the summer months in Marias Creek because the augmentation amounts would exceed dewatering losses by up to 1 gpm. Discharge of treated mine water into the shallow groundwater system would help minimize degradation or loss of down-slope wetlands, as required in Executive Order 11990. No erosion or sedimentation impacts are expected from this activity, because the tank would be located outside of the wetland, so there would be no additional trampling and disturbance of the wetland by livestock.

Following treatment, the infiltrated or augmented water would contain up to 230[35] ppm chloride, the state water quality criteria for chloride (230 ppm). Use of magnesium chloride for dust abatement would add more chlorides to the stream drainages. These additional chlorides are discussed below under each alternative. Projected levels are listed in the direct

[35] The maximum allowed by the November 2006 draft NPDES permit.

and indirect effects sections for Alternatives B, B1, C and D. There was no impact on chloride levels from dust abatement in Alternative D because roads are so far from the stream, but there would be a change in Nicholson Creek from the treated water discharge into the infiltration gallery, Roosevelt Adit and the Gold Bowl (Gold Bowl is considered in the Cumulative Effects analysis, because the discharge point into Gold Bowl is not on National Forest System Lands), and in Marias Creek from the water augmentation. Using maximum discharge rates for treated water and assuming road salts (magnesium chloride) were delivered to the streams over 365 day period, chloride levels in Marias Creek would increase a maximum of 152 ppm[36,37,38].

Fish Passage for All Action Alternatives[39]

Culverts at each live water crossing under the haul route, at the first crossing of Forest Road 3575 of Nicholson Creek, and at Forest Road 3550-080 crossing of Marias Creek would be replaced with culverts that can pass the 100-year flood. Those that are within fish habitat would be replaced with culverts that can pass all aquatic life designed using the stream simulation method. In addition, the culvert on a non-system road near the junction of Forest Road 3575 and 3575-100 would be replaced with a culvert that meets 100-year flood requirements and allows for all aquatic life passage. Replacement of these culverts would reestablish the natural stream channel under these roads and allow for more natural movement of water and sediment through the stream system. This would decrease potential for streams to damage roadbeds and cause sediment from road failures.

Wildlife Guzzlers

Wildlife guzzlers would be installed in the headwaters of Ethel and South Fork Bolster Creeks. Each guzzler would be on a previously disturbed site and would be fenced to keep cattle out. No erosion or sedimentation impacts are expected from this activity.

Hydromulching for All Action Alternatives

Hydrolmulching involves the use of material called tackifiers which helps hold the seed and mulch fibers together in a slurry so the distribution of seed is even across the treated areas. The tackifier is also useful for maintaining the mulch material on the slope until the seed begins to grow. The most widely used and effective tackifiers to bind mulch or hydromulch mixes contain acrylamide or groups of acrylamide molecules called polyacrylamides (PAM for short). These compounds also may be sprayed directly onto the soil to bind soil particles

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[36] Where the road lies within 100 feet of streams it was assumed that all salts applied to the road were delivered to the stream evenly over a 365 day period at which point they are incorporated into the stream's base flow volume as determined at its mouth. In reality higher stream flows during much of the year will dilute the 152 ppm to a lower value. The 152 ppm values is based on a 110 gpm flow rate in Marias Creek and maximum flows identified in the draft November 2006 NPDES. A shorter time period for chloride dilution was not used because the comparison is to the chronic aquatic life standard of 230, and a mitigation measure was added that $MgCl_2$ would only be added when precipitation was not expected within a 3-day period.

[37] Chloride levels could exceed this value if more water is added than specified in WADOEs FSEIS, but in no case would the chloride levels exceed 230 ppm because that is the chloride value of the treated water, which has the highest chloride value.

[38] Golder, 2006a predicts lower augmentation and infiltration rates; if lower rates are used, chloride levels would be even lower, because the augmented/infiltrated water has the highest values of chloride.

[39] In the preliminary EA, pools were planned to allow for fish passage, but Forest Service specialists felt that culvert replacements would be much more effectives in providing fish passage and the project was changed.

to reduce or eliminate soil erosion. PAM has a variety of uses and is even used in food processing and water treatment plants.

PAM or polyacrylamide is a chemical made of many subunits of acrylamide molecules which are linked together to form chain-like molecules. The anionic form of PAM is applied as a binder for mulches or directly to the soil. USEPA (2005) reported the anionic PAM, which is the form most often found in erosion control products, *has not been proven to be toxic to aquatic, soil or plant species. The molecule is too large to cross membranes, so it is not absorbed by the gastrointestinal tract, is not metabolized and does not bioaccumulate in living tissue. The Cationic form of PAM, although not of major concern for erosion control applications, has been shown to be toxic to fish because of its affinity to anionic hemoglobin in the gills.* The cationic form of PAM would not be used in any erosion control products for the road access to Buckhorn Mountain.

The Material Safety Data Sheet (MSDS) for generic Polyacrylamides (http://www.coulochem.com/MSDS/MSDS-035.pdf) lists short-term, human potential health effects as *may cause irritation*. Long-term effects are the same as short-term effects for skin contact and eye contact. No information is available for long-term effects for inhalation and ingestion. Toxicology information for animals (rabbits, rats and mice) indicates a slight irritation after acute exposure but no data are available for chronic exposure. The MSDS does not list any information for aquatic organisms. PAM is stable under normal temperatures and pressures. The MSDS for a PAM product, Trade Name Reinco TRACER® tackifier (2003), lists similar information.

USEPA (2005) reports the effects on water quality is potentially mixed. When PAM is used as a binder for mulch or as a direct application to the soil, it helps improve surface water quality by decreasing suspended sediments and other contaminants which could be associated with the soil particles and sediment loading. Roa, Espinosa et al. (no date) also report an increase in water quality by reducing sediment and nutrient loading, reducing turbidity and algae blooms in stream. However, shallow ground water could be affected if PAM is applied directly to the soil and improves infiltration, although that is not likely in the Buckhorn road project because the soils are already low in clay and silt particles (which is what the PAM would tend to aggregate). If the infiltration did improve, nutrients associated with the soil or additives, like fertilizer could leach through the soil at a more rapid rate. Careful application of PAM at prescribed rates can partially mitigate potential increased leaching.

Effects of Salts for Dust Suppressants for All Action Alternatives

The major known effects of salt in the environment relate to its capacity of moving easily with water through the soils. Impacts to aquatics from salts are discussed in the aquatics section. Dust suppressant use can potentially affect both surface and groundwater. However, as discussed below, salts from dust suppressants plus chlorides from the infiltrated or augmented water would be below State criteria. Transportation spills or accidental discharge of dust suppressants into streams could directly affect surface and groundwater depending on site characteristics. See the information on spills at the end of this chapter for more information.

Water Monitoring For All Action Alternatives

Water samples would be collected at wells and surface water from Marias Creek and Nicholson Creek watersheds at various intervals of days to months. Access would be by vehicle on existing roads, except in winter when snowmobiles would be required in Alternatives B1, C and D when monitoring sites are not on roads snow plowed for other operations. Although water monitoring may be required over a period as long as 60 years, no water resource impacts would occur from the access or water sample withdrawals.

Alternative A

Direct and Indirect Effects

WEPP estimates for total sedimentation in Alternative A are about 1025 tons per year in Marias Creek, 1448 tons per year in Nicholson Creek and 993 tons per year in Upper Myers Creek. This represents natural sedimentation and sediment from existing roads. Because of sedimentation from existing roads, Alternative A has about a 11% increase over estimated natural sedimentation levels in Marias Creek and 11% increase over estimated background sedimentation levels in Nicholson Creek and a 29% increase over estimated background sedimentation in Upper Myers Creek. The increase is primarily related to the existing road segments adjacent to the streams.

No water would be discharged into an infiltration gallery or at water augmentation sites. There would not be any potential changes in stream flow from these sites. No changes to wetlands would occur in Nicholson Creek, Marias Creek or Upper Myers Creek (Cow Camp Road/Pontiac Ridge) analysis watersheds.

No changes in surface water quality in Marias Creek, Nicholson Creek or Upper Myers Creek would occur because no $MgCl_2$ would be spread on the roads to abate dust.

Cumulative Effects

Because no project would occur under this alternative no cumulative effects would occur.

Alternatives B and B1

Direct and Indirect Effects

Based on WEPP modeling, Alternatives B and B1 would increase sedimentation from road construction and reconstruction about 49.4 and 51.3 tons per year in Marias Creek subwatershed, respectively if no consideration is given to mitigation measures that cannot be modeled in WEPP. The increased sedimentation level declines to 5 tons per year by the end of the third year because the soil surface is stabilizing by that time, and vegetation is becoming established on the cut and fill slopes, as well as the road ditch. The year 1 increase is about a 5% increase over the existing sedimentation levels, and less than 16% increase from all roads over geologic sedimentation levels in Marias Creek.

Megahan (1974) found about 70-80% of the accelerated surface erosion occurred in the first year about 10%-20% of the accelerated surface erosion occurred in the second year following the activity and about 5%-10% accelerated surface erosion occurred in the third

year after the activity. This is reflected in the sediment estimates in delivered sediment table below over year 1, year 2 and year 3.

The road generated sedimentation in Marias Creek subwatershed from the proposed roads on National Forest System lands or rights-of-way over the estimated existing sediment level is 5% during the first year. It would decline to less than 1% after 3 years.

Table III-26: Delivered Sediment Production (tons/year); Alternatives B (B1)

Watersheds	Total Existing Condition (all sources)[40]	Road Construction/ Reconstruction (year 1)	% Increase from Road Construction/ Reconstruction (Direct/Indirect year 1)	Cumulative Year 1 Sediment from all sources	Cumulative Year 2 Sediment from all sources	Cumulative Year 3 Sediment from all sources	%Change (Year 1) New construction/ reconstruction compared to existing road sediment	% Change from all roads compared to Natural Geologic Background (year 1)
Marias	1025	49.4 (Alt B) 51.3 (Alt B1)	5% (Alt. B/B1)	1074 (1076)	1040 (1040)	1030 (1030)	50% (52%)	16% (16%)
Nicholson	1448	0	0	1448	1448	1448	0%	11%
Upper Myers	993	0	0	993	993	993	0%	29%

In addition to the road construction and reconstruction related sedimentation (noted above in Table III-26) about 200 tons per year of sand would be put on road segments covered with snow and ice for improved traction and traffic safety. Some sand would be trapped on the road surface but most sand would eventually be carried into the road ditch and be either trapped behind the sediment traps in the road ditches or would drain through the relief culverts and be stopped with the sediment control measures at the outlet of the relief culverts. The sediment would need to be removed in either case, so the sediment control measures are in good operating condition. The sanding would occur each year the road is maintained for mine related work. Failure to keep the control structures clean would lead to much higher than predicted sediment loads reaching Marias Creek. Most of the sand would come off the road during the spring of each year, as the road snow and ice melts. Inspections of sediment control structures need to be especially vigilant during this time and their maintenance need to be kept up to date.

Because no roads would be built in Nicholson Creek or Myers Creek, there are no changes in the existing sedimentation rate in Nicholson Creek or Upper Myers Creek under Alternatives B and B1.

New and reconstructed road-generated stream sedimentation would increase about 50% over current road-generated sediment levels. Road construction induced stream sediment from just the Buckhorn Access Project over existing sediment levels is less than 5%. This would increase the average turbidity level by less than 1 NTU in Marias Creek and is within State surface water quality criteria. Even if WEPP estimates are off by 50, or even 100%, NTU increase would be less than 2 NTU, and within standards. Average turbidity levels in Nicholson Creek and Upper Myers Creek would not be impacted by the project.

The estimated sedimentation levels are based on the WEPP model's inclusion of mitigation measures (gravel surfacing, lined road-ditches and proper relief culvert spacing, based on

[40] Geologic background in Marias Creek results in about 926 tons per year

road gradient) incorporated into the road design. Other erosion control techniques have to be evaluated outside the WEPP model. For example, the sedimentation from the Buckhorn Access Project (estimated at 5% above existing levels, above paragraph) would be further reduced by other mitigation measures, such as silt fences when the toe of the road is within 100 feet of the stream, silt fences backed by straw bales at relief culverts where toe of the road is within the RHCA to form sediment basins, hydro mulching, rock aprons at the outlets of relief culverts and placement of slash on road fill slopes. Studies have detailed the erosion control effectiveness of different methods to control or minimize surface erosion from road construction. Silt fences have been shown by Grace (2003) to reduce the mean sedimentation by 85%. Grace also found the mean sedimentation reduction of sediment basins to be 89%. Burroughs and King (1989) determined the effectiveness of several ground covering treatments including straw mulch with netting or tackifier, erosion mats and hydro mulching. All the methods, except hydro mulching, were reported to reduce eroded soil from moving off-site by nearly 100% when the ground surface was covered 100% (100% coverage required about 4 tons per acre of straw mulch). Hydro mulching effectiveness varies from 65-80%, depending on total cover and length of slopes covered (longer slopes are more difficult to reduce sedimentation). Seyedbagheri (1996) summarized a study comparing windrowing of slash on road fills that suggests that windrows retained 75-85% of the eroded soil. Windrows also appeared to reduce the distance sediment moved away from the fill slope. Burroughs and King also discussed travel distances of sediment towards streams from fill slope erosion. Transport distances were influenced by how much water was diverted from the road surface to the fill slope. They point out the average transport distance (in north central Idaho) was about 26 feet when overland flow was not influenced by runoff over the fill slope from the road surface. When runoff from the road surface influenced runoff over the fill slope, the transport distance was increased to about 59 feet. The proposed road in Marias Creek has an insloped design to route road surface runoff to an inside ditch to be drained by relief culverts at specified distances. It is expected that windrows of slash on the fill slopes would help reduce the sediment transport distances, compared to an outsloped or crowned road surface.

Vegetative cover on the fill and cut slopes also helps reduce surface erosion and eventual sedimentation in Marias Creek. Grace (2003) determined re-vegetation of cut and fill slopes reduced sedimentation by 66%. Re-establishment of vegetative cover does take time. Vegetative cover would not likely be established on this road during the first year, but should be partially established in the second year, with increasing cover over time. In the *year 1* estimates of sedimentation, no effective vegetation cover is assumed in the first year. Longer disturbed cut and fill slopes are more difficult to re-vegetate. Overland flow has a chance to concentrate on the longer slopes. Straw mulch and/or hydroseeding with netting would be spread at high application rates on longer disturbed slopes to minimize erosion. Longer fill or road cut slopes would require more frequent monitoring to insure adequate cover is being established to minimize erosion.

The procedure used on the Clearwater National Forest (Bennett and Wilson, 1976) to compute stabilization effectiveness of multiple sediment reduction design measures was used in this analysis to determine the effectiveness of most measures:

$$\text{Percent Effectiveness} = 1 - [P_1 \times P_2 \times \ . \ . \ . \ P_n]$$

Where $P_{1,2\ldots n}$ are the different combinations of design and rehabilitation measures used. P factors for each measure are listed in the table below.

Table III-27: Reduction of Sedimentation by Stabilization Measures Outside of the WEPP Model

Stabilization Measures (outside WEPP)	% Reduction of Sediment	P (P = 100 - % Reduction of Sediment)
Silt Fence	85	.15
Settling Basins (around each relief culvert: straw bales and silt fence)	89	.11
Windrow Slash on Fill Slopes	75	.25
Hydro mulching	65	.35
Straw mulch and netting (fall-back if vegetation does not become established)	80	.20
Total Effectiveness (of the top 4 practices): 99%		

The amount of sedimentation reduction was determined outside WEPP by the values above because these Stabilization Measures aren't incorporated into the WEPP model. These additional measures disrupt the erosion and sediment delivery processes, which would reduce the actual sedimentation level by 99% delivered to Marias Creek. Because these measures would be implemented as the project progresses, sedimentation would be reduced to nearly current levels. These measure must be implemented as the road is constructed because a delay in installation by days or weeks after road construction and reconstruction would likely result in some of the eroded material getting into Marias Creek, because these measures are not effective until they are properly installed. Besides quick and proper installation of erosion control measures, the erosion control measures need to be maintained in a timely way, so that subsequent storms or runoff events can be accommodated. Failure to do timely maintenance of the erosion control structures would also cause additional sedimentation beyond what is projected for this alternative. One other mitigation measure is not accounted for in the potential reduction of stream sedimentation—the rock apron placed at the outlet of each relief culvert. No literature was found to document its effectiveness, but the apron does reduce the energy flow of water, and thus lowers its ability to carry sediment towards the stream.

All mitigation measures, including those accounted for in the WEPP model and those listed in Table III-27 are extremely important and are an integral part of these alternatives because the WEPP model without any mitigation estimated the sedimentation in Marias Creek would increase several times above the mitigated sedimentation levels. Considering all project related sediment from road construction and maintenance (including sand), Alternatives B and B1 would result in a total production of 249.4 and 251.3 tons of sediment, respectively. With effective erosion control measures, these are reduced by 99% to less than 3 tons of sediment actually reaching Marias Creek. This is less than one-half of one percent of existing sediment levels. Turbidity would still be within the State standards if 99% of the sediment (including road sand) is collected in the sediment control structures). The estimated changes in sediment without mitigation by Alternatives B, B1 and C would produce a turbidity increase in Marias or Nicholson Creek more likely to violate the state water quality turbidity criteria if mitigation measures were not applied. In addition, the mitigation measures would help protect the floodplain and related areas of Marias Creek, as required by Executive Order 11988.

The WEPP model was used in this FEIS and the State's FSEIS (WADOE, 2006 Page 3.7-2) (the State only analyzed the Marias Creek route). While the State FSEIS considered a variety of vegetative cover conditions (28%, 45% and 90% cover) no consideration was given for 0% cover. It is not likely a protective vegetative cover would be established during the first year after road work. When the State's sedimentation figures are extrapolated to 0% vegetative cover during the first year, the sedimentation increase would be about 58 tons per year, very similar to those figures generated by the Forest Service considering the limitations of the WEPP model. After the first year, the sediment increases between the State's FSEIS and the estimated increases are narrowed, as vegetation becomes established. Elliot (2002) points out, *"At best, any predicted runoff or erosion value by any model, will be within only plus or minus 50% of the true value. Erosion rates are highly variable, and most models can only predict a single value."* It is important to consider, however, that the benefit of the WEPP model is that it provides a relatively good comparison of alternatives (compared to no-action). The State's FSEIS also reported that the current vegetative cover on the Marias Creek road was about 28% and the WEPP model found the newly constructed and reconstructed road would produce about the same amount of sediment as the existing road if the vegetative cover were increased to 45%. Increasing the average vegetative cover from 28% to 45% on the road's cut and fill slopes would be difficult without a substantial maintenance of the vegetation on the road fill and cut slopes. Longer and sometimes steeper cut and fill slopes would be more difficult to re-vegetate than the shorter existing cut and fill slopes. Accumulated organic matter in the soils would be less as the road prisms are made larger and less developed soils are now on the surface. While inherent soil fertility is low, the less developed soils deeper in the soil profile would be even less and would tend to support less vegetative growth. The WA DOE analysis also failed to show any sedimentation due to the road sanding for winter driving.

In summary the road construction and reconstruction would increase surface erosion and potential sedimentation, as the WEPP model shows. The key to reducing stream sedimentation in Marias Creek is to implement the sediment reduction mitigation measures as the road is being constructed or reconstructed. Each relief culvert in the RHCA would be required to have a silt fence with the straw bales with the rock aprons in place before work starts on the next relief culvert. If these measures are not in place, risk of sedimentation of Marias Creek is increased from roads in the RHCA following a normal rain storm. The newly exposed soils without the sediment barriers in place would be subject to more erosion and potential stream sedimentation. The most rapid erosion from road construction occurs during the first year, and it occurs at a high rate for the first year. In this Forest Service FEIS, predicted erosion and sedimentation was increased by about 4 tons per year (based on Megahan, 1974) to account for approximately 10 days of road work not having most or all of the erosion control structures in place. The sedimentation control structures must be monitored and maintained as necessary to keep these structures as effective as possible especially in the first three years following construction and reconstruction.

Since Marias Creek was classified as a Rosgen stream type B4, road fill encroachment on the creek would cause some changes in the channel. This stream type is influenced by local constrictions, scour pools and minor sediment storage. It is sensitive to changes in flows and sediment loads. Flow velocity would increase if reaches were constricted by the road fill. The stream would undercut the fill and carry sediment downstream where it would eventually be deposited. Channel widening would occur where the stream has insufficient energy to carry the sediment. The effect on the road subgrade would be limited to road fill that was actually in the stream. The streamflow would undercut the fill and erode a portion of the road fill, perhaps taking a portion of the road subgrade. Marias Creek is a low energy stream and

the sediments added to the stream from any sources would tend to remain in the watershed over the short term, especially near the mouth. Eventually, additional sediment would move into Toroda Creek. The effects are not expected because no road fill into streams is proposed and in nearly all locations, additional road width would come from the cut-bank side of the road, away from Marias Creek.

About 55,550 gallons[41] per year of 30% solution of $MgCl_2$ (Magnesium Chloride) would be used to help reduce road dust during ore hauling operations on 6.7 miles of road in Marias Creek. According to the data collected during the early 1990s and 2000s the current levels of Chloride (Cl) and Magnesium (Mg) in Marias Creek are within criteria listed above. Since $MgCl_2$ is soluble in water, most of the Cl, and Mg would be carried away in the stream, especially on the road segments 100 feet or closer to the stream.

The Buckhorn Mountain Project FSEIS (WADOE FSEIS, 2006 Page 3.7-85) cites a report from the Colorado Department of Transportation that reports Cl, and Mg would be carried only relatively short distances of about 60 feet from the area of application. There is a difference of opinion on the distance of movement. Hull and Bishop (2003) report in southeastern Idaho that maximum accumulation of Cl, and Mg would occur at about 40 feet from the area of application, but found movement of up to 90 feet where there is a perched water table or otherwise downward restraining layer. Based on this information, 100 feet was used as a reasonable maximum distance that the salts would move in shallow ground water movement.[42]

Contributing to the salt movement is a factor called the partition coefficient. The *partition coefficient* for inorganic forms of chloride is zero (Rao, et al., n.d.), which means that there is virtually no ground water flow retardation for these elements and they would move with ground water over time, eventually reaching Marias Creek. The assumption in the direct and indirect effects analysis was that all the Cl, and Mg applied to roads within 100 feet would reach Marias Creek, although the rate would be related to frequency and magnitude of snow melt and rain storms, because surface water flow and shallow ground water flow would be the main carrier of the Cl, and Mg.

Water quality in Marias Creek would likely be affected by the salts on the road. Snow plowed from the road would contain dust abatement salts and where the road is close to Marias Creek, the soluble salts would get into the water. To minimize this, where the road is within

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[41] An engineering report submitted by the proponent uses a total of 72,000 gallons, but that amount includes treatment for the entire project, including on private lands at the mine site. However, the figure used in the DEIS was in error, and has been corrected here.

[42] Hull and Bishop (2003) found instances of movement up to about 340 feet under certain conditions. In Marias Creek the conditions that would lead to longer distances would include prolonged periods (10 days or more) of substantial rainfall (.3 inches) and very wet soil conditions as a result of the precipitation. Analysis of the long term precipitation at Republic, WA shows there is virtually no chance that a daily average of .3 inch of rain occurring over 10 consecutive days, so the 340 foot distance of salt movement is virtually not likely to occur. The modeling was done conservatively. The modeled distance of normal salt movement was above what was reported in the literature, and the water flow was always at the base flow. When flows are higher than the baseflow (during October through June or July), the concentration of salts will be lower than reported here. Augmentation flows are the higher of expected values and these will tend to raise chloride levels. Monitoring of the chloride levels is ongoing as a requirement of the NPDES. If the monitoring results show a chloride level that is exceeding the potential levels and approaches the standard, other methods that don't use chlorides to control dust can be used.

100 feet of Marias Creek, snow would be required to be blown upslope or end-hauled outside of the RHCA. At present, chloride levels are low in Marias Creek.

Approximately 21,540 gallons in Alternative B and 17,900 gallons in Alternative B1 of solution (92,720 pounds in Alternative B and 76,700 pounds in Alternative B1 of $MgCl_2$) would be applied each year on the road for dust control within 100 feet of the stream. $MgCl_2$ applied outside 100 feet is assumed not to get into the surface water flow in Marias Creek. Depending on when these chemicals get to the surface water would influence the Cl, and Mg levels in the stream. Water monitoring as required in the *Mitigation and Monitoring* section would help determine if increased levels of chloride and magnesium or other introduced salts occur, and help determine if other methods to control dust should be used. Based on average base flows of 110 gallons per minute in Marias Creek (Washington State Department of Ecology, 2006, Page 3.7-64 – SW-7), and background level of chloride of 3 ppm, the average concentration of chloride in Marias Creek would be about 147 parts per million (Alternative B) and 123 parts per million (Alternative B1) from the added salts on the road. Alternative B1 is less because about 0.5 miles of the road within 100 feet of the stream is paved and would not require any dust abatement. The estimated chloride levels are below the State water quality criteria of 230 ppm. In addition to the chlorides from road treatments, water discharged into the upper Marias wetlands would contain 190 ppm of chloride. Adding 3.5 gpm with 190 ppm chloride to 110 gpm (baseflow for Marias Creek) still result in chloride levels of 147 ppm (Alternative B) and 123 ppm (Alternative B1).[43,44]

No road related chlorides would be added to Nicholson Creek in Alternatives B or B1, but infiltrated water from the infiltration gallery, and augmented water at the Roosevelt Adit would add up to 33 gpm (up to 20 gpm at the infiltration gallery, 13 gpm at Roosevelt Adit) to Nicholson Creek with 190 ppm of chloride to the 223 gpm base flows in Nicholson Creek would increase the chloride concentration to 27 ppm including the current chloride levels[45]. As mentioned in the Cumulative Effects section, treated water of 24 gpm diverted to the Gold Bowl would increase the chloride level to 41[46] ppm, and if the Gold Bowl receives up to 64[47] gpm in the most extreme situation[48], the chloride level would increase to 61[49] ppm in

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[43] Baseflows and maximum infiltration and augmentation rates were used to account for all potential salt dilution. Flows above baseflows would further dilute salts from infiltration and augmentation because treated water will have higher chloride values than natural or road maintenance induced values. 190 ppm based on WADOEs FSEIS; draft NPDES sets limit at 230.

[44] Chloride calculations used for Marias Creek are based on WADOEs FSEIS augmentation value of 3.5 gpm. Golder 2006a predicts lower augmentation rates of 1 gpm, which would result in 1 ppm lower total chloride levels. The draft November 2006 NPDES permit indicates a maximum of 10 gpm augmentation in Marias, which would result in a total of 152 ppm chloride level in Alternative B or 130 ppm in Alternative B1 if augmented water is 230 ppm chlorides.

[45] Chloride calculations used for Nicholson Creek are based on WADOEs FSEIS augmentation value of 13 gpm at Roosevelt adit. Golder, 2006a predicts lower augmentation rates of 5 gpm during mining when the infiltration gallery would be operating, which would result in 22 ppm chloride. The draft November NPDES indicates that the infiltration gallery may operate at a maximum of 40 gpm, and Roosevelt with a maximum of 50 gpm. This would leave a total of 45 gpm during maximum flows to discharge at Gold Bowl on private lands which would result in a total cumulative chloride level of 68 ppm in Nicholson if augmented water is 230 ppm chlorides.

[46] 37 ppm using Golder 2006a augmentation rates or 68 using the draft NPDES maximum rates with augmented water at 230 ppm chlorides.

[47] The November 2006 draft NPDES indicates up to 40 gpm may be infiltrated.

[48] The water treatment plant can only sustain 100 gpm.

[49] 58 ppm using Golder 2006a augmentation rates or 88 ppm if the maximum flow of 135 gpm is discharged at various Nicholson outfalls with augmented water at 230 ppm chlorides (plus 10 at Marias equals total maximum flows in WADOEs FSEIS of 145 gpm).

Nicholson Creek in Alternatives B and B1. All of these values would continue to meet state water quality criteria for chlorides of 230 ppm.

If monitoring determined chloride levels did exceed the Washington State standard in the NPDES operating permit even with reduced use of chloride salts for dust control, other measures would be taken. Substitutes for chloride salts would include frequent watering for dust control or lignin sulfonate. Either of these methods would not increase the chloride levels in surface water, although the additional road watering for dust control would divert water from streams and reduce surface water flows from wherever the source of water is, but it would not be on NFS lands.

Magnesium levels in Marias Creek from the dust abatement would increase by 48 ppm (Alternative B) and 40 ppm (Alternative B1). Existing levels vary up to 15 ppm. Lower levels in Alternative B1 are due to no dust abatement on the paved section of road. There are no state standards for magnesium.

If there are problems with the dust suppressant magnesium chloride, the backup treatment would be lignin sulfonate. The Oregon Association of County Engineers and Surveyors Best Management Practices manual (1995) found:

> *No research was found that indicated that an application of lignosulfonates anywhere near a fish bearing stream would have any impact on temperature. The application of lignosulfonates may restore the functioning condition of a stream that is impacted by sediments that originate on gravel roads in the watershed. By limiting the fines that reach streams, sediment will be reduced and existing conditions would be improved. Chemical contaminant and nutrient addition to a steam will be maintained/avoided with the proper application of dust abatement palliatives.*

Lignin products have a high Biological Oxygen Demand in aquatic systems spills or runoff into ground water or surface water. This would reduce the oxygen levels of the water or may increase the concentrations of iron or sulfur compounds.

The Washington State 303(d) list includes the Kettle River near Barstow, Washington, over 50 miles below the confluence of Toroda Creek and the Kettle River. The impaired parameter at that location is Dissolved Oxygen. In the event oxygen levels in Marias Creek decrease because of contamination by lignin sulfonate, there would be no effect on the dissolved oxygen levels in the Kettle River at Barstow. The flow of Marias Creek is a very small component of Kettle River flow, and the turbulent flow over the distance between Marias Creek and the Kettle River at Barstow would add dissolved oxygen into the water.

Overall water quality changes in Marias Creek would not exceed state water quality criteria from the road construction or reconstruction activities. Water discharged to the infiltration gallery must meet the state standards set by the NPDES operating permit; water quality would meet state quality requirements. Water quality would meet the most restrictive of State or Federal surface of ground water quality standards (see draft permit at http://www.ecy.wa.gov/programs/wq/permits/central_permits.html).

About 0.1 total acres of wetlands would be disturbed or destroyed by road construction and reconstruction cuts and fill slopes. Of the eight wetlands mapped by ENSR (2005), six

would be impacted by the road. The Table III-28 below shows the size and wetland impacted by the road in this alternative:

Table III-28: Impacts on Wetlands Along the Marias Creek Haul Route
(from: Washington State Department of Ecology, 2006 Page 3.9-5)

Wetland Name	Total Wetland Area (square feet)	Estimated Impacted Area (square feet)	Percent Impacted	Dept of Ecology Rating System for Wetlands in Eastern Washington
MR1	1,935	80	4%	III
MR2	4199	0	0%	IV
MR3	1,231	1,231	100%	IV
MR4	719	719	100%	IV
MR5	3817	0	0%	IV
MR6	142	142	100%	IV
MR7	1,079	1,079	100%	IV
MR8	3,939	80	2%	III
Total		**3,331 (0.08 acres)**		

Road construction and reconstruction may influence wetlands by changing the timing of storage and release of ground water. Roads can intercept shallow ground water and re-route the water overland, where it leaves the watershed faster and increases the seasonal drying of wetlands. Wetlands are slightly affected by the construction or reconstruction of the road in Marias Creek. The subsurface water in the six wetlands would flow to the surface, and the affected wetlands would become smaller. The wetlands covered by widened road segments are unlikely to re-establish because the road drainage features would continue to divert water from the road ditch to the relief culverts and eventually to Marias Creek after passing through the sedimentation control structures.

The wetland below the Roosevelt Adit would be affected by the ground water draw-down associated with the mining activity on Buckhorn Mountain. A maximum of 20 gpm would be infiltrated year round, along with 13[50] gpm augmented at the Roosevelt Adit in July, August and September, which would offset or partially offset flows lost during mine dewatering depending on the season. Although activities in NFS lands would be adding to water availability, this would only offset impacts from dewatering on private lands. WADOEs FSEIS predicts no impact to this wetland during mining because of flow augmentation and disposal of excess water during mining. Wetlands along Nicholson Creek may be a little less wet in the summer and fall or edges may dry up earlier. Little change in productivity is expected (FSEIS, page 3.9-20,21).

Wetlands, seeps and springs in the headwaters of Marias Creek would be affected by the ground water drawdown associated with the mining activity on Buckhorn Mountain. 3.5[51]

[50] Infiltrated water is intended to offset losses as a result of mine dewatering, but maximum values are used to show the maximum possible effects. Golder 2006a indicates only a maximum of 5 gpm would need to be augmented during mining. The November 2006 NPDES indicates a possible maximum of 50 gpm could be discharged at Roosevelt adit – see footnote 47 above.

[51] Infiltrated water is intended to offset losses as a result of mine dewatering, but maximum values are used to show the maximum possible effects. Golder 2006a indicates only a maximum of 1 gpm would need to be augmented during mining. The November 2006 NPDES indicates a possible maximum of 10 gpm could be discharged in Upper Marias Creek – see footnote 46 above.

gallons per minute are proposed to be diverted from treatment plant at the mine to the wetlands in upper Marias Creek during July, August and September. The diverted water would replace the ground water shortfall from mine dewatering in the wetland area for the three months of augmentation starting in year 4 of mining and until 3-5 years after mine closure. After the flow augmentation ceases, less water would recharge the wetlands, until the groundwater reached equilibrium. The likely outcome would show as slightly reduced wetlands, seeps and springs size, or a reduction in water qualities such as the amount of standing water or the length of time each year the soils are saturated. This condition would exist until mining is completed and ground water equilibrium levels are restored. The lower portion of the mine would fill in an estimated 3-5 years with the rate of filling slowing the closer water gets toward equilibrium. WADOEs FSEIS concludes that wetlands along Marias Creek may be a little less wet in summer and fall or edges may dry up earlier. Little change in productivity is expected (FSEIS, page 3.9-22)

Mitigation for wetland loss due to replacement of the two existing culverts in Marias Creek is proposed by developing wetlands in association with those replacements. These would be areas adjacent to the creek where the elevation of the flood prone area would be lowered to allow ground water and surface water to fill the depression. The impacts with this would be additional sedimentation during the construction. During high flows, these small created wetlands would likely fill with sediment and debris, either reducing their size or covering them completely. During these events the Corps of Engineers expects such events to create or modify other wetlands along the drainage.

This is a minimal amount of wetland disturbance and helps meet the requirement of Executive Order 11990 to minimize loss or degradation of wetlands.

Alternative C

Direct and Indirect Effects

WEPP estimates of increased sedimentation from road construction and reconstruction in Alternative C are 42.3 tons per year in Nicholson Creek watershed, 3.4 tons per year in Marias Creek and 7.4 tons per year in Upper Myers Creek. The increased sedimentation level would decline to 1 ton per year by the end of the third year because the soil surface would stabilize by that time, and vegetation would be nearly fully established to the extent possible on the cut and fill slopes, as well as in the road ditch.

The road generated sedimentation from the activities proposed on National Forest System lands or rights-of-ways in the Nicholson Creek subwatershed is 3% over the estimated existing sediment for Nicholson Creek. This would increase the average turbidity level by less than 1 NTU in Nicholson Creek. Average turbidity levels in Marias and Upper Myers Creek would not be affected by the project.

Table III-29: Delivered Sediment Production (tons/year); Alternative C

Watershed	Total Existing Condition (all sources)[52]	Road Construction/ Re-Construction (year 1)	% Increase from Road Construction/ Reconstruction (Direct/Indirect – year 1)	Year 1 Sediment from all sources	Year 2 Sediment from all sources	Year 3 Sediment from all sources	%Change (Year 1) New construction/ reconstruction compared to existing road sediment	% Change from all roads compared to Natural Geologic Background (year 1)
Marias	1025	3.4	>1%	1029	1027	1026	3%	11%
Nicholson	1448	42.3	3%	1490	1466	1459	23%	14%
Upper Myers	993	7.4	>1%	1001	997	996	3%	30%

In addition to the road construction and reconstruction related sedimentation (noted above in Table III-29) about 230 tons per year of sand would be put on road segments covered with snow and ice for improved traction and traffic safety. Some sand would be trapped on the road surface but most sand would eventually be carried into the road ditch and be either trapped behind the sediment traps in the road ditches or would drain through the relief culverts and be stopped with the sediment control measures at the outlet of the relief culverts. The sediment would be removed in either case, so the sediment control measures are in good operating condition. The sanding would occur each year the road is maintained for mine related work. Failure to keep the control structures clean would lead to much higher than predicted sediment loads reaching Nicholson Creek. Most of the sand would come off the road during the spring of each year, as the road snow and ice melts. Inspections of sediment control structures need to be especially vigilant during this time and the erosion control structures need to have current maintenance.

The estimated sedimentation levels from the WEPP analysis are based on mitigation measures of gravel surfacing, lined road-ditches and proper relief culvert spacing, based on road gradient incorporated into the road design. The sedimentation would be further reduced because additional mitigation measures, such as silt fences, rock aprons at the outlets of relief culverts and placement of slash on road fill slopes are incorporated into the sedimentation outside of WEPP. These additional measures promptly implemented would disrupt the erosion and sediment delivery processes, which would reduce the actual road-generated sedimentation level to near pre-disturbance levels for Nicholson Creek. These erosion control techniques modify sediment outputs outside the WEPP model. For example, the road-generated sedimentation in Nicholson Creek would be further reduced by mitigation measures, such as silt fences (although because of high potential for grazing by cows, silt fences would not be backed by straw bales on NFS or DNR lands), hydro-mulching, rock aprons at the outlets of relief culverts and placement of slash on road fill slopes.

Studies have documented the erosion control effectiveness of different techniques which control or minimize surface erosion from road construction as noted under Alternatives B/B1 above. Actual stream sedimentation estimates were reduced by using the stabilization measures in Table III-30 for the Nicholson Creek route.

[52] Geologic background in Nicholson Creek results in about 1302 tons of sediment per year.

Table III-30: Reduction of Sedimentation by Stabilization Measures Outside of the WEPP model

Stabilization Measures (outside WEPP)	% Reduction of Sediment	P (P = 100 - % Reduction of Sediment)
Silt Fence	45	.55
Windrow Slash on Fill Slopes	75	.25
Hydro mulching	65	.35
Straw mulch and netting (fall-back if vegetation does not become established)	80	.20
Total Effectiveness (of the top 3 practices): 95% (80% where slash windrowing doesn't occur)		

The amount of sedimentation reduction was estimated outside WEPP by the values above because these Stabilization Measures aren't incorporated into the WEPP model used to estimate erosion and sedimentation amounts. These additional measures disrupt the erosion and sediment delivery processes, which would reduce the actual sedimentation level in Nicholson Creek by 80% delivered to Nicholson Creek where windrowing doesn't occur. Where windrowing of slash on road fills does occur, the effectiveness of the sedimentation mitigation measures are about 95%, but not all areas are planned to be covered with windrowed slash.

Since livestock would eat straw bales in Nicholson Creek, straw bales would not be used on NFS or DNR lands in Alternative C. The livestock would increase the likelihood of silt fence damage during the normal grazing because the National Forest System portion of Nicholson Creek is not fenced, so to account for the reduced effectiveness of the treatment to reduce sedimentation is reduced by half (in the table above). To reduce the potential for damaged silt fences, monitoring of the silt fences would be done weekly when cows are present to make sure the fences are as effective as possible. Because these measures would be implemented in Nicholson Creek as the project progresses, sedimentation would be reduced but not quite to current levels. These measure must be implemented as the road is constructed because delay in installation by days or weeks after road construction and reconstruction would likely result in some of the eroded material getting to Nicholson Creek, because these measures are not effective until they are properly installed. Because the point-to-point road construction would have segments of the road unfinished for up to 10 days, the sediment estimates in Table III-30 were increased using the time sediment relationships in Megahan (1974). Besides quick and proper installation of erosion control measures, the erosion control measures need to be maintained in a timely way, so that subsequent storms or runoff events can be accommodated. Failure to do timely maintenance of the erosion control structures would also cause additional sedimentation if the structures are overwhelmed by sedimentation from past storms beyond what is projected for this alternative.

Nicholson Creek is very close to the road, and in some cases there may not be the three to five feet between the bottom of the fill and the stream needed for proper installation of rock aprons and silt fencing. Where this occurs the reduced buffer distance would be less effective at slowing sediment, so following winter snowmelt or summer convective storms, sediment would accumulate more quickly at the silt fence. These sites would need additional field inspections and more frequent maintenance to insure there is adequate capacity for sediment storage when needed.

A mitigation measure not accounted for in the potential reduction of increased stream sedimentation is the rock apron placed at the outlet of each relief culvert. No literature was found to document its effectiveness, but the apron does reduce the energy flow of water, and thus lowers its ability to carry sediment towards the stream.

Considering all project related sediment from road construction and maintenance (including sand), Alternative C would result in a total production of 272.3 tons of sediment. With effective erosion control measures, these are reduced by 80-95% to about 14-54 tons of sediment actually reaching Nicholson Creek depending on if windrowing of slash is used or not. This amount is 1-4% above existing levels. The mitigation measures are extremely important and integral part of these alternatives because the WEPP model without mitigation estimated the sedimentation in Nicholson Creek would increase several times above the estimated mitigated sedimentation levels. The higher increases in sediment would produce a turbidity increase in Nicholson Creek more likely to violate the state water quality turbidity standard if mitigation measures were not applied. In addition, these mitigation measures would help protect the floodplain and related areas of Nicholson Creek, as required by Executive Order 11988.

In summary the road construction and reconstruction would increase surface erosion and potential sedimentation, as the WEPP model shows. The key to reducing stream sedimentation in Nicholson Creek is to implement the sediment reduction mitigation measures as the road is being constructed or reconstructed. If these measures are not in place, sedimentation of Nicholson Creek is highly likely from roads in the RHCA following a normal rain storm on newly exposed soils, since most erosion from road construction occurs during the first year, and it occurs at a rapid rate for the first year. Because the mitigation measures listed above would be completed as the road is reconstructed or constructed, the sedimentation rate would be reduced by 80-95%. The sediment control structures must be monitored and maintained as necessary to keep these structures as effective as possible.

Since $MgCl_2$ is soluble in water, most of the Cl, and Mg would be carried away in the stream, especially on the road segments within 100 feet of the stream. Snow plowed from the road would contain the dust control salts and where the road is close to Nicholson Creek, the soluble salts would get into the water. At present chloride levels are low in Nicholson Creek. Approximately 13,939 gallons of solution (59,800 pounds of $MgCl_2$) would be applied on the road for dust control within 100 feet of the stream each year. Depending on the timing of these chemicals getting to the surface water, this would increase the Cl, and Mg levels in the stream. Water monitoring as required in the *Mitigation and Monitoring* section would help determine when increased levels of chloride, magnesium salts occur, and help determine if other methods to control dust removal should be used. Based on average base flows of 230 gallons per minute in Nicholson Creek (Washington State Department of Ecology, 2006 Page 3.7-64 – SW-1), plus the treated water of 33 gpm from the infiltration gallery and Roosevelt adit, the average concentration (including the background of 3 ppm) is 64 gpm[53]. Cumulative effects on Nicholson Creek from the treated water discharges into the Gold Bowl would increase the chloride levels to 77[54] ppm if the treated water into the Gold Bowl was 24 gpm. If the treated water discharge increased from 24 gpm to 64 gpm in the Gold Bowl, the

[53] 63 ppm using Golder 2006a Roosevelt adit augmentation rates or 100 ppm based the November 2006 NPDES rates with augmented water at 230 ppm chlorides.
[54] 74 ppm using Golder 2006a Roosevelt adit augmentation rates.

chloride level would be 91 ppm[55]. Both situations are below the Washington State Water Quality standard of 230 ppm.[56]

No road treatment chlorides would be added to Marias Creek in Alternative C, but 3.5 gpm would be discharged into the small wetland near the head of the drainage in July, August and September. This water is estimated to contain 190 ppm of chloride which when added to the 110 gpm baseflows in Marias Creek would increase the chloride levels in Marias Creek 9 ppm including the existing chloride level in Marias Creek of 3 ppm[57]. These chloride values would all continue to meet State water quality criteria for chlorides. Effects from the potential use of lignin sulfonate as a back-up dust abatement method are the same as described under Alternative B and B1, including dissolved oxygen at Barstow. Magnesium levels in Nicholson Creek from the dust abatement would increase by 11 ppm. Existing levels vary up to 15 ppm. There are no state standards for magnesium.

Overall water quality changes in Nicholson Creek would not exceed state water quality criteria from the road construction or reconstruction activities. Water discharged to the Infiltration gallery must meet the state NPDES permit requirements, water quality would meet state quality requirements. Water quality would meet the most restrictive of State or Federal, ground or surface water quality standards.

Approximately 0.2 acres of wetlands (Shaw Environmental 2004; ENSR 2005) would be eliminated by the road reconstruction or construction in Nicholson Creek. The estimated impact area for each wetland is shown in Table III-31.

Table III-31: Impacts on Wetlands Along the Nicholson Creek Haul Route

Wetland Name[58]	Total Wetland Acres	Impacted Areas (Acres)	Impacted Area (square feet)	Percent Impacted	Dept of Ecology Rating System for Wetlands in E. Washington
E1	0.105	0.07	2,841	61.95%	IV
E2	2.274	<0.01	0.22	0%	II
E2A	0.005	<0.01	14	6.7%	II
E4	0.812	0.02	985	2.79%	III
E5	8.431	<0.01	20	0.32%	II
E6	0.215	<0.01	69	0.01%	IV
E7	0.08	0.07	3,045	87.88%	IV
E7A	0.039	0.01	258	15.35%	IV
F5	0.34	<0.01	17	0.12%	III
F8	0.016	<0.01	32	4.7%	III
F9	0.153	<0.01	0.54	0.01%	III
RA1[59]	4.7	<0.01	90	0%	II
Total		**0.21**	**7,330**		

[55] 90 ppm using Golder 2006a Roosevelt adit augmentation rates, or 116 ppm based on the November 2006 NPDES maximum flows with augmented water at 230 ppm chlorides.
[56] Baseflows and maximum infiltration and augmentation rates were used to account for all potential salt dilution. Flows above baseflows would further dilute salts from infiltration and augmentation because treated water will have higher chloride values than natural or road maintenance induced values.
[57] 5 ppm using Golder 2006a Roosevelt adit augmentation rates or 22 ppm based on the November 2006 NPDES maximum flows with augmented water at 230 ppm chlorides.
[58] One small wetland show in Shaw (2004) is not listed in Table III-31. Area impacted was less than 0.01 acres.
[59] RA1 from ENSR (2005) is a combination of CA1 and CA2 from Shaw Environmental, 2004.

The subsurface water in the 12 wetlands would flow to the surface, and the affected wetlands would become smaller. The wetlands may become wetter at the road cut or fill interface as shallow ground water flows to the disturbed area.

The wetland below the Roosevelt Adit would be affected by the ground water draw-down associated with the mining activity on Buckhorn Mountain. A maximum of 20 gpm would be infiltrated year round, along with 13[60] gpm augmented at the Roosevelt adit in July, August and September, which would partially offset flows lost during mine dewatering. Activities in NFS lands would be adding to water availability, which would offset or partially offset flows lost during mine dewatering depending on the season. Although activities in NFS lands would be adding to water availability, this would only offset impacts from dewatering on private lands. WADOEs FSEIS predicts no impact to this wetland during mining because of flow augmentation and disposal of excess water during mining. Wetlands along Nicholson Creek may be a little less wet in the summer and fall or edges may dry up earlier. Little change in productivity is expected (FSEIS, page 3.9-20,21).

The wetlands, seeps and springs in the headwaters of Marias Creek would be affected by the ground water draw-down associated with the mining activity on Buckhorn Mountain. 3.5[61] gallons per minute are proposed to be diverted from water going to the infiltration gallery to wetlands in upper Marias Creek. The diverted water is anticipated to replace the ground water shortfall from mine dewatering in the wetland area for the three months of augmentation starting in year 4 of mining. The likely outcome would show as a slightly reduced wetland area, or a reduction in wetland, seep and spring qualities such as the amount of standing water or the length of time each year the soils are saturated. This condition would exist until mining is completed and ground water equilibrium levels are restored.

Mitigation for wetland loss due to road construction is proposed by developing wetlands in association with the culvert replacements along Nicholson Creek. These would be areas adjacent to the creek where the elevation of the flood prone area would be lowered to allow ground water and surface water to fill the depression. The impacts with this would be additional sedimentation during the construction. During high flows, these small created wetlands would likely fill with sediment and debris, either reducing their size or covering them completely. During these events the Corps of Engineers expects such events to create or modify other wetlands along the drainage.

The wetlands covered by widened road segments are unlikely to re-establish because the road drainage features would continue to divert water from the road ditch to the relief culverts and eventually to Nicholson Creek after passing through the sedimentation control structures. This is a minimal amount of wetland disturbance and helps meet the requirement of Executive Order 11,990 to minimize loss or degradation of wetlands.

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[60] Golder 2006a indicates only a maximum of 5 gpm would be needed during mining.
[61] Golder 2006a indicates only a maximum of 1 gpm would be needed during mining.

Alternative D

Direct and Indirect Effects

Alternative D produces essentially no additional road generated sediment per year in Upper Myers Creek subwatershed from the 3575-120 road. Marias Creek would have essentially no increase in new road generated sediment because the road construction and reconstruction would be hundreds of feet away from the streams.

There are no changes in the existing sedimentation rate in any of the watersheds in Alternative D. Average turbidity levels in Marias, Nicholson, or Myers Creeks would not be increased by the project.

Table III-32: Delivered Sediment Production (Tons/Year); Alternative D

Watershed	Existing Condition (all sources)[62]	Road Construction/ Reconstruction (year 1)	% Increase from Road Construction/ Reconstruction (Direct/Indirect – year 1)	Year 1 Sediment all sources	Year 2 Sediment all sources	Year 3 Sediment all sources	%Change (Year 1) New construction/ reconstruction compared to existing road sediment	% Change from all roads compared to Natural Geologic Background
Marias	1025	0	0	1025	1025	1025	0%	11%
Nicholson	1442	0	0	1442	1442	1442	0%	11%
Upper Myers	993	0	0	993	993	993	0%	29%

In addition to the road construction and reconstruction related sedimentation (noted above in Table III-32) about 70 tons per year of sand would be put on road segments covered with snow and ice for improved traction and traffic safety. Some sand would be trapped on the road surface but most sand would eventually be carried into the road ditch and be either trapped in the road ditches or would drain through the relief culverts and be dispersed on the hillside. The sanding would occur each year the road is maintained for mine related work. Most of the sand would come off the road during the spring of each year, as the road snow and ice melts. Like with road construction and reconstruction sediment, sand would not reach any creeks because it would be trapped by intervening vegetation between the road and creeks. Considering all project related sediment from road construction and maintenance, Alternative D would result in no delivered sediment.

The Cow Camp road (FR 3575-120) on Pontiac Ridge does not enter any stream RHCAs and few sediment control structures are needed. Water quality in Upper Myers Creek or Marias Creek would not be affected Mg Cl_2 used for dust abatement. Snow plowed from the road would be too far from stream drainages for salts to be evident, and the short distance of roads on National Forest System lands and rights-of-way would further minimize the opportunity for salts to get into surface water. There would be no effects on floodplains in Marias, Nicholson or Upper Myers Creek in Alternative D consistent with Executive Order 11988.

Chloride levels in Nicholson Creek under this alternative would be the same as described for Alternatives B and B1. Chloride levels in Marias Creek under this alternative would be the same as described for Alternative C.

[62] Geologic background in Upper Myers Creek results in about 771 tons of sediment per year.

There would be no effects to wetlands in Marias, Nicholson or Myers Creek tributaries from Forest Service activities in Alternative D which is consistent with Executive Order 11990.

Overall water quality changes in Millard Creek or Upper Myers Creek would not exceed state water quality criteria from the road construction or reconstruction activities on National Forest System lands. Water discharged to the infiltration gallery would meet water quality permit limits set in the state NPDES permit requirements. Effects of infiltration gallery on chlorides in Nicholson Creek are the same as those described in Alternative B/B1 above. Water quality would meet the most restrictive of State or Federal standards for ground or surface water quality.

No wetlands would be impacted by the road reconstruction or construction of the Cow Camp road in Alternative D. No wetland disturbance helps meet the requirement of Executive Order 11990 to minimize loss or degradation of wetlands.

The wetland below the Roosevelt Adit would be affected by the ground water draw-down associated with the mining activity on Buckhorn Mountain. Up to 20 gpm would be infiltrated year round, up to 24 gpm (up to 67[63] gpm under certain conditions) in the Gold Bowl and, along with up to 13[64] gpm augmented at the Roosevelt adit in July, August and September, which would offset or partially offset flows lost during mine dewatering depending on the season. Although activities in NFS lands would be adding to water availability, this would only offset impacts from dewatering on private lands. WADOEs FSEIS predicts no impact to this wetland during mining because of flow augmentation and disposal of excess water during mining. Wetlands along Nicholson Creek may be a little less wet in the summer and fall or edges may dry up earlier. Little change in productivity is expected (FSEIS, page 3.9-20,21).

The wetland in the headwaters of Marias Creek would be affected by the ground water draw-down associated with the mining activity on Buckhorn Mountain. 3.5[65] gallons per minute are proposed to be diverted from water going to the infiltration gallery to wetlands in upper Marias Creek This diverted water would replace the ground water shortfall from mine dewatering in the wetland area for the three months of augmentation starting in year 4 of mining. The likely outcome would show as a slightly reduced wetland area, or a reduction in wetland qualities such as the amount of standing water or the length of time each year the soils are saturated. This condition would exist until mining is completed and ground water equilibrium levels are restored.

Cumulative Effects for All Action Alternatives

The cumulative effects analysis area is the Upper Myers Creek, Nicholson Creek and Marias Creek watersheds, and the portion of the Toroda Creek drainage below Newman wells. The time period for the cumulative effects analysis is 15-18 years (12 years for the life of the on-going exploration, mining operation, reclamation work plus 3-5 more years for monitoring or

[63] The treatment plant can only handle a maximum sustained flow of 100 gpm.
[64] Infiltrated water is intended to offset losses as a result of mine dewatering, but maximum values are used to show the maximum possible effects. Golder 2006a indicates that only 5 gpm would be needed to offset mine dewatering during mining but the November 2006 draft NPDES indicates up to 50 gpm could be discharged at the adit.
[65] Golder 2006a indicates only 1 gpm would be needed to offset mine dewatering during mining but the November 2006 draft NPDES indicates up to 10 gpm may be discharged in Upper Marias drainage.

re-vegetation on disturbed sites and cessation of water augmentation). This does not include water monitoring, which would go on for many years but would not have any affect on water quality, water quantity or flows. Cumulative effects included the direct and indirect effects of the road construction, reconstruction and maintenance for the haul route on National Forest System lands. The prior direct and indirect effects analysis describes the cumulative sediment effects relating to sediment from geologic, existing roads and the Buckhorn Access Project activities. Additional sediment generated by other past present and reasonably foreseeable future actions, including the Buckhorn Mountain (mining) Project is described below.

Direct and indirect effects of the mine that do not include stream sedimentation, surface water quality parameters of turbidity, chloride, magnesium levels and water flow volumes are not considered in the cumulative effects analysis because they do not add to the direct and indirect effects of the road construction, reconstruction and maintenance, or water flows as a result of augmentation and infiltration.

Cumulative effects analysis considers past, present and reasonably foreseeable activities that have overlapping effect with the hydrology effects of this project.

Past Actions

Crown Resources/Battle Mountain Gold/Newmont/Kinross Exploration and Predevelopment Activities are local in nature and have been restored except sites such as the 7 water monitoring wells and access routes to the monitoring wells where Crown has taken over responsibility for reclamation. Ongoing activities aren't having any effect on water quality or quantity. No cumulative effects in the analysis watersheds would occur.

Battle Mountain Gold/Newmont Reclamation has occurred and the disturbed sites have been mostly re-vegetated. No cumulative effects in the analysis watersheds would occur because vegetation intercepts sediment before reaching streams, which are far from these disturbance sites.

Gold Bowl Area ore zone location work has occurred and the disturbed sites have been re-vegetated, although drilling continues to occur on private lands. No cumulative effects in the Nicholson or Upper Myers analysis watershed would occur because vegetation intercepts sediment before reaching streams.

Historic Mining surface impacts (Roosevelt and other small mine and exploration workings constructed between the 1890s and 1960s) tend to be localized, with the exception of some long-term ground water impacts (see below). Surface impacts were limited to minor road construction, small disturbed areas at the portals of the underground workings and withdrawal of small amounts of water for domestic and mine exploration purposes. The disturbed sites have been re-vegetated and vegetation acts to intercept sediment before reaching streams. Although no active mining has taken place for over 50 years in the Buckhorn Block, a number of historic underground mine workings are present in the Buckhorn Mountain Area These include horizontal openings called adits and vertical or steeply dipping openings called shafts. Historic records indicate that most of the shafts are not much more than deep pits. Such developments have little hydrologic impact. Most of the adits are less than 200 or 300 feet in length and intersect little if any ground water (little or no discharge from the opening). Two of the adits, the Buckhorn (990 feet long) and the main Roosevelt adit (1,600 feet of total working length) are large enough to have potentially

caused notable hydrologic effects. At an elevation of 5,160 feet above mean sea level (MSL), the Buckhorn adit is high on west slope of the mountain and intersected limited ground water (2-6 gpm; CJ EIS, 1997). Open adits tend to drain water from an upside-down, wedge-shaped section of ground lying above the adit's axis. Draw down of the pre-existing ground water table above the Buckhorn adit was probably small because of its location near the top of the mountain. However, because the adit runs beneath the Buckhorn Mountain divide and drains into Myers Creek, about half of the discharge probably originally flowed to Nicholson Creek drainage (the deeper half of the adit lies west of the groundwater divide). The Buckhorn adit was plugged and sealed in the late 1990's by Newmont, thus re-establishing the former groundwater conditions. Any impacts to water quality from historic mining are captured in the current condition information regarding water quality in the affected environment above.

The Roosevelt adit is lower on the east side of Buckhorn Mountain at an elevation of 4,450 feet MSL. Average discharge from the Roosevelt is 40 gpm (Buckhorn Mountain Project FSEIS, 2006). Flow monitoring indicates that flows have varied from 5.6 gpm in March 1993 to 121 gpm in June 1993. Due to its length and location lower on the slope, the Roosevelt adit drains a larger wedge of ground and intercepts substantially more ground water, all of which would have normally flowed to Toroda Creek drainage. Local draw down of the water table probably results in a trough-shaped depression aligned along the main axis of the adit and 800-1000 feet wide at its maximum width (assumes 400 feet maximum depth beneath surface and 45 degree drainage slope). The water that currently discharges from the Roosevelt adit originally filled the draw-down depression and probably flowed subsurface across the width of the depression to the east. Based on the location of the workings with respect to Nicholson and Marias drainages (and assuming homogenous soil/rock characteristics) this may have moved as subsurface flow roughly equally to those drainages. The water may have eventually discharged to the surface in Nicholson and Marias Creek drainages.

Mining activities terminated at Roosevelt adit in 1920. At that time, no record of the amount of discharge or into which drainage it flowed is known. Because the adit lies just above the gentle divide between Marias and Nicholson Creeks, natural or man-caused events may have diverted flows either way over time, perhaps many times. Construction and maintenance of the 3575-120 and 3575-122 roads and their roadside ditches below the adit act to intercept water from the adit, as well as other surface flows, and direct them down the ditches, then under the road at relief culverts. This water currently flows into Nicholson Creek, although it's possible some water previously flowed into the Marias drainage depending on ditch maintenance and other factors.[66]

Noxious weed treatments have occurred in the cumulative effects analysis watersheds. Past and ongoing treatments include manual, biocontrol, cultural, and chemical methods, and these activities are expected to continue especially adjacent to the road rights-of-way because of the increased potential to introduce noxious weeds from increased traffic and soil

[66] Although Okanogan Highlands Alliance claims the Forest Service diverted water from the Marias Creek drainage to the Nicholson Creek drainage in 1992, the Forest Service has found no basis for this claim. In a response to an OHA Freedom of Information Act request in 1993, the Tonasket District Ranger provided fire "pre-attack" maps from the early and late 1980s showing that the Roosevelt adit flowed into Nicholson Creek at those times, although acknowledged that the reliability of the maps was unknown. Also, as acknowledged in the Crown Jewel Mine FEIS, it's possible a stream course change was affected by the mid-1970s Bishop Timber Sale, when the road was built and the culvert installed (Crown Jewel Mine FEIS, page 3-39).

disturbance. There are slight increases in soil erosion and stream sedimentation for a year or less after treatment when noxious weeds are removed and until seeded vegetation or natural vegetation becomes re-established, but water quality impacts from any sedimentation are minimal because of the very small areas treated by plant specific treatments.

Livestock grazing on Ethel, Gold and Cedar allotments has occurred, is continuing at present and is likely to be a reasonably foreseeable action. Impacts from grazing include soil erosion, stream sedimentation, and potential fecal coliform level increases in high use areas along the stream where grazing occurs. Riparian areas are high use areas because of access (existing roads), desirable vegetation and for water availability. Increased road width would make it easier for livestock to access riparian areas. Under Alternatives B and B1, these impacts are offset by fencing along Marias Creek and above the Marias Creek road and new upland water developments (water troughs) in the Buckhorn Access Project which would limit livestock access to and reduce the use of the creek. In Alternative C, the increased road width would make it easier for livestock to access some riparian areas. Livestock access to Nicholson Creek has been localized to fewer sites than other adjacent drainages, and it generally has not been a problem that can't be mitigated. The cumulative effects would be increasing livestock pressure on stream banks, and increasing stream sedimentation in Nicholson Creek where the road construction and reconstruction would occur in Alternative C. The new construction and reconstruction of the Cow Camp road would not increase access to Millard Creek in Alternative D.

Hunting, fishing and gathering by members of the Confederated Tribes of the Colville Reservation have occurred, continue now and are a reasonably foreseeable action. These activities have only local extents and are not expected to add to cumulative effects on water quality or quantity in the analysis watersheds.

Patenting of Crown Resources claims has occurred. This changed the way NEPA and SEPA addressed the environmental changes of the project, but the patenting itself did not add to cumulative effects in the analysis watersheds.

Past road closures on Crown Jewel Mine Project and Nicholson Timber Sale have occurred. Road closures were generally limited to gates or barriers of rock or soil, except for portions of Forest Roads 3575-142 and 3575-127 where the roadbeds were re-contoured to near natural topography. Both of these roadbeds would be partially re-established as part of the pipeline route to the infiltration gallery. The disturbed soils are local and have re-vegetated. No road closure related soil disturbance activities would add to cumulative effects in the analysis watersheds.

Nicholson Creek culvert replacements were accomplished in 2005. Two culverts were replaced; one on Ferry County Road 502 and one on Forest Road 3575. The culvert on FR 3575 was a fish barrier and eventually failed, adding sediment to the creek. This culvert was replaced with a bottomless arch. Both culverts now allow fish passage up Nicholson Creek. Combined with the replacement of the lowest Nicholson Creek culvert on FR 3575 under all alternatives, the culvert replacements would allow for free flow under the road up to river mile 3.2.

Ongoing (some of which are reasonably foreseeable activities also):

Wauconda Quarry (transportation overlap with supply route during operations) trucking on the Toroda Creek county road occurs. These activities are restricted to the upper 5 miles of

the Toroda Creek road and are not expected to add to cumulative effects of water quality or water use in the analysis watersheds because this trucking occurs on a paved County road and trucking does not cause erosion or affect water use.

Ongoing recreation and road use for snowmobiling, hunting, fishing, hiking, camping, sightseeing and OHV use continues in the analysis watersheds. These are local, minor impact activities and would not add to the direct and indirect effects of any alternative.

Reconstruction of Toroda Creek road is underway and will continue through 2007. Most of the work has already been completed in Ferry County. This activity would increase soil erosion and may increase stream sedimentation in Toroda Creek, depending on construction practices used to minimize erosion and stream sedimentation. Management practices by Okanogan and Ferry Counties, such as silt fences or vegetation establishment on the road cuts and fills would minimize stream sedimentation in Toroda Creek. Because both Nicholson and Marias Creeks are low energy streams, it's unlikely that sediment from the Access project would be delivered to Toroda Creek to mix with sediment during the Toroda road reconstruction project under Alternatives B, B1 and C. Alternative D, the Cow Camp route, is over one-quarter mile from Millard Creek, so any sediment produced would be intercepted by intervening vegetation before reaching Millard Creek, and therefore would never reach Toroda Creek to add more sedimentation during the Toroda Creek road reconstruction. Once on the County Pontiac Ridge Road, Millard Creek is within 300 feet of the road in several places, and sediment would likely reach the creek in this area, however, a pond downstream would act to settle out any sediment prior to it reaching Toroda Creek itself.

Road use permit for Forest Road 3575-120 and 3575-140 was issued in September 2006 and deferred road maintenance was performed on these roads: Crown/Kinross performed deferred maintenance on these roads so that they could continue to access their private lands, as required under ANILCA. Crown/Kinross is staging operations for access to their mine site on private lands at the western base of the Pontiac Ridge Road (CR 4895) road, and truck traffic is continuing, but Forest Road 3575-120 is over one-quarter mile from Millard Creek to the east and an unnamed creek to the west, and vegetation between the creeks and road would intercept any sediment. Therefore, the maintenance (grading the road and placing rock on the surface) and road use won't result in any sedimentation in Millard Creek or the unnamed creek. The Forest Service road use permit requires Crown/Kinross to control dust during their use of this road and allows them to plow snow off the road during winter. Sedimentation is possible from Crown/Kinross' use of the unpaved Pontiac Ridge Road because the unnamed creek lies very close to the road and the road crosses the creek in one location, but this creek has no surface connection with Myers Creek downstream and is not fish bearing. As noted above, use on the Forest Service road would not add cumulatively to this sedimentation.

Little Nicky Timber Sale (S22,27, T40N, R31E) was started in 2005 and includes 232 acres of harvest on DNR land with 80 acres within 900 feet of a stream. This timber sale would haul logs out on Forest Roads 3575-040 and 3575. Approximately 1200 feet of new road construction is within 900 feet of a stream. WEPP estimated increased sedimentation from the 80 harvested acres within 900 feet of the stream and new road construction is about 10.2 tons per year in 2005, 3.9 tons per year in 2006 and 2.8 tons per year in 2007. Accelerated sediment would continue to decline from those treated sites. Areas treated outside of the 900 feet buffer around streams are not likely to generate additional stream sedimentation, as determined in studies in central Idaho (Megahan and Ketchason, 1996).

This project would have no cumulative effects with the Cow Camp ore haul route, Alternative D because this haul route is over one-quarter mile from Millard Creek, so any sediment produced would be intercepted by intervening vegetation before reaching Millard Creek, and therefore would never reach Toroda Creek to add cumulatively. Once on the County Road 4895, Pontiac Ridge Road, Millard Creek is within 300 feet of the road in several places, and sediment would likely reach the creek in this area, however, ponds downstream would act to settle out any sediment prior to it reaching Toroda Creek itself. Because Nicholson Creek is a relatively low energy system, it's unlikely that sediment from this project would ever mix with sediment generated by construction and reconstruction of the Marias Creek route in Alternatives B or B1 in Toroda Creek. In Alternative C, the Nicholson route, road construction, reconstruction and related work would add eroded soil and stream sedimentation for several years. Road construction and reconstruction occurred in 2005 within 900 feet of the stream, so the year with the greatest sedimentation has already passed, so additional, but declining sediment increases are expected for two more years. Tree removal from the Little Nicky units generally has a short term sedimentation impact (1-2 years) until vegetation becomes re-established. Harvest prescriptions would create openings, potentially increasing water flows. The cumulative effect of this project is to add erosion and stream sedimentation to Nicholson Creek, which would add cumulatively to the sediment under Alternative C as described above. It's likely that most sediment would settle in Nicholson Creek because it's a low energy system, but some could reach Toroda Creek within the 15 year period depending on the relative occurrence of substantial (5-10 year recurrence interval) floods during that time. If there are no substantial floods from the Little Nicky project area, the sediment from the Little Nicky project won't flush out to add to sediment loads in Toroda Creek.

Reasonably Foreseeable Future Actions:

Toroda Road Culvert Replacement on Marias Creek. Okanogan County plans to replace the two culverts where Marias Creek passes under the Toroda road during Toroda road reconstruction with one culvert that is passable by all aquatic life. Replacement of this culvert would result in short term sedimentation although management practices by Okanogan County, such as silt fences or vegetation establishment on the road cuts and fills would minimize stream sedimentation in Toroda Creek. Long-term this culvert replacement would likely provide for better passage of water downstream during larger flood events without damage to the Toroda road.

Future road closures as part of road maintenance activities. Some roads that were closed by previous projects have been breached in the project area, and these roads would be re-closed as they are discovered during regular road maintenance activities which would reduce potential sedimentation from those roads.

The Buckhorn Mountain Project (non-NFS components, including conceptual mitigation on non-NFS lands*).* The Buckhorn Mountain (mining) Project would influence ground and surface water flow. The timing of maximum baseflow effects varies with the season, the stream and the elevation in the drainage. Transient flow modeling[67] shows that average baseflow in Nicholson Creek is expected to increase during mining due to mine dewatering and associated discharges at

[67] Changes are relative to the "no-action" (i.e. no mining) baseflow rates calculated in the Transient FEFLOW model using the same 50-year time period and the same modeled climatic conditions. Modeled climactic conditions include 25 years based upon actual area precipitation, encompassing two drought periods, and 25 years of average annual precipitation (20 inches per year).

Outfalls 001 (infiltration gallery) and 002 (Gold Bowl drainage on private land). Baseflow would decrease after mining ceased during the refilling of the Gold Bowl workings and would recover about 12 years after the end of mining (FSEIS, page 3.7-60). Probably the greatest impacts from construction of the mine on private land would be the flow reductions in the Myers Creek drainage streams of Gold, Bolster (North and South Forks), and Ethel Creeks during operations and the refilling of the Gold Bowl workings, and the permanent shift in the ground water divide, approximately a 4 gpm shift from the Myers Creek drainage to the Toroda Creek drainage. Maximum effects on Myers Creek baseflow would likely occur during the refilling of the Gold Bowl workings. The Buckhorn Access Project would not affect baseflows in Myers Creek so the details of these impacts are not discussed below, but details may be found in the WADOE Buckhorn Mountain Project FSEIS (2006). The predicted changes in baseflow shown below represent average monthly or average annual flows calculated by the 3-D transient hydrologic mode developed for the WADOE FSEIS.[68] Unless otherwise identified, baseflow rates quoted are monthly averages which are closer to instantaneous flow rates compared to the annual average. The annual average, however, allows a good comparison of baseflow.

Relative changes to baseflow tend to be greatest for upper surface water stations (SW-9 on Nicholson Creek, SW-10 on Gold Creek, SW-11 and SW-14 on Bolster Creek, see Figure II-5 in Chapter II for water monitoring points) during and immediately following mining because of their low flow rates. Predicted changes for these stations show decreases or increases in baseflow between 4 and 140 percent depending on location, season and project stage. Flows at the Roosevelt Adit (Outfall 003) are predicted to decrease by about 26% at the end of mining once infiltration and augmentation cease.

After mine dewatering and discharge to outfalls 001 and 002 cease, flow in Nicholson Creek at station SW-7 (about ¾ mile downstream of the Roosevelt Adit, Outfall 003) is predicted to temporarily decrease by up to 36 gpm, or about 30 percent, once water infiltration and augmentation cease. This could affect the functions and values of the 9-acre wetlands in the headwaters of Nicholson and Marias Creeks; however this is after activities affecting water quantity (infiltration and augmentation) have ceased on NFS lands, and therefore do not interact cumulatively. Dewatering may also affect function and values of other headwater wetlands in Myers, Nicholson and Marias Creek both on private and National Forest System land, although these are partially offset by water augmentation and infiltration proposed on National Forest System lands during, and after mining. Only the 9-acre wetland (RA1) would be affected by both dewatering and haul route construction on NFS lands. Flows during mining are expected to remain unchanged to RA1 and haul route construction would impact <0.01 acre of this wetland, so effects would be minimal. WADOE's FSEIS predicts indirect permanent impacts as a result of mine dewatering drawdown to one seep and one spring in the Nicholson Creek drainage, 4 springs in the Marias Creek drainage, and 6 seeps and 6 springs in the Myers Creek tributaries (Ethel/Bolster/Gold Creeks). The FSEIS also predicts indirect temporary impacts from mine dewatering drawdown to 5 seeps in the Nicholson Creek drainage, and possible impacts to 1 spring in the Nicholson Creek drainage, 4 springs and one seep in the Marias Creek drainage, and 5 springs and one seep in the Myers Creek tributaries (FEIS, page 3-7-55 to 3.7-57). Three of these are at or below the water augmentation and infiltration sites and one may have increased flows and 2 may have slightly reduced flows because of augmentation as a result of mine dewatering on private lands and water infiltration and augmentation on NFS lands. As noted above, one of these, the 9-acre wetland which has 4 seeps (S13-S16) would remain unchanged during mine dewatering because of infiltration and augmentation, but would be affected by <0.01

[68] Golder Associates 2006 Aquatic Resources Mitigation Plan less indicates less impacts to baseflows, but FSEIS flows were used here to account for maximum impacts.

acre of road construction. The road would remain after mining, when impacts of mine dewatering are greatest and flows are expected to be reduced 15-26%, with a permanent flow reduction of about 5%, so this wetland would have <0.01 acre loss from haul route construction and about 5% loss in productivity from permanent changes in flows (SFEIS, page 3.9-20). Details about the effects can be found in the table starting on page 3.7-58 of the FSEIS. Additionally, the Buckhorn Mountain (mining) Project includes wetland mitigation at several sites totaling 30 acres off National Forest System lands at the Pine Chee and Thorp property wetlands to compensate for impacts to wetlands in these headwaters Creeks, which is expected to achieve no overall net loss of wetland functions relative to the impacts of the entire Buckhorn project, both on and off NFS lands (WADOE, 2006, page 3.9-25).

As the mine fills with water after cessation of mining, stream depletion would decrease over time. The Gold Bowl workings, which are located on private lands, are anticipated to fill within 12 years (FSEIS, Fig. 3.7-11). Once the Gold Bowl workings fill, flow at water monitoring station SW-9 is expected to return to near pre-mining levels. Flow from Roosevelt Adit may not attain equilibrated discharge until the Southwest Zone (the shallowest ore deposit) fills with water, which could take about 20 years (FSEIS, page 3.7-40, 2006).

Augmenting stream flows at Roosevelt Adit (outfall 003) and Upper Marias Creek (outfall 004) for several years after cessation of mining by the pumping of water from the refilling-mine workings would delay the rebound of the ground water table and lengthen the period of impacts to streams, wetlands, springs and seeps by a year. WADOE's FSEIS predicts this decrease to be less than 4 gpm during this mine filling (FSEIS, page 3.7-67, 2006). The groundwater model indicates that the post-closure equilibrium water level would be approximately 110 feet lower in the western portion of the mine area and 10 feet higher in the eastern portion as compared to pre-mining conditions (FSEIS, pages 3.7-49, 2006).

Water would be removed from the ground as mining progresses and ground water levels would drop. These drops in ground water at the mine site would influence both surface and ground water levels in other areas thus affecting stream flows, wetlands, springs and seeps. Activities on National Forest System lands would not result in any ground or surface water losses. As explained in the direct and indirect effects sections above, some of the groundwater pumped and surface water run-off captured from private lands would be released on National Forest System lands into an infiltration gallery and/or at water augmentation sites. Effluent limits for all wastewater parameters are established as equal to the most restrictive of relevant surface water or ground water quality criteria. The NPDES permit does not authorize mixing zones. The cumulative effects of the changes in ground and surface water described below are based on modeling done for the State of Washington, Department of Ecology's final Supplemental Environmental Impact Statement (2006 Chapter 3.7) for the Buckhorn Mountain Project. The water infiltrated on National Forest System land would partially replace the water lost in Nicholson and Marias Creeks during mine dewatering on private lands. As stream flows decrease as a result of mine dewatering, discharge flows would be increased at the infiltration and augmentation (outfall) sites. During the wettest season, additional water would be captured and stored on private lands for release during July-September to augment flows during the driest season. Additional flows may be released at other times of the year, but the amounts would not exceed bank-full flows, thus eliminating potential for down gradient changes in channel morphology or erosion.

A sensitivity analysis completed as part of the FEFLOW modeling for the Department of Ecology, indicates that the baseflows presented below are quite similar (plus or minus 30 percent) when model parameters are varied within reasonable ranges. Actual baseflow rates

at any point in time may be higher or lower than the predicted average and are expected to fluctuate in response to variable rates of recharge, average yearly precipitation, and groundwater discharge. WADOE's FSEIS plans monitoring of flows to guide the timing and rate of flow augmentation (2006, page 3.7-90).

Discharge at the infiltration gallery would begin when water production exceeded mine uses. During the first 15 months, flow to the gallery is predicted to be 0 or 10 gpm, and thereafter, until mining ceases, a maximum of 20 gpm. Water in excess of the infiltration gallery capacity would be discharged onto private land at Outfall 002, which, after 15 months, would average 24 gpm. Predicted no-action (no mining) baseflow in Nicholson Creek at SW-7, below the infiltration gallery and Gold Bowl drainage varies between 64 and 120 gpm, depending on the season (although the water treatment plant can treat a sustained capacity of a maximum of 100 gpm). During mining SW-7 baseflow is predicted to increase by up to 14-29 gpm (again depending on the season) because of discharges to Outfalls 001 and 002. This increase corresponds to approximately 13-46 percent of the predicted no-action baseflow (FSEIS, page 3.7-60). However, after mining ceases and infiltration and augmentation on NFS lands are discontinued (the point at which the Buckhorn Access Project ceases to have any effect on water quantity, and therefore cumulative effects cease), the average annual baseflow at SW-7 would decrease by up to 36 gpm or 30% (Table 3.7-9, FSEIS) while mine workings refill. Post closure average annual baseflow would largely equilibrate about 12 years after mine closure to an estimated 69 gpm, 5 gpm higher than the predicted no-action baseflow in the Nicholson Creek drainage.

Predicted no-action baseflow at the Roosevelt Adit (GW-2) is an average annual 31 gpm (FSEIS, page 3.7-64, 2006). Flows from the Roosevelt Adit are predicted to decrease by up to 5 gpm at the end of mining and before the mine starts to refill with water. During July, August, and September, starting about Year 4 and continuing until 3-5 years after the end of mining, these losses would be partially offset by water augmentation at the Roosevelt Adit (GW-2). Up to 13 gpm[69] (instantaneous flow) would augment flows from the adit during July, August and September, which would increase baseflows during the driest part of the year. Monitoring of flow at Roosevelt adit and streams would guide the timing and rate of flow augmentation.

Equilibrated post-closure baseflow from Roosevelt Adit is predicted to decrease to 29 gpm, 2 gpm lower than present average annual baseflow. This partially offsets increases in other portions of the Nicholson Creek drainage including SW-7 (FSEIS, page 3.7-64, 2006).

Changes in baseflow become less pronounced lower in the drainage. The predicted no-action average annual baseflow in the lower part of Nicholson Creek (SW-1) is 230 gpm. Infiltration gallery plus Gold Bowl discharges would increase this baseflow during mining operations by up to up to13-28 gpm (4-15%), because stored water from both the Myers and Nicholson watersheds would become surface water in the Nicholson watershed. Immediately following mine closure, once infiltration and augmentation have stopped, the baseflow would drop by up to 18-38 gpm. Augmentation during July, August, and September would continue for an additional 3-5 years and baseflows during those periods would increase correspondingly. Thereafter, activities affecting water availability would cease on NFS lands and so would the cumulative effects on water availability with the mining project.

[69] FSEIS, page 3.7-39. Golder, 2006a indicates a maximum of 6 gpm would be augmented. Maximums presented in the FSEIS were used in this analysis to account for the higher impacts predicted in the FSEIS. The draft NPDES shows a maximum of 50 gpm could be discharged at the adit.

Again, post closure baseflows would eventually equilibrate to 235 gpm at SW-1, 5 gpm above present average annual baseflows.

Predicted no-action average annual baseflow in the upper Marias Creek drainage is 31 gpm at SW-8. Mine dewatering would decrease the Marias Creek baseflow by up to 1 gpm through the end of mining. During July, August, and September this loss would be offset by up to 3.5 gpm (instantaneous flow) of water augmentation in upper Marias drainage (FSEIS, page 3.7-67, 2006), resulting in a net gain of up to 1-2 gpm during the driest part of the year.[70] Post closure average annual baseflow would eventually equilibrate in about 20 years to 30 gpm.

Further down Marias Creek at SW-2, the predicted no-action average annual baseflow is 110 gpm. Dewatering is predicted to reduce baseflow by up to 1-2 gpm through the end of mining. During July, August and September, these losses would also be offset by water augmentation in upper Marias Creek resulting in a net gain of up to 1 to 2 gpm during the driest part of the year for 3 years after the end of mining. Thereafter, activities affecting water availability would cease on NFS lands and so would the cumulative effects on water availability with the mining project. Following mine closure and after augmentation ceases, the baseflow would be decreased ≤2 gpm until groundwater re-equilibrates, whereupon it would return nearly to pre-project flows, 110 gpm.

This information is displayed graphically in Table III-33. This information is taken from modeling done for the State of Washington, Department of Ecology's final Supplemental EIS (2006).

Table III-33: Predicted Changes in Baseflow for Nicholson and Marias Creek Monitoring Stations

Station	Predicted No-action Average Annual Baseflow (gpm)	Maximum Predicted Change in Ave. Monthly Baseflow During Mining with Infiltration & Gold Bowl Discharge (gpm)[71]	Water Augmentation during July, August and September (later years of mining)	Predicted Average Annual Baseflow at Year 7 during Mining[73] (gpm)	Maximum Predicted Change in Ave. Monthly Baseflow during reclamation without infiltration (gpm)[74]	Predicted Equilibrated Post-Closure Average Annual Baseflow (gpm)	Watershed
SW-1	230	+13-28	+3-13	240	-18-38	235	Nicholson
SW-7	69	+14-29	+3-13	79	-18-36	74	Nicholson
GW-2	31	-5	+3-13	26	-6	29	Nicholson (Roosevelt Adit)
SW-2	110	-1-2	+0.75-3.5	110	-1	110	Marias
SW-8	31	-0-1	+0.75-3.5	31	-0-2	31	Marias

Mine dewatering would affect wetlands, springs, and seeps above the infiltration and augmentation sites and in the Myers Creek drainage as described in WADOEs FSEIS

[70] Golder Associates' work indicates a slightly less augmentation than WADOE's FSEIS. WADOE's numbers were used to account for maximum impacts. The November 2006 draft NPDES shows a maximum of 10 gpm could be discharged in Upper Marias Creek.
[71] Flows vary seasonally.

(2006). Since no activities on NFS lands would affect water availability in these areas, there are no cumulative effects with these areas.

The Buckhorn Mountain (mining) Project would decrease the ground water elevation in the project area. Operational impacts would occur to wetlands from a reduction in groundwater flow to wetlands and streams at the headwaters of Marias Creek and Nicholson Creek. Seeps and springs near the mining operation would have reduced flow or go dry during the mining operation. The drying or reduction in size of wetlands would generally increase over the mining period until the mining is finished, and restoration begins. Seeps and springs further from the mining operation would be less affected as the distance increases and because of water augmentation mitigation. The Buckhorn Access Project would partially or fully compensate for these losses below the infiltration and augmentation sites, depending on the site, time of year, and stage of mining. July through September, water augmentation and infiltration would partially to fully offset reduced flows in Nicholson drainage below the water augmentation and infiltration sites and below the Marias Creek augmentation site. Wetlands, seeps and springs above the water infiltration and augmentation sites that may be dewatered through mining would not be impacted by any Buckhorn Access Project activities.

As noted above, the Buckhorn Mountain (Mining) Project would result in dewatering of the underground mine. Water removed from the mine, along with some of the captured surface water (water in contact with mine facilities) on the private lands at the mine would be treated at a treatment plant on private lands. According to the State's draft NPDES permit fact sheet (November 2006), water from the underground workings, dewatering wells or in contract with ore or development rock stockpiles would be conveyed to a sedimentation basin that drains into the mine water surge pond. The sediment basin would remove floating oil and grease and suspended solids, and the surge pond would regulate the flow to the treatment plant. Some of all of the water in the surge pond would be recycled back into the mine as needed for drilling and dust suppression. The remaining water would be conveyed to the water treatment plant, which may operate on a sustained basis or intermittently, depending on the water balance. The treatment plant would remove metals and nitrogen by four ion-exchange columns placed in series. Each ion-exchange column is designed to remove specific pollutants or types of pollutants, then tested for compliance with permit limits. In some cases, preliminary predicted treatment system effluent water quality in the FSEIS, does not meet water quality criteria. However, additional testing is being performed to finalize the treatment system design in consultation with Ecology and other agencies, and treated water will be required to meet the most restrictive of relevant Federal or State, surface water or ground water criteria by the NPDES permit, which can be reviewed at:

http://www.ecy.wa.gov/programs/wq/permits/central_permits.html.

The final NPDES permit is expected to be issued in January of 2007. Table III-34 below details the predicted treated water quality in the FSEIS (page 3.7-75) and the effluent limitations in the draft NPDES for the water that would be authorized to be discharged at in the Gold Bowl drainage on private lands, and at the infiltration and augmentation sites on National Forest System lands. WADOE's FSEIS acknowledges that there is potential that water quality could become degraded, but the potential impacts are considered avoidable with mitigation (WADOE, 2006, 3.17-2)

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[72] Golder (2006a), Aquatic Resources Mitigation Plan, estimates augmentation rates of up to 6 and 0.1 gpm for Nicholson and Marias Creeks, respectively, based on an average recharge year. The November 2006 draft NPDES permit indicates maximum discharges of 50 gpm at Roosevelt adit and 10 gpm at Upper Marias Creek.

[73] From Golder (2006a), Aquatic Resource Mitigation Plan.

[74] Flows vary seasonally.

Table III-34: Effluent Limitations: Treatment Plant Effluent and Limits Set by Draft NPDES Permit

Parameter	Average Background[75]	Predicted Treated Effluent Quality[76]	Limit Set by Draft NPDES[77]
Ammonia (as N) (mg/L)	0.11	0.30	0.34
Antimony (mg/L)	<0.003	0.014	0.014
Arsenic (mg/L)	0.01	0.005	N/A[78]
Cadmium (mg/L)	<0.004	0.005	0.0014
Chloride (mg/L)	0.79	230	230
Chromium (mg/L)	N/A	0.05	0.05
Copper (mg/L)	0.002	0.02	0.016
Fluoride (mg/L)	0.13	0.4	4
Iron (mg/L)	0.06	0.3	0.3
Lead (mg/L)	0.003	0.04	0.004
Manganese (mg/L)	0.002	0.05	0.05
Mercury (mg/L)	<0.0002	0.0002	0.000012
Nickel (mg/L)	<0.02	0.22	0.23
Nitrate (as N) (mg/L)	0.104	10	10
Oil and Grease (mg/L)			15
Selenium (mg/L)	0.004	0.005	0.005
Silver (mg/L)	0.001	0.01	0.007
Sulfate (mg/L)	45.6	250	250
Thallium (mg/L)	<0.002	0.002	0.017
Total Dissolved Solids (mg/L)	180.7	500	500
Total Suspended Solids (mg/L)			30
Turbidity (NTU)[79]			22
Zinc (mg/L)	<0.007	0.14	0.15
pH (Standard Units)	7.80	6.5-8.5	Minimum is equal to or greater than 6.5 and the maximum is less than or equal to 8.5

According to the Draft NPDES permit fact sheet (2006), the infiltration gallery will be monitored and regulated through an Adaptive Management Plan to ensure that water does not cause slope instability or rise to less than one foot of the ground surface as measured in piezometers at the infiltration gallery. The Forest Service is also requiring that any additional discharges in streams or the infiltration gallery above flows needed to replace flows lost due

[75] For surface water, from Table 3.7-2 of the WADOE FSEIS.
[76] From draft NPDES wastewater characterization table based on Golder 2006b.
[77] Limits set in the November 2006 draft NPDES permit. The final NPDES permit is expected in January 2007. According to the draft NPDES permit the modeling done in the Golder 2006b engineering report still shows some treated effluent values above the limits set by the NPDES, but the permit limits will still be the required limits. No discharge will be permitted until permit limits are met.
[78] The November 2006 draft NPDES does not set a limit for arsenic, but instead requires the Proponent to provide treatment of mine water and stockpile stormwater as described in the engineering report (Golder, 2006b).
[79] Forest Service estimates are less than 1 NTU increase for all alternatives

to mine dewatering would be made so that resulting stream flows remain below bank full conditions.

Figures 3 and 4 below show the handling of mine water in relation to the water treatment plant and water outfalls (infiltration and augmentation sites). Figure III-3 below shows the wastewater and stormwater treatment and disposal plan.

Figure III-3: Wastewater and Stormwater Treatment and Disposal Schematic

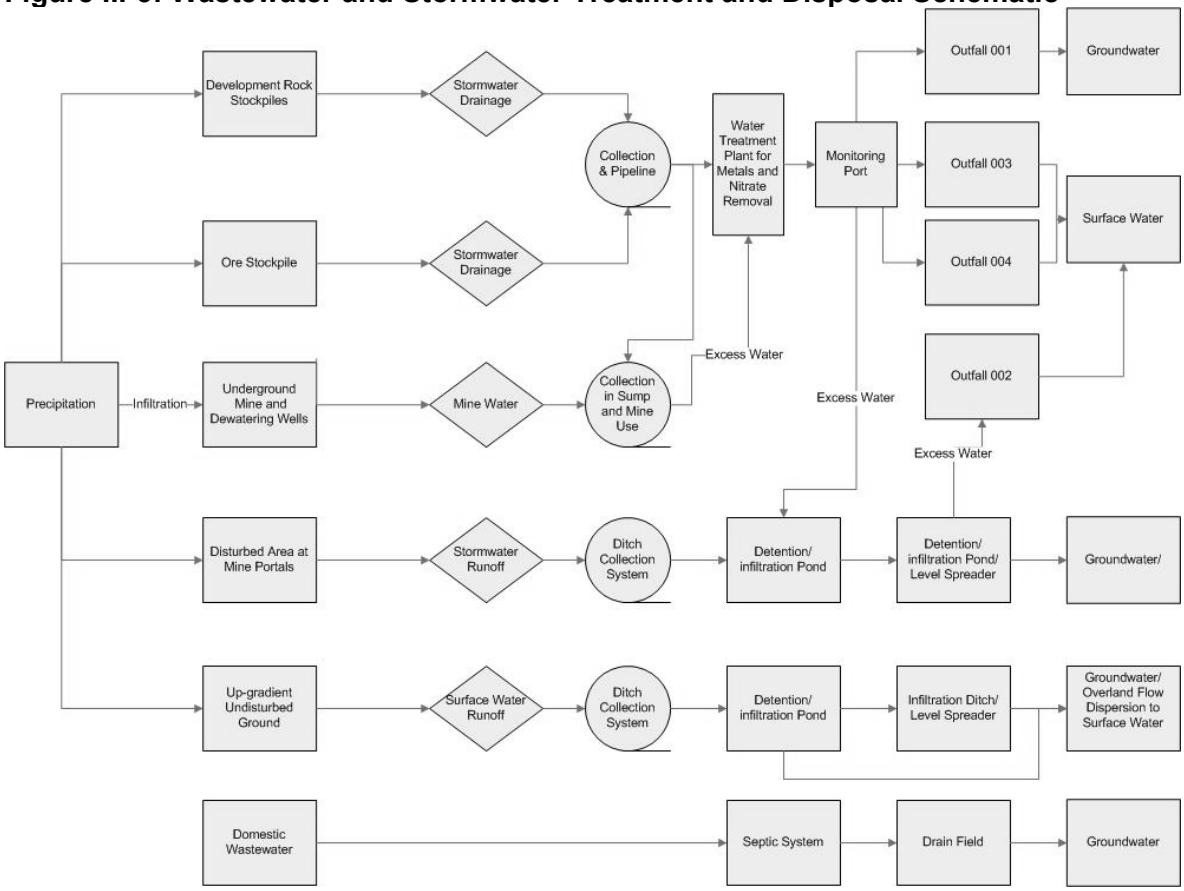
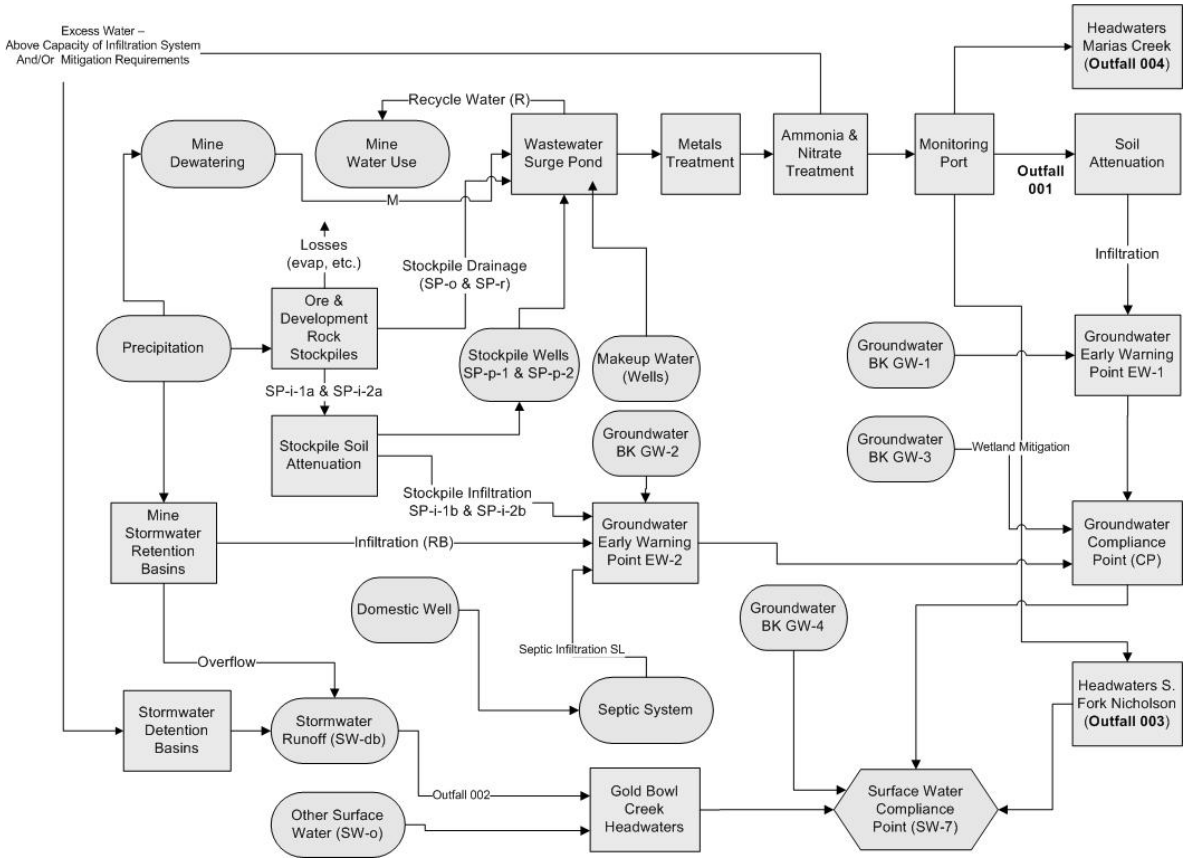


Figure III-4 below shows more details about water storage, treatment and outfalls. Outfall 001 is the infiltration gallery; Outfall 002 is the Gold Bowl site on private lands; Outfall 003 is the Roosevelt Adit; and Outfall 004 is the Marias Creek augmentation site.

Figure III-4: Detailed Waste Storage, Treatment and Outfall Schematic



As can be seen on these figures, water from precipitation that comes in contact with development rock stockpiles, ore stockpiles, or the underground mine and dewatering wells will be run through the water treatment facility before being sent to the infiltration gallery, Roosevelt Adit or Marias Creek headwaters. Water that is from other disturbed areas or from up-gradient undisturbed areas would be stored, and discharge is permitted to the Outfall in Gold Bowl drainage (002) subject to limitations set in the NPDES (2006).

Treated water from the mine workings would have a chloride level of 190[80] ppm. This water will be discharged into the Gold Bowl, off National Forest System lands. This will increase the chloride levels in Nicholson Creek by about 14 ppm (from 27 ppm in Alternative B, B1 and D) to 41 ppm from discharge of 24 gpm, and 61 ppm if 64 gpm are discharged into Gold Bowl[81]. In Alternative C the 24 gpm discharge into Gold Bowl would increase the chloride level from 66 ppm to 77 ppm, and up to 92 ppm when 64 gpm are discharged into the Gold Bowl.[82] Magnesium chloride used on private roads at the mine site and on DNR roads would not add cumulatively to chloride levels because of the distance between these roads and creeks. Chloride levels would continue to meet state standards.

[80] 230 according to the November 2006 draft NPDES permit.
[81] During maximum flow discharge indicated in the November 2006 draft NPDES permit, cumulative chloride levels could rise to 88 ppm in Nicholson Creek in Alternatives B and B1.
[82] These values would be less if Golder 2006a Roosevelt augmentation rates are used. – see direct/indirect effects discussion regarding chlorides. During maximum flows indicated in the November 2006 draft NPDES permit, cumulative chloride levels could rise to 116 ppm in Alternative C.

Dust suppression water for activities on NFS lands would be withdrawn from Newman Ranch wells during the irrigation season at about 37 gpm. During the rest of the year, about 12 gpm would be taken from the wells. Compared to the current situation of irrigation withdrawals and consumptive use of 130 gpm during the irrigation season and no water withdrawal outside of irrigation season, under Alternative B1, stream flow changes in Toroda Creek would increase during the irrigation season and decrease during the remainder of the year, as compared to Toroda Creek's average hydrograph. While use of the Newman Ranch well for dust suppression would result in a stream flow reduction in Toroda Creek upstream of Marias Creek of up to 12.3 gpm during November 1 though March 31, and up to 37 gpm in April and October, flows would potentially increase 8-191 gpm from May 1 to September 30. The water would not be used for several years following the cessation of mining, which would result in an average increase in flow of 124 gpm during the irrigation season (WADOE, FSEIS, 2006, page 3.7-86).

Although Alternative B1 uses less water because of the half mile of paved road, it would require regular washing of the paved surface at the transition between gravel and paved road, so water use would be similar under Alternatives B and B1. Even with the larger amount of paving under Alternative C, because of it's length, this road would require about 50% more water usage than Alternative B, which might exceed the amount of water in the Newman Wells water right, and require another water source.

A much smaller amount of water would be needed for dust suppression on NFS lands in Alternative D because so little of the route on NFS lands is unpaved. However, cumulatively, it's likely the State of Washington would require dust suppression on the gravel Pontiac Ridge Road. The gravel section on NFS lands plus the gravel Pontiac Ridge Road is about 70% of the mileage of gravel road under Alternative B, and cumulatively would result in about 30% less water usage of Alternative B. As can be seen by the above table, only incidental changes in Toroda Creek flows would occur as a result in the timing change of the water withdrawals, although more water would be available during the driest part of the year.

As noted in the Direct and Indirect Effects, based on WEPP modeling, total sediment levels in Marias Creek from road construction and reconstruction, in the first year, plus sanding would be would be 3, 14 and 0 tons per year in Alternatives B/B1, C and D respectively. Cumulatively, when added to existing sources of sediment, this would result in a total of 1028, 1462 and 993 tons per year in Alternatives B/B1, C and D, or a less than 1% increase in sediment levels overall. This would result in less than 1 NTU increase in all alternatives, meeting the State standard of less than 5 NTU increase.

Under Alternative D, it's likely that part of County Road 4895 would need to be reconstructed. About 2 miles of this route is within 300 feet of Millard Creek and it's likely some sediment may get into Millard Creek under this scenario. However, any sediment would settle out in ponds further down Millard Creek and would not add to sediment in either Beaver or Toroda Creeks.

Fly ash would be mixed with cement when backfilling the mine shafts. Some minor amounts of metals may leach out of the fly ash into ground water. This however should be in tiny amounts (Zhang et al. 2001). Samples from the proposed mine are undergoing humidity cell testing, which includes two samples of cemented backfill material. These two samples show higher amounts of metal leaching than the drill core samples, but the overall amounts of metals released are still low. Some rock samples are considered to have potential to

generate acidity (Golder Associates Inc., August 8, 2005, July 27, 2006). When backfilling is done for the mine, potentially acid generating rock would be preferentially placed in areas that would be permanently flooded to prevent oxygen contact. In other areas alkaline producing amendments may be added to the back fill rock, e.g. marble (Golder, September 1, 2006). These treatments would keep acid generation and results to water quality within State standards.

WADOE's FSEIS acknowledges that predicted permanent changes in the groundwater divide as a result of mining could impair senior water rights, but states that measures have been identified to mitigate that impact (WADOE, 2006, 3.17-2). Activities on National Forest System lands would not affect any water rights except as they relate to the information regarding the Newman wells above.

Aquatics

The section below summarizes the affected environment information, along with direct, indirect, and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Aquatics Report and Biological Evaluation by District Fish biologist Nancy Wells dated December 20, 2006 in the analysis file.

AFFECTED ENVIRONMENT

Marias and Nicholson Creeks are 6th field Hydrologic Unit Codes (HUCs), both located in the 5th field HUC of Toroda Creek Watershed. Toroda Creek is in the 4th field Kettle River sub-basin.

Management Indicator Species

The management indicator fish species found in Marias and Nicholson Creeks are rainbow trout (*Oncorhynchus mykiss*) and non-native eastern brook trout (*Salvelinus fontinalis*). Rainbow trout are resident, and have been augmented by stocking throughout the 20th century with rainbow stocks from elsewhere in the State of Washington.

Eastern brook trout are introduced, non-indigenous species, native to the eastern United States. Eastern brook trout were introduced throughout Okanogan County beginning in the late 19th century, as a food source. Eastern brook trout compete for food and living space against the native resident, less aggressive rainbow trout.

Redband trout identified by genetic testing were collected from Toroda Creek in the summer of 2005 (WADOE FSEIS, 2006, pg 3.10-15). Fish with the exterior appearance of redband trout (*Oncorhynchus mykiss gairdneri*), a sub-species of rainbow trout on the Regional Forester's Sensitive Species List were found in Marias Creek in fish surveys in the analysis area prior to 2005, although none were observed in the 2005 surveys.

Anadromous species of fish (salmon or steelhead trout) are not present in this watershed. Kettle Falls historically was the barrier to upstream travel by anadromous fish. In 1939, Grand Coulee Dam was constructed without fish passage facilities, replacing Kettle Falls as the fish passage barrier on the Columbia River. In 1955, Chief Joseph Dam was constructed, also without fish passage facilities. Chief Joseph Dam is downstream of Grand

Coulee Dam, and its construction resulted in the loss of more anadromous fish habitat in the Columbia River.

Federally Listed Fish

No occurrences of Federally listed Threatened, Endangered, or Proposed for listing, or Candidate species of fishes, including salmon, steelhead, and bull trout have been documented in the area. As noted above, Kettle Falls, which lies more than 50 miles downstream from the project area, historically was a barrier to upstream travel by anadromous fish.

Magnuson-Stevens Essential Fish Habitat

Because no anadromous fish can access the Kettle River, Myers Creek, Toroda Creek, or Marias or Nicholson Creeks, due to Chief Joseph and Grand Coulee dams, there is no Essential Fish Habitat in the vicinity of the project area. The Magnuson-Stevens Act does not apply to this project.

Federal Species of Concern

Amphibians

Columbia Spotted frog (Rana luteiventris)

Columbia spotted frogs (*Rana luteiventris*) are present and well distributed throughout both the Toroda and Upper Myers Creek watersheds (Wells, personal observation). These frogs make use of stream edges, ponded water, and wetlands, most often associated with non-woody wetland plant communities, hiding among sedges, rushes and grasses (Leonard, et al., 1993). Spotted frogs are rarely found very far from water, into which they make escape from predators (Nussbaum, Brodie, and Storm, 1983).

Livestock trampling on stream banks and wetland edges can crush spotted frog egg packets, and add sediment to waters where tadpoles are rearing, reducing the opportunity for feeding, and also affecting available oxygen when manure is introduced to shallow wetted areas.

Aquatic Mollusks

California floater mussel (*Anodonta californiensis*)

The range of California floater mussels used to be from southern British Columbia to northern Baja California, and as far east as Wisconsin. Today, they are extinct through much of their former range. California floaters are a candidate for protection in the State of Washington, and a Federal species of Concern. No California floaters were observed during fish habitat surveys in Toroda, Marias, Nicholson, or Myers Creeks (Unpublished reports, Tonasket RD, 1999 and 2005; Pentech, 2004; and URS, 2005).

California floaters have been observed in Curlew Lake (pacificbio.org website). Both the Kettle River and its tributaries and the Sanpoil River and its tributaries are within the range of the California floater, and appear to have suitable habitat for the California floater, but neither system has been surveyed for their presence (Hallock, 2005. Pers. comm.).

Habitat preference for California floaters is lower elevation soft, silty substrate in lakes, ponds, and large rivers. This type of habitat is not present in Nicholson or Marias Creeks.

The glochidium (larval form of California floaters) requires a host fish, usually a minnow, and after reaching a certain size, release from the fish and begin the life of a sedentary filter feeder. No minnow type fish were found in Toroda, Marias, Nicholson, or Myers Creek.

Regional Forester's Sensitive Species List

Redband trout (*Oncorhynchus mykiss gairdneri*), a sub-species of rainbow trout, were collected from Toroda Creek in the summer of 2005 (WADOE FSEIS, 2006. Pg. 3.10-13). Genetic testing determined conclusively that the collected fish were redband trout. The sample size was very small, just four fish, so it cannot be said the entire population of rainbow trout in Toroda Creek are redband trout.

No redband/rainbow trout were present in Marias Creek at the time the collection sampling was done. At the time of sample collecting (summer 2005), the stream flow was low in Marias Creek, so it is likely that any fish present had retreated to Toroda Creek. Redband trout (genetically identified in the late 1990s) are present in the Kettle River sub-basin, and in the North Fork and mainstem Sanpoil Rivers (Shuhda, 2004. Pers. comm.).

The only westslope cutthroat population present in the project area is located in the headwaters of the South Fork Sanpoil River, well upstream from the Kettle River Mill or any potential road traffic associated with the project.

No occurrences of pygmy whitefish, brook or pacific lamprey, fish species that are on the Regional Forester's Sensitive Species list, have been documented in the analysis area. Hybrid "cut-bows" (cutthroat and rainbow trout crossbreeds) were found during surveys of Toroda Creek in 1998. Cutthroat trout (sub-species unknown) were occasionally planted in the watershed; the last known decade that cutthroat planting in Toroda Creek occurred was the 1970s according to Washington Department of Fish and Wildlife.

Toroda Watershed Information

The Toroda Creek Watershed Assessment identified the following concerns in Marias Creek and Nicholson Creek:

- Marias Creek: The banks and channel are receiving heavy livestock use due to the road being so close to the stream. Large woody debris (LWD) recruits have been removed from the road prism, and banks are unstable. Culverts are not fish passable nor can they pass a 100-year event.
- Nicholson Creek: The banks and channel are receiving heavy livestock use due to the road being so close to the stream. Potential LWD recruits have been removed from the road prism, so banks are unstable. Culverts are not fish passable nor can they pass a 100 year storm event (two culverts on Nicholson Creek have since been replaced, one under Ferry County road 502 and one under FR 3575).

A Washington State Department of Ecology Open-File Technical Report 95-16 (1995) lists Toroda Creek as being closed for surface water availability based on fisheries concerns and documents dating back to the 1950s (USFS, 2004). The closure was done at the recommendation of the Washington Department of Fish and Wildlife.

Data Collection

In fish bearing streams on National Forest System land, information was collected using the Tonasket Riparian Analysis Process (TRAP) and the Hankin and Reeves stream survey method. Non-fish bearing streams were surveyed using the TRAP process to determine the condition of stream channels and their associated riparian zones.

The Hankin and Reeves stream survey method is the Pacific Northwest (Region 6) Forest Service required survey protocol for all fish bearing stream reaches. Surveys using this protocol were conducted in spring 2005. This survey method was used in the fish bearing reaches located on National Forest System lands of Marias Creek and its tributaries, Bat Canyon Creek, and Bear Trap Canyon Creek. A Hankin and Reeves Fish survey was also conducted in Nicholson Creek. The Hankin and Reeves survey process does not assess the riparian condition as thoroughly as the TRAP method. In some cases, both methods were used to assess the conditions of fish bearing reaches of stream, but both were not used for all reaches of fish bearing streams within the assessment areas of each of the streams.

Inland Native Fish Strategy (INFISH)

Riparian Management Objectives (RMOs) values and Standards and Guidelines are found in INFISH (USDA, 1995), which amended the Okanogan National Forest Land Resource Management Plan for a portion of the Okanogan National Forests including the Buckhorn Access Project area. Toroda Watershed is not a designated Priority Watershed for INFISH.

The RMOs have one "Key" feature: The number of pools. The number of pools criterion applies to every stream. There are five Supporting Features: The Width to Depth Ratio and the Temperature supporting features apply to all streams. The remainder of the supporting features apply either to forested or non-forested Riparian Habitat Conservation Areas (RHCAs). The area of this analysis has both forested and non-forested sites, so all supporting features are listed in Table III-35 below, and are indicated as to which type of RHCA they apply.

Table III-35: Nicholson Creek and Marias Creek 2005 Stream Survey Data Compared to INFISH RMOs by Stream

Habitat Feature	Interim Objective	Nicholson Creek (RM 2.6 to 6.1)	Marias Creek (RM 0.4 to 4.3)
Pool Frequency (all systems)	Varies by channel width See footnote[1]	Not meeting INFISH Obj[1] Actual avg. wetted width=4.4' 37.3 pools per mile[2]	Not meeting INFISH Obj.[1] Actual avg. wetted width= 4.4' 38.2 pools per mile[2]
Water Temperature	No measurable increase. in maximum water temp[3]	Temperature data to be gathered by Tonasket Ranger District	Temperature data to be gathered by Tonasket Ranger District
Water Temperature	Max. water temp. <64◦F (migration & rearing hab.)	No data for 2005, data logger failed. Temperature activity likely the same as Marias Creek.	No excursions over 64°F. between the months of May and October 2005
	Max. water temp. <60◦F (spawning hab.)	No data for 2005, data logger failed. Temperature activity likely the same as Marias Creek.	No excursions over 60°F. between the months of May and October 2005

Habitat Feature	Interim Objective	Nicholson Creek (RM 2.6 to 6.1)	Marias Creek (RM 0.4 to 4.3)
Large Woody Debris (forested systems)	> 20 pieces per mile: >12" diameter > 35' length	Meets INFISH Objectives. Actual value: 28.6 pieces per mile	Meets INFISH Objectives. Actual value: 29.7 pieces per mile
Bank Stability (non-forested systems)	> 80 percent stable	Meets INFISH Objectives. Actual value: 96% stable banks	Meets INFISH Objectives. Actual value: 95% stable banks
Lower Bank Angle (non-forested systems)	>75 percent of banks with <90 degree angle	Not measured, but ocular estimates indicate likely below objectives	Not measured, but ocular estimates indicate likely below objectives
Width/Depth Ratio (all systems)	<10, mean wetted width divided by mean depth	Not meeting INFISH Objective Actual wetted width/depth 15.1	Not meeting INFISH Objectives Actual wetted width/Depth 19.3

[1]Wetted width in feet:	10	20	25	50	75	100	125	150	200
Number of pools per mile:	96	56	47	26	23	18	14	12	9

[2]Stream survey pool definition: Pools have a channel spanning hydraulic control, and the length of pool is greater than the width of pool (except for plunge pools).
[3]The 7-day moving average of daily maximum temperature is measured as the average of the maximum daily temperature of the warmest consecutive 7-day period.

Marias Creek
Marias Creek is a perennial fish bearing stream. At the time of survey, May 2005,on NFS lands, fish species found were rainbow trout (*Oncorhynchus mykiss*) and eastern brook trout (*Salvelinus fontinalis*), a species of charr.

Stream surveys indicated problems with culvert barriers, cattle trampling causing bank erosion, and fine sediment above Forest Plan standard, in addition to the information provided in Table III-35. More details, reach by reach, can be found in the Aquatic Specialists' report and the Stream Survey Reports in the project file.

Wetlands, Seeps, and Springs
There are approximately 8 acres of wetlands and associated seeps and springs in the upper most reaches of Marias Creek subwatershed. Figure III-1 in the Hydrology report shows the locations of wetlands impacted by haul routes. Many of these wetlands are adjacent to Marias Creek, but none have been observed to serve as rearing habitat for fish fry. These wetlands do provide a continuing supply of water to Marias Creek, and may help to keep temperatures low compared to what they would be without the input from wetlands, seeps and springs. These wetlands do provide excellent habitat for Columbia spotted frogs, tree frogs, western toads, and long-toed salamanders. No tiger salamanders were observed.

Nicholson Creek
Nicholson Creek is a perennial fish bearing stream. The only fish species found during surveys in 2005 on National Forest System lands were eastern brook trout (a species of charr). A previous survey in 1992 by A.G. Crook Company also only found eastern brook trout. In 2006, surveys done by URS found rainbow trout below the culvert at river mile 0.47, on private land.

Stream surveys indicated problems with surface fine sediment slightly above Forest Plan standards, 4 culvert fish passage barriers on National Forest System lands and rights-of-

way, the road close to the creek, and some areas heavily impacted by cattle trampling with bank erosion in addition the information provided in Table III-35 above. Reach by reach information can be found in the Aquatic Specialist's report and Stream Survey Report in the project file.

There are no fish bearing tributaries to Nicholson Creek.

Wetlands, Seeps and Springs
Portions of the nine acre wetlands, as well as other smaller wetlands and associated seeps and springs are located in the Nicholson Creek subwatershed. Figure III-1 in the Hydrology report shows the locations of wetlands impacted by haul routes. Many are adjacent to Nicholson Creek, but none have been observed to serve as rearing habitat for fish fry. These wetlands do provide a continuing supply of water to Nicholson Creek, and may help to keep temperatures low compared to what they would be without the input from wetlands, seeps and springs. These wetlands do provide excellent habitat for Columbia spotted frogs, tree frogs, western toads, and long-toed salamanders. No tiger salamanders were observed.

Winter Needs of Fish

Because of the low pool numbers in both Marias and Nicholson Creeks and their relative shallowness, the creeks are subject to anchor ice. To find winter living space, fish must migrate to existing pools in the creeks, or to Toroda Creek. Overcrowding in the pools can occur resulting in fish kills due to oxygen depletion. For fish that reach Toroda Creek, they cannot return to the creeks because of the existing impassable culvert barriers. Two of these barriers on Nicholson Creek were replaced with fish passable culverts in 2005. Barriers to Toroda Creek are still present on both creeks at River Mile (R.M.) 0.47 on Nicholson Creek and R.M 0.59 on Marias Creek.

ENVIRONMENTAL CONSEQUENCES

Alternative A: No Action

Direct/Indirect Effects

The sediment being delivered to the creek would remain the same as described in the Hydrology report for the No Action Alternative, which could result in filled pools over time. Sediment delivery could be reduced somewhat as more vegetation grows and entrains moveable soils. Some of the existing sediment delivery sites could be corrected by routine road maintenance. Low pool numbers and several culvert barriers would persist.

The temperature regime would remain the same, or perhaps get somewhat cooler as trees and vegetation grow to shade the creeks, particularly in previous harvest units along Marias Creek.

Livestock access to the creeks would remain, and shade that might be provided by grasses and shrubs would likely be grazed or browsed, and the stream banks continue to be trampled delivering sediment to streams. Opportunities to change livestock management strategies exist via annual operating plan meetings with the permittee(s) and Allotment Management Plan updates (a NEPA process), apart from this project.

Recruitment of large woody debris would remain the same as it is currently.

Cumulative Effects for Alternative A (No Action)

Because there would be no project activities under this alternative, there are no cumulative effects with other projects. Reclamation for previously approved mine predevelopment activities would commence such as removal of water monitoring wells, surface water monitoring sites, and reclamation of access roads to these sites.

Effects Common to All Action Alternatives

Water Quantity

Nicholson Creek

Direct/Indirect Effects

Treated water from mine operations would be infiltrated on National Forest System lands in an infiltration gallery (outfall 001). The quality of the treated water would meet standards set by the NPDES permit, which requires that water quality meet the most restrictive of State or Federal standards and whichever of surface or groundwater standards is most restrictive. This water would add to ground water in the Nicholson Creek drainage. Along with water augmentation provided in Nicholson Creek at outfalls 002 and 003, the water infiltration system would minimize groundwater losses from mine operations in these watersheds, and during mining increase by 4-15% water availability to fish in the section of Nicholson Creeks where they are presently located.

Water augmentation in Nicholson Creek would result from the water released to the infiltration gallery (outfall 001) and from water augmentation proposed during July, August and September at the Roosevelt adit (outfall 003). A maximum of 20 gpm would be infiltrated in upper Nicholson Creek, except as noted below. Water augmentation would begin at the Roosevelt adit (outfall 003) at the headwaters of Nicholson Creek, July through September, would progressively increase during the mine life and reclamation up to 13 gpm[83], except as noted below.

As explained in the cumulative effects report for hydrology, these flows would offset expected reductions from mine dewatering during the drier season. Augmentation would occur in months when the stream is usually low, and occasionally there are areas of very low water, or dry channel, that inhibit fish movement up and down stream. Augmenting flow in Nicholson would allow fish movement within Nicholson Creek similar to present conditions. The infiltration gallery may be able to handle more than 20 gpm without adverse erosional, consequences, so more water could be infiltrated at this site. Similarly, other water augmentation sites could receive more water than calculated into the hydrology cumulative effects analysis. Because a mitigation measure is included that additional water could not be infiltrated except when flows do not approach bank full discharge, these additional flows should not result in any stream bank undercutting or deposition, and no adverse consequences to aquatic species are expected. Replacement of the lowest culvert on Nicholson Creek on Forest Road 3575 and on the non-system road near the junction of Forest Road 3575 and 3575-100 in all alternatives would improve passage conditions under all alternatives. Under Alternative C, all culverts on the Nicholson Creek road would be

[83] Golder 2006a predicts only a maximum 6 gpm will be needed during average years to offset losses from mine dewatering.

replaced and made passable for aquatic organisms.[84] All of these culvert replacements would be designed to accommodate a 100-year flood, consistent with INFISH standard and guidelines RF-4 and RF-5.

Maintaining or increasing flows would be beneficial to amphibians and aquatic mollusks by maintaining habitat during the dry season.

Cumulative Effects

Water releases from the infiltration gallery (outfall 001) and the Roosevelt adit (outfall 003) and Goldbowl Creek (outfall 002) in the Nicholson Creek subwatershed and outfall 004 in the Marias Creek subwatershed are not expected to affect the water quality of the creek or the wetlands, seeps, or springs of the Toroda Creek Watershed, because before being released, the water must meet the Washington State water quality standards set by the NPDES permit.

The increased flows on National Forest System lands as described above would partially or fully offset flow reductions from mine dewatering on private lands, and when activities on NFS lands and the mine are considered together, cumulatively, flows would not generally increase or decrease by large amounts. The greatest effect on flows from dewatering would be after the end of mining while the mine fills with water. See the hydrology cumulative effects report for more details on the effect of mine dewatering, water infiltration and augmentation.

Impacts on fish as a result of mine dewatering on private lands and infiltration/augmentation on NFS lands is a series of small increases and decreases in water quantity in lower Nicholson Creek where fish reside. Baseflows would increase up to 4-15%, which is within the natural variability of the stream, and would not raise the stream above current bankfull discharge level. Increases in stream flows from water augmentation would occur during months when the stream flows are low, which may allows fish movement to other sites within Nicholson Creek, and to Toroda Creek as a result of fish passage barrier replacements. During the Buckhorn Access Project, the greatest impact to fish would be during years with below average precipitation since groundwater recharge would be less than normal, resulting in less water for infiltration/augmentation and lower stream flows. Fish populations are not expected to change during this project as a result of changes in stream flows. The greatest impact to fish habitat would be after mining when augmentation at outfall 002 on private land and infiltration on NFS lands cease (and therefore all cumulative effects with this project cease) and the mine is refilling.

Fish do not reside in upper Nicholson Creek, but amphibians do. Any reduction in flow may make some amphibian egg deposition areas unusable, but because adult amphibians are mobile, other sites would be available for use in the creek, wetlands, vernal pools, puddles, and ditches. In the months of July through September in upper Nicholson Creek, flows as a result of dewatering on private lands and infiltration/augmentation on NFS lands would increase slightly above baseline. Amphibians are not expected to be affected by this change in flows.

Dewatering the mine would result in drying of wetlands, seeps and spring, and a loss of habitat for amphibians above the infiltration and water augmentation site in Nicholson Creek, but the Buckhorn Access Project would not add cumulatively to these losses.

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[84] The preliminary EA noted a partial barrier on lower Nicholson Creek on private lands based on information in the State's DSEIS on the Buckhorn Mountain Project. This information was incorrect and has been removed from both documents.

Under current Buckhorn Mountain Project plans, a stormwater storage pond planned for installation on private lands are planned for conversion to wildlife watering ponds upon reclamation. Once mining activities cease, the fencing is removed, and few people are left to disturb wildlife, these ponds would serve as a water source for amphibians to offset dewatering impacts on seeps, springs and wetlands on both private and NFS lands until mine equilibrium.

None of the other past, present, or reasonably foreseeable future actions listed at the beginning of this chapter would affect water flow, except as noted in the Hydrology cumulative effects analysis.

Marias Creek

Direct/Indirect Effects

Water augmentation to a cattle watering trough, with overflow directed to a wetland in the upper headwaters of Marias Creek (outfall 004) would occur during July through September. Flows would be increased up to 3.5[85] gpm through water augmentation, which would offset flow reductions from mine dewatering on private lands. The resulting slight decrease without augmentation of flows is not likely to have an effect on fish, amphibians, or aquatic mollusks in lower Marias Creek since this is within the natural variability of the stream.

Aquatic organisms would benefit during the normal low flow in lower Marias Creek from removal of the fish barrier culverts on National Forest System lands, since all Marias Creek culverts under Forest Roads 3550 and 3550-080 would be made passable to aquatic organisms in Alternatives B and B1. Currently, fish can become isolated in pools. Culvert replacement would allow aquatic life to move up and down Marias Creek, although replacement of culverts on NFS lands would not provide year-round fish passage to Toroda Creek (although see cumulative effects below).

Cumulative Effects

Surface water augmentation provided in upper Marias Creek would minimize groundwater losses from mine operations in Marias Creek, and result in little change to water availability to fish in section of Marias Creek where they are presently located, in lower Marias Creek (water monitoring station SW-2), where the fish reside. Baseflows would decrease from October through June (outside the augmentation period). From July through September, the normal flow for that time period would increase slightly. The small decrease in streamflow from October to June, and slight decrease from July to September is not likely to have an effect on fish, amphibians, or aquatic mollusks in lower Marias Creek since it is within the natural variability of the stream.

In upper Marias Creek, there would be little if any change in streamflow. Augmentation would occur in upper Marias Creek in July, August and September and would fully mitigate dewatering impacts. There would be a long-term decrease in flow in Marias Creek between 0.1 and 0.3 gpm at re-equilibrium. This minor flow reduction is not expected to have an adverse effect on aquatic organisms in the creek.

[85] Golder 2006a predicts that less than 1 gpm will be needed during an average year to offset flow losses from mine dewatering.

Fish do not reside in upper Marias Creek, but amphibians do. California floaters are not expected to be found in upper Marias Creek because of their preference for slower moving and deeper water than is found in upper Marias Creek. Egg positioning sites of amphibians in the creek, wetlands, vernal pools, puddles, and ditches would be similar to what is currently available.

Okanogan County, in conjunction with Crown/Kinross, plan to replace the culvert where the Toroda Creek road passes over Marias Creek. The culvert would be removed and replaced with one that is passable to all forms of aquatic life. The work would be done by Okanogan County. This project would permit increased passage to Marias Creek from Toroda Creek, and back during high flow conditions, but not year round. During the drier parts of the year, Marias Creek upstream from the culvert goes subterranean. Coupled with the culvert replacements along the Marias Creek road in Alternatives B and B1, this would restore aquatic life passage up and down Marias Creek, as well as connectivity to Toroda Creek during certain flow conditions.

Dewatering the mine would result in drying of wetlands, seeps and springs, and a loss of habitat for amphibians above the water augmentation site in Marias Creek, but the Buckhorn Access Project would not add cumulatively to these losses.

Toroda Creek

Direct/Indirect Effects

No direct or indirect effects to aquatic life in Toroda Creek are expected from activities on National Forest System lands.

Cumulative Effects

Water for dust abatement use would be drawn from a well on private land adjacent to Toroda Creek. The well is in hydrologic continuity with Toroda Creek, so the water removed would affect Toroda Creek flows. The withdrawals would occur throughout the life of the project until mine closure.

Currently the Newman well is used to irrigate 50 acres annually from April through October. Irrigation use from the well would not occur during mining and reclamation (year 0 to 10). From year 11 to 24, use of the irrigation right would be limited to 40 acres (10 acres would not be irrigated). Starting in year 25, full use of the irrigation right would resume.

During the months of November through March, inclusive, when this well is typically not used for irrigation purposes, there would be some water drawn for dust abatement purposes. The flow reduction in Toroda Creek below Nicholson Creek, by year 7, from the withdrawal would be 0.4 to 1.1 %. Based on work done by Golder Associates (2006a), this reduction in flows results in a decrease of 685 cubic feet of wetted habitat between the well and Nicholson Creek. Downstream of Nicholson Creek, there would be a streamflow reduction of 2.7 gpm in year 7. This reduction of flow is not expected to affect fish, amphibians, or aquatic mollusks.

From April through October, the flow in Toroda Creek would be greater than currently, because not as much water would be removed for dust abatement as is currently withdrawn for irrigation purposes. The result would be an increase in flow in Toroda Creek during the life of the project until current irrigation practices resume in year 25. The stream flow increase in Toroda Creek below Nicholson Creek, in year 7, would be between 0.1 to 2.4%. Based on the work done by Golder (2006a), the change in water use would create an equivalent gain of 4,380 cubic feet of habitat along 12 miles of Toroda Creek from the well to the Kettle River. This flow increase would be slightly beneficial to fish, amphibians, and aquatic mollusks. The more substantial increases are during the driest months when aquatic species are more at risk during low flows.

Myers Creek

Direct/Indirect and Cumulative Effects

Mine dewatering would result in a reduction in stream flow in Myers Creek of up to 6.4 gpm by year 13. Impacts would gradually decrease over the mine flooding period; however there would be a permanent loss of about 4 gpm below Bolster (WADOE, FSEIS, 2006. Pg. 3.7-67). Although mine dewatering on private lands would cause flow reductions to wetlands, seeps and springs and amphibian habitat in the Myers Creek drainage, the Buckhorn Access Project would not add cumulatively to this loss because no Forest Service activities would affect ground water or surface water availability in that drainage.

Mine development would move the ground water divide eastward on Buckhorn Mountain, shifting some drainage area and flow from Myers Creek to the Toroda Creek drainages. Streams on the west side of Buckhorn Mountain that may be impacted by mine dewatering include Gold, Bolster, Ethel and Myers Creeks. During mining, baseflow in all of these creeks is predicted to decrease. The decrease in baseflow ranges from approximately 1 to 4 gpm. This corresponds to a 1 to 23 percent decrease in predicted baseflow. The amount of baseflow at several of these stations is small, and thus a change of even a gallon per minute can result in a decrease of over 20% of total predicted flow (WADOE, FSEIS, 2006. Pg. 3.7-67).

Losses in Myers Creek during May to September, the dry summer season, would be mitigated using existing water rights in the Myers Creek drainage, providing an alternate water source for Bolster Creek residents, and wildlife guzzlers. According to WADOE's FSEIS (Pg. 3.10-23) up to 12 acres of water right at the Leslie Ranch will be deed to trust for the duration of mining and for several years during mine flooding. Additionally, water would be augmented in Myers Creek from the Lost Creek Ranch well when flows drop below 1 cfs, and a stock watering right would be deeded to trust from a 97 acre Myers Creek property owned by Crown Resources. Livestock will also be excluded from the floodplain of the 97 acre parcel, and restoration of riparian and floodplain vegetation will occur to further restore and enhance aquatic habitat in Myers Creek.

Although activities on NFS lands won't affect this shift, infiltration and augmentation of water in Marias and Nicholson Creek drainages may offset or partially offset water losses in the Toroda watershed and maintain habitat for Management Indicator Species (MIS) of trout. Water availability for aquatic organisms would be reduced by mine dewatering in the Myers Creek Watershed, but no activities on NFS lands would add to that reduction and impacts are mitigated as described above.

The only mitigation that occurs on NFS lands would be the installation of guzzlers that would provide watering areas for wildlife in headwater areas. These would not affect fish, mollusk, or amphibian habitat.

Other Direct/Indirect Effects Common to All Action Alternatives

Scientific research has determined there is a precipitous drop in salmonid (trout and charr) fry survival when fine sediment in a spawning area is greater than 15% (Bjornn, T.C., and D. W. Reiser in Meehan, William R., Ed., 1991).

The WEPP model (See Soils and/or Hydrology report for description of this model) identifies that without intensive road design intended to intercept as much sediment as possible, in addition to use of all Best Management Practices (BMPs) directed at keeping sediment delivery in check, that stream sediment loads delivered to the creek would be extremely high. Sediment particles less than or equal to 6.4 mm. are a concern because they fill the spaces between rocks in the substrate of streams.

When fish spawn, the eggs sink down into these spaces between the rocks (called interstitial spaces) where they rest and mature. When the fry emerge from the eggs, the fry remain in the substrate until they have used up the food provided by their yolk sacs. They then come out of the gravels to live in the water column of the creek. Sediment particles that are $\leq$6.4mm fill the interstitial spaces, smothering the eggs and fry, and preventing the area from being utilized further by spawning fish.

Potential for sediment delivery to the creek is greatest during the first three years of the project. After three years, seeded vegetation is expected to have grown enough for the emergent portion to intercept and hold sediment being delivered overland and for the root mass to entrain potentially erosive soils on the slopes.

The 1989 Forest Plan Forest Wide Standard and Guidelines 3-3 states that sediment in fishery streams shall be maintained at levels low enough to support good reproductive success of fish populations as well as adequate instream food production by indigenous aquatic communities to support those populations. Standard and Guideline 3-3 also states that fines in spawning areas should be maintained at less than 20% (source unknown) as the area weighted average.

Current sediment levels in all fish bearing streams in the project area are above the Forest Plan standard of 20% and substantially above the 15% scientifically determined by Bjornn, and Reiser in Meehan, William R., Ed., 1991). Alternatives B, B1, and C, would increase sedimentation, thus an amendment of the Forest Plan standard for this project would be necessary. Sediment level increases in Alternatives B, B1, and C are expected to be quite minimal because of the intensive and extensive erosion control measures that would be implemented (see Hydrology report) and compensatory mitigation is included to improve fish passage and fence cattle from Marias Creek. Alternative D does not require this amendment since no fish bearing streams are located on NFS lands along this route. Therefore, fish habitat is expected to be maintained in all alternatives.

An additional concern for spawning habitat is the delivery of the larger sizes of pebbles, gravels, stones, and rocks from blasting rock during road construction and from use of the road surface. When blasted, rocks can become angular, and may be delivered to the creek. Road surface material is intentionally angular to interlock and provide a relatively smooth

running surface. Movement of vehicles along the road can cast the surface rock aside, allowing delivery to the creek. The result of the angular material in the creek is that these larger particles interlock over the surface of spawning substrate, trapping existing eggs and fry, and making the substrate unusable for future generations of fish. Road design along with silt fencing, with straw bales behind (when the road is within 100 feet of the creek or below culverts within the RHCA) and windrowing slash would be highly effective in preventing much of the road surface material from being delivered to streams, as would regular maintenance of the silt fencing, wattles or straw bales, windrows, and the road surface. The Hydrology report earlier in this chapter gives more information regarding the effectiveness of these mitigation measures.

Winter traction would be provided by spreading sand on the road surface. The use of sand increases the possibility of sediment being delivered to the creek. If left in the snow on the road surface or in the road ditches, the sand should be entrained in the wattles or straw bales, vegetation, and rock within the ditches and other sediment entraining elements designed into the road system. If, where the road is within 100 feet of the creek, the snow were side-casted off the stream side of the road with the sand mixed in, the sand could be moved to where it is outside the system designed to entrain it, and would likely be delivered to the stream. Thus, where the road is within 100 feet of the stream edge, snowplowed snow would either be blown to the uphill side of the road, or the snow/sand mix would be end-hauled and placed where, when the snow melted, the sand would not be delivered to a water body. This is consistent with INFISH standard and guideline RF-2f to avoid sidecasting of snow in RHCAs.

As described in the Hydrology report, water quality, and thus fish habitat, may be affected because of the salts used as dust abatement products on the haul route. A rise in magnesium and chloride levels in Marias or Nicholson Creeks could result in a fish or egg kill in the stream. Trout species are sensitive to chloride concentrations as low as 400 ppm. The Environmental Protection Agency identifies as national criteria for levels of chloride to be 230 ppm as chronic toxicity and 860 ppm for acute toxicity (EPA, 1988.) These standards are for all aquatic life forms. Amphibians and their eggs in the wetlands, streams, seeps, and springs near enough to the road to have dust abatement products delivered to them, could be affected similarly. However, expected chloride concentrations from water infiltration and augmentation and from dust abatement would be below standards for chronic toxicity to aquatic life in Alternatives B, B1 and C (see hydrology report), so no impacts to aquatic life are expected. Monitoring of chlorides would be done to ensure chlorides remain below the standard of 230 ppm. Because of the distance to water in Alternative D, no impacts from magnesium or chlorides are expected.

The assumption in this direct and indirect effects analysis is that magnesium chloride applied to roads within RHCAs would reach Marias Creek (Alternatives B and B1) or Nicholson Creek (Alternative C), though the rate would be dependent upon the frequency and magnitude of snow melt and rainstorms. No salts are expected to reach Millard Creek from activities on National Forest System lands or rights-of-way because of the distance to the creek from the road. Expected chloride concentrations would be within state and EPA standards (see Hydrology report).

Water quality monitoring may not only occur through the life of the project (approximately 10 years), but perhaps as long as sixty years. Water quality monitoring is not expected to result in impacts to the streams, their channels, or the riparian vegetation in the vicinity of the sampling stations.

Water monitoring as described in the monitoring section of Chapter 2 would determine when magnesium or chloride levels are elevated. If the levels are above those suitable for aquatic life forms, an investigation to determine the cause would be conducted. If a fish or amphibian mortality is detected, dust abatement using lignin sulfonate and/or water would be used in order for the haul to continue, while a fish mortality investigation is conducted, except as necessary to complete the investigation. The methods to be used for the investigation would be those described in the Field Manual for the Investigation of Fish Kills (USDI/USFWS, 1990, or its successor).

It is not expected that lignin sulfonate would be used during the life of the project, but because it is different than magnesium chloride, it was selected to be an alternate dust suppressant, in the event of an investigation. Other available brine based dust suppressants act similarly to magnesium chloride, and thus would defeat the purpose of an investigation. Using plain water alone for the entire haul route may require water in excess of that available in the area.

Lignin sulfonate can affect aquatic organisms by binding up available oxygen in the water. In the event lignin sulfonate must be used, it would not be applied within 25 feet of stream crossings, or where the creek is within 25 feet of the road (USDA/USFS, 1999.). In those locations plain water would be used.

Utility lines would be buried in the road prism except for one pole at the start of the Marias Creek road where the transition to a buried line occurs. The telephone and data lines would be extended from the residence at Cow Camp, and the electrical lines would be buried in the ore haul route, except under Alternative C where part of another route would be used across National Forest system land and rights-of-way. The power lines (likely 4 cables in one trench) would be buried using a backhoe or excavator as part of road construction.. The soils removed to install the utility lines would be placed right back into the trench where the utility lines are placed. Those soils are not expected to be delivered to a creek; fish and aquatic habitat are not expected to be affected from this particular activity because all disturbance would be in the road bed.

Water releases from the infiltration gallery (outfall 001) are not expected to affect the water quality of the creek or the wetlands, seeps, or springs, because before being released, the water must meet the Washington State water quality standards set by the NPDES permit. No impacts to fish are expected to occur from the water infiltration gallery (outfall 001). If a fish kill occurs attributable to the infiltration gallery (outfall 001) or water augmentation, a fish kill investigation would be done, as described in the Field Manual for the Investigation of Fish Kills (USDI/USFWS, 1990, or its successor). Water releases from the infiltration gallery (outfall 001) and other augmentation sites would not be done, except as necessary to complete the investigation. The same would occur for an amphibian kill. No deleterious effects to aquatic species are expected from the infiltration gallery or other water augmentation sites, because water quality standards would be met (see hydrology cumulative effects).

All culverts for live streams in the newly constructed and reconstructed haul route roads would be designed to pass water and debris expected from a hundred year storm event, and would be made passable by aquatic species, consistent with INFISH standard and guidelines RF-4 and RF-5. Culverts installed only for ditch relief purposes do not need to be designed for a 100-year flood event, or be fish passable under INFISH guidelines.

Relief culvert sediment delivery measures for any of the haul routes are described in the Surface Water and Ground Water Quality (WQ-1) Management and Mitigation section of Chapter II of this document. In addition, the relief culverts themselves would be aligned with the slope so water would be delivered directly at the base of the fill slope into the settling basin formed by the rock aprons, silt fencing and straw bales (where used) below the relief culverts. This avoids the problem of water falling from above on to the road fill and producing an erosion problem, because of the distance and the velocity the water would have as it fell from a culvert running almost level underneath the road, and ending well above the toe of the fill slope.

California floaters (freshwater mussels), if present in the Marias Creek or Nicholson Creek sub-watersheds should only be minimally affected, under Alternative B, B1, or C respectively, and would not be affected in Alternative D.

Off-channel wetlands would be created above two culvert replacement locations in Marias Creek under Alternatives B and B1 and above several culvert locations in Nicholson Creek in Alternative C to off-set the loss of wetlands at these culverts during culvert replacement. Soils near the stream channel would be excavated, with the resulting hole filling with water. The excavated soils would be removed from the site, so as not to contribute to additional sediment in the creek. These wetlands may fill in as the result of a flood event, but likely would be replaced by new such habitat established by the flood event.

Spotted frog egg laying, rearing and adult living areas in both Marias and Nicholson Creeks, and wetlands frequented by livestock are already affected by the existing sediment load. This is from the existing roads delivering sediment, and bank trampling by livestock. Because mitigation measures are included for a well-reinforced silt fence and windrowed slash compacted to be in contact with the ground, the spotted frog population in Marias Creek or Nicholson Creek sub-watersheds should only be minimally affected by sedimentation, under Alternatives B, B1, or C respectively. Sediment levels are predicted to be at or near existing levels with mitigation in place. In addition, fencing of livestock from the haul route in Alternatives B and B1 would decrease sedimentation and protect frog habitat since access by livestock to Marias Creek would be much more difficult. Spotted frogs should not be impacted at all in Alternative D.

Alternative B and B1: Marias Creek Haul Route

Direct/Indirect Effects

The two lower reaches of Marias Creek already have substantially greater than 15% fines of $\leq$ 6.4mm size. Reach 2 has 32% fines, and Reach 3 has 30%. The haul route parallels Marias Creek for 4.0 miles of these reaches. In some places, the Riparian Habitat Conservation Areas (RHCAs) between the creek and the road are wide enough to intercept and hold the sediment and road gravels that may be delivered. In other places, the road is within 5 feet of the creek, on private land at the base of Marias Creek.

The existing sediment load already impairs spawning habitat in Marias Creek. This is from the existing roads delivering sediment, and bank trampling by livestock. If substantial additional sediment delivery to the creek occurred, the fish population in Marias Creek could be lost. To prevent this, mitigation measures have been incorporated to minimize as much as possible the potential for sediment delivery to the stream. The road design would

incorporate silt fencing using heavy stakes, with noxious weed and seed free straw bales behind the silt fence, and windrows of slash to be placed between the road edge and the creek, and all ditches along the haul route would have noxious weed/seed-free wattles or straw bales placed to entrain sediment in the ditches.

The WEPP modeling for Alternatives B and B1 predicts a 5% increase above the present amount of sediment being delivered to Marias Creek from road construction and reconstruction with the mitigations for frequent relief culverts, vegetated ditches and/or wattles in ditches and well-graveled roads. The model could not be altered to also include the positive sediment interception value of windrowed slash in contact with the ground, sturdy silt fencing backed by straw bales, or rock aprons. These are predicted to be 99 percent effective in reducing sediment, so actual sediment delivery increase would be less than 1% including sand used for winter traction not calculated into the WEPP figures (see hydrology report).

Monitoring and maintenance of the erosion control features would occur to assure they are effective and operational. Monitoring and maintenance would also occur following any precipitation event of 0.25 inch or more in 24 hours, as recorded at the mine site.

A fence would be constructed to keep livestock off the haul route, and by default, livestock would be kept out of the stream, which would reduce or eliminate bank trampling for the life of the project. The fence would remain in place after the project is completed, if the permittee decides to take over maintenance responsibilities, continuing protection of the creek from livestock access.

A new corral would be constructed in lower Marias Creek for bringing livestock on and off the allotment. This would be placed along side the haul route in the same location as the temporary corrals in past years. It is not expected to have any effect to streams or aquatic organisms.

The installation of new troughs filled from a well, slash windrows, fencing and water gaps would benefit the creek, and the fish in it, by reducing or eliminating sediment delivery by livestock bank trampling.

The temperature in Marias Creek in the months between May and October 2005 did not rise above 55°F. Temperatures greater than 60°F are considered to be of concern for trout species. The temperature of Marias Creek is not expected to change as a result of this project. Although slight raises in temperature from water infiltration and augmentation may be allowed under the NPDES operating permit, the draft NPDES fact sheet (WADOE, 2006.) has determined based on Golder's engineering report (2006a) that maximum effluent temperatures levels would not exceed the State's surface water quality criterion (WADOE,2006.). These are expected to be well below the 60°F maximum temperatures needed for good salmonid habitat since little streamside vegetation would be removed and augmented and infiltrated water has been show to meet State standards. Cattle exclusion from Marias Creek may actually increase shading and lower temperatures.

Large woody debris in the stream channel is currently meeting the INFISH requirement of greater than 20 pieces per mile that are $\geq$35 feet long and greater than 12 inches diameter at the small end. Large woody debris is also necessary in the RHCAs to intercept sediment before it can reach the creek, and also retain moisture in the RHCA. See the Wildlife discussion in this document for large woody debris requirements for terrestrial needs.

Large wood is the primary pool forming agent in Marias Creek. The pool numbers do not meet those required by INFISH, but that is likely the result of the small width of the creek, making it difficult for a falling tree to make contact with the channel. Many fallen trees end up spanning the channel rather than falling in such a way as to have some effect in the wetted channel. This project may reduce the number of available large woody debris recruits to the creek due to rights-of-way and hazard tree removals that are necessary for construction of the two-lane road, although most right-of-way clearing would be on the uphill side of the road. Because INFISH LWD objectives are met, these trees would not be left on site. This would be consistent with INFISH standard and guideline RA-2

As a result of the sediment control structures, including frequent relief culverts, silt fences, straw bales or wattles, and windrows of slash, the sediment produced during the first year is expected to be similar to the sediment currently entering the system (see Hydrology report), so pools would continue to fill at existing rates.

Mitigation measures designed to reduce sediment delivery to the creek identified in Chapter II are imperative because without them sediment could be delivered to the creek posing a substantial likelihood that the fish population in the creek to be lost. Sediment delivery to the creek would reduce the existing spawning habitat by filling the existing pools, and the interstitial spaces where the eggs and fry reside. Fish eggs are typically laid at a pool crest or pool tail-out (the upstream and downstream ends of a pool), where water has a greater abundance of oxygen to provide to the eggs and fry in the substrate. When pools are filled, few places remain for viable egg laying.

Many of the mitigation measures proposed in Chapter II were included with the intent of avoiding the loss of the fish population in Marias Creek. The compensatory mitigation measures are designed to improve fish habitat by replacing culverts to allow for passage of all aquatic life. The lowest culvert on the Forest Service rights-of-way on Nicholson Creek would be replaced. This culvert is currently a serious fish passage barrier and replacement of the culvert plus replacement of a culvert with an aquatic species passable culvert on a non-system road would allow fish to migrate up and down stream from Toroda Creek to river mile 3.2.

On Marias Creek, the culvert on the 3550-080 road would also be replaced with aquatic organism passable culvert; this coupled with the culvert replacements during reconstruction of the Marias Creek road would allow for fish passage up and down Marias Creek to approximately river mile 4.2.

Individual fish may be lost, and also some spawning habitat, but the population is not expected to be lost with the use of the mitigation measures and monitoring the effectiveness of the mitigation measures. The fish that reside in these streams are common throughout the area and are not threatened or endangered species. Redband trout, a sensitive species, are found in Toroda Creek (WADOE, FSEIS, 2006. Pg. 3.10-13), but the minor amount of sediment delivered to Marias Creek would likely to be entrained in Marias Creek prior to reaching Toroda Creek. In addition, a passage barrier would be removed so fish could retreat to Toroda Creek if sedimentation covers most or all spawning gravels until gravels were flushed under natural events and fish can return to these creeks. With the substantial minimization of sediment as a result of sediment control structures, replacement of 6 fish barrier culverts with culverts that allow for all aquatic life passage (3 on and one off NFS lands in Marias Creek and two on Nicholson Creek), fencing of cows from Marias Creek, and

water augmentation and infiltration, this project is not expected to have any adverse impacts to inland native fish consistent with INFISH standard and guideline RF-2.

Aquatic mollusks, including California floaters are unlikely to be affected by Alternative B because there is little suitable habitat in Marias or Toroda Creeks and if any are present, mitigation would help minimize additional sediment delivered to the creeks.

Alternative B1

The direct, indirect and cumulative effects in Alternative B1, would be the same as for Alternative B, but with a slight increased potential for sediment delivery to lower Marias Creek, a fish bearing reach, because of the half-mile of paving at the junction of Marias Creek Road and Toroda Creek Road, as determined by the WEPP model (See Hydrology and Soils reports). Closing the roads in Bear Trap Canyon may also reduce any ongoing sedimentation into that drainage.

Alternative C: Nicholson Creek Haul Route

Direct and Indirect Effects

Three reaches of Nicholson Creek already have greater than 15% fines of ≤ 6.4mm size. Reach 2 has 22% fines, Reach 3 has 27%, and Reach 4 has 20%. The haul is within the RHCA of Nicholson Creek for 2.37 miles of these reaches on National Forest system land. In some places, the Riparian Habitat Conservation Areas (RHCAs) between the creek and the road are wide enough to accommodate intercepting and holding the sediment and road gravels that may be delivered. In others places, the road is immediately adjacent to the creek.

The existing sediment load already impairs spawning habitat in Nicholson Creek. This is from the existing roads delivering sediment, and bank trampling by livestock. Additional substantial sediment delivery to the creek could result in the loss of the fish population in Nicholson Creek. To prevent this, mitigation measures have been incorporated to minimize the potential for sediment delivery to the stream, although some mitigation measures under this alternative are not as effective and thus would result in more sediment delivery. The road design would incorporate silt fencing using heavy stakes, straw bales (in Sections 25 and 26) and windrows of slash to be placed between the road edge and the creek, and all ditches along the haul route would have noxious weed/seed-free wattles placed to entrain sediment in the ditches.

The WEPP modeling for Alternative C determined a 3% increase from the present amount of sediment to be delivered to Nicholson Creek from road construction and reconstruction with the mitigations for frequent relief culverts and vegetated ditches and/or wattles in ditches. The model could not be altered to also include the positive sediment interception value of windrowed slash in contact with the ground, sturdy silt fencing or rock aprons. Together, these are predicted to be 80-95 percent effective in reducing sediment (including sand for winter traction), so actual sediment delivery would be just slightly above current conditions (see hydrology report).

Monitoring and maintenance of the erosion control features would occur to assure they are effective and operational. Monitoring and maintenance would also occur following any precipitation event of 0.25 inch or more in 24 hours, as recorded at the mine site.

Although livestock would not be excluded by fencing from the Nicholson Creek haul route, as proposed for Marias Creek in Alternatives B and B1, windrows placed below the road to trap sediment would also be barriers to livestock movement. However, windrows would not be as effective at preventing livestock trampling of stream banks as fences.

A corral would be built for use when moving livestock onto and off the north pasture of Cedar allotment at the beginning and end of the grazing season. This corral would be placed outside of RHCAs, and is not expected to have any effect to streams or aquatic organisms.

A fence would be constructed to keep livestock away from the "Grass Lakes" ponds, adjacent to the Nicholson Creek Road. This fence would secure aquatic habitat from livestock access. No fish reside in this pond, but the pond does provide habitat for Columbia spotted frogs and other amphibians and small aquatic organisms.

The temperature data collecting device that was in Nicholson Creek for the period of May to October 2005 failed. It is likely Nicholson Creek had a similar temperature regime to Marias Creek in 2005. Nicholson Creek is better shaded than Marias Creek, so it is expected that the temperature of Nicholson Creek in 2005 did not rise above 60°F. Temperatures of greater than 60°F. are considered to be of concern for trout species. The temperature of Nicholson Creek is not expected to change as a result of this project since little streamside vegetation would be removed and augmented and infiltrated water has been shown to meet standards but would be monitored.

Large woody debris in the stream channel is currently meeting the INFISH requirement of greater than 20 pieces per mile that are $\geq$35 feet long and greater than 12 inches diameter at the small end. Large woody debris is also necessary in the RHCAs to intercept sediment before it can reach the creek, and also retain moisture in the RHCA. See the Wildlife discussion in this document for large woody debris requirements for terrestrial needs.

Large wood is the primary pool forming agent in Nicholson Creek. The pool numbers do not meet those required by INFISH, but that is likely the result of the small sizes of substrate material in the channel, and small width of the creek, making it difficult for a falling tree to make contact with the channel. Many fallen trees end up spanning the channel rather than falling in such a way as to have some effect in the wetted channel.

This project may reduce the number of available large woody debris recruits to the creek due to rights-of-way clearing although construction would only be toward the uphill side of the road, and hazard tree removals for construction of the two lane road.

As a result of the sediment control structures, including frequent relief culverts, silt fences, straw bales or wattles, and windrows of slash, the sediment produced during the first year is expected to slightly higher than the sediment currently entering the system (see Hydrology report), so pools would continue to fill at slightly higher rates.

Many of the mitigation measures proposed in Chapter II were included with the intent of avoiding the loss of the fish population in Nicholson Creek. The compensatory mitigation measures are designed to improve fish habitat by providing for fish passage up and down Nicholson Creek. On Marias Creek, the culvert on the 3550-080 road would also be replaced with an aquatic organism passable culvert; this coupled with the culvert

replacements during reconstruction of the Marias Creek road would allow for fish passage up and down Marias Creek to approximately river mile 4.

Individual fish may be lost, and also some spawning habitat, but the population is not expected to be lost with the use of the mitigation measures and monitoring the effectiveness of the mitigation measures. The fish that reside in these streams are common throughout the area and are not threatened or endangered species. Redband trout, a sensitive species, are found in Toroda Creek, but the minor amount of sediment delivered to Nicholson Creek is likely to be entrained prior to reaching Toroda Creek.

With the minimization of sediment as a result of sediment control structures, replacement of several fish barrier culverts in Nicholson Creek and one on NFS lands and on off NFS lands in Marias Creek with culverts that allow for all aquatic life passage, fencing of cows from Grass Lakes, and water augmentation and infiltration, this project is not expected to have adverse impacts to inland native fish consistent with INFISH standard and guideline RF-2.

This alternative caries a little higher risk to fish populations than Alternatives B, B1, because the mitigations for sediment in this alternative may be as low as 80%, compared to 95% in alternatives B and B1. Alternative D, having no fish bearing streams on the NFS lands is the best alternative for protecting fish populations.

Aquatic mollusks, including the California floater are unlikely to be affected by Alternative C, because there is little, if any, suitable habitat for them in Nicholson or Toroda Creeks, and in addition, the sediment interception mitigations would act to keep additional sediment from reaching the creek.

Alternative D: Pontiac Ridge, Beth-Beaver Creek Road, and Toroda Creek Road

Direct/Indirect Effects

Of the total length of this route, less than one mile cross through US Forest Service managed lands. Culverts placed in draws would be designed to pass a 100-year flood, 24-hour storm event, and would be expected to pass water and debris that would come with such an event. Culverts installed only for ditch relief purposes do not need to be designed for a 100-year, 24-hour storm event, or be fish passable. No increase in sedimentation is expected under this alternative, and downstream pools would not be affected.

The temperature of any fish bearing streams is not expected to be affected by use of this route, because additional right-of-way clearing made would do little to influence local streams because the route is not adjacent to any streams.

Large woody debris in the fish bearing portions of Nicholson and Marias Creeks would be affected because this route does not use those watersheds.

As compensatory mitigation for impacts to habitat, the lowest culvert on the Forest Service rights-of-way on Nicholson Creek would be replaced. This culvert is currently a serious fish passage barrier and replacement of the culvert would allow fish to migrate up and down stream to about river mile 3.2.

This alternative protects fish populations the most of all the action alternatives. No loss of individual fish, fish populations or spawning habitat is expected from this alternative.

Because no sediment would be delivered to any creek, and fish passage barriers would be replaced on both Marias and Nicholson Creeks as a part of this project, this alternative would avoid adverse impacts to inland native fish consistent with INFISH standard and guideline RF-2.

Cumulative Effects for Alternative D

This alternative would result in haul on County Roads 4895 and 9480 to access the Toroda Creek Road. Although Millard Creek is adjacent to CR 4895 for about 2 miles and CR 4895 may have to be widened under this alternative, this is not a fish bearing reach, and impacts to aquatic species would be minimal. In sections 29 and 30 of Township 39 North, Range 31 East, Okanogan County Road 9480 parallels Beaver Creek. This section of the County Road is across National Forest System lands. In places along this part of the haul route Beaver Creek goes subterranean, with occasional ponding where the water is above the ground. Because the section of road between CR 4895 and the Toroda Creek Road is paved it is unlikely that sediment would be delivered to the stream from this proposed haul route. No redband trout inhabit these waters.

Cumulative Effects for All Action Alternatives

Cumulative effects analyses examine past, present and reasonably foreseeable activities in the vicinity of the proposed action.

The cumulative effects analysis area is the Toroda Creek 5th field watershed and the Upper Myers Creek 6th field sub-watershed. The time period examined for cumulative effects is 15 years. This time period includes on-going exploration, the expected operation period of the mine; two to three years of post-project restoration; and about three years for the re-vegetation of the restoration work to become effective and water augmentation to cease.

Past Actions

Crown Resources/Battle Mountain Gold/Newmont/Kinross Exploration and Predevelopment activities, Reclamation activities: No cumulative effects in the analysis watersheds would occur on water flow, water quality or wetland functions on National Forest System lands, as most of the disturbed sites have been re-vegetated. Ongoing activities are not affecting aquatic species because vegetation between the disturbance and creeks intercepts sediment before it reaches creeks, and other water quality parameters are not be affected.

Historic Mining: As described in the hydrology report, historic mining probably has affected the route that water drains off Buckhorn Mountain, and any past changes in water flows or quality may have affected aquatic populations, but collectively the effect of these mining activities are part of the current water quality and quantity, and result in the aquatic species populations seen today in the Buckhorn Block, which are described in the affected environment section above.

Noxious weed treatments: Past and ongoing treatments of noxious weeds include manual, bio-control, cultural, and chemical methods, and these activities are expected to continue, especially adjacent to the road rights-of-way because of the increased potential to introduce weeds from increased traffic. There are slight, short term increases in soil erosion and stream sedimentation for a year or less after treatment when noxious weeds are removed and until seeded vegetation or natural vegetation becomes re-established. However, left

untreated, the potential for erosive soils to be exposed is higher than if noxious weeds are treated and for vegetation to become established and effective in holding soil, and collecting and holding sediment. The impacts of the slight short term increases on soil erosion and sedimentation are highly localized because only individual plants are treated.

Livestock grazing on the Wheaton, Toroda, Sheridan, Bodie, Cumberland, Cedar and Wauconda allotments in the Toroda Creek Watershed and Ethel and Gold allotments in the Myers Creek 6th field HUC: Grazing is a past, on-going, and a reasonably foreseeable action. Impacts from grazing include stream bank, channel, and wetland damage, with the cumulative effect of sediment delivery to streams, ponds, wetlands, seeps and springs affecting viability of eggs, frog tadpoles and fry in the gravels/water, and occasionally adult frogs as well, and potentially any California floater mussels that may be present. Manure in the creeks can reduce availability of oxygen in water affecting the health of fish and reduce availability of oxygen in water affecting the health of eggs, fry, tadpoles and mussels. Livestock tend to congregate for long periods of time where water, shade, and palatable graze exist in the same vicinity. These areas are usually immediately adjacent to streams, ponds and wetlands. The actions proposed under Alternative B and B1 would reduce impacts to streams from grazing through fencing, slash barriers, silt fencing backed by straw bales, and providing water troughs, which cumulatively could reduce ongoing impacts from livestock grazing. Under Alternative C, only Grass Lake pond would be fenced, so cattle access to Nicholson and Cedar Creeks would only be discouraged by slash windrows and silt fencing placed below the road to trap sediment which would not be as effective in keeping livestock from creeks.

The patented mine area and some National Forest System land would be fenced, keeping livestock restricted from an area they once lightly grazed. A fence would be constructed to keep livestock off of the Marias Creek Road in Alternatives B and B1, to avoid livestock and vehicle collisions, which would benefit aquatic species in Marias Creek because the fence would also generally keep cows from the creek, and potentially reduce sedimentation from grazing. However, no fence would be constructed on the Nicholson road route adjacent to the stream in Alternative C, making it easier for livestock to access riparian areas. The cumulative effect in Alternative C would be increased stream sedimentation in Nicholson Creek from livestock pressure on stream banks, and where road construction and reconstruction would occur. Additionally, cow manure in the creeks can reduce availability of oxygen in water, affecting the health of fish. Livestock tend to congregate for long periods of time where water, shade, and palatable forage exist in the same vicinity. These areas are usually immediately adjacent to streams. Because Millard Creek is so far from the Cow Camp road, cows would not have easier access to the creek in Alternative D.

Hunting, fishing and gathering by members of the Confederated Tribes of the Colville Reservation: These activities have happened in the past, are on-going and an expected reasonably foreseeable activity, and are not expected to add to cumulative effects in the analysis watersheds because they do not result in any ground disturbance. Although individual fish may be killed by fishing, these fish would be incidental to overall fish populations.

Patenting of Crown Resources claims: This did not add to cumulative effects in the analysis watersheds, because no fish bearing streams are located in the vicinity of the patented lands. Patenting by itself, did not result in any impacts to other aquatic species because it causes not ground disturbance.

Past road closures on Crown Jewel Mine project and Nicholson Timber Sales:
No road closure related soil disturbance activities would add to cumulative effects in the analysis watersheds as because disturbed soils have already re-vegetated.

Firewood gathering: Large woody debris recruits have been removed over time resulting from firewood removal from the RHCAs, although LWD levels are met in both Nicholson and Marias Creeks. Although project activities would cause some minor decrease LWD recruits, standards would still be met.

Past Road Construction in the Marias and Nicholson Drainages resulted in roads being built very close to these creeks and their tributaries. These roads collectively are causing high sediment delivery to Marias and Nicholson Creek, as described in the Hydrology affected environment and Alternative A effects. The high sediment rates are clearly affecting aquatic populations and habitat in both these creeks, as described in the Aquatics affected environment earlier in this section. The sediment control structures in Alternatives B, B1 and C area designed to intercept both sediment still occurring from the past actions, particularly the Marias and Nicholson Creek roads (Alternatives B/B1 and C respectively) and new sediment caused by the Buckhorn Access Project as described in the direct and indirect effects above and in the Hydrology report Alternative D would not add cumulatively to road sediment.

Nicholson Creek culvert replacements under Forest Road 3575 and Ferry County Road 502 were accomplished in 2005. Both culverts were fish and aquatic life barriers and not adequate to pass the 100-year, 24-hour storm event. An open bottomed arch was installed under Forest Road 3575 using the stream simulation method, which allows for passage by all aquatic organisms. Under Alternative C, all culverts on the Forest Road 3575 would be replaced and would provide fish passage up and down Nicholson Creek except where natural barriers exist. The culvert under the Forest Service rights-of-way at the beginning of Nicholson Creek Road would be replaced under Alternatives B, B1, C, and D, and would provide all aquatic life passage up to the natural barrier at river mile 3.2.

Ongoing Activities (some of which are reasonably foreseeable activities also):

Wauconda Quarry: The transportation supply route would overlap with trucking from the Wauconda Quarry at the southern end of the Toroda Creek road. These activities are restricted to the Toroda Creek Road and are not expected to add to cumulative effects in the analysis watersheds because this trucking activity does not cause erosion or affect water use on or off NFS lands.

Ongoing recreation and road use for snowmobiling, hunting, fishing, hiking, camping, sightseeing and OHV use: These activities have happened in the past, are ongoing and will continue in the future. These are local, minor activities and would not add to the direct and indirect effects. Although OHV use can cause ground disturbance that results in erosion that might cause sediment to enter creeks, it's likely that OHV users would avoid the area around the ore haul route. OHV users would likely use different areas of the Buckhorn Block and not add any erosion in the creeks along the ore haul routes. Entire use in the Buckhorn Block by OHV users is fairly minimal and can likely be accommodated in non-haul route drainages without erosion.

Recreation at Beth and Beaver Lake Campgrounds: Supply traffic during construction in all alternatives and ore haul traffic in Alternative D has the potential to overlap with people

accessing campgrounds on County Road 9480, but this traffic is not expected to have any effect on aquatic species because these roads are paved.

Firewood gathering: Firewood removal from within RHCAs is no longer allowed, but the practice does continue, though illegally. If Alternatives B or B1 are implemented, the illegal wood cutting in Marias Creek would likely shift to Nicholson Creek due to the frequency of the mine related traffic on the Marias Creek Road. If Alternative C is implemented, illegal wood cutting in Nicholson Creek would likely shift to the Marias Creek drainage due to the frequency of mine related traffic on the Nicholson Creek road (recreationists are likely to avoid the haul route areas – see Recreation section). Loss of trees to firewood cutting in RHCAs can reduce the woody recruits needed for pool habitat, a key element in INFISH; although most trees in these systems span the creeks without coming in contact with the creek to create pools because the streams are so narrow (see direct and indirect effects analysis). Large woody debris is not a required component of Columbia spotted frog habitat or California floaters, but often in the taking of large woody debris, the micro climate of wetlands and creeks can be changed which might change areas where spotted frogs hide from predators or areas used by mussels. The removal of large trees can also impair the water body when vehicles are driven nearby a fallen tree for easier loading. This can muddy the waters or affect the small woody debris that Columbia spotted frogs use to attach their egg packets. Increased law enforcement activity in the area because of the mine may result in greater and effective encounters with illegal firewood gatherers.

Little Nicky Timber Sale (232 acres of harvest on DNR land, began in 2005 and haul is out on Forest Roads 3575-040 and 3575 road with some road reconstruction - riprap, culvert replacement): This project would have no cumulative effects with the Cow Camp route, Alternative D because they are in separate watersheds. Because Nicholson Creek is a relatively low energy system, it's unlikely that sediment from this project would ever mix with sediment generated by construction and reconstruction of the Marias Creek route in Alternatives B or B1 in Toroda Creek. In Alternative C, the Nicholson route, road reconstruction and related work would add eroded soil and stream sedimentation for several years (most added during the first 3 years after construction and reconstruction work, 2 of which have already passed), with the greatest sedimentation occurring during the first year of road work. Tree removal from the Little Nicky units generally has a short term sedimentation impact (1-2 years) until vegetation becomes re-established. Harvest prescriptions would create openings, potentially increasing water flows. The cumulative effect of this project is to add erosion and stream sedimentation to Nicholson Creek for the time frames mentioned, although Little Nicky may be completed in the Spring of 2006 prior to the commencement of activities on the Buckhorn Access Project (see Hydrology cumulative effects for quantified sediment impacts). It's likely that most sediment would settle in Nicholson Creek because it's a low energy system, but some would reach Toroda Creek within the 15 year period.

Road Use Permit for Use and Deferred Maintenance of Forest Roads 3575-120 and 3575-140: The maintenance associated with this project was performed September through November of 2006. Because no RHCAs occur on these roads, no effects to aquatic species are expected either from the maintenance, ongoing use or snowplowing of this road. Sedimentation is possible from Crown/Kinross' use of the unpaved Pontiac Ridge Road because the unnamed creek lies very close to the road and the road crosses the creek in one location, but this creek has no surface connection with Myers Creek downstream and is not fish bearing. As noted above, use on the Forest Service road would not add cumulatively to this sedimentation.

Reconstruction of Toroda Creek road is underway and will continue through 2007.: Most work has already been completed in Ferry County. This activity would increase soil erosion and may increase stream sedimentation in Toroda Creek, depending on construction practices used to minimize erosion, stream sedimentation and impact to streamside wetlands. Management practices by Okanogan and Ferry Counties, such as silt fences or vegetation establishment on the road cuts and fills would minimize stream sedimentation in Toroda Creek.

Both Marias Creek and Nicholson Creek are low energy streams, and it is unlikely that sediment from the Buckhorn Mine Access Project would be delivered to Toroda Creek to mix with sediment during the Toroda Creek road reconstruction project if Alternative b, B1 or C were implemented.

Alternative D, using the Cow Camp route, has no stream along side it until the route reaches the Pontiac Ridge Road, where Millard Creek is within 300 feet of the road in several places. There is a pond downstream of these places where sediment would settle out and not reach Toroda Creek.

Cumulative effects between the Toroda Creek Road Reconstruction Project and the Buckhorn Access Project are not expected to occur.

Reasonably Foreseeable Future Actions

Replacement of Marias Creek culvert under Toroda Creek Road.
The culvert would be removed and replaced with one that is passable to all forms of aquatic life. The work would be done by Okanogan County. This project would permit passage to Marias Creek from Toroda Creek, and back during high flow conditions, but not year round because Marias Creek upstream from the culvert goes subterranean during the drier parts of the year. Coupled with the culvert replacements along the Marias Creek road in Alternatives B and B1, this would restore aquatic life passage up and down Marias Creek, as well as connectivity to Toroda Creek during certain flow conditions.

This activity would increase soil erosion and may increase stream sedimentation in Toroda Creek because it is so close to Toroda Creek, depending on construction practices used to minimize erosion and stream sedimentation and Marias Creek flows. There would be cumulative effects of increase steam sedimentation under Alternatives B, B1 and C in Toroda Creek since it's likely the road construction and reconstruction in Marias or Nicholson Creek would occur at the same time as the Toroda road reconstruction. Management practices by Okanogan County, such as silt fences or vegetation establishment on the road cuts and fills would minimize, or perhaps eliminate stream sedimentation in Toroda Creek. Alternative D, the Cow Camp road is mostly in the Myers Creek watershed and far from streams so no cumulative effects would occur.

Ferry County has completed a culvert aquatic life passable culvert replacement; it is listed under Past Actions for Nicholson Creek culvert replacements.

Future road closures as part of road maintenance activities. Some roads that were closed by previous projects have been breached in the project area, and these roads would be re-closed as they are discovered during regular road maintenance activities which would reduce potential sedimentation from those roads. If these closures were close to fish bearing streams, this could decrease ongoing impacts to fish from sedimentation.

The Buckhorn Mountain project (non-NFS components, including conceptual mitigation on non-NFS lands): Amphibian populations could be affected because the Buckhorn mining project would decrease the ground water elevation in the project area. Impacts to wetlands, seeps and springs would occur from a reduction in groundwater flow in the headwaters of most streams draining Buckhorn Mountain, including Marias, Nicholson, Bolster, Gold and Ethel Creeks. Seeps and springs near the mining operation would have reduced flow or go dry during the mining operation and after infiltration water has stopped in the Nicholson Creek drainage, although most of the springs and seep would not be affected cumulatively by Forest Service activities. Only a total of 0.01 acre of 9-acre wetland would be directly impacted by the Buckhorn Access Project where overlaps would occur from mine dewatering. During mining, flows to this wetland are not expected to be impacted, but after mining, flows would be reduced. The haul road construction would fill about 0.01 acre of wetland habitat. Although flows would be reduced to this portion of wetland, the wetland would no longer exist in that area. Productivity in the remaining wetland is expected to be reduced by 5% (see Hydrology report). Except for those directly impacted by road route construction, wetlands, seeps and springs below the infiltration gallery (outfall 001) and augmentation sites would be essentially maintained (although with some fluctuations over the life of the mine) until infiltration and augmentation cease, which is when the most substantial impacts of wetlands, seeps and springs would occur (although because activities would have ceased on NFS lands, NFS activities would not interact cumulatively with post-mine impacts). Wetlands, seeps and springs above the water augmentation sites or in the Myers Creek drainage would be impacted by mine dewatering on private land, but these areas are above the water augmentation and infiltration sites and are not impacted cumulatively by any activities on NFS lands. Seeps and springs further from the mining operation would be less affected as the distance increases. Water augmentation and infiltration as part of the Buckhorn Access Project would partially or fully offset ground water losses from mine dewatering depending on the time of year (see Hydrology report and WADOE, FSEIS, 2006.) and cumulatively would have little or no effect on aquatic species.

The Washington State Department of Ecology in its environmental impact statement for the Buckhorn Mountain (Mine) Project identified that flow in approximately half a mile of Gold Bowl Creek below the mine site would be lost during mining, and that there would be a corresponding loss of benthic invertebrates. Gold Bowl Creek goes subterranean below the point of the half mile area WADOE is predicting would go dry. Thus, activities that would occur on Forest Service managed lands would not add to this loss. The WADOE does not consider this loss to be of significance (WADOE, FSEIS, 2006, Pg. 3.17-3). Extra stormwater that does not come in contact with development rock stockpiles, ore stockpiles, or the underground mine and dewatering wells would be captured and discharged at on private lands at outfall 002 in the upper Gold Bowl drainage to supplement this loss of flows. Most of this water would be no different than stormwater from areas not impacted by the mine and therefore would be the same as normal background values. Any added mine water would be treated to standards set in the NPDES permit and therefore would not impact aquatic species.

In summary, considering the past, ongoing and future actions above, plus the Buckhorn Access Project, none of the alternatives in this project are expected to have substantial cumulative effects to aquatic species. In fact, cumulative impacts from the Buckhorn Access Project actually decrease water quantity impacts on NFS lands from the mine on private lands.

BIOLOGICAL EVALUATION

The biological evaluation in the analysis file is summarized below. It takes into account cumulative activities occurring on non-National Forest System land that are not under the control of the Forest Service. The findings in the biological evaluation are as follows:

Threatened, Endangered, Proposed, and Sensitive Species

Table III-36: Threatened Endangered, Proposed, and Sensitive Species Determinations

Fish Species	Status	Explanation &/or Determination
Federally Listed Fish Species:		
Upper Columbia steelhead trout	Endangered	Not present in the Toroda, Myers, or Sanpoil Watersheds. Not addressed in this Biological Evaluation.
Upper Columbia spring Chinook salmon	Endangered	Not present in the Toroda, Myers or Sanpoil Watershed. Not addressed in this Biological Evaluation.
Bull trout	Threatened	Not present in the Toroda or Myers watersheds, or downstream of the mill site in the Sanpoil watershed. Not addressed in this Biological Evaluation.
Federal Amphibian Species of Concern:		
Columbia spotted frog	Species of Concern	**Determination**: May Impact Individuals, not likely to lead to Federal listing for all alternatives.
Federal Mollusk Species of Concern:		
California floater	Species of Concern	**Determination**: May Impact Individuals, not likely to lead to Federal listing for Alternatives B, B1, C, and D. No Impact in Alternative A.
Fish species on the Regional Forester's Sensitive Species List:		
Redband trout	Sensitive	**Determination**: May Impact Individuals, not likely to lead to Federal listing.
Westslope cutthroat trout	Sensitive	**Determination:** No Effect to the population in the South Fork Sanpoil River headwaters. Westslope cutthroat trout are not present in the Toroda or Myers Creek Watersheds and are not addressed in this Biological Evaluation.
Fish Species	**Status**	**Explanation &/or Determination**
Fish species on the Regional Forester's Sensitive Species List:		
Pygmy whitefish	Sensitive	Not present in the Toroda, Myers or Sanpoil River Watersheds. Not addressed in this Biological Evaluation.
Brook lamprey	Sensitive	Not present in the Toroda, Myers or Sanpoil River Watersheds. Not addressed in this Biological Evaluation.
Pacific lamprey	Sensitive	Not present in the Toroda, Myers or Sanpoil River Watersheds. Not addressed in this Biological Evaluation.

Federal Species of Concern

Spotted Frogs

DETERMINATION for Alternative A: May Impact Individuals, But Not Likely to Lead to Federal Listing, due to slow but continued pool filling and changes to wetland areas from sediment delivered by livestock, and roads.

DETERMINATION for Alternative B, B1, C and D: May Impact Individuals, But Not Likely to Lead to Federal Listing, due to livestock access to creeks and wetlands. The Biological Assessment must also cover effects of all project activities, even those on private and State lands under requirements of the Endangered Species Act, and the BE determination is also based on the small potential of a tailings pond spill from the expanded tailings facility on private lands.

California Floater Mussel

DETERMINATION for Alternative A: No Impact.

DETERMINATION for Alternative B, B1, C and D: May Impact Individuals, But Not Likely to Lead to Federal Listing. This is based on the requirements under the Endangered Species Act to cover the effects of all project activities, even those on private and State lands, which include the small potential of a breach or leak in the expanded tailings facility on private lands.

Redband Trout

DETERMINATION for Alternative A: May Impact Individuals, But Not Likely to Lead to Federal Listing, due to slow but continued pool filling from sediment delivered by livestock impacts, and roads.

DETERMINATION for Alternatives B, B1 and C: May Impact Individuals, But Not Likely to Lead to Federal listing, due to sediment delivery, and loss of potential large woody debris recruits although standards required by INFISH would be met. The Biological Assessment must also cover effects of all project activities, even those on private and State lands under requirements of the Endangered Species Act, and the BE determination is also based on the very small potential for breach or leak in the expanded tailings facility on private lands.

DETERMINATION for Alternative D: May Impact Individuals, But Not Likely to Lead to Federal Listing. This is based on the requirements under the Endangered Species Act to cover the effects of all project activities, even those on private and State lands, which include the very small potential of a breach or leak in the expanded tailings facility on private lands.

Westslope Cutthroat Trout

Westslope cutthroat trout are present in the headwaters of the South Fork Sanpoil River (WADOE, 2006) well upstream of the mill site in Republic, Washington. This population would not be affected by any of the activities associated with the Buckhorn Mine.

DETERMINATION for all alternatives: No Impact.

This biological evaluation considers the ore processing at the Kettle River Mill because it is a result of allowing access across National Forest System lands under any action alternative. The very small possibility of a spill from or breach of the existing or expanded tailings pond exists. This would lead to fish and amphibian kills in the North Fork Sanpoil and the mainstem Sanpoil Rivers. In addition to the immediate fish and amphibian kill, the eggs and/or fry in the substrate would also be affected, removing generations of fish from the system. Depending on the extent of the spill or breach, the substrate could also be affected by becoming embedded with the spoils from the tailings facility. A spill plan is already in place for the mill and the existing tailings facility, and would be updated to include the expanded tailings facility. Additional information relating to the potential for transportation spills and effects on aquatic species is located at the end of this chapter. This information is provided gratuitously to readers; the Forest Service Buckhorn Access Project would in no way add to the impact at the private tailings facility and the Forest Service has no control or any authority over those actions.

Air Quality

The section below summarizes the affected environment information, along with direct, indirect, and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project, Air Quality and Climate Reports by Buckhorn Project Manager Phil Christy dated November 22, 2006, and additional information provided to the Forest Service by the Department of Ecology and their contractors for the Buckhorn Mountain Project FSEIS and Kinross and their contractors.

AFFECTED ENVIRONMENT

The Buckhorn Mountain airshed is currently “unclassified” in terms of National Ambient Air Quality Standards in the State of Washington. Typically, airsheds are defined as unclassified when they cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant [Federal Clean Air Act, 107(d) (1) (A) (iii)]. For the Buckhorn Mountain airshed, State and Federal air quality managers have little to no monitoring data from which to assess existing ambient conditions. Battle Mountain Gold collected one year of site specific PM10 (particulate matter smaller than ten microns) data during the 1996 to 1997 timeframe. This site specific monitoring indicated that the PM10 background concentrations are 6.5 ug/m^3 for the annual averaging time and 12.0 ug/m^3 for the 24-hour averaging time. Ambient Air Quality Standards are 150 ug/m^3 (micrograms/cubic meter) for the 24-hour and 50 ug/m^3 for the annual averaging time. This information was used in the Air Quality Modeling results for the mine project to determine if air quality standards would be met.

Toxic air pollutants in the Buckhorn Mountain airshed come from many sources inside and outside the airshed. One of the sources is impacts from industry and other sources in Canada. Air Quality regulations change at the border with Canada. Most sources of toxic air pollutants come from activities such as vehicle operation, wood stove heating, industrial combustion activities, and other industrial processes. These activities are limited in the Buckhorn Mountain airshed and therefore, are considered not significant for background purposes. Some also come from slash treatments and wildfires on State, private, and Federal lands. The area has low rainfall which can result in higher instances of fugitive dust

effects along gravel and dirt roads. Yearly average precipitation at the site is estimated to be about 20 inches per year.

The Clean Air Act (as amended in 1990) is a legal mandate designed to protect public human health and welfare from air pollution. The act defines National Ambient Air Quality Standards (NAAQS) as levels of pollutant above which detrimental effects on human health and welfare could occur. Particulate matter or PM is the major pollutant of concern. PM means any airborne finely divided solid or liquid material with an aerodynamic diameter smaller than 100 micrometers (microns). Each state or delegated permitting authority has the responsibility to attain or maintain air quality that meets National Ambient Air Quality Standards (NAAQS). The State Implementation Plan (SIP) provides means by which goals of the Clean Air Act are to be attained. The Clean Air Act also contains a provision that provides for prevention of significant deterioration (PSD) of air quality in areas that currently have very clean air. Three air quality classes were established (Class I, II, and III). The classification of an area determines the amount or "increment" of air quality deterioration that is allowed over a baseline level. Class I areas have the smallest increments and therefore allow the least amount of air quality deterioration.

The Buckhorn Access Project could potentially impact two key airsheds: the Pasayten Wilderness airshed, and the Spokane Indian Reservation airshed both of which are Class I airsheds. Both airsheds were subjected to Air Quality Related Values analysis for visibility prepared by McVehil-Monnett Associates, Inc. for Crown Resources (McVehil-Monnett Associates 2005b). The Pasayten Wilderness lies approximately 42 air miles west of the project area. The Spokane Indian Reservation is approximately 60 air miles southeast of the project area.

ENVIRONMENTAL CONSEQUENCES

The Buckhorn Mountain airshed boundaries for effects analysis extends from the western boundary of the Spokane Tribal Lands in the east, north to the Canadian boundary, and west to the eastern boundary of the Pasayten Wilderness area and south to the Colville Indian Reservation. Generally, other projects within 10 to 20 miles could have overlapping air quality effects from burning that would mingle with this project. Activities involved include pile burning, burning landings, underburning, and broadcast burning. Emission sources from controlled burns planned or active on the east side of the Okanogan River that have the ability to cumulatively impact the airshed include; Summit Timber Sale (751 tons TSP), Siwash Thin (<2 tons of TSP), Buster Timber Sale, Two Lakes Timber Sales (704 tons of TSP), Redmill Timber Sale, Oakley Timber Sale, Sneed Timber Sale (burning 40% completed), Upper Aeneas Timber Sale (1,477 tons of TSP), Bailout Timber Sale, Bailey Fire Salvage Reoffer, Cayuse Natural Fuels, Surprise Natural Fuels, and Josephine Natural Fuels on the Tonasket Ranger District.

Potential projects on State lands include Little Nicky Timber Sale, Bannon Timber Sale (estimated 60 – 70 tons of TSP), Sheridan Timber Sale, My Toroda Timber Sale, Goosmus Timber Sale, Aeneas 320 Timber Sale, Silverbell Timber Sale, Trout Creek Timber Sale, Lone Ranch Timber Sale, Bull Goose Timber Sale, Smart Aleck Timber Sale, Bracken Creek Timber Sale, Lundimo Timber Sale, Storm King Timber Sale, Mires Creek Timber Sale, Turner Creek Timber Sale, and Bonaparte Meadows Timber Sale.

On the Republic Ranger District, projects that include burning are Aeneas Fuel Reduction Project, Copper Butte Hazard Tree Reduction Project, Trout Vegetation Management Projects, Vulcan Vegetation Projects, and Berton Timber Sale.

This regional approach to the airshed incorporates both anthropogenic (of human origin) and non-anthropogenic impacts into the analysis. Air quality impacts would cease when mining and reclamation operations cease. No long-term air quality impacts would occur because disturbed surface areas would be stabilized and reclaimed to control potential wind erosion. Direct and indirect air quality impacts from actions on National Forest System land are mostly related to roads and to a limited extent, disposal of slash from road/facility construction.

Two of the most prevalent problems associated with unpaved roads are: 1) controlling traffic generated dust, and 2) maintaining stability of roads throughout the year. Traffic generated dust from unpaved roads contributes to airborne particulates which degrade adjacent vegetation and water quality, agricultural products, cause respiratory problems, increase wear and tear on vehicles, and result in a higher rate of deterioration of the roadway. Reducing dust improves drivers' sight distance improving safety, reduces effects on adjacent roadside stream and wildlife habitats, reduces effects on roadside vegetation, decreases the number of motor grader bladings needed to improve ride quality and vehicle control, and decreases the loss of surface aggregate.

Fugitive dust emissions would occur on National Forest System land in all action alternatives during the operating life of the mine from construction activities, ore haul, supply haul, employee traffic, and other operations requiring traversing of the area roads. The Proponent used emission calculations employing methods published by the EPA and air quality computer models to estimate the ambient concentrations of fugitive dust and other pollutants during the peak year of the Project for operations and the total emissions for the length of the project for Alternative B (McVehil-Monnett Associates 2005, 2005a, and 2005b). This information was scaled to determine effects on National Forest System land under other action alternatives. Quantitative methods such as this often are more precise than qualitative methods of comparing environmental impacts. However, quantitative methods also carry uncertainty because they are based on a number of assumptions, and numbers should be used for comparison between alternatives, rather than absolutes.

Controls of emission of Project-related vehicles along public roads are normally not included in air quality permits, but they are important impacts from the project on National Forest System lands. The Washington Department of Ecology for permitting purposes considers Forest Service roads to be public roads.

Air quality numbers in this environmental document should be used to compare relative impacts from various activities alternatives. Washington State law requires that the Washington Department of Ecology (WADOE) determine whether this project would cause or contribute to an exceedence of an ambient air quality standard prior to approving a Notice of Construction Air Quality Permit. The Proponent has stated that its air quality analysis for Alternative B demonstrates compliance with these requirements. The WADOE has approved the notice of construction – air quality permit, which shows that the project can meet air quality standards.

Alternative A (No Action)

The project area would essentially remain unchanged in regards to air quality. The Regional Area consists mainly of undeveloped forest lands with little industrial activity south of the Canadian border and few cities to contribute to air pollution. The nearest industrial activity is located in Midway, British Columbia, 4 - 6 miles to the north of the project site. The project area would continue to be classified as being in attainment with existing air quality standards. In the absence of industrial, commercial, or population growth, there is little likelihood that ambient monitoring would be conducted and, thus, little chance that the classification would change.

Effects Common to All Action Alternatives

Direct and Indirect Effects

BACT Assessment for Haul Road Dust - Control of dust from roads can be completed by (in descending order of control efficiency) paving, application of chemicals, and watering. The BACT (Best Available Control Technology) assessment completed by the Proponent determined that paving is not feasible for ore haul operations due to the steepness of roads, up to 8.5 % grades, during the winter time; initial construction costs; long-term maintenance costs; and concerns with track-out dust. The application of dust control chemicals was judged BACT for the proposed haul by the Proponent.

After considering the proponents BACT assessment, to provide a range of reasonable alternatives, the Forest Service determined other resource concerns, such as adjacency to residences or eliminating track-out dust from County roads, would be addressed by paving sections of roads to reduce impacts from dust. These sections of roads are relatively flat, generally 3.5% or less, so the steepness of the grade was not a concern. Sealing or bound paving has been found to be 95-100% effective at suppressing dust (Foley et al., 1996).

Water alone can be a dust suppressant. Water is probably the oldest of all dust palliatives; it is readily available and generally applied by spraying over the road surface. Its dust suppressing capacity is very temporary because of evaporation. It is commonly used on construction sites and unpaved roads where the surfaces are disturbed only for short time periods. Water is probably the most cost effective short-term solution for dust control (Gebhart et al., 1999). Water has been found to be between 40 to 85% effective in suppressing the suspension of soil particles for short time periods, but not effective over longer periods (Foley et al., 1996). However, the effectiveness depends upon temperature and humidity. Water can be effective for a period as short as half an hour and as long as twelve hours (Foley et al., 1996). Water has little residual effect. Once it is applied, it evaporates quickly, especially in hot, dry climates. Water is most efficient on sites where vehicular traffic is limited or there are short pulses of traffic. The Proponent has proposed to use this method to control dust on the access road during ore haul road construction. Should this dust control not be adequate, the proponent would be required to use additional forms of dust control or more frequent watering.

Salts and brines are the most common type of dust suppressant used. Calcium chloride ($CaCl_2$) and magnesium chloride ($MgCl_2$) are the major products in this category (Sanders and Addo, 1993). Calcium chloride is a byproduct of the ammonia soda (Solvay) process and a joint product from natural salt brines. Magnesium chloride is created either from

seawater evaporation or from industrial by-products prepared from magnesium ammonium chloride hexahydrate.

Salts and brines stabilize the road surface by absorbing moisture from the atmosphere, so it is critical to have sufficient humidity levels of 20 – 80% when applying these products (Bolander, 1999). Salts absorb moisture from the air and retain it by resisting evaporation (Foley et al., 1996). As an option, roads using these products can be lightly watered to provide moisture for these products to work. The Proponent has proposed to do this. The Proponent has proposed to put up to 37 gpm of water on the roads to control dust during construction and operations, besides treatments with up to 72,000 gallons of dust suppressants per year (Alternative B) for roads on all ownerships. Salts are more effective than water in controlling dust if sufficient moisture is available (Bolander, 1999).

The effectiveness of salts to control dust decreases with time. The dust abatement properties of magnesium chloride have been found to last about 12 weeks (Monlux, 1993 cited by Expert Panel, 2002) in one study. Treated unpaved roads must be periodically maintained with additional applications of water and magnesium chloride, as needed, to maintain effectiveness. Magnesium chloride has not been effective, in some cases, even with product reapplication, for periods of more than about a year but in other cases such as at the National Engineering and Environmental Laboratory, magnesium chloride brine was applied four times between 1984 and 1993 (1984, 1985, 1992, and 1993) to suppress airborne dust emissions. The treatment met the objectives of controlling dust (Hull, L.C. and Bishop C.W., 2003).

Another problem with salts is that they migrate readily in the environment. DeCastro et al., (1996 cited by Expert Panel, 2002) modeled the movement of road stabilization additives of road surfaces to determine how long the additives remained effective. They found that calcium and magnesium chlorides are easily carried from the soil.

The Proponent has proposed to use magnesium chloride as their chemical treatment of choice, assumed to be 75% effective overall in combination with the use of water. Magnesium chloride starts to absorb water from the air at 32% relative humidity independent of temperature; can be more effective than calcium chloride solutions for increasing surface tension, resulting in a very hard road surface when dry; and the treated road can be re-graded with less concern for losing moisture and density. However, magnesium chloride requires a minimum humidity level to absorb moisture from the air; is more suitable in drier climates than calcium chloride; can be corrosive to steel and aluminum in concentrated solutions; rainwater tends to leach out highly soluble chlorides; if there is a high fines content in treated material, the surface may become slippery when wet; and the effectiveness when the solution is less than 20% is similar to water.

Health and Environmental Effects - The majority of research on dust suppressants has been done by industry and has focused on the effectiveness (or performance) of dust suppressants to abate dust, however, little information is available on the potential environmental and health impacts of these compounds. Some of the numerous pathways of exposure of dust suppressants for humans, flora, and fauna and how suppressants may migrate through the environment to potentially sensitive receptors are listed below:

- Atmospheric transport and transformation,
- Surface runoff carrying suppressants and/or breakdown products,
- Uptake of dust suppressants by plants,

- Ingestion of dust suppressant constituents by animals,
- Ingestion of exposed animal's by humans,
- Infiltration conveying suppressants to vadose zone and groundwater table,
- Volatilization,
- Occupational contact by applicators: dermally, orally, or by inhalation,
- Potential impacts on soil microbial ecology (lignin sulfonate),
- Transport of suppressant particulates by wind erosion to unintended areas,
- Off-site runoff of dust suppressant and carrier solvent,
- Consumption of contaminated groundwater,
- Downwind drift of spray off-site during application and through dust, and
- Ingestion of dust suppressant constituents by humans (Expert Panel, 2002).

Recognizing that it is important to achieve and maintain clean air, the concern is that application of dust suppressants, such as magnesium chloride to improve air quality, could potentially have other adverse environmental impacts to soil, water, plants and wildlife, which are discussed in the soil, hydrology, botany, forest vegetation and wildlife resource sections.

Health Effects - The small size of PM in wood smoke, dust, and diesel exhaust allows some particles to be carried deep into the lungs. Most particles larger than 10 microns are intercepted in the nose and mouth through inertial impaction. The Environmental Protection Agency has identified PM 10 and PM 2.5 particle sizes as the standards for evaluating emissions and its effect on human health. PM 10 (coarse) particles are those particles less than 10 microns in size. PM 2.5 (fine) particles are those particles less than 2.5 microns in size. Inhalable PM includes both fine and coarse particles. These particles are too small to be filtered out by the human respiratory system. These small particulates can cause respiratory problems, especially to sensitive portions of the population. In addition to health problems, PM can cause reduced visibility.

Recent epidemiological studies (Samet, et al., 1998; American Thoracic Society, 2000; HEI, 2001 cited in Fugitive Dust Transport under Arid Conditions: A Field and Modeling Study in Dona Ana County, New Mexico) continue to show a statistical correlation between increased ambient particle concentration and adverse health effects. Review of many studies suggests that an increase of 10 micrometers per cubic meter (*u*m/m3) of particles is associated with a 0.5 to 1.0 percent increase in the death rate (HEI, 2001 cited in Fugitive Dust Transport under Arid Conditions: A Field and Modeling Study in Dona Ana County, New Mexico). High levels of soil dust are a nuisance that degrades the quality of life.

Health Impacts of Diesel Exhaust - In a study by EPA titled *Air Quality Criteria for Particulate Matter;* diesel exhaust was examined for acute toxic effects. It was found that toxic effects caused by exposure to diesel exhaust are mainly attributable to exposure within enclosed areas (i.e., mortality from carbon monoxide intoxication, and lung injury from respiratory irritants). Diesel emissions from vehicles and equipment are diluted in the ambient air giving low exposure to humans. When diesel exhaust is diluted to limit the concentrations of the gaseous components to satisfy NAAQS limits, acute effects are not found.

Several respiratory tract studies on animals have been conducted to show health effects to the lungs due to direct exposure to diesel fumes. However, potential effects to humans could only be studied on populations exposed occupationally such as miners, truck drivers, railroad workers, maintenance shop workers, and heavy equipment operators. Because of

limited evidence in the various animal and human studies, it was concluded that diesel engine emissions best fit into cancer weight-of-evidence Category B1 and thus are considered probable human carcinogens.

The maximum annual averaged total PAH (polyaromatic hydrocarbons) concentration from haul road exhaust emissions is substantially less than the annual acceptable source impact level. The cancer risk estimate is considerably less than the guideline for acceptable risk from 70 years of continuous exposure to an individual carcinogenic air toxic. These results are based on modeling of haul road exhaust emissions by McVehil-Monnett (McVehil-Monnett, 2005b) for the Proponent in the vicinity of the Beal borrow site where exhaust emissions should be higher than on haul roads on National Forest System land.

Other Effects - None of the alternatives would emit enough particulates to cause cloud formation which might contribute to local weather impacts. The emissions of "greenhouse gases" would be low compared to similar emissions from activities elsewhere in the region.

It appears that the existing baseline nitrogen deposition rate at the Pasayten Wilderness is already near the level that could cause impacts to plants. It's unlikely that haul across National Forest System lands would result in exceedence levels of nitrogen deposition in the Pasayten Wilderness; however, the worst-case scenario documented below in cumulative effects for the entire project could result in exceedences.

The fugitive dust and tailpipe emissions from the proposed project on National Forest System land is unlikely to cause visibility impacts at the Pasayten Wilderness Area because of the distance between the haul route and Wilderness and the prevailing wind directions.

Based on professional judgment and assuming the same assumptions are used as made above for transport of project related emissions, then mine-related visibility impacts would be lower than the accepted no-impact thresholds under all action alternatives. Visibility impacts to the Pasayten Wilderness would not be a major concern because the wind rose indicates a low frequency of winds toward the wilderness during the spring to fall visitor use period of the year. Visibility is generally not an important issue during periods of low visitor use or during periods when frequent weather impairment occurs, such as in winter.

The perimeter fence around the project, includes 74 acres of National Forest System land, would be placed so that the project would meet all State air quality standards at "the property line," and would protect people and animals from other mining related air quality impacts and for safety. Installation of this perimeter fence would cause minimal short-term air quality impacts from disturbance of vegetated soil. Re-vegetation of any soil disturbance would be part of installation and reclamation activities.

The infiltration pipeline, associated road, and infiltration gallery would create mostly short-term air quality impacts from disturbance. Most disturbed areas, except the road itself, would be re-vegetated as part of construction. Once constructed, a small amount of dust would be created each time the road is driven. This dust is estimated to total less than 1 ton of TSP per year assuming that the road is driven less than one time a day. Impacts on air quality and adjacent vegetation would be minor since this road would be used infrequently. A small amount of dust would be created when these features are reclaimed, but this impact would be short-term.

Construction/Reclamation - All of the action alternatives would cause short-term increases in air pollution emissions during facility construction on National Forest System lands and rights-of-way and during reclamation, which are not expected to have a major impact. The emissions rates during construction and reclamation would be lower than they would be during the operations phase. During the first three to four months of mine haul route construction, residents living along Forest Road 3575-120 from Okanogan County Road 4895 (Pontiac Ridge) to patented land could be affected. Estimated dust production, TSP and PM10, for the three to four month period of use is estimated at less than 36 tons of TSP and approximately 8.5 tons of PM10 based on water being used as the dust suppressant and road surfacing being improved. Dust impacts would be lower if treated with a salt or brine solution besides using water. All houses along this route are more than 100 feet, and all but one is more than 300 feet, from the route so the majority of dust would have settled before reaching these residences, except the one that is about 125 feet from the road. Impacts at this residence would be considered substantial because water is not as effective of a dust suppressant. San Joaquin Valley data (Gilles et. al., 1999, and Gebhart et al., 1999) showed a large (>90%) decrease in dust concentrations within 100 meters of an unpaved road. There is published data showing that about 90% of the dust suspended 2 meters above ground level from an untreated, unpaved road is re-deposited within 50 meters of its source (Watson et. al., 1996 cited in Fugitive Dust Transport under Arid Conditions: A Field and Modeling Study in Dona Ana County, New Mexico, and Gebhart et al., 1999). PM 2.5 tends to travel about twice the distance as PM 10. There are no live streams along this route, on National Forest System land or rights-of-way, which could be affected by dust disposition, but there is one small wetland, approximately 0.05 acres in size, in a road cutbank along the 3575-140 road. During road construction/ reconstruction, burning of created slash would take place. The smoke impacts of this burning are expected to be slight since much of the large woody debris and slash would be placed below roads to decrease erosion.

The potential for smoke impacts to a Class 1 airshed is low because the Pasayten Wilderness lies 42 miles west of the analysis area and prevalent wind patterns usually contain a westerly component. East winds are rarer and are least likely to result in conditions where the State would grant burning approval. The potential for smoke from pile burning of roadside slash proposed in the Buckhorn Access Project to have an impact on the Class 1 airshed of the Spokane Indian Reservation is low due to the 60 mile distance. With a steady NW wind flow and the potential for burning on the Colville NF along with Colville Tribal lands, there is a possibility of cumulative smoke effects to the Spokane Indian Reservation. Monitoring by the state smoke management program would result in curtailment of burning if atmospheric conditions developed with the potential to cause impact. In that case, the State would most likely curtail burning on the Colville National Forest with its closer proximity to the area but potentially might also curtail burning on the Tonasket Ranger District and other public and private land managers also.

Reclamation traffic would generally follow the ore haul route selected for each alternative. The Proponent would be required to post a reclamation performance security (bond) to ensure that adequate funds are available to perform the reclamation actions. These reclamation actions are designed to prevent future air quality problems such as what happened at Holden Mine from windblown dust. No long-term air quality impacts on National Forest System land and rights-of-way would occur from the project after reclamation was completed because all disturbed areas would be stabilized and reclaimed to control potential wind erosion. The amount of dust created during reclamation is

estimated to be less than 5% of the amount produced annually during operations as facilities are removed from private land.

Operation - All of the action alternatives would cause an increase in air pollutant emissions during the life of the project, and for a short period thereafter, and would result in corresponding short-term increases in the air pollutant concentrations near the project. Of the most concern on National Forest System land would be the impacts from fugitive dust, dust suppression, and diesel emissions, which are discussed above and are generally similar except for the length and area of impact. Dust emissions generated by the haul roads from ore, supply, and employee transportation are shown in Table III-37 below. Note that these figures are for comparison purposes only. These emissions are shown for the entire haul route on National Forest System land and rights-of-way. As it relates to each alternative and residences along this route, this is further discussed under each alternative.

Speed is a big factor in how much dust is produced. The US EPA publication AP-42 contains comments on fugitive dust controls. AP-42 suggests the control efficiency afforded by speed reduction be considered linear. For example, if the average speed is effectively reduced by 17%, (e.g. from 30 mph to 25 mph) then a control efficiency of 17% should be applied to the emission factor.

Table III-37: Total Dust Emissions on National Forest Haul Roads

	Alternative A	Alternative B	Alternative B1	Alternative C	Alternative D
TSP	0	678 tpy*	523 tpy	945 tpy	211 tpy
PM10	0	181 tpy	139 tpy	251 tpy	56 tpy

*Estimates in tons/year (tpy)
(PM 10 = suspended particulates less then 10 microns)
(TSP = Total suspended particulates)

Fugitive dust and associated impacts to vegetation and visibility would be generated by project related traffic during both the construction phase and the operations phase. The construction phase is predicted to add 172 average daily traffic (ADT) and the operations phase is predicted to average 328 ADT on the roads accessing the Project, assuming that employees mostly do not carpool or are not bused to the mine site.

A concern has been expressed about track-out dust onto pavement. Track-out dust should not be a major problem going from a graveled road treated with a dust suppressant to an asphalt road because the graveled road would be properly maintained and water use would be moderated to preclude muddy conditions that contribute to track-out. Using Siwash Creek road as an example, a gravel road treated with a dust suppressant onto a paved County road, noticeable track-out during summer is less than 25 feet. Most track-out occurs in the first 5 revolutions of the wheel, about 25 – 30 feet for a haul truck (Bolander, personal communications). Since the entire road would have an aggregate surface with chemical stabilization prior to the paving, only a small amount of dust would likely be tracked-out onto the paved road. Track-out would be most noticeable during winter as a result of sanding the gravel road for traction.

Alternative B

Predicted TSP and PM10 amounts from dust for ore and supply haul and employee access route on National Forest System land is estimated to be approximately 678 tons per year of

TSP and 181 tons per year of PM10 emissions during the years of operation. This would be higher than Alternatives B1 and D, but lower than Alternative C.

Two residences are located along this proposed haul route. One residences is approximately 300 feet and the other is approximately 700 feet from the route, so at least 90% of the dust would have settled before reaching these residences. Dust impacts at both residences would be considered slight.

Four dispersed camping sites are located on this proposed haul route. Dust impacts at three of the four sites would be considered substantial since they are less than 150 feet from the access route. Dust at the other site would be considered slight. Dust impacts on dispersed recreation under this alternative would be considered slight. Generally, because of dust on vegetation, recreationists would not use areas within about 150 feet of the proposed haul road. This alternative would have no dust impacts on the Jackson Creek inventoried roadless area, and slight impacts on the Coogan and Nicholson-Marias Ridge unroaded areas because most dust would settle within 150 feet of the road along the haul route.

Alternative B1

The dust impacts of Alternative B1 are similar to Alternative B except the paving of the lower 0.5 miles of Forest Road 3550 would decrease the dust impacts to the residence located above this section of road though water run-off from the paved road would be increased over a graveled road treated with a dust suppressant. Track-out of mud or dust from the gravel to the paved surface is not likely to cause dust problems at this residence because it would occur well before the residence. Lowering the speed limit from 30 to 25 is estimated to reduce the amount of dust created by 16 – 17%. Dust impacts to adjacent features are estimated to be about 23% lower than Alternative B due to the paving of 0.5 miles of the access route and the lower speed limit.

Predicted TSP and PM10 amounts from dust for ore and supply haul and employee access is estimated to be approximately 523 tons per year of TSP and 139 tons per year of PM10 emissions during operations.

Alternative C

Predicted TSP and PM10 amounts from dust for ore and supply haul and employee access is estimated to be approximately 945 tons per year of TSP and 251 tons per year of PM10 emissions during the years of operation. This is the highest of any of the action alternatives.

Two houses along this route are less than 100 feet from the proposed haul route, but because of the paving of the 3575 access road past these residences, dust impacts on the nine residences along this route would be minimal. Track-out dust from the transition from gravel to paved surface would occur well away from the residences, with intervening vegetation, and should not be a problem.

Dust impacts on dispersed recreation near the haul route under this alternative would be considered substantial due to the length of area affected and the 15 dispersed campsites that would receive substantial amounts of dust. Generally, because of dust from traffic on vegetation, recreationists would likely not use areas, including dispersed camping sites, within about 150 feet of the proposed haul road. This alternative would have slight dust

impacts on the Jackson Creek inventoried roadless area because of its adjacency to the haul route, almost no impacts on the Nicholson-Marias Ridge unroaded area, and no impacts on the Coogan unroaded area.

Alternative D

Predicted TSP and PM10 amounts from dust for ore and supply haul and employee access is estimated to be approximately 211 tons per year of TSP and 56 tons per year of PM10 emissions during the years of operation.

Because of the paving of the 3575-120 access road past the residences, dust impacts on these seven residences would be minimal, although one residence at Cow Camp would be less than 200 feet from the road and may be slightly impacted by dust.

Dust impacts on dispersed recreation under this alternative would be considered slight. Any track-out dust from the transition from gravel to paved surface would occur, but residences in the vicinity of the road are far removed from the road at this transition and dust should not be a problem.

Generally, because of dust from traffic on vegetation, recreationists would not use areas within about 150 feet of the proposed haul road. This alternative would have no dust impacts on the Jackson Creek inventoried roadless area, or the Coogan and Nicholson-Marias Ridge unroaded areas.

Cumulative Effects All Action Alternatives

Spatial and temporal boundaries for air quality analysis are identified above. At the mine site, sources of air pollutants would include underground mining operations and non-road vehicle emissions, surface material handling and vehicle emissions, and emissions from operations on unpaved areas.

During the project, the pollutant concentrations are expected to dissipate to near-background levels within approximately ten miles downwind of the site. The project emissions are expected to cause increases in particulate concentrations which are measurable, but not large (generally less than 15% of the ambient air quality standards) at nearby population centers in Chesaw and Bolster. The project is not expected to cause measurable increases in particulate concentrations in the Midway, British Columbia population center. Most fugitive dust emissions from road dust would be deposited within 100 meters (330 feet) of the road surface itself.

Nitrogen oxide, carbon monoxide, sulfur dioxide, and volatile organic compounds would be emitted from tailpipes of the ore haul, supply, and employee transport vehicles. Trace metals including arsenic, chromium, cobalt, copper, lead, molybdenum, nickel, niobium, rubidium, strontium, thorium, tin, tungsten, uranium, vanadium, yttrium, zinc, and zirconium are naturally present in the gold and silver ore and soil in the area and would be emitted by all action alternatives from the mine site. These trace metals, emitted as part of fugitive dust, are not expected to cause significant air quality impacts based on modeling completed for the Proponent by McVehil-Monnett Associates, Inc.

If a combination of worst-case meteorological and chemical assumptions are used (upper level winds transporting the emissions westward; 100% conversion of NOx emissions to

nitrate) then the project as a whole would add substantially to the existing nitrogen deposition baseline loading; the resulting total nitrogen deposition would be higher than the published threshold values. However, this assessment is based on a combination of assumptions that are not realistic for this project area. If it is assumed that normal north-south valley winds along the Okanogan River Valley would disrupt this westward transport of project related emissions or if it is assumed that relatively little of the tailpipe emissions oxidize in the atmosphere, then the project related deposition would be much lower than the published no-impact thresholds under all action alternatives. There is a low level of risk in the Pasayten Wilderness for nitrogen deposition in winter. The risk is low because of a combination of plume scrubbing by rugged terrain, vegetative cover, and weather impairment. These factors would remove most, if not all, of the material before it reaches the wilderness boundary. The short-term existence of the project is mitigating since ecosystem harm from deposition comes from long-term exposure such as from the I-5 corridor and not short-term projects such as this.

The Calpuff Lite Regional Haze Analysis (McVehil-Monnett Associates 2005b) indicates that regional haze impacts at the receptors located at the Class 1 areas would potentially be above the 5% FLAG (Federal Land Manager's Air Quality Related Values Workgroup) values for the Pasayten Wilderness Area 30 – 38 days in any given year based on 5 years modeled. This same model also showed exceedences for the Spokane Indian Reservation. The maximum regional haze change for the five years modeled at both Class 1 areas would be above the 10% level of acceptable change (LAC) for visibility impacts and would be considered as adverse by the Federal Land Managers. 10% is the level at which Federal Land Managers view cumulative regional haze change as potentially adverse. 10% is the FLAG level of acceptable change. Air Quality managers at the Department of Ecology consider this change in visibility as significant, if real. The Proponent agreed to run a definitive analysis using the CALPUFF Screening Mode model. This is a more refined analysis since the model goes into finer detail about meteorological and topographical effects than the CALPUFF Lite screening model, which used meteorological information from Spokane and average topography. The screening model indicated that Regional Haze impacts would mostly fall between November through February when there is little use of the Pasayten Wilderness; one day of impacts, each, in March and October, over a 5-year period, were indicated.

For the refined analysis, the same emission source parameters were used as in the screening analysis of the three primary stationary sources, constituting the proposed action. Details regarding these inputs and their derivation are provided in WADOE's FSEIS on page 3.4-36. The results are summarized in the following table:

Table III-38: Refined Analysis Regional Haze Impact Summary – Class I Areas

Class I Area	Modeled Year	Max Predicted Daily Visibility Change (%)	Number of Days in Class I Area Above 5% Change	Number of Days in Class I Area Above 10% Change	Receptor Location of Maximum (Lambert Conformal Mapping)	
					X (km)	Y (km)
Pasayten Wilderness Area	2000-01	4.00	0	0	-62.749	149.456
	2001-02	1.95	0	0	-61.473	158.404
	2002-03	2.56	0	0	-61.473	158.404
Spokane Indian Reservation	2000-01	3.51	0	0	61.816	54.186
	2000-02	1.49	0	0	54.210	48.946
	2000-03	3.19	0	0	49.489	50.992

This confirms that haze would not be a problem from this project in the Class I airshed.

In order for the Project to necessitate a Prevention of Significant Deterioration (PSD) permit, the non-fugitive emissions from the proposed mine project would have to exceed 250 tons per year of a regulated pollutant (dust from public roads is not a regulated pollutant). The emissions inventory as submitted to WADOE by the Proponent for Alternative B indicates that the PM10 emissions would be about 68.943 lb/hr including haul impacts on gravel roads (but not including employee or supply traffic impacts), or 302 tons/year. Regulated PM10 pollutants would be about 37 tons of this. TSP emissions would total about 253.882 lbs/hr including haul impacts on gravel roads (but not including employee or supply traffic impacts), 1112 tons/year. Regulated TSP pollutants would be about 117 tons of this. Regulated emissions under all action alternatives would be similar and would be below the threshold necessitating a PSD permit.

Modeled air quality impacts of criteria pollutants for the Buckhorn Mountain mine, Marias Creek haul route, and the backfill borrow site are shown in the table below.

Table III-39: Criteria Pollutants (Ecology 2006, page 3.4-19)

Pollutant	Averaging Time	Modeled Concentration (*ug*/m^3)	Ambient Air Quality Standard (*ug*/m^3)	Percentage of Ambient Air Quality Standard
CO	1-hour	742.2	40,000	2%
	8-hour	292.3	10,000	3%
NO_2	Annual	36.8	100	37%
SO_2	1-hour	596.5	1,050	57%
	3-hour	355.2	1,300	27%
	24-hour	104.8	365	29%
	Annual	13.3	80	17%
Total suspended	24-hour	133.7	150	89%
Particulate	Annual	23.3	60	39%
PM_{10}	24-hour	41.3	150	28%
	Annual	5.8	50	12%
$PM_{2.5}$	24-hour	41.3	65	64%
	Annual	5.8	15	39%

Air quality impacts from past actions no longer occur. Smoke from prescribed fires (broadcast burning, underburning, and pile burning), during mostly spring and fall seasons, would likely continue across the Tonasket and Republic Ranger Districts in at least the foreseeable future and from burning on the Colville Confederated Tribal land, Canada, and nearby private and State owned lands. Smoke from all sources, except the Colville Confederated Tribes land and Canada, is regulated by the State of Washington Department of Natural Resources. Even with regulation, prescribed fire smoke can create short-term impacts. These usually last only a day or two and quickly disperse due to burn approval from the State coming at times of favorable atmospheric conditions. The State approves the amount of prescribed burning based on expected smoke dispersal. Prescribed burning has never resulted in a violation of air quality standards, although nuisance smoke occasionally occurs. Prescribed Fire Managers in conjunction with the State of Washington monitor atmospheric conditions and emissions from all sources of smoke to curtail potential smoke impacts.

The Washington State Department of Natural Resources manages the air quality of the state by regulating the quantity of burning throughout the year. Burns planned by the Forest Service, State agencies, and private landowners must be approved by DNR Smoke Management before ignition. The DNR takes into account atmospheric circulation patterns to determine trajectory of smoke emissions and how quickly smoke dissipates to harmless levels. When regional haze and/or particulate counts accumulate to predetermined limits, additional smoke emissions are prohibited.

Managing smoke from controlled burning involves timing and cooperating with the weather to minimize the impacts of smoke. Burning takes place when fuels and weather conditions meet predetermined prescription parameters. The burning of either logging slash or natural fuels is done primarily in the dry periods of the spring and fall. In any year, the burning program may involve ignitions on an average of 20 days in a year. Burn days are chosen when winds would move the smoke out of the project area and dissipate it. Ignition typically ceases by late afternoon so the burn would consume most of the fuels before down slope wind patterns develop in the evening. Any residual smoke from burning that lingers overnight generally shows in a "mid-elevation" inversion layer within the valleys. Inversions generally break up mid-morning and the smoke dissipates upward. Smoke settling into the valley bottoms is rarely seen.

Controlled burning rarely is close enough to affect visibility along highways. The National Forest System land where controlled burning is conducted is generally higher in elevation than major highways in the valley bottoms. When burning is done during the day with good air circulation, the likelihood of smoke interfering with driving visibility is low. There is no burning planned that is in close proximity to the haul route that pose much of a risk for smoke intrusions.

In general, smoke emissions from controlled burns are occasional short-term events that disappear in the large-scale motions of daily wind and rain. Cumulative effects of controlled burn smoke in the atmosphere are negligible since the natural atmospheric processes work to rid the air of particulates over time. State and national air quality regulations work to limit the rate of emissions so the production of particulates does not exceed the natural cleansing processes of the atmosphere. Permissions are granted for controlled burning emissions only after ambient air quality is considered. In other words, the everyday activities that produce vehicle exhaust, dust, home stove smoke and other emissions are taken into account before smoke from forestry and agricultural burning is permitted. The additive

effects of controlled burn smoke is unlikely to be important in combination with vehicle exhaust and other emissions since burning occurs during optimal conditions that would in turn dissipate vehicle exhaust and other emissions as well as smoke. Therefore, controlled burning smoke, when compared to other human activities, is a transient product from which it is difficult to estimate the impacts on a localized area. However, current smoke management techniques and air quality regulation are working to minimize adverse aesthetic and health effects over the general area of Eastern Washington.

In September 2006, Crown/Kinross was issued a Road Use Permit for the use of portions of Forest Roads 3575-120 and 3575-140 for the commencement of mine construction on private land. 20 – 40 truck passages a day are expected. As part of that 1-year permit, Crown/Kinross was required to complete some road maintenance activities including road surfacing. They surfaced the road with a compacted 4" lift of pit run rock, followed by a compacted lift of 1 ½", minus, rock. Crown/Kinross is expected to maintain the road surface, control dust, and plow snow off the road as part of this permit. When the ore and supply haul route is completed, most mine construction traffic would be expected to switch to the ore haul route. During the use of this route for an expected 4 – 5 month period, prior to the start of haul route construction, residents living along Forest Road 3575-120 would be affected. The Proponent is using water to control dust on the access road during initial mine construction past residences on Forest Road 3575-120. Should this dust control not be adequate, the proponent would be required to use additional forms of dust control or more frequent watering. Estimated dust production, TSP and PM10, for this period of use is estimated at less than 36 tons of TSP and approximately 8.5 tons of PM10. All houses along this route are more than 100 feet, and all but one is more than 300 feet, from the route so the majority of dust would have settled before reaching these residences, except the one that is about 125 feet from the road. Impacts from dust at this property on Forest Road 3575-120 during the 4-5 month construction period would be considered substantial because water is only 50% effective in controlling dust.

Potential cumulative effects of smoke to the general population would most likely be from a visual or nuisance perspective.

During a 2-3 month period, rock would be excavated and crushed at the Beal Borrow site, which could result in some localized impacts to air quality, but the Buckhorn Access Project would not add incrementally to this air quality impact.

Conclusion

Regulated emissions under all action alternatives would be similar and would be below the threshold necessitating a PSD permit. The potential for smoke and dust impacts from activities on National Forest land and rights-of-ways to Class 1 airsheds is low because the Pasayten Wilderness lies 42 miles west of the analysis area and prevalent wind patterns usually contain a westerly component, and because of distance, smoke and dust impacts to the Spokane Indian Reservation would be low. The maximum annual averaged total PAH (polyaromatic hydrocarbons) concentration from haul road exhaust emissions is substantially less than the annual acceptable source impact level. There is a low level of risk in the Pasayten Wilderness for nitrogen deposition and visibility impacts from activities on National Forest land. The risk is low because of a combination of distance, plume scrubbing by rugged terrain, vegetative cover, and weather impairment in winter. The impacts of this project on National Forest land would not be significant because State and Federal air quality standards would be met.

Noise

This section below summarizes the affected environment information, along with direct, indirect, and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Noise Report, by Buckhorn Project Manager Phil Christy dated January 8, 2007 in the analysis file.

AFFECTED ENVIRONMENT

A noise impact analysis was performed to determine if the haul road sound levels would conform to the Ecology Maximum Environmental Noise Levels, and the WSDOT, Forest Service and EPA Noise Guidelines, and whether further restrictions or mitigation would be required on haul to limit noise.

As part of the analysis, ambient sound level surveys were performed in August 1992, June 1993, January 1994, and July 2004 to quantify the ambient sound levels (Shaw Environmental, Inc. 2004; Hart Crowser, 1993). The ambient sound levels are defined as the background sound level that exists at a location of concern before the project is built. The ambient sound levels are caused primarily by traffic, near and distant, insect or bird sounds, a breeze through the trees, or miscellaneous manufactured sources.

The sound levels expected from haul were then predicted and compared with the existing sound levels and applicable noise regulations and guidelines, and are summarized below. Refer to the Noise Baseline Report in Project files for details.

Noise can be defined as unwanted, disturbing sound. The impact of a noise source depends on the levels and characteristics of the background sound, as well as the characteristic of the source. Sound is transmitted through the atmosphere as low-intensity pressure waves. Most people can detect and respond to a wide range of sound intensities and frequencies.

The logarithmic decibel scale (dB) is used to indicate the intensity of the sound. To measure sound on a scale that approximates the way people hear, more emphasis must be placed on those sound frequencies (or pitch) that people hear best. The EPA recommends the use of the “A-weighted” sound pressure levels, expressed as A-weighted decibels or dBA, for analyzing community noise issues. Because decibels are a logarithmic scale, a doubling of the sound pressure corresponds to a noise increase of 3 dBA. For example, a single loaded truck pulling a slight grade typically produces about 86 dBA of noise at a distance of 50 feet from the truck. Therefore, two identical trucks operating together (with each producing 86 dBA) produce a theoretical noise level of 89 dBA. Below is a table of the range of common sounds.

Table III-40: Typical Range of Common Sounds

Item	Maximum A-Weighted Sound Level in dB
Chain Saw – to operator	103 – 117
Snowmobile – to operator	85 – 110
Heavy Truck - at 50’	86 – 104
Automobile - at 50’	59 – 92
Vacuum cleaner – in home	59 – 86
Washing machine – in home	44 – 77
Dryer – in home	49 – 73

Many factors determine whether an increase in the noise level above the existing background is "audible." The most important factor is the nature of the new noise source as compared to the nature of the background noise. In the case of truck haul, the noise caused would be different from the rural background sounds, so relatively small increases in noise levels might be noticeable. During the background noise surveys done during 1992 to 1994, the noise from exploratory drilling equipment operating at the mine site was noticeable even when the equipment caused noise increases as low as 2 dBA. Based on those observations, a similar increase in haul noise would probably be noticeable.

Applicable Regulations and Guidelines

The following regulations and guidelines are applicable to the analysis of noise from haul.

Maximum Environmental Noise Levels, Chapter 173-60 Washington Administrative Code (WAC). The Washington State Department of Ecology specifies allowable sound levels as a function of both source and receiver land use, and time of day. The land use is specified by the Environmental Designation for Noise Abatement (EDNA). The noise criterion applicable to the project's property line and the nearest residential neighbors are as follows:

- **Property Line Sound Level Criteria** – 70 dBA, 24 hours-per-day.
  - Source Class C EDNA – Industrial
  - Receiver Class C EDNA – (iii) "Agricultural and silvicultural property used for the production of crops, wood products, or livestock."

- **Residential Sound Level Criteria** – 60 dBA, 7 a.m. – 10 p.m., 50 dBA, 10 p.m. – 7 a.m.
  - Source Class C EDNA – Industrial
  - Receiver Class A EDNA – Residential

Motor Vehicle Noise Performance Standards, Chapter 173-62 WAC The Washington State Department of Ecology limits the 50-foot sound level of trucks according to the gross vehicle weight, speed, and date of manufacturing. Trucks 10,000 pounds and over are limited to 86 dBA at 50 feet for speeds less than 45 mph and 90 dBA for speeds over 45 mph.

Okanogan County Noise Ordinance. Prevention of public disturbances caused by loud, unpleasant, or raucous noise is governed by Okanogan County Ordinance 88-1. However, that regulation is not well suited to develop limits on routine, near continuous noises that would originate from the proposed haul activities.

Forest Service Guidelines for Recreational Areas. The Forest Service recommends that recreational noise area impacts caused by new industrial activity should be limited based on the recreational classification of the recreation area (Forest Service, 1980). Table III-41, Recommended Maximum Noise Impacts to Recreation Areas, lists the recommended allowable noise increase above existing baseline values. It is not intended that these values be used as strict numerical limits. Instead, the potential noise impacts in recreational areas are intended to be assessed on a case by case basis, accounting for factors such as the noise duration and the time of day when the noise would occur.

Table III-41: Recommended Maximum Noise Impacts to Recreational Areas

Recreation Site Classification	Recommended Allowable Noise Impact in dBA (above background)
Primitive Area	1
Semi-primitive Areas	
Trail Camps	5
Undeveloped Roadside Camps	10
Semi-modern Areas	
Roadside Campgrounds	20
Highly Developed Campgrounds	40

EPA Region 10 Noise Guidelines, April 1973 (EPA, 1973). These guidelines quantify community response to noise as a function of the increase in the ambient sound level. They do not set allowable standards. The Environmental Protection Agency has no enforceable noise limits applicable to industrial operations. They indicate that increases in ambient sound of 0 – 5 dBA causes few complaints, constitutes a "slight" impact. Increases of 5 – 10 dBA causes more complaints, constitutes a "significant" (this is not "significant" within the meaning of NEPA, so the word "substantial" is substituted) impact. Increases over 10 dBA can cause substantial complaints, constitutes a "very serious" impact.

Several types of sound level data were collected. This collected data is summarized in the Noise Baseline Report in Project files.

ENVIRONMENTAL CONSEQUENCES

Several paragraphs and tables below are included to provide an understanding of noise that may be heard on National Forest System lands even though they are not directly from National Forest System lands. These noise levels were measured at sites which were utilized by ore trucks and/or other heavy truck traffic associated with the K2 mine as examples of noise levels which might be heard on the ore haul route and for calibration of the Federal Highways Administration, Highway Traffic Noise Prediction Model. Passenger cars and pickup truck noise levels were also measured to represent employee traffic noises expected on the haul routes.

The analysis area for most direct, indirect, and cumulative noise effects is considered the Canadian border on the north, the North Fork Beaver Creek/OCR 9480 on the south, Toroda Creek/OCR 9495 on the east and OCR 4883/9480 on the west. Cumulative effects are the overall impacts of all past, present, and reasonably foreseeable future actions. Actions that were considered included the mine proposal on private lands and timber sales. Also included are the cumulative effects of the gravel crushing and haul for placement of gravel surfacing on National Forest System roads. All reasonably foreseeable future projects within the next decade were included, although additional currently unknown projects may arise in the future.

Truck 50 Foot Sound Levels

Shaw consultants measured the sound levels of a number of ore haul trucks and other vehicle pass-bys to confirm that the existing ore trucks meet the WSDOT Motor Vehicle Noise Performance Standards (WAC 173-62). The standards specify that trucks 10,000 pounds and over are limited to 86 dBA at 50 feet for speeds less than 45 mph and 90 dBA for speeds over 45 mph. None of the ore haul truck sound levels exceeded the criterion at

speeds over 45, but there were exceedences for trucks traveling under that speed. The three dBA exceedences of 86 dBA were for two full ore trucks on the hill at the Kettle River mill and one full ore truck traveling at 45 mph. Based on the sound levels recorded, the sounds of loaded trucks climbing to the mine site would likely be similar, or slightly lower, than full haul trucks at the Kettle River Mill, where trucks are climbing up to the mill. Trucks on this project would not be expected to exceed 86 dBA below 45 mph since trucks would be required to be equipped with quiet type mufflers (mitigation measure NO-1).

Traffic Noise Model Verification

Traffic counts were collected by Shaw at all measurement locations and used to predict the expected traffic sound levels for each location, independent of the measurements taken in the field, using the FHWA model. In those areas where the traffic was light, and there were no heavy trucks, the measured equivalent sound level (Leq) was always higher than the traffic count predicted Leq because non-traffic related noise sources were dominant. However, in areas with trucks, the traffic sound dominated the ambient sound levels, and the predicted levels showed excellent agreement with the measured level.

Temperature Inversion Study

Temperature inversions, a reversal of the normal temperature gradient where temperatures get colder the further air is from ground level, at the site could enhance sound propagation, and thereby increase noise impacts. The on-site meteorological station operated by Battle Mountain Gold at the proposed mine site indicated that temperature inversions occurred during the evening to early morning hours on each day of the August 1992 baseline noise monitoring. As part of that baseline monitoring, the potential adverse impacts caused by temperature inversions were assessed by operating a drill rig at the proposed mine site, then observing the sound levels at various distances from the rig (Hart Crowser, 1993).

The test was completed during two different weather conditions: on a clear afternoon where there was no temperature inversion, and on a clear morning with a strong temperature inversion. Sound did not travel far during the afternoon, when there was no temperature inversion. The sound attenuation caused by the forest within the first 200 feet of distance away from the drill rig was about 12 dBA during both the morning and afternoon tests, and was therefore not affected by the morning temperature inversion. During the afternoon tests, the drill rig was undetectable by the electronic monitor that was only 0.5 miles away from the rig. However, sound traveled much further during the morning test run during a temperature inversion. At that time, dogs that were believed to be about two miles away were clearly audible at the South Corral. The drill rig, about one mile away, was clearly audible at the South Corral, and the drill rig caused a detectable noise level increase of about 1.5 dBA at the South Corral when it was cycled on and off. Based on that drill rig study, it was confirmed that temperature inversions would cause increases in noise levels in the areas surrounding the mine.

The noise levels from haul and access road construction and reconstruction, and ongoing maintenance on National Forest System roads is expected to be similar between action alternatives. Differences would mainly be in the length and timing of haul during operations and the number of residences within 500’ of the haul route. Minor differences between alternatives would be in the number of different crews working on constructing the road at a given time and the amount of reclamation to be completed at the end of the project.

Alternative A

Direct and Indirect Effects

There would be a slight reduction in noise levels compared to the present, since fewer vehicles would be expected on area roads than during the recent pre-development phase. This decrease in vehicle noise would be slight, generally less than that caused by the passing of six vehicles a day.

Cumulative Effects

Reclamation efforts on National Forest System land for impacts from existing water monitoring sites and pre-development activities would increase vehicle traffic and construction type noise for a short period, 1 – 3 months, during reclamation activities. Since reclamation activities are generally located away from residences, except one road to be reclaimed near Cow Camp, and that is over 800 feet from the nearest residence, the only impacts on residents living on Forest Service access roads would be an occasional truck driving by or an excavator walking up the road. These impacts would be on Forest Road 3575-120 coming up from OCR 4895, Pontiac Ridge Road. If reclamation was taking place during the September and October hunting seasons (deer, bear, birds), localized disturbance to hunters would be expected. This disturbance in any given location would only last a day or two and would be considered slight. No disturbance to dispersed hunting camps would be expected, except of a very temporary nature.

Effects Common to all Action Alternatives

Direct and Indirect Effects

In the 1970's the EPA sponsored studies on environmental noise effects on public health and welfare. In these studies, the EPA identified a range of yearly Day-Night Sound Levels sufficient to protect public health and welfare from the effects of environmental noise. This is summarized in what is referred to as the "Levels Document" (EPA 1978). The identified protective levels are not viewed as standards, criteria, regulations, or goals by the EPA, but are a basis for several state and local agencies' noise regulations.

According to the Levels Document, the basic premise for diagnosing a health effect from environmental noise is a change in individual hearing level greater than 5 dBA. Changes smaller than 5 dBA are considered insignificant. The study concluded that a 5 dBA noise induced hearing damage would occur with a 24 hour per day equivalent sound level (Leq) of 70 dBA occurring over a 40-year period. The daily Leq along the haul route on National Forest Roads is not expected to reach this level. The highest predicted Leq in the vicinity of National Forest System land or rights-of-way is near the junction of Forest Road 3575 (Nicholson Creek road) and OCR 9495/FCR 502 (Toroda Creek road), which is predicted to be 63 to 64 dBA for haul at 50 feet and for construction at 500 feet. The proposed construction and operations period is about 9 years in length, so there should not be a long-term health effect from noise on the project along any haul route based on predicted noise levels.

Noise annoyance is also addressed in the Levels Document. Most project impacts would be considered noise annoyance. For identifying protective noise levels, annoyance was quantified by using the percentage of people who are annoyed by certain noise levels. The

study concluded that for outdoor activity the 24 hour per day Leq threshold for annoyance is 55 dBA. Maintaining daily average noise levels less than or equal to 55 dBA are sufficient to protect public health and welfare. Maintaining 55 dBA outdoors would in turn ensure adequate protection for indoor living. Fifty-five dBA Leq would be exceeded at any residences within an estimated 800 feet of road construction/reconstruction, when taking place, and within an estimated 200 feet of the supply and ore haul route during operations. Refer to Table III-46 for a summary of effects by alternative to residences within 500 feet of the haul road for the various phases of the project.

Construction activities are only planned for daytime hours. Construction noise is exempt from the Ecology Maximum Environmental Noise Level regulations during daytime hours (i.e., 7:00 a.m. to 10:00 p.m.), per Chapter 173-60-050 WAC.

Ore and Supply Haul Route Construction

It is expected that up to five different crews may be used to reconstruct/construct the proposed ore and supply access road under each action alternative. The construction method would be similar under all action alternatives but the location of the construction would be different. The impacts of these differences in location are displayed under each alternative.

The construction of the access road is expected to begin with 3 to 4 crews working simultaneously at different locations along the route. Each crew would start by felling and skidding trees. Dozers and excavators would then rough in the road, followed by further road construction/reconstruction using scrapers, graders, loaders, and haul trucks. In the second month, the delivery and placement of the road gravel surfacing would commence and continue for two - three months

Table III-42 gives an estimate of possible construction equipment. Because of the shorter distance of construction/reconstruction under Alternative D, the construction period would be shorter and one less crew might be used. Differences in construction period and crews between Alternatives B, B1, and C are expected to be small except Crew 5, displayed below, would be larger, or work several more weeks on National Forest System land under Alternative C due to the greater distance of road to be surfaced. Once the haul road is completed, most employee and supply traffic would be transferred to the ore and supply haul route. At that time the noise impacts would be similar to the operations ore and supply haul phase though there would not be as many heavy trucks present; an estimated 20 to 40 passes per day by heavy trucks instead of 105 to 110 passes during the operations period.

Table III-42: Construction Equipment for Mine Access Road

#	Crews 1, 2, and 3	#	Crew 4	#	Crew 5
3	D8N Dozer	1	225 Hydraulic Excavator	5	Highway Trucks hauling gravel
2	621 Scrapper	1	955 Loader	1	140G Grader
2	14 G Grader	2	Hand Compactor	1	Water Truck
1	Water Truck	1	Water Truck	1	Smooth Drum Vibratory Compactor
1	815 Compactor				
1	Log Skidder				
2	Chain Saws				

Other

If noise levels at work sites are above regulatory limits, protective hearing apparel would be worn by employees in these work areas. For this Environmental Impact Statement, it is assumed that state and federal agencies would require the noise levels within the work place comply with the occupational noise limits and to ensure that appropriate hearing protection is required for workers by the Proponent or their sub-contractors. In that case, worker hearing safety is not an issue that warrants further assessment.

Based on noise and the combination of other resource concerns, there would likely be little recreational use of National Forest System land within 800 feet of the ore and supply haul routes for the duration of the construction/reconstruction of the road (3-4 months) and within 500 feet of the ore and supply haul route during the operation of the mine. At distances greater than 500 feet, noise levels would be considered slight by the recreating public based on the Ambient Plus 10, EPA criteria.

During the construction of the ore haul route, 20 – 40 truck passages a day are expected on Forest Roads 3575-120 and 3575-140. The ore haul construction activity is expected to last 3 to 4 months. When the ore and supply haul route is completed, most mine construction traffic would be expected to use the ore haul route.

Approximately 6 residences are located within 500 feet of the 3575-120 road portion of this route. No residences are known to be located within 500 feet of the 3575-140 road where it is on National Forest System land. Five of the six residences along the 3575-120 portion of the road would be “slightly” impacted by noise during this use period because the residences are greater than 200 feet from the road. Impacts at the other residence would be considered “substantial” because it is less than 200 feet from the road and is surrounded on two sides by the road.

During operations, the water tower would likely be accessed off Forest Roads 3575-120 and 3575-140. The greatest noise impact to a resident would be to the home at Cow Camp and that would be very slight since the water tower is not likely to be accessed more frequently than once a day but more likely only several times a week. This access route would be plowed open in the winter.

Reclamation Sound Levels

Reclamation noise impacts are expected to be similar between all action alternatives since most road related reclamation, up to the junction with the new road to the patented land above the 3575-120 road, would be done during the construction of the operations ore and supply haul road and noise impacts are included with construction impacts. Reclamation under Alternatives B1, C, and D would be the same from this junction to the patented lands. Reclamation under Alternative B would only rip the second lane of the road instead of re-contouring the road back to one lane over this 0.6 mile section and noise would be less extensive. Reclamation of the haul route from Toroda Creek road to this point would be different under Alternative B1 than under Alternatives B, C, and D. This difference is discussed later in this section.

Site demolition equipment and road reclamation equipment would likely have similar sound levels to, or slightly less than that used for the construction/ reconstruction of the facility or road, but the duration of the impact would be much shorter. The majority of reclamation at

the end of the project on National Forest System land would be related to the infiltration gallery, infiltration pipeline, and associated road; the road between Forest Road 3575-120 and the patented land; the proposed monitoring well, staff gauges, and piezometers; the surface water monitoring locations; removal of project fences; and the blading and ripping along the lower portion of the Alternative B1 haul route. The paved sections would be left in place so no ripping would occur adjacent to the residence adjacent to the lower Marias road in Alternative B1. The only home to be impacted with potential "substantial" noise impacts from reclamation would be the cabin adjacent to Cow Camp and that would be about 1000 feet from any activities so impacts would be considered "slight."

In general, only one large truck bringing supplies and one carrying off scrap would be expected on any given road each day. The road impacted would be the same as the supply route during operations. Forest Roads 3550/3550-125 for Alternatives B and B1, 3575/3575-150/3575-100/3575-120 for Alternative C and 3575-120 for Alternative D. Reclamation activities are only expected to have slight noise impacts on recreational use and residences since most activities would not be taking place adjacent to the residences and the area of reclamation for roads, and the infiltration gallery/pipeline/road would be at a constantly moving location. The number of reclamation employees for actions on National Forest System land would be small and the time of employment would generally be short so impacts should be slight. A few recreational users of the Buckhorn Block may be displaced from a given area for a few days but other adjacent areas would be available to be used.

Cumulative Effects

Past actions are not considered in this analysis because they are no longer causing any noise.

Mine Construction Supply Route

In September 2006, Crown/Kinross was issued a Road Use Permit for the use of portions of Forest Roads 3575-120 and 3575-140 for the commencement of mine construction on private land. 20 – 40 truck passages a day for a period up to 8 months is expected from this activity. As part of that permit, Crown was required to complete some road maintenance activities, and road surfacing. The surfacing of the road with a compacted 4" lift of pit run rock and a compacted lift of 1 ½", minus, rock has been completed. Crown is expected to maintain the road surface, control dust, and plow snow off the road as part of this permit. When the ore and supply haul route is completed, most mine construction traffic would be expected to use the ore haul route.

Approximately 6 residences are located within 500 feet of the 3575-120 road portion of this route. No residences are known to be located within 500 feet of the 3575-140 road. Noise impacts to five of the six residences along the 3575-120 portion of the road would be slightly increased during this use period because the residences are greater than 200 feet from the road. Impacts at the other residence would be considered substantial because it is less than 200 feet from the road and is surrounded on two sides by the road.

Effects of Rock Crushing and Haul

The equipment at the Beal borrow pit to be used to provide the crushed rock surfacing for the haul roads on National Forest System land would include: a screening plant, rock crusher, dozer, loader, water truck, and highway trucks to haul the material to the roads

being constructed/reconstructed. Two property line sound level criteria are applicable to the Beal Site. The predicted level of 57 dBA at the nearest residence, as shown in Table III-43, is below the Ecology daytime sound level criterion of 60 dBA (7 a.m. to 10 p.m.). The predicted levels are also equal to existing ambient levels on the road, and thus below the EPA Ambient Plus 10 criterion. Thus, noise impacts from the quarrying and rock crushing operations for road surfacing would be considered "slight", though noticeable, at these residences due to distance and existing noise levels.

According to Ferry County Ordinance #2006-03, new plats, short plats, development permits and building permits within 1,320 feet of the of Beal borrow site would be required to contain notices that they may be near commercial activities that are not compatible with residential development for certain periods of time.

Table III-43: Predicted Borrow Area Operational Sound Levels at Nearest Receptor, dBA

Location	Predicted Leq, Nearest Residence	173-60 WAC Daytime	Ambient Leq	EPA Plus 10 Leq
Beal Borrow Site (#5)	57	60	55	65

The haul trucks used for gravel haul are assumed similar to the trucks used for ore haul. The hauling of road surfacing is shown to meet the Ecology daytime sound level criterion, though construction activities are exempt, of 60 dBA (7 a.m. to 10 p.m.) on both sections of County Road since all residences are at least 100 feet from the road, refer to Table III-44. The predicted levels meet the EPA Plus 10 Leq for Ferry County Road 501, near the Beal borrow site, because of the greater amount of traffic presently on the road and higher baseline Leq. The predicted levels only meet the EPA Plus 10 Leq for Okanogan County Road 9495/Ferry County Road 502 at distances greater than 200 feet from the road because of the low background level of ambient noise on this road. Impact of this haul on several residences along this haul route would be considered "substantial" since the residences are within 200 feet of the road. The noise impact would be considered "slight" at the other residences.

Table III-44: Predicted Traffic Sound Levels, Leq

Road	Ambient Conditions	173-60 WAC Daytime	EPA Plus 10 Leq Guidelines	50'	100'	200'	500'
FCR 501	55*	60	65	63	59	54	48
OCR 9495	44	60	54	63	58	54	48

* without helicopter overhead

Other Cumulative Effects

If recreationists and residents are close enough to the mine site or haul routes, they may hear Project-related noise. Blasting at the mine would likely occur two or three times a day. Generally, this noise would not be heard except during the initial development of the portals. Noise at the mine during operations would be "substantial" for a distance of about 500 to 800 feet from the noise source, depending on the source, but much of the affected area would be within the mine fence which would not be open to public use so impacts to the public would be considered "slight". Impacts to the nearest residence would also be "slight".

Reclamation of the mine site would be taking place at the same time as the reclamation on National Forest System land. Employee traffic associated with this reclamation would generally cause the greatest impact to homes along Forest Roads and would have impacts similar to, but less than employee traffic during operations since there would be fewer vehicles and the times of impact would be shorter since most employees would have a common start and stop time. There would be an estimated one heavy haul truck providing supplies to the mine each day and one hauling salvaged materials away from the mine. The impact of these two trucks a day would be considered "slight" after having 50 to 55 trucks per day going by any given point for 8 to 9 years.

A mine operational noise level of 69 dBA is predicted at the closest (northern) property boundary for up to 8 or 9 months with the temporary diesel generator operating, then 64 dBA once power is supplied to the mine via power lines. Sound levels under both scenarios are below the Ecology 70 dBA daytime/nighttime limits.

Mine operational noise levels less than 30 dBA are predicted at the nearest residence. This is well below the Ecology 60 dBA daytime and 50 dBA nighttime limits.

Timber harvesting, unrelated to the Buckhorn Mountain Project, would result in localized noise from timber felling, removal, and hauling along sections of Okanogan and Ferry County roads. This would periodically add to the haul route sound levels. If logging, or other heavy truck haul activities, were to add 5 pass-bys per hour, the projected increase in noise would be about 2 dBA; one to two pass-bys per hour would increase noise 0.5 to 1 dBA. Other than the Little Nicky Timber Sale on DNR land, which should be completed by the time the mine is operational, no other timber harvest actions have been proposed in or around the Buckhorn Block.

An estimated 10,000 tons of ore remains to be hauled from the K2 mine on FCR 501 to the Kettle River mill to be processed, an estimated 310 – 335 truck loads. This ore is expected to be hauled at a rate of about 200 tons/day, approximately 6 – 7 truck loads, for an estimated 50 – 55 days or may be hauled during periods when ore is not available at the Buckhorn mine. The amount of additional ore haul traffic is expected to be slight, and between the two projects would not exceed mill capacity at the Kettle River Mill. Even if this ore was hauled in addition to the Buckhorn ore, the increase in haul road sound levels would be about 0.5 dBA which would not be noticeable.[86]

Although it's possible that the culvert on the Toroda Road and Toroda Road reconstruction may be going on at the same time as reconstruction of the Marias or Nicholson Creek Roads, these activities would only slightly raise noise levels at residences near these junctions.

Noise impacts on recreation are discussed in the recreation section below.

[86] This conclusion is different than the WADOEs FSEIS, because the FSEIS appears to use the incorrect conclusion that both mines would be hauling approximately 50 truck loads per day.

Alternative B

Direct and Indirect Effects

Two residences are located along the National Forest portion of the proposed haul and employee access route: one at the start of Forest Road 3550, which is about 300 feet from the ore, supply, and employee access road, and another at Cow Camp. The latter residence is about 1300 feet from the junction of the new haul road and Forest Road 3575-120 and about 700 feet, at the closest point, from the proposed Marias Creek haul route. There are 4 dispersed camping sites within about 125 feet of the proposed operations haul route, one of which would be destroyed during construction of the haul road.

Construction

The road construction noise predictions indicate that sound level changes south of the road construction at Pontiac Ridge Road would be 37 – 40 dBA, a "slight" increase above background. South of the mine, the sound level would be at 63 dBA Leq. These sound level changes would be considered "slight" for anyone living or recreating more than 800 feet from the construction activities and "very serious" for anyone living or recreating within 800 feet of the construction activities based on the Ambient Plus 10 criterion. "Very serious" noise impacts can be expected to the two residences and at the three dispersed camping sites, when construction activities are taking place within 800 feet. The sound would maximize as each construction crew passes. The period of construction/ reconstruction activity is estimated to be 3 months. The State does not regulate daytime construction sound levels.

The haul trucks to be used for gravel placement are assumed similar to the trucks which would be used for ore haul. The hauling of road gravel is shown to meet the Ecology daytime sound level criterion of 60 dBA Leq (7 a.m. to 10 p.m.) for all residences at least 100 feet from the haul road. The predicted levels only meet the EPA Plus 10 Leq for distances greater than 200 feet from the road because of the low background level of ambient noise. Impact of this haul on the two residences along this route would be considered slight since both residences are greater than 200 feet from the road, but the impact at the three remaining dispersed campsites would be considered substantial, meaning these sites would likely not be used for the duration of road surfacing. Because the road would be under construction, access to these three sites would likely not be available anyway.

Ore and Supply Haul Road Sound Levels

The Buckhorn Mine ore would be hauled from the mine across Forest access roads, through Toroda and Curlew, then south on State Route 21 to the Kettle River mill. Assuming 50 loads of ore are hauled per day and 4 supply trucks visit the mine each day during the period of 6:00 a.m. to 6:00 p.m., seven days a week, this would be a heavy haul truck passing a given spot on the ore and supply access route approximately every 6.6 minutes. When employee traffic is included, a vehicle would be passing a given spot on the operations haul route every 2.4 minutes, on average, assuming all traffic is between 5:00 a.m. to 7:00 p.m. Because of work shifts, actual rates would be higher or lower depending on the time of day. Because of noise, dust, road closures, and safety concerns, the public would likely not utilize the area in the vicinity of the ore and supply haul route on National Forest System lands during ore haul operations. Because of noise and dust, wildlife would generally also not use this area (see Wildlife section later in this document).

Traffic noise levels on Forest access routes are summarized in Table III-45. It can be seen from the table that all of the predicted levels are less than the WSDOT Leq 66 criterion at the nearest residence, but maximum sound levels, Lmax, for loaded trucks would be in the vicinity of 84 - 87 dBA under all Action Alternatives. The ambient sound levels on Forest Roads are very low, in the 30s Leq (34 – 38). An increase in the sound level of 10 dBA or more, with a predicted level greater than 50 dBA is considered a "substantial" impact by WSDOT, while EPA considers this increase to be a "very serious" impact and this is above the Forest Service Recommended Maximum Noise Impacts to Recreational Areas such as roadside camps. There would be three dispersed camping sites within 200' of Alternative B. Noise impacts would likely eliminate use of these campsites since many are directly adjacent to the road or within 125 feet of the road. The general "Ambient Plus 10 dBA and greater than 50 dBA" level is met at distances between 200 to 500 feet from the haul roads on National Forest access roads.

Table III-45: Traffic Sound Levels, Project Traffic Levels, Leq

Location	Road	Ambient Conditions	50'	100'	200'	500'
11	FR 3575 (Alt. C)	47[87]	60	56	51	45
12	FR 3550 (Alt. B & B1)	38	60	56	51	45
15	OCR 4895 (Alt. D)	38	61	56	52	46
14	OCR 9480 (Alt. D)	55	64	59	55	49
18	FR 3575-120 (All)	34	60	56	51	45
19	Toroda Creek Rd. (All)	32 – 44	63	58	54	48

Ambient noise levels surrounding the haul and employee access roads would increase substantially during the life of the project. The noise levels would again decrease to near existing background levels upon completion of the reclamation of the project though most would return to near background once ore and supply haul has been completed. The improvement of haul and supply roads as part of this project would increase use of this area after the end of operations due to improved access likely causing a slightly higher baseline noise level than exists presently.

Noise impacts from ore and supply haul traffic on residences would be considered "slight" if more than 200 feet from the haul road during operations, but would be considered "substantial" if within 200 feet of the haul road under the Ambient Plus 10 criteria. Under unusual climatic conditions, which would generally be between 6:00 to 8:00 a.m. on days when background noise levels are low and temperature inversions have developed, "slight to substantial" noise impacts under EPA Region 10 criteria and Forest Service Guidelines for recreational areas, would occur since noise travels further without dampening during these conditions. Under these conditions, noise levels are similar within 200 feet of the noise source but the dampening effect of vegetation and distance are reduced beyond this distance.

Impacts on residences are summarized in Table III-46 below for all alternatives. Impacts on dispersed camping sites are summarized in Table III-47 below.

[87] Bird noise included, otherwise ambient may be closer to 38 similar to FR 3550

Table III-46: Summary of Impacts to Residences Within 500 Feet of Road

	Construction	Operation	Reclamation	Employee[88]
Alternative A	Not Applicable	Not Applicable	Slight	Slight
Alternative B and B1			Slight	
"very serious"	1	0 <100'		0 (0)
"substantial"	0	0 <200'		0 (1)
"slight"	0	1 >200'		1 (7)
Alternative C			Slight	
"very serious"	9	2 <100'		0 (0)
"substantial"	0	3 <200'		2 (3)
"slight"	0	4 >200'		7 (13)
Alternative D			Slight	
"very serious"	7	0 <100'		0 (0)
"substantial"	0	2 <200'		1 (3)
"slight"	0	5 >200'		6 (13)

Table III-47: Summary of Impacts to Dispersed Camping Sites Within 200' of Road

	Construction	Operation	Reclamation	Employee
Alternative A	Not Applicable	Not Applicable	Slight	Slight
Alternative B and B1			Slight	
"very serious"	3	3		3
"substantial"	0	0		0
"slight"	0	0		0
Alternative C			Slight	
"very serious"	17	15		15
"substantial"	0	2		2
"slight"	0	0		0
Alternative D			Slight	
"very serious"	0	0		0
"substantial"	0	0		0
"slight"	0	0		0

Noise impacts from employee traffic on National Forest System roads (Forest Roads 3550 and 3575-120) during the general hours of 5:00 a.m. to 9:00 a.m. and 5:00 p.m. to 9:00 p.m. would equate to a Leq at 50 feet in the range of 59 to 63 dBA. It can be seen that all of the predicted levels are less than the WSDOT Leq 66 criterion at the nearest residence, but noise impacts at residences or dispersed camping sites within 125 feet would be considered "substantial." All residences on this proposed haul route are greater than 125 feet from the haul route but all three dispersed camping sites are within 125 feet.

Cumulative Effects Alternatives B and B1

If Alternative B or B1 is selected, there are approximately 10 residences located within 500 feet of the Toroda Creek road between FR 3550 and FR 3575 that would be "slightly" impacted from ore haul on OCR 9495 Toroda Creek road. These residences would not be impacted under Alternative C. The impact would be considered "slight" since these residences are greater than 200 feet from the road. This is displayed in the summary table below.

[88] The numbers outside the "( )" represent residences along the ore and supply haul route only. The numbers inside the "( )" represent residences along both routes used by employees. Besides the ore and supply haul route, this would include Forest Road 3575-120 for Alternatives B, B1, and C and Forest Road 3575 for Alternative D.

Table III-48: Cumulative Impacts to Residences of Ore and Supply Haul from Mine Site to FR 3575 & OCR 9495 Junction

	Alternative A	Alternatives B & B1	Alternative C	Alternative D
OCR 9495 (3550–3575) [Alt. B, B1 & D]*	None	"Slight" 10	None	"Slight" 10
OCR 4895, 9480 & 9495 (3575-120 – 3550) [Alt. D][89]	None	None	None	"Very Serious" 1 "Substantial" 1 "Slight" 5
Cumulative Impact All Haul* "Very Serious" "Substantial" "Slight"	"Slight"	 0 0 12	 2 3 4	 1 3 20

Alternative B1

Direct and Indirect Effects

The noise impacts of Alternative B1 are similar to Alternative B except that there would be slightly greater impacts during reclamation because reclamation of the road between Forest Road 3575-120 and the patented mine site would be more extensive, though in both cases the impact would be "slight" since it would take place more than 800 feet from any residence. The other major difference is that under Alternative B1 the gravel portion of the ore haul road on National Forest land below Forest Road 3575-120 would be returned to a 17 – 18' width, with intervisible turnouts, similar to the existing 3550 road. The surfacing on the reclaimed portion would be placed on the surface of the remaining portion, ripping the area that has had the surfacing removed, and planting this area with grasses and herbs. This narrowing of the road would likely be done with a grader, a bulldozer and a roller/compactor. Noise levels would be similar to road construction but the duration at any given point would be short. No residences are within 800 feet of where this reclamation would take place because the lower portion of the Marias Creek road would be paved near the residence and not reclaimed.

The other difference would be that empty and full ore trucks and supply trucks would generally only be allowed on the access road between 6:00 a.m. and 6:00 p.m. while Alternative B only restricts full ore trucks to 6:00 a.m. to 6:00 p.m.; empty ore haul trucks and supply trucks could operate outside of these hours.

Alternative C

Direct and Indirect Effects

In general, the noise impacts of this alternative would be similar to Alternative B with the following differences. During road construction/reconstruction on National Forest System lands and rights-of-way, very serious noise impacts can be expected to 9 residences and 17 dispersed camping sites under Alternative C when construction activities are taking place, within 800 feet of those residences/sites. The period of construction/ reconstruction activity

[89] Impacts include off National Forest land or rights-of-way, but cumulative to the junction of FR 3575 and OCR 9495.

is estimated to be 3 - 4 months under Alternative C depending on the number of trucks used to haul gravel for placement on the haul route.

The trucks used for gravel surfacing during reconstruction are assumed similar to the trucks which would be used for ore haul. Impacts for ore and supply haul, and employee access would be similar to gravel surfacing haul. The hauling of road gravel and ore and supply haul is shown to meet the Ecology daytime sound level criterion of 60 dBA (7 a.m. to 10 p.m.) at all residences that are at least 100 feet from the road. Two residences on this haul route and all but two of seventeen dispersed camping sites are less than 100 feet from the proposed haul route so impacts at these locations would be considered "very serious," refer to Tables III-46 and III-47.

The predicted noise levels from haul trucks only meet the EPA Plus 10 dBA, Leq criteria at distances greater than 200 feet from the road because of the low background level of ambient noise on this road. Impact of this haul on two residences and 15 dispersed camping sites along this haul route would be considered "very serious" since they are within 100 feet of the road. Impact of this haul on three residences and two dispersed camping sites along this haul route would be considered "very serious" since they are within 200 feet of the road. Impacts at the four remaining residences within 500 feet of the haul route would be considered "slight" since they are greater than 200 feet from the haul route, refer to Tables III-46 and III-47.

Noise impacts from employee traffic on National Forest System roads (Forest Roads 3575 and 3575-120) during the general hours of 5:00 a.m. to 9:00 a.m. and 5:00 p.m. to 9:00 p.m. would equate to a Leq at 50 feet in the range of 59 to 63 dBA. It can be seen that all of the predicted levels are less than the WSDOT Leq 66 criterion at the nearest residence, but noise impacts at residences or dispersed camping sites within 125 feet would be considered "substantial." Two residences and 15 camping sites are within 125 feet. About 91 acres of the Jackson Creek IRA are within 500 feet of the Nicholson Creek road and noise impacts within that area under Alternative C would be "substantial." Outside of the 500 foot zone, noise impacts would be "slight." The noise impact at the seven residences and two dispersed camping sites greater than 125 feet would be considered "slight."

Ore haul is proposed to be accomplished in 6 days per week with supply haul only proposed for 5 days a week, except the infrequent, unexpected need for supply delivery on weekends. This would equate to a heavy haul truck passing a given spot on the road approximately every 5.7 minutes between 6:00 a.m. to 6:00 p.m., Monday to Saturday with no heavy haul truck traffic on Sundays. When employee traffic is included, a vehicle would be passing a given spot on the operations haul route every 2.3 minutes assuming all traffic is between 5:00 a.m. to 7:00 p.m., Monday to Saturday. Because of work shifts, actual rates would be higher or lower depending on the time of day. However, because of noise, dust, and safety concerns, the public likely would not utilize the area in the vicinity of the ore and supply haul route during ore haul operations. Because of noise and dust, wildlife would generally also not use this area (see Wildlife section later in this chapter).

Cumulative Impacts

The proposed Little Nicky Timber Sale on DNR land in the lower portion of Nicholson Creek would haul out about 500 loads of logs over 3 to 5 months, 50 to 100 working days depending on the number of trucks hauling logs. Approximately 25 loads of rights-of-way logs and several hundred loads of tractor yarded logs have already been hauled off this

project. The cumulative impacts of this haul, in combination with haul under Alternative C would be considered “very serious” for two residences within 100 feet of the haul route; “substantial” for the three residences within 200 feet but greater than 100 feet of the road; and “slight” for the other four residences within 500 feet of the haul route. There would be no impacts from this haul on dispersed camping sites. The haul from this timber sale and ore and supply haul would increase disturbance to these residences if not going on at the same time but would change impacts little if going on simultaneously. Haul from this timber sale may be delayed during road construction/ reconstruction on the lower section of Forest Road 3575. Because of timing, most haul on this timber sale may be completed prior to the start of possible road construction.

Alternative D

Direct and Indirect Effects

The noise impacts of this alternative would be similar to Alternative B with the following differences. There are approximately 7 residences within 500 feet of the National Forest System roads or rights-of-way portion of the haul route, with one within 125 feet.

There are no dispersed camping sites affected.

During road construction/reconstruction on National Forest lands and rights-of-way, very serious noise impacts can be expected to 7 residences when construction activities are taking place within 800 feet of the residence. The period of construction/ reconstruction activity is estimated to be about 2 months.

The trucks used for gravel surfacing haul are assumed similar to the trucks which would be used for ore haul. Noise impacts of ore and supply haul would be similar to gravel haul. The hauling of road gravel and ore and supply haul is shown to meet the Ecology daytime sound level criterion of 60 dBA (7 a.m. to 10 p.m.) since all residences are at least 100 feet from the road. The predicted levels meet the EPA Plus 10 Leq at distances greater than 200 feet from the road because of the low background level of ambient noise on this road. Impact of this haul would be considered “substantial” at one residence which is within 200 feet of the road under the EPA Ambient Plus 10 criterion. Impact on the other six residences would be considered “slight.”

Noise impacts from employee traffic on National Forest System roads (Forest Roads 3575-120 and 3575) during the general hours of 5:00 a.m. to 9:00 a.m. and 5:00 p.m. to 9:00 p.m. would equate to a Leq at 50 feet in the range of 59 to 63 dBA. It can be seen that all of the predicted levels are less than the WSDOT Leq 66 criterion at the nearest residence, but noise impacts at residences within 125 feet would be considered “substantial” under the EPA Ambient Plus 10 criterion. One residence is within 125 feet. The noise impact at the other six residences would be considered “slight.”

Ore and supply haul would be accomplished in 5 days per week. This would be a heavy haul truck passing a given spot on the road approximately every 4.7 minutes Monday to Friday, except the infrequent, unexpected need for supply delivery on weekends. When employee traffic is included, a vehicle would be passing a given spot on the operations haul route every 2.1 minutes assuming all traffic is between 5:00 a.m. to 7:00 p.m., Monday to Friday. Because of work shifts, actual rates would be higher or lower depending on the time of day. Because of noise, dust, and safety concerns, the recreating public likely would not

utilize the area in the vicinity of the ore and supply haul route during ore haul operations. Because of noise and dust, wildlife would generally also not use this area (see Wildlife section later in this document). Because most of this route is not on National Forest System land, but is in Forest Service rights-of-way across private land or is land managed by the Department of Natural Resources, the impact on recreational users on National Forest system land would be "slight."

Cumulative Effects

If Alternative D was selected, there are approximately 17 additional residences between FR 3575-120 and FR 3575 on County roads that would be affected, refer to Table III-48. Effects to 15 of these residences is defined as "slight" with effects to 1 residence considered "substantial" and the impact to the other residence "very serious" since it is within 100 feet of the haul route, under the Ambient Plus 10 criterion.

Conclusion

During mine construction, noise impacts on five of the six residences on private land on Forest Road 3575-120, the supply and employee access road, would be considered "slight," with impacts on the other residence considered "substantial." During construction of the ore and supply haul route, noise impacts would be considered "slight" for anyone living or recreating more than 800 from the construction activities and "substantial" for anyone living or recreating within 800 feet. The sound level would maximize as each construction crew passes. During ore haul noise impacts at all residences or dispersed camping sights within 125 feet of the haul road would be considered "substantial." No residences are within 125 feet of the ore haul route in Alternative B or B1, two are under Alternative C and in Alternative D. Because of noise, three dispersed recreation sites in Alternative B or B1 are not likely to be used during ore haul, and one would be eliminated. In Alternative C, fifteen dispersed site are not likely to be used. No dispersed sites are impacted in Alternative D. Noise impacts during reclamation for all action alternatives are considered "slight." Noise impacts from quarrying and rock crushing/ screening at the Beal Pit for road surfacing would be considered "slight" at adjacent residences due to distances and existing noise levels, though noticeable. Impacts of the hauling of surfacing to National Forest roads would be considered "slight" for most residences, but "substantial" for some residences located within 200 feet of the road due low present ambient noise levels.

There should not be a long-term health effect on local residents or recreation users from noise on the project along any haul route based on predicted noise levels. Most project impacts would be considered noise annoyance. The general noise effect of the project would be to diminish recreational values in the area since most recreation use is associated with roads. Noise impacts to most dispersed camping sites along the haul routes would be consider "very serious" and these sites would likely not be used. Noise impacts from the action alternatives would comply with Washington State Noise Regulations. The noise effects of this project would be "substantial" for recreation users and for alternatives that have residences located generally within 125' of the ore and supply haul route on National Forest land and rights-of-ways (Alternatives C and D). Residences along the ore and supply haul route in Alternatives B and B1 are over 200 feet from the route and impacts would be "slight" to these residences.

Scenery

The section below summarizes the affected environment information, along with direct, indirect, and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Scenery Discipline Report by Buckhorn Project Manager Phil Christy dated November 22, 2006 in the analysis file.

AFFECTED ENVIRONMENT

Buckhorn Mountain and the surrounding Okanogan Highlands landscape are characterized by moderately steep topography, ranging from rugged, mountainous terrain to rolling hills. The area's hills and mountains are characterized by broad, rounded summits. In the higher elevations, the landscape is heavily forested with coniferous trees such as larch, Douglas fir, and ponderosa pine. Occasional clearings are apparent, some of which are natural but many are a result of past logging. In the lower elevations, frequent clearings used primarily for agricultural purposes dominate the landscape. The dominate colors in the higher elevations include blues and greens of the forest vegetation; light browns in open and cleared areas, and buff, dark brown, and red colored rock outcroppings. In the lower elevations, yellows and light greens predominate due to the extensive grazing lands interspersed with coniferous vegetation and homes.

Based on the Okanogan National Forest, Forest Plan (USDA, 1989), the entire project area where impacts are proposed to occur has a low visual significance, except the lowest portion of Marias Creek which is a sensitivity level 2 and is considered natural appearing. The visual quality objective for the project area is maximum modification.

The hills and ridges surrounding Buckhorn Mountain obscure most activities proposed on National Forest land as part of this project.

Twelve viewpoints/corridors were considered based on topographic maps and field knowledge. Shaw Environmental, Inc, 2004, developed cross sections for nine of these corridors. The other three are where Forest Roads meet Okanogan County Roads (OCR) 9495 and 4895. Based on a detailed map analysis, five major corridors were found that have views of Buckhorn Mountain.

- To the west of Buckhorn Mountain, the Oroville-Toroda Creek Road corridor (OCR 9480) has several viewpoints between Hee Hee Stone and Mary Ann Creek. The east side of the mountain is screened from view by the ridge running generally north-south from Buckhorn Mountain.
- To the southwest, the Nealy Road Corridor (OCR 4861) allows views to the mountain. After its intersection with OCR 4887, however, Buckhorn Mountain is screened by the intervening hills. The east side of the mountain is screened from view by the ridge running from Buckhorn Mountain. The summit and east side of Buckhorn Mountain are not visible from the town of Chesaw or from the Bolster area.
- From the east, Buckhorn Mountain and the east slopes of the mountain are visible from three locations along Ferry County Road (FCR) 502, looking up the Nicholson Creek drainage, totaling just over three quarters of a mile in length. The majority of Buckhorn

Mountain is not visible from Toroda Creek road, OCR 9495, south of Nicholson Creek, due to steep hills rising immediately above the road.

- From the north, Buckhorn Mountain is visible from British Columbia Highway 3 as it climbs out of the Kettle River Valley, west of Rock Creek. East of Rock Creek, Highway 3 extends along the Kettle River Valley, which is too low in elevation to provide views of Buckhorn Mountain. The east side of the mountain is screened from view by the ridge running from Buckhorn Mountain.
- Mount Bonaparte (elevation 7,257 feet), located 12 miles southwest of Buckhorn Mountain, has a developed hiking trail and a historic lookout tower located at its summit. The project site is not visible from the hiking trail as it ascends, but is visible from the summit. The summit provides a wide, panoramic view of the Okanogan Highlands. The east side of the mountain is screened from view by the ridge running from Buckhorn Mountain.

Based on a detailed map analysis and field visits, the first ¼ to 1 mile of any of the ore and supply haul routes would be visible from the adjacent Okanogan County road, OCR 9495 or 4895 for a period of 15 to 60 seconds when traveling on the County Road. The upper portions of the proposed new road above Forest Road 3575-120 to patented land and the upper portions of the supply route during construction, Forest Road 3575-140, may be slightly visible, or dust or headlights from their use may be visible, from Ferry County Road (FCR) 502 at three locations in the vicinity of Graphite Creek.

The methodology used, a definition of the study area, visual quality inventory and management plans, characteristic landscape, site visibility, view corridors and viewpoints are all discussed in the Visual Assessment Baseline Report, Crown Jewel Project, January 1993, prepared by Susan Corser (ACZ, 1993) and the Scenic Resources Discipline Report, prepared by URS (URS, 2005).

ENVIRONMENTAL CONSEQUENCES

Impacts of the proposed project on National Forest System (NFS) land and from adjacent scenic corridors vary little between the action alternatives. The visual impacts associated with all of the action alternatives are discussed below. The greatest visual impact of any action alternative would primarily concern the Beal backfill site on private land. Rock for the roads on NFS lands would be from this site.

The analysis area for most direct and indirect scenic effects is considered the Canadian border on the north, the North Fork Beaver Creek/OCR 9480 on the south, Toroda Creek/OCR 9495/FCR502 on the east and OCR 4883/9480 on the west. Also included are the effects of activities on National Forest System land when viewed from County roads, highways, and major recreation points.

The cumulative effects boundary used for assessing effects are county roads, highways, and major recreation points which can see Buckhorn Mountain. Cumulative effects are the overall impacts of all past, present, and reasonably foreseeable future actions. Actions that were considered included the mine proposal on private lands and timber sales. Also included are the effects of the gravel crushing and haul for placement of gravel on National Forest System roads. All reasonably foreseeable future projects within the next decade were included, although additional currently unknown projects may arise in the future.

Alternative A – No Action

Direct and Indirect Effects

There would be no adverse visual impacts due to not implementing the proposed project.

Cumulative Effects

Because the project would not occur, no cumulative effects would occur. However, selection of this alternative would result in continued reclamation efforts of the Buckhorn Mountain site from existing impacts of previous mineral exploration and pre-development activities would continue to improve the scenic integrity of the site. Slight beneficial effects to visual resources are anticipated because of the planned reclamation. As a result, lands disturbed from past activities would be restored.

Effects Common to all Action Alternatives

Direct and Indirect Effects

Impacts of the proposed project on existing scenic resources, varies little between the alternatives. Some of the impacts are just transferred from one location to another. Actions on National Forest System lands are either obscured from view from most potential view corridors or the views fall into a background distance zone of 8 – 9 miles. In general, the first ¼ to 1 mile of any of the ore and supply haul routes would be visible from the adjacent Okanogan County road, OCR 9495 or 4895, for a period of 15 to 60 seconds when traveling on the County Road. Paving these sections of roads in Alternatives B1, C and D would decrease the visibility problems because less dust would be visible but the vehicles and their lights would still be visible. The individual effects are further discussed under each alternative.

The proposed new access road to patented land, similar between all action alternatives, above Forest Road 3575-120, may be slightly visible, or dust and lights from it may be visible from Ferry County Road (FCR) 502 on three separate road segments, totaling just over ¾ of a mile in the vicinity of Graphite Creek. Present traffic on FCR 502 is estimated to be 162 vehicles per day near the Okanogan/Ferry County line. An estimated 55% of the traffic past these viewpoints would be mine related once operations start, about 363 total vehicles per day.

With a vehicle traveling the section of road between Forest Road 3575-120 and the patented land every 2 or 3 minutes, most vehicles headed west on Ferry County Road 502 would likely see an indication of a vehicle traveling this route. Trees, where present, below the newly constructed road would screen the road, fill slopes and cut-banks to some extent but dust is likely to rise above these trees and headlights would be able to be seen between the trees in darkness. Much of this section of road is constructed in such a manner that the bottom of the fill slope to the top of the cut slope would be a difference in elevation of 50 to 60 feet. Many of the trees in the area are 80 to 90 feet tall. There is a bald knob between the viewpoints and the road that as a person gets closer to the Okanogan/Ferry County boundary, trees on the back side of the knob start to screen the view. Dust control and seeding of road cuts and fills on this section of road would be very important for minimizing impacts and making it look more natural and meeting the maximum modification visual quality objective.

The project area only needs to meet a maximum modification visual quality objective, which allows human activity to dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background. All project disturbances on National Forest land should meet this standard. Although the new road construction between Forest Road 3575-120 and the patented lands would be visible from FCR 502 in the vicinity of Graphic Creek, this background view would be close to the horizon and disturbance on the adjacent patented lands, including the water tower and radio repeaters higher on Buckhorn Mountain, would draw attention away from the disturbance on National System Forest land, this section of road that is visible would meet the maximum modification standard.

Another area of the project that would be visible from a distance would be along Forest Road 3575-140, which is proposed to be used during construction of the ore and supply haul route for up to a four month period. This area would be visible from the same points on Ferry County Road 502 as discussed above. During this period, no more than 2 to 4 commercial haul trucks would likely be on this road every hour, though there would be other construction related traffic such as employees arriving and departing work. Employee traffic is estimated to provide 100 to 150 passages a day. Supply transport is estimated to provide 20 to 40 passages a day. The upper section of this road, particularly above the junction with Forest Road 3575-141, would be visible from Ferry County Road 502. Most of this section of road has trees along the road which would screen much of it from view. Dust from passing vehicles and headlights would more likely be seen than the vehicles themselves. This section of road would be used infrequently during operations to access the water tower so the visibility of dust and vehicles during that time would be low. Because this background view would be close to the horizon and disturbance on the adjacent patented lands would draw attention away from the disturbance on National Forest land, this section of road would meet the maximum modification standard.

The headlights of ore and supply haul trucks, employee and company passenger vehicles would be visible to residents living along Forest Road routes during both construction and operations. With the proposed haul schedules of each alternative, it would be dark during part of the day, mostly from October to April during ore haul. The headlights, by themselves, would cause little visual effect. The greater impacts would be from noise and dust from the vehicles. Noise and dust are discussed previously in separate sections of this chapter.

When driving on the ore and supply haul roads associated with the project, the roads would be wider and new road construction would generally not follow contours as in a typical forest road, but these roads would still meet the maximum modification standard. The surrounding areas to the roads would still look natural and would meet the maximum modification standard when viewed as background.

Other project facilities such as the infiltration pipeline/road, infiltration gallery, cattle guards, gates, corrals, fences, culvert replacements, and water guzzlers in Marias and Nicholson Creeks would meet the maximum modification standard when viewed as background. For forest visitors who hike the infiltration pipeline/road, the openings (manholes) down to the pipe would not look natural, but these openings would only be seen by a small number of the recreating public who walk the road, generally during hunting. The water dosing tank for the infiltration gallery, above the 3575-120 road, with associated light would also not look natural. When viewed as background, the light at the infiltration gallery would not be visible, because vegetation would screen the light. These facilities would still meet the maximum

modification visual quality objective because, when viewed as background, they would not be visible.

Alternative B

Direct and Indirect Effects

The first ¼ mile of the ore and supply haul route would be visible from adjacent Okanogan County Road 9495, Toroda Creek Road, for a period of about 15 seconds when traveling on the County Road. Not paving the first section of Forest Road 3550, Marias Creek Road, would make vehicles more visible for travelers on Toroda Creek Road due to the dust raised. Because a vehicle would be traversing this section of road approximately every 2 to 3 minutes, some dust would hang in the air most of the time during the drier months between 5:00 a.m. to about 7:00 p.m., 7 days a week, especially if dust suppressants become inactive from lack of water. The dust would generally be the most visible between 5:00 a.m. and 9:00 a.m. and 5:00 p.m. to 7:00 p.m. due to the heavier traffic loads from employees arriving and leaving work. This dust would create a slight safety concern since this intersection could be slightly obscured at times by dust.

Alternative B1

Direct and Indirect Effects

The first ¼ mile of the ore and supply haul routes would be visible from adjacent Okanogan County Road 9495, Toroda Creek Road, for a period of about 15 seconds when traveling on the County Road. Because the first half mile of the route would be paved so there would be little visible dust in the air, use of the road would be less visible than under Alternative B. A vehicle would be traversing this section of road approximately every 2 to 3 minutes between 5:00 a.m. to about 7:00 p.m., 7 days a week. Vehicle traffic would be the highest between 5:00 a.m. and 9:00 a.m. and 5:00 p.m. to 7:00 p.m. due to the heavier traffic loads from employees arriving and leaving work.

Alternative C

Direct and Indirect Effects

The first mile of the ore and supply haul route would be visible from adjacent Toroda Creek Road, for a period of about 60 seconds when traveling on the County Road. Because the first 2.4 miles of this route would be paved, there would be little visible dust in the air A vehicle would be traversing this section of road approximately every 2 to 3 minutes between 5:00 a.m. to about 7:00 p.m., 6 days a week, Monday through Saturday. Only employee traffic would be expected on Sundays since there would be no ore haul. There would be no supply haul on Saturdays or Sundays except for the transport of infrequent, unexpected shortages. Vehicle traffic would be highest between 5:00 a.m. and 9:00 a.m. and 5:00 p.m. to 7:00 p.m. due to the heavier traffic loads from employees arriving and leaving work. Because of no ore haul on Sundays and only infrequent supply haul on Saturday and Sunday, the scenic impacts would be less than Alternatives B and B1.

Alternative D

Direct and Indirect Effects

The first ¼ mile of the ore and supply haul route would be visible from the adjacent Okanogan County Road 4895, for a period of about 15 seconds when traveling on the County Road. Because the first 1.3 miles of the route would be paved, there would be little visible dust in the air, thus use of the road would be less visible than Alternative B. Since there are fewer travelers on County Road 4895 which is gravel and does not have dust abatement, this alternative would have the least scenic impacts to the general population. A vehicle would be traversing this section of road approximately every 2 to 3 minutes between 5:00 a.m. to about 7:00 p.m., 5 days a week. Only employee traffic would be expected on Saturdays and Sundays except for infrequent, unexpected supply deliveries. Vehicle traffic would be the highest between 5:00 a.m. and 9:00 a.m. and 5:00 p.m. to 7:00 p.m. due to the heavier traffic loads from employees arriving and leaving work. Because of no ore haul on Saturdays and Sundays and only infrequent supply haul, the scenic impacts would be less than Alternatives B, B1, or C.

Cumulative Effects for All Alternatives

The cumulative visual impacts of any alternative considered would primarily concern the patented mine site, use of the Beal borrow site for gravel for ore haul roads on National Forest System land, and the Little Nicky Timber Sale. Other timber sales are presently not planned within the analysis area on government lands. Timber harvest on private lands surrounding the Buckhorn Block is likely to continue. The greatest visual impact of any action alternative would primarily concern the Beal backfill site on private land. Rock for the roads on NFS lands would be from this site as well as backfill for the mine on private land.

Either the mine site is obscured from view from most potential view corridors or the existing views fall into a background distance zone of over 4 miles. For example, the top of the development rock pile and, at times, steam from the upper ventilation raises may be visible from the Mount Bonaparte summit viewpoint, but this would be at a distance of over 12 miles. These same facilities, plus the water tower near the summit and the radio repeaters on the summit of Buckhorn Mountain would also be visible from the Neely Road viewpoint, the Molson-Chesaw Road viewpoint, and the Highway 3 viewpoint in Canada. Most of the mine facilities, access roads to the upper portal and steam from the ventilation raise would be visible from viewpoints along Toroda Creek in the vicinity of Graphite Creek on Ferry County Road 502. These views would fall into a background distance zone of over 8 miles. Present traffic is estimated to be 162 vehicles per day near the Okanogan/Ferry County line. These facilities would draw viewers attention away from activities on adjacent National Forest System land since they would be more noticeable, but since they are in the background, would be muted.

At each of the above viewpoints, lights, and glare, would be visible from some distance away, depending on placement and the type of stationary and mobile lights used. The headlights of ore and supply haul trucks would also be visible from most viewpoints, at times.

Maintenance of Forest Roads 3575-120 and 3575-140 during construction of the mine would be noticeable to residents living on the Pontiac Ridge road and living along the Cow Camp road, Forest Road 3575-120, from trucks placing surfacing on the road and other

road maintenance activities such as dust control and grading roads. These activities were approved in September 2006 as part of a Road Use Permit. The vehicles using Forest Road 3575-140, particularly above the junction with Forest Road 3575-141, under this permit would be visible from several points on FCR 502. Most of this section of road has trees along the road which would screen much of it from view. Dust from passing vehicles and headlights would more likely be seen than the vehicles themselves. Because this background view would be close to the horizon and disturbance on the adjacent patented lands would draw attention away from the use of this road, this section of road would meet the maximum modification standard.

The Little Nicky Timber Sale, presently being harvested on DNR lands above Forest Road 3575, would be noticeable along the road because of the contrast between treated stands and untreated stands. Under all of the action alternatives, more traffic would be expected to use Forest Road 3575 for either recreational activities or access to the mine site. Much of the 3575 road east of the 3575-150 junction has not had timber harvest directly adjacent to the road or the past timber sales have extensive re-vegetation.

A key land use activity in the project area is timber harvest. Federal, State, and private timber harvests have historically occurred regularly with their corresponding effects on visual resources. No timber harvest on federal lands in the area are proposed in the next five years, but a number of State timber sales are sold or planned in the Toroda Creek and State Highway 21 areas. These, along with any timber harvest on private lands surrounding the Buckhorn Block are expected to continue as these lands are developed over time, which would continue to modify the natural landscape surrounding the Buckhorn Block

Gravel for placement on roads on National Forest System land is proposed to come from the Beal Borrow site, on private land, on West Kettle River Road, FCR 501. When traveling south out of the Toroda area, moving from a middleground to foreground view provides an extended direct view of the proposed borrow site, access road, and stormwater diversion ditch for approximately 1.6 miles. The view of the proposed site is directly in front of viewers once they pass Bamber Creek Road for approximately 0.7 miles when coming from the south. The open extended view, and lack of screening foliage combine to form a low overall visual absorption capability (VAC) rating. The view of the Beal Borrow site from the homes along the Custom's Road view corridor was assigned a moderate VAC rating primarily due to the middle ground distances involved and the presence of foliage along the river that would partially screen the Beal property, but the Beal property would generally be visible at most times to some extent. A dirt berm adjacent to the proposed pit has been built to screen most pit activities from view from the Customs Road area. The visual impacts of use of this site would last for a period of 8 to 9 years for borrow to backfill the mine, but the site would only be used extensively to provide gravel for Forest Roads for a period of 3 to 4 months the first year. Additional gravel to resurface roads from wear would be hauled over the operating life of ore and supply haul but these gravel trucks would generally not be distinguishable from the trucks hauling backfill to the mine site and would likely be the ore haul trucks on their return trip to the mine site from the mill. The Beal borrow site would be visible to all travelers on West Kettle River road, FCR 501, which presently has 474 to 520 vehicle passages per day when K2 mine traffic is not included. The proponent has indicated that operations at K2 may be restarted once Buckhorn is operational to recover the remaining ore at K2. This would likely add 6-7 truckloads of ore per day for 50-55 days. However, Kettle River Mill operates at 1500 tons, regardless of where the ore is coming from, and K2 ore is likely to be hauled when Buckhorn ore is not available, so any increases would be slight. The excavation of road gravel and backfill material from this site would

have the greatest visual impact of any of the components of this project. Lighting at the site would pose the greatest night-time visual impact because of the proximity of residents and the West Kettle River Road, FCR 501.

Electrical power would be provided to the mine site buried in the road across National Forest System lands. Under Alternatives B and B1, a section of the power line that crosses Section 36 (DNR managed lands) and Crown private land would deviate from the road route in possibly two areas. The power line across these two areas may be buried in a more direct route or transition to an above ground line and return to a buried line in the mine access road. In general, the only location where this may be visible from on NFS lands is from the 3575-120 road through private land at Cow Camp. The new power line to the site under Alternatives B and B1 would include the placement of a pole adjacent to Forest Road 3550, Marias Creek, at the junction with the Toroda Creek road which would be visible to travelers on both roads.

Conclusion

Visual impacts under all action alternatives would not be significant and would meet the maximum modification standard on National Forest System land.

Recreation

The section below summarizes the affected environment information, along with direct, indirect, and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Recreation Discipline Report by Buckhorn Project Manager Phil Christy dated November 22, 2006 in the analysis file.

AFFECTED ENVIRONMENT

Existing recreation conditions were analyzed by examining the potentially affected recreational facilities and resources and the level of recreation use these facilities receive. The level of use is described in terms of recreation visitor days per year and the number of hunters and hunter days per year. The background report *Crown Jewel Project: Recreation Baseline Report* prepared by Corser (Corser, 1993) identified recreation opportunities for this area. Information on recreation resources and facilities on National Forest System land was updated from what was presented in this report.

Data on hunting activities and game harvests comes from the Washington Department of Fish and Wildlife (WDFW, 2005). Background information on recreation use on the Okanogan National Forest was obtained from the National Visitor Use Monitoring project (NVUM) [Forest Service, 2002]. Information is also presented on visitor use of potentially affected developed campgrounds and organization camps on the Tonasket District.

Recreation resources and activities that may be directly affected by the Project are mostly dispersed and developed recreation resources and activities, including hunting, firewood gathering, driving for pleasure, berry picking, and mushroom picking, in the Okanogan National Forest adjacent to the Buckhorn Mountain area. Other recreational resources and activities that may be affected are sightseeing along the scenic byways or loops in Okanogan and Ferry Counties. In addition, recreation resources and activities may be affected by changes in population that occur because of the project.

The top five recreation activities of visitors to the Okanogan National Forest are viewing wildlife/nature, driving for pleasure, general relaxation, hiking/walking, and developed camping. When asked to pick one out of several activities as their primary activity for their current recreation visit to the forest, the top primary activities were viewing wildlife/nature, driving for pleasure, cross-country skiing, developed camping, and hiking/walking (Forest Service, 2002).

Visitors participating in recreational activities on the Okanogan National Forest come from a wide area; a survey of recreation visitors conducted in 2000 recorded 238 different home zip codes (Forest Service, 2002).

Bonaparte Lake and Lost Lake Campgrounds, 3 – 5 miles southwest of the project area, are the most visited campgrounds on the Tonasket Ranger District. Both Bonaparte Lake and Lost Lake Campgrounds receive heavy use week long in July and August, while use on weekends during May, June and September, October tends to be moderate. Beth Lake and Beaver Lake are also popular campgrounds, especially among residents of Okanogan and Ferry Counties. All of the campgrounds in the Five Lakes area (Beth, Beaver, Little Beaver, Lost, and Bonaparte) are usually full on summer holiday weekends, but use levels are currently not considered to be over capacity.

Visitors to Beth and Beaver Lake campgrounds typically access the facilities by driving along the Oroville-Toroda Creek Road (Okanogan County Road 9480). Access to Lost Lake Campground is generally from Highway 20 or Havillah. Access to Bonaparte Lake is generally from Highway 20.

Trout fishing is very popular, attracting anglers from throughout the state at these campgrounds and adjacent lakes. Beaver, Little Beaver, Lost, Beth, and Bonaparte Lakes are very popular because of the unique fishing experience they provide. These are high-elevation lakes providing fishing in the late spring and summer months, compared to most other lakes in the state, which are often fished out by Memorial Day.

The framework for recreation planning by the Forest Service is the recreational opportunity spectrum, an inventory system that categorizes the desired range of recreational opportunities in a given area as falling into one or more of seven classes, ranging from “urban” to “primitive.” The recreation opportunity spectrum describes the settings for activities occurring in the area on National Forest System land, the type of recreational experience, and the managerial intent.

The current Land and Resource Management Plan (Forest Plan) for the Okanogan National Forest, completed in 1989 (Forest Service, 1989), provides an inventory of recreation opportunities in the National Forest, as well as future management prescriptions for the area. The results of the inventory are presented on the plan’s “recreation opportunity spectrum” map, as part of the Forest Plan. The Buckhorn Block is inventoried as Roaded Natural and Semi-primitive Non-motorized ROS classes. Please refer to the Recreation Discipline Report, in the analysis files, for details about the existing recreation opportunity spectrum.

The recreation opportunity spectrum designations were established to describe existing conditions in the forest at the time the Forest Plan was signed. After developing the inventory, management prescriptions were developed to guide future activities in these areas. The plan’s management prescriptions designated most of this area to be modified to a “roaded

modified" recreation opportunity spectrum. This means that recreation opportunities are provided in a substantially modified environment, except for campsites. Roads, landings, slash and debris may dominate some areas. Access is relatively easy, provided by sedan, trailer, and recreation vehicles.

The Forest Service's current direction for the Jackson Creek Inventoried Roadless Area does not allow for timber harvest or road construction, except under very limited circumstances (see the Unroaded/Undeveloped Character section of this chapter).

Hunting is the predominate recreational activity occurring in the immediate vicinity of the proposed mine site. Large game harvest data collected for the Okanogan East Game Management Unit by the Washington Department of Fish and Wildlife (WDFW) provide an indication of large game hunting trends in the area around the mine site. Deer hunting in this game unit is the primary activity, with a 6-year annual average (1999 – 2004) of 3,515 hunters for deer and 722 hunters for bear. Hunter days for this game management unit averaged 17,203 hunter days for deer and 4,699 hunter days for bear. Total harvest for this 6-year period averaged 617 deer and 47 bear for the game unit. Between 1999 and 2004, hunting for large game species on this game unit showed a mixed trend in terms of number of hunters and hunter days but a generally upward trend in hunter success ratios for deer and a mixed trend for bear.

The Okanogan East Game Management Unit (204) is bounded on the west by the Okanogan River, on the south by Highway 20, on the east by Toroda Creek and the Kettle River, and on the north by the Canadian border. National Forest System land in the Buckhorn Block represents slightly over 9% of the total area in this Game Management Unit.

The Buckhorn Block is a proclaimed block of the Okanogan and Colville National Forests that is spatially separate from other proclaimed areas of the Forests, and is surrounded by private, State, and a small amount of Bureau of Land Management land.

Small game hunting also occurs near the proposed project site, primarily for grouse. Grouse and quail harvest data are compiled by the WDFW for Okanogan County. The small game hunting trends shown by these countywide data provide the closest approximation of small game hunting trends near the project site. Between 2000 and 2004 small game hunting showed a mixed trend in terms of number of hunters with a downward trend in terms of total harvest.

Numerous informal hunting camps, particularly used during the general rifle season, are scattered in the Buckhorn Area. Hunting occurs throughout the area in the fall and it is not unusual to encounter several hunting parties each mile of road traveled along and off Forest Roads 3575, 3575-150, and 3575-120. Fewer hunters are found along and off Forest Road 3550. Hunting camps are located on flat areas and landings along open roads, including one camp normally on the landing at the end of the 3550-125 road. Almost all of the dispersed camping that takes place in the Buckhorn area is related to hunting activity, deer rifle seasons, deer archery season, bear hunting, and bird hunting. Because there are no developed campgrounds in the Buckhorn Block, data on numbers of people camping in this area is not available.

The level of fishing in the Buckhorn Block is very low. Some fishing occurs along Toroda Creek, but public access is very limited. The Five Lakes area, south of the Buckhorn Block, is

where most fishing takes place. Fishing also takes place off National Forest System land in the Kettle River and along Milo Creek.

The Project area was once part of the North Half of the Colville Indian Reservation, and was returned to the Federal government. Effects to tribal members would be similar to the effects on all hunters and anglers described in this section.

The existing road system in the Buckhorn Block is used mostly by local residents, except during hunting seasons, for recreational activities. There is a limited amount of hiking, horseback riding, cross country skiing, bird watching, plant gathering, firewood gathering, berry picking, mushroom gathering, and snowmobiling in the area. Most of the organized snowmobiling occurs south of the project area near Bonaparte and Lost Lakes and from Highlands SnoPark. Most of the organized cross-country skiing occurs from Highlands SnoPark on the adjacent developed trail system that is maintained and groomed in the winter by Highlands Nordic Ski Club. Most hiking occurs south of the project near the developed trails on and near Bonaparte Mountain. A limited amount of hiking did take place in the Cedar and Jackson Creek/Graphite Mountain area but much of this has been discouraged by Border Patrol intercepts in recent years. Historically this area contained several well-used trails but roads eventually replaced these trails over time.

There are recreational activities related to plant gathering and bird watching that occur occasionally in the Buckhorn Block. Members of the Confederate Tribes of the Colville Reservation use the general area to gather native plants, mushrooms, and berries, such as huckleberries, serviceberries, choke cherries, and wild carrots. Most of this activity occurs near existing roads at various elevations and locations depending on the species being searched for and collected. Local residents from the Chesaw area also collect plants in the general area for medicinal purposes, such as the mountain arnica (Corser, 1993).

Because the Okanogan Highlands, in general, attracts many birdwatchers, a few likely visit areas in the Buckhorn Block including the “frog pond,” and “9-acre wetland” off Forest Road 3575-120, and a spruce bog and the headwaters of Cedar Creek near Forest Road 3575. Birdwatchers generally concentrate in areas with better roads and developed recreational facilities (Corser, 1993).

The only time there is any indication of recreational overuse in the project area is during the general rifle-hunting season for deer. Use is at, or slightly above, maximum capacity during the general rifle-hunting season. As demand for roaded, dispersed recreation areas increases in the future, the area may experience more recreational pressure.

There are two historic loops on County Roads and State Highways in the general vicinity of the Buckhorn Block. Ore and supply haul as a result of the mining project on private lands would affect these routes. These two scenic/historic itineraries are:

- The Okanogan County Tourism Council has created the Highlands Historic Loop Drive, which highlights historic sites in northern Okanogan and Ferry Counties. Okanogan County Roads 9480 and 9495, which surround the Buckhorn Block, are part of this loop.
- The Gold Country Byways is a similar itinerary highlighting historic and scenic locations in the region. It also includes Okanogan County Road 9495.

The only Recreation Special Use Permit, that would be affected by the mine project is Don Super's permit for Highland's Stage Company. Most of his permitted use is in the Bonaparte or Clackamas blocks or out of Conconully, but on his permitted trips to Republic he travels on the Toroda Creek Road, OCR 9495, for about three miles with his horses and wagons. Highland's Stage Company has not done this trip in the last five years. This route would be used to access the proposed supply route for the mine under Alternatives B, B1, and C.

ENVIRONMENTAL CONSEQUENCES

The analysis area for most direct, indirect, and cumulative recreational effects is considered the Canadian border on the north, the North Fork Beaver Creek/OCR 9480 on the south, Toroda Creek/OCR 9495 on the east and OCR 4883/9480 on the west. Recreational effects on develop campgrounds and Special Uses used a boundary of Highway 20 on the south and would include the Bonaparte Block because of the potential for construction workers to use campgrounds in that block.

Cumulative effects are the overall impacts of all past, present, and reasonably foreseeable future actions. Actions that were considered included within the Buckhorn Block: the mine proposal on private lands, timber sales, road closures, patenting of about 155 acres, and grazing. Also considered was population growth with time. Other cumulative activities listed as the beginning of this chapter do not have any cumulative effects with this project. All reasonably foreseeable future projects within the next decade were included, although additional currently unknown projects may arise in the future.

Alternative A – No Action

Direct/Indirect Effects

There would be no change from existing conditions because of this project. All of the roads that are currently open would continue to be available for the use of all forest users benefiting the recreation experience of the public, particularly for hunting, firewood gathering, berry picking, and mushroom gathering. Dispersed recreational use, particularly hunting related activities, would not change. Bird watching, gathering of plants for medicinal purposes and use of the area by members of the Confederated Tribes of the Colville Reservation to gather native plants and berries would not change. Existing recreation opportunities would not change. Access to all presently used dispersed camping areas would remain. There would be no impacts to developed campgrounds or any Special Use Permittee.

Cumulative Effects

Because this project would not occur under this alternative, no cumulative effects would occur. However, predevelopment mine-related and exploration traffic approved under other projects would cease after reclamation of previous activities is completed in one to three years. Areas affected by exploration and predevelopment would be reclaimed, which would restore the recreational value of these areas to near pre-exploration conditions. Recreational activities, on these areas, would resume approximately a year after reclamation of the remaining disturbances begins, although it would take considerably longer than that for the sites to appear natural and for replanted areas to provide mature habitat. It is anticipated that most of the area on the west side of Buckhorn Mountain, closed temporarily as part of the Crown Jewel Project, would retain its present Roaded Natural Recreation Opportunity Spectrum since it is not expected that this area would be reopened to road related recreational activities.

It is anticipated that most of the area on the east side of Buckhorn Mountain would retain its present Recreational Opportunity Spectrum of a mix of Roaded Natural and Roaded Modified areas. The areas that are presently unroaded would remain in that condition. Two areas, Jackson Creek and Coogan Creek that presently provide a "semi-primitive, non-motorized" type of recreation opportunity would retain that recreation opportunity spectrum for the near term. It is not expected that the areas accessed by Forest Roads 3575-125 and 3575-141, closed temporarily as part of the Crown Jewel Project, would be reopened to road related recreational opportunities. Future timber sale projects, none currently proposed on National Forest System land within the next five years, would likely close additional roads, in order to decrease open road densities, as was done in the three Nicholson Timber Sales.

The proposed haul of timber from the Little Nicky sale on Department of Natural Resource managed land along Forest Road 3575, would cause some minor disruption in recreational use of this road due to conflicting traffic. This sale is expected to produce about 500 loads of logs, coming down Forest Road 3575-040, which would then traverse the lower 3 miles of Forest Road 3575 to Okanogan County Road 9495, Toroda Creek Road. Most impacts from this timber sale would likely take place over a 3 to 5 month period, during the spring and summer of 2006 and 2007. Approximately 25 loads of rights-of-way timber have already been hauled off this project and the tractor logging portion of the project is presently being completed. The cable logging portion is expected to be completed in 2007.

Effects to All Action Alternatives

Direct/Indirect Effects

In general, the effects on recreation resources are somewhat similar between all four action alternatives. The differences in effects are related to three factors: specific location of impacts, hunting pressure and dispersed camping, and the number of days per week and timing of ore and supply haul.

Direct effects would include both temporary and permanent alterations to the recreational resources in the Buckhorn Block. The most important impact would result from people generally not wanting to drive the same roads as the ore, supply, and employee traffic; not wanting to recreate adjacent to these roads due to noise and dust; and the effects of the project on recreational hunting, and dispersed camping associated with this hunting. Because of the road closures associated with the project during the 2 to 4 months of construction/reconstruction associated with each ore and supply route, recreationists such as hunters, plant gathers, snowmobilers, off-road vehicle users, hikers, anglers, and horseback riders that might use these roads, during that time, would be displaced until these roads are again opened to public use. Alternative specific road closures are discussed under each individual alternative.

The impacts of utility line installation would mostly be part of the road closure associated with the construction/reconstruction of existing roads, with the telephone line being placed in an existing road rights-of-way. This additional construction disturbance would impact road users for less than a day. The effect would cause recreationists slight delays, generally less than 30 minutes while equipment has the 3575-120 road temporarily blocked. A portion of the Alternative C installation, along the 3575-100 road, would have a slightly different effect and that is explained under that Alternative.

Road closures associated with the project likely would not be reopened to the public at the end of the project because the Forest Service currently does not have funding to maintain these roads safely, similar to what has happened with road closures implemented as part of previous minerals exploration and pre-development activities, and the three recent Nicholson Timber Sales. This was further discussed under Alternative A.

Adverse effects on recreational resources and activities would occur during the construction and operational phases (approximately 9 years) and would affect primarily dispersed recreation activities, mostly associated with hunting during the general rifle season, but, in general, all hunting during September and October for deer, bear, and birds.

The estimated population increase of any of the action alternatives is small (less than 1%) and would represent a relatively minor total increase in demand for recreational resources and activities.

There would be a long-term benefit to recreational use of the area from the haul road upgrades planned as part of all action alternatives. The recreational benefit would be similar between the alternatives on National Forest System land with there likely to be a slightly larger benefit from Alternative C since more miles of road would be upgraded and the road being upgraded receives the greatest amount of recreation traffic presently. The benefits would be similar between Alternatives B and D since Alternatives B would improve a longer section of road but road use is higher on the road improved by Alternative D. Alternative B1 would have the least benefit to recreational use since the road would be returned to its present usable width as part of reclamation.

Areas traversed by the proposed ore and supply haul route would receive little recreation use during the operations phase of this project, when ore is being hauled, due to a vehicle passing any given point along the route every 2 to 3 minutes from about 5:00 a.m. in the morning until about 7:00 p.m. in the evening when employee traffic is included. As a comparison, except for speed limits, vehicle use on the haul and supply route would be similar to present traffic on Toroda Creek Road, OCR 9495, near its junction with Highway 20 which is a paved road with 20-foot wide lanes, 4 foot gravel shoulders, and minimal grades.

The other major difference between the alternatives is the timing of ore and supply haul and the effects that this would have on recreational use of the area. The average number of weekly passages by commercial haul trucks is estimated to be 756 weekly vehicle passages (378 round trips) on the ore and supply haul route. There should be no commercial vehicles on other routes. If those passages are spread out evenly over 7 days (Alternatives B and B1), that would be approximately 108 passages (54 round trips) per day of commercial trucks. If those passages are spread out over 5 days of the week (Alternative D), that is approximately 151 passages (75.5 round trips) per day of commercial trucks. The basic effect on recreation is that the shorter haul period would increase traffic by up to 40% during the period that the commercial trucks are hauling, but haul would be mostly eliminated on weekends allowing for more recreational enjoyment of the area and less impacts to recreational uses. Little traffic between 9:00 p.m. and 5:00 a.m. would be expected under any alternative.

Employee traffic would be similar between all action alternatives with employee start times being mostly 6:00 to 8:00 a.m. and 6:00 to 8:00 p.m. so associated traffic would be mostly surrounding these times. The number of employees traveling to the mine site would be similar on all days of the week. Average number of daily passages by passenger vehicles (Alternatives B, B1, and C) is estimated at 169 on the ore and supply haul route with an

addition 51 passages on Forest Road 3575-120, the Cow Camp road. Most of these passages, 220 total passages, would be on Forest Road 3575-120 under Alternative D. This would equate to approximately 1540 weekly vehicle passages of employee traffic.

Mine related traffic is expected to increase the number of accidents on National Forest roads. This increase in accidents on National Forest System lands and rights-of-ways is estimated to be between 1.5 (Alternative D), 4.7 (Alternative B), 3.9 (Alternative B1) and 7.4 (Alternative C) accidents per year (Shaw, 2004). Because of the lower speed limit on Alternative B1, C and D, 25 mph versus 30 mph, they are estimated to have 16% fewer accidents than Alternative B per mile traveled due to increased stopping time before impacting an object.

Other potential effects would be associated with the use of Forest Service campgrounds at Beth, Beaver, Lost, and/or Bonaparte Lakes by individuals looking for work or during the construction phase of the project. It is estimated under the action alternatives there would be 24 non-local construction workers/families that would temporarily move into the area during the construction phase. Population during the construction period is expected to increase by about 54 persons. If all non-local construction workers stayed at Beth and Beaver Lake campgrounds, highly unlikely, they would fill these two campgrounds to near capacity. The Forest Service restricts the time at any given campground to two weeks or continuously on National Forest System lands to less than 30 days.

Most of the area on the west side of Buckhorn Mountain would retain its present Roaded Natural Recreation Opportunity Spectrum since it is not expected that this area would be reopened to road related recreational activities under any action alternative, and the limited amount of traffic needed to monitor wells and piezometers would not change this ROS condition.

Hunting would be affected by the road and area closures resulting from the project, as well as potential increased hunting pressure by employees. Although the road closures would reduce access to certain areas for hunting, road closures can sometimes improve the quality of hunting by reducing disturbance to habitat. The land fenced off from public access, though small, approximately 74 acres of National Forest System land and 220 acres of private land would displace existing hunting activity to other portions of the study area or to adjacent areas. Wildlife game species would also likely be displaced from along the employee access, supply and ore haul routes for the life of the mining and reclamation operation due to frequent disturbances and dust; a vehicle would be passing a given point up to every 2 to 3 minutes. In addition, some wildlife are expected to be injured or killed by vehicle collisions (see Wildlife section later in this chapter).

Bird watching would be affected by road and area closures and from the disturbance of ore and supply haul and employee transportation. Birds near the haul route would likely be displaced further away from these routes, recreationists who seek them would have further to travel to reach them, and there would be few opportunities to pull off and park alongside the haul route. The effects would be greatest under Alternative C since more of the better locations for bird watching are adjacent to the Nicholson Creek haul route. Alternative D would cause the least disturbance since the least National Forest System land is traversed. Alternatives B and B1 would result in more disturbance of birds than Alternative D, mostly because the road is either within or near the Marias Creek riparian area and vehicle traffic would likely result in displacement of birds (see Wildlife Section), although Alternative B1 creates a 1,000 acre area where very little disturbance would occur and pedestrian based bird watching opportunities would improve.

There are few recreational fisheries resources that would be directly impacted by project activities since most fish in Buckhorn Mountain streams are 7" in length, or shorter (below legal keep length), and there is little fishing activity in the area based on discussions with local anglers. Since there are no fish bearing streams along the haul route in Alternative D on National Forest System land, it would have the least impacts.

The gathering of plants for medicinal purposes and use of the area by members of the Confederated Tribes of the Colville Reservation to gather native plants, mushrooms, and berries would change under all of action alternatives. The change would be proportional to the miles of haul route across National Forest System land, for all action alternatives, since gathering would not likely take place within about 500 feet of the haul route due to dust potentially on the plants and the change in the natural environment from noise, and the miles of road closed to public use. Thus, the least, long-term impacts would be predicted for Alternative D (0.6 miles of road) and the greatest impacts for Alternative B1 (12.0 miles of road), due to the closure of about 5.8 miles of road in Bear Trap Canyon. Alternative C has approximately 10.3 miles of road affected. Alternative B has approximately 6.2 miles of road affected.

Under all action alternatives, there may be slight impacts to recreational use of the area from Proponent vehicles traveling to the infiltration gallery, inspecting the infiltration area pipeline, and inspection of the water tower. These facilities may need to be checked on a daily to weekly basis to assure proper operation but impacts would be slight. There would also be Proponent vehicles doing water quality monitoring of surface and ground water monitoring stations. These stations are generally visited on a monthly or quarterly basis so impacts would be slight.

Under all action alternatives, there may be slight impacts to recreational use of the area from infrequent unplanned supply shortages being delivered outside of normal operating hours.

If recreationists are close enough to the haul routes, they may hear Project-related noise. Noise impacts from ore and supply haul traffic on recreationists would likely be considered "slight," if an individual were more than 500 feet from the haul road, but would be considerable if within 200 feet of the haul road. Under unusual climatic conditions, which would generally be in the morning on days when background noise levels are low and temperature inversions have developed, "slight to substantial" noise impacts under EPA Region 10 criteria and Forest Service Guidelines for recreational areas, would occur at greater distances than listed above since noise travels further without dampening during these conditions. Only one home is located within 500 feet of the Marias Creek route, whereas both Nicholson (Alternative C) and Cow Camp (Alternative D) have several homes located within 500 feet of the haul route. Refer to the Noise Section of this chapter for further discussion of noise impacts on adjacent residents and on recreational users.

Recreation activities at the Buckhorn Access Project site under all action alternatives should resume 3 to 5 years after project reclamation begins and there are fewer vehicles accessing the site.

Alternative B

Direct/Indirect Effects

Forest Road 3550-125 above the 3550-130 junction would be closed to use by the recreating public thus decreasing areas and roads open to recreational use.

There is one dispersed hunting camp located at the end of the 3550-125 road during the general rifle season that would be eliminated under this alternative since the road would be built on top of it.

The dispersed camping site adjacent to Forest Road 3550-122 would not likely be used for camping during project operations because of the disturbance from road use and impacts from dust from the haul road being less than 200 feet away from the campsite.

The dispersed camping site on Forest Road 3550-080 would still be available, but because of the high traffic volumes on the adjacent 3550 road and impacts from dust, this site would not likely be used for camping because of the disturbance from the haul road use less than 200 feet away from the camp site.

The dispersed hunting camp above the 3550 road, about 2 miles from Toroda Creek road, would still be available for use but would likely not be used for camping because of the disturbance and dust from the adjacent road use on Forest Road 3550 by ore and supply haul and employee traffic. This dispersed site is located less than 150 feet from the 3550 road.

Alternatives B and B1 would have similar acres of disturbance (57 acres) on National Forest System land and rights-of-ways removing their availability for recreational use, besides the temporary elimination of access to 74 acres of National Forest System land within the fence around the mine site.

The heaviest hunting pressure and most dispersed camping use are located in the north half of the Buckhorn Block so Alternatives B, B1, and D would disturb this recreation use the least.

The large increase in traffic on the ore haul route is likely to displace wildlife into areas further away from the road, which may discourage hunters from using this area near the haul routes. Additionally, some deer would likely be killed or injured by vehicles (see Wildlife section later in this chapter). Using rough numbers since the Buckhorn Block represents about 9% of the land area in the Okanogan East Game Management Unit, and assuming that Alternative B would reduce hunter days by 20% in the Buckhorn Block; this would represent a loss of about 394 hunter days in large game hunting (deer and bear), per year from the block. These numbers are based on comments from hunters who have hunted this portion of the Buckhorn Block in the past and their reaction to the mining and haul proposal. Some hunters may go to other areas to hunt and some may just not hunt at all. It is likely that hunting pressure would increase in Nicholson Creek as hunters avoid Marias Creek.

Alternative B only restricts loaded ore trucks to 6 a.m. to 6 p.m. Unloaded trucks can travel outside these hours on National Forest System roads. Supply haul timing is not restricted though the Proponent states that most supply trucks would be between 6 a.m. and 6 p.m. Recreational use on weekends would be disturbed on the ore and supply haul routes and within 125-200 feet of these roads. The only general quiet and dust free period would be between 9:00 p.m. and 5:00 a.m. daily. Because Alternative B has the least restrictions on

haul timing for ore haul trucks, empty haul trucks would be expected on the haul route daily between 5:00 a.m. to 6:00 a.m. and 6:00 p.m. to 7:00 p.m. When included with ore and supply haul, this would cause the greatest disturbance to recreational use of any of the alternatives, although two extra hours of ore haul traffic on the roads is unlikely to make much difference to recreationists.

Alternative B1

Direct/Indirect Effects

The impacts of Alternative B1 are similar to Alternative B with four exceptions. Alternative B1 has a restriction of 6 a.m. to 6 p.m. for loaded and unloaded ore and supply trucks, but haul can still occur 7 days a week. This restriction would reduce the recreational impacts of the alternative to a minor extent since recreational users of the roads and area would have to contend with heavy haul trips for a shorter period each day.

The closure of Forest Roads 3550 and 3550-122, up Bear Trap Canyon, would close off an area of approximately 1,000 acres; approximately 5.8 miles of road, from most recreation use, particularly hunting since most hunters use vehicles to provide access to this area. Using rough numbers since the Buckhorn Block represents about 9% of the land area in the Okanogan East Game Management Unit, and assuming that Alternative B1 would reduce hunter days by 25% in the Buckhorn Block; this would represent a loss of about 492 hunter days in roaded large game hunting (deer and bear), per year from the block. These numbers are based on comments from hunters who have hunted this portion of the Buckhorn Block in the past and their reaction to the mining, haul, and road closure proposal. Some hunters may go to other areas to hunt and some may just not hunt at all.

Unlike Alternative B, Alternative B1 would pave the first 0.5 miles of the haul route. This would slightly benefit recreation use by making a short section of road easier to travel and would reduce dust from this section of road. All but about 0.2 miles of the reduced dust benefit would be on private lands.

Unlike Alternative B, Alternative B1 would return the ore and supply haul route on Forest Roads 3550 and 3550-125 to its present usable width, average 17 – 18 feet, during reclamation. This may slightly reduce recreational use of the road than if the road were left as a double lane road, although the road surface would be improved over current conditions.

Alternative C

Direct/Indirect Effects

Most of the impacts of this alternative are similar to Alternative B, but the location of the impacts would be moved from Forest Roads 3550/3550-125 to Forest Roads 3575/3575-150/3575-100/3575-120.

Alternative C would disturb 65 acres on National Forest System land and rights-of-ways removing their availability for recreational use, besides the temporary elimination of the 74 acres of National Forest System land within the fence around the mine site.

Power line installation impacts of this alternative would be somewhat different from the other action alternatives since the power line for a portion of its route would not be in the ore haul

route, but up the 3575-100 road. The power line is proposed to come up the 3575-100 road to the junction with the 3575-120 road near the frog pond instead of following the haul route. This power line route would cause additional recreation disturbance during installation since traffic using the 3575-100 road during this time would experience short delays when equipment is blocking the road during power line installation. These delays might last over a 10-day period and would generally be less than 30 minutes in duration each.

The heaviest hunting pressure and most dispersed camping use are located in the north half of the Buckhorn Block so Alternative C would have the greatest impacts on recreational hunter use because of the large number of trucks passing by these dispersed sites and along the main roads. It was assumed that none of the dispersed campsites within 200 feet of the ore and supply haul route would be used because of noise disturbance and the intrusion of dust. There are approximately 17 of these sites alongside the road of which only one is more than 100 feet from the haul road. They varied from high use sites, which are occupied several times a year to sites that are used less frequently. About 91 acres of the Jackson Creek IRA are within 500 feet of the Nicholson Creek road and noise impacts within that area under Alternative C would be "substantial." Outside of the 500 foot zone, noise impacts would be "slight."

The large increase in traffic on the ore haul route is likely to displace wildlife into areas further away from the road due to noise and dust, which may discourage hunters from using areas near the haul route. Additionally, some deer would likely be killed or injured by vehicles (see Wildlife section later in this chapter). Using rough numbers since the Buckhorn Block represents about 9% of the land area in the Okanogan East Game Management Unit, and assuming that Alternative C would reduce hunter days by a third in this block; this would represent a loss of about 650 hunter days in large game hunting (deer and bear), per year from the block. These numbers are based on comments from hunters who have hunted in the Buckhorn Block in the past and their reaction to the mining and haul proposal. Some hunters may go to other areas to hunt and some may just not hunt at all. It's likely that hunting pressure would increase in Marias Creek as hunters avoid Nicholson Creek.

Alternative C limits ore haul to Monday to Saturday and supply haul to Monday to Friday, 6:00 a.m. to 6:00 p.m. for loaded and unloaded trucks, except for infrequent unplanned supply shortages. Little traffic disturbance would be expected by recreationists between 9:00 p.m. and 5:00 a.m. daily or on Sundays. Traffic on Sunday would be limited to employee traffic, mostly between 5:00 a.m. to 9:00 a.m. and 5:00 p.m. and 9:00 p.m. The impacts of employee access would be similar to all other action alternatives except the location would generally be on the Nicholson Creek route.

Alternative D

Direct/Indirect Effects

Most of the impacts of this alternative are similar to Alternative B but the location of ore, supply, and employee traffic impacts would be moved from Forest Roads 3550/3550-125 to Forest Road 3575-120. All noise and dust impacts from use of the 3575-120 road would be on private and Washington Department of Natural Resource land, and not on NFS land because the Forest Service road is a right-of-way through these lands.

Alternative D would have the fewest acres of disturbance (26 acres) on National Forest System land and rights-of-way thus the least land would be removed from recreational use

and the least disturbance to recreational use would be expected. Much of this disturbance is in NFS rights-of-way for roads across private land, which is not used by the public for recreation activities.

This alternative would not disturb any existing, traditional dispersed hunting camps on National Forest System land since most disturbance is associated with NFS rights-of-ways across private land or a new road to be constructed above Forest Road 3575-120 to patented land which would be closed to the public during operations.

The heaviest hunting pressure and most dispersed camping use are located in the north half of the Buckhorn Block so Alternative D would have the least impacts on recreational hunting use on National Forest System lands. Using rough numbers since the Buckhorn Block represents about 9% of the land area in the Okanogan East Game Management Unit, and assuming that Alternative D would reduce hunter days by 5% in the Buckhorn Block; this would represent a loss of about 99 hunter days in large game hunting (deer and bear), per year from the block. These numbers are based on comments from hunters who have hunted in the Buckhorn Block in the past and their reaction to the mining and haul proposal. Some hunters may go to other areas to hunt inside and outside the Buckhorn Block and some may just not hunt at all.

Alternative D has the most restrictive timing for ore and supply haul (loaded and unloaded trucks) limited to 6 a.m. to 6 p.m. on National Forest roads, Monday through Friday, except for infrequent unplanned supply shortages. Recreational use on weekends would be disturbed mostly by employee traffic from about 5:00 a.m. to 9:00 a.m. and 5:00 p.m. to 9:00 p.m. with little expected traffic between 9:00 a.m. and 5:00 p.m. on Saturdays and Sundays. Because most of this haul route is not across National Forest System lands and access would be on a double lane road, this alternative would have very little impact on recreational use of the Buckhorn Block.

Cumulative Effects of all Action Alternatives

The mining project may result in slight direct and indirect population growth that would increase demand for hunting, fishing, hiking, snowmobiling, cross-country skiing and other recreation activities. The added population would slightly increase pressure to a minor extent on community parks and recreation facilities. Many of these facilities are already below standards, and any substantial increase in demand would be difficult to accommodate.

Blasting would likely occur two or three times a day and would be heard by people recreating close to the mine. This would resemble a sonic boom, or thunder heard from a distance or a slight vibration of the ground.

Cumulative effects on recreational resources could also result from the combined effects of normal increases in recreation demand unrelated to the Buckhorn Access Project and effects from the Buckhorn Mine project. Without Buckhorn Mine related increases, demand for dispersed camping along roaded areas is expected to increase by 29% by the year 2020 (WIAC, 1990). Demand for developed recreation opportunities is expected to increase by 42% over the same period (Forest Service, 1989). Relative to these projections, Buckhorn Mine related demand would place a small amount of additional pressure on existing recreational resources, especially on developed facilities. Many of the mine employees during construction and operations are likely to be hunters, which may put additional hunting pressure on the local area. Area population is projected to increase by about 54 persons

during construction and 178 persons during operations. This represents less than a 1 percent increase in Ferry County and Okanogan County populations. However, as discussed above in the direct and indirect effects of the Forest Service access project, recreation use is likely to severely decrease in the areas directly impacted by this access project. It is likely that any increase in recreation would occur away from the selected haul route and other mine related facilities on National Forest System lands.

Given limited temporary housing currently available in the area, many of these workers may choose to live in mobile homes or recreation vehicle parks. Space at these facilities is also limited and may result in increased stay limit violations at Forest Service campgrounds and dispersed camping sites and at State Parks. This would place pressure on these resources and would influence the recreation setting at these facilities. Job seekers who do not find work may also increase demand on these facilities. Any growth associated with the mining project would place increased demand on recreation resources in the Five Lakes area, especially the developed recreation facilities. Under current conditions, use of these Forest Service campgrounds is approaching capacity on weekends during mid-summer, and the lakes tend to be over-fished already.

Proposed supply haul under Alternatives B, B1, and C would have slight negative impacts due to increased traffic on Toroda Creek road on Don Super's, Highland Stage Company permit since about 3 miles of his route when traveling to Republic is on OCR 9495 (Toroda Creek), between OCR 4875 (Bench Creek) and Forest Road 3150-100 (Cougar Creek). Don's wagon train covers this route generally less than twice a year and many years, including the last five, did not use this route at all.

Alternative D would have the greatest impacts on traffic accessing Beth and Beaver Lakes because the ore haul, supply haul, and employee traffic routes would use OCR 9480 which is used to access these lakes from the east, though traffic would not pass by the lakes themselves. As noted above, most people access these lakes from the west on OCR 9480.

In the immediate vicinity of the mine site and proposed haul roads, wildlife and hunters may be displaced or affected by noise, dust, traffic and lighting.

All action alternatives would have some negative effects on the enjoyment of people traveling the Highlands Historic Loop Drive, which highlights historic sites in northern Okanogan and Ferry Counties due to increased large vehicles and passenger vehicles on the road. Okanogan County Roads 9480 and 9495, which surround the Buckhorn Block, are part of this loop; and on the users of the Gold Country Byways, which has a similar itinerary highlighting historic and scenic locations in the region. It also includes Okanogan County Road 9495. Impacts between the action alternatives would be similar.

Based on the longer distance traveled on the loops by haul trucks, Alternative D would have the greatest impact, followed by Alternatives B and B1, with the least impact from Alternative C, but based on the number of days of ore haul per week, Alternatives B and B1 would have the greatest impact, followed by Alternative C, with the least impact from Alternative D since little heavy truck traffic would occur on weekends.

The proposed haul of timber from the Little Nicky Timber Sale on Department of Natural Resource managed land along Forest Road 3575, would cause some disruption in recreational use of this road due to conflicting traffic. This sale is expected to produce about 500 loads of logs, coming down Forest Road 3575-040, which would then traverse the lower

3.5 miles of Forest Road 3575 to Okanogan County Road 9495, Toroda Creek Road. Under Alternative C, it is possible that the Department of Natural Resource sale would be delayed two to four months until reconstruction activities were completed along the Nicholson Creek Road below the junction with Forest Road 3575-040, although, because Little Nicky is currently operating, it may be completed prior to commencement of road construction under Alternative C. Alternatives B, B1, and D would not affect use of Forest Road 3575. There might be some small amount of use by employees accessing the mine site from these routes under Alternative D instead of driving around to the ore haul route if they were coming from the Curlew or possibly the Republic area. Under Alternative C, logging traffic would add to the mining traffic on Nicholson Creek road, increasing heavy truck traffic on this road for two to five months by an estimated 5 – 10%. This would further disrupt recreational use of the Nicholson Creek drainage.

A portion in the middle of the 3575-140 road, where it crosses patented lands, has been eliminated from public access as a result of patenting and the haul route between the upper and lower portals. This road would no longer be used as a through route from Forest Road 3575-120 to Forest Road 3575-100; instead, vehicles would need to use Forest Roads 3575-120 and 3575-100.

Future timber sale projects, none currently proposed on National Forest System land would likely close numerous roads, in order to decrease maintenance costs and open road density, as was done in the three Nicholson Timber Sales.

Some roads that were closed by previous projects have been breached in the project area, and these roads would be re-closed as they are discovered during regular road maintenance activities which would reduce potential sedimentation and impacts to wildlife from those roads. This would decrease the roads available to recreationists and firewood cutters.

Road maintenance on and the use of Forest Roads 3575-120 and 3575-140 to access private land at the mine site is presently ongoing and would continue until the ore haul access route is completed in the summer of 2007. Use of this route for mine construction, expected from September 2006 to June 2007, would cause some disturbance in the recreational use of these two roads due to conflicting traffic, but may also see increased use by the public, particularly Forest Road 3575-120, because deferred maintenance was done in the fall of 2006.

There would be a long-term benefit to landowners along the haul roads due to upgrades planned as part of Alternatives C and D due to widening the road double lane and paving of the road. The benefit would be similar between Alternatives C and D since there is similar numbers of residences along each road and the road lengths are similar.

Conclusion

The general effect of the project would be to diminish recreational values in and immediately adjacent to the Buckhorn Block. Impacts from the action alternatives would comply with the "Roaded Modified" recreational opportunity spectrum established by the Okanogan Forest Plan for this area for all action alternatives. Direct, short-term impacts of all of the action alternatives would consist of the closure of Forest Roads and the consequent interruption of access throughout the Buckhorn area; increased traffic, noise and dust on access roads, particularly the proposed ore and supply haul routes and employee access route; the closure of 74 acres within the fenced mine site boundary to public use; noise; and visual impacts. The result of this project is that recreationists, and particularly hunters, who would normally use

areas directly adjacent to the haul routes, would likely have to move to other drainages in the Buckhorn Block or elsewhere for recreational activities.

Wildlife

The section below summarizes the affected environment information, along with direct, indirect, and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Wildlife Report, Biological Evaluation by District Wildlife Biologist Jeremy Anderson dated January 8, 2007 in the analysis file, and a Biological Assessment (BA) by Mr. Anderson dated January 19, 2006 in the analysis file. U. S. Fish and Wildlife Service concurred with the findings in the B.A. in a letter dated February 16, 2006.

GENERAL AFFECTED ENVIRONMENT

Species specific affected environment information is found under the analysis for each species. Table III-49 displays the plant association groups (PAG) within the Buckhorn Block of the National Forest lands and the acres in each category.

Table III-49: Plant Association Groups, Biophysical Environments, and the Acres in Each Category Within the Buckhorn Block of the National Forest Lands

Plant Association Group	Biophysical Environment	Acres
Non-Forest	Non-Forest	575
PIPO/AGSP	Hot-Dry	134
PSME/PUTR/AGSP	Warm-Dry	3,123
PSME/CARU-CAGE	Cool-Dry	9,346
PSME/PHMA-SYAL	Warm-Dry	9,466
PSME/VAME-VAMY-VACA	Cool-Mesic	149
ABLA/PAMY/CARU	Cool-Dry	5
ABLA/VASC	Cold-Dry	350
ABLA/VAME-LIBOL	Cold-Mesic	4,225
ABLA/RHAL-XETE	Cold-Mesic	13
ABLA/COCA/EQUIS	Cold-Wet	2,826
No Data	N/A	2
TOTAL ACRES		30,214

A structural stage analysis was not conducted due to the small acreage affected by this project (57 acres for Alternatives B and B1, 65 acres for Alternative C, and 26 acres for Alternative D). The percentage of the 3 townships where these acres are spread out would have been small enough as to be nearly immeasurable (3 townships = 69,120 acres). Additionally, the rounding of the calculations and the less than 100% accuracy of the GIS information and habitat mapping would have made the percentage changes difficult to detect. The habitats affected by this project are not unique within these townships.

The Buckhorn mountain project area includes parts of five discrete management areas (MAs) that have open road density standards (see Management Area map, EIS Chapter I). Table III-50 displays the current open road densities for each MA that has a standard.

Table III-50: Current Open Road Density

Management Area	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	3.5	3.8	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	44.2	1.8	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	7.5	1.4	1.0

Late Successional Forest Nonwinter Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for late successional forest nonwinter habitat within the Myers and Toroda Creek watersheds. A buffer of 50 meters along the travel routes was used. Currently, an estimated 3066 (9%) acres out of 32,757 total within the watersheds are affected by roads. This equates to a rating of "low level of human influence on late successional nonwinter habitats." The estimates were based on "open" travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model.

Late Successional Forest Nonwinter Security Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for late successional forest nonwinter security habitat within the Myers and Toroda Creek watersheds. A buffer of 200 meters along the travel routes was used. Currently, an estimated 10,823 acres out of 32,757 total (33%) within the watersheds are affected by roads. This equates to a rating of "moderate level of human influence on late successional nonwinter security habitats."

Late Successional Forest Winter Security Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and winter trails for late successional forest winter security habitat within the Myers and Toroda Creek watersheds. A buffer of 200 meters along the travel routes was used. Currently, an estimated 9,430 acres out of 32,757 total (29%) within the watersheds are affected by roads. This equates to a rating of "low level of human influence on late successional winter security habitats."

Riparian Nonwinter Habitat Influence Index: The habitat index recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for riparian nonwinter habitat within the Myers and Toroda Creek watersheds. A buffer of 60 meters along the travel routes was used. Currently, an estimated 6,050 acres out of 18,197 total (33%) within the watersheds are affected by roads. This equates to a rating of "moderate level of human influence on riparian nonwinter habitats."

Riparian Habitat Nonwinter Route Density Index: The effects of roads and motorized trails within the Toroda and Myers Creek watersheds were analyzed using the habitat index recommended by Gaines et al. (2003). The existing condition for riparian habitat falls under the category of "high level of human influence on riparian nonwinter habitat" for these two watersheds. This means that more than 25% of the riparian area is impacted by road densities of > 2 miles per square mile. For the combined area of these two watersheds, 60% of the riparian habitat falls into this category.

Riparian Habitat Winter Recreation Route Density Index: The effects of roads and winter trails within the Toroda and Myers Creek watersheds were analyzed using the habitat index recommended by Gaines et al. (2003). The existing condition for winter riparian habitat falls under the category of "high level of human influence on riparian winter habitat" for these two watersheds. This means that more than 25% of the riparian area is impacted by road densities of > 2 miles per square mile. For the combined area of these two watersheds, 58% of the riparian habitat falls into this category.

GENERAL ENVIRONMENTAL CONSEQUENCES

Species Not Affected by this Project

Species not expected to be impacted by this project and therefore not analyzed in detail in this document include: American peregrine falcon, common loon, eared grebe, masked duskysnail, sandhill crane, western gray squirrel, and bighorn sheep.

The American peregrine falcon utilizes large cliffs as nesting habitat and forages primarily on waterfowl. Cliff habitat located near suitable foraging areas does not occur within the project area, nor have any peregrine falcons been detected within the project area. Common loons and eared grebes do not occur near any of the proposed haul routes across National Forest lands. Under Alternative D, the ore trucks are expected to use the east side of the Pontiac Ridge road and bypass Beth and Beaver lakes on the east. Common loons have been observed on these lakes, although eared grebes have not. These lakes are on the Bonaparte Block of National Forest System Lands, but the haul route is not expected to go past these lakes once it leaves the Buckhorn Block. Therefore, there are not expected cumulative effects due to any of the currently proposed haul route alternatives.

Masked duskysnails inhabit kettle lakes, and no habitat of this type is found within the project area of land. Sandhill cranes nest in marshes and wet meadows, none of which occur within the analysis area. The range of the western gray squirrel does not extend far enough east to overlap the project area, so they are not expected to be present. Bighorn sheep are not known to be present within the project area, and there is no known bighorn sheep habitat within this area.

Effects Common To All Species

Alternative B

Direct/Indirect Effects

The proposed speed limit for this alternative is 30 mph which is the design speed of the road. This is 5 mph lower than the existing County speed limit on gravel roads. Because of the higher speed limit proposed on this alternative than the other action alternatives, the probability of road kill is greater than in the other action alternatives that have a speed limit of 25 mph. Ore haul and supply traffic would be primarily between 6:00 a.m. and 6:00 p.m., although unloaded ore trucks may be moving prior to 6:00 a.m. and after 6:00 p.m., although supply traffic could be traveling at any time. This timeframe for ore haul covers all of the daylight hours during the winter, and therefore would have the greatest disturbance and road kill threat to those animals most active during the day. Ore haul would average 50-70 round trips per day, with an increase of 25 trucks per day before and after spring breakup, or a

truck every 3 to 7 minutes. This does not include supply or employee traffic, which would further increase disturbance, especially from 5:00 a.m. to 9:00 a.m., and 5:00 p.m. to 9:00 p.m. when employees are beginning or ending their shifts. Employees would be working 8-hour, 10-hour, and 12-hour shifts depending on job. Ore haul would be primarily Monday through Friday with reduced ore haul possible on Saturdays and Sundays. With the exception of possible stoppage of ore haul during spring breakup, ore haul would occur year-round. Although this traffic does not create a complete barrier to movement across the ore haul route, it does substantially increase the probability of disturbance for any wildlife near the road and creates a semi-permeable barrier to movement for many wildlife species.

Mine employees would use any route during snow-free months to access the mine, although during the winter only Forest Roads 3550 and 3550-125 would be plowed, although the proponent may also request to plow Forest Road 3575-120 for employee access from the south, which would increase winter disturbance. Employee traffic during the winter on this route would add to the disturbance to many species. During the snow-free months, employee traffic on other routes would increase the potential for disturbance, and possibly wildlife mortality, although this effect would possibly be more dispersed (more possible routes) than caused by the ore trucks. Employee traffic would likely be congregated around shift changes and not as evenly distributed along the ore haul route as the ore trucks. However, during those times when employees are using the roadways the disturbance is likely to be more intense (potentially 169 one way trips per day along the ore haul route, and approximately 51 along the 3575-120 road) despite being of shorter duration. Supply trucks would not be as numerous as ore trucks and would follow the ore haul route and increase the potential for disturbance to wildlife.

Construction/reconstruction activities on the ore haul route, along with snow removal and maintenance of the ore haul route, would potentially disturb wildlife. The noise and human presence associated with these activities would cause wildlife to utilize habitat adjacent to the roadways less and force them to redistribute into other habitat.

The livestock fence constructed along the ore haul route would be of similar design. Fence construction would include clearing of trees and vegetation, and this would result in potentially a very small loss of habitat for some species. A permanent corral would be installed in lower Marias Creek at the location where temporary corrals have been used in the past. The installation of all these features, and also the water gaps, troughs, and cattle guards, would cause short-term disturbance to wildlife while they are constructed and used.

The utility lines would be buried in the road prism during road construction along the ore haul route or existing roads and should not affect wildlife other than the disturbance associated with the installation of the lines. The power lines would be buried along the haul route, and the telephone and data lines would be buried along Forest Road 3575-120 from the end of the present telephone line at Cow Camp, and both along the new road construction from the 3575-120 to the mine site. There would be additional disturbance added to the disturbance associated with the other components of this project.

The silt fences and other erosion control features used along the ore haul route would somewhat interfere with wildlife movement, but only where those features are located. Wildlife would be forced to find ways around these barriers. Silt fencing would be a minimum of 3 feet in height and would be placed along the toe of the fill slope where it lies within 100 feet of a stream. Silt fence would also be placed below relief culverts and would be backed by straw bales. Silt fences and straw bales would be monitored monthly from May through

September and quarterly for the rest of the year. They would also be surveyed within 24 hours of a precipitation event of more than 0.25 inches in 24 hours at the Buckhorn weather station. The installation, monitoring, and replacement of silt fences and straw bales would create disturbance to any wildlife in the vicinity during the activities and temporarily displace them. Additionally, some slash created by the road reconstruction/construction would be placed below the road to act as erosion control features and would impede some wildlife movement in those sections along the road where they are placed. These rows of slash may also create some habitat for smaller wildlife species.

Most of the surface water monitoring sites and the water monitoring wells would be monitored during the winter. They would be generally accessed once a month, possibly less often or possibly more frequently. The frequency of monitoring would likely decrease over time. Under this alternative, the mining company would use either a snowmobile or would plow the roads into the wells for access. Snowmobiling would cause less impacts to wildlife during the winter due to the smaller area disturbed and fewer visits. Plowing roads to the monitoring sites would potentially cause multiple visits each month (once to plow, and once to monitor) to keep the road open. Snowmobile access would require only one trip per month and would be restricted only to the route to access the sites. The road may have to be plowed several times a month to maintain access, and this would increase the human presence in these areas and increase disturbance to wintering wildlife. Plowing the road would increase access for wildlife that do not normally have access to these areas due to snow depths. This would possibly increase competition and predation near the roadways. Snowmobiling would also compact snow, although this would be over a smaller surface area than plowing open the road. Plowing the road would impact a larger area of sub-nivean (below the surface of the snow) habitat and create a wider barrier for these species.

The fence constructed to prevent livestock from wandering onto the Marias Creek road and providing windrows below the road to trap sediment would both have the side benefit of preventing livestock access to Marias Creek, which would allow riparian areas along the creek to recover and improve habitat and browse for wildlife.

Two wetlands would be created at culvert replacements along Marias Creek to mitigate the impacts to wetlands from the replacement of the culverts across Marias Creek. These two sites are on NFS lands and would be adjacent to the replaced culverts along the ore haul route. They would entail the use of an excavator to dig out along the streambank in order to create the wetlands. The creation of these wetlands would cause noise disturbance to any wildlife adjacent to the sites. Additionally, these wetlands would be of little value to wildlife during the life of the mine due to their proximity to the ore haul route. Mine related traffic is likely to disturb any wildlife that may utilize this wetland habitat, and there would also be the risk of roadkill to species utilizing these wetlands so close to the mine traffic. It is possible that once traffic subsides after the mining is completed, these wetlands would have more value as wildlife habitat. However, there is a high likelihood that these wetlands would be filled with sediment and debris in the event of a sizeable storm event further reducing their value as wildlife habitat for wetland species.

Under this alternative, Forest Roads 3575-120 to FR 3575-140 and Forest Road 3575-140 to Forest Road 3575-143 and to the water tower would be plowed during the winter. All but about 0.5 miles of Forest Road 3575-120 would be plowed because of this necessary access and plowing to residences on its southern end, and the Forest Service does not control access across DNR lands. The remaining few hundred feet of road wouldn't be wide enough to provide an area without disturbance for wildlife to cross the ridge during winter so the

proponent would be allowed to request plowing Forest Road 3575-120 to the mine site to provide access for employees during winter, which would eliminate any undisturbed connectivity corridor for wildlife from the west to east (and vice versa) of Buckhorn Mountain.

Once the mining is completed, the 3550-130 road would be permanently closed and the section of new road construction in Section 31 would be opened for public access. Because these road sections are close to the same length, no differences to wildlife are expected from the current situation, although there would be a slight reduction in open roads from the "during mining" densities.

Cumulative Effects

Open road densities by management area for Alternative B are displayed below. These road densities are the sum total of all past road construction actions plus road construction under Alternative B in affected management areas.

Table III-51: Alternative B During Project Open Road Density

	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	3.8	4.2	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	45.8	1.9	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	7.5	1.4	1.0

The model recommended by Gaines et al. (2003) was used to estimate the area affected in these representative habitats. The estimates were based on "open" travel routes (past actions), and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore, the intensity of impacts along the ore haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the models shown below.

Late Successional Forest Nonwinter Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for late successional forest nonwinter habitat within the Myers and Toroda Creek watersheds. A buffer of 50 meters along the travel routes was used. An estimated 3080 acres out of 32,757 total acres (9%) within the watershed would be affected by roads under Alternative B. This equates to a rating of "low level of human influence on late successional nonwinter habitats." There would be roughly 14 more acres impacted under this alternative than under existing conditions.

Late Successional Forest Nonwinter Security Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for late successional forest nonwinter security habitat within the Myers and Toroda Creek watersheds. A buffer of 200 meters along the travel routes was used. An estimated 10,832 acres out of 32,757 total acres (33%) within the watershed would be affected by roads. This equates to a rating of "moderate level of human influence on late successional nonwinter security habitats." There would be roughly 9 more acres impacted under this alternative than under existing

conditions.

Late Successional Forest Winter Security Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and winter trails for late successional forest winter security habitat within the Myers and Toroda Creek watersheds. A buffer of 200 meters along the travel routes was used. An estimated 9,449 acres out of 32,757 total acres (29%) within the watershed would be effected by roads. This equates to a rating of "low level of human influence on late successional winter security habitats." There would be roughly 19 more acres impacted under this alternative than under existing conditions.

Riparian Nonwinter Habitat Influence Index: The index recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for riparian nonwinter habitat within the Myers and Toroda Creek watersheds. A buffer of 60 meters along the travel routes was used. An estimated 6,052 acres out of 18,197 total acres (33%) within the watershed would be affected by roads under Alternative B. This equates to a rating of "moderate level of human influence on riparian nonwinter habitats." There would be roughly 2 more acres impacted under this alternative than under existing conditions.

Riparian Habitat Nonwinter Route Density Index: The effects of roads and motorized trails within the Toroda and Myers Creek watersheds were analyzed using the index recommended by Gaines et al. (2003). For Alternative B, the impacts on riparian habitat fall under the category of "high level of human influence on riparian nonwinter habitat" for these two watersheds. This means that more than 25% of the riparian area is impacted by road densities of > 2 miles per square mile. For the combined area of these two watersheds, 60% of the riparian habitat falls into this category. This is the same overall percentage as the existing condition, however this alternative does increase the road densities to > 2 miles per square mile for an additional 9 acres above existing conditions.

Riparian Habitat Winter Recreation Route Density Index: The effects of roads and winter trails within the Toroda and Myers Creek watersheds were analyzed using the index recommended by Gaines et al. (2003). The impacts on riparian habitat fall under the category of "high level of human influence on riparian winter habitat" for these two watersheds. This means that more than 25% of the riparian area is impacted by road densities of > 2 miles per square mile. For the combined area of these two watersheds, 58% of the riparian habitat falls into this category. This is the same overall percentage as the existing conditions, however this alternative does increase the road densities to > 2 miles per square mile for an additional 105 acres above existing conditions. The estimates were based on "open" travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater under this alternative than under existing conditions, but this substantial difference in intensity was not captured in the model.

Alternative B1

Direct/Indirect Effects

The effects of this alternative would be nearly identical to Alternative B for many components, although there would be several notable differences. These differences are discussed below.

The speed limit would be 25 mph and would have a lower likelihood of road kill to wildlife than Alternative B. The difference between 25 mph and 30 mph is a 20% decrease in speed. At 25 mph a vehicle would travel approximately 36.67 feet every second. At 30 mph a vehicle would travel approximately 44 feet per second. This amounts to a 20% decrease in distance traveled each second. Reaction time for both the human drivers and the wildlife crossing the road would increase, and the force of impact in the event of a collision would decrease. This combination would result in a lower likelihood of wildlife being struck by a vehicle, and it would decrease the likelihood of that animal suffering a major injury or death. The difference in the number of road kills between 25 and 30 mph may be slight for many species. However, even a 5 mph change in speeds in this low range can result in increased mortality for small species such as birds. One review (Erritzoe et al. 2003) found that collisions with birds were rare at speeds <25 mph, while most road kills occurred at speeds >35 mph. Although, they also found that "many bird traffic casualties" occurred in some places where speed limits were near 30 mph, such as cities (Erritzoe et al. 2003). The difference between 25 and 30 mph is likely to have varied effects to mortality among different species and likely varies between habitat types.

There would be approximately 0.5 miles of paving of Forest Road 3550 road, but this would not affect wildlife or their habitats, other than to reduce dust on vegetation along that section of the road. Another difference would be the hours of ore haul. Under this alternative unloaded and loaded trucks would be on the ore haul route from 6:00 a.m. to 6:00 p.m. only which is such a minor difference from Alternative B that no change in effects are expected. The rest of the project components would be the same as Alternative B and therefore the effects would be the same. Ore haul would be year-round and would mainly occur Monday-Friday with possible reduced haul on Saturday and Sunday.

Roads would be closed in MAs 14-18, 25-18, and 26-16 to mitigate for the substantial increase in traffic along the ore haul route. The closure of these roads would lower the road density in MA 14-18 so that it met Forest Plan standards/guideline. MA 25-18 currently meets the Forest Plan standards/guidelines and would continue to do so. MA 26-16 would still not meet the Forest Plan, although the closures in Bear Trap Canyon would improve road densities to 1.1 miles per square mile. The roads that would be closed year-round would be the 3550-122 road near the intersection with the 3550 road, and the 3550 road near the intersection with the 3550-125 road. Both closures would be accomplished with a gate that would allow administrative use. The closure of these roads in Bear Trap Canyon would improve habitat conditions for many species, primarily due to the reduced disturbance associated with vehicles. This would partially off-set the substantial increase in traffic along the ore haul route. The reduction in traffic volume on these roads would be substantially less than the increase in volume along the ore haul route. However, the closure of these roads would provide more habitat that has reduced disturbance and therefore provide another area for wildlife displaced by the substantial increase in traffic along the ore haul route to utilize. About 1,000 acres would be mostly motorized vehicle free as a result of these closures. The northern ends of these road closures, near where they intersect with the ore haul route, would still be impacted by disturbance effects from mine related traffic due to their proximity to the haul route. This is another reason why these road closures only partially mitigate the increase in traffic along the ore haul route.

Most surface water sites and the monitoring wells would be monitored during the winter. They would generally be accessed once a month, possibly less often, but possibly more often. Under this alternative, the mining company would use snowmobiles except where the

monitoring site is along roads plowed for other mine operations. Snowmobiling would cause less impacts than plowing to wildlife during the winter due to the smaller area disturbed and fewer visits compared to plowing (Alternative B). Snowmobiling would compact snow, although this would be over a smaller surface area than plowing open the road. The impacts related to increased wildlife access would be less under this alternative. Snow compaction would not be as great as compared to plowing and therefore there would be less opportunity for predators and competitors to access habitats in winter that they are usually excluded from due to snow depth.

The fence constructed to prevent livestock from wandering onto the Marias Creek road and providing windrows below the road to trap sediment would both have the side benefit of preventing livestock access to Marias Creek, which would allow riparian areas along the creek to recover and improve habitat and browse for wildlife.

The gravel portion of the haul route to DNR land, including the small section that switchbacks off DNR then back onto DNR land would be partially reclaimed to its current running surface. This action would extend the timeframe for wildlife disturbance from reclamation activities for a short period.

Cumulative Effects

Displayed below are the open road densities by MA for Alternative B1. Included in this alternative are the road closures in the Bear Trap Canyon area as mitigation for the ore haul route. These road densities are the sum total of all past road construction actions plus road construction under Alternative B1 in affected management areas.

Table III-52: Alternative B1 During Project Open Road Density

	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	1.6	1.5	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	43.9	1.8	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	6.0	1.1	1.0

The models and indices recommended by Gaines et al. (2003) were used to estimate the area affected in these representative habitats. The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore, the intensity of impacts along the ore haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the models shown below.

Late Successional Forest Nonwinter Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for late successional forest nonwinter habitat within the Myers and Toroda Creek watersheds. A buffer of 50 meters along the travel routes was used. An estimated 3,045 acres out of 32,757 total acres (9%) within the watersheds would be affected by roads under Alternative B1. This equates to a rating of “low level of human influence on late successional nonwinter habitats.” There would be roughly 21 less acres impacted under this alternative than under existing conditions. This

is due to the road closures in Bear Trap Canyon as mitigation.

Late Successional Forest Nonwinter Security Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for late successional forest nonwinter security habitat within the Myers and Toroda Creek watersheds. A buffer of 200 meters along the travel routes was used. An estimated 10,724 acres out of 32,757 total acres (33%) within the watersheds would be effected by roads. This equates to a rating of "moderate level of human influence on late successional nonwinter security habitats." There would be roughly 99 less acres impacted under this alternative than under existing conditions. This is due to the mitigation of closing the roads in Bear Trap Canyon.

Late Successional Forest Winter Security Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and winter trails for late successional forest winter security habitat within the Myers and Toroda Creek watersheds. A buffer of 200 meters along the travel routes was used. An estimated 9,414 acres out of 32,757 total acres (29%) within the watersheds would be affected by roads. This equates to a rating of "low level of human influence on late successional winter security habitats." There would be roughly 16 less acres impacted under this alternative than under existing conditions. This is due to the road closures in Bear Trap Canyon.

Riparian Nonwinter Habitat Influence Index: The index recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for riparian nonwinter habitat within the Myers and Toroda Creek watersheds. A buffer of 60 meters along the travel routes was used. An estimated 5986 acres out of 18,197 total (33%) within the watersheds would be affected by roads. This equates to a rating of "moderate level of human influence on riparian nonwinter habitats." There would be roughly 64 less acres impacted under this alternative than under existing conditions.

Riparian Habitat Nonwinter Route Density Index: The effects of roads and motorized trails within the Toroda and Myers Creek watersheds were analyzed using the index recommended by Gaines et al. (2003). For Alternative B1, the impacts on riparian habitat fall under the category of "high level of human influence on riparian nonwinter habitat" for these two watersheds. This means that more than 25% of the riparian area is impacted by road densities of > 2 miles per square mile. For the combined area of these two watersheds, 60% of the riparian habitat falls into this category. This is the same overall percentage as the existing conditions, however this alternative does decrease the acres with road densities of > 2 miles per square mile by 44 acres below existing conditions. This is due to the road closures in Bear Trap Canyon.

Riparian Habitat Winter Recreation Route Density Index: The effects of roads and winter trails within the Toroda and Myers Creek watersheds were analyzed using the index recommended by Gaines et al. (2003). The impacts on riparian habitat fall under the category of "high level of human influence on riparian winter habitat" for these two watersheds. This means that more than 25% of the riparian area is impacted by road densities of > 2 miles per square mile. For the combined area of these two watersheds, 58% of the riparian habitat falls into this category. This is the same overall percentage as the existing conditions, however this alternative does increase the road densities to > 2 miles per square mile for an additional 65 acres above existing conditions.

Alternative C

Direct/Indirect Effects

The effects of this alternative would be similar to those of Alternatives B for many components, although they would occur in a different drainage and there would be several notable differences. These differences are discussed below. The area impacted would be larger, thereby leading to more area that wildlife would likely avoid. The speed limit would be 25 mph and would have a lower likelihood of road kill to wildlife than Alternative B, and the same effect described in Alternative B1.

Ore haul would occur year-round, Monday-Friday with no haul on Sunday, with possible reduced haul on Saturday. This would cause less impacts on Sundays than Alternatives B and B1, although it would increase haul during the rest of the week and thus increase impacts on those days.

Under this alternative, Forest Roads 3575-120 to FR 3575-140 and Forest Road 3575-140 to Forest Road 3575-143 and to the water tower would be plowed during the winter. All but about 0.5 miles of Forest Road 3575-120 would be plowed because of this necessary access and plowing to residences on its southern end, and the Forest Service does not control access across DNR lands. The remaining few hundred feet of road wouldn't be wide enough to provide an area without disturbance for wildlife to cross the ridge during winter so the proponent would be allowed to request plowing Forest Road 3575-120 to the mine site to provide access for employees during winter, which would eliminate any undisturbed connectivity corridor for wildlife from the west to east (and vice versa) of Buckhorn Mountain.

Additionally, wildlife would be disturbed by the large increase in traffic along the ore haul route and would potentially alter their use of the area, but Forest Roads 3550 and 3550-125 in Marias Creek would not be plowed, and the existing wildlife closure on parts of this road would remain in place and provide a large area of winter refuge.

The utility lines for this alternative would not completely follow the ore haul route prism. The power lines would follow the 3575 road until the junction with the 3575-100 road, and then leave the ore haul route to follow the 3575-100 road until reconnecting with the ore haul route at the 3575-120 road. In the other action alternatives the power lines are buried in the road prism of the ore haul route for that alternative. Telecom lines for all alternatives would be buried along the new road from where they end at Cow Camp. The installation of the utility lines would cause disturbance to any species present near the activity during the duration of the installation, which would be in addition to disturbance associated with the haul route reconstruction, increasing the area of impact. However, this disturbance would be very short-term, and once utility construction activities are completed would be eliminated. In Alternative C, because the power line does not completely follow the ore haul route, there would be additional disturbance associated with the installation of the power line compared to the other action alternatives.

Grass Lake meadow/pond would be fenced to keep livestock out as mitigation for the impacts to wildlife and aquatic species. This would improve the wildlife habitat within the meadow. The installation of the fence would cause short-term disturbance to wildlife. A corral would be constructed along the 3575-150 road in an existing timber harvest unit. The construction of this corral would cause short-term disturbance to wildlife in the area.

Silt fences and erosion control features would be as discussed for Alternative B, except for a few differences. Straw bales would only be places below relief culverts on the section of Forest Service road rights-of-way through private land in Sections 25 and 26 and the section of new road to patented land above Cow Camp. Straw bales and silt fences would be monitored monthly except when cattle are present, and then they would be monitored weekly. The installation, monitoring, and replacement of these features would temporarily disturb and displace wildlife that are adjacent to the activities.

Most of the surface water sites and the monitoring wells would be monitored during the winter using snow machines. They would be accessed once a month, possibly more or less frequently. Impacts would be the same as those discussed under Alternative B1.

Several wetlands would be created at culvert replacements along Nicholson Creek to mitigate the impacts to wetlands from the replacement of the culverts across Nicholson Creek. These sites are on NFS lands and would be adjacent to the replaced culverts along the ore haul route. They would entail the use of an excavator to dig out along the streambank in order to create the wetlands. The creation of these wetlands would cause noise disturbance to any wildlife adjacent to the sites. Additionally, these wetlands would be of little value to wildlife during the life of the mine due to their proximity to the ore haul route. Mine related traffic is likely to disturb any wildlife that may utilize this wetland habitat, and there would also be the risk of roadkill to species utilizing these wetlands so close to the mine traffic. It is possible that once traffic subsides after the mining is completed, these wetlands would have more value as wildlife habitat. However, there is a high likelihood that these wetlands would be filled with sediment and debris in the event of a sizeable storm event, further reducing their value as wildlife habitat for wetland species.

Cumulative Effects

Displayed below are the road densities by MA for Alternative C. These road densities are the sum total of all past road construction actions plus road construction under Alternative C in affected management areas.

Table III-53: Alternative C During Project Open Road Density

	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	3.5	3.8	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	44.8	1.9	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	7.5	1.4	1.0

The models and indices recommended by Gaines et al. (2003) were used to estimate the area affected in these representative habitats. The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore, the intensity of impacts along the ore haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the models shown below.

Late Successional Forest Nonwinter Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003)

was used to estimate the area affected by roads and trails for late successional forest nonwinter habitat within the Myers and Toroda Creek watersheds. A buffer of 50 meters along the travel routes was used. An estimated 3,076 acres out of 32,757 total acres (9%) within the watersheds would be affected by roads. This equates to a rating of "low level of human influence on late successional nonwinter habitats." There would be roughly 10 more acres impacted under this alternative than under existing conditions.

Late Successional Forest Nonwinter Security Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for late successional forest nonwinter security habitat within the Myers and Toroda Creek watersheds. A buffer of 200 meters along the travel routes was used. An estimated 10,826 acres out of 32,757 total acres (33%) within the watersheds would be affected by roads. This equates to a rating of "moderate level of human influence on late successional nonwinter security habitats." There would be roughly 3 more acres impacted under this alternative than under existing conditions.

Late Successional Forest Winter Security Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and winter trails for late successional forest winter security habitat within the Myers and Toroda Creek watersheds. A buffer of 200 meters along the travel routes was used. An estimated 9,442 acres out of 32,757 total acres (29%) within the watersheds would be affected by roads under Alternative C. This equates to a rating of "low level of human influence on late successional winter security habitats." There would be roughly 12 more acres impacted under this alternative than under existing conditions.

Riparian Nonwinter Habitat Influence Index: The index recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for riparian nonwinter habitat within the Myers and Toroda Creek watersheds. A buffer of 60 meters along the travel routes was used. An estimated 6,050 acres out of 18,197 total acres (33%) within the watersheds would be affected by roads under Alternative C. This equates to a rating of "moderate level of human influence on riparian nonwinter habitats." There would be roughly the same acres impacted under this alternative than under existing conditions.

Riparian Habitat Nonwinter Route Density Index: The effects of roads and motorized trails within the Toroda and Myers Creek watersheds were analyzed using the index recommended by Gaines et al. (2003). The impacts on riparian habitat fall under the category of "high level of human influence on riparian nonwinter habitat" for these two watersheds. This means that more than 25% of the riparian area is impacted by road densities of > 2 miles per square mile. For the combined area of these two watersheds, 60% of the riparian habitat falls into this category. This is the same overall percentage as the existing conditions, however this alternative does increase the road densities to > 2 miles per square mile for an additional 5 acres above existing conditions.

Riparian Habitat Winter Recreation Route Density Index: The effects of roads and winter trails within the Toroda and Myers Creek watersheds were analyzed using the index recommended by Gaines et al. (2003). The impacts on riparian habitat fall under the category of "high level of human influence on riparian winter habitat" for these two watersheds. This means that more than 25% of the riparian area is impacted by road densities of > 2 miles per square mile. For the combined area of these two watersheds, 58%

of the riparian habitat falls into this category. This is the same overall percentage as the existing conditions, however this alternative does increase the road densities to > 2 miles per square mile for an additional 5 acres above existing conditions.

Alternative D

Direct/Indirect Effects

There would be much less disturbance on National Forest System lands and rights-of-way and reduced habitat alteration compared to the other action alternatives. Approximately 0.6 mile of the ore haul route crosses National Forest System lands, all of which would be new road construction. The rest of the haul route would follow the existing Cow Camp road and Forest Service rights-of-way to the Pontiac Ridge Road, OCR 4895.

The speed limit would be 25 mph, and this would have a lower risk of roadkill to wildlife compared to Alternative B that has a speed limit of 30 mph. Ore and supply haul would occur Monday-Friday with no haul on the weekends. This would mean less impacts on Saturday and Sunday, but increased impacts on Monday-Friday. The number of ore trucks per day would average 70 round-trips, because no ore haul would occur on Saturdays or Sundays. Employees would still be able to take any route during snow-free months, similar to other the other action alternatives.

The total mileage of ore haul route across National Forest System lands and rights-of-way would only be 3.7 miles, of which approximately 0.6 miles would be new construction and 3.1 miles would be reconstruction on NFS rights-of-ways across State and private lands. The other project components are similar or identical to the other action alternatives, so the effects of those components are the same.

The power, data, and telephone lines would be buried in the road prism along the ore haul route and there would be minimal new disturbance associated with the installation of the utility lines since they would be done at the same time and location as road reconstruction/ construction is taking place.

Most of the existing network of surface water sites and the monitoring wells would be monitored during the winter by snow machine. They would be accessed once a month, possibly less often, possibly more often early in the life of the mine. Impacts would be the same as those discussed under Alternative B1.

Cumulative Effects

Displayed below are the road densities by MA for Alternative D. These road densities are the sum total of all past road construction actions plus road construction under Alternative D in affected management areas.

Table III-54: Alternative D During Project Open Road Density

	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	3.5	3.8	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	44.8	1.9	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	7.5	1.4	1.0

The models and indices recommended by Gaines et al. (2003) were used to estimate the area affected in these representative habitats. The estimates were based on "open" travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore, the intensity of impacts along the ore haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the models shown below.

Late Successional Forest Nonwinter Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for late successional forest nonwinter habitat within the Myers and Toroda Creek watersheds. A buffer of 50 meters along the travel routes was used. An estimated 3,076 acres out of 32,757 total acres (9%) within the watersheds would be affected by roads. This equates to a rating of "low level of human influence on late successional nonwinter habitats." There would be roughly 10 more acres impacted under this alternative than under existing conditions.

Late Successional Forest Nonwinter Security Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for late successional forest nonwinter security habitat within the Myers and Toroda Creek watersheds. A buffer of 200 meters along the travel routes was used. An estimated 10,826 acres out of 32,757 total acres (33%) within the watersheds would be affected by roads. This equates to a rating of "moderate level of human influence on late successional nonwinter security habitats." There would be roughly 3 more acres impacted under this alternative than under existing conditions.

Late Successional Forest Winter Security Habitat (northern goshawk, American marten, Pacific fisher, and white-headed woodpecker): The model recommended by Gaines et al. (2003) was used to estimate the area affected by roads and winter trails for late successional forest winter security habitat within the Myers and Toroda Creek watersheds. A buffer of 200 meters along the travel routes was used. An estimated 9,442 acres out of 32,757 total acres (29%) within the watersheds would be affected by roads. This equates to a rating of "low level of human influence on late successional winter security habitats." There would be roughly 12 more acres impacted under this alternative than under existing conditions.

Riparian Nonwinter Habitat Influence Index: The index recommended by Gaines et al. (2003) was used to estimate the area affected by roads and trails for riparian nonwinter habitat within the Myers and Toroda Creek watersheds. A buffer of 60 meters along the travel routes was used. An estimated 6,050 acres out of 18,197 total acres (33%) within the watersheds would be affected by roads. This equates to a rating of "moderate level of

human influence on riparian nonwinter habitats." There would be roughly the same acres impacted under this alternative than under existing conditions.

Riparian Habitat Nonwinter Route Density Index: The effects of roads and motorized trails within the Toroda and Myers Creek watersheds were analyzed using the index recommended by Gaines et al. (2003). For Alternative D, the impacts on riparian habitat fall under the category of "high level of human influence on riparian nonwinter habitat" for these two watersheds. This means that more than 25% of the riparian area is impacted by road densities of > 2 miles per square mile. For the combined area of these two watersheds, 60% of the riparian habitat falls into this category. This is the same overall percentage as the existing condition, however this alternative does increase the road densities to > 2 miles per square mile for an additional 5 acres above existing conditions.

Riparian Habitat Winter Recreation Route Density Index: The effects of roads and winter trails within the Toroda and Myers Creek watersheds were analyzed using the index recommended by Gaines et al. (2003). The impacts on riparian habitat fall under the category of "high level of human influence on riparian winter habitat" for these two watersheds. This means that more than 25% of the riparian area is impacted by road densities of > 2 miles per square mile. For the combined area of these two watersheds, 58% of the riparian habitat falls into this category. This is the same overall percentage as the existing condition, however this alternative does increase the road densities to > 2 miles per square mile for an additional 5 acres above existing conditions.

Effects Common to All Species and All Action Alternatives

Indirect toxic impacts to wildlife could occur in the unlikely event of an accidental transport spill of chemicals (such as diesel) into any of the creeks along the haul route. With any potential spill, the likelihood of wildlife being affected by contaminated water is low since a spill would be a short-term accidental event, assuming that containment and cleanup are immediate and effective. In the case of large spills, or those that are not contained and cleaned quickly, the effects to wildlife and habitat may be more far-reaching and long-term. Cleanup would occur according to the Spill Response Plan (see Chapter II) and it's unlikely that any effects of a spill on National Forest System lands would reach Toroda Creek, although it would depend on the time of year and flows. Marias and Nicholson Creeks are low energy streams. The likelihood of a spill reaching Toroda Creek would depend on the location of the spill and its viscosity, although there would still be a low probability even during spring runoff. In addition, the extent of human activity associated with emergency containment and cleanup activities would be avoided by wildlife. More information on spills is provided at the end of this chapter.

The 1.7 miles of fence on National Forest System land placed around the patented lands would enclose 74 acres of National Forest System land. This fence would be made as passable to wildlife as possible. It would be 3 strands of barbed wire spaced so that it would only be a minor obstacle to wildlife but would minimize access to the road and stream by cattle.

The supply route during mine construction would be Forest Roads (FR) 3575-120, and 3575-140 for which the Forest Service issues a road use permit in September 2006. Supply related traffic during road construction and reconstruction would be heavy for the first 3 months and then may shift to the ore haul route as it is completed. The Forest Service issued Crown/Kinross a road use permit to access their private lands in September 2006 so supply traffic to the private lands, and the associated disturbance of wildlife has already

begun. Supply traffic related to the road construction and reconstruction, infiltration gallery and other items that are part of this decision would not begin until Spring of 2007.

Supply traffic during mine operation would amount to substantially less traffic per day than ore haul, the impacts would be of the same type as ore haul, although it would follow the ore haul route and would add to the impacts along the route. Employee traffic would follow the ore haul route in winter because that may be the only plowed access to the mine, although the proponent can request to plow open Forest Road 3575-120 for employees who want to access the mine from the south . During the summer, employees could potentially use other roads to access the mine, although most would probably follow the ore haul route because it would be the best maintained road. Employee traffic would have an impact nearly equal to that of ore haul traffic because the number of trips per day for each type would be similar. Employee traffic could amount to more traffic volume per day than ore haul. The impacts would be similar in type to that of ore haul, although employee traffic would not be as evenly distributed throughout the day as ore haul. Employee traffic would likely be very concentrated during the 5:00 a.m.-9:00 a.m., and 5:00 p.m. and 9:00 p.m. time periods due to shift changes. During the rest of the day employee traffic would be less. Employees using roads other than the ore haul route would spread impacts to those alternate routes, and those impacts would be similar to those discussed for along the haul route.[90]

FR 3575-120 to 3575-140 to 3574-143 would be utilized to access the water storage tank for the mine, and this route would be plowed during the winter. This would additionally increase the traffic on roads that are normally snowed over during winter. Disturbance along this route would increase slightly over current conditions, although the increase would be fairly small. The water storage facility would likely only be visited once every 1-2 weeks, unless it needed more extensive repair. The Proponent may optionally plow the 3575-120 road to allow employee traffic to access the mine via this route during the winter in addition to the ore haul route. Only a few hundred feet would need to be plowed open as the rest of the 120 road would already be plowed open for other reasons. It would already be partially plowed from the mine site to access the 140 road and the water tower in winter. On the south end it would be plowed up to the private residences. Completely opening the 120 road would encourage employee and public use of the road during a time when it would normally be snow covered and inaccessible via automobile. Up to 51 employee vehicle trips (one-way) would be expected on the 120 road if it was plowed open in winter. This would spread the impacts of employee traffic over a larger area instead of being concentrated along the ore haul route in winter. The affected area would be the same as during summer when employees can access the mine via the 120 road.

The infiltration gallery and conveyance pipeline would impact wildlife habitat. The conveyance pipeline would include the removal of vegetation from a 40-foot wide corridor for the pipe and service road that follows the pipe. The area around the dosing tanks and infiltration gallery would be cleared as well, and the total acreage for the pipeline and gallery would be approximately 6 acres. There would likely be increased disturbance in these areas to wildlife. There would also be 6 acres of habitat removal associated with these facilities. The access road that would run along the conveyance pipe would be closed to public access and would be approximately 4640 feet in length. The new road/pipeline would run primarily

[90] WADOE's FSEIS indicates on page 3.11-16 that "winter traffic on the Marias Creek Road will be reduced by carpooling or restricting traffic not related to the mine in order to reduce collisions with deer." This statement is incorrect. Forest Road 3550 (the Marias Creek Road) would be open to all traffic, although FR 3550-125 would only be open to mine traffic. Although carpooling is encouraged, it would not be required.

along previously obliterated roads. The 3575-120 road from the ore haul route to the infiltration gallery would be plowed in winter in order to access the infiltration gallery. Additionally, the road along the conveyance pipeline would be accessed via snowmobile in winter, although it would be plowed in the event that heavy equipment was necessary for repairs. Under the Alternative B this would be changed to allow the Proponent to plow the road when they needed access instead of using a snowmobile. The plowing and snowmobile use of these roads in winter would increase disturbance to wildlife during winter. It would improve access for some wildlife, which would cause them to enter habitats that they normally could not access due to snow depths. This would have impacts on other wildlife through such mechanisms as competition for scarce resources in winter.

There would be approximately one year of reclamation and 3-5 years of reclamation monitoring work after the mine ceases operation. Operations should last 8 years. Reclamation includes removal of the boundary fence, infiltration gallery, and sections of the conveyance pipe. The section of the ore haul route from the mine portal to Cow Camp would be returned into a one-lane road with intervisible turnouts. Reclamation in Alternative B1 would partially reclaim Forest Road 3550 and 3550-125 by scraping rock to one side of the road to create a driving surface similar to the current width on the road. The remaining surface would be ripped and seeded. The reclamation and monitoring activities would potentially disturb any species present nearby. Only ground previously altered/disturbed would be impacted by reclamation, so no additional habitat should be lost as a result of these activities.

The section of new construction of ore haul route from the 3575-120 road to the mine site would be the same under all action alternatives. There would consequently be a loss of potential habitat within the footprint of this new road. Up to 5 acres of forested habitat would be lost to the footprint of the new road construction, although some habitat would be restored on the old road bed after reclamation. The slight differences between alternatives in reclamation of this new road would not result in any different effects between alternatives to wildlife.

The new road construction from Forest Road 3575-120 to the patented lands passes through a stand of mature Douglas-fir with a grassy understory. The construction of this section of road would remove potential habitat, and the continued use of this area would increase disturbance to any blue grouse nearby. The disturbance would cause grouse to avoid using habitat adjacent to the roadway and shift use to other available habitat. Forest Road 3575-140, which accesses the proposed water storage facility, also passes through potential habitat. There is a grass/sagebrush opening with scattered small trees near the top of Buckhorn Mountain.

Dust and dust suppressants can negatively impact wildlife and their habitats near roadways (Foreman and Alexander 1998, Trombulak and Frissell 2000). They can alter microsite conditions near the roadway and create unfavorable conditions for animals and the habitats they rely on. Impacts to plants and invertebrates near the roadway would impact forage and prey available for small amphibians, birds, reptiles, and mammals. In turn, the predators that feed on these small animals would also be impacted. The chemicals may also directly impact animals due to their toxic effects. These unfavorable conditions near the roadway may cause species to avoid using those sites and shift to more favorable habitat. Salts may accumulate along the roadway, which in turn may attract some wildlife, and thereby increase their susceptibility to being killed by vehicles.

Toxic effects of dust suppressants depend on the chemicals and species impacted. Magnesium chloride, utilized as a dust suppressant in this proposal, has been documented to cause weight loss in small mammals (Kurata et al. 1989, Tanaka et al. 1994), although the lethal dose of this chemical is relatively high and therefore considered "practically non-toxic" (Fischel 2001). Other effects include skin and eye irritation. Lignin sulfonate is an alternative dust abatement chemical that is biodegradable and is added to livestock feeds (Mansfield and Stern 1994, Flickinger et al. 1998). These effects would be limited to the roadway and immediately adjacent habitats.

Biodiversity can be negatively affected by roads (Gucinski et al. 2000). Trombulak and Frissell (2000) identified seven general ecological effects of roads: mortality from road construction, mortality from vehicle collisions, modification of animal behavior, alteration of the physical environment, alteration of the chemical environment, spread of exotics, and increased use of the area by humans.

Depending on the mobility and habits of a species, higher mortality may be experienced along roadways in amphibians and reptiles (Car and Fahrig 2004, Joslin and Youmans 1999). Road related mortality may not limit populations of common species, particularly species of rodents, but even the mortality associated with forest roads can depress the populations of some snakes (Rudolph et al. no date). Road width may fragment habitat and limit movement of some smaller species of mammals, reptiles, and amphibians, and road salt may limit movements of amphibians (Foreman and Alexander 1998, Jochimsen et al 2004). Roads have differing barrier effects on small mammals (McDonald and St. Clair 2004) and this probably depends on road width and traffic volume, so although the substantial increase in road traffic along the haul route is not as consequential as a major highway, it would still possibly alter movement patterns of small animals. The haul route is not likely to be a complete barrier, but is more likely to be a semi-permeable one. Roads also create new microclimates on and adjacent to the road (Spellerberg 1998), and this may affect the suitability of the sites immediately adjacent to the road for habitat for small prey species. Forest roads can also reduce soil macroinvertebrate abundance and species richness near roadways (Haskell 1999), and these provide prey for amphibians and some ground foraging birds, which in turn provide prey for other species.

Mine employees would undergo training that would include environmental considerations. Included in this training would be hunting and firearm prohibitions, speed limits, prevention of wildlife harassment, and the identification of and sighting reports for threatened and endangered species. This would reduce the occurrence of persecution that may be exhibited against some wildlife species.

The operation of the mine would result in a drop in water tables, as described in the Hydrology section in this document. The result would be reduced flows to streams, seeps and springs, and potential small alteration of riparian habitat adjacent to these sites. This would be partially or fully mitigated depending on the time of year and location by the infiltration gallery and the diversion of water to the Roosevelt adit, which flows to the 9-acre wetlands, and to some wetlands in the headwaters of Marias Creek, all of which are on NFS lands. A water trough would be installed near the wetlands in the headwaters of Marias Creek. The water for these diversions would come from the infiltration gallery conveyance pipeline or another pipeline laid parallel in the same trench. Augmentation and infiltration would partially or fully mitigate the reduced flows due to the lowered water tables. More details regarding the effects on water quantity can be found in the Hydrology Cumulative Effects section in this document.

Wildlife guzzlers would also be installed on the southwest side of Buckhorn Mountain to partially mitigate the reduction in available water for wildlife, and impacts to seeps, springs and wetlands in the Myers Creek drainage from mine dewatering on private lands. These guzzlers would provide water to deer while they are near full, and would provide water to small animals while there was any water within the guzzler. Guzzlers would be placed on NFS lands, one near the headwaters of Ethel Creek and the other near the headwaters of the South Fork Bolster Creek. Others would be on DNR managed lands near Gold Creek and the North Fork Bolster Creek. Each guzzler would be placed on a previously disturbed site such as a road. It would be years after the mine ceases operation before the water table rises back to full equilibrium, so these mitigation measures would remain in place for at least several years after the mine ceases operation. The installation of these mitigation features would cause some disturbance to wildlife due to human presence and the use of equipment to transport the materials. This disturbance would be short in duration and would cause wildlife to temporarily avoid those areas. The installation of these mitigation features would partially compensate for the altered stream flows, impacted riparian areas, and loss of some seeps and springs caused by mine dewatering on the west side of Buckhorn Mountain.

Under current Buckhorn Mountain Project plans, the stormwater storage ponds that are planned for installation on private lands are planned for conversion to wildlife watering ponds upon reclamation. Once mining activities cease, the fencing is removed, and few people are left to disturb wildlife, these ponds would serve as a water source for wildlife to offset dewatering impacts on seeps, springs and wetlands on both private and NFS lands until mine equilibrium.

The culvert in the lowest section of Forest Road 3575, the culvert on Forest Road 3575-080, and a culvert on a non-system road that crosses Nicholson Creek would be replaced under all alternatives with culverts allowing for passage by aquatic species. There would be a small amount of disturbance during these replacements, which would displace any wildlife near the construction site for a short period.

Water monitoring sites (well, staff gauges, piezometers, wetland monitoring sites, and surface sites) would be used to monitor the impacts of the mining activity. Some of these sites are on NFS lands. Some sites currently exist. The installation of these sites and the continued monitoring of them would cause disturbance to wildlife near these sites. Many sites would only be visited once a month. This would cause wildlife to temporarily avoid these areas. Monitoring sites in the vicinity of Ethel Creek would be administratively accessed via closed roads, thus increasing disturbance along those roadways slightly when monitoring occurs. Water monitoring may continue for up to 60 years or more after mining, although there should only generally be four visits per year after mining has ceased. This monitoring is different than the reclamation monitoring that would take place for 3-5 years after mining has ceased. Although the duration of this water monitoring would be long, the intensity would be low and would be difficult to detect above current vehicular traffic levels in the Buckhorn Block of NFS lands. Disturbance effects to wildlife should be minor.

Snags would be created within riparian areas to mitigate for the loss of any snags due to the construction/reconstruction of the road and other project components. Snags would be created in areas other than along the ore haul route in order to minimize disturbance effects from mine related traffic. When considered at the broader scale of the entire Buckhorn Block of National Forest System lands (30,353 acres) or the entire watersheds, the loss of snags to this project would be so small as to be nearly immeasurable. The mitigation would create 3.5

times as many snags as the number of acres of NFS lands cleared, so the result would be more snags available than are currently available.

No Management Requirement (MR) cells are located along the Marias (Alternatives B and B1) or Cow Camp (Alternative D) routes. However, two MR cells are identified on the MR grid directly adjacent to the Nicholson (Alternative C) route, and one is directly adjacent to the 3575-100 road where the electrical line would be buried. Road widening could potentially affect the two MR cells along the 3575 road, removing a slight amount of acres, but the areas where these cells are designated are continuous mature and old growth stands that are at the edge of the Jackson Creek inventoried roadless area, and the MR requirements can be met further away from the road where good habitat is present. An additional Three-Toed Woodpecker MR was designated in the Nicholson Timber Sale, but this stand is well over the required 75 acres and widening the road would only impact a few acres in the stand. Burying the utility line in the 3575-100 road would have no effect on the MR cell adjacent to that road.

The Forest Plan (1989) requires that sufficient woody debris be left on the forest floor for wildlife habitat. Approximately 57 acres would be cleared for project activities in Alternative B and B1, 65 acres in Alternative C and 26 acres in Alternative D. To entrain sediment, woody debris would be placed below the haul route in slash windrows, which would provide sufficient woody debris, although, because of the disturbance along the haul route many wildlife may avoid these areas.

Cumulative Effects Common to All Species

A written discussion of cumulative effects for each species can be found in each species' section. Cumulative effects are overall impacts of all past, present, and reasonably foreseeable future actions. Actions that were considered include: the mine proposal on private lands, timber sales; fire and effects of fire suppression; grazing; noxious weed management; and recreation. The area considered for cumulative effects includes Myers and Toroda Creek HUC 5 (hydrologic unit code) watersheds and the State, BLM, and private lands adjacent to the National Forest. All known projects potentially to occur within the next decade, or during the life of the mine, were included, although additional, currently unknown projects may arise in the future. This project, when considered cumulatively with the other projects, would not seriously hinder the recovery goals for bald eagles, Canada lynx, gray wolves, or grizzly bears. This project, when considered cumulatively, would not result in a trend towards federal listing for the sensitive species analyzed in this document. Cumulative effect of this project on MIS and other species of interest would be insignificant. The cumulative effects of mine dewatering and water infiltration/augmentation are described earlier in this chapter in the Hydrology section, including impacts to stream flows, wetlands, seeps and springs.

The adjacent State and BLM lands also would have timber harvest, grazing, and other activities ongoing. Private lands potentially may undergo future development, grazing, timber harvest, or agriculture.

The incremental effects of this Buckhorn Access Project when considered cumulatively with the other activities would be insignificant.

The Buckhorn Mountain Project (non-NFS lands and components) is proposed as an underground mine to be largely backfilled after mining, and the existing Kettle River Mill, which is on private land, is proposed to be used rather than a new mill. Use of the Kettle

River Mill for the Buckhorn Mountain ore processing would require enlargement of the existing tailings disposal facility (TDF). The Buckhorn Access Project would not have any overlapping effects with this part of the Buckhorn Mountain (Mining) Project. The area that would be affected by the mine facilities at Buckhorn Mountain has been previously affected by historical mining and more recent mine exploration and predevelopment work. Part of the area is conifer forest and part is previously disturbed land on which reclamation has been started. The new haul road segment would be located primarily through conifer forest with small areas of shrub steppe, grassland steppe, and riparian forest. The backfill borrow site is primarily grassland steppe and open conifer forest. The TDF borrow site at the Kettle River Mill is primarily shrub steppe. Springs, seeps, and headwater streams around the upper part of Buckhorn Mountain that may be affected by dewatering of the mine include headwaters of Nicholson and Marias Creeks on the east slope, all tributary to Toroda Creek, and Gold, Bolster, and Ethel Creeks, all tributary to Myers Creek, on the west slope. Riparian habitat supported by these waters provides wildlife habitat (Washington State Department of Ecology 2006, p 3.11-1 – 3.11-2).

The Buckhorn Mountain (Mining) Project (on private and State lands) would impact approximately 116 acres. Crown controls 105 of those acres, and 11 acres are administered by the State (Washington State Department of Ecology 2006, p. S-4). The Beal Borrow site (backfill borrow site) and the borrow area for expanding the TDF would primarily impact grassland and shrub-steppe habitat. The mine facilities would remove early successional and mature conifer forests. The new ore haul road through State and private lands would impact mature conifer forests, as well as some riparian forests.

Similar to the effects of the Forest Service project for the Buckhorn Access Project, the road building in the Buckhorn Mountain Project on State and private lands would increase disturbance to wildlife due to increased vehicle traffic as well as construction noise. The ore trucks, supply trucks, and employee traffic would additionally raise the probability of wildlife being struck by a vehicle and killed although the low speed limits would minimize this potential. The new road on State and private lands would also fragment habitat and create more edge, further reducing habitat suitability for many species. Dust and dust abatement chemicals along the roadway would degrade habitat quality adjacent to the road and potentially remove those areas from available habitat. Use of existing roadways would have similar effects.

The noise associated with the mine construction and operation would add to the disturbance to nearby wildlife and may result in animals leaving the vicinity. Noise levels would reduce substantially once mining and reclamation was completed. Reclamation and monitoring would restore some of the wildlife habitat, although it would take many years to grow to mature forest components that were lost due to mine construction.

Rock was excavated from private lands near the base of the Pontiac Ridge road and from another pit over by Curlew and used for heavy maintenance on Forest Roads 3575-120 and 3575-140 to improve it for supply traffic during the construction of the mine site. This rock was used on National Forest System lands. These activities on private land and DNR managed lands impacted wildlife, but this heavy road maintenance is now complete so the only cumulative effects with the Buckhorn Access Project are the use of these roads and continuing displacement of wildlife. The ongoing disturbance on private lands and land managed by the Department of Natural Resources likely caused and are causing wildlife to avoid the area and utilize other habitats instead.

Rock would be excavated from the Beal borrow site on private land in Ferry County. This rock would be used for backfill at the mine, as well as for surface aggregate on the haul route across National Forest System lands and rights-of-ways. The activity at the Beal borrow site would disturb and likely displace any wildlife present on the site (a mixture of grassland and conifer), as well as remove potential habitat. This site may provide summer and winter habitat for a variety of species.

The expansion of the tailing disposal facility at the Kettle River Mill, located on private lands 47 miles from the Buckhorn Access Project is included in this analysis because it is required for the Biological Assessment. This information is provided gratuitously to readers. Effects at the TDF do not, however have any overlapping effects with the effects from the Buckhorn Access Project and are therefore not cumulative effects to the Buckhorn Access Project. Construction at the Kettle River Mill would increase disturbance during the construction of this facility. There would also be a loss of some habitat to the footprint of the expanded facility and the borrow site. The State Department of Ecology's Buckhorn Mountain Project FSEIS briefly describes the effects on wildlife of the chemicals in the existing TDF. The chemical makeup is similar to the makeup of the tailings facilities for the Crown Jewel Mine (1997) study, and would likely have low impacts to wildlife. Most impacts would be to birds, bats, and amphibians that could have easier access to the tailings facility liquids than terrestrial wildlife that would be excluded by a fence. Ammonia would be the biggest concern and would have the greatest toxic effects. Cyanide, metals, and ammonia would result in only a small number of mortalities as expected under the Crown Jewel project at the tailings facility, and that document did not deem those significant. As described in the State's FSEIS (2006, p. 3.7-28), average cyanide concentrations at the Kettle River mill ranged between 0.11 and 8.9 mg/L during 2003 and 2004, below the values modeled in the Crown Jewel Mine FEIS. Average concentrations during the project are likely to be in the same range, with occasional spikes higher than that. These levels may be higher than those predicted under the Crown Jewel project, although ammonia would still be the primary toxic concern. The same animals that were predicted to be killed under the Crown Jewel project should be expected to be killed under this project at the higher ammonia and cyanide concentrations. A fence around the facility would discourage wildlife use, for example by deer. Bird mortalities would be monitored and mitigation to discourage bird use would be evaluated and applied if mortalities are notable (Washington Department of Ecology 2006, p. 3.11-15).

The operation of the mine on private land would result in a drop in water tables. The result would be reduced stream flows, reduced seeps and springs, and loss of riparian habitat adjacent to these sites. The full effects of the mine dewatering probably wouldn't occur until the end of mining. Dewatering impacts during and for a short time after mining would be partially mitigated by the diversion of water to below the Roosevelt adit, and some wetlands in the headwaters of Marias Creek on NFS lands. A water trough would be installed near the wetlands in the headwaters of Marias Creek. The water for these diversions would come from the infiltration gallery conveyance pipeline. This would partially mitigate the reduced flows due to the lowered water tables. Wildlife guzzlers would also be installed to partially mitigate the reduction in available water for wildlife. These guzzlers would provide water to deer while they are near full, and would provide water to small animals while there was any water within the guzzler. Guzzlers would be placed on NFS lands, near the headwaters of Ethel Creek and near the headwaters of the South fork Bolster Creek. Others would be on DNR lands near Gold Creek and the North Fork Bolster Creek. Each guzzler would be placed on a previously disturbed site such as a road where noxious weeds are absent. It would be years after the mine ceases operation before the water table rises back to full equilibrium, so these mitigation measures would remain in place for at least several years

after the mine ceases operation. The Proponent has an adaptive management plan for these guzzlers, as well as for their other mitigation features associated with wetlands, seeps, and springs (Golder Associates, September 1, 2006). This adaptive management plan contains monitoring measures, data analysis methods, and thresholds that trigger certain mitigation measures. Depending on the level of impacts, additional guzzlers would be installed, or further wetland enhancement at some of the privately owned mitigation properties would be initiated. If monitoring and data analysis determines that the effects of water table draw down are likely to be greater than that originally predicted, then the adaptive management plan states that a contingency plan would be created and new mitigations adopted. The installation of these mitigation features would cause some disturbance to wildlife due to human presence, the use of equipment to transport the materials, and the use of a trencher to place the pipelines. This disturbance would be short in duration and would cause wildlife to temporarily avoid those areas. The installation of these mitigation features would partially compensate for the altered stream flows, impacted riparian areas, and loss of some seeps and springs.

The dewatering of the mine would affect the following springs, seeps, and headwater streams: headwaters of Nicholson and Marias Creeks on the east slope of Buckhorn Mountain; and Ethel, Gold, and Bolster Creeks (tributaries of Myers Creek) on the west slope. This includes impacts to the wetlands in the vicinity of the Roosevelt Adit and infiltration gallery, and as discussed above water augmentation and infiltration would partially or fully offset the dewatering impacts depending on the time of year and location (see Hydrology Cumulative Effects section earlier in this document). Reduced flows from mine dewatering may also result in reduced riparian habitat productivity (Buckhorn Mountain Project FSEIS 2006). The Buckhorn Access Project would not have overlapping effects with dewatering impacts in the Myers Creek drainage.

Water discharge from the mine would have to meet State water quality standards as set by the NPDES permit. Impacts to wildlife or habitat due to water quality are unlikely if the discharge meets these standards. This includes all water from the mine that ends up in the springs, seeps, wetlands, guzzlers, water troughs, and Roosevelt Adit. The possibility of wildlife mortalities due to toxic effects from mine water are expected to be remote (Buckhorn Mountain FSEIS 2006)

Two water troughs may also be placed on State lands in T40N, R30E, Section 36. These would serve to attract livestock away from the ore haul route. These range mitigations would have the added benefit of helping redistribute livestock away from Marias Creek and therefore improving riparian conditions for wildlife. The installation of these features would temporarily disturb wildlife near the activities, but this disturbance is expected to be relatively short in duration.

There would be several mitigation sites that are on private lands that would be retained to benefit wetlands and wildlife habitat. These include the Pine Chee wetland, Hungry Hollow, Lower Nicholson Creek, the property along Myers Creek north of Forest Road 3575, and Cow Camp sites (total of approximately 500 acres [Washington State Department of Ecology 2006; p. 3.11-15]). These were identified by the State and the mining company as areas to maintain or enhance to partially compensate for the loss of wildlife habitat and wetlands due to the Buckhorn Mine. Some of these sites are adjacent or near the Buckhorn Block of NFS lands. The Proponent has an adaptive management plan to use for these sites, as well as for their other mitigation features (Golder Associates, September 1, 2006). This adaptive management plan contains monitoring measures, data analysis methods, and thresholds that

trigger certain mitigation measures. If monitoring and data analysis determines that the effects of water table draw down are likely to be greater than that originally predicted, then the adaptive management plan states that a contingency plan would be created and new mitigations adopted.

Workers associated with the mine construction and operation may choose to recreate and hunt in the Buckhorn Block of NFS lands because they become familiar with the area through work. Other hunters and recreationists that have traditionally used the areas may choose not to do so during the life of the mine activities due to the substantial increase in traffic and disturbance. It is possible that hunting pressure on local wildlife would either increase or decrease over the life of the mine construction and operation, depending on how many hunters leave versus how many begin using the area.

Previous and on-going exploration for gold associated with the Buckhorn Mountain Project has been done by several corporations over the years. Most exploration disturbance areas have been reclaimed. The gold exploration disturbed habitats and wildlife that were present during those activities, and the reclamation activities started the lands on their way to providing future wildlife habitat. Past projects may have impacted the balance of water in certain drainages within the Buckhorn Block, and may have impacted water availability. Wildlife likely shifted use from drainages that may have had more water before these activities to drainages that had more water after these activities.

Past mining and logging activities in the Buckhorn Mountain area has caused habitat loss for many wildlife species, although a few species may have benefited. The removal of forested habitats would have degraded habitat conditions for those species relying on that habitat type. Bat habitat may have been created by mine adits and old buildings for species such as bats. The roads built to access these mines would have added to habitat loss, as well as increased forested habitat fragmentation and disturbance to wildlife. Past projects may have impacted the balance of water in certain drainages within the Buckhorn Block, and may have impacted water availability. Wildlife likely shifted use from drainages that may have had more water before these activities to drainages that had more water after these activities.

The patenting of the Crown Resources claims resulted in a transfer of wildlife habitat out of public ownership and into private ownership. After mine closure, it is possible, although not reasonably foreseeable because nothing has yet been proposed, that these private lands would be developed and this would result in a loss of more wildlife habitat and high levels of human presence and disturbance. Alternatively the lands could be placed in a conservation easement.

Past road closures associated with the Crown Jewel Mine project and the three Nicholson Timber Sales would have improved habitat for most species of wildlife because of the detrimental effects of roads and disturbance. However, the creation of these roads in the first place degraded habitat and the road closures are only partially restoring historic conditions. Some roads that were closed by previous projects have been breached in the project area, and these roads would be re-closed as they are discovered during regular road maintenance activities which would further reduce existing road densities in the project area and reduce potential disturbance of wildlife species. The cumulative result of the past road construction, new road construction, past road closure and new road closures are displayed in the alternative road density charts above.

Hunting, fishing, and gathering by members of the Confederated Tribes of the Colville

Reservation would impact certain species of wildlife typically taken during hunting, as well as contributed to human presence and disturbance of wildlife.

Livestock grazing within the Ethel, Gold, and Cedar allotments, as well as others within the Myers Creek and Toroda Creek HUC5s would continue to alter vegetation and therefore wildlife habitat. Domestic livestock did not evolve in these ecosystems, nor did these ecosystems evolve with a grazer that behaves like domestic livestock. Wild ungulates evolved in the presence of native predators, such as wolves, and therefore behave differently than do domestic livestock. Livestock, like any other exotic species, can alter vegetation and even compete with native species for food, water, and space. Additionally, disturbance to wildlife from livestock or human activity related to livestock management would impact wildlife.

Noxious weed treatments would improve habitat conditions for many wildlife species by retaining native vegetation and therefore wildlife habitat. Herbicide application may kill native plants (wildlife habitat) accidentally, although this impact should be localized because of the techniques (spot treatment) used for herbicide treatments on NFS lands. Herbicide treatments have the potential to kill amphibians or invertebrates that provide prey for other wildlife, although proper application should limit the potential for this effect. The human presence associated with noxious weed control activities could disturb wildlife in the vicinity of the activity, although the disturbance is likely to be short in duration. It is likely that, because of the Buckhorn Access Project, noxious weed control efforts under the existing Integrated Weed Management decisions would have to be increased along the haul route, which would increase human presence, but impacts to wildlife wouldn't increase along these routes because disturbance would be fairly continuous from traffic.

Past, ongoing, and future firewood cutting and hauling has caused and would continue to cause habitat loss for snag dependent species, as well as disturbance due to the human activities. Snags are expected to be lost close to open roads, and those snags further from easy access points are likely to remain on the landscape for a longer period of time. The removal of snag habitat not only impacts those species dependent on snags, but it also impacts the predators that prey on those species. It's unlikely firewood cutters would fall snags along the ore haul routes because of the magnitude of the traffic on these routes. It is likely that firewood cutters would increase snag losses in other areas. This would be less prevalent in Alternative C and D since those alternatives have no haul on Sunday, or Saturday and Sunday, respectively.

Recreational activities have occurred in the past and are likely to continue into the future. Human activities would contribute to wildlife disturbance, and in some cases recreation may contribute to habitat loss. Examples of habitat loss include the cutting of standing or downed dead trees for firewood and travel off road with ATVs. Wildlife disturbance, particularly during critical periods of the year such as winter, is likely to be the biggest impact associated with recreational activities. Road use is especially high during the deer hunting season in the fall. Recreational use around Beth and Beaver lakes increases disturbance to wildlife within the larger HUC5s of this analysis, although most of the effects would mix primarily with Alternative D where ore haul traffic would be within a mile of Beth and Beaver lakes. It's likely recreationists would move to areas away from the haul routes because of the level of noise, dust and other disturbance, further increasing disturbance in other areas.

The traffic from the Wauconda Quarry would overlap with the supply traffic for the Buckhorn mine. This traffic impacts wildlife through disturbance and through direct mortality. The

general impacts of traffic on wildlife are discussed in more detail under direct and indirect effects for this project. The supply traffic for the Buckhorn mine would not add substantially to the impacts of the traffic from the Wauconda Quarry on the Toroda Creek road.

Okanogan and Ferry County roads along Toroda Creek would be reconstructed in order to support the increase in truck traffic related to the mine. Reconstruction of the Ferry County portion of this was mostly completed this fall. The construction activities has and would continue to cause localized increases in disturbance to wildlife, although this disturbance would only last as long as the construction activities.

The culvert on Marias Creek where the creek crosses under the Toroda Creek Road would be replaced by Okanogan County as part of the road upgrade for the mine project. This would provide better passage for aquatic organisms. This would have little effect for terrestrial wildlife species. Those that would be impacted would only have minor disturbance impacts from construction activities to replace this culvert. This would be a short-duration project and would add very little to the long-term cumulative disturbance impacts from this project. Riparian planting in the same area would cause short term disturbance and may create better wildlife habitat, although this is directly adjacent to the Marias haul route in Alternatives B and B1, and may increase potential for injury or mortality to wildlife.

Work has begun on the State DNR's Little Nicky Timber Sale in T40N, R31E, S22 & 27. This project includes 232 acres of harvest, haul out the 3575-040 and 3575 roads, and road reconstruction including riprap and ditching. Forested habitat for many species would be altered on the 232 acres of harvest though many of the trees to be removed are already dead. Depending on the types, quantities, and sizes of trees removed, habitat for some species may be degraded while others might be improved. The timber harvest may degrade connectivity. The lands to be harvested are near the boundary of the National Forest and the Jackson Creek Inventoried Roadless Area. Those wildlife species needing large expanses of unfragmented habitat are most likely to utilize the Jackson Creek IRA and other unroaded areas. The timber harvest on State lands may impact connectivity of habitats. Additionally, the harvest would increase disturbance to wildlife and may cause them to shift habitat use to other areas. It's likely that most timber sale haul would occur prior to road reconstruction on the Nicholson Creek road in Alternative C and that the cumulative impacts would be minimal.

Fire suppression may have increased stand densities and allowed natural openings to fill in with conifers.

The new road that would be constructed for ore haul from Marias Creek across State lands may lead to future timber sales on State lands due to improved access, although none are planned at this time and therefore are not reasonably foreseeable. These potential future timber sales would reduce forested habitat for some species, increase habitat for those species preferring more open habitats, increase disturbance during the life of the timber sale activities, and fragment forested habitat.

The border patrol commonly uses the roads on the National Forest near the border with Canada. This use increases disturbance to wildlife, particularly disturbance associated with roads and traffic. Border patrol agents may be on these roads at any time of the day, and they may utilize roads closed to the public but open to administrative use. Although this use may have cumulative effects with all the alternatives, it would particularly mix with Alternative C because that haul route is the main road most utilized by border patrol as it is the closest open NFS road to the Canada border.

The incremental effects of the Forest Service's Buckhorn Access Project would add cumulatively to the past, present, and future foreseeable actions in the area. The primary effect of this project would be the substantial increase in traffic along the ore haul route and the corresponding disturbance to a variety of wildlife species. There would also be a relatively small loss of habitat due to road construction, as well as a risk of road related injury or mortality from increased traffic.

The loss of habitat due to this Buckhorn Access Project would be small when considered cumulatively with the rest of the actions listed above, especially when considered at the larger HUC5s. The incremental disturbance effects of this project would be substantial when considered cumulatively, although the effect would be limited to the vicinity around the ore haul route. The disturbance would create a semi-permeable barrier to movement for some wildlife species and would stretch across most of the Buckhorn Block of NFS lands from east to west. The disturbance associated with timber sales, public traffic, operation of the mine site, and ore haul once it leaves NFS lands would all contribute to road related impacts to wildlife species. Most individuals would move to habitat with less human disturbance, some individuals would acclimate to the disturbance, and a few would be lost to road-related mortality. The loss of individuals to mortality would generally be low for this project, primarily due to the low speed limits (25-30mph) across NFS lands. The semi-permeable barrier and disturbance created by this project would not likely contribute to detectable population declines, although it would alter habitat use for many species.

Alternative D would result in the use of the Pontiac Ridge road for ore haul after leaving NFS lands. This road primarily passes through private lands before intersecting with County Road #9480 where it passes through a small segment of the Bonaparte Block of NFS lands. From that point the ore haul route would pass primarily through State lands and continue to the Toroda Cr. Road. The habitat along this route is a mixture of forested and open habitats. Several homes are scattered along this route as well. This area would experience the same type of disturbance and roadkill effects as the other ore haul routes. Riparian habitats would also be disturbed by traffic noise along sections of Millard and Beaver Creeks. These effects should be similar in type as those along Marias and Nicholson Creeks for Alternatives B, B1, and C.

Alternative A

No cumulative effects would occur under the no action alternative because no project would occur. However, reclamation approved in previous NEPA documents would commence immediately, which would begin the restoration process of previous habitat conditions. The activities associated with this reclamation would slightly disturb any wildlife in the area, and wildlife may avoid the immediate area of disturbance but this would be short-term.

SPECIES SPECIFIC ANALYSIS

Threatened and Endangered Species

This project is located outside the range for the marbled murrelet, and northern spotted owl, and these species would not be considered further in this document. Consultation was conducted with USFWS and a concurrence letter was received from that agency on February 16, 2006.

Bald Eagle

Affected Environment

Bald eagles can be found year-round in Okanogan and Ferry Counties. Although widely distributed, their populations in Washington are much smaller than they were historically. Nests in Washington are typically in uneven-aged, coniferous stands with an old-growth component and territories may have several alternate nests (USFWS 1986). Large, emergent trees and snags are also important perch sites during the breeding season (MBEWG 1991). Breeding habitat is usually within a few miles of a lake or river where the eagles can prey on fish or waterfowl, although other prey may additionally be taken. Nest trees are typically the largest ones within a stand (ponderosa pine, Douglas-fir, etc.), although nests may also be located on cliffs. Bald eagles will generally choose areas away from human disturbance, although this is not always the case. Winter habitat may be near open water, although eagles also winter where other food sources are available. These non-aquatic foods are sources of carrion from ungulates and other larger animals. Winter roosts may be up to 20 miles away from the food source and may be partially dependent on warmer microsite conditions. Roost trees and nest trees may be used for many years and both types are usually the larger, more accessible trees in a stand (NatureServe, 2005).

The wide-scale trend for bald eagle habitat is not described in Wisdom et al. 2000 as it is for many of the other species in this analysis, although the conservation status for bald eagles is listed as “apparently secure” in the state of Washington (NatureServe, 2005).

The Pacific States Bald Eagle Recovery Plan (USFWS, 1986) outlines the steps for bald eagle management and habitat protection on federal lands. The Recovery Plan identifies the Kettle River as a key bald eagle recovery area with the recovery goal of one active territory. The Kettle River lies approximately 5 miles east of the project area, although all ore haul routes travel along the Kettle River towards Republic once off of National Forest System lands. This area and ore haul off of National Forest System land is analyzed under cumulative effects.

Suitable bald eagle winter habitat is located along the Kettle River and Toroda Creek (adjacent to the project area to the east), and potential nesting and roosting habitat is present there as well. No bald eagle nesting or winter roost trees have been documented along the Kettle River or Toroda Creek in the analysis area (Crown Jewel FEIS, 1997).

Foraging eagles wander widely in search of food and, in the analysis area, places where dead deer could occur are widespread. Wintering bald eagles have been documented along Toroda Creek and along the portion of the Kettle River that forms the eastern boundary of the analysis area. Eagles have been observed along the Kettle River between the Canadian border and Curlew, Washington from October to April. It is likely this number varies from year to year. Field surveys documented winter concentrations of deer, a primary prey species, along the Myers Creek drainage at the western boundary of the analysis area (Crown Jewel FEIS, 1997). Other ungulates that have been documented in this area in the past include moose and elk, as well as both mule deer and white-tail deer (Tonasket Ranger District GIS, Crown Jewel Mine FEIS 1997).

Currently there are no known bald eagle nesting sites within the project area, however, it is not unlikely that during the course of this project, a nest territory or two could be established along the Kettle River. An eagle was documented once within the Nicholson Creek drainage during the winter in the early 1990s (Crown Jewel Mine FEIS, 1997).

Environmental Consequences

Alternative A

Under the No Action alternative there would be no effects to bald eagle habitat or any disturbance effects from this project. There would not be any road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance to species such as deer that may provide carrion sources for bald eagles in winter.

Alternative B

This alternative would not directly alter habitat and would not likely disturb bald eagles. No bald eagles are known to nest or roost on National Forest System lands within the Marias Creek drainage or near Buckhorn Mountain. Use of the 3550, 3550-125, and the newly constructed road by mine related traffic would therefore not directly affect bald eagles or their habitats. It is possible that eagles may use the lower portions of the Marias Creek drainage during the winter while foraging for deer carcasses, although this activity has not been documented within the Marias Creek drainage. Ore haul would be year-round and would mainly occur Monday-Friday with possible reduced haul on Saturday and Sunday.

The ore haul route across National Forest System lands would likely affect many other species, primarily through disturbance along the roadway. Deer are among the species likely to be affected, particularly because mine traffic would occur year-round over roadways that have previously been snow covered in winter. There would be a large increase in traffic along this road, and deer use of the area would likely be altered.

The effects of this project on deer are important in determining the effects on bald eagles because deer carcasses can provide important food for eagles. If deer are redistributed due to disturbance from the project, then deer carcasses are also likely to be redistributed. See the deer analysis for more information on the effects of the project on deer.

In the short-term this disturbance may decrease deer use of this area and thereby decrease available carrion for any bald eagles wintering along Toroda Creek. There would also be the possibility of deer mortality along the ore haul route, although this is not likely due to the speed limit of 30 mph across National Forest System lands along the ore haul route.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Bald eagles, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. Additionally, deer would avoid using areas near the roadway and would redistribute to other habitats, and this would impact the distribution of deer carcasses in winter that provide forage for bald eagles. 57 acres of deer habitat would be lost from construction of the project components.

Alternative B1

The effects of this alternative would be nearly identical to Alternative B for many components, although there would be one notable difference. The speed limit would be 25 mph and would result in a lower likelihood of road kill to eagles or their prey than Alternative B.

Alternative C

The effects of this alternative would be less on wintering deer than Alternatives B and B1 because this alternative only passes through 1.3 miles of deer winter range management areas identified in the Forest Plan. This is much less than Alternatives B and B1. The speed limit would only be 25 mph which is less than Alternative B and therefore this alternative would have a lower risk of roadkill to eagles or deer. There would still be effects on deer summer range similar to Alternatives B and B1, although more area would be affected. Approximately 7 miles of the ore haul route pass through deer summer range. The total length of the ore haul route across National Forest System land and rights-of-way is approximately 13 miles. Deer located on other land ownerships adjacent to roads with National Forest rights-of-way would be impacted in a similar manner as on National Forest System lands. Deer would be disturbed by project activities and would redistribute to other habitat. This would be the same under all action alternatives.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Bald eagles, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. Additionally, deer would avoid using areas near the roadway and would redistribute to other habitats, and this would impact the distribution of deer carcasses in winter that provide forage for bald eagles. 65 acres of deer habitat would be lost from construction of the project components.

Alternative D

This alternative also would not alter bald eagle habitat and would not likely affect the birds directly. There would be much less disturbance to deer on National Forest System lands and rights-of-way, reduced habitat alteration compared to the other action alternatives. Approximately ½ mile of the ore haul route crosses National Forest System lands and rights-of-way, all of which would be new road construction. The rest of the haul route would follow the existing Cow Camp road and Forest Service rights-of-way. This is not in a management area managed for deer winter range, although it is near one. There would be much less effects on summer range for deer compared to Alternatives B, B1, and C. The speed limit would be 25 mph and would have a lower likelihood of road kill to wildlife than Alternative B.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Bald eagles, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. Additionally, deer would avoid using areas near the roadway and would redistribute to other habitats, and this would impact the distribution of deer carcasses in winter that provide forage for bald eagles. 26 acres of deer habitat would be lost from construction of the project components. The overall direct and indirect effects of this alternative would be substantially less than the other action alternatives.

Effects Common to all Action Alternatives

Bald eagles would possibly, although not likely, be directly disturbed by these alternatives. One bald eagle was observed within the Nicholson Creek drainage during one winter in the 1990s. Habitat for ungulates would also be directly affected, although only to a small degree. The total acreage directly impacted by the footprint of the road and facilities would be so

small as to be nearly immeasurable as a percentage of the discrete management areas impacted.

Additionally, ungulates would be disturbed by the large increase in traffic along the ore haul routes and would potentially alter their use of the area. This could in turn affect the availability of carrion available in the winter for bald eagles near Toroda Creek because less deer may utilize the habitat along the ore haul routes.

Cumulative Effects

This project would add to the cumulative effects on bald eagles within the HUC5s that overlap the Buckhorn Block of the NFS. The time period analyzed for cumulative effects on bald eagles included the construction period of the Buckhorn mine, through operation of the mine, and until the reclamation work is done for the mine (approximately 13-15 years). Past actions that were considered included those all the way back to the historic mining and logging within the Buckhorn Block of the NFS. The size of the area considered in this cumulative effects analysis included both HUC5s that overlap with this block of NFS lands (Toroda and Myers Creeks).

This project would not contribute to direct habitat loss for bald eagles, and most of the impacts would be through indirect effects on deer, a source of winter carrion for eagles. The ore haul routes for Alternatives B and B1 go through deer winter range, and the disturbance associated with the mine traffic would likely alter deer use of the surrounding habitats. This might lead to a different distribution of ungulate carrion than historically, so bald eagles may have to alter their foraging accordingly. The same is true of Alternative C, although that ore haul route does not go through as much winter range. The other actions considered under cumulative effects are not as likely to have as effects as long term as this project. The cumulative effects due to disturbance to deer would be substantial, although they would be focused within the vicinity of the ore haul route. Past timber harvest and fire suppression have affected the availability and distribution of winter, summer, and hiding cover within the Buckhorn Block of NFS lands. Pre-existing roads have probably altered deer habitat use as well, and this project would substantially contribute to the road effects on deer along the ore haul routes. Alteration of deer habitat and therefore deer distribution in turn alters bald eagle habitat suitability due to the presence/absence of carrion. Previous timber harvest and fire suppression on all ownerships may have caused a loss of large trees that would have provided habitat as bald eagle nest or roost trees.

Eagles have been found along Toroda Creek, Kettle River, Beth/Beaver Lakes, and even in the lower reaches of Nicholson Creek. It is possible that this project would lead to increased disturbance to bald eagles, although the likelihood of this happening due to the components of this project is small. The most likely disturbance would be from ore haul once it leaves NFS lands along the aforementioned streams/lakes. The highway along the Kettle River currently and previously has experienced heavier traffic, so the impacts of mine related traffic along this section of roadway would be less dramatic. As this is already a disturbed area, bald eagles in the area would likely already be accustomed to higher levels of traffic.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Effect

Effects Determination Alt B, B1, C, and D: May Affect, Not Likely to Adversely Affect.

Canada Lynx

Affected Environment

In Washington, lynx habitat generally consists of Engelman spruce, subalpine fir, and lodgepole pine (seral species) stands above approximately 4000 feet in elevation. Other vegetation that is intermixed with these forest types and considered lynx habitat may include: cool, moist Douglas-fir, grand fir, western larch, and aspen (Ruediger et al. 2000, Ruggiero et al. 1994, Wisdom et al. 2000). Lynx need habitat with abundant prey, primarily snowshoe hare (Butts 1992). Early-seral and mid-seral forests provide understories capable of supporting snowshoe hare populations in the winter. Late-seral forests provide denning habitat as well as alternate prey sources (red squirrels) and a high density of hares. Riparian areas also support snowshoe hare populations. Downed logs are important for lynx denning or resting (Wisdom et al. 2000). Lynx have been known to move long distances (>370 miles) in Washington (Ruggiero et al. 1994) and lynx may travel 3-6 miles in a day in search of food (Ruediger et al. 2000, Witmer 1998).

Snowshoe hare and hare habitat are important components of lynx habitat. Foraging habitat may result from fire, timber harvest, wind throw, or insects/disease. Hares are most often found in young (15-30 years old) lodgepole pine stands in north-central Washington. They are also found in mature, multi-storied conifer stands with dense understories, particularly where branches would be within reach of hares in the snow during winter to provide cover and forage. Dense tree and shrub stems are preferred (1 inch diameter at breast height, >4500 stems/acre) (Ruediger et al. 2000, Ruggiero 1994). Winter foraging habitat is an important feature of lynx habitat. Stem height must be above snow depth, so stems should be 1-2.5 meters high, depending on local conditions. During snow-free months, hare may use areas with less stem density that provide more herbaceous food. Denning habitat consists of mature, dense stands of timber with large accumulations of downed woody material that provide kittens with thermal and security cover. Denning stands are >200 year old Engelman spruce, subalpine fir, and lodgepole pine stands on north-northeast aspects. Downed wood is at high densities and supported 0.3-1.2 meters above the ground. This is necessary to provide vertical and horizontal structural diversity. Stands are generally >2.5 acres in size, have minimal human disturbance, and are near foraging areas. Travel corridors are important between denning and foraging areas. Alternate den sites are important to allow the female to move kittens away from threats (Ruggiero 1994).

Wisdom et al. (2000) described the broad-scale trends in source habitats for species within the Interior Columbia River Basin. They defined source habitats as those characteristics of macrovegetation that contribute to stationary or positive population growth for a species in a specified area and time. At the broad scale, the Canada lynx uses forest mosaics as habitat. Primary habitat for the lynx was defined as subalpine and montane forests that are cold or moist forest types. Within the montane forest types, only the Pacific silver fir-mountain hemlock, red fir, and Sierra Nevada mixed conifer do not provide source habitat within the basin. Only Engelmann spruce-subalpine fir provides source habitat within the subalpine forest types. Source habitats include several structural stages for foraging and denning. Habitat for the Canada lynx has increased from 43.30% to 49.58% of the entire basin since historic times (1850-1890) to the current time period (1985-1995). This equates to an absolute increase of 6.28% and a relative increase of 14.49% in available habitat of the correct vegetation type. Within the Northern Glaciated Mountains Ecological Reporting Unit (ERU) 7, where this project is located, habitat for the Canada lynx has increased from

47.43% to 56.88%. This equates to an absolute increase of 9.44% and a relative increase of 19.91% (Wisdom et al. 2000). Roads and other non-vegetative factors may decrease the suitability of these source habitats.

The Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. 2000) addressed risks and recommended conservation measures to reduce risks to lynx. A Conservation Agreement between the U. S. Fish and Wildlife Service and the U. S. Forest Service acknowledges the responsibilities of each agency until the Forest Plan can be revised to incorporate lynx conservation.

Extensive lynx habitat exists and viable lynx populations occur 40 miles west in the Meadows area of the Okanogan and Wenatchee National Forests and north to the limit of forested habitat in Canada. Lynx have also been recorded 30 miles east in the Kettle River Range on the Colville National Forest. The areas surrounding Buckhorn Mountain are generally low elevation and are not suitable for lynx.

The Buckhorn Mountain block of National Forest System lands has approximately 4742 acres of vegetation plant association groups that are considered potential lynx habitat (Tonasket Ranger District GIS), but this is not sufficient habitat to be included in a Lynx Analysis Unit (habitat criteria suggest at least 10 square miles of habitat to establish a LAU). The closest LAUs are the Bonaparte LAU, 2 miles southwest on the north slope of Bonaparte Mountain, and the Bodie Mountain LAU ½ mile southeast.

The suitability of the Buckhorn Block of NFS lands for lynx dispersal habitat is primarily rated as “good.” The entire length of the ore haul route from the Buckhorn Block of NFS lands to the Kettle River Mill is rated primarily in the “good” range. Most of the Buckhorn Block of NFS lands does not fall within the top 50% of relative linkage values as a least-cost (linkages between habitat concentrations with the fewest landscape barriers to animal movement) corridor, although much of the entire ore haul route from the Buckhorn Block to the Kettle River Mill is within or adjacent to habitat within the top 50% (Singleton et al. 2002). This area provides connectivity between LAUs to the east, west, and south. It also provides habitat connectivity between both the US and Canada.

A few lynx sightings have been reported in the northeastern portion of the Tonasket Ranger District since 1990. This includes two sightings recorded approximately ½-1 mile from the Nicholson Creek ore haul route, Alternative C (Tonasket Ranger District GIS). As part of the National Lynx Survey, a survey grid was conducted in the Bonaparte LAU in 2000, 2001, and 2002. No lynx were detected during the survey.

Snowshoe hare, the primary prey of lynx, were seen along the proposed ore haul routes during 2005 field visits. Red squirrels, a secondary prey source, are also widespread throughout the Buckhorn Block of the Tonasket Ranger District.

Environmental Consequences

Alternative A

There would be no effects to lynx or lynx habitat under this alternative. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance. It is unlikely that lynx are present, although those that are dispersing through the area would only encounter the current level of human disturbance, which is low

outside of the fall deer hunting season.

Alternative B

This alternative lies outside of any LAU and therefore would not have an affect on lynx habitat. Although there are patches of plant-association-groups commonly identified as lynx habitat, some of which may be impacted by this project, there is not enough present within the Buckhorn Block of NFS lands to be considered suitable to establish a LAU. It is possible that lynx may disperse through the area and may therefore be disturbed by project activities, although lynx are fairly tolerant of human presence (Ruediger et al. 2000). Snowshoe hare and red squirrels, prey for dispersing lynx, were both observed along this ore haul route. It is likely that these prey species would be affected by the large increase in traffic, year-round, on the roads that make up the ore haul route. Disturbance and the probability of road kill for these animals would increase, thereby potentially affecting the prey availability for dispersing lynx. Lynx are generally tolerant of human disturbance (Ruediger et al. 2000), although this large increase in traffic would increase the difficulty for dispersing lynx to cross the ore haul route.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Lynx are generally tolerant of disturbance, but the substantial increase in traffic may sometimes deter lynx from crossing the roadway. Lynx, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. Project activities would remove some snowshoe hare habitat within the footprint of the project activities, and it may also cause disturbance to snowshoe hare and mortality along the ore haul route.

Alternative B1

The effects of this alternative would be similar to Alternative B for most components, particularly concerning disturbance and habitat loss to lynx and their prey. The primary difference would be the reduced speed limit which would reduce the potential for road kill.

Alternative C

The effects of this alternative would be similar to those of Alternatives B for many components although more area would be impacted. Although there are patches of plant-association-groups commonly identified as lynx habitat, some of which may be impacted by this project, there is not enough present within the Buckhorn Block of NFS lands to be considered suitable to establish a LAU. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. This ore haul route would not go through an LAU, and would therefore not directly affect lynx habitat. Lynx may still disperse through the area, and two recorded occurrences are less than 1 mile from this alternative's ore haul route.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Lynx are generally tolerant of disturbance, but the substantial increase in traffic may sometimes deter lynx from crossing the roadway. Lynx, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. Project activities would remove some snowshoe hare habitat within the footprint of the project activities, and it may also cause disturbance to snowshoe hare and mortality along the ore haul route.

Alternative D

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance, although the effects would be less than under the other action alternatives due to the smaller affected area on NFS lands and rights-of-way. Lynx are generally tolerant of disturbance, but the substantial increase in traffic may sometimes deter lynx from crossing the roadway. Lynx, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. Project activities would remove some snowshoe hare habitat within the footprint of the project activities, and it may also cause disturbance to snowshoe hare and mortality along the ore haul route. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The overall direct and indirect effects of this alternative would be substantially less than the other action alternatives.

Cumulative Effects

The entire Buckhorn Block of NFS lands was used to analyze cumulative effects of this project on lynx because no LAU exists within this section of NFS lands. The timeframe for the entire life of the mine was analyzed (13-15 years), as well as projects in the past that affect lynx habitat and roads. Projects considered included timber harvest, fire suppression, and previous road building.

This project would have small impacts on lynx and lynx habitat. Very little lynx habitat exists within the Buckhorn Block of NFS lands, which is why no LAU has been established in this location. However, it is possible that lynx would occasionally travel through the area as they move between suitable habitats. Lynx are generally tolerant of human activities, so the other projects within the Buckhorn Block are likely to cause only minimal disturbance to lynx if they are present. This project, because of the substantial increase in traffic volume along the ore haul routes, would create a semi-permeable barrier to movement stretching from the east to the west across the Buckhorn Block (Alternatives B, B1, and C). Although lynx are generally tolerant of human activity, there is an increased probability that they would be discouraged from crossing the ore haul route due to the increased volume of traffic. This effect would be greater for this project than for most of the others analyzed under cumulative effects.

Past timber harvest has altered vegetation and therefore lynx habitat, as did fire suppression. Overall, the distribution of vegetation across the Buckhorn Block is likely altered from historic conditions. Some areas may be more suitable for lynx that historically due to fire suppression created more favorable vegetative characteristics. And timber harvest likely removed some habitat from being suitable.

The probability of road related mortality for lynx is greater for this project than for the others considered under cumulative effects, although mortality is of a low probability due to the unlikely presence of lynx and the low speed limits of this project. Although this project would add incrementally to the cumulative effects on lynx, the overall effect is likely to be relatively low due to the unlikely presence of lynx.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Effect

Effects Determination Alt B, B1, C, and D: May Affect, Not Likely to Adversely Affect

Gray Wolf

Affected Environment

Wolves were historically present throughout the Cascades of Washington and the northeastern part of the state (Laufer and Jenkins 1989), although no known packs currently inhabit Okanogan County. Gray wolves are generalists that use a broad spectrum of elevations and habitats. They avoid areas with >1 mile of road per square mile, primarily because of the increased human presence in those areas (Thiel 1985, Wisdom et al. 2000). However, they may inhabit areas with greater road densities if those habitats are adjacent to relatively unroaded areas (Mech 1989). Wolves den in areas near forest cover and ungulates for prey that are away from human activity. Denning is from mid-April to July and wolves are sensitive to disturbance during that time. They use rendezvous sites for resting and gathering areas after the pups are mobile enough to leave the den. Rendezvous sites are often around meadows near forested stands that provide resting areas under trees. Home ranges have been estimated at 19-687 square miles, and probably depend on the availability of ungulates for food (Wisdom et al. 2000). Ungulates comprise 85-95% of their diet, although beaver, snowshoe hare, and other small animals may make up the remainder. Carrion may additionally be a food source (Mech 1970, Witmer et al. 1998).

At the broad scale, the gray wolf uses forest and range mosaics as habitat within the Interior Columbia River Basin. Habitat for the gray wolf has declined from 83.82% to 70.71% of the entire basin from historical times (1850-1890) until current times (1985-1995). This equates to an absolute decline of 13.12% and a relative decline of 15.65%. Within the Northern Glaciated Mountains ERU 7, habitat for the gray wolf has declined from 73.64% to 70.73%. This equates to an absolute decline of 2.90% and a relative decline of 3.94% (Wisdom et al. 2000).

At least one wolf occurrence has been recorded approximately 5 miles from the eastern edge of the project area (Tonasket Ranger District GIS).

Previous winter wildlife surveys estimated a relatively high population density of approximately 10 deer per square mile within the Buckhorn Mountain area. During surveys in the winter of 1991/1992, most deer moved from the Buckhorn Mountain area to lower elevation habitats when snow depths reached 12 to 16 inches in the mountains. Groups of 200 deer or more have been observed in the Myers Creek drainage at the western boundary of the analysis area (Crown Jewel FEIS, 1997).

An increasing number of recent wolf sightings have been reported throughout the northern portions of Washington. There have been more than 100 reports of wolf sightings from 1989 to 1997 in Okanogan and Ferry counties (Crown Jewel FEIS, 1997). Wolves have been confirmed in recent years on the Tonasket and Methow Valley Ranger Districts (records on file at District Offices).

Current open road densities in the project area are shows in the table below.

Table III-55: Discrete Management Areas Affected by the Buckhorn Access Project, as Well as the Current Road Densities in each MA.

Management Area	Square Miles	Miles of Open Road	Current Road Density	Forest Plan Road Density
14-17	2.7	2.8	1.0	2.0
14-18	0.9	3.5	3.8	2.0
14-19	0.3	0.5	1.7	2.0
25-18	24	44.2	1.8	3.0
26-15	2.3	2.8	1.2	1.0
26-16	5.5	7.5	1.4	1.0

Habitat consisting of areas with low road densities exists within the Buckhorn Block of the Tonasket Ranger District. The 10,800 acre Jackson Creek Inventoried Roadless Area (IRA) lies at the very northeast corner of the analysis area. Additionally two unroaded/undeveloped areas are located north and south of the Marias Creek Road. The Coogan area is 2,745 acres, and the Marias-Nicholson Ridge area is 3,465 acres. These are areas that are unfragmented by roads and harvest, and would provide important refugia for wolves. If areas with roads closed to public use with a dirt berm or pulled culvert were included, the size of these refugia areas could be considered to be even larger.

The effects of roads and motorized trails within the Toroda and Myers Creek watersheds were analyzed using the models developed in Gaines et al. (2003). The existing condition for wolves falls under the category of "high level of human influence on wolf habitat" for these two watersheds. This means that less than 50% of the area is classified as security habitat. For the combined area of these two watersheds, only 23% of the area can be called security habitat. Security habitat is defined as areas with a "moving windows" road density of <1 mile per square mile ("moving windows" analysis measures road density for each GIS pixel based on a specified distance around each pixel, rather than road density analysis which is measured and averaged for an entire management area). There is currently 47,730 acres of security habitat within these two watersheds, most of which lies within roadless and unroaded areas. This includes the areas within the Buckhorn Block listed above.

Dispersal habitat suitability for gray wolves is primarily rated as "good," with some rated as "moderate," for the Buckhorn Block of NFS lands. The suitability along the entire ore haul route from the Buckhorn Block of NFS lands to the Kettle River Mill is rated as "moderate" to "good." The Buckhorn Block of NFS lands falls into a habitat concentration area and habitat with a relative linkage value in the top 50% as a least-cost corridor (Singleton et al. 2002). This means that this area provides connectivity between wolf habitat in both the US and Canada.

Environmental Consequences

Alternative A

This alternative would have no effect for gray wolves. Although wolves, individuals or packs, are not currently known to inhabit this vicinity, it is possible that wolves may disperse through the area or establish a home range that includes this block of National Forest System land. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance. Conditions in the Buckhorn Block of the Tonasket and Republic Districts would likely remain similar to what they are currently, and human

presence within these areas are relatively low, with the exception of the fall deer hunting season.

Alternative B

Similar to the effects for lynx, Alternative B could potentially disturb any wolves that may be dispersing through the area or establish a territory in the area in the future. Under this alternative, traffic along the roads constituting the ore haul route would substantially increase year-round. There potentially would be impacts to deer during both summer and winter. This ore haul route passes primarily through, or immediately adjacent to, deer winter range management areas described in the Forest Plan. Deer and other ungulates are the primary source of prey for wolves, and mule and white-tail deer as well as elk and moose have been recorded in this block of National Forest System land. Deer are likely to be disturbed by the large increase in traffic along the ore haul route and may therefore alter their distribution and reduce their use of habitats adjacent to the roadway. Wolves in the area would therefore have to alter their use of the area to locate deer.

The primary effect associated with this project would be the issue of disturbance. Roads and trails have been known to alter wolf movements (Whittington et al. 2004).

Mine employees would undergo training that would include environmental considerations. Included in this training would be hunting and firearm prohibitions, speed limits, prevention of wildlife harassment, and the identification and reporting the threatened and endangered species sightings. This would reduce the occurrence of persecution that may be exhibited against wolves. Persecution is one of the major impacts that roads have on wolves because it increases the likelihood of a human/wolf encounter by increasing the number of people.

Road densities would be increased in several MAs under this alternative for roads open to the public or the mine traffic. MA 14-18 already exceeds the Forest Plan standard of 2.0 miles per square mile with a current road density of 3.8. The road density would increase to 4.2 miles per square mile under this alternative. MA 25-18 would rise from 1.8 miles per square mile to 1.9, but this would still be well below the Forest Plan standard of 3.0. The increases in road miles would spread the area of impact from road disturbance and further reduce habitat. This would increase the area that wolves would avoid.

Alternative B would pass near the Coogan and the Marias-Nicholson Ridge unroaded areas (see the Inventoried Roadless and Unroaded Areas section of this EIS), and consequently the disturbance from the increased traffic on the haul route may decrease the suitability of these areas as habitat for wide-ranging carnivores. This may cause animals to avoid using those areas closest to the haul route. Additionally, the traffic on the haul route would limit movement of animals between these areas.

Based on the models developed in Gaines et al. (2003), 35 acres of security habitat would be lost by increasing road densities to >1 miles per square mile along the ore haul route based on a moving windows analysis. This is a small acreage when analyzed at the scale of the Toroda and Myers Creek watersheds and the percentage of security habitat remains unchanged from current conditions (23%). Therefore, the rating for the watersheds remains the same as Alternative A: “high level of human influence on wolf habitat.” The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater under this

alternative than under existing conditions, but this substantial difference in intensity cannot be captured in the model.

It is possible that mine employees would choose to recreate within the Buckhorn Block of NFS lands as they become more familiar with the area. This increased recreation pressure would be balanced by the likely reduction in recreationists who have traditionally used the area but would be displaced due to the substantial increase in traffic. There may be a slight increase in recreation pressure overall, and this would add to the disturbance, and potential persecution, of carnivores.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Wolves, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. The construction of this project component would result in a loss of habitat for both wolves and their prey.

Alternative B1

The effects of this alternative would be similar to Alternative B for most components, particularly concerning disturbance and habitat loss to wolves and their prey. The primary difference would be the reduced speed limit which would reduce the potential for road kill.

Road densities would not be increased in any management area under this alternative. The road density would drop to 1.5 in MA 14-18under this alternative due to the road closures in Bear Trap Canyon. Although MA 26-16 would still exceed Forest Plan standards, road densities would drop from 1.4 to 1.1 miles per square mile from the current density of 1.4 due to the road closures in Bear Trap Canyon. The decrease in road miles in MA 14-18 would mitigate some of the impacts due to increased traffic along the ore haul route.

Based on the models developed in Gaines et al. (2003), approximately 240 acres of security habitat would be created under this alternative by decreasing road densities to <1 miles per square mile within the Bear Trap Canyon area, based on a moving windows analysis. The calculations took into account the road closures as mitigation and the road construction for the ore haul route. This is a small acreage when analyzed at the scale of the Toroda and Myers Creek watersheds and the percentage of security habitat remains unchanged from current conditions (23%). Therefore, the rating for the watersheds remains the same as Alternative A: “high level of human influence on wolf habitat.” The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater under this alternative than under existing conditions, but this substantial difference in intensity was not captured in the model.

Alternative C

This proposed ore haul route goes through less area designated for management as deer winter range by the Forest Plan. Only approximately 1.3 miles of the ore haul route passes through a deer winter range Forest Plan MA (MA 14-17). This is much less than Alternatives B and B1. Therefore the effects for wintering deer would be less than under Alternatives B and B1, although the effects for summer range would be similar to those alternatives. The amount of summer range crossed by this alternative is a few miles longer than under

Alternatives B and B1, so the total affected area would be larger.

Road densities would be increased in several MAs under this alternative for roads open for the public or mine traffic. MA 25-18 would rise from 1.8 miles per square mile to 1.9, but this would still be well below the Forest Plan standard of 3.0. The increases in road miles would spread the area of impact from road disturbance and further reduce habitat. This would increase the area that wolves would avoid.

Based on the models developed in Gaines et al. (2003), 20 acres of security habitat would be lost by increasing road densities to >1 miles per square mile along the ore haul route based on a moving windows analysis. This is a small acreage when analyzed at the scale of the Toroda and Myers Creek watersheds and the percentage of security habitat remains unchanged from current conditions (23%). Therefore, the rating for the watersheds remains the same as Alternative A: "high level of human influence on wolf habitat." The estimates were based on "open" travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater under this alternative than under existing conditions, but this substantial difference in intensity was not captured in the model.

Summer range is not as limited as winter range, so deer would be better able to adapt their habitat use in response to the disturbance near the roadway. This ore haul route is 13 miles of reconstruction and construction across National Forest System lands and rights-of-way. Alternatives B and B1 only have 6.7 miles, although most of the route in Alternative C would be considered summer range.

Unlike the other alternatives, this ore haul route passes directly adjacent to the Jackson Creek Inventoried Roadless Area. It is that area that would be most suitable for wolves, if they are present at all within this block of National Forest System land. The increased disturbance associated with traffic on the haul route would reduce the suitability of the habitat along the western edge of the Jackson Creek IRA. This may cause wide-ranging carnivores to avoid use of that section of the IRA. Additionally, the same would be true of the northernmost section of the Marias-Nicholson Ridge unroaded area. The substantial increase in traffic along the haul route would limit animal movement between these two areas.

The upper portion of Forest Road 3550 and all of 3550-125 and the portion of 3550-130 east of DNR lands would remain closed from December 1 until March 31 each winter to protect deer winter range along Marias Creek. This would also limit disturbance to wolves that may be in the area searching for deer. This road is bounded on both the north and south by unfragmented blocks of unroaded/undeveloped land (see Inventoried Roadless Area/Unroaded/Undeveloped section later in this chapter). Keeping this road closed during winter would effectively create a 6,210 acre refugium for wolves and deer during snow bound months.

The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Wolves, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of

National Forest System lands. The construction of this project component would result in a loss of habitat for both wolves and their prey.

Alternative D

The upper portion of Forest Road 3550 and all of 3550-125 and the portion of 3550-130 east of DNR lands would remain closed from December 1 until March 31 each winter to protect deer winter range along Marias Creek. This would also limit disturbance to wolves that may be in the area searching for deer. This road is bounded on both the north and south by unfragmented blocks of unroaded/undeveloped land (see Inventoried Roadless Area/Unroaded/Undeveloped section later in this chapter). Keeping this road closed during winter would effectively create a 6,210 acre refugium for wolves and deer during snow bound months.

Road densities would be increased in MA 25-18, which would rise from 1.8 miles per square mile to 1.9, but this would still be well below the Forest Plan standard of 3.0. The increases in road miles would spread the area of impact from road disturbance and further reduce habitat. This would increase the area that wolves would avoid.

Based on the models developed in Gaines et al. (2003), 20 acres of security habitat would be lost by increasing road densities to >1 miles per square mile along the ore haul route based on a moving windows analysis. This is a small acreage when analyzed at the scale of the Toroda and Myers Creek watersheds and the percentage of security habitat remains unchanged from current conditions (23%). Therefore, the rating for the watersheds remains the same as Alternative A: “high level of human influence on wolf habitat.” The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater under this alternative than under existing conditions, but this substantial difference in intensity was not captured in the model.

This haul route does not pass near an Inventoried Roadless Area or an unroaded area, so this alternative would have less impacts on wildlife that need secure habitat using those areas compared to the other action alternatives.

The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Wolves, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. The construction of this project component would result in a loss of habitat for both wolves and their prey. The overall direct and indirect effects under this alternative would be less than the other action alternatives.

Cumulative Effects

The area analyzed for gray wolves included the two HUC5s that overlap with this project and the Buckhorn Block of NFS lands. The time period included the entire life of the mine (13-15 years), as well as projects in the past that affect gray wolf habitat and roads.

Wolves are not likely to be present within the cumulative effects analysis area, although they may pass through as they move between suitable habitats, or they may even establish a territory within the area during the life of the mine. This project would be the most likely of all the Buckhorn Mine related components to contribute to disturbance of wolves and their prey (deer), although direct habitat loss would be minimal. The disturbance along the road may create a semi-permeable barrier to movement for wolves and their prey. The ore haul routes for Alternatives B and B1 travel through deer winter range, and the disturbance of the substantial increase in traffic may cause deer to redistribute to other areas during the life of the mine activities. Most other activities within the analysis area would be shorter in duration or lower in intensity.

The increased probability of mortality due to traffic would be relatively low for this project due to the low relative speeds. This project would not result in as much opportunity of persecution against wolves due to the low likelihood of the mine employees leaving the haul route. Recreationists would be more likely to roam over a greater portion of the Buckhorn Block, increasing their odds of encountering a wolf. The closure of the roads in the Bear Trap Canyon area under Alternative B1 would improve conditions for wolves because it would reduce traffic and human use within that area.

Although this project would add incrementally to the cumulative effects on wolves, the overall effect is likely to be relatively low due to the unlikely presence of wolves.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Effect

Effects Determination Alt B, B1, C, and D: May Affect, Not Likely to Adversely Affect

Grizzly Bear

Affected Environment

The current range and population of grizzly bears is only 1 percent of historic levels (Witmer et al. 1998), and their decline can be attributed to a variety of causes (Mattson and Merrill 2002). Historically, they were recorded on the east slope of the North Cascades and down towards the Okanogan and Columbia rivers (Almack et al. 1993). Grizzly bears not only use forested habitats, but historically used open habitats such as the Great Plains (Finch 1991). This is another species that is road sensitive because roads fragment habitat and allow human access that consequently increases disturbance and persecution. High densities of open roads, and the associated human activity, may limit bear use of the area, even though the habitat may remain high quality (Mace et al. 1996, McLellan and Shackleton 1988, Wielgus et al. 2002). The most important limiting factor for grizzly bears is mortality due to humans (Wisdom et al. 2000).

The General Affected Environment section at the beginning of this Wildlife section contains a table displaying the current road densities by MA. The road densities within the MAs affected by road density changes from the project area meet Forest Plan standards for road densities except for MA 14-18 and MA-26-16. All MAs have road densities of 1.0 miles per square mile or greater. The roads within the Buckhorn Block of NFS lands would likely deter grizzly use of the area and cause disturbance during bear movement through the area.

Grizzly bears are omnivores and generalists that use a broad spectrum of elevations and habitats. Their habitat varies depending on food availability and may change between seasons and between years. Wisdom et al. 2000 summarized several factors that affect grizzly habitat selection that include: abundance and quality of foods; reproductive status of females and concerns about security of dependent young; presence and identity of other bears, especially adult males; and presence of humans and prior contact with humans. Dens for hibernation, birth, and rearing of young may be excavated by bears, or may occur naturally in montane, subalpine, and rocky areas (Wisdom et al. 2000).

Grizzlies den for nearly half the year, so they must consume food high in energy (fats, carbohydrates) and protein in order to survive hibernation. The seasonal availability of food sources largely determines grizzly bear habitat use. In the spring after bears emerge from the den, they will forage on carrion, grass, ground squirrels, and other burrowing animals. Summer diets generally consist of grasses, forbs, and ferns. Fruits from trees and shrubs, grasses, and insects are eaten in the fall. Ungulates may be an important prey source and bears may play a large role in determining ungulate population levels (Witmer et al. 1998), although bears are not present in any numbers to affect ungulate population levels in this area. Higher elevations can have talus areas that are known to provide foraging habitats for bears in summer (mid-June through mid-September) searching for concentrations of insects (Mattson et al. 1991). No high elevation talus is available in this project area. Anadromous fisheries, such as chinook salmon and steelhead, likely provided a historical food source for bears within Washington, although anadromous fish have not historically reached the project area due to Kettle Falls being a barrier to upstream travel by anadromous fish.

Foraging habitat consists of open forest, riparian areas, shorelines of lakes, meadows, seeps, and avalanche chutes. They are generally located adjacent to security cover that is made up of uneven-aged forests with well developed understories and limited human disturbance (Witmer et al. 1998). The availability of cover partially determines how a bear will respond to disturbance (McLellan and Shackleton 1989). Forbs may be selected over grasses because they provide more protein and greater digestibility (Rode et al. 2001).

At the broad scale, the grizzly bear uses forest and range mosaics as habitat within the Interior Columbia River Basin. Habitat for the grizzly bear has declined from 81.27% to 67.63% of the entire basin from the historical period (1850-1890) to the current time period (1985-1995). This equates to an absolute decline of 13.64% and a relative decline of 16.78% in available habitat. Within the Northern Glaciated Mountains ERU 7, habitat for the grizzly bear has declined from 70.39% to 58.27%. This equates to an absolute decline of 12.12% and a relative decline of 17.22% (Wisdom et al. 2000).

Grizzly bear habitat may be degraded by fire suppression, grazing, and other activities that alter riparian areas, shrublands, and herbland areas that are used for foraging. The proper storage of food and garbage, and the prompt removal of dead livestock can help prevent grizzly/human interactions (Witmer et al. 1998, Wisdom et al. 2000).

This project lies outside of any Bear Management Unit (BMU) and the North Cascades Grizzly Bear Recovery Zone (NCGBRZ) (USFWS 1993, USFWS 1997). However, a grizzly bear was positively identified through DNA analysis northeast of Tonasket in 2003 near the town of Chesaw approximately 5 miles from the project area.

Some big game winter range occurs within the project area (MA 14 and 26), primarily along the Marias Creek ore haul route (Alt B and B1). Additionally, other forage habitat for bears

exists in the form of riparian areas and other herbland/shrubland habitats.

Grizzly bears presently occur in the Selkirk Range (Selkirks Recovery Zone) 75 miles east of Buckhorn Mountain, the North Cascades 50 miles to the west (Northern Cascades Recovery Zone), the Monashee Mountains 40 miles to the north-northeast, and the Cathedral Park - Ashnola River Region 50 miles to the northwest.

The suitability of the Buckhorn Block of NFS lands as grizzly bear dispersal habitat is rated as "moderate" to "good." The entire length of the ore haul route from the Buckhorn Block of NFS lands to the Kettle River Mill ranges from "poor" to "moderate" with some areas of "good" dispersal habitat. The Buckhorn Block of NFS lands does not fall within the top 50% of relative linkage values as a least-cost corridor, and neither does the rest of the ore haul route to the Kettle River Mill (Singleton et al. 2002). This area provides connectivity between grizzly bear recovery zones to the east and west, as well as habitat both in the US and Canada.

The Buckhorn Mountain area contains some of the necessary characteristics for suitable grizzly bear habitat (e.g., vegetation types and food sources), but other important habitat characteristics including isolation, sanitation (related to recreationists and other users), and safety are lacking. The general lack of these habitat features reduces the likelihood that grizzly will occupy habitat in the analysis area in the future. In general, the managed and roaded condition, and presence of some human habitation in all directions around Buckhorn Mountain limit the suitability of the area for grizzly occupancy.

If a grizzly did utilize the Buckhorn Block of the Tonasket Ranger District, there would be a few unroaded areas that would be important in providing habitat. The 10,800 acre Jackson Creek Inventoried Roadless Area (IRA) lies at the very northeast corner of the analysis area. Additionally two unroaded/undeveloped areas are located north and south of the Marias Creek Road. The Coogan area is 2,745 acres, and the Marias-Nicholson Ridge area is 3,465 acres. These are areas that are unfragmented by roads and harvest, and would provide refugia for grizzly bears.

Mine employees would undergo training that would include environmental considerations. Included in this training would be hunting and firearm prohibitions, speed limits, prevention of wildlife harassment, and the identification and reporting the threatened and endangered species sightings. This would reduce the occurrence of persecution that may be exhibited against grizzlies. Persecution is one of the major impacts that roads have on grizzlies because it increases the likelihood of a human/grizzly encounter by increasing the number of people.

Environmental Consequences

Alternative A

This alternative would have no effect on grizzly bears. Although bears are not currently known to inhabit this vicinity, it is possible that bears may disperse through the area or establish a home range that includes this block of National Forest System land. However, there would be no road construction or improvement, no ore haul, or any activities proposed under this alternative that would result in habitat loss or disturbance. Conditions in the Buckhorn Block of the Tonasket District would likely remain similar to what they are currently, and human presence within the area is relatively low, with the exception of the fall deer hunting season.

Alternative B

Similar to the effects for wolves, Alternative B could potentially disturb any grizzly bears that may be dispersing through the area or establishing a territory in the area in the future. Due to the amount of people living around the Buckhorn Mountain block of National Forest System lands, and the relatively roaded nature of the project area, grizzly bears are unlikely to establish residency within the project area. It is more likely that bears would use this area during dispersal to more suitable habitat. Under this alternative, traffic along the ore haul route would substantially increase year-round. Grizzlies avoid open roads and the associated human presence (Wielgus et al. 2002). As discussed in the deer section, deer may be impacted during both summer and winter, and deer provide an important source of spring food for grizzlies in the form of carrion.

Road densities for grizzly bears are typically based on a Bear Management Unit (BMU) and include roads open to the public as well as those only open to administrative use. No BMU exists within the Buckhorn Block of NFS lands. The Effects Common to All Species section of this analysis contains the density by Management Area of roads open to the public and mine traffic. Construction of the ore haul route would increase road densities, and this would increase the area potentially avoided by bears and increase the difficulty for bears passing through the area.

Deer may alter their distribution in order to avoid the disturbance associated with the ore haul route, and consequently the carrion distribution would be altered. Road killed deer along the ore haul route, although not highly probable at a 30 mph speed limit, would potentially provide a food source for grizzly bears. However, grizzlies, if present, are unlikely to utilize these food sources because of their proximity to the roadway and humans.

Although this block of National Forest System land in general is not highly suitable for grizzly bears due to the current high density of roads, there are areas within this block away from the project activities that would be more suitable for grizzly bears due to their relatively unroaded condition and limited human presence. The Jackson Creek drainage is an example of habitat within this block that would be more suitable for grizzly bears, if they were present. The northern portion of the Coogan and southern portion of the Marias Ridge unroaded/undeveloped areas would provide less habitat unaffected by road related disturbance for grizzly bears because of the magnitude of increase in traffic on the Marias Creek Road. Any bears present would tend to avoid these areas.

It is possible that mine employees would choose to recreate within the Buckhorn Block of NFS lands as they become more familiar with the area. This increased recreation pressure would be balanced by the likely reduction in recreationists who have traditionally used the area but would be displaced due to the substantial increase in traffic. There may be a slight increase in recreation pressure overall, and this would add to the disturbance, and potential persecution, of carnivores.

If a grizzly did inhabit the Buckhorn Block of the Tonasket Ranger District during the life of the mine, the bear would be more likely to seek out a den site away from human disturbance. The year-round substantial increase in traffic may make it difficult for the bear to find a suitable den site, and may disturb the bear during the winter while it is in the den.

The overall effect of this alternative would be a reduction in functional habitat along the

roadway due to increased disturbance. Grizzlies, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. 57 acres of potential habitat would be lost as a result of this alternative, although because of the magnitude of human activity in these areas it's unlikely bears would use this habitat.

Alternative B1

The effects of this alternative would be similar to Alternative B for most components, particularly concerning disturbance and habitat loss to grizzlies. The primary differences would be the reduced speed limit which would reduce the potential for road kill and road closures in Bear Trap Canyon. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

Road densities for grizzly bears are typically based on the BMU and include roads open to the public as well as those only open to administrative use. No BMU exists within the Buckhorn Block of NFS lands. The Effects Common to All Species section of this analysis contains the density by Management Area of roads open to the public and mine traffic. The closures of the roads in Bear Trap Canyon would help mitigate the substantial increase in traffic along the ore haul route. Although the ore haul route would be a semi-permeable barrier, the closure of the roads in Bear Trap Canyon would give bears moving through the area another area to escape the effects of the ore haul. Bear Trap Canyon would still be open to administrative use, so these roads would still be considered to contribute to road densities when analyzed for grizzly bears. It would be an improvement over existing conditions, however.

Alternative C

The effects of this alternative would be similar to those of Alternatives B for many components. The notable differences are discussed below. Unlike the other alternatives, this ore haul route passes directly by the Jackson Creek IRA. It is that area that would be most suitable for grizzly bears, if they are present at all within this block of National Forest System land.

The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

Road densities for grizzly bears are typically based on the BMU and include roads open to the public as well as those only open to administrative use. No BMU exists within the Buckhorn Block of NFS lands. The Effects Common to All Species section of this analysis contains the density by Management Area of roads open to the public and mine traffic. Construction of the ore haul route would increase road densities, and this would increase the area potentially avoided by bears and increase the difficulty for bears passing through the area.

The increased disturbance associated with traffic on the haul route would reduce the suitability of the habitat along the western edge of the Jackson Creek IRA. This may cause wide-ranging carnivores to avoid use of that section of the IRA. Additionally, the same would be true of the northernmost section of the Marias-Nicholson Ridge unroaded area. The substantial increase in traffic along the haul route would limit animal movement between these two areas.

The upper portion of Forest Road 3550 and all of the 3550-125 and the portion of 3550-130 east of DNR lands would remain closed from December 1 until March 31 each winter to protect deer winter range along Marias Creek. This would also limit disturbance to grizzlies that may be in the area after hibernation searching for deer carrion. This road is bounded on both the north and south by unfragmented blocks of unroaded/undeveloped land (see Inventoried Roadless Area/Unroaded/Undeveloped report). Keeping this road closed during winter would effectively maintain a 6,210 acre short-duration refugium for grizzly bears if they emerge from den and are present prior to April 1st.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Grizzlies, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. 65 acres of potential habitat would be lost as a result of this alternative, although because of the magnitude of human activity in these areas it's unlikely bears would use this habitat.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. This haul route does not pass near an Inventoried Roadless Area or unroaded areas, so this alternative would have less impacts on wildlife using those areas compared to the other action alternatives.

The upper portion of Forest Road 3550 and all of the 3550-125 and the portion of 3550-130 east of DNR lands would remain closed from December 1 until March 31 each winter to protect deer winter range along Marias Creek. This would also limit disturbance to grizzlies that may be in the area after hibernation searching for deer carrion. This road is bounded on both the north and south by unfragmented blocks of unroaded/undeveloped land (see Inventoried Roadless Area/Unroaded/Undeveloped report). Keeping this road closed during winter would effectively maintain a 6,210 acre short-duration refugium for grizzly bears if they emerge from the den and are present prior April 1st.

Road densities for grizzly bears are typically based on a BMU and include roads open to the public as well as those only open to administrative use. No BMU exists within the Buckhorn Block of NFS lands. The Effects Common to All Species section of this analysis contains the density by Management Area of roads open to the public and mine traffic. Construction of the ore haul route would increase road densities, and this would increase the area potentially avoided by bears and increase the difficulty for bears passing through the area.

The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Grizzlies, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. 26 acres of potential habitat would be lost as a result of this alternative, although because of the magnitude of human activity in these areas it's unlikely bears would use this habitat. The overall direct and indirect effects of this alternative would be less than the other action alternatives.

Cumulative Effects

The two HUC5s that this project overlaps were used for cumulative effects analysis because no BMU exists within the Buckhorn Block of NFS lands. Grizzlies are unlikely to be within these HUC5s, although they may occasionally pass through as they move between suitable habitats. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous road building.

Past road building would have had the greatest impact on grizzly bears and their habitat, excluding this project. Those roads increase human access into the Buckhorn Block and thereby increase disturbance to any grizzly present as well as increase the opportunities for persecution against grizzlies. Although this project won't change road densities drastically, it would substantially increase traffic volume during the life of the mine. This would contribute a large amount of potential disturbance to any grizzlies that may be traveling through the Buckhorn Block of NFS lands. This disturbance would be focused around the ore haul routes, although the route in Alternatives B, B1, and C stretch across the Buckhorn Block from east to west. This disturbance would potentially discourage grizzly movement across the ore haul route. This disturbance would cover a larger area than the disturbance associated with most of the other actions considered under cumulative effects. Continued recreation in the area would be the most likely action to contribute to grizzly bear disturbance of the other actions because that action increases the probability of a human/grizzly encounter.

The increased probability of mortality due to traffic would be relatively low for this project due to the low relative speeds. This project would not result in as much opportunity of persecution against bears due to the low likelihood of the mine employees leaving the haul route. Recreationists would be more likely to roam over a greater portion of the Buckhorn Block, increasing their odds of encountering a grizzly. The closure of the roads in the Bear Trap Canyon area under Alternative B1 would improve conditions for grizzlies because it would reduce traffic and human use within that approximately 1,000 acre area. Bear Trap Canyon would still be open to administrative use, so these roads would still be considered to contribute to road densities when analyzed for grizzly bears. It would be an improvement over existing conditions, however.

Although this project would add incrementally to the cumulative effects on grizzlies, the overall effect is likely to be relatively low due to the unlikely presence of grizzlies.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Effect

Effects Determination Alt B, B1, C, and D: May Affect, Not Likely to Adversely Affect

Sensitive Species

California Wolverine

Affected Environment

Wolverines generally prefer habitats that are remote with minimal human presence (Wisdom 2000, Witmer 1998). Summer foods may include carrion, small mammals, birds, and berries.

Wolverines use isolated talus fields, such as in subalpine cirque basins, for natal dens, although they may also use downed logs, hollow snags, or hollow live trees. Maternal dens may be located in talus or sites with large downed trees (Wisdom et al. 2000). Other food sources include killing live ungulates, marmots, ground squirrels, fish, berries, and birds. It is important to maintain a diversity of prey species in wolverine habitat, especially high densities of ungulates that provide carrion (Witmer et al. 1998). Wolverines historically were widespread across the United States but probably occurred at low densities. The current distribution of wolverines in Washington is unknown. It is suspected that after being trapped and reduced in numbers in the state, they recolonized from Canada in the latter half of the last century. They probably occupy the North Cascades and only disperse through the Okanogan Valley. It is suspected that self-sustaining populations did not occur through the Okanogan Highlands, although this may be a dispersal corridor from Canada (Ruggiero et al. 1994).

At the broad scale, the California wolverine uses forest mosaics as habitat within the Interior Columbia River Basin. Habitat for the wolverine has increased from 32.83% to 37.57% of the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute increase of 4.73% and a relative increase of 14.41% in available habitat of the correct vegetation type. Within the Northern Glaciated Mountains ERU 7, habitat for the wolverine has declined from 43.59% to 42.85%. This equates to an absolute decline of 0.75% and a relative decline of 1.72% (Wisdom et al. 2000).

Although the vegetation may be present to provide habitat for wolverines, roads and human presence may limit the suitability of that habitat. The Jackson Creek Inventoried Roadless Area, and Coogan and Marias-Nicholson Ridge unroaded/undeveloped areas are located within the project area, so it is possible that wolverines are present and utilize this area as part of a larger home range, although no denning habitat is available in the form of talus fields in cirque basins. It is more likely that if wolverines are present that they are dispersers and are not residents.

The effects of roads and motorized trails within the Toroda and Myers Creek watersheds were analyzed using the models developed in Gaines et al. (2003). The existing condition for wolverines falls under the category of “high level of human influence on wolverine habitat” for these two watersheds. This means that less than 50% of the area is classified as security habitat. For the combined area of these two watersheds, only 23% of the area can be called security habitat. Security habitat is defined as areas with a moving windows road density of <1 mile per square mile. There is currently 47,730 acres of security habitat within these two watersheds, most of which lies within roadless and unroaded areas. This includes the areas within the Buckhorn Block listed above.

Another model developed under the Gaines et al. (2003) document, analyzes the impacts of motorized winter trails on wolverine denning habitats. There are no landtype associations within the two watersheds that would provide wolverine denning habitat (alpine cirques), so this model was not utilized for any of the alternatives. However, these areas may be used as connectivity habitat.

The suitability of the Buckhorn Block of NFS lands as wolverine dispersal habitat is rated as primarily “good” to “moderate.” The suitability of the entire length of the ore haul route from the Buckhorn Block of NFS lands to the Kettle River Mill is primarily “poor,” although it varies and some is rated as “good.” The Buckhorn Block of NFS lands as well as the entire ore haul route do not fall into least-cost corridor with a relative linkage value in the top 50%

(Singleton et al. 2002). This means that the area provides connectivity between wolverine habitats both in the US and in Canada.

Environmental Consequences

Alternative A

Alternative A would not affect wolverines or their habitat. No suitable denning habitat is present for wolverines, and there would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance. Conditions in the Buckhorn Block of the Tonasket District would likely remain similar to what they are currently, and human presence within the area is relatively low for most of the year.

Alternative B

Similar to the effects for other wide-ranging carnivores, Alternative B could potentially disturb any wolverines that may be dispersing through the area. Under this alternative, traffic along the ore haul route would substantially increase year-round. As discussed in the deer section, there potentially would be impacts to deer during both summer and winter, and deer provide an important source of carrion. Deer may alter their distribution in order to avoid the disturbance associated with the ore haul route, and consequently the carrion distribution would be altered. Road killed deer along the ore haul route, although not highly probable at a 30 mph speed limit, would potentially provide a food source for wolverines. However, wolverines, if present, are unlikely to utilize these food sources because of their proximity to the roadway and humans.

Although this block of National Forest System land in general is not highly suitable for wolverines due to the current roads and lack of denning habitat, there are areas within this block away from the haul route that would be more suitable for wolverines due to their relatively unroaded condition and limited human presence. Roadless areas are important in managing for overall biodiversity (Strittholt and Dellasala 2001). The Jackson Creek IRA, and Coogan and Marias-Nicholson Ridge areas have habitat within this block that would be more suitable for wolverines, if they were present, although no denning habitat is present there. Any wolverines found there would likely be dispersers.

Wildlife in remote areas may be disturbed by something as simple as a hiker or other recreationist (Ream 1979), so the substantial increase in noise and traffic along the ore haul route is likely to disturb wolverines and similar wildlife that may be dispersing through the project area.

The ore haul route would have a greater impact on small mammals near the roadway, and these are important prey items for wolverines. The mine related traffic would likely result in increased mortality to small mammals (squirrels, etc.), and there would consequently be fewer of these prey items available near the ore haul route compared to current conditions. However, road mortality generally doesn't limit overall population sizes in most common species. The most important effects of roads and traffic noise are related to disturbance and therefore avoidance of roadsides, as well as fragmentation and edge effect (Foreman and Alexander 1998).

Alternative B would pass near the Coogan and the Marias-Nicholson Ridge unroaded areas (see the Inventoried Roadless and Unroaded Areas section of this EIS), and consequently

the disturbance from the increased traffic on the haul route may decrease the suitability of these areas as habitat for wide-ranging carnivores. This may cause animals to avoid using those areas closest to the haul route. In the case of this alternative, the ore haul route would potentially cause secretive species to avoid the northern part of the Coogan area, as well as the south portion of the Marias-Nicholson Ridge area. Additionally, the traffic on the haul route would limit movement of animals between these areas.

Based on the models developed in Gaines et al. (2003), 35 acres of security habitat would be lost by increasing road densities to >1 miles per square mile along the ore haul route based on a moving windows analysis. This is a small acreage when analyzed at the scale of the Toroda and Myers Creek watersheds and the percentage of security habitat remains unchanged from current conditions (23%). Therefore, the rating for the watersheds remains the same as Alternative A: "high level of human influence on wolverine habitat." The estimates were based on "open" travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater under this alternative than under existing conditions, but this substantial difference in intensity was not captured in the model.

It is possible that mine employees would choose to recreate within the Buckhorn Block of NFS lands as they become more familiar with the area. This increased recreation pressure would be balanced by the likely reduction in recreationists who have traditionally used the area but would be displaced due to the substantial increase in traffic. There may be a slight increase in recreation pressure overall, and this would add to the disturbance, and potential persecution, of carnivores.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Wolverines, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. The construction of the project components would reduce habitat for wolverine and their prey.

Alternative B1

The effects of this alternative would be similar to Alternative B for many components, particularly concerning disturbance and habitat loss to wolverines and their prey. The primary difference would be the reduced speed limit in this alternative (25 mph) which would reduce the potential for road kill and the road closures in Bear Trap Canyon. The road closures in Bear Trap Canyon would provide an additional area within the Buckhorn Block of NFS lands where wolverines and other secretive creatures could escape the substantial increase in traffic along the ore haul route.

Based on the models developed in Gaines et al. (2003), approximately 240 acres of security habitat would be created under this alternative by decreasing road densities to <1 miles per square mile within the Bear Trap Canyon area, based on a moving windows analysis. The calculations took into account the road closures as mitigation and the road construction for the ore haul route. This is a small acreage when analyzed at the scale of the Toroda and Myers Creek watersheds and the percentage of security habitat remains unchanged from current conditions (23%). Therefore, the rating for the watersheds remains the same as Alternative A: "high level of human influence on wolverine habitat." The estimates were based on "open" travel routes, and the substantial increase in the traffic volume along the ore

haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater under this alternative than under existing conditions, but this substantial difference in intensity was not captured in the model.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Wolverines, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. The construction of the project components would reduce habitat for wolverine and their prey, although this is partially offset by road closures creating about 1,000 acres of low human use habitat.

Alternative C

The likelihood of disturbance to dispersing wolverines would be similar to Alternatives B for many components. The notable differences are discussed below. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. As discussed in the deer and bald eagle analysis of this document, this proposed ore haul route goes through less area designated for management as deer winter range by the Forest Plan. Ungulate carrion, and sometimes live ungulates, constitute an important source of food for wolverines. The effects for wintering deer would be less than under Alternatives B and B1, although the effects for summer range would be similar to those alternatives. A larger area would be affected for deer summer range because the ore haul route is longer under this alternative.

The increased disturbance associated with traffic on the haul route would reduce the suitability of the habitat along the western edge of the Jackson Creek IRA. This may cause wide-ranging carnivores to avoid use of that section of the IRA. Additionally, the same would be true of the northernmost section of the Marias-Nicholson Ridge unroaded area. The substantial increase in traffic along the haul route would limit animal movement between these two areas.

Based on the models developed in Gaines et al. (2003), 20 acres of security habitat would be lost by increasing road densities to >1 miles per square mile along the ore haul route based on a moving windows analysis. This is a small acreage when analyzed at the scale of the Toroda and Myers Creek watersheds and the percentage of security habitat remains unchanged from current conditions (23%). Therefore, the rating for the watersheds remains the same as Alternative A: “high level of human influence on wolverine habitat.” The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater under this alternative than under existing conditions, but this substantial difference in intensity was not captured in the model.

The upper section of Forest Road 3550 and all of the 3550-125 and the portion of 3550-130 east of DNR lands would remain closed from December 1 until March 31 each winter to protect deer winter range along Marias Creek. This would also limit disturbance to wolverines that may be in the area searching for deer carrion, as described under the gray wolf and grizzly bear sections above.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Wolverines, if present, may avoid use of the habitat

adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. The construction of the project components would reduce habitat for wolverine and their prey.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. The upper section of Forest Road 3550 and all of the 3550-125 and the portion of 3550-130 east of DNR lands would remain closed from December 1 until March 31 each winter to protect deer winter range along Marias Creek. This would also limit disturbance to wolverines that may be in the area searching for deer carrion, as described under the gray wolf and grizzly bear sections above. This haul route does not pass near an Inventoried Roadless Area or an unroaded area, so this alternative would have less impacts on wildlife using those areas compared to the other action alternatives.

Based on the models developed in Gaines et al. (2003), 20 acres of security habitat would be lost by increasing road densities to >1 miles per square mile along the ore haul route based on a moving windows analysis. This is a small acreage when analyzed at the scale of the Toroda and Myers Creek watersheds and the percentage of security habitat remains unchanged from current conditions (23%). Therefore, the rating for the watersheds remains the same as Alternative A: “high level of human influence on wolverine habitat.” The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater under this alternative than under existing conditions, but this substantial difference in intensity was not captured in the model.

The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Wolverines, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. The construction of the project components would reduce habitat for wolverine and their prey. The overall direct and indirect effects of this alternative would be less than the other action alternatives.

Cumulative Effects

The two HUC5s that this project overlaps were used for cumulative effects analysis. Wolverines are unlikely to be within these HUC5s, although they may occasionally pass through as they move between suitable habitats. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous road building.

Additional roads incrementally increase the negative effects of disturbance and reduction in wildlife habitat (Craighead, no date), and wolverines generally avoid people. This project would not drastically alter road densities, although it would substantially increase the traffic volume along the ore haul routes. This disturbance would be focused around the ore haul route, although the route in Alternatives B, B1, and C stretches across the Buckhorn Block from east to west. This disturbance would potentially discourage wolverine movement

across the ore haul route. This disturbance would cover a larger area than the disturbance associated with most of the other actions considered under cumulative effects.

Past road building had the greatest impact on wolverines and their habitat, excluding this project. The increased probability of mortality due to traffic would be relatively low for this project due to the low relative speeds. The closure of the roads in the Bear Trap Canyon area under Alternative B1 would improve conditions for wolverines because it would reduce existing traffic and human use within that area. Suitable denning for wolverines is very limited within the Buckhorn Block of NFS lands, and past timber harvest and road building may have additionally limited the areas available for wolverine movement between suitable habitats. This project substantially increases the road related disturbance along the ore haul route.

Although this project would add incrementally to the cumulative effects on wolverines, the overall effect is likely to be relatively low due to the unlikely presence of wolverines.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Impact

Effects Determination Alt B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Gray Flycatcher

Affected Environment

Sagebrush and arid woodlands are the primary habitat for gray flycatchers. It uses arid open woodlands, aspen, tall sagebrush/bunchgrass, and mountain mahogany communities for feeding and nesting. Gray flycatchers also use riparian woodlands for foraging. It is found in mature sagebrush communities where the sagebrush reaches small tree size. The species feeds on moths, grasshoppers, beetles, and other small insects by fly catching close to the ground or by gleaning from the ground and low plants. Gray flycatchers build cup nests in low trees or sagebrush (within 3-13 feet of the ground) (Paige and Ritter 1999). In Washington, gray flycatcher habitat appears to consist primarily of open stands of small to medium (<50 feet) ponderosa pine with a shrub/pine understory (NatureServe 2005).

The wide-scale trend for gray flycatcher habitat is not described in Wisdom et al. 2000, although the conservation status for gray flycatchers is listed as “imperiled” in the state of Washington (NatureServe 2005).

Gray flycatchers have been sighted on the Tonasket Ranger District in ponderosa pine/sagebrush habitats on Tunk Mountain, as well as south of Loup Loup Pass on the Methow Valley Ranger District.

Some ponderosa pine habitat exists, to a limited extent, at the lower elevations of this project such as along Nicholson Creek. The ponderosa pine is often in denser stands of timber. The presence of gray flycatcher is therefore not probable.

Environmental Consequences

Alternative A

There would be no impacts to gray flycatchers or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

Very little, if any, potential habitat for gray flycatchers exists along the Marias Creek ore haul route. There are some open, south-facing, steep, drier slopes along the lower reaches of Marias Creek, although the proposed ore haul route is immediately adjacent to very little of this. No stands of tall, mature sagebrush are present along the ore haul route.

It is unlikely that gray flycatchers are present due to the lack of suitable habitat. Consequently, the effects of this alternative are likely to be minor, at most. Ore haul and employee traffic would substantially increase traffic along the ore haul routes, but because gray flycatchers are unlikely to be present they would be unlikely to be disturbed or killed.

Alternative B1

The effects of this alternative would be similar to Alt B for many components, particularly concerning disturbance and habitat loss to gray flycatchers. The primary difference would be the reduced speed limit which would reduce the potential for road kill.

Alternative C

The effects of this alternative would be similar to those of Alternatives B for some components. However, a little more ponderosa pine is present in the lower reaches of Nicholson Creek and some is located near the proposed ore haul route. Similar to Marias Creek, there are some open, south-facing, steep, drier slopes along the lower reaches of Nicholson Creek in the Graphite Mountain area, although the proposed ore haul route is immediately adjacent to very little of this and no tall, mature stands of sagebrush are present.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. The ore haul route across National Forest would not cross suitable gray flycatcher habitat.

Effects Common to All Action Alternatives

The 3575-140 road to be used to access the water storage facility passes though some open habitat with short sagebrush, although this site is relatively small and located at a higher elevation near the top of the Buckhorn Mountain, and would be used frequently during mine construction, but during mine operations this road would be used infrequently. The infiltration gallery and pipeline, fences, utility lines, range mitigation and other project components would alter very little potential habitat if any, and due to the lack of suitable habitat gray flycatchers are unlikely to be present.

Cumulative Effects

The area considered for cumulative effects on gray flycatchers included primarily the Buckhorn Block of NFS lands, as well as adjacent lands. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous grazing.

This project would have very little impact to potential gray flycatcher habitat and has a low potential for disturbance effects. The most likely areas for gray flycatchers include the private lands used as borrow sites for road gravel, and even these may not be highly suitable habitats due to a lack of sagebrush. This project is not as likely to have had as great an impact on gray flycatcher habitat as residential development, agriculture, and grazing on adjacent private lands.

Although this project would add a small incremental impact to the cumulative effects on gray flycatchers, the overall effect is likely to be relatively low due to the unlikely presence of gray flycatchers and the limited amount of habitat impacted by this project.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Impact

Effects Determination Alt B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Great Gray Owl

Affected Environment

Great gray owls typically use montane, Engelmann spruce, and subalpine fir forests (Wisdom et al. 2000).

This species uses late-seral multi- and single-layered stages as habitat. Great gray owls need openings juxtaposed to forested areas to meet its life history requirements. They use old forest, unmanaged young forest, stand initiation stages in montane forests, Engelmann spruce-subalpine fir forests, pine, and riparian woodlands (NatureServe 2005, Widsom et al. 2000). They use forested areas for nesting and adjacent openings for foraging. These owls need large trees and snags for nesting (18-37 inches dbh), although they do not build their own nests. They use depressions in broken topped snags, stumps, mistletoe brooms, artificial platforms, or stick nests of northern goshawks or red-tailed hawks. The loss of snags and downed wood contributes to the decline in prey species habitat (Wisdom et al. 2000). They prey on voles, pocket gophers, and other small rodents (Holt et al. 1990).

At the broad scale, the great gray owl uses broad-elevation old forests as habitat within the Interior Columbia River Basin. Habitat for the great gray owl has declined from 26.53% to 24.94% of the entire basin from historical times (1850-1890) to current times (1985-1995). This equates to an absolute decline of 1.59% and a relative decline of 5.99% in available habitat. Within the Northern Glaciated Mountains ERU 7, habitat for the great gray owl has declined from 38.33% to 14.75%. This equates to an absolute decline of 23.58% and a relative decline of 61.53% (Wisdom et al. 2000).

Surveys were conducted in 2005 for great gray owls. These surveys were based on the protocol described by Quintana et al. (2004). No great gray owls were positively detected and no nests were identified. These surveys focused on natural openings and the surrounding habitat as described in Quintana et al. (2004). Very few natural meadows exist that fit the protocol and could provide suitable habitat for great gray owls, and those small meadows that do exist are located along the proposed Nicholson Creek ore haul route. Great gray owls may still exist along the ore haul routes and may be using artificial openings created by timber harvest for foraging habitat. Great gray owls were recorded in the early 1990s on private land less than a half mile from the Cow Camp ore haul route (Alternative D) as it passes through private lands on the Forest Service rights-of-way.

Environmental Consequences

Alternative A

There would be no impacts to great gray owls or their habitat with this alternative. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

No natural meadows greater than 10 acres in size would be impacted by this alternative. Some man-made openings created through timber harvest are adjacent to the proposed ore haul route and may provide suitable foraging habitat for great gray owls. Great gray owls potentially could be nesting near the ore haul route along Marias Creek, and if present could potentially be disturbed by the dramatic increase in traffic along this road. Additionally, foraging owls may be disturbed, or struck by mine related traffic. This is less likely because these owls are primarily active at dusk, dark, and dawn. Most of the ore haul would be conducted during daylight hours during the nesting season, although some ore haul conducted in the morning after 6:00 a.m. may impact foraging owls.

The ore haul route would have a greater impact on small mammals near the roadway, and these are important prey items for great gray owls. The mine related traffic would likely result in increased mortality to small mammals (mice, voles, etc.), and there would consequently be fewer of these prey items available near the ore haul route compared to current conditions. Although populations of these small mammals may not be limited by the potential road kill, movement across the roadway would be restricted. Additionally, microsite conditions along the roadway would be altered and could potentially reduce the suitability of the habitat near the roadways. The silt fences and other erosion control structures may impede movement of small mammals as well.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Great gray owls may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a 57 acre loss of habitat for both great gray owls and their prey due to the construction of the project components.

Alternative B1

The effects of this alternative would be similar to Alternative B for many components, particularly concerning disturbance and habitat loss to great gray owls and their prey. The

primary difference would be the reduced potential from road kill from reducing the speed limit which would reduce the potential for road kill and road closures in Bear Trap Canyon.

Alternative C

The effects of this alternative would be similar to those of Alternative B for some components. There are a couple small, natural meadows that are less than 10 acres in size that may provide suitable foraging habitat for great gray owls. These areas were surveyed and no great gray owls were found. Similar to the Marias Creek ore haul route, there are several artificial openings created by timber harvest that may provide suitable foraging habitat for great gray owls. It is possible that great gray owls would nest near these artificial openings. Consequently, it is possible that nesting great gray owls may be disturbed by mine related traffic along the Nicholson Creek ore haul route, if these owls are present.

The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Great gray owls may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a 65 acre loss of habitat for both great gray owls and their prey due to the construction of the project components.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Very few natural meadows are found along this road. Great gray owls may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a 26 acre loss of habitat for both great gray owls and their prey due to the construction of the project components. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The overall direct and indirect effects of this alternative would be less than the other action alternatives.

Cumulative Effects

The Buckhorn Block of NFS lands and the adjacent lands were considered for this cumulative effects analysis. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous timber harvest.

Road related disturbance would be the primary incremental effect that this project would add to cumulative effects. The disturbance would be relatively localized, although it would be of high intensity and of long duration. Very few acres of potential habitat would be lost directly to this project, although a larger area would be impacted by the noise disturbance. Previous timber harvest in the area is more likely to have had a direct impact on habitat, although the noise disturbance would have been shorter in duration. Timber harvest would have increased artificial openings that would have provided suitable foraging habitat, although it would have also reduced potential nesting habitat. Recreation and the activities at the mine site would be the most likely to contribute to noise disturbance for owls, excluding this

project.

The mining activity on private lands would increase disturbance during the life of the Buckhorn Mine, and this disturbance would be spread throughout the day and night due to the 24 hour operational schedule, and the increased disturbance from haul and employee traffic before dawn and after dusk, when added to the noise and disturbance from the mine site may cause owls to move further away from the mine.

Alternative D would have cumulative effects for great gray owls. The nearest sighting of a great gray owl to the Buckhorn Block of NFS lands occurred near the proposed ore haul route across private land along the Cow Camp road. As with the other action alternatives, great gray owls could occur on private and other non-NFS ownerships. It is possible that great gray owls on non-NFS lands would be impacted by disturbance related to mine traffic and be displaced from habitat along the roadway.

Although the incremental impact of this project would be focused near the ore haul route, the substantial increase in traffic volume would make that impact intense within that area of disturbance. This may cause owls to shift habitat use to areas with less disturbance within the Buckhorn Block of NFS lands.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Impact.

Effects Determination Alt B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Pacific Fisher

Affected Environment

Fishers use late-seral montane forests and unmanaged young forest stands. They need large diameter snags and downed woody material to provide habitat for prey species. Snags and downed wood also provide denning and resting habitat (Wisdom et al. 2000). In the east-side forests of Washington, fishers are found in true fir and mixed conifer stands at higher elevations. Snow depth may be a limiting factor at higher elevations, and in winter fishers may utilize lower elevation, mesic forests (Ruggiero et al. 1994). Fishers are known to feed on small mammals, birds, carrion, and fruits (Burt and Grossenheider 1980, Ruggiero et al. 1994, Witmer et al. 1998). Fishers avoid open areas and are generally found in late-successional forests with the fewest openings. On the east-side of the Cascades, fishers have been observed at elevations of 5900-7200 feet, although they may be found lower (Ruggiero et al. 1994). Riparian areas provide important habitat for fishers as they typically have high canopy cover, structural diversity, abundant prey, and provide travel corridors (Witmer et al. 1998).

At the broad scale, the Pacific fisher uses broad-elevation old forests as habitat within the Interior Columbia River Basin. Habitat for the fisher has declined from 11.65% to 9.38% of the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute decline of 2.27% and a relative decline of 19.51% of available habitat. Within the Northern Glaciated Mountains ERU 7, habitat for the fisher has declined from 18.80% to 1.51%. This equates to an absolute decline of 17.29% and a relative decline of 91.99%

(Wisdom et al. 2000).

Fishers are not known to occur within the project area. Very limited, higher elevation, true fir habitat is available within the project area, and most of it is located near the infiltration gallery and the 3575-120 road in that area. There are also numerous drier, open slopes at the lower elevations, as well as man-made openings located throughout the project area. Fishers, if they are present, are likely to only be dispersers.

Habitat consisting of areas with low road densities exists within the Buckhorn Block of the Tonasket Ranger District. The 10,800 acre Jackson Creek Inventoried Roadless Area (IRA) lies at the very northeast corner of the analysis area. Additionally two unroaded/undeveloped areas are located north and south of the Marias Creek Road. The Coogan area is 2,745 acres, and the Marias-Nicholson Ridge area is 3,465 acres. These are areas that are unfragmented by roads and harvest, and would provide important refugia for fishers.

Environmental Consequences

Alternative A

There would be no impacts to fishers or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance. Conditions in the Buckhorn Block of the Tonasket District would likely remain similar to what they are currently, and human presence within the area is relatively low for most of the year.

Alternative B

Similar to the effects for other wide-ranging carnivores, Alternative B could potentially disturb any fishers that may be dispersing through the area. Under this alternative, traffic along the roads constituting the ore haul route would substantially increase year-round.

The speed limit of 30 mph would limit the probability of fishers being struck by mine related vehicles, although the other action alternatives have a speed limit of 25 mph and therefore a lower probability of collision. The primary effect associated with this project would be the issue of disturbance related to the large increase in traffic. Dispersing fishers would likely travel along the riparian areas, and Forest Road 3550 proposed as an ore haul route in this alternative follows Marias Creek for more than 4.0 miles of its length. Fishers dispersing along this riparian corridor would likely be disturbed by the substantial increase in traffic.

The ore haul route would have a greater impact on small mammals and birds near the roadway, and these are important prey items for fishers. The mine related traffic would likely result in increased mortality to small mammals (mice, voles, etc.) and birds, and there would consequently be fewer of these prey items available near the ore haul route compared to current conditions. Although populations of these small mammals would not likely be limited by the potential road kill, movement across the roadway would be restricted. Additionally, microsite conditions along the roadway would be altered and could potentially reduce the suitability of the habitat near the roadways. The silt fences and other erosion control structures may impede movement of small mammals as well. Using models recommended by Gaines et al., 14 acres of late successional forest non-winter habitat, 9 acres of late successional forest nonwinter security habitat, and 19 acres of late successional forest winter security habitat for this species would be impacted under this alternative.

Fishers need snags to provide habitat for prey species and to provide resting habitat. Snags along the currently existing roads within the project area are generally absent due to firewood cutters, so the reconstruction of these sections of roadway is unlikely to impact many snags. The new construction would be off limits to the public during operation, so these snags would not be lost to woodcutting during the life of the project. After the life of the mine, the new road would be opened to the public and snags along the route are likely to be lost to woodcutters. Snags would be created within riparian areas as mitigation to compensate for the removal of snags during construction of the ore haul routes. Overall, the area affected by the construction of the components described under this alternative would result in a very small loss of snags when considered at the broader scale of the Buckhorn Block of National Forest System lands or the larger watershed scale. This project would consequently have only minor impacts to snag habitat, and these would be mitigated by the creation of more new snags than would be lost through project activities. These new snags would not be created along the ore haul route. Instead, they would be created away from the route in order to reduce the impact of disturbance from ore haul trucks on these snags. This would enhance their value as mitigation.

Alternative B would pass near the Coogan and the Marias-Nicholson Ridge unroaded areas (see the Inventoried Roadless and Unroaded Areas section of this EIS), and consequently the disturbance from the increased traffic on the haul route may decrease the suitability of these areas as habitat for wide-ranging carnivores. This may cause animals to avoid using those areas closest to the haul route. Additionally, the traffic on the haul route would limit movement of animals between these areas.

It is possible that mine employees would choose to recreate within the Buckhorn Block of NFS lands as they become more familiar with the area. This increased recreation pressure would be balanced by the likely reduction in recreationists who have traditionally used the area but would be displaced due to the substantial increase in traffic. There may be a slight increase in recreation pressure overall, and this would add to the disturbance, and potential persecution, of carnivores.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Fishers, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest lands. There would be a loss of habitat for fishers and their prey due to the construction of the project components.

Alternative B1

The effects of this alternative would be similar to Alternative B for many components, particularly concerning disturbance and habitat loss to fishers and their prey. The primary difference would be the reduced speed limit which would reduce the potential for road kill and the road closures in Bear Trap Canyon providing a larger area of refuge for this species. Using models recommended by Gaines et al., 21 acres of late successional forest non-winter habitat, 99 acres of late successional forest nonwinter security habitat, and 16 acres of late successional forest winter security habitat for this species would not be impacted that is currently being impacted by open roads under this alternative.

Alternative C

The effects of this alternative would be similar to those of Alternative B for some components, except the impact would be spread over a much larger area because of the longer haul route. Notable differences are discussed below. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The ore haul route would also travel along the 3575-120 road past the infiltration gallery and pipeline, and this area has true fir habitat. This alternative travels along Nicholson Creek, and as stated for Alternative B, fishers are more likely to travel along riparian areas. About 2.6 miles of this route is within riparian habitat conservation acres. If they are present, then disturbance would increase within these areas due to the substantial increase in traffic.

The increased disturbance associated with traffic on the haul route would reduce the suitability of the habitat along the western edge of the Jackson Creek IRA. This may cause wide-ranging carnivores to avoid use of that section of the IRA. Additionally, the same would be true of the northernmost section of the Marias-Nicholson Ridge unroaded area. The substantial increase in traffic along the haul route would limit animal movement between these two areas.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Fishers, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. Using models recommended by Gaines et al., 10 acres of late successional forest non-winter habitat, 3 acres of late successional forest nonwinter security habitat, and 12 acres of late successional forest winter security habitat for this species would be impacted under this alternative. There would be a loss of habitat for fishers and their prey due to the construction of the project components.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. This haul route does not pass near an Inventoried Roadless Area or an unroaded area, so this alternative would have less impacts on wildlife using those areas compared to the other action alternatives. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Fishers, if present, may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest lands. Using models recommended by Gaines et al., 10 acres of late successional forest non-winter habitat, 3 acres of late successional forest nonwinter security habitat, and 12 acres of late successional forest winter security habitat for this species would be impacted under this alternative. There would be a loss of habitat for fishers and their prey due to the construction of the project components. The overall direct and indirect effects to fishers and their prey would be less for this alternative than for the other action alternatives.

Effects Common to All Action Alternatives

The infiltration gallery and pipeline are located in and near an area of true firs and higher elevations that may provide the best habitat within the project area for dispersing fishers. However, there are several man-made openings in this area and this reduces the suitability

of the habitat for fishers. If they are present in this area, fishers would be disturbed by the construction and continued activities around the infiltration gallery and pipeline. Additionally, the footprint of these facilities would result in a small reduction in forest cover around these sites, about 2 acres.

Cumulative Effects

The two HUC5s that this project overlaps were used for cumulative effects analysis. Fishers are unlikely to be within these HUC5s, although they may occasionally pass through as they move between suitable habitats. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous road building and timber harvest.

Excluding this project, past road building and timber harvest would have had the greatest impact on fisher habitat. This project does not reduce forested habitat by many acres, although the area impacted by the noise/human disturbance would extend beyond the footprint of the project components. This disturbance would be focused around the ore haul route, although the route in Alternatives B, B1, and C stretches across the Buckhorn Block from east to west. This disturbance would potentially discourage fisher movement the ore haul route.

The increased probability of mortality due to traffic would be relatively low for this project due to the low relative speeds and the unlikely presence of the species. The closure of the roads in the Bear Trap Canyon area under Alternative B1 would improve conditions for fishers because it would reduce existing traffic and human use within that area.

Although this project would add incrementally to the cumulative effects on fishers, the overall effect is likely to be relatively low due to the unlikely presence of fishers.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Impact.

Effects Determination Alt B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Pacific Fringe-tailed Myotis

Affected Environment

Pacific fringe-tailed bats use mines, bridges, old buildings, and snags as roosting habitat. Snags are an important habitat component because these bats can roost under the exfoliating bark. Due to the short lifespan of this exfoliating bark, bats may require more snags on the landscape than cavity nesting birds (Wisdom et al. 2000). Nagorsen and Brigham (1993) describe the broad habitat for the fringed-tailed bat as arid grasslands and forest, including ponderosa pine and Douglas-fir dry forests. Fringed-tailed bats have been found on the Okanogan National Forest in the Hunter Mountain area (Perkins, 1989), which is over 90 miles southwest of the project area. This species feeds on insects such as moths, crickets, leafhoppers and beetles. They have been trapped in riparian areas while foraging on aerial insects and they glean non-flying insects off foliage. Riparian areas often provide higher quantities of insects for foraging (Wisdom et al. 2000). Fringed bats typically search

for water after they emerge at night to forage, and they generally can drink from an open water source by skimming the surface while flying. Proximity of water is important in determining the suitability of roost sites. They typically begin migrating to winter hibernacula in October or November and exit hibernation in March or April (Christy and West 1993).

At the broad scale, the Pacific fringed myotis uses forests, woodlands, and sagebrush as habitat within the Interior Columbia River Basin. Habitat for the fringed myotis has increased from 43.56% to 51.12% across the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute increase of 7.56% and a relative increase of 17.36% in available habitat. Within the Northern Glaciated Mountains ERU 7, habitat for the fringed myotis has increased from 60.30% to 63.07%. This equates to an absolute increase of 2.77% and a relative increase of 4.60% (Wisdom et al. 2000).

The Pacific fringe-tailed myotis is not known to occupy the project area, although old mine adits and buildings are present on both private and USFS lands.. Bat surveys were conducted for these sites in association with the mine development on Buckhorn Mountain, although the Pacific fringe-tailed myotis was not detected during those surveys (Crown Jewel FEIS 1997). It is still possible that they exist in the area and remain undetected. Snags that could be used as roosting habitat are present along the proposed new road construction between the 3575-120 road and the patented lands, as well as along the existing roads proposed as ore haul routes. Both the Marias and Nicholson Creek roads travel along the riparian areas, and bats are known to use riparian areas due to the abundance of insects.

Environmental Consequences

Alternative A

There would be no impacts to the Pacific fringe-tailed myotis or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

The Pacific fringe-tailed myotis may be impacted by this alternative. Although none have been documented within the project area, some potentially suitable roosting habitat is available in the form of old mine adits and old buildings. Additionally, snags with exfoliating bark can provide suitable roosting habitat and these may be found throughout the analysis area. This species of bats, like many other bats, forages around water sources and within riparian areas because these areas support higher concentrations of insects. This route impacts about 4.0 miles with Riparian Habitat Conservation Areas. The ore haul route proposed under this alternative travels along Marias Creek (existing Forest Road 3550). It is unlikely that ore haul would disturb foraging bats because ore haul would be conducted during mostly daylight hours. However, ore haul may disturb roosting bats if they are present in snags near the ore haul route. Mine related traffic, other than ore haul, may disturb foraging bats within riparian areas if it occurs after sunset. Employee traffic would occur primarily from 5:00 – 9:00 a.m. and 5:00 – 9:00 p.m. and would represent a substantial volume of traffic (approximately 169 one-way trips per day on the Marias route). The overall effect would be potential abandonment of these areas by bats and use of other roosting habitat away from the disturbance.

Pacific fringe-tailed myotis need snags to provide habitat for roosting. Snags along the

currently existing roads within the project area are generally absent due to firewood cutters, so the reconstruction of these sections of roadway is unlikely to impact many snags. The new construction would be off limits to the public, so snags adjacent to this section would not be lost to woodcutting during the life of the project. The new road would be open to the public after the life of the mine and snags may be lost at that time. Snags would be created within riparian areas as mitigation to compensate for the removal of snags during construction of the ore haul routes. Overall, the area affected by the construction of the components described under this alternative would result in a very small loss of snags when considered at the broader scale of the Buckhorn Block of National Forest System lands or the larger watershed scale. This project would consequently have only minor impacts to snag habitat, and these would be mitigated by the creation of new snags. These new snags would not be created along the ore haul route. Instead, they would be created in areas away from the route in order to reduce the impact of disturbance from ore haul trucks on these new snags. This would enhance their value as mitigation.

Indirect toxic impacts to individual bats could occur in the unlikely event of an accidental transport spill of chemicals (such as diesel fuel) into creeks along the haul route. With any potential spill, the likelihood of a bat drinking contaminated water is very low since a spill would be a short-term accidental event. In addition, the extent of human activity associated with emergency containment and cleanup activities would be avoided by bats. Bat prey (insects) would be more likely to be killed by a spill. This might force bats to forage elsewhere in the short-term.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Bats may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat for bats due to the construction of the project components.

Alternative B1

The effects of this alternative would be similar to Alternative B for most components, particularly concerning disturbance and habitat loss to bats. The primary difference would be the reduced speed limit which would reduce the potential for road kill.

Alternative C

The effects of this alternative would be similar to those of Alternative B for some components. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. This alternative travels along Nicholson Creek, and as stated for Alternative B, riparian areas provide large concentrations of insects. Large snags near these sites may be used for roosting habitat. If Pacific fringe-tailed myotis is present, then disturbance would increase within these areas due to the substantial increase in traffic. 2.6 miles of this route is within Riparian Habitat Conservation Areas. Frog Pond is a small pond along the 3575-120 road that would provide suitable foraging habitat for bats. Bats roosting near this pond would potentially be disturbed by mine related traffic. Additionally, non-ore haul related mine traffic traveling along this route after sunset could potentially disturb foraging bats.

The haul route uses the 3575-120 road which goes near the Roosevelt Adits, and any bats using this or other adits in the area would potentially be disturbed by the substantial increase

in vehicle traffic and human activity.

Indirect toxic impacts to individual bats could occur in the unlikely event of an accidental transport spill of chemicals (such as diesel fuel) into creeks along the haul route. With any potential spill, the likelihood of a bat drinking contaminated water is very low since a spill would be a short-term accidental event. In addition, the extent of human activity associated with emergency containment and cleanup activities would be avoided by bats. Bat prey (insects) would be more likely to be killed by a spill. This might force bats to forage elsewhere in the short-term

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Bats may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat for bats due to the construction of the project components.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. No Riparian Habitat Conservation Areas are affected by this route. The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Bats may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat for bats due to the construction of the project components. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The overall direct and indirect effects to bats would be less than for the other action alternatives.

Effects Common to All Action Alternatives

The construction of the section of new road from Forest Road 3575-120 to the mine site goes through a mature stand of Douglas-fir. A few large snags are scattered along this route. These potentially could provide suitable roosting habitat for bats and may be lost during road construction. Bats would have to utilize alternate habitat away from this disturbance. Snag loss due to construction activities would be mitigated by snag creation within the riparian areas other than along those areas near the ore haul route. This would reduce the impacts from disturbance on the newly created snags and thereby enhance their value as mitigation. Three and a half times as many snags would be created as the number of acres of NFS lands cleared.

The new section of road for the ore haul route across National Forest System lands from the 3575-120 road to the mine site is part of all alternatives. This is the section of road nearest the greatest concentration of old mine adits and buildings that may provide roosting habitat for bats. Although this section of new road construction is not along a riparian area, the proximity to potential roosting habitat makes disturbance a possibility, although it is likely to be only a low probability of this being a direct effect. This section of road is near the Roosevelt Adit, as is the access road for the infiltration gallery and water augmentation conveyance pipeline, and the boundary fence. The construction and continued use of these facilities would potentially disturb any bats utilizing the Roosevelt Adit and other adits.

Cumulative Effects

The entire Buckhorn Block of NFS lands and adjacent lands were considered for this cumulative analysis. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous mining.

Previous mining activity created adits and old buildings that can provide habitat for bat species. Additionally, past timber harvest likely led to reduced large snags, which would have potentially been used for roosting. Road building allowed firewood cutters to harvest snags and further reduce potential habitat. This project may alter the distribution of snags, although overall levels may be unchanged due to mitigation to replace snags that are lost to project construction. Mining activities on private lands may cause disturbance for bats, and the backfilling of the Buckhorn Mine once it is finished would keep that mine from being potential bat habitat in the future. The old mine buildings located at the proposed mine site may provide habitat for bats at some point in the year. The increased activity associated with the mine would potentially disturb any bats using these buildings. This project may contribute to disturbance to roosting or foraging bats, although this effect would be focused around the ore haul routes.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Impact.

Effects Determination Alt B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Sharp-Tailed Grouse

Affected Environment

Sharp-tailed grouse use areas of gentle topography (Wisdom et al. 2000). They use the following habitats: open-canopied big, mountain, and low sagebrush; wheatgrass and fescue bunchgrasses; herbaceous wetlands; upland/mountain shrubs such as chokecherry-serviceberry-rose and shrub wetland cover types. Sagebrush and grasslands are used for nesting and brood-rearing while upland shrubs and riparian areas are used for security. Sharp-tailed grouse use upland shrubs and riparian areas in the winter. They forage on herbaceous plants and also arthropods during spring and summer. During the fall and winter they forage on fruits and buds of woody vegetation (chokecherry, serviceberry, hawthorn, rose, snowberry, buffaloberry, willow, aspen, and birch), insects, and agricultural crops. Nesting habitat has >60% vegetative cover, and nests/brood rearing sites are generally located where cover is approximately 10 inches high. High structural diversity and a high diversity of native herbaceous plants are also important for nesting, especially arrowleaf balsamroot and bluebunch wheatgrass. Preferred habitats tend to be areas that don't have heavy livestock grazing and also have shrubs and riparian areas nearby for escape cover (NatureServe 2005, Wisdom et al. 2000).

At the broad scale, the Columbian sharp-tailed grouse uses grasslands and open-canopy sagebrush as summer habitat within the Interior Columbia River Basin. Habitat for the Columbian sharp-tailed grouse has declined from 58.80% to 32.35% of the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute decline of 26.44% and a relative decline of 44.97% in available habitat. Within the Northern

Glaciated Mountains ERU 7, habitat for the Columbian sharp-tailed grouse has declined from 36.63% to 2.83%. This equates to an absolute decline of 33.80% and a relative decline of 92.27% (Wisdom et al. 2000).

Sharp-tailed grouse are not known to use the project area, although historic leks (communal courtship display sites) have been identified on private land. No potential habitat exists within the project area on National Forest System lands for sharp-tailed grouse. Some lower elevation, open areas are present on south facing slopes, but the topography is too steep for sharp-tailed grouse.

Environmental Consequences

Alternative A

There would be no impacts to sharp-tailed grouse or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Effects Common to All Action Alternatives

There would be no impacts on National Forest System lands to sharp-tailed grouse or their habitat. There are no sagebrush or grasslands in gentle topography along or near the proposed ore haul routes. Nor is there any suitable habitat near any of the other project components on National Forest System lands under any alternative such as the infiltration gallery or pipeline. Sharp-tailed grouse are not expected to be present within the project area on National Forest System lands due to lack of habitat.

Cumulative Effects

The area analyzed for cumulative effects includes the Buckhorn Block of NFS lands as well as surrounding ownerships. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous grazing.

Rock and gravel to be used to gravel the construction supply route would come from private lands at the base of the Pontiac Ridge Road. This private land is within 2 miles of documented sharp-tailed grouse occurrences, and the surrounding area may provide potential habitat for sharp-tailed grouse. The activity on this private land would create some disturbance that may impact sharp-tailed grouse if they are nearby. This would displace the grouse onto other habitat.

This project would only have small incremental cumulative effects, and those effects would be done on private lands used as a borrow site for road gravel during construction activities at the mine. Sharp-tailed grouse have been documented within a couple miles of that borrow site. The rest of the activities on NFS lands would not likely impact sharp-tailed grouse due to an absence of suitable habitat. The largest impacts likely came from residential development, agriculture, and grazing on private lands.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Impact.

Effects Determination Alt B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Townsend's Big-Eared Bat

Affected Environment

Townsend's big-eared bats are cavern bats that use habitat from low to mid-elevation (Nagorsen and Brigham, 1993). Townsend's forage on small moths as their primary prey but they also eat other aerial insects. Townsend's big-eared bat roost sites have been found in Okanogan County in caves, mines and old buildings (Nagorsen and Brigham, 1993), although they may also use bridges and water diversion tunnels (Pierson et al. 1999). Townsend's big-eared bat habitat includes subalpine, montane, riparian, and upland woodland areas. They will use most forest types, including aspen, except for stem-exclusion and stand-initiation stages. They will also use upland shrublands and herblands, as well as riparian shrublands. They may be found feeding in shrub-steppe and open ponderosa pine areas (Wisdom et al. 2000).

At the broad scale, the Townsend's big-eared bat uses forests, woodlands, and sagebrush as habitat within the Interior Columbia River Basin. Habitat for the Townsend's big-eared bat has declined from 55.71% to 51.21% of the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute decline of 4.50% and a relative decline of 8.08% in available habitat. Within the Northern Glaciated Mountains ERU 7, habitat for the Townsend's big-eared bat has increased from 32.37% to 38.73%. This equates to an absolute increase of 6.35% and a relative increase of 19.62% (Wisdom et al. 2000).

No Townsend's big-eared bats are known to occupy the project area, although old mine and buildings adits are present on private, Forest Service, and BLM lands. Bat surveys were conducted for sites that would have been potentially impacted by the Crown Jewel Mine, although Townsend's big-eared bats were not detected during those surveys (Crown Jewel FEIS 1997). It is still possible that they exist in the area and remain undetected. They have been detected in the Myers Creek valley near this project area (Crown Jewel Mine FEIS 1997).

Environmental Consequences

Alternative A

There would be no impacts to the Townsend's big-eared bat or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

The Townsend's big-eared bat may be impacted. Although none have been documented within the project area, some potentially suitable roosting habitat is available in the form of old mine adits and old buildings. This species of bats, like many other bats, forages around water sources and within riparian areas because these areas support higher concentrations of insects. About 4.0 miles of this route is within Riparian Habitat Conservation Areas. The ore haul route proposed travels along Marias Creek (Forest Road 3550). It is unlikely that

ore haul would disturb foraging bats because ore haul would be conducted primarily during daylight hours. Bats are unlikely to be roosting on National Forest System lands because the potentially suitable mine adits and old buildings are located away from the ore haul route. Mine related traffic, other than ore haul, may disturb foraging bats within riparian areas if it occurs after sunset. Employee traffic would occur primarily from 5:00 – 9:00 a.m. and 5:00 – 9:00 p.m. and would represent a substantial volume of traffic (approximately 169 one-way trips per day on the Marias route).

The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance. Bats may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of foraging habitat due to the construction of the project components.

Alternative B1

The effects of this alternative would be similar to Alternative B for most components, particularly concerning disturbance and habitat loss to bats. The primary difference would be the reduced speed limit, which would reduce the potential for road kill.

Alternative C

The effects of this alternative would be similar to those of Alternative B for some components. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. This alternative travels along Nicholson Creek, and as stated for Alternative B, riparian areas provide large concentrations of insects. About 2.6 miles of this route is within Riparian Habitat Conservation Areas. Mine related traffic (non-ore haul) after sunset could potentially disturb foraging bats within the riparian areas or near the Frog Pond. The Frog Pond is a small pond near the junction of Forest Roads 3575-120 and 3575-100 that provides suitable foraging habitat for bats. The ore haul route includes Forest Road 3575-120. Forest Road 3575-120 passes near the lower Roosevelt adit where bats have been detected, although no Townsend's big eared bats have been found there. Use of this route would potentially cause disturbance to any bats utilizing that, and other, adits. Employee traffic would occur primarily from 5:00 – 9:00 a.m. and 5:00 – 9:00 p.m. and would represent a substantial volume of traffic (approximately 169 one-way trips per day on the Nicholson route).

The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance. Bats may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of foraging habitat due to the construction of the project components.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance. No RHCAs are affected by this haul route. Bats may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat due to the construction of the project components. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The overall direct and indirect effects of this alternative would be less than the other action alternatives.

Effects Common to All Action Alternatives

The infiltration gallery pipeline/access road and project boundary fence pass near some old adits and therefore the installation and use of these sites would potentially disturb bats.

The new section of road for the ore haul route across National Forest System lands from the 3575-120 road to the mine site is part of all alternatives. This is the section of road nearest old mine adits and buildings that may provide roosting habitat for bats. Although this section of new road construction is not along a riparian area, the proximity to potential roosting habitat makes disturbance a possibility, although it is likely to be only a low probability of this being a direct effect. This section of road is near the Roosevelt Adits, as is the access road for the conveyance pipeline, and the boundary fence. The construction and continued use of these facilities would potentially disturb any bats utilizing the Roosevelt Adits and other adits.

Indirect toxic impacts to individual bats could occur in the unlikely event of an accidental transport spill of chemicals (such as diesel fuel) into creeks along the haul route. With any potential spill, the likelihood of a bat drinking contaminated water is very low since a spill would be a short-term accidental event. In addition, the extent of human activity associated with emergency containment and cleanup activities would be avoided by bats. Bat prey (insects) would be more likely to be killed by a spill. This might cause bats to forage elsewhere in the short-term.

Cumulative Effects

The area analyzed for cumulative effects includes the Buckhorn Block of National Forest system (NFS) lands as well as the surrounding other ownerships. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous mining.

Previous mining on Buckhorn Mountain created adits and old buildings that can provide habitat for bats. The current mine proposal would mostly backfill the Buckhorn Mine after it is completed, so that mine would not provide future habitat for bats. Disturbance associated with mining activities may cause bats to avoid using the existing adits and old buildings near the activities. This project would cause some potential disturbance to bats, although only the Roosevelt Adits and others may be disturbed by mine related traffic. Adits located on patented land would also be disturbed by mining activities. The old mine buildings located at the proposed mine site may provide habitat for bats at some point in the year. The increased activity associated with the mine would potentially disturb any bats using these buildings. Otherwise, this project would not create or remove potential roosting habitat for cavern bats. Townsend's big-eared bats have not been detected in any of these adits, so there is only a low probability of this species being disturbed.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Impact

Effects Determination Alt B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Management Indicator Species

American Marten (Identified as "Pine" Marten in the Forest Plan)

Affected Environment

American Marten need large diameter snags and downed woody material to provide habitat for prey species. Martens rarely use landscapes with >25% of the area in clearcuts and natural openings (Wisdom et al. 2000). Structurally diverse, mature to overmature, mesic coniferous forests are the preferred habitat of martens (Ruggiero et al. 1994). Snags and coarse wood are important for providing prey habitat as well as resting sites for martens (Witmer et al. 1998). Their diet consists primarily of voles, although they also will eat tree squirrels, ground squirrels, snowshoe hare, shrews, mice, gophers, fish, ungulates (carrion), insects, bird eggs, nestlings, and fruit, depending on seasonal availability. Structural diversity provided by downed wood, low-hanging live branches, and shrubs is important for providing resting sites and access to subnivean (under the snow) prey in the winter (Ruggiero et al. 1994, Witmer et al. 1998).

Martens prefer larger, mature, coniferous forested stands and will generally avoid openings (Chapin et al. 1998, Hargis et al. 1999, Poole et al. 2004, Snyder 1984), so fragmentation can degrade habitat quality for martens.

Martens are Forest Plan indicator species for old growth habitat.

At the broad scale, the American marten uses broad-elevation old forests as habitat within the Interior Columbia River Basin. Habitat for the American marten has decline from 18.82% to 11.54% of the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute decline of 7.28% and a relative decline of 38.67%. Within the Northern Glaciated Mountains ERU 7, habitat for the American Marten has declined from 28.00% to 3.34%. This equates to an absolute decline of 24.66% and a relative decline of 88.06% (Wisdom et al. 2000).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. The group of greatest concern includes martens which have habitat that exists as isolated patches with limited opportunity for population interactions. This group may see local populations extirpated due to the loss of functional blocks of habitat of sufficient size. This group has the most restrictive habitat requirements, either in terms of stand structure and condition or stand size, or both. Conservation measures that have been developed that address the habitat needs of martens include the Okanogan Land and Resource Management Plan (old growth retention requirements, MR cells, snag/downed log guidelines) and the Eastside Screens (LSOG and snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

Martens were historically present in the Okanogan Highlands, and they are potentially still present within or near the project area (Crown Jewel Mine FEIS 1997). Habitat for martens is naturally fragmented in this part of the Okanogan Highlands with blocks of forested areas separated by open lowlands (Halekas and Kallstrom 2003, unpublished report).

Habitat consisting of areas with low road densities exists within the Buckhorn Block of the Tonasket Ranger District. The 10,800 acre Jackson Creek Inventoried Roadless Area (IRA) lies at the very northeast corner of the analysis area. Additionally two unroaded/ undeveloped areas are located north and south of the Marias Creek Road. The Coogan area is 2,745 acres, and the Marias-Nicholson Ridge area is 3,465 acres. These are areas that are unfragmented by roads and harvest, and would provide important refugia for martens.

Environmental Consequences

Alternative A

There would be no impacts to martens or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance. Conditions in the Buckhorn Block of the Tonasket District would likely remain similar to what they are currently, and human presence within the area is relatively low for most of the year.

Alternative B

Similar to the effects for other carnivores, Alternative B could potentially disturb any martens that may be dispersing through the area, or utilize the project area as part of their territory. Under this alternative, traffic along the roads constituting the ore haul route would substantially increase year-round. There are several past timber harvest units and a few natural openings near the ore haul route that may limit the suitability of the adjacent forested stands as marten habitat.

Ore haul would substantially increase traffic along Forest Road 3550. Employees would primarily use the ore haul route, although they may additionally use other roads to access the mine during the snow-free months and possibly Forest Road 3575-120 during winter months. Although this does not create a complete barrier to movement across the ore haul route, it does substantially increase the probability of disturbance for any wildlife near the road and creates a semi-permeable barrier to movement for many wildlife species. Dispersing or resident martens would likely travel along natural corridors such as riparian areas, and Forest Road 3550 proposed as an ore haul route in this alternative, follows Marias Creek for much of its length. About 4.0 miles of this route are within the RHCA. Martens traveling along this riparian corridor would likely be disturbed by the substantial increase in traffic. This disturbance would hinder their ability to cross the road or travel along the riparian area adjacent to the road. This would degrade the quality of the habitat near the haul route and cause martens to use habitats further away from the disturbance. Using models recommended by Gaines et al.,14 acres of late successional forest non-winter habitat, 9 acres of late successional forest nonwinter security habitat, and 19 acres of late successional forest winter security habitat for this species would be impacted under this alternative.

The ore haul route would have a greater impact on small mammals and birds near the roadway, and these are important prey items for martens. The mine related traffic would likely result in increased mortality to small mammals (mice, voles, etc.) and birds, and there would consequently be fewer of these prey items available near the ore haul route compared to current conditions. Disturbance for these prey species would also increase due to the mine related traffic. Although populations of these small mammals would not likely be limited by the potential road kill, movement across the roadway would be restricted. Additionally,

microsite conditions along the roadway would be altered and could potentially reduce the suitability of the habitat near the roadways. The silt fences and other erosion control structures may impede movement of small mammals as well.

Martens need snags to provide habitat for prey species and to provide resting habitat. Snags along the currently existing roads within the project area are generally absent due to firewood cutters, so the reconstruction of these sections of roadway is unlikely to impact many snags. The new construction would be closed to the public during the life of the mine, so these snags would not be lost to woodcutting during the life of the project, although the road would be opened at the end of mining and snags would likely be lost at that time. Snags would be created within riparian areas as mitigation to compensate for the removal of snags during construction of the ore haul route. This would be done in areas other than along the ore haul route, thereby enhancing the value of these created snags as mitigation because they would not be impacted by the disturbance from the ore haul route. Overall, the area affected by the construction of the components described under this alternative would result in a very small loss of snags when considered at the broader scale of the Buckhorn Block of National Forest System lands or the larger watershed scale. This project would consequently have only minor impacts to snag habitat, and these would be mitigated by the creation of new snags.

Alternative B would pass near the Coogan and the Marias-Nicholson Ridge unroaded areas (see the Inventoried Roadless and Unroaded Areas section of this EIS), and consequently the disturbance from the increased traffic on the haul route may decrease the suitability of these areas as habitat for wide-ranging carnivores. This may cause animals to avoid using those areas closest to the haul route. Additionally, the traffic on the haul route would limit movement of animals between these areas.

It is possible that mine employees would choose to recreate within the Buckhorn Block of NFS lands as they become more familiar with the area. This increased recreation pressure would be balanced by the likely reduction in recreationists who have traditionally used the area but would be displaced due to the substantial increase in traffic. There may be a slight increase in recreation pressure overall, and this would add to the disturbance, and potential persecution, of carnivores.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance, as well as some direct loss of habitat where facilities and roads are constructed. Martens may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat for martens and their prey due to the construction of the project components.

Alternative B1

The effects of this alternative would be similar to Alternative B for most components, particularly concerning disturbance and habitat loss to martens and their prey. The primary difference would be the reduced speed limit, which would reduce the potential for road kill and the road closures in Bear Trap Canyon. Using models recommended by Gaines et al., 21 acres of late successional forest non-winter habitat, 99 acres of late successional forest nonwinter security habitat, and 16 acres of late successional forest winter security habitat for this species would not be impacted that is currently being impacted by open roads under this alternative.

Alternative C

The effects of this alternative would be similar to those of Alternative B for some components. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. This alternative travels along Nicholson Creek, and as stated for Alternative B, martens are more likely to travel along natural corridors like riparian areas. About 2.6 miles of the route is within RHCAs. If they are present, then disturbance would increase within these areas due to the substantial increase in traffic. Disturbance would cause avoidance of nearby habitats and martens to utilize areas further away from the disturbance. Using models recommended by Gaines et al., 10 acres of late successional forest non-winter habitat, 3 acres of late successional forest nonwinter security habitat, and 12 acres of late successional forest winter security habitat for this species would be impacted under this alternative.

The increased disturbance associated with traffic on the haul route would reduce the suitability of the habitat along the western edge of the Jackson Creek IRA. This may cause wide-ranging carnivores to avoid use of that section of the IRA. Additionally, the same would be true of the northernmost section of the Marias-Nicholson Ridge unroaded area. The substantial increase in traffic along the haul route would limit animal movement between these two areas.

The likelihood of disturbance to dispersing martens would be similar to Alternatives B and B1 although the size of the area affected by the ore haul route under this alternative would be larger than under the other action alternatives, and increasing the disturbance effects Monday through Friday.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance, as well as some direct loss of habitat where facilities and roads are constructed. Martens may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat for martens and their prey due to the construction of the project components.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C, and no RHCAs would be affected. This haul route does not pass near an Inventoried Roadless Area or an unroaded area, so this alternative would have less impacts on this reclusive species using those areas compared to the other action alternatives. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance, as well as some direct loss of habitat where facilities and roads are constructed. Martens may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. Using models recommended by Gaines et al., 10 acres of late successional forest non-winter habitat, 3 acres of late successional forest nonwinter security habitat, and 12 acres of late successional forest winter security habitat for this species would be impacted under this alternative. There would be a loss of habitat for martens and their prey due to the construction of the project components. The direct and indirect effects of this alternative

would be less than the other action alternatives.

Effects Common to All Action Alternatives

The infiltration gallery and pipeline are located in and near an area of true firs and higher elevations that may provide suitable habitat within the project area for martens. However, there are several man-made openings in this area and this reduces the suitability of the habitat for martens. If they are present in this area, martens would be disturbed by the construction and continued activities around the infiltration gallery and pipeline. Additionally, the footprint of these facilities would result in a small reduction in forest cover around these sites. Between 26 and 65 total acres of forested habitat would be lost due to project construction depending on the alternative, although not all of this would be suitable for martens.

Cumulative Effects

The two HUC5s that this project overlaps were used for cumulative effects analysis. Martens are unlikely to be within these HUC5s, although they may occasionally pass through as they move between suitable habitats. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous road building and timber harvest.

The Okanogan Highlands are naturally fragmented and do not provide ideal marten habitat. Previous timber harvest within the Buckhorn Block of NFS lands has additionally broken up the contiguous blocks of forest. Road building additionally fragmented habitat and increased the potential for disturbance to martens.

Although this project won't change road densities drastically, it would substantially increase traffic volume during the life of the mine. This would contribute a large amount of potential disturbance to martens that may be traveling through the Buckhorn Block of NFS lands. This disturbance would be focused around the ore haul route, although the routes in Alternatives B, B1, and C stretch across the Buckhorn Block from east to west. This disturbance would potentially discourage marten movement across the ore haul route.

The increased probability of mortality due to traffic would be relatively low for this project due to the low relative speeds. The closure of the roads in the Bear Trap Canyon area under Alternative B1 would improve conditions for martens because it would reduce traffic and human use within that area.

Although this project would add incrementally to the cumulative effects on martens, the overall effect is likely to be relatively low due to the unlikely presence of martens.

Based on the above analysis, the effects would not be significant.

Effects Determination Alt A: No Impact.

Effects Determination Alt B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Barred Owl

Affected Environment

Barred owls inhabit mature forests (www.owling.com 2005), although they are not dependent on those stands (BISON information database 2004). Earlier successional stages will be used if enough large trees and snags are scattered in the stand. Stands with canopies greater than 60% are preferred. Suitable nesting habitat has approximately 2 snags per acre >20 inches dbh (NatureServe 2005). They will forage in openings near these mature stands of timber and can be found in a broad elevational range. They roost during the day in densely foliaged trees. Winter roosts are typically in conifers. Cavities in trees and snags are used for nesting (Mazur et al. date unknown, Postupalsky et al. date unknown), although barred owls will also use abandoned hawk nests. Barred owls forage on small mammals or birds up to the size of grouse. They also may forage opportunistically on invertebrates, arthropods, amphibians, reptiles, and fish (www.owling.com 2005).

The wide-scale trend for barred owl habitat is not described in Wisdom et al. 2000, although the conservation status for barred owls is listed as "secure" in the state of Washington (NatureServe 2005).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. The barred owl is in a group whose habitat is broadly distributed, but some gaps exist. There are disjunct patches that generally allow these species to interact as a metapopulation. This group has more general habitat requirements, but may need some stand elements, such as snags, which limit their ability to use particular areas. Conservation measures have been developed that address habitat needed by this species include the Okanogan Land and Resource Management Plan (old growth requirements, snag/downed log guidelines) and the Eastside Screens (riparian conservation areas, LSOG guidelines, and snag/downed log guidelines). The alternatives for this project would meet the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As discussed in Chapter II of this document, the Eastside Screens do not apply to this project.

Barred owls are expected to occur in the project area, and they have been documented approximately one mile from the Nicholson Creek road.

Environmental Consequences

Alternative A

There would be no impacts to barred owls or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

Barred owls potentially could be nesting near the ore haul route down Marias Creek, and if present could be disturbed by the dramatic increase in traffic along this road. Additionally, foraging owls may be disturbed, or struck by mine related traffic. This is less likely because

these owls are primarily active at dusk, dark, and dawn. Most of the ore haul would be conducted during daylight hours, although some ore haul conducted in the morning after 6:00 a.m. and during winter during and after dusk may impact foraging owls. Employee traffic would primarily occur in two windows: 5:00 – 9:00 a.m. and 5:00 – 9:00 p.m.

The ore haul route would have a greater impact on small mammals near the roadway, and these are important prey items for barred owls. The mine related traffic would likely result in increased mortality to small mammals (mice, voles, etc.), and there would consequently be fewer of these prey items available near the ore haul route compared to current conditions. Although populations of these small mammals would not likely be limited by the potential road kill, movement across the roadway would be restricted. Additionally, microsite conditions along the roadway would be altered and could potentially reduce the suitability of the habitat near the roadways. The silt fences and other erosion control structures may impede movement of small mammals as well.

As discussed in the fisher and marten sections, snags are generally absent along the existing roadways due to past firewood cutting. The new road construction would be closed to the public during the life of the mine and the snags near those roads would not likely be lost to firewood cutters, although after mine closure, when the new road is opened to the public it's likely snags along that section of road would be lost. Snags would be created within the riparian areas as mitigation for lost snags during the construction/reconstruction of the roads, although the number of snags lost would likely be very small when considered on a broader scale such as the entire Buckhorn Block of National Forest System lands or the entire watersheds. The number of snags created as mitigation would be 3.5 times the acres disturbed. These snags would not be created along the ore haul route. They would be created away from the ore haul route in order to avoid disturbance effects associated with the ore haul traffic. This would enhance their value as mitigation.

The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance and direct loss of up to 57 acres of forested habitat, not all of which is potential barred owl habitat. Barred owls may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat for barred owls and their prey due to the construction of the project components.

Alternative B1

The effects would be similar to Alternative B for most components, particularly concerning disturbance and habitat loss to barred owls and their prey. The primary difference would be the reduced speed limit which would reduce the potential for road kill.

Alternative C

The effects would be similar to those of Alternative B for some components. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. Suitable nesting habitat is located near the ore haul route, and several barred owls have been documented within approximately 1 mile of the ore haul route. Consequently, it is possible that nesting barred owls may be disturbed by mine related traffic along the Nicholson Creek ore haul route, if owls are present.

The overall effect would be a reduction in functional habitat along the roadway due to

increased disturbance and direct loss of up to 65 acres of forested habitat, not all of which is potential barred owl habitat. Barred owls may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat for barred owls and their prey due to the construction of the project components.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance and direct loss of up to 26 acres of forested habitat, not all of which is potential barred owl habitat. Barred owls may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat for barred owls and their prey due to the construction of the project components. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The overall direct and indirect effects would be less than the other action alternatives.

Effects Common to All Action Alternatives

The new road construction from the 3575-120 to the mine site is common to all alternatives and would impact potentially suitable nesting habitat. The other associated activities such as the infiltration gallery, pipeline, fences, range mitigation, and road to the water storage site would have some impacts to barred owls. The footprint of these components would impact potential nesting and foraging habitat. However, much of the roadway for the conveyance pipeline would be along an old, previously obliterated roadbed where no nesting habitat is present within the roadbed. If barred owls are present near these sites, the activities associated with the construction and continued operation of these facilities would potentially disturb them. This may cause them to avoid habitat near the disturbances.

Roads also create new microclimates on and adjacent to the road (Spellerberg 1998), and this may affect the suitability of the sites immediately adjacent to the road for habitat for small prey species. Forest roads can also reduce soil macroinvertebrate abundance and species richness near roadways (Haskell 1999), and these provide prey for amphibians and some ground foraging birds, which in turn provide prey for other species.

Cumulative Effects

The area considered for cumulative effects included the entire Buckhorn Block of NFS lands as well as adjacent land ownerships. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous timber harvest and road building.

Past timber harvest likely reduced suitable barred owl habitat, although past fire suppression likely led to reduced fire return intervals and therefore reduced the occurrence of open, drier stands of timber. This project would not reduce habitat substantially, although disturbance near the ore haul routes would increase substantially. Although the footprint of the activities would not cover a large area, the disturbance would extend outward from the road. Recreation and the activities at the mine site would be the most likely to contribute to noise disturbance for owls, excluding this project.

Although the incremental impact of this project would be focused near the ore haul route, the substantial increase in traffic volume would make that impact intense within that area of disturbance. This may cause owls to shift habitat use to areas with less disturbance within the Buckhorn Block of NFS lands.

The mining activity on private lands would increase disturbance during the life of the Buckhorn Mine, and this disturbance would be spread throughout the day and night due to the 24 hour operational schedule, and the increased disturbance from haul and employee traffic before dawn and after dusk, when added to the noise and disturbance from the mine site may cause owls to move further away from the mine.

Based on the above analysis, the effects would not be significant.

Effects Determination Alternative A: No Impact.

Effects Determination Alternatives B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Mule Deer

Affected Environment

Mule deer forage on a variety of shrubs and grasses, and have been known to eat mushrooms as well (NatureServe 2005). Deer habitat consists not only of forage, but also important cover components for hiding and thermal cover. The arrangement of these habitats on the landscape is important in determining habitat suitability (Thomas 1979).

The Okanogan Forest Plan (USDA 1989) directs deer management on the Okanogan National Forest. Most of the emphasis for mule deer in the Forest Plan was on winter range and approximately 48 percent of the entire Buckhorn Block of National Forest System lands is in management allocations emphasizing deer winter range. The direction was primarily to maintain various levels of conifer cover in the allocations. On all other land allocations, primarily summer range for deer, minimum amounts of hiding and thermal cover were to be retained. Two important components of deer winter range is “snow-intercept/thermal cover” and winter thermal cover.

The wide-scale trend for mule deer habitat is not described in Wisdom et al. 2000, although the conservation status for mule deer is listed as “secure” in the state of Washington (NatureServe 2005).

Mule deer viability questions were not answered in the Interior Columbia Basin work, but Gaines (no date) cites work that suggests a reduction in habitat capability. The affect on habitat comes from the increased use of the forest by humans. Conservation measures have been developed that address habitat needed by this species include the Okanogan Land and Resource Management Plan (winter range standards and guidelines). See the direct/indirect effects analysis for mule deer for a discussion on road closures as mitigation and deer cover.

Table III-56 displays the current road densities in the discrete Management Areas affected by this project.

Table III-56: Discrete Management Areas Affected by the Buckhorn Access Project, as Well as the Current Road Densities in Each MA.

Management Area	Square Miles	Miles of Open Road	Current Road Density	Forest Plan Road Density
14-17	2.7	2.8	1.0	2.0
14-18	0.9	3.5	3.8	2.0
14-19	0.3	0.5	1.7	2.0
25-18	24.0	44.2	1.8	3.0
26-15	2.3	2.8	1.2	1.0
26-16	5.5	7.5	1.4	1.0

Mule deer winter habitat disturbance index: The index recommended by Gaines et al. (2003) was used to estimate the area affected by travel routes within deer winter range. Plowed roads, snowmobile trails, and other routes open to the public within deer winter range MAs within the Buckhorn Block of NFS lands were used in these calculations. Roughly 1,238 out of 13,199 acres (9%) of deer winter range within the Buckhorn Block are currently impacted by roads. This equates to a rating of "low level of human influence on deer winter range" within the Buckhorn Block.

Deer Summer Habitat Disturbance Index: The index recommended by Gaines et al. (2003) was used to estimate the area affected by travel routes within deer summer range. All road and motorized trails open to the public were included in the analysis. These calculations include varying buffers depending on the level of use. A low traffic road with >0 to 1 vehicle per 12 hours has a buffer of 900 meters. A moderate traffic road with >2 to <4 vehicles per 12 hours has a buffer of 1000 meters. A high traffic road with >4 vehicles per 12 hours has a buffer of 1300 meters. It is unknown how many vehicles pass over every open road within the Myers and Toroda Creek watersheds on a daily basis in summer. Even with an estimate of moderate traffic along most roads the area affected by road within these watersheds would be around 90%. Even with every road rated as low (an unrealistic assumption), the affected area would still be over 75% of the two watersheds. Regardless of the ratings, the area affected would be far above the >50% threshold for a "high level of human influence" due to the quantity of roads, thereby putting the existing condition in the "high level" rating for these two watersheds. Due to the difficulties in estimating traffic volumes on every road within both watersheds, estimates for each action alternative were not calculated. The ore haul route would far exceed the traffic volume rating of "high."

Environmental Consequences

Alternative A

There would be no impacts to mule deer or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

Most of the ore haul route for Alternative B passes through, or just north of the boundary of two Forest Plan deer winter range Management Areas, MAs 14-18 and 26-16 (USFS 1989). The remainder primarily passes through MA 25-18, which is managed for deer summer range, although this area also has a 2-acre parcel of deer winter range (see Effects Common to All Action Alternatives below). All Management Areas along the ore haul route additionally

are managed for deer summer range.

There would be approximately 5.4 miles of reconstruction or new road construction within or adjacent to deer winter range. There are approximately 6.7 total miles of reconstruction and new construction on National Forest System lands or rights-of-way. The substantial increase in year-round traffic along the ore haul route would disturb wintering mule deer, and disturbance in winter can be critical for ungulates. Deer are likely to begin avoiding the area near the ore haul route within 1300 meters, and the large increase in traffic is likely to act as a semi-permeable barrier to deer movement during the day. Direct mortality due to ore truck/deer collisions is likely to be infrequent due to the relatively low speeds of trucks (30 mph), although the risk would be higher than with Alternatives B1, C and D that have a speed limit of 25 mph. Ore haul would be year-round and would mainly occur Monday-Friday with possible reduced haul on Saturday and Sunday. During the winter, run-outs would be maintained on the plowed ore haul route to provide wildlife with escape avenues off of the roadway.

Ore and supply haul would occur primarily between 6:00 a.m. and 6:00 p.m., and this timeframe would occupy all of the daylight hours during the winter. This would restrict the opportunity for deer, and other wildlife, to travel across the roadway without ore haul related disturbance during dawn, dusk, and daylight hours. Additionally, employees may be traveling outside of this timeframe, further increasing the daily timeframe of disturbance to deer. Employee traffic would primarily occur in two windows: 5:00 – 9:00 a.m. and 5:00 – 9:00 p.m.

Fawning cover typically exists within riparian areas, so it is likely that the suitability of the habitat for fawning along Marias Creek would be degraded due to the substantial increase in traffic and deer are likely to avoid use of riparian areas adjacent to project roads for fawning. About 4.0 miles of this route are through RHCAs. Although the speed is relatively low, fawns would be more likely to be injured or killed by traffic than adults.

Ungulates are known to display avoidance behavior to roads and traffic, and roads can act as barriers to movement (Dyer et al. 2002). Ungulates can respond negatively to a variety of human disturbances (Rowland et al. 2004, Wisdom et al. 2004a), but the exact response to roads and traffic is difficult to predict because it depends on many factors, including the response of other wildlife and the habitat selection of other species (Wisdom et al. 2004b). Human disturbance and motorized access can impact ungulates through increased movements away from the disturbance, energy expenditure, and reduced foraging opportunities (Johnson et al. 2004).

The plowing of the ore and supply haul route, which is on a road that is normally snow-covered in winter, could potentially increase access by hunters. This increased ease of access would increase the vulnerability of deer in this area, and it may also increase deer avoidance of the road.

The new construction on National Forest System lands near Forest Road 3550-125 would have limited impact on deer habitat. Most of this area has been harvested previously. The new construction from the Forest Road 3575-120 to the patented lands would remove a few acres of summer thermal and hiding cover, as well as the road reconstruction/widening along the rest of the proposed route.

The total acres of ground alteration for all Alternative B components are only 57 acres.

When examined by discrete management area, the maximum possible percent change for deer cover is very small (approximately 0.1-0.5%). Due to rounding of calculations, less than 100% mapping accuracies, and other sources of variability, the percent change in any deer cover category (snow-intercept thermal, winter thermal, summer thermal, and hiding) for any of the discrete management areas would be so small as to be unreliable and of very little analytical utility. Therefore, a full deer cover analysis is not warranted, nor would it be of any use because the percent change would be nearly undetectable. Noise and human presence disturbance effects extend beyond the actual footprint of the roadway, and the area affected by disturbance was calculated for each alternative based on the models recommended in Gaines et al. (2003).

The increased traffic related to mine employees traveling to and from the mine would have similar effects as ore and supply haul. Traffic due to employees would substantially increase over currently low traffic conditions. Employees could also use any route available to them, although during the winter only the ore haul route and potentially the Cow Camp road would be plowed. Employee traffic would have similar effects on deer disturbance and vehicle/deer accidents as the ore haul traffic.

Open road densities by management area for Alternative B are displayed below.

Table III-57: Alternative B During Project Open Road Density

Management Area	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	3.8	4.2	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	45.3	1.9	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	7.5	1.4	1.0

Forest Plan amendment would be needed to increase road density in MA14-18 and allow for the Marias route to be designated as an open route through deer winter range.

The ore haul route would impact livestock use, and several mitigation measures were proposed to reduce the risk of collisions with livestock yet still provide effective livestock management. Fences along the Marias Creek ore and supply haul route would keep cows off the road, but this would limit their access to water. New water developments would be used to limit the impacts of livestock on riparian areas and promote distribution of livestock across the allotment. Maintaining good livestock distribution would reduce the potential for utilization problems on shrubs and deer browse. The installation of the livestock fences, cattle guards, and water developments would cause some disturbance to deer, although the impacts of those features on deer habitat would be minimal. The changes in livestock use patterns are not expected to have large impacts on deer habitat. The fences would be as wildlife permeable as possible to allow deer movement while still restricting cattle movement. The fences would pose a small obstacle for deer, but overall would not alter their habitat use.

Mule Deer Winter Habitat Disturbance Index: The index recommended by Gaines et al. (2003) was used to estimate the area affected by travel routes within deer winter range. Plowed roads, snowmobile trails, and other routes open to the public within deer winter range MAs within the Buckhorn Block of NFS lands were used in these calculations. Roughly 4,108 acres out of 13,199 acres (31%) of deer winter range within the Buckhorn Block would be impacted by roads. This is only an estimate, however it places the impacts near the

threshold of the “low” and “moderate” categories. To be conservative, a rating of “moderate level of human influence on deer winter range” was used for Alternative B. Roughly 2870 more acres would be impacted then under current conditions. The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the model.

Overall, the effects should not result in a large reduction of the deer herd. Deer would primarily avoid the area and use other areas, although some may be injured or killed in vehicle accidents. The primary effect would be an avoidance of habitat near the ore haul route due to the increased disturbance. There would also be a restriction in movement of deer across the roadway due to the disturbance and this would alter deer distribution and habitat utilization. 57 acres of habitat would be lost due to the construction of the project components.

Alternative B1

Roads would be closed in MAs 14-18, 25-18, and 26-16 to mitigate for the substantial increase in traffic along the ore and supply haul route. The closure of these roads would lower the road density in MA 14-18 to below the Forest Plan standards/guidelines. MA 25-18 currently meets the Forest Plan standards/guidelines. MA 26-16 would still not meet the Forest Plan, although the road closures would lower the road density to 1.1 miles per square mile from the current density of 1.4 miles per square mile, moving the management area towards the desired future condition. The roads that would be closed year-round would be Forest Road 3550-122 near where it crosses Marias Creek, and Forest Road 3550 road near the spur to the left after the intersection with Forest Road 3550-125. Both closures would be accomplished with a gate that would allow administrative use and both closures would tie into the new range fence. The closure of these roads in Bear Trap Canyon would improve habitat conditions for many species, primarily due to the reduced disturbance associated with vehicles. This would partially off-set the substantial increase in traffic along the ore haul route. The reduction in traffic volume on these roads would be substantially less than the increase in volume along the ore haul route. However, the closure of these roads would provide more habitat that has reduced disturbance and therefore provide another area for wildlife displaced by the substantial increase in traffic along the ore haul route to utilize.

Displayed below are the open road densities by MA for Alternative B1. Included in this alternative are the road closures in the Bear Trap Canyon area as mitigation for the ore haul route.

Table III-58: Alternative B1 During Project Open Road Density

Management Area	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	1.6	1.5	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	43.9	1.8	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	6.0	1.1	1.0

No amendments for road density would be needed although Forest Road 3550 would be

designated as an open route through deer winter range, amending the Forest Plan.

The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

Mule Deer Winter Habitat Disturbance Index: The index recommended by Gaines et al. (2003) was used to estimate the area affected by travel routes within deer winter range. Plowed roads, snowmobile trails, and other routes open to the public within deer winter range MAs within the Buckhorn Block of NFS lands were used in these calculations. Roughly 3,098 acres out of 13,199 acres (23%) of deer winter range within the Buckhorn Block would be impacted by roads under Alternative B1. This equates to a rating of "low level of human influence on deer winter range." Roughly 1,860 more acres would be impacted under this alternative then under current conditions. The estimates were based on "open" travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the model. These estimates also include the road closures in Bear Trap Canyon, which partially mitigate the construction and plowing of the ore haul route compared to Alternative B.

Overall, the effects should not result in a large reduction of the deer herd. Deer would primarily avoid the area and use other areas, although some may be injured or killed in vehicle accidents. The primary effect would be an avoidance of habitat near the ore haul route due to the increased disturbance. There would also be a restriction in movement of deer across the roadway due to the disturbance and this would alter deer distribution and habitat utilization. 57 acres of habitat would be lost due to the construction of the project components.

Alternative C

The Nicholson Creek ore haul route has similar type effects to those listed above. However, only approximately 1.3 miles of the ore haul route passes through deer winter range, Forest Plan MA (MA 14-17), and only 2.6 miles are with the RHCA where fawning potentially occurs. This is much less than Alternatives B and B1. Therefore, the impacts to wintering deer would be less.

The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

The overall route length on NFS lands and rights-of-ways is greater under this alternative, so the disturbance effects to deer on summer range would be greater than under Alternatives B and B1. Consequently, deer would avoid a larger area. Summer range is not as limited as winter range, so deer would be better able to adapt their habitat use in response to the disturbance near the roadway. This ore haul route is 13.0 miles of reconstruction and construction across National Forest System lands and rights-of-ways. Alternatives B and B1 only have 6.7 miles of construction and reconstruction across National Forest System lands and rights-of-ways. The effect would be that deer would avoid a larger area due to the longer ore haul route.

Displayed below are the road densities by MA for Alternative C.

Table III-59: Alternative C During Project Open Road Density

Management Area	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	3.5	3.8	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	44.8	1.9	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	7.5	1.4	1.0

No Forest Plan amendments for road density or route designation are needed because Forest Road 3575 is already designated as an open route through deer winter range.

Mule Deer Winter Habitat Disturbance Index: The index recommended by Gaines et al. (2003) was used to estimate the area affected by travel routes within deer winter range. Plowed roads, snowmobile trails, and other routes open to the public within deer winter range MAs within the Buckhorn Block of NFS lands were used in these calculations. Roughly 2,357 acres out of 13,199 acres (18%) of deer winter range within the Buckhorn Block would be impacted by roads. This equates to a rating of "low level of human influence on deer winter range." Roughly 1,119 more acres would be impacted under this alternative then under current conditions. The estimates were based on "open" travel routes, and the substantial increase in the traffic volume along the ore and supply haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore and supply haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the model.

Overall, the effects should not result in a large reduction of the deer herd. Deer would primarily avoid the area and use other areas, although some may be injured or killed in vehicle accidents. The primary effect would be an avoidance of habitat near the ore and supply haul route due to the increased disturbance. There would also be a restriction in movement of deer across the roadway due to the disturbance and this would alter deer distribution and habitat utilization. 65 acres of habitat would be lost due to the construction of the project components.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. There would be 3.7 total miles of new road construction or reconstruction across National Forest System lands or rights-of-way. However, only about 0.6 miles of this would be across National Forest System lands, and the rest would be along the Forest Service rights-of-way across state and private lands. No RHCAs are affected by this alternative.

This ore haul route would not pass through any MAs designed for deer winter range. The new construction on National Forest System land would pass through MA 25-18, and therefore only deer summer thermal and hiding cover would be affected. Summer habitat for deer is more widespread and not as limited as winter range, so there would be more opportunities for deer to utilize habitat away from the disturbance associated with these activities. This route would not pass through any riparian areas on National Forest System lands, so the effects on fawning habitat would be less than under the other action alternatives.

Displayed below are the road densities by MA for Alternative D.

Table III-60: Alternative D During Project Open Road Density

Management Area	Square Miles	Road Miles	Road Density Miles per Sq. Mi.	Forest Plan Standard
MA 14-17	2.7	2.8	1.0	2.0
MA 14-18	0.9	3.5	3.8	2.0
MA 14-19	0.3	0.5	1.7	2.0
MA 25-18	24.0	44.8	1.9	3.0
MA 26-15	2.3	2.8	1.2	1.0
MA 26-16	5.5	7.5	1.4	1.0

No Forest Plan amendments for road density or route designation are needed.

The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

Mule Deer Winter Habitat Disturbance Index: The index recommended by Gaines et al. (2003) was used to estimate the area affected by travel routes within deer winter range. Plowed roads, snowmobile trails, and other routes open to the public within deer winter range MAs within the Buckhorn Block of NFS lands were used in these calculations. Roughly 1,788 acres out of 13,199 acres (14%) of deer winter range within the Buckhorn Block would be impacted by roads. This equates to a rating of “low level of human influence on deer winter range.” Roughly 550 more acres would be impacted under this alternative then under current conditions. The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore and supply haul route where the road currently exists was not part of the model. Therefore, the intensity of impacts along the ore and supply haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the model.

Overall, the effects should not result in a large reduction of the deer herd. Deer would primarily avoid the area and use other areas, although some may be injured or killed in vehicle accidents. The primary effect would be an avoidance of habitat near the ore haul route due to the increased disturbance. There would also be a restriction in movement of deer across the roadway due to the disturbance and this would alter deer distribution and habitat utilization. 26 acres of habitat would be lost due to the construction of the project components. The overall direct and indirect effects would be less than the other action alternatives.

Effects Common to All Action Alternatives

The infiltration gallery and infiltration pipeline would reduce a small amount of deer habitat (summer thermal and hiding cover). This ground disturbance would be less than 6 acres and would be nearly immeasurable as a percentage of discrete Management Area 25-18. The construction and use of these facilities would increase disturbance of deer present in these areas. The new road to be constructed along the infiltration pipeline would provide easier access for hunters. Although it would be closed to vehicle access, even closed roads can increase ungulate vulnerability to hunters. Closed roads are often used by hunters on foot and can still impact ungulate security (Hillis et al. 1991, Henckel 1991, Hurley and Sargent 1991, Moroz 1991, Mathewson 1991, Unsworth and Kuck 1991). Forest Road 3575-140, which is partially located in deer winter range which would be used as the access route to the

water storage facility would have decreased traffic since it is presently the only access road to the mine site. All development activities have used this road. Under all action alternatives, the main access road would be switched to the new road (which is not in deer winter range) to be constructed from Cow Camp to patented land. Therefore, there would be a slight decrease in disturbance to deer in deer winter range as a result of the decreased use of this road. During the first 3 – 4 months of ore haul route construction, this road would see increased use and therefore there would additional disturbance to deer during this period.

The fences constructed on National Forest System lands around the mine site, and the fences constructed to manage livestock and keep them off the Marias ore haul route (Alternatives B and B1) or out of Grass Lakes pond (Alternative C), would be designed to be as permeable to wildlife as possible. The fences should therefore pose only a small obstacle to deer and the likelihood of mortality by entanglement should be relatively low.

Additionally, the section of ore haul route across National Forest System lands from the 3575-120 road to the mine site would be new construction and it would be the same under all action alternatives. There would consequently be a loss of potential habitat within the footprint of this new road. Up to 5 acres of forested habitat would be lost to the footprint of the new road construction, although not all of it may be potential habitat.

The patenting of the mine site has fragmented the small MA 14-19. Bordering the west side of the patented lands is a 66 acre section of MA14-19. This would be added to the adjacent MA 26-15 which also is managed for deer winter range. In this manner those 66 acres that were previously managed for deer winter range would continue to be managed as such in the future. A small 2-acre section of MA 14-19 to the south of the patented lands, as well as another tiny sliver to the east of the patented lands, are now surrounded by the patented lands and MA 25-18. The 2 acre section and the other tiny sliver on the east would be added to MA 25-18. These sections are isolated from any nearby MAs that are managed for deer winter range, and they are small enough to have lost any value as stand alone sections of deer winter range. The addition of these small slivers of MA 14-19 to MA 25-18 would not substantially decrease the amount of deer winter range MAs available within the Buckhorn Block of NFS lands.

Cumulative Effects

The two HUC5s that this project overlaps were used for cumulative effects analysis. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous road building.

This project would cause a substantial increase in traffic and disturbance along the ore haul routes. Alternatives B and B1 travel through the largest amount of deer winter range, although Alternative C also travels through some. The risk of road kill due to this project is relatively low due to the low speed limits (25-30mph). The disturbance effects may not lead to a large decline in the deer population, but it would likely cause deer to alter their distribution and habitat use within the Buckhorn Block of NFS lands. The closure of roads in Bear Trap Canyon, in Alternative B1, would help mitigate this by providing a larger area within the Buckhorn Block with no vehicle traffic to disturb wildlife.

Although potential deer mortalities are difficult to estimate, it is anticipated that approximately 5-10 deer would be killed each year due to being hit by mine related traffic between the mine, mill, and other sources of traffic (Buckhorn Mountain Project FSEIS 2006, p. 3.11-10). This

would not likely cause a major decline in the overall deer population.

Alternative D would follow Pontiac Ridge road before following Okanogan County Road #9480 to the Toroda Creek Road. This area likely provides some deer winter range and would be disturbed by mine traffic in this alternative, though much of it has been subdivided and sold for home sites. This would likely cause some deer to seek habitat elsewhere away from the mine traffic. The type of effects, and wildlife responses, would be similar in type as for the ore haul routes along Marias or Nicholson Creeks. Much of this land is private, although some along the #9480 road is in State ownership as well as a small segment within the Bonaparte Block of NFS lands, although the road itself is a County Road.

This project would not alter many acres of deer habitat due to the small footprint of the activities. A larger area of deer cover has likely been changed due to fire suppression creating denser stands, timber harvest altering stand characteristics, and previous road building increasing human disturbance on deer. This project would add to the disturbance substantially within the corridor impacted by the ore haul routes. This project is likely to reduce the number of current hunters using the areas near the ore haul route because recreationists would not like the noise, dust, and traffic related to ore and supply haul. However, it is possible that mine employees would become familiar with the area and begin to hunt the Buckhorn Block. Deer hunting is an important recreation activity in the Buckhorn Block (see Recreation section in this chapter).

Rock has been excavated from private lands near the base of the Pontiac Ridge road and used for road maintenance on Forest Roads 3575-125 and 3575-140 for supply traffic during the construction of the mine site. Most rock was used on National Forest System lands to fill in drainage dips in the road to allow easier truck access, especially for lowboy trailers. This activity on private lands continues to disturb deer and likely causes them to avoid the area.

Based on the above analysis, the effects would not be significant.

Effects Determination Alternative A: No Impact.

Effects Determination Alternatives B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Pileated, Three-Toed Woodpecker, and other Primary Cavity Excavators

Affected Environment

Pileated woodpeckers use old forest single and multi-story Douglas-fir, western larch, western white pine, and old forest single story Engelmann spruce/subalpine fir. This species of woodpecker uses large diameter snags (> 21 inch dbh) for nesting and roosting, large diameter snags/log for foraging, and large diameter hollow live trees for roosting (Wisdom et al. 2000). Pileated woodpeckers forage on carpenter ants, wood boring beetles, and during late summer and fall they may forage on fruits and nuts (NatureServe 2005).

At the broad scale, the pileated woodpecker uses broad-elevation old forests as habitat within the Interior Columbia River Basin. Habitat for the pileated woodpecker has declined from 10.62% to 8.40% of the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute decline of 2.22% and a relative decline of 20.88% in available habitat. Within the Northern Glaciated Mountains ERU 7, habitat for the pileated

woodpecker has declined from 20.24% to 1.37%. This equates to an absolute decline of 18.86% and a relative decline of 93.22% (Wisdom et al. 2000).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. The group of greatest concern includes pileated woodpeckers which have habitat that exists as isolated patches with limited opportunity for populations interactions. This group may see local populations extirpated due to the loss of functional blocks of habitat of sufficient size. This group has the most restrictive habitat requirements, either in terms of stand structure and condition or stand size, or both. Conservation measures that have been developed that address the habitat needs of this species include the Okanogan Land and Resource Management Plan (old growth requirement, MR cells, snag/downed log guidelines) and the Eastside Screens (LSOG and snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

Three-toed woodpeckers use late-seral subalpine and montane forests with old forests of lodgepole pine, whitebark pine, and Engelmann spruce-subalpine fir. This species forages on wood-boring beetle larvae and are attracted to mature/overmature stands with bark beetles, disease, and heart rot, and areas that have recently had stand-replacing fires and therefore beetles. Snags (9-20 inches dbh) are important habitat components for nesting and foraging, and large recently burned areas with abundant beetles are preferred to other habitats. Snags with heart rot may be necessary for nesting, although new snags (<5 yrs) are needed for foraging because beetles are typically absent once a snag dries out around 5 years after creation (Wisdom et al. 2000).

At the broad scale, the three-toed woodpecker uses broad-elevation old forests as habitat within the Interior Columbia River Basin. Habitat for the three-toed woodpecker has increased from 6.97% to 8.53% of the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute increase of 1.56% and a relative increase of 22.44% in available habitat. Within the Northern Glaciated Mountains ERU 7, habitat for the three-toed woodpecker has declined from 8.52% to 3.32%. This equates to an absolute decline of 5.19% and a relative decline of 60.96% (Wisdom et al. 2000).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. Three-toed woodpeckers belong in a group whose habitat exists primarily as patches with some that are isolated. This group represents species that generally speaking use higher elevation habitats, which are closer to the Historic Range of Variability (HRV), but may be somewhat isolated. Conservation measures that have been developed that address the habitat needs of this species include the Okanogan Land and Resource Management Plan (old growth requirements, MR cells, snag/downed log guidelines) and the Eastside Screens (snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

The other primary cavity nesters may also be present in the project area.

At the broad scale, the *black-backed woodpecker* uses broad-elevation old forests as habitat within the Interior Columbia River Basin. This species uses late-seral multi- and single-layered stages as habitat. Black-backed woodpeckers use old forest stages of montane, subalpine, lower montane, and riparian forests. Managed and unmanaged young forest lodgepole pine stands also provide habitat. Burned areas and insect infested areas are key habitat components for nesting and foraging. They use live and dead mature pines and other large trees for foraging, primarily by flaking off the bark to find bark and wood boring beetles. Consequently, black-backed woodpeckers need areas that have been disturbed by fire, wind, or insect outbreaks and thus have high concentrations of beetles. The first 1-5 years after a fire is an important time period for these woodpeckers as they can find abundant food, and they may even use small snags in their search for beetles. Small diameter snags are preferred for nesting, usually in the 9- to15- inch dbh range, and they use lodgepole pine, ponderosa pine, spruce, fir, and western larch trees in mature to old stands (NatureServe, 2005, Wisdom et al. 2000). No recent fires have occurred in the Buckhorn Block to provide habitat for this species.

Habitat for the black-backed woodpecker has declined from 23.05% to 15.29% of the entire basin. This equates to an absolute decline of 7.77% and a relative decline of 33.70% in available habitat from historic times (1850-1890) to current times (1985-1995). Within the Northern Glaciated Mountains ERU 7, habitat for the black-backed woodpecker has declined from 26.07% to 1.58%. This equates to an absolute decline of 24.49% and a relative decline of 93.95% (Wisdom et al. 2000).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. Black-backed woodpeckers belong in a group whose habitat exists primarily as patches with some that are isolated. This group represents species that generally speaking use higher elevation habitats, which are closer to the HRV, but may be somewhat isolated. Conservation measures that have been developed that address the habitat needs of this species include the Okanogan Land and Resource Management Plan (snag/downed log guidelines) and the Eastside Screens (snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LMRP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

Habitat for the *downy woodpecker* consists of deciduous or mixed forests, riparian woodlands, and a broad array of other forested habitats. They excavate nests in snags, live trees, or even fence posts at a height of 3-50 feet. They forage on the bark of trees for insects, although they may also eat fruits and nuts when available (NatureServe 2005). The wide-scale trend for downy woodpecker habitat is not described in Wisdom et al. 2000, although the conservation status for downy woodpeckers is listed as “apparently secure” in the state of Washington (NatureServe 2005).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. Downy woodpeckers belong in a group whose habitat exists primarily as patches with some that are isolated. This group represents species that generally speaking use higher elevation habitats, which are closer to the HRV, but may be somewhat isolated. Conservation measures that have been

developed that address the habitat needs of this species include the Okanogan Land and Resource Management Plan (old growth requirements, snag/downed log guidelines) and the Eastside Screens (snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

The *hairy woodpecker* is found in a broad array of forest types, although they tend to prefer areas with higher canopy covers and mature trees with adequate densities of snags for nesting and foraging. Trees with fungal heart rot are preferred for excavating cavities. Hairy woodpeckers eat mainly insects found on or in trees, although they also eat fruits, nuts, and other invertebrates that can be found on trees, downed wood, or even the ground (NatureServe 2005). The wide-scale trend for hairy woodpecker habitat is not described in Wisdom et al. 2000, although the conservation status for hairy woodpeckers is listed as "secure" in the state of Washington (NatureServe 2005).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. The hairy woodpecker is in a group whose habitat is broadly distributed, but some gaps exist. There are disjunct patches that generally allow these species to interact as a metapopulation. This group has more general habitat requirements, but may need some stand elements, such as snags, which limit their ability to use particular areas. Conservation measures that have been developed that address the habitat needs of this species include the Okanogan Land and Resource Management Plan (snag/downed log guidelines) and the Eastside Screens (snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

At the broad scale, the *Lewis' woodpecker* uses low-elevation old forests as habitat within the Interior Columbia River Basin. Lewis' woodpecker habitat consists of old-forest, single-storied stands of ponderosa pine and multi-storied stands of Douglas-fir, western larch, and riparian cottonwood woodlands. They prefer burned stands of ponderosa pine, particularly those that experience stand-replacing fires. Lewis' woodpecker needs openings to forage because it is an aerial insectivore. Preferred snag densities are 24 snags/acre of 9 inch dbh trees and 6.3 snags/acre for 21-inch dbh trees. Nesting generally occurs in open forests/tree clumps with snags and shrubs, downed woody debris, and grasses as ground cover. Nest trees are generally large diameter (17-inch) ponderosa pine or cottonwoods that are in advanced decay. This species will also use cavities excavated by other species or natural cavities (Wisdom et al. 2000). This woodpecker is unlike the others in that it rarely uses its beak to drill into trees in search of insects. Instead, it typically forages on flying insects by capturing them in flight. It may also glean them from the ground or from tree bark. Lewis' woodpeckers also eat nuts, pine seeds, berries, and fruit in late summer and fall (Dobkin no date).

Habitat for the Lewis' woodpecker has declined from 13.78% to 2.29% of the entire basin. This equates to an absolute decline of 11.49% and a relative decline of 83.35% in available habitat from historic times (1850-1890) to current times (1985-1995). Within the Northern Glaciated Mountains ERU 7, habitat for the Lewis' woodpecker has declined from 18.17% to

0.83%. This equates to an absolute decline of 17.34% and a relative decline of 95.45% (Wisdom et al. 2000).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. The group of greatest concern includes Lewis's woodpecker which have habitat that exists as isolated patches with limited opportunity for populations interactions. This group may see local populations extirpated due to the loss of functional blocks of habitat of sufficient size. This group has the most restrictive habitat requirements, either in terms of stand structure and condition or stand size, or both. Conservation measures that have been developed that address the habitat needs of this species include the Okanogan Land and Resource Management Plan (snag/downed log guidelines) and the Eastside Screens (snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

The *northern flicker* uses open stands of deciduous or coniferous forests and riparian areas. They nest in snags, stumps, or the dead tops of live trees. Northern flickers forage on ants, wasps, grasshoppers, beetles, fruits, and seeds. They feed on the ground or by capturing insects in the air (NatureServe 2005). The wide-scale trend for northern flicker habitat is not described in Wisdom et al. 2000, although the conservation status for northern flickers is listed as "secure" in the state of Washington (NatureServe 2005).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. Viability and habitat capability are not listed for the northern flicker. Conservation measures that have been developed that address the habitat needs of this species include the Okanogan Land and Resource Management Plan (snag/downed log guidelines) and the Eastside Screens (snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

At the broad scale, the *white-headed woodpecker* uses low-elevation old forests as habitat within the Interior Columbia River Basin. This species needs large diameter snags (>21 inches dbh) or trees for nesting and foraging, primarily ponderosa pine. Snags need to be soft (decay) for this species to use them, and they primarily forage on live trees (>10 inches dbh) (Wisdom et al. 2000). White-headed woodpeckers forage primarily on seeds, especially those of ponderosa pine, although they may also eat insects (NatureServe 2005).

Habitat for the white-headed woodpecker has declined from 22.87% to 8.50% of the entire basin. This equates to an absolute decline of 14.37% and a relative decline of 62.83% in available habitat from historic times (1850-1890) to current times (1985-1995). Within the Northern Glaciated Mountains ERU 7, habitat for the white-headed woodpecker has declined from 22.33% to 0.43%. This equates to an absolute decline of 21.90% and a relative decline of 98.06% (Wisdom et al. 2000).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and

habitat capability for this group where the information was available. The group of greatest concern includes white-headed woodpeckers which have habitat that exists as isolated patches with limited opportunity for populations interactions. This group may see local populations extirpated due to the loss of functional blocks of habitat of sufficient size. This group has the most restrictive habitat requirements, either in terms of stand structure and condition or stand size, or both. Conservation measures that have been developed that address the habitat needs of this species include the Okanogan Land and Resource Management Plan (snag/downed log guidelines) and the Eastside Screens (LSOG guidelines and snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

At the broad scale, the *Williamson's sapsucker* uses broad elevation old forests as habitat within the Interior Columbia River Basin. This species uses late-seral multi- and single-layered stages as habitat. Williamson's sapsucker uses old forest single and multi-story Douglas-fir, western larch, ponderosa pine, western white pine, and old forest single story aspen and cottonwood. This species of woodpecker uses large diameter snags for nesting and roosting (>21 inch dbh) (Wisdom et al. 2000). Williamson's sapsuckers forage on insects such as ants by drilling into trees. They have also been known to feed on sap. Cavities are excavated in pine, larch, fir, and aspen (Dobkin no date).

Habitat for the Williamson's sapsucker has declined from 20.97% to 9.14% of the entire basin. This equates to an absolute decline of 11.83% and a relative decline of 56.42% in available habitat from historic times (1850-1890) to current times (1985-1995). Within the Northern Glaciated Mountains ERU 7, habitat for the Williamson's sapsucker has declined from 25.22% to 1.19%. This equates to an absolute decline of 24.03% and a relative decline of 95.27% (Wisdom et al. 2000).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. Williamson's sapsuckers belong in a group whose habitat exists primarily as patches with some that are isolated. This group represents species that generally speaking use higher elevation habitats, which are closer to the HRV, but may be somewhat isolated. Conservation measures that have been developed that address the habitat needs of this species include the Okanogan Land and Resource Management Plan (snag/downed log guidelines) and the Eastside Screens (snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

Yellow-bellied sapsuckers (currently split into two species, of which the red-naped sapsucker, *Sphyrapicus nuchalis*, is found in Washington) are commonly found in coniferous forests with aspens or other hardwoods. Nest cavities are often not reused, although they may be excavated in the same tree over the course of several years. Cavities are typically in live deciduous trees, especially aspens, with heart rot. Red-naped sapsuckers will drill for sap and glean and excavate insects from trees. They will also feed on tree cambium, ants, beetles, wasps, caterpillars, beetles, and small amounts of fruit and berries (Dobkin, no date, NatureServe Explorer 2005). The wide-scale trend for red-naped sapsucker (or the yellow-bellied sapsucker) habitat is not described in Wisdom et al. 2000, although the conservation

status for red-naped sapsuckers is listed as “apparently secure” in the state of Washington (NatureServe 2005).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. Red-naped sapsuckers belong in a group whose habitat exists primarily as patches with some that are isolated. This group represents species that generally speaking use higher elevation habitats, which are closer to the HRV, but may be somewhat isolated. Conservation measures that have been developed that address the habitat needs of this species include the Okanogan Land and Resource Management Plan (snag/downed log guidelines) and the Eastside Screens (snag/downed log guidelines). The alternatives for this project would be consistent with the Okanogan LRMP, and mitigation for this project includes creating 3.5 times as many snags as the number of acres of NFS lands cleared. As stated in Chapter II of this EIS, the Eastside Screens do not apply to this project.

All species of the above described primary cavity excavators are likely present in or near the project area (Crown Jewel Mine FEIS 1997). The Okanogan LRMP provides direction for maintaining snags to provide habitat for wildlife.

Primary Cavity Excavator Habitat Influence Index (white-headed woodpecker, three-toed woodpecker, and pileated woodpecker): The index recommended by Gaines et al. (2003) was used to estimate the area affected by roads for primary cavity excavator habitat within the Myers and Toroda Creek watersheds. A buffer of 60 meters along the travel routes was used. Currently, an estimated 15,097 acres out of 103,623 total acres (15%) within the watershed would be affected by roads. This equates to a rating of “low level of human influence on primary cavity excavator habitats.”

<u>*Environmental Consequences*</u>

Alternative A

There would be no impacts to woodpeckers or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

The road reconstruction for the ore haul route would not likely cause a large reduction in the number of snags available as woodpecker habitat. Woodcutters generally harvested most of the dead trees near open roadways, so few snags are currently available along the proposed ore haul route. The new construction would slightly reduce the available snags by removing those that lie within the footprint of the new road (<5 acres). The new construction would not be open to the public during the life of the mine, so those areas are not likely to see a reduction in snag numbers adjacent to the roadway due to firewood cutting during the life of the mine. After the life of the mine, the newly constructed roads would be open to the public, and consequently the snags near the roadway would likely be lost to firewood cutters. This would reduce snag habitat near those sections of road, although the snag mitigation of creating 3.5 times as many snags as the number of acres of NFS lands cleared so the result would be more snags available than are currently, which would likely compensate for at least part of the loss of snags to firewood cutters. Considering that most snags are likely already

absent along the open roads due to firewood cutters, and therefore this project would result in very few snags being directly lost to road construction activities, an in-depth DecAID analysis was not completed. The creation of snags as mitigation would likely increase the number of snags available compared to existing conditions. Additionally, the acreage directly impacted by road construction activities is very small compared to a larger landscape such as a watershed or the Buckhorn Block of NFS lands. Using the models recommended by Gaines et al., 14 acres of late successional forest non-winter habitat, 9 acres of late successional forest nonwinter security habitat, and 19 acres of late successional forest winter security habitat for pileated woodpeckers and white-headed woodpeckers would be impacted under this alternative.

Alternative B has a speed limit of 30 mph, and this alternative consequently has a higher probability of road kill compared to the other action alternatives.

Primary Cavity Excavator Habitat Influence Index (white-headed woodpecker, three-toed woodpecker, and pileated woodpecker): The index recommended by Gaines et al. (2003) was used to estimate the area affected by roads for primary cavity excavator habitat within the Myers and Toroda Creek watersheds. A buffer of 60 meters along the travel routes was used. An estimated 15,208 acres out of 103,623 total acres (15%) within the watershed would be affected by roads under Alternative B. This equates to a rating of "low level of human influence on primary cavity excavator habitats." There would be roughly 109 more acres impacted under this alternative than under existing conditions. The estimates were based on "open" travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater under this alternative than under existing conditions, but this substantial difference in intensity was not captured in the model.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Woodpeckers may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest lands. There would be a loss of habitat for woodpeckers due to the construction of the project components, although this would be more than compensated for by the creation of snags as mitigation.

Alternative B1

The effects of this alternative would be similar to Alternative B for most components, particularly concerning disturbance and habitat loss to woodpeckers. The primary difference would be the reduced speed limit which would reduce the potential for road kill. Using the models recommended by Gaines et al., 21 acres of late successional forest non-winter habitat, 99 acres of late successional forest nonwinter security habitat, and 16 acres of late successional forest winter security habitat for pileated woodpeckers and white-headed woodpeckers would not be impacted that is currently being impacted by open roads under this alternative.

Primary Cavity Excavator Habitat Influence Index (white-headed woodpecker, three-toed woodpecker, and pileated woodpecker): The index recommended by Gaines et al. (2003) was used to estimate the area affected by roads for primary cavity excavator habitat within the Myers and Toroda Creek watersheds. A buffer of 60 meters along the travel routes was used. An estimated 15,026 acres out of 103,623 total acres (15%) within the watershed

would be affected by roads. This equates to a rating of “low level of human influence on primary cavity excavator habitats.” There would be roughly 71 less acres impacted than under existing conditions. This is due to the road closures in Bear Trap Canyon. The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore, the intensity of impacts along the ore haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the model.

Alternative C

The type of effects would be similar to Alternative B. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The area affected is larger than Alternatives B and B1 because the ore haul route is over 6 miles longer across National Forest System lands and rights-of-way. Using the models recommended by Gaines et al., 10 acres of late successional forest non-winter habitat, 3 acres of late successional forest nonwinter security habitat, and 12 acres of late successional forest winter security habitat for pileated woodpecker and white-headed woodpeckers would be impacted under this alternative.

Primary Cavity Excavator Habitat Influence Index (white-headed woodpecker, three-toed woodpecker, and pileated woodpecker): The index recommended by Gaines et al. (2003) was used to estimate the area affected by roads for primary cavity excavator habitat within the Myers and Toroda Creek watersheds. A buffer of 60 meters along the travel routes was used. An estimated 15,152 acres out of 103,623 total acres (15%) within the watershed would be affected by roads. This equates to a rating of “low level of human influence on primary cavity excavator habitats.” There would be roughly 55 more acres impacted than under existing conditions. The estimates were based on “open” travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the model.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Woodpeckers may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat for woodpeckers due to the construction of the project components, although this would be more than compensated for by the creation of snags as mitigation.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance. Woodpeckers may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. There would be a loss of habitat for woodpeckers due to the construction of the project components, although this would be more than compensated for by the creation of snags as mitigation. Using the models recommended by Gaines et al., 10 acres of late successional forest non-winter habitat, 3 acres of late successional forest nonwinter security habitat, and 12 acres of late successional forest winter security habitat for

pileated woodpecker and white-headed woodpeckers would be impacted under this alternative. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The overall direct and indirect effects would be less than with the other action alternatives.

Primary Cavity Excavator Habitat Influence Index (white-headed woodpecker, three-toed woodpecker, and pileated woodpecker): The index recommended by Gaines et al. (2003) was used to estimate the area affected by roads for primary cavity excavator habitat within the Myers and Toroda Creek watersheds. A buffer of 60 meters along the travel routes was used. An estimated 15,152 acres out of 103,623 total acres (15%) within the watershed would be affected by roads. This equates to a rating of "low level of human influence on primary cavity excavator habitats." There would be roughly 55 more acres impacted than under existing conditions. The estimates were based on "open" travel routes, and the substantial increase in the traffic volume along the ore haul route where the road currently exists was not part of the model. Therefore the intensity of impacts along the ore haul route would be substantially greater than under existing conditions, but this substantial difference in intensity was not captured in the model.

Effects Common to All Action Alternatives

Snags would be created within riparian areas to mitigate for the loss of any snags due to the construction/reconstruction of the road and other project components. When considered at the broader scale of the entire Buckhorn Block of National Forest System lands (30,353 acres) or the entire watersheds, the loss of snags to this project would be so small as to be nearly immeasurable. The mitigation would create 3.5 times as many snags as the number of acres of NFS lands cleared, so the result would be more snags available than are currently. Along currently open roads snags are likely to be low in density due to past firewood harvesting. Snags would not be created along the ore haul route. They would be created in areas away from the route in order to avoid the disturbance effects associated with the ore haul trucks. This would enhance the value of these snags as mitigation.

The substantial increase in traffic due to ore haul and employee vehicles would increase the probability of disturbance to woodpeckers that may be near the roadway. This disturbance may be minor due to the relative lack of snags (woodpecker habitat) near open roads as a result of past firewood cutting.

The infiltration gallery, infiltration pipeline, boundary fence, and livestock fences may result in a loss of some snags, although the area of ground disturbance would be relatively small (<21 acres). The use of 3575-140 to access the water storage facility would not increase the effects to available snags because this road is currently open to the public. However, the construction and/or continued use of all these areas would increase the amount of disturbance for woodpeckers that may be nesting or foraging in the area.

The section of ore and supply haul route across National Forest System lands that is new construction between Forest Road 3575-120 and the mine site is common to all action alternatives. There would consequently be a loss of potential habitat for woodpeckers within the footprint of this new road. The new construction would not be open to the public during mining operations, so those areas are not likely to see a reduction in snag numbers adjacent to the roadway due to firewood cutting during the life of the mine. After mine closure, the newly constructed roads would be open to the public, and consequently the snags near the roadway would likely be lost to firewood cutters. This would reduce snag habitat near those

sections of road, although the snag mitigation of creating 3.5 times as many snags as the number of acres of NFS lands cleared would likely still compensate for at least part of the loss of snags to firewood cutters. Relatively few acres would be lost to the footprint of this project (57 acres for Alternatives B and B1, 65 acres for Alternative C, and 26 acres for Alternative D), and where road reconstruction would occur on currently open roads, snags along the roadway are likely limited due to continued firewood cutting. The loss of snags would likely be minor. Additionally, the loss of green trees to project activities is likely to be minor when compared to a larger landscape such as a watershed or the Buckhorn Block of NFS lands. Although a few larger trees would likely be lost to road construction/reconstruction, this should be minor when compared to what exists across the landscape in the form of green-tree replacements for snags.

Cumulative Effects

The two HUC5s that this project overlaps were used for cumulative effects analysis. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous road building and timber harvest.

This project would only contribute a small incremental amount to the loss of snags when considered cumulatively. Past timber harvest and road building likely reduced the availability of snags across the landscape. Roads allowed firewood cutters to gain access to larger areas and harvest dead trees. Snags lost due to road construction would be mitigated by creating 3.5 times as many snags as the number of acres of NFS lands cleared. Other past, present and reasonably foreseeable future actions would not affect snag availability. The main effect would be disturbance from the substantial increase in traffic on the ore haul route. This would cause woodpeckers and other wildlife to utilize habitat further away from the disturbance. This disturbance would be additive with the disturbance from the mine activity on private lands, recreationists, and other human activity within the area around the ore haul routes.

Based on the above analysis, the effects would not be significant.

Effects Determination Alternative A: No Impact.

Effects Determination Alternatives B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Ruffed Grouse

Affected Environment

Ruffed grouse are commonly found in younger forested stands where there is abundant cover in the form of young trees and brush. Habitat generally has some deciduous component. Drumming and brood rearing occur in habitats with high densities of woody stems (cover). Grouse will eat berries, insects, and leaves, and during winter will feed on the buds of deciduous trees and shrubs. Nests are hollowed depressions in the leaf litter around trees, shrubs, stumps, or other cover (NatureServe 2005, Ruffed Grouse Society 2005).

Ruffed grouse are indicators of deciduous and riparian habitats in the Okanogan Forest Plan.

The wide-scale trend for ruffed grouse habitat is not described in Wisdom et al. 2000,

although the conservation status for ruffed grouse is listed as “secure” in the state of Washington (NatureServe 2005).

Gaines (no date) developed a tool to link the broad scale habitat trends of MIS to the project level. Using information from the Interior Columbia Basin work he listed the viability and habitat capability for this group where the information was available. Viability and habitat capability are not listed for ruffed grouse. Conservation measures that have been developed that address the habitat needs of this species include the Inland Native Fish Strategy (INFISH, 1995) riparian habitat conservation areas (RHCAs).

Ruffed grouse are known to occur within the project area, and abundant riparian and deciduous habitat can be found throughout.

Riparian areas in the project area include those along areas of wetlands in the upper reaches of Marias Creek, the 9-acre wetlands in the upper reaches of Nicholson and Marias Creeks, and around the Frog Pond. Within the Marias Creek analysis watershed there are 550 acres within RHCAs, and 480 acres within the Nicholson Creek analysis watershed. There are none near the haul route in Alternative D, although 690 acres are within RHCAs within the upper Myers analysis watershed (see the Hydrology section of this EIS).

Environmental Consequences

Alternative A

There would be no impacts to ruffed grouse or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

The haul route follows Marias Creek (existing Forest Road 3550) and the reconstruction of this road would impact ruffed grouse habitat and cause disturbance to ruffed grouse using these areas. This would remove some habitat and also cause grouse to avoid these areas and utilize other habitats away from the disturbance. Some grouse could potentially be struck by mine related vehicles. The speed limit of 30 mph would have a higher probability of road kill than the other action alternatives. Ruffed grouse use riparian areas as habitat and therefore are likely to be present along Marias Creek. The substantial increase in traffic and noise along the ore haul route would potentially disturb ruffed grouse, including during breeding and nesting season. There are other areas along the ore haul route that provide cover for ruffed grouse, and these areas include deciduous shrubs. These non-riparian areas may have ruffed grouse as well that would be impacted by this project.

The haul route follows Marias Creek (existing 3550 road) and the reconstruction of this road would impact ruffed grouse habitat and also cause disturbance to ruffed grouse using these areas. This would remove some habitat and also cause grouse to avoid these areas and utilize other habitats away from the disturbance.

The new road construction would increase disturbance, and the probability of grouse being struck by a vehicle, as well as result in a direct reduction in habitat along the footprint of the road, although none of the new construction is with RHCAs. Along Marias Creek there would be 0.1 acre of wetlands impacted by the project (see the Hydrology section of this EIS).

There are 4.0 miles of the proposed ore haul route parallel to Marias Creek and within RHCAs (see the Aquatics section of this EIS). Construction of the livestock fences and livestock mitigation would generally occur in riparian areas which would disturb this species for a short time.

The overall effect of this alternative would be a reduction in functional habitat along the roadway due to increased disturbance. Ruffed grouse may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. Using the indices recommended by Gaines et al., 2 more acres of riparian nonwinter habitat would be affected by roads and trails, 9 more acres of riparian nonwinter habitat would be affected by road and motorized trails, and 105 acres of riparian winter habitat would be affected for this species. There would be a loss of habitat due to the construction of the project components. The reconstruction of the haul route along Marias Creek (Forest Road 3550) would widen the road and remove some ruffed grouse habitat.

Alternative B1

The effects of this alternative would be similar to Alt B, particularly concerning disturbance and habitat loss to ruffed grouse. The primary difference would be the reduced speed limit which would reduce the potential for road kill. Using the indices recommended by Gaines et al., 64 more acres of riparian nonwinter habitat would be affected by roads and trails, 44 more acres of riparian nonwinter habitat would be affected by road and motorized trails, and 65 acres of riparian winter habitat would not be impacted that is currently being impacted by open roads for this species.

Alternative C

The type of effects would be similar to those of Alternative B. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The ore haul route would pass the Frog Pond, as well as passing near the 9-acre wetlands near Forest Road 3575-122. Ruffed grouse using these areas would be disturbed by the substantial increase in vehicle traffic and noise. Additionally, the ore haul route in this alternative passes near or through several riparian areas along streams, as well as a wet meadow along Forest Road 3575. Ruffed grouse using these areas would likely be disturbed by project activities including fence construction around the wet meadow, and the widening of the haul route near the streams would remove some ruffed grouse habitat. Ruffed grouse would likely avoid using areas near the disturbance, and overall would likely utilize areas further away from the project activities. Construction of the fence around Grass Lakes pond would protect grouse habitat from cattle damage.

There are more deciduous trees along this ore haul route, especially in the area around Forest Roads 3575-150 and 3575 intersection. Ruffed grouse using this area as habitat are likely to be disturbed by the substantial increase in traffic along the ore haul route. Grouse would avoid areas near the road and utilize habitats further from the disturbance.

The area affected is larger than in Alternatives B and B1 because the ore haul route is over 6 miles longer across National Forest System land and rights-of-way. 0.2 acres of wetlands would be impacted (see the Hydrology section in this EIS). There would be 2.6 miles of the proposed ore haul route within the RHCAs (see the Aquatics section of this EIS). Additional shrubby, deciduous areas along the roadway would be impacted.

The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance. Ruffed grouse may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System land. Using the indices recommended by Gaines et al., no additional acres of riparian nonwinter habitat would be affected by roads and trails, 5 more acres of riparian nonwinter habitat would be affected by road and motorized trails, and 5 acres of riparian winter habitat would be affected for this species. There would be a loss of habitat due to the construction of the project components. The ore haul route would pass by some riparian areas, and the widening of the road would reduce habitat for ruffed grouse and other riparian species.

Alternative D

This alternative would have a much smaller affected area than Alternatives B, B1, and C. The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance. No RHCAs would be crossed on NFS land or rights-of-ways (see Aquatics section of this EIS) and no wetlands would be impacted (see the Hydrology section of this EIS). Ruffed grouse may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System land. Using the indices recommended by Gaines et al., no additional acres of riparian nonwinter habitat would be affected by roads and trails, 5 more acres of riparian nonwinter habitat would be affected by road and motorized trails, and 5 acres of riparian winter habitat would be affected for this species. There would be no loss of habitat due to the construction of the project components. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The overall direct and indirect effects of this alternative would be less than the other action alternatives.

Effects Common to All Action Alternatives

The section of new road construction that is common to all alternatives would increase disturbance, and the probability of grouse being struck by a vehicle, as well as result in a direct reduction in habitat along the footprint of the road. None of this portion of the ore haul routes would be considered riparian, although some areas of dense shrubs and deciduous vegetation may provide habitat. The conveyance pipeline, infiltration gallery, access road to the pipeline, access road to the water storage facility, boundary fence, range mitigation, and water monitoring well, staff gauges, and piezometers may also remove a small amount of potential habitat, and the construction and ongoing activities at those sites would increase the potential for disturbance. Some of this habitat removal would be riparian, and some other areas would include shrubs and deciduous vegetation that may also provide grouse habitat.

Cumulative Effects

The two HUC5s that this project overlaps were used for cumulative effects analysis. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous road building and timber harvest.

This project would not result in a large number of riparian/deciduous acres being removed, although disturbance to grouse would substantially increase due to ore haul traffic. Alternatives B, B1, and C all have ore haul routes that follow existing roads along major streams. The Buckhorn Mountain Project and mining activities on private lands would lower the water table and impact streams, seeps, springs, and wetlands. The lowering of the water

table would be partially mitigated by using water from mining activities to augment some wetlands and streams that would be impacted. The full effects of lowering the water table would not occur until near the end of mining, and water augmentation to partially mitigate these effects.

Past timber harvest, livestock grazing, and roads likely altered the riparian/deciduous vegetation within the Buckhorn Block of NFS lands. Roads also increased access for hunters and this likely contributes to grouse mortality on this block of NFS lands. Grouse hunting in the Buckhorn Block is an important recreation activity. Fire suppression has led to conifers encroaching upon aspen and deciduous shrubs. This has reduced available habitat for grouse.

Based on the above analysis, the effects would not be significant.

Effects Determination Alternative A: No Impact.

Effects Determination Alternatives B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Species Of Interest

Blue Grouse

Affected Environment

Blue grouse are edge species often found where forested areas are adjacent to open areas. Blue grouse are habitat generalists that use montane forests, subalpine forests, lower montane forests, upland shrubland/herbland, and riparian woodlands. Habitats include Douglas-fir, ponderosa pine, western larch, aspen, mixed conifer, antelope bitterbrush-bluebunch wheatgrass, wheatgrass bunchgrass, and chokecherry-serviceberry-rose communities. Blue grouse forage on insects, seeds, and berries, and young birds feed primarily on insects. Nests are constructed on the ground. Winter habitat for blue grouse is generally higher in elevation than spring and summer habitat. Blue grouse use old-forest single and multi-story or understory reinitiation stages of ponderosa pine, Douglas-fir, western larch, and mixed conifer (Wisdom et al. 2000). Blue grouse need large, dense conifers for roosting habitat in winter, and studies have found that this may be provided by Douglas-fir (day roosts) and subalpine fir (night roosts). In the winter they feed on the buds and needles of conifers such as Douglas-fir (NatureServe 2005).

At the broad scale, the blue grouse uses broad-elevation old forests during winter as habitat within the Interior Columbia River Basin. Winter habitat for the blue grouse has declined from 21.30% to 13.68% of the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute decline of 7.62% and a relative decline of 35.79%. Within the Northern Glaciated Mountains ERU 7, winter habitat for the blue grouse has declined from 22.45% to 18.72%. This equates to an absolute decline of 3.73% and a relative decline of 16.63% (Wisdom et al. 2000).

At the broad scale, the blue grouse uses forest mosaics as summer habitat within the Interior Columbia River Basin. Summer habitat for blue grouse has declined from 30.41% to 26.94% of the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute decline of 3.47% and a relative decline of 11.42% in available habitat.

Within the Northern Glaciated Mountains ERU 7, summer habitat for the blue grouse has declined from 33.90% to 26.32%. This equates to an absolute decline of 7.58% and a relative decline of 22.36% (Wisdom et al. 2000).

Some natural openings exist within the project area. Along Forest Road 3575-140, which would be used to access the water storage facility during operations and the mine site during initial construction for 3 to 4 months, there is an opening near the top of Buckhorn Mountain that includes grasses and sagebrush. The surrounding forest type is primarily Douglas-fir and western larch. The lower reaches of Marias Creek and Nicholson Creek have open, grassy southern slopes. The forest types around these areas are primarily Douglas-fir, western larch, and some ponderosa pine. There is some subalpine fir and spruce is present along Forest Road 3575-120 near the proposed water infiltration gallery. Deciduous trees and shrubs are scattered around the project area, particularly along the riparian areas. Scattered aspen and other deciduous trees are found throughout the area, such as near the intersection of Forest Roads 3575 and 3575-150. The new road construction from Forest Road 3575-120 to the patented lands passes through a stand of mature Douglas-fir with a grassy understory.

Blue grouse are likely present within the project area, and potentially suitable habitat is found scattered throughout.

Environmental Consequences

Alternative A

There would be no impacts to blue grouse or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

The ore haul route passes through potentially suitable blue grouse habitat, and consequently the birds may be disturbed by ore haul, supply trucks, and employee traffic. The Marias Creek route passes deciduous vegetation, Douglas-fir, spruce, and grassy slopes surrounded by forest, all of which are habitat components for blue grouse. The new road construction from Forest Road 3575-120 to the patented lands passes through a stand of mature Douglas-fir with a grassy understory. The construction of this section of road would remove potential habitat, and the continued use of this area would increase disturbance to any blue grouse nearby. The disturbance would cause grouse to avoid using habitat adjacent to the roadway and shift use to other available habitat. Forest Road 3575-140, which accesses the proposed water storage facility, also passes through potential habitat. There is a grass/sagebrush opening with scattered small trees near the top of Buckhorn Mountain.

The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance, and there would be a direct removal of some habitat within the footprint of the activities. Blue grouse may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System land.

Alternative B1

The effects would be similar to Alternative B, particularly concerning disturbance and habitat loss to blue grouse. The primary difference would be the reduced speed limit which would reduce the potential for road kill.

Alternative C

The effects would be similar to those of Alternative B. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The ore haul route would also travel along Forest Road 3575-120 past the infiltration gallery and pipeline, and this area has subalpine fir habitat. There is also a stand of deciduous trees near the intersection of Forest Roads 3575 and 3575-150. If blue grouse are present near the roadway, then disturbance would increase within these areas due to the substantial increase in traffic. Grouse would consequently use habitat near the disturbance less and redistribute to habitats further from the disturbance.

The area affected is larger than Alternatives B and B1 because the ore haul route is over 6 miles longer across National Forest land and rights-of-way.

The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance, and there would be a direct removal of some habitat within the footprint of the activities. Blue grouse may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System land.

Alternative D

This alternative would have a much smaller affected area than Alternatives B, B1, and C because of the much smaller amount of road construction and reconstruction, and shorter haul route across NFS lands. The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance, and there would be a direct removal of some habitat within the footprint of the activities. Blue grouse may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The overall direct and indirect effects would be less than the other action alternatives.

Effects Common to All Action Alternatives

The construction of the water infiltration gallery and pipeline would remove some trees from a stand dominated by subalpine fir and spruce. Fewer natural openings are near the infiltration gallery, although some man-made openings are nearby. The construction and continued use of these areas increases the potential for disturbance to blue grouse. The human presence/noise associated with the construction of the boundary fence would also potentially disturb blue grouse temporarily while these activities take place. This might temporarily displace grouse from these sites to nearby habitat for the duration of these activities.

The section of ore haul route across National Forest System lands that is new construction from Forest Road 3575-120 to the mine site would be common to all action alternatives. There would consequently be a loss of potential habitat for blue grouse within the footprint of

this new road. Approximately 5 acres on NFS lands would be lost to the footprint of this section of new road.

Cumulative Effects

The Buckhorn Block of NFS land and surrounding adjacent ownerships were used for cumulative effects analysis. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous timber harvest.

Timber harvest and fire suppression are the factors most likely to have caused habitat change within the Buckhorn Block of NFS lands. Timber harvest may have decreased roosting habitat but increased openings. Fire suppression may have increased stand densities and allowed natural openings to fill in with conifers. Recreationists likely cause disturbance to grouse within the area, although this project would substantially increase disturbance near the ore haul routes during the life of the mine and recreationists would likely avoid these areas. This project would only directly reduce blue grouse habitat by a small amount when analyzed at the scale of the entire Buckhorn Block, although the disturbance would extend beyond the footprint of the ore haul route to encompass a larger area. Hunting of grouse is an important recreational activity in the Buckhorn Block.

Based on the above analysis, the effects would not be significant.

Effects Determination Alternative A: No Impact.

Effects Determination Alternatives B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Northern Goshawk

Affected Environment

Goshawks use late seral stages of montane forests as well as young unmanaged stands. They need large diameter snags and downed woody material to provide habitat for prey species. Nests are generally located in the largest trees and densest canopy within the area. Foraging habitat includes many structural stages and cover types, and goshawks generally use a mixture of stands to provide for their habitat needs. Goshawks may migrate to lower elevations or to more open habitat, although some do not migrate at all. Prey availability may be the determining factor (Wisdom et al. 2000).

Habitats include old forests and unmanaged young forests in montane, lower montane, riparian areas, and chokecherry-serviceberry-rose. They may also use more open woodland areas in the winter. Key habitat components are snags, downed wood, large trees, herbaceous/shrubby understories, and a mixture of forest structural stages and openings. Prey includes tree squirrels, ground squirrels, rabbits, hares, grouse, and passerines. Dense understories can limit herbaceous ground cover that is important for many prey species (Wisdom et al. 2000). Grazing and timber harvesting can reduce the suitability of nesting and foraging habitat for goshawks, and human disturbance, toxins, and poaching also negatively affect goshawks (Finch 1991). Many of the prey species taken by goshawks are found on the ground or in the lower canopies (Reynolds et al. 1991).

At the broad scale, the northern goshawk uses forests, woodlands, and montane shrubs as habitat during the winter within the Interior Columbia River Basin. Winter habitat for the northern goshawk has declined from 21.37% to 14.59% of the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute decline of 6.78% and a relative decline of 31.73% in available habitat. Within the Northern Glaciated Mountains ERU 7, winter habitat for the northern goshawk has declined from 28.43% to 2.94%. This equates to an absolute decline of 25.50% and a relative decline of 89.66% (Wisdom et al. 2000).

At the broad scale, the northern goshawk uses broad-elevation old forests during summer as habitat within the Interior Columbia River Basin. Summer habitat for the northern goshawk has declined from 22.75% to 12.93% for the entire basin from historic times (1850-1890) to current times (1985-1995). This equates to an absolute decline of 9.82% and a relative decline of 43.16% in available habitat. Within the Northern Glaciated Mountains ERU 7, summer habitat for northern goshawks has declined from 28.63% to1.54%. This equates to an absolute decline of 27.09% and a relative decline of 94.62% (Wisdom et al. 2000).

Several old nests were documented near the ore and supply haul routes and other project components. No goshawks were found during surveys for the Department of Ecology's DSEIS. Potential goshawk foraging and nesting exists throughout the project area. It is therefore likely that goshawks continue to be present within the project area and would be impacted by this project.

Environmental Consequences

Alternative A

There would be no impacts to northern goshawks or their habitat. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

Northern goshawks and their habitats are likely to be impacted. The ore and supply haul route passes potential goshawk nesting and foraging habitat, and historical sightings have occurred within the vicinity. The new ore haul route construction goes through a stand of mature Douglas-fir with an open understory. It is possible that any goshawks nesting or foraging near the proposed ore haul route would be disturbed by the substantial increase in traffic related to the ore haul and employee vehicles. Additionally, prey species such as small mammals and birds would be disturbed by the substantial increase in traffic and would likely use the habitat adjacent to the ore haul route less than under current conditions. Some goshawk prey would be killed by the traffic, although this should have little impact on overall prey populations. The speed limit would be 30 mph and would have a higher probability of road kill than the other action alternatives. Using the models recommended by Gaines et al., 14 acres of late successional forest non-winter habitat, 9 acres of late successional forest nonwinter security habitat, and 19 acres of late successional forest winter security habitat for this species would be impacted under this alternative.

As discussed in the woodpecker section, some snags would be lost to the construction of the ore and supply haul route, although this loss would be mitigated through the creation of snags within the riparian areas. Snags are an important component of goshawk prey habitat.

The ore haul route and erosion control features would impact movement and habitat suitability along the roadway for small mammals and birds. As discussed in the marten and great gray owl sections, this would reduce the available prey near the roadway. Consequently, goshawks would utilize these areas less and would shift their habitat use to areas with more abundant prey.

The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance as well as a direct loss of potential habitat to the footprint of the project activities. Goshawks may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands.

Alternative B1

The effects would be similar to Alternative B, particularly concerning disturbance and habitat loss to goshawks and their prey. The primary difference would be the reduced speed limit which would reduce the potential for road kill. Using the models recommended by Gaines et al., 21 acres of late successional forest non-winter habitat, 99 acres of late successional forest nonwinter security habitat, and 16 acres of late successional forest winter security habitat for this species would not be impacted that is currently being impacted by open roads under this alternative.

Alternative C

The effects would be similar to those of Alternative B. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. Several old nest sites are located near the proposed ore haul route, and the potential exists for goshawks to be currently nesting near the route. There is suitable nesting and foraging habitat, and if goshawks are present they would potentially be disturbed by the substantial increase in traffic along the ore and supply haul route. Employee traffic would potentially increase not just along the ore and supply haul route, but also along all other open roads leading to the mine site, except in winter when only the ore and supply haul route and potentially the Cow Camp road would be plowed. Goshawk prey species near the ore and supply haul route would also be disturbed and may utilize these areas less than under current conditions. A few prey items would even be killed by the traffic along the roadway. The effect would be that goshawks would utilize areas near the roadway less and would use other habitats in search of prey.

The area affected is larger than the Alternatives B and B1 because the ore and supply haul route is over 6 miles longer across National Forest System lands and rights-of-ways (13.0 miles total). Using the models recommended by Gaines et al., 10 acres of late successional forest non-winter habitat, 3 acres of late successional forest nonwinter security habitat, and 12 acres of late successional forest winter security habitat for this species would be impacted under this alternative.

The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance as well as a direct loss of potential habitat to the footprint of the project activities. Goshawks may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands.

Alternative D

This alternative would have a much smaller affected area than Alternatives B, B1, and C because there is much less road construction and reconstruction on NFS lands and rights-of-way. The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance as well as a direct loss of potential habitat to the footprint of the project activities. Goshawks may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System land. Using the models recommended by Gaines et al., 10 acres of late successional forest non-winter habitat, 3 acres of late successional forest nonwinter security habitat, and 12 acres of late successional forest winter security habitat for this species would be impacted under this alternative. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The overall direct and indirect effects would be less than the other action alternatives.

Effects Common to All Action Alternatives

The construction and continued use of the boundary fence, access road to the water supply facility, water infiltration gallery, water augmentation facilities, and pipelines would disturb any goshawks using those areas. Goshawks, and their prey, would likely avoid using areas near the disturbance and would redistribute to areas away from the activities. The construction of these facilities would reduce potential goshawk habitat by 26 to 65 acres, depending on the alternative, including the ore and supply haul route. Not all of these acres would be mature forests potentially used for nesting, although much of it would be forested and would provide for a forest mosaic goshawks would use as foraging habitat. This would be a very small amount of the entire Buckhorn Block of National Forest System land or the entire watersheds.

Roads also create new microclimates on and adjacent to the road (Spellerberg 1998), and this may affect the suitability of the sites immediately adjacent to the road for habitat for small prey species. Forest roads can also reduce soil macroinvertebrate abundance and species richness near roadways (Haskell 1999), and these provide prey for amphibians and some ground foraging birds, which in turn provide prey for other species.

Cumulative Effects

The two HUC5s that this project overlaps were used for cumulative effects analysis. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous road building and timber harvest.

Past timber harvest has likely created more openings and reduced the amount of mature stands within the Buckhorn Block of NFS lands. Fire suppression has likely led to an increased stand density which may increase canopy closures and improve goshawk habitat, but it may also increase understories to the point that it is difficult for goshawks to forage. This project would not reduce mature stands by many acres, although it would substantially increase disturbance along the ore and supply haul routes. This disturbance would extend beyond the footprint of the road and may cause goshawks to utilize areas near the ore haul route less than they previously have. Recreationists could potentially disturb goshawks within this area, although the disturbance would likely be less concentrated than the ore and supply haul traffic. However, recreationists would be more likely to leave the roadway on foot than mine employees, so recreationists would increase their probability of encountering

a goshawk, although because of the substantial increase in traffic, recreationists aren't likely to use areas adjacent to the haul routes.

Based on the above analysis, the effects would not be significant.

Effects Determination Alternative A: No Impact.

Effects Determination Alternatives B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Other Migratory Birds

Affected Environment

Many species of neotropical migrants have suffered population declines since the late 1970's (Dobkin, no date).

On January 10, 2001, President Clinton signed an Executive Order (EO 13186) titled "Responsibilities of Federal Agencies to Protect Migratory Birds." The EO states that environmental analysis of Federal actions, required by NEPA or other established environmental review processes, evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.

Additional guidance comes from the Memorandum of Understanding (MOU) between USDA Forest Service and USDI Fish and Wildlife Service, signed January 17, 2001. The purpose of this MOU is to strengthen migratory bird conservation through enhanced collaboration between the Forest Service and Fish and Wildlife Service, in coordination with state, tribal and local governments. The MOU identifies specific activities for bird conservation, pursuant to EO 13186 including: Strive to protect, restore, enhance, and manage habitat of migratory birds, and prevent the further loss or degradation of remaining habitats on National Forest System lands. This includes: Identifying management practices that impact populations of high priority migratory bird species, including nesting, migration, or over-wintering habitats, on National Forest System lands, and developing management objectives or recommendations that avoid or minimize these impacts.

This project lies within the Partners in Flight Northern Rocky Mountains conservation planning region (PIF 2000). This conservation strategy is a set of recommendations to use in management, but they are not binding requirements. However, they provide a way to categorize and analyze important migratory bird habitat and focal species and determine project effects. The use of these plans supports the goal of maintaining long-term sustainability of migratory bird species and their habitats as specified by the EO and Migratory Bird Treaty Act (MBTA) of 1918.

Table III-61: Partners in Flight Priority Habitats and Focal Species for the Northern Rocky Mountains Region.

Partners in Flight Priority Habitats and Focal Species		
Habitat	**Habitat Feature**	**Focal Species**
Northern Rocky Mountains Region		
Coniferous forest		
Dry forest (ponderosa pine and ponderosa pine / Douglas-fir / grand fir	Large patches of old forest with large trees and snags	White-headed woodpecker
	Old forest with interspersed grassy openings and dense thickets	Flammulated owl
	Open understory with regenerating pines	Chipping sparrow
	Patches of burned old forest	Lewis's woodpecker
Coniferous forest		
Mesic mixed conifer (late-successional)	Large snags	Vaux's swift
	Overstory canopy closure	Townsend's warbler
	Structurally diverse, multi-layered	Varied thrush
	Dense shrub layer in forest openings or understory	MacGillivray's warbler
	Edges and openings created by wildfire	Olive-sided flycatcher
Riparian		
Riparian woodland	Large snags	Lewis's woodpecker
	Canopy foliage and structure	Red-eyed vireo
	Understory foliage and structure	Veery
Riparian shrub	Willow/alder shrub patches	Willow flycatcher
Unique habitats		
Subalpine forest		Hermit thrush
Montane meadows (wet/dry)		Upland sandpiper
Steppe shrublands		Vesper sparrow
Aspen		NA
Alpine		NA

Many of the priority habitats are present within the project area to varying degrees, although the older successional stages are not present in large quantities, particularly along the lower reaches of Marias Creek and Nicholson Creek. Riparian areas are common within the project area, primarily because the Marias and Nicholson ore and supply haul routes follow the roads near those creeks. Snags are present near the ore haul routes, although most have been removed by woodcutters due to the easy access. Some subalpine forests are found near the water infiltration gallery and Forest Road 3575-120. Scattered aspen and other deciduous trees can be found near the ore haul routes. A few wet meadows and/or ponds are present along Forest Roads 3575 and 3575-100. The lower reaches of Nicholson and Marias Creeks have open grassy/shrubby south-facing slopes. Along Forest Road 3575-140 near the top of Buckhorn Mountain is an open slope containing sagebrush and grasses. There are many areas along the proposed ore and supply haul routes that are dry and mesic, immature stands of forested habitat. Ponderosa pine is primarily found along the

lower sections of Nicholson Creek and is lacking elsewhere. Many man-made openings exist along the ore and supply haul routes and are in varying stages of regeneration.

Environmental Consequences

Alternative A

There would be no impacts to migratory or their habitat with this alternative. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

Many of the priority habitats are present within the project area to varying degrees, although the older successional stages are not present in large quantities, particularly along the lower reaches of Marias Creek. The priority habitats most likely to be impacted by the ore and supply haul route are the riparian habitats and RHCA, primarily because the route runs along Marias Creek for about 4.0 of its length (see the Aquatics section of this EIS). Along Marias Creek there would be 0.1 acres of wetlands impacted by the project (see the Hydrology section of this EIS).

The construction and reconstruction of the ore haul route would remove some available habitat within the footprint of these activities (36 acres). The largest impact would be from disturbance near the ore and supply haul route. There would be a substantial increase in traffic due to the ore haul, supply trucks, and employee vehicles. Any migratory birds breeding, nesting, or foraging near the roadway would potentially be disturbed by the increased noise and activity. This would cause some birds to avoid using these habitats or to breed or nest unsuccessfully in these areas near the roadway. Some birds may even be hit by the mine related traffic.

Roads are a common part of the US landscape, and it is estimated that the effect of these roadways extends beyond the footprint of these roads to include approximately 20% of the US landbase (Forman 2000). The impact of roadways is disproportionate to the physical area they occupy (Jackson no date).

Not only would the disturbance near the road potentially impact bird use, but the roadway clearing may inhibit movement across the opening (Develey et al 2001, Laurance et al. 2004). Forest dependent birds may be less likely to cross the road opening, and noisier openings may be an even larger deterrent. Birds may also not perceive the road and traffic as a danger and may be susceptible to mortality (St. Clair 2003). Roads can affect landscape configuration by altering mean patch size, edge density, and core area (McGarigal et al. 2001). Roads can fragment habitat more than clearcuts do by breaking larger patches into smaller patches and increasing edge (Reed et all. 1996, Tinker et al. 1998). Some birds may be attracted to the habitat created by this road edge (Helldin and Seiler 2003), although others would be forced away from it.

This fragmentation and resulting edges may be ecological traps for forest-interior birds, they increase the occurrence of the nest parasite brown-headed cowbird which is commonly found along forest edges, and road openings are avoided by some forest-interior species (Rich et al. 1994). Forest fragmentation may increase the susceptibility of birds to larger predators, because forest-interior birds and nests are typically predated upon by smaller

predators in unfragmented landscapes (Keyser et al. 1998). Traffic related mortality of adult birds may decrease nest success adjacent to busy highways (Kuitunen et al. 2003). Traffic noise may also affect breeding birds and reduce habitat use and nesting success near busy roads (Reijnan et al. 1997).

Woodland songbird use may decline when noise levels reach an average of 42 decibels (dB), and grassland birds may decline at average noise levels of 48 dB (Foreman and Alexander 1998). The increase in noise levels from construction of the ore and supply haul route, and the increase in traffic from ore haul, supplies, and employees would cause a substantial increase in ambient noise levels. Noise levels would be substantially above the 42 dB out to approximately 200 feet from the roadway, and it would still exceed 42 dB minimally even at a distance of 500 feet (Noise Resources section). Consequently, songbird use of habitat within 500 feet of the ore and supply haul route and employee access routes would likely decrease during the construction and operation of the mine. The impact zone for noise out to 500 feet from the ore and supply haul route would include roughly 760 acres of National Forest System land. Table III-62 displays by alternative the acres of migratory bird habitat on National Forest System lands impacted by noise. As noted in the effects common to all alternatives, under Alternative B1, numerous road closures would be implemented, improving migratory bird habitat in the Bear Trap Canyon area.

Table III-62: Migratory Bird Habitat on National Forest System Lands Impacted by Noise Under Each Action Alternative, Assuming a 500 Foot Buffer Along the Haul Route.

Action Alternative	National Forest acres impacted out to 500' from haul route
B and B1 – Marias Creek	760
C – Nicholson Cr	1250
D – Cow Camp	75

Forest roads can also reduce soil macroinvertebrate abundance and species richness near roadways (Haskell 1999), and these provide prey for some ground foraging birds.

Many snags near the open roadways have already been removed by firewood cutters, so this habitat component is likely lacking immediately adjacent to the ore haul routes. The new sections of road built for this alternative would not be open to the public, so the loss of snags due to firewood cutting is likely to be minor along these sections, although losses would likely occur after the road is open to the public at the end of mining. The construction of these sections of roadway would remove any snags within the footprint of the roadway. Some of the snags that do exist near the currently open roads would be lost during the reconstruction and widening of these roads to accommodate the substantial increase in traffic. The loss of these snags would be mitigated by the creation of new snags within the riparian areas. Thus, the loss of the snags within the 57 acres of disturbance of this project would not likely affect the overall snag densities within the entire 30,353 acre Buckhorn Block of National Forest System lands or within the larger watersheds.

The speed limit would be 30 mph, and consequently the probability of road kill would be higher than for the other action alternatives.

The primary effect would be a reduction in functional habitat along the roadway due to increased disturbance. Migratory birds may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System

lands. The construction of the haul route and other project components would result in a direct loss of up to 57 acres of various kinds of forested habitat. Additionally, there would likely be at least a small amount of mortality related to collisions with vehicles, as well as some failed nesting attempt near the roadway. These impacts would likely continue for the life of the mine, and then impacts related to the haul routes would diminish to levels somewhat above current conditions. The increased disturbance and the small amount of direct habitat loss would result in some nest failures. The increased traffic would also result in some mortality due to collisions, although this should be minimal due to the relatively low speeds. Most of the effects would be in areas already affected by roads, such as along the ore and supply haul route that uses existing Forest Road 3550. This project would increase those impacts along that section of roadway, as well as create some newly impacted areas with the short segments of new road construction on National Forest System lands. The area directly impacted by this project would be small when analyzed at the scale of the HUC 5 watershed, although the impacts would be locally intense.

Alternative B1

The effects would be similar to Alternative B, particularly concerning disturbance and habitat loss to migratory birds. The primary difference would be the reduced speed limit which would reduce the potential for road kill and the road closures in Bear Trap Canyon.

The difference in the number of road kills between 25 and 30 mph may be slight for many species. However, even a 5 mph change in speeds in this low range can result in increased mortality for small species such as birds. One review (Erritzoe et al. 2003) found that collisions with birds were rare at speeds <25 mph, while most road kills occurred at speeds >35 mph. Although, they also found that “many bird traffic casualties” occurred in some places where speed limits were near 30 mph, such as cities (Erritzoe et al. 2003). The difference between 25 and 30 mph is likely to have varied effects to mortality among different species and likely varies between different habitat types.

Alternative C

The effects would be similar to those of Alternatives B. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. Habitat along the Nicholson Creek ore and supply haul route is similar to the other alternatives. There is more ponderosa pine habitat impacted by this ore and supply haul route along the lower reaches of Nicholson Creek than with the other alternatives. Additionally, this ore haul route goes past the Frog Pond and a wet meadow, and therefore disturbance to birds using these habitats is likely to increase. The area affected is larger than Alternatives B and B1, because the ore and supply haul route is over 6 miles longer across National Forest System lands and rights-of-ways. This alternative would impact 0.2 acres of wetlands (see the Hydrology section in this EIS). There would be 2.6 miles of the proposed ore haul route within the RHCAs (see the Aquatics section of this EIS). Additional shrubby, deciduous areas along the roadway would be impacted by this alternative.

More subalpine fir would be impacted than under the other alternatives because of the subalpine fir found in the vicinity of the 3575-120 road near the infiltration gallery, the 3575-100, and 3575-150 roads. Migratory birds near the ore haul route would be disturbed and may utilize these areas less than under current conditions. The reduced habitat effectiveness of the areas near the roadway would cause birds to redistribute to other habitats.

The area affected is larger than Alternatives B and B1 because the ore haul route is over 6 miles longer across National Forest System land and rights-of-ways (13.0 miles total). The impact zone for noise out to 500 feet from the ore haul route would include roughly 1,250 acres of National Forest System lands.

The primary effect would be a reduction in functional habitat along the roadway due to increased disturbance. Migratory birds may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. The construction of the haul route and other project components would result in a direct loss of up to 65 acres of various kinds of forested habitat. Additionally, there would likely be at least a small amount of mortality related to collisions with vehicles, as well as some failed nesting attempt near the roadway. These impacts would likely continue for the life of the mine, and then impacts related to the haul routes would diminish to levels somewhat above current conditions. The increased disturbance and the small amount of direct habitat loss would result in some nest failures. The increased traffic would also result in some mortality due to collisions, although this should be minimal due to the relatively low speeds. Most of the effects would be in areas already affected by roads, such as along the ore and supply haul route that uses existing Forest Road 3550. This project would increase those impacts along that section of roadway, as well as create some newly impacted areas with the short segments of new road construction on National Forest System lands. The area directly impacted by this project would be small when analyzed at the scale of the HUC 5 watershed, although the impacts would be locally concentrated.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. The impact zone for noise out to 500 feet from the ore haul route would include roughly 75 acres of National Forest System land.

The primary effect would be a reduction in functional habitat along the roadway due to increased disturbance. Migratory birds may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System land. The construction of the haul and supply route and other project components would result in a direct loss of up to 26 acres of various kinds of forested habitat. Additionally, there would likely be at least a small amount of mortality related to collisions with vehicles, as well as some failed nesting attempts near the roadway. These impacts would likely continue for the life of the mine, and then impacts related to the haul routes would diminish to levels somewhat above current conditions. No wetlands or RHCAs would be affected by this alternative (see Hydrology and Aquatics sections in this document).

The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B.

The overall direct and indirect effects of this alternative would be less than the other action alternatives. The increased disturbance and the small amount of direct habitat loss would result in some nest failures. The increased traffic would also result in some mortality due to collisions, although this should be minimal due to the relatively low speeds. Most of the effects of this alternative would be in areas already affected by roads. This project would increase those impacts, as well as create some newly impacted areas with the short segments of new road construction on National Forest System lands. The area directly

impacted by this project would be small when analyzed at the scale of the HUC 5 watershed, although the impacts would be locally concentrated.

Effects Common to All Action Alternatives

The increased traffic along Forest Road 3575-140 road accessing the water storage facility would increase the probability of disturbance to migratory birds along that roadway. However, this road would only be used once every 1-2 weeks for maintenance, so disturbance would be minimal. Because the disturbance would be intermittent, there would be a higher likelihood that birds would try the nest near the road and would potentially abandon the nest when the disturbance does occur. Along the ore and supply haul route, the disturbance would be nearly continuous and birds would be less likely to establish a nest in the first place. The construction and continued use of the water infiltration gallery and pipeline would additionally create disturbance, and it would reduce habitat within the footprint of these facilities (6 acres). Migratory birds are sensitive to habitat fragmentation because it increases edge and reduces available habitat for forest-interior species, and the construction of the conveyance pipeline road and the new sections of ore haul route would fragment forested habitat.

Roads also create new microclimates on and adjacent to the road (Spellerberg 1998), and this may affect the suitability of the sites immediately adjacent to the road for habitat for small prey species. Forest roads can also reduce soil macroinvertebrate abundance and species richness near roadways (Haskell 1999), and these provide prey for amphibians and some ground foraging birds, which in turn provide prey for other species.

Cumulative Effects

The area analyzed for cumulative effects for migratory birds included the Buckhorn Block of NFS lands as well as the surrounding land ownerships. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous road building and timber harvest.

Timber harvest has likely led to altered vegetation patterns and stand structures across this block of NFS lands. Additionally, fire suppression has altered stand characteristics by allowing denser stands to develop. This has led to the loss of habitat for some species and the creation of habitat for others. Past road building has increased forest fragmentation and disturbance. This project would not substantially alter road densities or increase forest fragmentation, although there would be a substantial increase in disturbance along the roadway due to the increased traffic volumes. This project would increase the probability of road mortality for migratory birds, although the speed limits along the haul route would be relatively low (25-30 mph). The project would cause the removal of snags during road construction, although this loss would be mitigated by the creation of 3.5 times as many snags as the number of acres of NFS lands cleared. Wetlands, springs and seeps would be impacted due to the lowered water table caused by the Buckhorn Mine activity on private lands and may have diminished flows. Some of this would be mitigated by pumping treated water from the mine site to the infiltration gallery and water augmentation sites, depending on the site and time of year (see Hydrology cumulative effect section).

The Little Nicky timber sale on State lands would impact migratory bird habitat by reducing habitat for those species preferring denser stands and improving habitat for those species preferring more open conditions. Habitat was also lost when approximately one mile of new

road was constructed for this project. Activities such as this would also increase disturbance, although this project is likely to be completed prior to commencement of construction of the ore haul route in Alternative C. The mine itself would increase disturbance to migratory birds on 25 acres of forested habitat to be cleared, as well as 19 acres of grass/conifer seedling revegetated area (Washington State Department of Ecology 2006, p. S-16).

Cumulatively this may not lead to large population declines, although it may cause individuals to utilize different habitats within the Buckhorn Block of NFS and adjacent land ownerships.

Based on the above analysis, the effects would not be significant.

Effects Determination Alternative A: No Impact.

Effects Determination Alternative B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Other Raptors

Affected Environment

Other raptors that may be seasonally present or resident in or near the Tonasket Ranger District include: osprey, northern harrier, sharp-shinned hawk, Cooper's hawk, Swainson's hawk, red-tailed hawk, ferruginous hawk, rough-legged hawk, golden eagle, American kestrel, merlin, prairie falcon, long-eared owl, short-eared owl, great horned owl, northern saw-whet owl, flammulated owl, western screech owl, and northern pygmy owl.

Raptors, in addition to northern goshawks, that are most likely to use the project area include: red-tailed hawk, golden eagles, kestrels, Cooper's hawks, sharp-shinned hawks, and most of the owl species (NatureServe 2005).

Raptors use a variety of habitats in the project area varying from open, grassy slopes to multi-story mature forest stands. Prey varies from small birds, small mammals, reptiles, insects, amphibians, and fish depending on the raptor species, age, and prey availability.

Environmental Consequences

Alternative A

There would be no impacts to raptors or their habitat with this alternative. There would be no road construction or improvement, no ore haul, or any activities that would result in habitat loss or disturbance.

Alternative B

The construction and reconstruction of the ore and supply haul route would remove some available habitat within the footprint of these activities (36 acres). The largest impact would be from disturbance near the ore and supply haul route. There would be a substantial increase in traffic due to the ore haul, supply trucks, and employee vehicles. Any raptors breeding, nesting, or foraging near the roadway would potentially be disturbed by the increased noise and activity. This would cause some raptors to avoid using areas near the

disturbance and redistribute their habitat use elsewhere. Similar effects to prey species would also cause raptors to utilize habitat near the roadway less than they would currently. Some birds may even be hit by the mine related traffic. The probabilities of road kill at the speed limit of 30 mph is not as great as the likelihood that raptors would be disturbed by traffic and therefore utilize habitats near the roadway less than they currently do. Prey for raptors (small mammals, amphibians, reptiles, and birds) are more likely to be killed by vehicles on the haul route, and these prey species may also begin to utilize the areas near the roadway less than they do currently due to the increased disturbance. This would impact the distribution of available prey for raptors increasing the likelihood that raptors would move away from these haul routes.

Biodiversity can be negatively affected by roads (Gucinski et al. 2000). Trombulak and Frissell (2000) identified seven general ecological effects of roads: mortality from road construction, mortality from vehicle collisions, modification of animal behavior, alteration of the physical environment, alteration of the chemical environment, spread of exotics, and increased use of the area by humans. All of these may not occur directly to raptors, but these effects may occur to the food chain that raptors rely on.

Noise and disturbance can have varying effects on raptors. Some will nest successfully near noise and human activity, while other individuals of the same or different species may not (Lehman et al. 1999). Traffic has been found to have varying effects on raptors. As traffic increases, raptor use of areas near roadways may decrease for some species (Bautista et al. 2004).

Depending on the mobility and habits of a prey species, higher mortality may be experienced along roadways in amphibians and reptiles (Car and Fahrig 2004, Joslin and Youmans 1999). Road related mortality may not limit populations of common species, particularly species of rodents, but even the mortality associated with forest roads can depress the populations of some snakes (Rudolph et al. no date). Road width may fragment habitat and limit movement of some smaller species of mammals, reptiles, and amphibians, and road salt may limit movements of amphibians (Foreman and Alexander 1998, Jochimsen et al 2004). Roads have differing barrier effects on small mammals (McDonald and St. Clair 2004) and this probably depends on road width and traffic volume, so although the substantial increase in road traffic along the haul route is not as consequential as a major highway, it would still possibly alter movement patterns of small animals. The haul route is not likely to be a complete barrier, but is more likely to be a semi-permeable one. Roads also create new microclimates on and adjacent to the road (Spellerberg 1998), and this may affect the suitability of the sites immediately adjacent to the road for habitat for small prey species. Forest roads can also reduce soil macroinvertebrate abundance and species richness near roadways (Haskell 1999), and these provide prey for amphibians and some ground foraging birds, which in turn provide prey for other species such as raptors.

Many snags near the open roadways have been removed by firewood cutters, so this habitat component is likely already lacking immediately adjacent to the ore haul routes. Snags and downed wood provide important habitats for many raptor prey species. The new sections of road built would not be open to the public during operations, so the loss of snags due to firewood cutting is likely to be minor along these sections, although once they are opened after mine activities cease, it's likely snags would be lost along these sections of road. The construction of these sections of roadway would remove any snags within the footprint of the roadway. Some of the snags that do exist near the currently open roads would be lost during the reconstruction and widening of these roads to accommodate the substantial increase in

traffic. The overall ground disturbance would be 57 acres. Snag loss would be mitigated by the creation of snags within riparian areas. However, the loss of snags on these 57 acres would be very small when compared to the overall snag densities of the entire Buckhorn Block of National Forest System lands or the larger watersheds. The mitigation by creating 3.5 times as many snags as the number of acres of NFS lands cleared would more than compensate for the loss of snags. These snags would be created in areas away from the ore haul route in order to reduce the effects of disturbance from the ore haul trucks on these new snags. This would enhance their value as mitigation.

The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance. There would also be a direct loss of habitat under the footprint of the activities in the project, and even a small risk of collisions with mine related traffic. Raptors may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands.

Alternative B1

The effects would be similar to Alternative B. Ore and supply haul, plus employee traffic, would substantially increase traffic along the haul route, although all ore trucks, both unloaded and loaded, and most supply trucks, would be limited to 6:00 a.m. to 6:00 p.m. only. This would limit the impact on raptors, particularly owls, from dusk until dawn. Even the diurnal raptors would have fewer hours of daytime disturbance than under Alternative B. The speed limit would be 25 mph minimizing the potential for vehicle collisions with these species.

Alternative C

The effects would be similar to those of Alternative B. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. Habitat along the Nicholson Creek ore haul route is similar to the other alternatives. Employee traffic would potentially increase not just along the haul route, but also along all other open roads leading to the mine site, except in winter when only the ore haul route would be plowed, although the proponent could request to plow Forest Road 3575-120 if enough employees need to access the mine from the south. Raptors near the ore haul route would be disturbed and may utilize these areas less than under current conditions. Raptor prey species would also be disturbed or even killed by the dramatic increase in traffic along the ore and supply haul route.

The area affected is larger than Alternatives B and B1 because the ore and supply haul route is over 6 miles longer across National Forest System land and rights-of-way (13.0 miles total).

The overall effect would be a reduction in functional habitat along the roadway due to increased disturbance. There would also be a direct loss of habitat under the footprint of the activities in the project, and small risk of collisions with mine related traffic. Raptors may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands.

Alternative D

This alternative would have a much smaller affected area on NFS lands and rights-of-way than Alternatives B, B1, and C. The overall effect would be a reduction in functional habitat

along the roadway due to increased disturbance. There would also be a direct loss of habitat under the footprint of the activities in the project, and even a small risk of collisions with mine related traffic. Raptors may avoid use of the habitat adjacent to the roadway and redistribute to habitat elsewhere within the Buckhorn Block of National Forest System lands. The speed limit would be 25 mph and would have a lower likelihood of road kill than Alternative B. The overall direct and indirect effects would be less than the other action alternatives.

Effects Common to All Action Alternatives

The construction and continued use of the boundary fence, access road to the water supply facility, water infiltration gallery and pipeline, and water augmentation facilities would disturb any raptors or their prey using those areas. Raptors, and their prey, would likely avoid using areas near the disturbance and would redistribute to areas away from the activities. Additionally, the construction of the new sites would remove potential raptor habitat and habitat for their prey. Between 26 and 65 acres of habitat would be lost, depending on the alternative, to the construction of the new sites.

Cumulative Effects

The two HUC5s that this project overlaps were used for cumulative effects analysis. The time period examined included the entire life of mine activities (13-15 years), as well as into the past to cover such activities as previous road building and timber harvest.

Timber harvest has likely altered stand structures within the Buckhorn Block of NFS lands, which would favor some species and reduce habitat for others. Additionally, fire suppression has led to encroachment of conifers into openings and the development of denser stands. Depending on the habitat requirements of a particular species, this may be favorable or unfavorable. Increased road densities have likely increased disturbance to raptors such as through increased recreational activities due to the roads.

The mining activity on private lands would increase disturbance during the life of the Buckhorn Mine, and this disturbance would be spread throughout the day and night due to the 24 hour operational schedule. Both diurnal and nocturnal raptors would be impacted. Raptors may avoid areas near mine facilities.

This project would substantially increase traffic along the ore and supply haul routes and would therefore increase disturbance to raptors, although this disturbance would primarily effect raptors active during the day, at dawn, and at dusk because of the roughly 12 hour haul schedule. There would be an increased risk of mortality related to vehicles, although this would be low due to the relatively slow speed limits (25-30mph). This project would not directly remove many acres of raptor habitat due to the small footprint of the activities, although the disturbance from traffic noise would extend beyond the roadway.

Rock was excavated from private lands near the base of the Pontiac Ridge road for use on Forest Roads 3575-120 and 3575-140 for supply traffic during the construction of the mine site. Rock would also be excavated at the Beal borrow site for use during construction on the ore haul route and for mine backfill. This rock would be used on National Forest System lands. This area is open habitat, and those raptors that use the area would be disturbed by the activities on private land. This would cause raptors to avoid this area. Additionally, the activity would disturb raptor prey species such as small mammals and birds, causing them to avoid the area. The activity on private land wouldn't remove habitat for either prey species

and raptors.

This project would not likely result in noticeable population declines for raptors, although it may cause individuals to avoid habitat near the roadway due to the disturbance.

Based on the above analysis, the effects would not be significant.

Effects Determination Alternative A: No Impact.

Effects Determination Alternatives B, B1, C, and D: May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.

Forest Vegetation

The section below summarizes the affected environment information, along with the direct, indirect and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Forest Vegetation Report, by District Silviculturist Paul Nash dated January 8, 2007 in the analysis file. Additional information can be found in the Toroda Watershed Assessment (2004) in the analysis file.

AFFECTED ENVIRONMENT

The vast majority of stands along the proposed routes are currently forested, with mature trees, although previous selective harvest has occurred within many of these stands. No Forest Plan old-growth is found within or directly adjacent to the potential haul routes or other activities requiring tree removal on NFS lands. A portion of the Nicholson Creek road rights-of-way (Alternative C) has received shelterwood harvest treatment in the recent past and would be considered partially stocked with mature trees.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

Most of the effects to vegetation from the proposed road construction and reconstruction for any of the action alternatives would be limited to the road clearing area. Approximately 37, 53, and 15[91] acres of forestland would be converted to nonproductive land for the foreseeable future in Alternatives B/B1, C and D, respectively from road construction and reconstruction and construction of the infiltration gallery. Although only the infiltration gallery (6 acres) is planned to be reclaimed with trees, long-term, vegetation including trees could be re-established on roads, although productivity is likely to be reduced. However, full road reclamation is not planned because the Marias road would continue to be used. It is estimated that the volume of timber to be removed during road construction/reconstruction and infiltration gallery and pipeline construction would be about 370, 265 and 225 thousand board feet in Alternatives B/B1, C and D respectively, and only the infiltration gallery would

[91] Acres differ from those presented in WADOEs FSEIS (2006) because the proponent provided new information about road clearing limits which increased the acres of disturbance. They do not include 5 of the 6 acres of disturbance for the infiltration gallery and pipeline since little vegetation is found in these footprints. Slightly less land would be returned to production in Alternative B than B1 because of more extensive reclamation in B1.

be brought into productive forestland post project (volumes per acre to be removed are highest in Alternative D, followed by Alternatives B/B1, then C). Although trees would be cleared within the RHCAs, this is not "timber harvest" within the meaning of INFISH standards and guideline TM-1. INFISH clearly recognizes that road construction may occur within RHCAs (RF-2), and clearing of trees is necessary in order to construct roads.

Salt compounds would be used for dust control, and road runoff from ditch relief culverts may reduce vegetation growth and vigor, or result in some mortality of plants between the ditch relief culvert and sediment control structures and creeks, but these effects would be minimal in relation to all unimpacted vegetation between the roads and creeks. Dust abatement activities are expected to minimize dust accumulation on leaf surfaces. Although plant growth and vigor are likely to be affected by dust, based on local observations it is not likely that mortality in trees or shrubs would result (see botany effects below).

The effects of well, staff gauges, and piezometers and pipelines would result in the removal of existing vegetation, where it has not already been removed by previous activity, but vegetation would return within 1-3 years after operations are completed. In each of the alternatives, wells, staff gauges, and piezometers would result in tree removal on approximately 2 acres with a volume of about 20 thousand board feet, respectively.

Based on interpretation of satellite imagery (Utah State University, 1997 – Size Class and Pacific Meridian Resources, 1994 – Size Class), each of the proposed routes pass through some patches and groves of trees that are of late and old structure. However, none of these stands are large enough to meet the 30-acre criteria for Forest Plan Old Growth.[92] Field verification of these stands indicated that they also lacked some of the required components for Forest Plan old-growth.

Prime forest land, which is defined by the ability to produce at least 85 cubic feet of growth per year per acre, is very rare on the Okanogan National Forest. According to satellite imagery (Utah State University - 1997– Plant Association Group Classification), no stands of prime forestland would be affected by this project.[93]

Cumulative Effects

This cumulative effects analysis considers effects on forest vegetation in the Buckhorn Block of the National Forest for the life of the mine, plus 3-5 years of reclamation. As noted above, stand structure adjacent to the haul routes and facilities is primarily mature. According to the Toroda Watershed Assessment (USDA, 2004), which assesses the current vegetation conditions in the watershed, including the effects of all past actions, most of the Marias and Nicholson Creek routes (Forest Roads 3550 and 3575 respectively) are located in the Warm-Dry biophysical environment. Information on individual treatments for each of the past timber sales is not relevant to this decision because no vegetation management treatments are proposed, and timber within the rights-of-way for road construction and reconstruction, plus other facilities would be cleared. Fire suppression has allowed untreated stands to have fuel levels above the historic range of variability. Stands treated within the past 20 years through timber harvest and/or prescribed fire probably have fuel levels within historic range of variability. The Cow Camp route (Forest Road 3575-120) is generally in the Cool-Mesic

[92] Okanogan LRMP, Glossary – page 33
[93] Productivity Class Based Upon Plant Association (Williams and Lillybridge, 1983) - Okanogan National Forest TRACS Database Direction, Enclosure 4, October 16, 1995

biophysical environment, and fuel loads in stands treated within the past 50 years through timber harvest and/or prescribed fire are likely near the average of the historical range, while untreated stands are probably on the high end of the historic range. The Buckhorn Access Project would not effect fuel levels in the project area because activity fuels would be treated.

The new road that would be constructed for ore haul from Marias Creek across State lands may lead to future timber sales on State lands due to improved access, although none are planned at this time and therefore are not reasonably foreseeable. These potential future timber sales would may alter forested habitat from denser to more open stands.

Overall stand structure would also remain the same in the Buckhorn Block, however as noted above, approximately 39, 55 and 17 acres of forestland would be cleared for project activities on NFS lands under Alternatives B/B1, C and D, respectively. Cumulatively, 40 acres of clearing would occur at the mine site, with an additional 18 acres of clearing for haul and access road construction on DNR and private lands[94], so cumulative losses of forestland from the project within the Buckhorn Block are 97, 113 and 75 acres respectively. No ongoing or future activities that might affect stand structure on National Forest System lands are planned, so no cumulative effects from future actions are expected. The Little Nicky Timber Sale is currently operating on State Department of Natural Resources with a planned 232 acres of forestland harvest north of the Nicholson Creek route and would change habitat to more open stands. Although this harvest won't impact any lands within the Buckhorn Block, the harvest would occur directly adjacent to the block, and log haul would be down the Nicholson Creek road which would add to dust effects along the lower Nicholson Road in Alternative C. It's not likely that the added dust or salt would even be noticeable or result in any additional tree or shrub death over the effects of ore haul on the Nicholson Road under Alternative C. It's also likely that Little Nicky haul would be completed prior to commencement of construction under Alternative C.

Botany

The section below summarizes the affected environment information, along with the direct, indirect and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Botany Reports and Biological Evaluation, by District Botanist Larry Loftis dated December 1, 2006 in the analysis file. Additional information regarding field surveys is also located in the analysis file.

AFFECTED ENVIRONMENT

Threatened, Endangered, Proposed, and Sensitive Plants

No populations of threatened, endangered, or proposed species were found on National Forest lands near proposed activities. Likewise no populations are known nearby.

Populations of sensitive species occur in and in the vicinity of the analysis area. A grape fern, *Botrychium crenulatum*, population is known. *Platanthera obtusata*, a small orchid is also known to occur by streams and in wetlands. *Talinum sediforme* populations occur in the vicinity, although not close to the mine access roads or other activities on NFS lands.

[94] WADOE FSEIS, 2006, page 2-3.

Eight species of fungi on the Regional Forester's sensitive species list occur on the Okanogan National Forest, with some potential to occur on Tonasket Ranger District. None of these eight are known to occur on the east side of Tonasket Ranger District. Distribution maps show all eight to occur farther west toward the Cascade Mountains (BLM and USDA FS Interagency Special Status and Sensitive Species Program, species distribution maps [Online]) (Castellano et al., 2003, 1999). None of the eight species were found during field surveys in 2005. Their known range is west of the analysis area.

Other Species

Small populations of the cultural plants Serviceberry (*Amelanchier alnifolia*), Spring beauty (*Claytonia lanceolata*), Chokecherry (*Prunus virginiana*), Russet buffaloberry (*Shepherdia canadensis*), and big huckleberry (*Vaccinium membranaceum*) were noted. The lichen *Bryoria* occurs commonly in trees in the analysis area. These species are of interest to local Indian tribes (Dumas, pers. comm.) (Turner 1997).

A population of *Scutellaria angustifolia* ssp. *micrantha* was found in the Marias Creek drainage. This species is on the Washington Natural Heritage Program review group 1 list. Two populations of the moss *Hedwigia ciliata* were also found in Marias Creek drainage. A population of another moss, *Helodium blandowii* was found in Nicholson Creek. Both mosses are on the Washington Natural Heritage Program working group list. Information on the extent of these species in Washington is limited, especially for the mosses. For now all three species are considered uncommon in Washington and therefore of interest to the Washington Natural Heritage Program.

ENVIRONMENTAL CONSEQUENCES

Alternative A: No Action

Direct and Indirect Effects

Threatened, Endangered, Proposed, and Sensitive Plants

Since there would be no activities, no direct effect is expected on sensitive plants. Likewise, no indirect effect is expected for sensitive species.

Other Species

Since no activities would occur there would be no direct impact to cultural plants in the analysis area. Likewise no indirect impact is foreseen for these species.

Cumulative Effects

The boundary for cumulative impacts considered for this analysis is to within 1/2 mile of the roads and other ancillary activities of the project. The time considered for cumulative impacts is to 15 years in the future. This project would not occur under this alternative so no cumulative effects would occur. Reclamation of the project site from impacts of previous exploration and development activities would being as soon as feasible as described in previous NEPA documents.

Threatened, Endangered, Proposed, and Sensitive Plants

Since there would be no ground disturbance with no action, no cumulative impact would occur with other actions to sensitive species or their habitat.

Other Species

With no ground disturbance, no cumulative impacts are expected for cultural plants or species of concern.

All Action Alternatives

Direct and Indirect Effects

Threatened, Endangered, Proposed, and Sensitive Plants

None of the populations of *Talinum sediforme* known in the vicinity are close enough to proposed activities to be directly impacted. Dust from hauling on the roads in the area is unlikely to reach the populations, especially as dust control would be applied to roads. No other indirect impacts are expected.

Because the eight species of fungi are not found or expected in the project area, no direct or indirect impact is expected to these species.

No populations of sensitive plants were found in the area proposed for road construction from the mine site to Forest Road 3575-120, so no direct impacts to sensitive plants are expected from this road. This proposed road is far enough away from known populations of sensitive plants that indirect impact from dust settling on sensitive species is unlikely. Dust abatement treatments are also proposed on roads to help control dust.

The water from mine dewatering, ore or development rock stockpiles would be treated, and along with water captured from areas that do not come in contact with mine facilities would be reused in mining or infiltrated or augmented on NFS or private lands. The pipeline and infiltration gallery would not be placed on sensitive plant populations. Therefore no direct or indirect impacts would come from this activity.

The location of the proposed enclosure fence is not on or near known sensitive plant populations. Therefore construction of the fence would not directly or indirectly impact sensitive plants.

Vehicles associated with mine activities, e.g. trucks, would occasionally drip minor amounts of fluids, e.g. antifreeze and petroleum products, on the roadway. These fluids would be subject to biodegradation by microbes and therefore would gradually break down (Boopathy 2004) (Chaîneau, et al. 1999) (McVicker, et al. 1998) (Widrig and Manning, 1995) (Klecka et al., 1993) (McGahey and Bouwer, 1992) (Leahy and Colwell, 1990). Therefore only tiny amounts would be expected to escape into streams that have sensitive plant habitat. The amount would be so small that no impact would be expected.

Access is needed to monitoring wells. During the winter, depending on the alternative, access may be by snowmobile or by plowing the road so that wheeled vehicles can drive to the wells. Water monitoring could continue for a long time, possibly as much as 60 years.

No direct impact to sensitive plant populations or habitat would occur from this activity or from the construction of the new monitoring well, staff gauges and piezometers. If noxious weed seeds were brought in on vehicles, weeds could establish in the analysis area. If weed populations spread into sensitive plant habitat there would be a chance of indirect impact from competition. Efforts would be made to control noxious weeds (see noxious weeds section) so impact, if any, would be small.

No sensitive plants were found during surveys where fish passage culverts are proposed for construction in Marias and Nicholson Creek. Therefore no direct or indirect impact is anticipated from culvert replacement.

Guzzlers for wildlife are proposed for installation on Forest Service land near Buckhorn Mountain. Installation is to be on previously disturbed areas that are noxious weed free. No direct or indirect impact to sensitive plants is expected from the guzzlers.

No sensitive plants were found along the proposed livestock fences, including where they cross creeks. Therefore, there would be no direct or indirect impact to a population from fence construction.

Water augmentation would occur in the headwaters of Marias and Nicholson Creeks. The augmentation would piped to the Roosevelt Adit and a stock water trough in upper Marias Creek. The water would come from dewatering the mine, ore and development rock stockpiles and surface water captured on the mine site in the storm water control system and would be required to meet State water quality standards set by the NPDES permit. This extra water would help ameliorate the impacts of any drop in the water table from mine dewatering on wetland species such as *Platanthera obtusata*, although some impact would still be possible because infiltration and augmentation would offset impacts of mine dewatering on private lands at certain times of the year and over the life of the mine. The trough would be installed on dry ground to avoid impacting sensitive plant habitat. Runoff would be piped into the wetland.

Chloride levels from the infiltration water would increase (see hydrology section of this FEIS). This chloride would be available to move through the soil along the creeks and wetlands. There might be some indirect impact on *Platanthera obtusata* plants growing next to the creek, primarily in the headwaters because this water would not yet be diluted by the creek. It is estimated that as many as five plants could be impacted by decreased growth or mortality.

Other Species

Dust may settle on vegetation adjacent to roads. There is evidence that dust can impact plants, e.g. by blocking stomata and increasing absorption of infrared radiation (Auerbach et al 1997) (Farmer 1993). To control dust on roads, road surfaces would be treated with either water and magnesium chloride, or lignin sulfonate. The dust suppression agents would keep impacts from dust minimal.

Application of magnesium chloride, which is a salt, on roads may impact vegetation adjacent to the road. Some impacts may occur up to 25 feet from the road, depending on how sensitive the species are to salt (Bolander 1999). The salts may also dissolve and enter creeks, although once in the creek the salt would be diluted (see Hydrology section). Vegetation next to the channel may receive some indirect impact depending on how

sensitive the species are. For example alder (*Alnus* spp.) can be sensitive to salt, however red osier dogwood (*Cornus stolonifera*) is relatively tolerant (Renault et al 2001) (Bolander 1999).

Lignin sulfonate may be used as an alternate material for dust suppression. Lignin sulfonate is a byproduct of paper production derived from naturally occurring lignin in wood; it binds soil surface particles together. Lignin sulfonate is used as an ingredient in some fertilizers, e.g. as a chelating agent (Alvarez and Rico 2003) (Goos et al 2000) (Rico et al 1996) (Salardini and Murphy 1978) (Tracite® Copper 6% fertilizer label). It is also being studied for use in soil to promote the interaction of ectomycorrhizal fungi with conifer seedlings (Niemi et al 2005). It is thus unlikely to be harmful to vegetation unless sprayed directly onto plants, which is not planned.

There may be direct impact to vegetation adjacent to the roadside if lignin sulfonate is splashed onto plants during application, e.g. from plugging the stomata. The material is water soluble so a storm could dissolve it into runoff. Most would be kept away from streams by relief culvers or captured by straw bales before it got to a stream. Lignin that entered a stream would be unlikely to reach the roots of riparian vegetation, as it would tend to be tied up in the soil. However in a big storm, enough lignin might be carried into a creek to coat some low growing vegetation adjacent to the channel, plugging stomates.

Once in the soil lignin sulfonate is subject to degradation by microorganisms, primarily white rot fungi (Cullen and Kersten 2004) (Mai et al 2004) (Hernandez-Perez et al 1999) (Shin and Lee 1999) (Marzullo et al 1995) (Gold and Alic 1993). Since it is broken down by microorganisms, any material that escapes from the road would not be expected to persist.

Alternative B

Direct and Indirect Effects

Threatened, Endangered, and Proposed Plants

No threatened, endangered, or proposed plant species were found on National Forest System lands near proposed activities. Likewise no populations are known nearby. Suitable pond habitat for *Howellia aquatilis* does not occur along or near the proposed road access route.

From about the road junction between Forest Roads 3550 and 3550-125 the access road is too high in elevation (above 3500 feet) to be considered good habitat for *Spiranthes diluvialis* (USDI Fish and Wildlife Service, 1998) (USDA Forest Service, 1998). The species was not found along the proposed access road. The portion of Marias Creek below 3,500 feet at or near to the proposed widening of Forest Roads 3550 has considerable canopy coverage, and does not appear to be suitable habitat for *S. diluvialis*.

Since neither *H. aquatilis* nor *S. diluvialis* were found, there should be no direct effect for these species. Likewise no indirect effect would be expected, as suitable habitat for these species is not present.

Sensitive Plants

A population of *Platanthera obtusata* occurs on Marias Creek near but not inside the area proposed for road widening. Therefore there should be no direct impact to *P. obtusata*. Because of proximity to the construction, the population may be indirectly impacted from dust because of the large number of vehicles traveling on the road. There is evidence that dust can impact plants, e.g. by blocking stomata and increasing absorption of infrared radiation (Auerbach et al 1997) (Farmer 1993). As described above it is proposed to treat the road surface to control dust, using either water and magnesium chloride, or lignin sulfonate. The road surface treatment and the population's location in the trees should control dust and therefore keep dust low enough to not impact the plants. The application of dust suppression agents is expected to keep indirect impacts from dust essentially nonexistent.

Magnesium chloride and water may be used for dust abatement. The *P. obtusata* population is far enough from the road that no direct impact from application of salts is expected. Application to the road would make these salts available to dissolve and move into Marias Creek. Precipitation would dissolve the salts and eventually allow them to enter the stream. As noted above, once these salts enter the stream they would be much diluted (see also the Hydrology section previously in this chapter). Salts are known to impact certain plants, e.g. by reducing seed germination and plant growth (Kobayashi et al., 2004) (Joutti et al 2003) (Robidoux and Delisle 2001). Although *P. obtusata* is not mentioned in these journal articles, for the sake of this analysis it will be assumed that some impact may occur, especially if a large storm occurred.

The population of *Platanthera obtusata* on Marias Creek is far enough from the road that no direct impact from lignin sulfonate can occur. There are some plants close to the edge of the creek. The road would be insloped to a ditch, which would divert water through sediment control structures and ditch relief culverts, which might result in some lignin sulfonate being deposited on the plants next to the creek channel. Indirect impact could occur to these plants from lignin washing down the creek and plugging stomata, reducing plant growth.

Sediment is not likely to impact the *P. obtusata* population because relief culverts, lining ditches with wattles or straw bales, seeding of ditches and road banks, and silt fences backed by straw bales at relief culverts are proposed. This should effectively limit sedimentation so that it would not impact the population (see the Hydrology and Soils sections earlier in this chapter for more detail). Also not all of the plants are next to the stream channel, further reducing the likelihood of sediment impact.

The population considered consists of 16 plants (in addition to the 5 that would be impacted by all alternatives). There are at least 48 other known occurrences of *P. obtusata* in the Washington Natural Heritage database (Washington Natural Heritage Program pers. comm.). Most populations are in northeast Okanogan County. So if this population is damaged, 48 populations would still remain to maintain the species in the state.

Fence construction and slash windrows along the Marias Creek road would reduce cattle access to the creek. This would reduce trampling and grazing activities in and near the creek, which is good habitat for sensitive species.

Two small wetlands would be created in Marias Creek when culverts are replaced. No sensitive plants were found in the area of the proposed wetlands, so no direct or indirect impacts are expected to sensitive species.

The other known *P. obtusata* sites in the Marias drainage are in another tributary and far enough away from proposed disturbance that no direct or indirect impact is expected.

Other Species

The lichen *Bryoria* is a cultural plant of interest to local Indian tribes. Construction of the new road would involve cutting down trees. *Bryoria* grows in trees, so the plants growing in felled trees would die. This species is rather common, and much would be left in other trees, so the overall impact to the species would be minor.

An occasional plant of other cultural species were noted, such as Serviceberry (*Amelanchier alnifolia*), Russet buffaloberry (*Shepherdia canadensis*), and big huckleberry (*Vaccinium membranaceum*). Those immediately in the rights-of-way of the proposed new road or adjacent to the roads to be widened would be destroyed. Since only a few plants were noted, impacts to these species would be minor. There would still be many of them left in the landscape at large.

Two small wetlands would be created in Marias Creek when the culverts are replaced in Marias Creek. Cultural plants were not noted along the creek channel, so no impact to cultural plant species is expected from wetland creation.

A population of *Scutellaria angustifolia* ssp. *micrantha* was found in the lower part of the Marias Creek drainage. The population occurs in rocky soil on a south facing slope, well upslope from the creek. It is far enough away from the road that no direct impact would occur from widening. It is far enough from the road that dust abatement would keep road dust to such a small amount that no impact is expected. Since it is not near the stream channel, the population would not be impacted by sedimentation or dissolved salt.

Two populations of the moss *Hedwigia ciliata* were found in the Marias Creek drainage. One population is on a large boulder close to the road, the other is on a rock outcrop near the road. The population on the boulder could receive direct impact from road widening, so the road widening would avoid this boulder. Moving the road bed away from the boulder would also reduce impact from dust and dust suppression agents on this population. The other is far enough away from the road to not be directly impacted from widening the road. Road dust may impact both populations, although the dust treatment described above would ameliorate dust impacts. Both populations are close enough to the road that some impact from dust may still occur. The populations grow high enough on the rocks to be well away from creek flow, so no impact from sedimentation or salts is anticipated.

Information is incomplete on the distribution of moss species in eastern Washington; however *Hedwigia ciliata* is also known to occur in Ferry County (Washington Natural Heritage Program 1997). Should one population be damaged by road widening the other population would still be left, plus populations in Ferry County.

Alternative B1

Direct and Indirect Effects

Threatened, Endangered, Proposed, and Sensitive Plants

Effects on sensitive plants would be essentially the same as described in Alternative B.

Other Species

Impacts on cultural plants would be the same as described in Alternative B.

Paving the lower part of the Forest Road 3550 would further reduce the probability of dust impacts on *Scutellaria angustifolia* ssp. *micrantha*. For the moss *Hedwigia ciliata* impacts would be the same as described in Alternative B.

Alternative C

Direct and Indirect Effects

Threatened, Endangered, Proposed, and Sensitive Plants

No threatened, endangered, or proposed plant species were found on National Forest System lands near proposed activities, nor are populations of these species known to occur nearby. The only area near the mine access road that might be habitat for *Howellia aquatilis* is the pond near the junction of Forest Roads 3575-100 and 3575-120, often called the Frog pond. This site has been looked at several times, but *H. aquatilis* has never been found there. Therefore there would be no effect for this species.

Similar to what is described in Alternative B, much of Nicholson Creek route is too high in elevation to be good habitat for *Spiranthes diluvialis.* Those portions below 3,500 feet elevation tend to have closed canopy that are not good habitat for *S. diluvialis* or are on NFS rights-of-way through private or DNR lands. Since the species was not found and the habitat does not appear right for the species, no effect is expected for this species.

A population of *Botrychium crenulatum* occurs close to Forest Road 3575-150. The population is far enough away from the road that widening would have no direct impact on the plants. However, road dust has the potential to impact the population but magnesium chloride would be used to abate dust, which would keep dust impacts minimal. The *B. crenulatum* is slightly down slope from the road, but not in a drainage channel from the road. Therefore, there would be little or no movement of dissolved magnesium chloride to the population. Therefore, no indirect impact is likely for this population.

Platanthera obtusata also occurs close to Forest Road 3575. Part of the population is close enough to receive direct impact from road widening. Thus a few plants (estimate 2 or 3 plants) would be lost. If the road course were to be moved here to avoid these plants there would be a greater risk of soil movement and sedimentation downstream on to other plants. Widening the existing road rights-of-way would lessen the risk of sedimentation impacts downstream. Seeding, relief culverts, and other measures would be implemented to keep soil movement contained. As described in Alternative B, there may be indirect impact from dust from the road settling on plants, e.g. clogging stomata, potentially reducing plant growth.

However road surface treatments would control dust, therefore, dust impacts are expected to be minimal.

As described in Alternative B, the application of magnesium chloride to the road would allow these salts to dissolve into the water. *P. obtusata* plants below the road may receive indirect impacts from these salts, e.g. reduced growth. Likewise if lignin sulfonate is used for dust suppression and a large storm occurs, *P. obtusata* plants below Forest Road 3575 and close to the creek could have deposition of lignin sulfonate on them and clog the stomata, potentially reducing plant growth. If this happens there are still at least 48 other known occurrences of this species in Washington to sustain the species.

Widening the road in the lower part of the Nicholson drainage would not impact known sensitive plant populations. However since the road is so close to the creek any sediment going into the creek would impact potential habitat for a number of species that occur in riparian habitat.

Fencing Grass Lakes pond would prevent cattle from reaching potential sensitive plant habitat around the pond.

Other Species

Other than the road segment from the mine site to Forest Road 3575-120, this alternative would widen existing roads instead of building new road, but the route is much longer so the effects to *Bryoria* from tree felling would be similar to Alternative B.

A few other cultural plant species would be lost by road widening, e. g. *Shepherdia canadensis*. These losses would not be large enough to impact viability of the species because these plants are common in northeast Washington. As described above, dust abatement would keep dust impacts to a minimum. The cultural plants are not in streams where they would receive runoff from dissolved magnesium chloride, so there would be no impact from that.

A population of a moss, *Helodium blandowii* was found in Nicholson Creek. It would not receive direct impact from road widening, and the dust controls described above would keep dust from being a concern. As described above, it is possible that magnesium chloride would get into the water, although it would be diluted. Whether or not there would be impacts to a moss from these salts is unknown. If lignin sulfonate is used this material may also get into the water and potentially harm *H. blandowii*, but the species is known to occur in other areas. Heinlen found it at five sites in Okanogan County on the east side of the Okanogan River (Heinlen 2002, pp 143-150). Other sites are known in Pend Oreille, Skamania, and Stevens counties (Washington Natural Heritage Program 1997). These should sustain the species in the state.

Alternative D

Direct and Indirect Effects

Threatened, Endangered, Proposed, and Sensitive Plants

Other than the new road construction from the mine site to Forest Road 3575-120, this alternative would only widen the existing Cow Camp road. No sensitive plants were found

there. There would be no direct impact on known sensitive plant populations. Forest Road 3575-120 road is far enough away from known populations that there should be no indirect impact, e.g. from dust, or dissolved magnesium chloride.

Alternative D would have the least direct and indirect impact on sensitive plant species of the action alternatives.

Other Species

As described above, other than the section from the mine site to Forest Road 3575-120, this alternative would widen existing roads instead of building new road. Thus fewer trees would need to be felled than the other action alternatives. There would be less impact to the lichen *Bryoria*. Likewise very few other cultural plants would be harmed by road widening.

Cumulative Effects

All Action Alternatives

Threatened, Endangered, Proposed, and Sensitive Plants

No known threatened, endangered, or proposed plants are known in or near National Forest System lands with proposed activities. Therefore there would be no cumulative effects for *Howellia aquatilis* or *Spiranthes diluvialis*.

The residue from explosives (Ammonium nitrate/fuel oil, ANFO) use in the mine would be underground. Most of the ANFO would be consumed when detonated, with a minor amount of residue left. Although it is possible some ANFO residue could get into ground water and eventually surface in wetlands that are sensitive plant habitat, it would likely be in small amounts. Fuel oil residue may be bound up in the soil, reducing its availability to the environment (Murphy and Zachara 1995). The residue would be subject to biodegradation that would further reduce the amount available to the environment (Chaîneau et al., 1999). Treated water would be treated to State standards set by the NPDES permit. Ammonium nitrate is also a fertilizer, so if a small amount escapes; it is unlikely to harm sensitive plants or their habitat (Brady 1990 pp 473-475).

Fly ash would be mixed with cement when backfilling the mine shafts. Some minor amounts of metals may leach out of the fly ash into ground water. This however should be in tiny amounts (Zhang et al. 2001). Samples from the proposed mine are undergoing humidity cell testing, which includes two samples of cemented backfill material. These two samples show higher amounts of metal leaching than the drill core samples, but the overall amounts of metals released are still low. Some rock samples are considered to have potential to generate acidity (Golder Associates Inc., August 8, 2005, July 27, 2006). When backfilling is done for the mine, potentially acid generating rock would be preferentially placed in areas that would be permanently flooded to prevent oxygen contact. In other areas alkaline producing amendments may be added to the back fill rock, e.g. marble (Golder, September 1, 2006). These treatments would keep acid generation minimal, if any. Therefore no impact is expected to sensitive plants from ground water.

If metals do leach into ground water they would be subject to adsorption and thus tied up in the soil (Xia et al 1997a, 1997b) (Farquhar et al 1997) (Skeaff et al 2002) (Elliot et al 1986).

Mine water would be treated to meet State water quality requirements set by the NPDES permit. Therefore, there should be no cumulative impact to sensitive plants or their habitat.

Past exploration work for the Crown Jewel project has been done in the mine area. Most of the disturbed area from exploration has had reclamation work, such as seeding of grasses and planting of trees and shrubs. This work was accepted as complete and meeting re-vegetation monitoring criteria in 2005. This work should help retain soils in place, preventing sedimentation that might have cumulative impact with sensitive plant habitat. The vegetation also makes it harder for noxious weeds to establish that might spread into sensitive plant habitat. Some reclamation remains to be done, e.g. closing of monitoring wells, temporary roads, core drill holes on private land. None of these remaining areas are near known sensitive plant populations, so their reclamation should not cumulatively impact sensitive plants.

Dewatering the mine would lower the water table and the amount of water available to go into streams and wetlands down slope from the mine. If flows are reduced and streams, seeps, springs, and wetlands are reduced in size, it would impact *Platanthera obtusata* or its habitat, in Marias and Nicholson Creeks. The impact would be exacerbated if lower water levels made the ground more accessible to cattle, allowing them to trample and graze the ground more. Impacts to ground water flow were modeled using the FEFLOW model (URS Corporation 2005). The model predicts the water table in the upper parts of Marias Creek possibly dropping as much as a foot at the end of mining without infiltration. Baseflows at the lower Roosevelt Adit could decrease by up to 13 gpm at the end of mining.

As mentioned above, it is proposed to infiltrate and augment the flow into the headwaters of Marias and Nicholson Creeks. In addition to the infiltration gallery in the Nicholson Creek drainage, water would be piped to the Roosevelt Adit and a stock water trough in upper Marias Creek in July, August and September. The water would come from dewatering the mine, ore and development rock stockpiles and treated at the mine site. This extra water, along with water captured through stormwater controls would help ameliorate the impacts of any drop in the water table. The trough in Marias Creek would provide a site for cattle to drink at above the wetlands, which should lessen trampling in the wetland (Porath et al 2002) (McInnis and McIver 2001). The trough would be installed on dry ground to avoid impacting sensitive plants. Runoff would be piped into the wetland.

Populations of sensitive species in Nicholson Creek are far enough away from the mine that the creek would have essentially recovered its normal flow. Thus no cumulative impact from cattle is expected to sensitive plant populations in Nicholson Creek.

Likewise springs and seeps that are close to the mine are predicted to have lower flow by FEFLOW. Although sensitive plants were not found at these sites they are nevertheless good habitat for sensitive species. Water augmentation would be below these springs and seeps, and therefore some habitat may be lost because of mining, but the activities on NFS lands would not add cumulatively to this loss.

The mine project fence would cause livestock to follow it and create a path next to it. No sensitive plants were found where the fence crosses the creek, so there would be no cumulative impact to a population. There would be some cumulative impact from trampling to the sensitive plant habitat in the creek. After the project is finished, this project fence would be removed, which would end this impact.

The construction of new road from the mine site to Forest Road 3575-120 would increase cow access to a draw that is wet in the spring. Although sensitive plants were not found there, the moisture would provide habitat for some sensitive species. Trampling would increase in the moist area.

Timber sales have occurred in the past on NFS lands near proposed project activities. These sales opened up the canopy and created roads. The opening of the canopy created transitory range, especially along roads, which also changed the patterns of livestock use. As a result, cattle have easier access to hillsides, streams, and wetlands. This may have slightly increased browsing activity to sensitive and culturally important plants. Conversely, fire suppression has allowed canopies to close in areas that have not been harvested, shading out these plants.

Fence construction done in the Marias Creek drainage would reduce cattle access to the Marias Creek road, and therefore also to Marias Creek. This would reduce trampling and grazing activities in the creek, which is good habitat for sensitive species.

Noxious weeds are known to occur in the analysis area. If left unchecked, weeds may occupy habitat for sensitive species. To prevent them from spreading, control measures would be taken under the existing integrated weed management decisions to contain and attempt to eliminate them. One treatment method is to use herbicides. Based on restrictions in the existing NEPA decisions for integrated weed management, herbicide application would not occur in areas of known sensitive plant populations, so no cumulative impact to sensitive plants is expected from this treatment. Borrow sites from private lands are not expected to exacerbate weed problems on NFS lands because any gravel used on roads would be required to be noxious weed seed free.

Firewood cutting is a past, ongoing and expected activity in the analysis area. The construction of new road would provide more area to access for wood cutters after mine closure (the new road sections would be closed to the public during operations). In 10-15 years, wood cutters may possibly introduce noxious weed species into these new areas that could invade sensitive plant habitat. Under Alternative B1, access for firewood cutting would be reduced through additional road closures, so spread of noxious weeds into the Bear Trap Canyon area would be reduced. Recreational users of the forest, e.g. hunters would also have new access to the forest in 10-15 years, again with the possibility of spreading noxious weeds. As long as funding is available, noxious weed control may ameliorate such impact. Since Alternative D constructs the smallest amount of new road it would have the least cumulative impact with firewood and recreation.

Fire suppression has occurred in the analysis area for many years. The lack of fire has allowed many trees to live, with the canopy closing in some timbered areas. This has reduced the amount of sunlight reaching the ground, thus decreasing sensitive plant habitat. The construction of new road and widening of existing road would only change this along the road rights-of-ways, so little if any cumulative impact on habitat with fire suppression would be expected.

As mentioned previously, no populations of sensitive fungi were found during field surveys, and their known range is west of the analysis area. Therefore no cumulative impact is expected for these species.

Other Species

As mentioned above noxious weeds occur in the analysis area. To keep them from spreading, control measures including herbicides are used. Herbicide application may kill some non target plants growing with the weeds, but none would be rare enough to be on the Regional Forester's sensitive species list. Herbicide application under the existing decisions would consist of spot spraying individual weed plants, limiting the amount of damage to a small area in the immediate vicinity of the weeds. Since noxious weeds often occur in disturbed ground, the broad leafed plants associated with them would usually be species that grow in disturbed ground, e.g. yarrow (*Achillea millefolium*), or dandelion (*Taraxacum officinale*). These species would soon reestablish themselves from seeds. Grasses would be impacted where glyphosate is used. The existing noxious weed decisions require the use of glyphosate in riparian areas, so grasses may be killed; however only spot spraying is permitted under these decisions. If young trees along road rights-of-ways are harmed it would help contribute to maintaining visibility along the rights-of-way.

Noxious weeds were not noted in the same areas where cultural plants are growing. Therefore there would be no cumulative impact from herbicide application under existing NEPA decisions to cultural plants. Borrow sites from private lands are not expected to exacerbate weed problems on NFS lands because any gravel used on roads would be required to be noxious weed seed free.

The construction of the road from the mine site to Forest Road 3575-120 would increase cow access to habitat for cultural plants near the road. Few plants were seen there, mostly serviceberry. Since serviceberry (*Amelanchier alnifolia*) is a shrub, it is normally not browsed a lot by cattle. However, there would be some cumulative impact to serviceberry.

Alternative B

Threatened, Endangered and Sensitive Species

The construction of new road from the existing road 3550-125 would provide easier access for cattle to the ridge area. However no threatened, endangered or sensitive plants were found there and the area on NFS lands is dry ground, which is not ideal habitat for the sensitive plants most vulnerable to grazing. Therefore no cumulative impact would occur to populations and only a minor amount would occur to habitat.

Other Species

Since new road would be constructed from the end of the 3550-125 road, access to hillsides would be somewhat easier for cattle in that area. There may be a slight increase in browsing activity to serviceberry shrubs (*Amelanchier alnifolia*) in that area. However, only a few plants were seen along the proposed route.

Alternative B1

Threatened, Endangered and Sensitive Species

Cumulative impacts for road construction or widening and fire suppression would be the same as in Alternative B. Cumulative impact from past timber sales would be the same as in Alternative B.

Other Species

Cumulative impacts for other species would be the same as alternative B.

Alternative C

Threatened, Endangered and Sensitive Species

Cumulative impacts from fire suppression and road widening to sensitive plant habitat would be expected to be essentially nonexistent.

As described above, past timber harvest has occurred, most notably the Nicholson sales. These sales created roads and transitory range, changing livestock grazing patterns. Since cattle already use them, the widening of existing roads should not increase cattle access to existing populations or habitat.

The Little Nicky sale is currently underway on State Department of Natural Resources land in the lower part of the Nicholson drainage. This project is downstream from the known sensitive plant populations, so there should be no cumulative impact to populations. Widening and paving road 3575 might push some sediment into the stream channel, which might have cumulative impact with the sale on sediment, but as noted above, no populations are known along Nicholson Creek below the sale area.

Other Species

Other than the construction of the road from the mine site to road 3575-120, only existing roads would be widened. Therefore there should be no increase in cow access to cultural plant populations.

Alternative D

Threatened, Endangered and Sensitive Species

This alternative has the smallest amount of proposed road widening on NFS lands and rights-of-way of the action alternatives. None of the widening is near known sensitive plant populations. Therefore this alternative would have the least amount of cumulative impact of the action alternatives.

The State of Washington and Okanogan County would likely require dust suppression on County Road 4895. This could be magnesium chloride and water or lignin sulfonate. Magnesium chloride could dissolve and reach Millard Creek or Beaver Creek but the Buckhorn Access Project would not add cumulatively to this because of the distance between these creeks and the road. As described above these salts would be diluted. No sensitive plants are known there based on the State databases, so no cumulative impact is expected. The dilution is expected to keep impacts from occurring to habitat. Lignin sulfonate may also dissolve and enter the stream. Impacts would be as described in other alternatives above. CR 9480 is paved so dust suppression agents would not be utilized in close proximity to Beaver Creek.

Other Species

Few cultural plants were noted along the roads proposed for widening. Cows can already use these existing roads. No increase in cumulative impacts from cows to cultural plants from widening is anticipated.

As described above dust suppression agents may be used on the road. Impacts to road side and riparian vegetation would be as described above.

DETERMINATION CONCLUSIONS

Threatened, Endangered, and Proposed Plants

For *Howellia aquatilis* – No Effect

For *Spiranthes diluvialis* – No Effect

For Sensitive Species

Alternative A – No impact to any species.

Alternatives B and B1 – No impact to *Botrychium crenulatum* and *Talinum sediforme* and may impact individuals or habitat of *Platanthera obtusata*, but would not likely contribute to a trend toward federal listing or loss of viability to the populations or species.

Alternative C – No impact to *Talinum sediforme* and may impact individuals or habitat of *Botrychium crenulatum* and *Platanthera obtusata*, but would not likely contribute to a trend toward federal list or loss of viability to the populations or species.

Alternative D – No Impact to *Botrychium crenulatum* and *Talinum sediforme* and may impact individuals or habitat of *Platanthera obtusata*, but would not likely contribute to a trend toward federal listing or loss of viability to the populations or species.

Sensitive Fungi

None of the eight species of fungi known on the Okanogan National Forest were discovered during field surveys in 2005. Since none were found and their known range is west of the analysis area, these species best fit into Outcome 1: Low likelihood of occurrence, low risk to species viability or trend toward listing (BLM and USDA FS Interagency Special Status and Sensitive Species Program, Attachment 1 Likelihood of Occurrence Key [Online].

For Sensitive Fungi - Low likelihood of occurrence, low risk to species viability or trend toward listing.

Based on the above findings, no significant impacts are expected to threatened, endangered, sensitive or cultural plant species from any of the alternatives.

Range

The section below summarizes the affected environment information, along with the direct, indirect and cumulative effects from the Buckhorn Mountain project, as analyzed in the Buckhorn Access Project Range Resources Report, by Rangeland Management Specialist, Christina Bauman dated November 20, 2006 in the analysis file.

AFFECTED ENVIRONMENT

Three grazing allotments, comprised of U.S. Forest Service, U.S. Bureau of Land Management, Washington State Department of Natural Resources, and privately owned lands, are located within the vicinity of the proposed project. The project area is grazed under the administration of the U. S. Forest Service grazing permits by four permittees. The allotments affected by the proposed projects in the action alternatives are the Cedar C&H (Cattle and Horse), the Gold C&H, and the Ethel C&H Allotments. It should be noted that no commercial horse grazing occurs within any of the three allotments, even though the title of the allotments contain "Horse." The Graphite C&H Allotment borders the Eastern edge of the Cedar C&H Allotment, which is administered by the Colville National Forest. It is outside the analysis area and would receive no effect from any of the alternatives selected.

Allotments- General Information

Patenting of National Forest System lands resulted in the loss of a small amount of forage for livestock grazing in the three allotments. The patented area received low use because this area has lower forage production and water availability compared to the other areas within the allotments. Additionally, some of the lands had grazing restrictions following reclamation of past mine development activities (ex: closure and re-contouring the Buckhorn Mountain drill roads and bore holes). Reclamation activities were completed in 2002 with most work being accepted in 2005.

Grazing within these allotments occurs annually during a three- to four-month season, (Spring through Summer). Cattle (cow-calf pairs) are moved in grazing sections, called units or pastures of the allotments. Rotation and grazing are primarily dependent on the availability of grasses and water, topography (i.e., steepness), and other factors such as accessibility and range improvements.

The three grazing allotments, along with the associated leased and jointly operated lands, produce enough forage to adequately feed approximately 663 cow/calf pairs for about four (4) months (June through September) each summer. This includes 545 cow/calf pairs allocated from National Forest System lands and approximately 118 cow/calf pairs from other leased lands. This is equivalent to approximately 3550 Animal Unit Months. An Animal Units Month (AUM) is the measure of the amount of forage needed to sustain one cow for one month. One cow-calf pair is equivalent to 1.32 AUMs. Calculation of AUMs is based on the number of cow-calf pairs identified in the grazing permits.

All three allotments have smaller (most parcels <60 acres each) land acreages adjoining the larger pieces of National Forest System lands, which are operated together within the grazing system rotations. These lands are either held privately, or are State or Bureau of Land Management leased lands.

A system of stock driveways, roads, allotment boundary fences, drift fences, pasture division fences, and private land fences (approximately 17 on National Forest System Lands, of minimum 1 mile lengths) allow the permittees to move livestock around when one pasture forage utilized by livestock approaches Forest Plan standards. Utilization surveys are conducted throughout the grazing season to determine move dates between units and on and off the National Forest. Utilization of these allotments has been generally good to date, with a few areas on all three allotments that need improvement. Problem areas have been designated as special areas of concern and are checked several times throughout the grazing season in conjunction with the utilization surveys. There are a few areas where 50 to 90 percent of the mean annual forage produced is utilized. These tend to be isolated spots around the allotments, usually around watering holes, water troughs, salting areas, and areas with high quality forage. However, most grazing takes place in the uplands, along roads, and in plantations close to water. This is because many of the old timber units, roadsides, and landings have been planted to clover (*Trifolium repens*), Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), and orchardgrass (*Dactylis glomerata*) which remain highly nutritious long after native grasses have cured (Stoddart et al 1975, Hall and Bryant 1995). Native grasses outside these areas are bluebunch wheatgrass (*Agropyron inerme*), Idaho fescue (*Festuca idahoensis*), and pinegrass (*Calamagrostis rubescens*). As the grasses cure and the weather gets hotter and dryer, livestock begin utilizing cooler areas near riparian areas because these have more nutritious plants than the uplands during those time periods (Stoddart et al 1975, Hall and Bryant 1995).

Within the analysis area, water for livestock is provided by a system of eighty-eight (88) water developments (troughs and cribs) and as well as a few ponds and a number of watering holes along creeks. Range records (2230 FS files) indicate the Frog Pond was developed for livestock watering in the 1920s. Livestock access to stream drainages varies from restricted in fairly steep drainages with downed timber, to easy in timber harvest units or adjacent to roads. Most water developments mentioned above are located outside the riparian zones, emphasizing the uplands to draw livestock away from watering primarily in the creeks. Both water developments, and salting on the ridges, away from water sources, helps keep livestock from overgrazing the lowlands.

There are also a number of stock driveways in the analysis area. Two of these stock drives have become overgrown, or blocked by both vegetative growth and fallen trees. The livestock operators are keeping only those open that link areas of available forage or which facilitate livestock movement throughout the allotments. The roadways have also been used as the stock driveways within these allotments, primarily the Marias Creek and Nicholson Creek roads. These roadways are used as the primary ingress/egress routes for moving the cattle on or off the permitted grazing areas.

The following section breaks out specifics for each allotment. An allotment map is available in the analysis file describing allotment locations, grazing pastures/units and range improvements (corrals, fences, and water developments).

Cedar C&H

The Cedar C&H allotment is approximately 23,370 acres. It is currently allocated to two permittees. It has three (3) pastures, Marias, Bear Trap, and Cedar. These pastures have areas designated for rangeland management monitoring referenced geographically by Marias- the Coogan and North areas, Bear Trap canyon, and Cedar-Frog Pond, Nicholson

Creek, Cedar Creek, and Jackson areas. There was only slight loss of forage from the patenting of land. The permitted AUMs have remained the same.

In the Marias pasture there are 34 water developments (troughs, cribs, or ponds). Twelve (12) are in the Coogan area, and 22 are in the North area. Many of these have water available for only the early part of the grazing season. Many are dry and need reconstruction/relocation. The number of water developments providing water varies each year due to annual fluctuations in precipitation, and water table. Due to the recent years of drought, and poor watering sources, the cattle have a tendency to drink from Marias Creek, and subsequently use the areas near the Marias Creek road. There are two stock drives coming from the Coogan area down to Marias Creek. There is one site for a portable corral adjacent to the Marias Creek Road, on the National Forest System land next to the east boundary with private land. There is a division fence between the Bear Trap and Marias pastures, with a corral strategically located off Forest Road 3575-080 to serve livestock gathering for both units. The pasture receives grazing rest in the North area every other year, and grazing deferment (differing grazing time frames) every other year in the Coogan area.

The Bear Trap pasture contains eleven (11) water developments, one stock driveway, and shares a corral with the Marias Creek pasture. Grazed with the Bear Trap pasture, there is a corral and a water development on the Washington State Department of Natural Resource (DNR) lands in Section 36. Again, watering sites vary in providing available water for livestock. The cattle do use a portion of Marias Creek for watering as well. The unit contains several old logging units, providing forage as “transitory range.” Transitory range is that forage made available resulting from tree canopy removal, allowing the understory vegetation to grow and produce palatable plants for the livestock to graze. It can produce higher quantities of forage for twenty years or more, until the trees grow larger, and the canopy closes (Baumgardner,1989). This unit has better grazing utilization than the other two pastures on the allotment resulting from better livestock distribution. This distribution results from more reliable watering sources than the Marias pasture. The riparian areas are monitored for meeting the Forest Plan Standards and Guidelines for grazing. It is grazed each year at an offset or different time than the previous year. A stock drive connecting Forest Road 3575-120 (Section 25, Range 30 E., Township 40 N.) and the Marias Creek Road, FR 3550, provides critical access for livestock movement in the Bear Trap unit of the Cedar C&H Allotment.

The Cedar pasture (the largest) contains thirty (30) water developments (one is on DNR lands), one (1) corral site, and two (2) stock drives. It receives grazing rest every other year. As with the other pastures, water availability varies, but water is more available in the west portion (Frog Pond, Cedar) than the eastern portion (Jackson) later in the grazing season. The Frog Pond area was initially developed as a livestock watering facility over fifty years ago. The Frog Pond is an area monitored for grazing utilization. Monitoring sometimes determines the need for the ranchers to move the cattle to the more northerly and easterly portions of the pasture. These areas have better watering sources than the Marias pasture. Cattle use the Nicholson Creek road, Forest Road 3575, as a movement corridor. There are three other areas along the Nicholson Creek road where cattle may congregate. These are the Grass Lakes area, (middle of Section 17, Township 40 N. Range 31E.), the #10 water development (“Dint” Section 16 of Township 40 N. Range 31E.) and the #2 water development (“Road” Section 17 of Township 40 N. Range 31 E.) The last two water developments are immediately adjacent to Forest Road 3575. The stock drives in this pasture are utilized by cattle, and occasional forest visitors. Fences on the boundary

between the United States and Canada are sometimes in poor repair, due to lack of maintenance by the Provincial (Canadian) permittee and the international boundary rights-of-way contract crews dropping trees on them. The United States Forest Service permittee has a time consuming job keeping the cattle where they belong. Livestock movement toward the center of the pasture is most desired.

All three proposed ore haul routes would go through this allotment.

Gold C&H

The Gold C&H allotment is only approximately 4,460 acres. It is located adjacent to lands directly affected by the proposed project. It has ten (10) water developments and boundary fences between it and Canada, the Cedar C&H allotment and private lands. It contains some DNR and Bureau of Land Management lands leased for grazing. However, there was only slight loss of forage from the patenting of land. Its AUMs have remained the same. It is currently utilized by one rancher.

There are no proposed ore haul routes through this allotment.

Ethel C&H

The Ethel C&H allotment is approximately 2,440 acres, and is located adjacent to lands directly affected by the proposed project. It is currently utilized by one rancher. It has two pastures: Lower (1) and Upper (2). It is utilized lightly with limited water availability in the Upper pasture. The Upper pasture has the only three (3) water developments. Fences divide the two (2) pastures. There is a fence between the Ethel C&H and Gold C&H Allotments. A fence and a natural boundary divide the Ethel C&H allotment and the Cedar C&H allotment.

The proposed supply access roads, Forest Roads 3575-125 and 3575-140, during early mine construction would be the primary access to the Ethel C&H allotment. Forest Road 3575-140 would also be used to access the water tower under all alternatives and other roads in the allotment would be used for water monitoring. The ore and supply haul route for Alternative D also uses Forest Road 3575-120.

ENVIRONMENTAL CONSEQUENCES

Alternative A - No Action Alternative

Direct/Indirect Effects

Under this alternative, new approvals for the use of National Forest System lands would not be granted. Only those activities currently occurring in the area would continue. Of these, reclamation activities might for a three to five year period require change in livestock management at rehabilitation sites. This may result in a need to reschedule grazing in these areas to utilize other non- rehabilitated areas.

Existing livestock impacts along Marias Creek and at Grass Lakes would continue to occur because none of the range improvements proposed in Alternatives B, B1, or C would occur.

However, the No Action Alternative, would allow the permittees to continue with current operations. Trucking livestock or coordinated livestock herding on or off the allotment would not be necessary. Coordination with the mining company for mitigations measures (fences, corral construction, livestock on roadway) would not be necessary. Therefore the rancher would spend less time on coordination, and more time on other livestock management needs for the allotment.

There would be no potential for cattle to be killed or injured by haul /supply trucks, or any other affiliated mine traffic.

Cumulative Effects

Because there is no action under this alternative, there are not cumulative effects. Selection of this alternative would result in implementation of past decisions for rehabilitation of the roads and monitoring wells, which may initially decrease the available forage for cows in the proximity of the patented land for up to five years. The patented lands, if not fenced would be grazed by cattle.

Effects Common to all Action Alternatives

Permittees would have to maintain communications between the Proponents and themselves to manage livestock operations. This increased time would take away from time spent on other livestock management activities on National Forest System lands. The Cedar C&H permittees are expected to be impacted more than the Gold C&H or Ethel C&H permittees. Since most of the activities occur on the Cedar C&H allotment, the effects are specific to it, unless otherwise mentioned.

Noise levels are not expected to cause problems with grazing livestock. Domesticated animals become accustomed to these sounds, and it does not interfere with their activities.

Vehicle and livestock collisions would potentially occur on the ore, supply, and employee access routes during construction and operations. Employees may choose to utilize any route to access their place of work during the non-snow bound months. During snow-bound months, they would likely use the ore haul route unless the proponent request to plow the 3575-120 road to allow them access from the south during winter. Cattle and/ or horseback riders could be present in the late spring, summer and early fall on these roadways. Since grazing is scheduled during the summer months, this would be the timeframe when accidents would most likely occur with cattle and/ or horseback riders.

The water infiltration gallery and existing and new monitoring well and some of the staff gauges and piezometers are in the Cedar C&H allotment. They would have no effect to cattle grazing patterns or use. There is no effect expected from the water monitoring activities on any allotment throughout the potential 60-year monitoring time frame. Surface water monitoring locations are located on all three allotments.

There are no expected effects from plowing the Cow Camp Road to the new access road because no range activities are occurring when snow is on the ground. Ongoing mine construction haul and mine construction has had little to no effect on livestock use or distribution in the 2006 grazing pattern. It is not expected to alter range activities other than specifically described in each alternative effects section.

Alternative B

Direct/Indirect Effects

This alternative is generally described as Crown/Kinross' proposal for use of National Forest System lands to access their lands and transport the ore utilizing the Marias Creek road as the primary haul route. It would also use the roadways connected with the Cow Camp road for supply during construction, but not for ore haul. These effects are based upon the expected time frame for construction, mine operations, and reclamation of most disturbed areas occurring during a 13-15 year time period.

In this alternative, the primary concerns on the Cedar allotment are centered around 1) keeping the livestock off the roadways to reduce as much as possible collisions between vehicles and cattle and 2) maintaining livestock access to water and forage, while allowing for proper livestock distribution. Since most of the activities occur on the Cedar C&H allotment, the effects are specific to it, unless otherwise mentioned.

This alternative, like Alternative B1, has several mitigation measures to keep livestock access to the Marias Creek road, Forest Road 3550, to a minimum. Summarized, these mitigation measures on the Cedar allotment fence cattle from the roadway in key locations, improve cattle movement and distribution, provide and improve corrals, and improve watering sources to the north area of the Marias pasture allowing the cattle to utilize an area previously difficult to use because of limited water. Development of a well and three stock watering troughs above the cut banks on the north side of the Marias Creek road would provide water above the road, and coupled with fencing, should prevent most livestock from getting down onto the road and also to Marias Creek. During the time of the mine's operations, the Proponent would maintain these improvements. That would free up the permittees' time to spend on other livestock management needs on the allotment. These improvements would remain in place at the end of the project with maintenance responsibility transferring to the permittees after project completion. They would then continue to facilitate livestock management activities on the allotment.

In this alternative and Alternative B1 cattle would be able to access portions of Marias Creek. However, this access would be limited. There would be water gaps or "hardened" sites where cattle can access the creek to drink, without causing breakdown of the stream banks. The areas of Marias Creek which are not "hardened" are less accessible to livestock due to the following factors: 1) fencing along the Marias Creek roadway, 2) existing natural barriers formed by steepness of terrain, 3) dense, and downed trees, or 4) other existing physical barriers on the landscape.

The boundary fence around the mining operations area encloses about 74 acres of National Forest System land in with about 220 acres of private land controlled by the Proponent. This small acreage has very little forage production and does not affect the livestock stocking for any of the three allotments. This fence delineates the project boundary and would also prevent livestock use within the fence. Maintenance of the fence is the Proponents responsibility and they would have an employee actively check the fence line for integrity. If cattle get inside the boundary fence, the Proponent has agreed to help the rancher remove the cattle, and allow for the rancher to access the area to remove the cattle. Since the fence is to be removed at the end of activities, there is no concern about the fence going into disrepair and becoming a hazard. Post project, cattle would have easy access to the private,

patented mine lands. This is range area, and if the private land owner wishes to keep cattle off their land, the owner would have to build their own fence on the property boundary line.

Rehabilitation activities may require that the livestock have very limited access to newly re-vegetating sites for 3 to 5 years. This is to ensure re-vegetation on newly planted sites. There are no direct effects expected from fertilizing the rehabilitated sites for grazing.

The fencing along the roadway, water gaps and short pieces of associated drift fence are designed to keep livestock off the Marias route roadways. These features are not guaranteed to eliminate cattle from sometimes accessing the route, but should limit the number of cattle on the roadway and the potential of injury or death to cattle from collisions with vehicles. Coordination and communications between the permittee and the mining company relating to scheduled livestock drives and incidental livestock on the roadway, would also reduce the potential.

The proposed speed limit for this alternative is 30 mph. This is 5 mph lower than the existing speed limit. The difference between this alternative and Alternatives B1, C and D (25 mph) is a 20% increase in speed. This also amounts to a 20% increase in distance traveled each second. Reaction time would be less than under the other action alternatives for human drivers, in response to horseback riders (ranchers) moving livestock, and those animals crossing the road. The force of impact in the event of a collision would increase. This combination would result in a slightly higher likelihood of collisions between vehicles with animals or horseback riders. It would contribute slightly to potential safety concern for the rancher, and increase the likelihood of an animal suffering a major injury or death.

Other activities proposed by Alternative B which should have no effect on the livestock operations and grazing activities are the use of new and existing surface water monitoring sites, the use of existing monitoring wells and the development of a new monitoring well by the infiltration gallery, staff gauges, piezometers, the water infiltration gallery and associated road and pipeline, and culvert replacement or removals in Nicholson Creek. Activities affiliated with the watering monitoring such as snow plowing in winter may incidentally cause some unknown damage to a roadside range fence between the Marias and Nicholson Creek units, if snow is plowed and piled on top of it. This is not predictable and a snowplow operator can easily avoid it.

Replacement of the culvert where the 3550-080 road crosses Marias Creek and on the non-system road that crosses Nicholson Creek would not affect range activities. Maintaining the access across, rather than though, Nicholson Creek would help continue to keep cows out of the creek at the non-system road crossing.

The water augmentation line to the Roosevelt Adit and the water trough in upper Marias Creek would effect livestock distribution. The increased water to wetlands resulting from the augmentation may attract more livestock use, and subsequently result in the need for the permittee to move the cattle actively out of the area. The water trough would aid in attracting the cattle from the wetlands, although because cattle can currently access the wetlands, it is likely to reduce current wetland use.

The small wetlands to be created above the live stream replacement culverts on Marias Creek would be accessible to livestock. These areas would likely become attractants to cattle. This could retard the success of the riparian vegetation. The lower wetland (Township 40 North, Range 31 East, Section 2) would be located in closed proximity to a

corral proposed to be built as part of this project (presently a temporary corral is used in this located each year), and the adjacent roadside fence. This area may receive cattle use during the herding of cattle on the roadway. The cattle may also access it incidentally during times they habitually make their way toward the corral if they get by fences or other barriers. The upper wetland (Township 40 North, Range 31 East, Section 31) is less likely to be accessed by cattle at times they are scheduled to be in the Marias, or Bear Trap units.

The proposed design for guzzlers in the headwaters of Ethel and South Fork Bolster Creek currently would have a fence surrounding the guzzler sites, so that cattle cannot access or damage them.

Cattle may incidentally access and damage the silt barriers or straw bales put in place to act as sediment traps along the roadways. This access is unlikely to occur in Alternatives B and B1 due to both fences and natural barriers inhibiting livestock access to the Marias Creek roadway.

Alternative B1

Direct/Indirect Effects

This effects analysis is nearly identical to the Proponent's Proposed Action, Alternative B, because the same mitigation measures are proposed for managing livestock grazing.

There is a difference between the proposed Alternative B (30 mph) and Alternative B1 (25 mph) speed limit. This 5 mph lower speed limit results in increased time for reaction, and a slightly reduced likelihood of a collision. The 20% decrease in velocity would lessen the force of impact, decreasing the potential of injury or fatality to animals on the roadway, or associated horseback riders. .

There is also a difference in that the short piece of paved road may increase the chance that truckers may exceed the 25 mph speed limit. If an animal were to get into this area, there might be an increased potential of being hit by a vehicle. The proposed corral for gathering the cattle at the end of grazing season is located beside the paved stretch. The required use of snowmobiles rather than plowing roads to access water monitoring sites during winter would not impact the grazing program since no grazing occurs during the winter season.

The road closures in Bear Trap Canyon would not affect livestock operations because permittees would still have administrative access, and may reduce harassment of cattle.

Use of passive reclamation to a one lane road would have no effect upon the grazing within the analysis area.

Alternative C

Direct/Indirect Effects

This alternative would have similar effects as Alternatives B, B1, and D for the following activities: the water infiltration gallery and pipeline, the guzzlers proposed in the headwaters of Ethel and South Fork Bolster Creek, the water augmentation line to the Roosevelt Adit and the water trough in upper Marias Creek, culvert replacements, the existing water monitoring network, and the new monitoring well by the infiltration gallery, staff gauges and piezometers.

The required use of snowmobiles rather than plowing roads to access water monitoring sites during winter would not impact the grazing program since no grazing occurs during the winter season.

This alternative proposes that the ore and supply route during operations would utilize the Nicholson Creek route. These effects are based upon the expected time frame of mine construction, operations, and most reclamation occurring during a 13-15 year time period. Water monitoring would likely continue for a longer time period, up to 25 to longer than 60 years. Since most of the activities occur on the Cedar C&H allotment, the effects are specific to it, unless otherwise mentioned.

Since the north pasture is rested every other year, and livestock have less tendency to loiter on the roadway because of better water sources and forage availability, there is less potential for livestock/vehicle collisions on the Nicholson Creek route. If a need was identified to try to gain more livestock control, keeping them off the road way at a later date, this would be covered in the annual grazing instructions or in the grazing allotment management planning process a few years from now.

There is a difference between the proposed Alternative B (30 mph) and Alternative C (25 mph) speed limit. This 5 mph lower speed limit results in increased time for reaction, and a slightly reduced likelihood of a collision. The 20% decrease in velocity would lessen the force of impact, decreasing the potential of injury or fatality to animals on the roadway, or associated horseback

The proposal to fence the area of Grass Lakes would help mitigate potential livestock over use of this riparian area, as cattle are moved off the road way.

The proposed new corral in Nicholson Salvage One, Unit 11 would aid in controlling livestock movement, and thereby potentially reduce the likelihood of cattle on the ore, supply, and main employee access route.

Livestock use around the Frog Pond area is likely to be shifted away, to other areas of the Cedar pasture, due to vehicle traffic and noise and increasing the potential for collision. Because the area is more confined and it is more difficult to move cattle directly off the road way, more work would be required for the permittees, and reduce the forage used in this area, increasing use in other areas of the Cedar pasture.

There are two water developments in immediate proximity to Forest Road 3575, the #2 (Township 40N, Range 31E, Section 17) and the #10 (Township 40N, Range 31E, Section 16) water developments. These two spring sources provide important water for the livestock. The sources would be considered and the road designed to avoid them to protect this resource.

Rehabilitation activities may require that the livestock have very limited access to newly re-vegetating sites for 3 - 5 years. This is to ensure re-vegetation success on newly planted sites. The exception is that grazing should be discouraged on steep cutbanks. This may reduce available grazing times, or available forage in the Cedar pasture of the Cedar C&H allotment because of fewer livestock control measures in place (corrals, fences, water).

Cattle may incidentally access and damage the silt fence barriers put in place to act as sediment traps below culverts. Straw bales would not be used in this alternative on National

Forest System lands to back silt fences below relief culverts to decrease the potential for damage from cows to the sediment control structures. The exception is the new section of road to patented lands above Cow Camp. Damage may occur in areas where the cutbanks are less steep and cows can easily access the areas near silt fences, where water is nearby to attract cattle.

Because Nicholson Creek is not fenced, the wetlands created above the replaced culverts in live streams may be accessible to livestock. Most of the replaced culverts in live streams are located outside of the Cedar grazing allotment on private and DNR managed lands. These areas would likely become attractants to cattle which could retard the success of the riparian vegetation establishment, causing cattle to linger longer in these sites. This likelihood is increased due to the proximity of the roadway.

Alternative D

Direct/Indirect Effects

This alternative would have similar effects as Alternatives B and B1 for the following activities: the water infiltration gallery and pipeline, the guzzlers proposed in the headwaters of Ethel and South Fork Bolster Creek, the water augmentation line to Roosevelt Adit and the water trough in upper Marias Creek, culvert replacements, the existing water monitoring network, and the new monitoring well by the infiltration gallery, staff gauges and piezometers. The required use of snowmobiles rather than plowing roads to access water monitoring sites during winter would not impact the grazing program since no grazing occurs during the winter season.

There is a difference between the proposed Alternative B (30 mph) and Alternative D (25 mph) speed limits. This 5 mph lower speed limit results in increased time for reaction, and a slightly reduced likelihood of a collision. The 20% decrease in velocity would lessen the force of impact, decreasing the potential of injury or fatality to animals on the roadway, or associated horseback.

Forest Road 3575-120 would be the main access route on National Forest System land and rights-of-ways decreasing the amount of impacted National Forest System land. Since most of the activities occur on the Cedar and Ethel C&H allotments, the effects are specific to it, unless otherwise mentioned.

Rehabilitation activities may require that the livestock have very limited access to newly re-vegetating sites for 3 to 5 years. This is to ensure re-vegetation success on newly planted sites. This may reduce available grazing times, or available forage in the Bear Trap pasture of the Cedar C&H allotment because of fewer livestock control measures are in place (corrals, fences, water).

Since this alternative has less livestock controls in place (corrals or fences) livestock may be able to access the roadway on National Forest System lands. This shorter route combined with the shortened time frame which cattle graze in the area would have a medium to low likelihood of the cattle being on the roadway. However, when the cattle are grazing in the area, the likelihood of a truck colliding with a cow is greatly increased, however, because cattle graze in this area and only a small amount of allotment, this alternative would have the least impact on grazing.

Like Alternative C, cattle may incidentally access and damage the silt barriers put in place to act as sediment traps along the roadways. However, this alternative would have very few sediment traps because of the distance to streams. In the one location where water is nearby, cattle may trample the silt fences because cutbanks are less steep and cows can easily access them but this area has in the past received little use by cattle due to a lack of suitable forage.

Cumulative Effects for All Alternatives

There would be no changes to stocking AUMs. Impacts potentially affecting livestock distribution and potential for vehicle livestock collisions are mitigated. The patenting of the public lands to private has had no effect on the grazing since the patented land does not have high forage production value and previous use of the area was low. Past timber sales in the area promoted forage production as transitory range. These existing roadways were previously used for livestock movement and would experience substantially increased use by vehicles during ore haul, which would make them less usable for livestock movement. The Buckhorn Mountain Project proposal for habitat mitigation calls for excluding cattle from 50 acres at Cow Camp, which should not effect livestock operations in the allotments. The Little Nicky Timber Sale on DNR lands may draw cattle into the transitory range created in those uplands and away from riparian areas. Permittees may have less vehicle access as a result of future non-system road closures.

The North pasture, part of the Alternative C, is rested every other year, and livestock have less tendency to loiter on the roadway because of better water sources and forage availability, which creates less potential for livestock/vehicle collisions on this route.

Under Alternative D, it is more likely that livestock may be displaced resulting from traffic pushing them into areas not desired or utilization or too frequently (riparian areas). The concentrated traffic corridor may limit the viability of the ranchers to access the area to round up cows, making the route less safe if cattle are in the area, or eventually eliminating the area as a safe place to graze livestock without vehicle/cattle collision potential, until ore haul ceases. Ore and supply trucks, and most employee access would be routed through more of the Okanogan County road system under Alternative D. Forest Road 3575-120 would be the main access route on National Forest System land and rights-of-ways decreasing the amount of impacted National Forest System land.

Other past, ongoing and reasonably foreseeable future actions listed at the beginning of this chapter would not have any cumulative effects with livestock management. Based upon the analysis above, the direct, indirect and cumulative effects are not significant.

Noxious Weeds

The section below summarizes the affected environment information, along with the direct, indirect, and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Noxious Weeds Report, by District Noxious Weeds Coordinator Carol Ogilvie dated November 20, 2006 in the analysis file. A Vegetation Management Plan for the project is available in the Analysis File.

AFFECTED ENVIRONMENT

This analysis considers the direct and indirect effects of the proposed project on lands managed by the Tonasket Ranger District. It also considers cumulative effects that may occur off National Forest System (NFS) lands from an action that occurs on NFS lands or on NFS lands from other actions that affect noxious weeds.

Existing vegetation can act as a barrier against most noxious weeds. Maintaining a healthy plant community by reducing wildfire intensity, minimizing future disturbance and reducing road densities may encourage natural controls and help avoid conditions that favor unwanted vegetation. Additionally, failure to control noxious weeds can cause a net loss in desirable species and a substantial increase in noxious weed plants.

Noxious weed inventories were completed in the summer of 2005 on National Forest System lands for the Buckhorn Access Project alternatives where disturbance is likely to occur and along transportation routes. This document does not approve new herbicide use, although the area would be treated as needed under existing Integrated Weed Management decisions.

Most of the known noxious weed sites within the Buckhorn Access Project alternative assessment area have been spot treated with a residual herbicide (picloram) or glyphosate since 1998 and/or hand pulled under current Forest Integrated Weed Management Environmental Assessments, 1997 and 2000 (Weed EAs). As part of the reclamation requirements for the previous disturbances on the Crown Jewel Project, reclaimed areas were monitored for noxious weeds in 2003, 2004 and 2005 and any weeds found were treated. An invading plant species is not eradicated until its viable propagules are depleted from the soil. As long as control is less than 100%, viable seeds would remain in the soil, emphasizing that reproduction must be stopped completely if eradication is to succeed (Sheley and Petroff, 1999). For example, seeds from knapweed species may remain viable for seven to 10 years.

As directed under the Forest Weed EAs, 1997 and 2000, all herbicide applications are made by Washington State Licensed Pesticide Applicators. Use of only spot spraying target species and maintaining buffers around areas of sensitive plants and other areas reduces the risk of damage to non-target species.

Noxious weeds documented along Marias Creek include diffuse and spotted knapweed, musk, bull and Canada thistle, sulfur cinquefoil, common houndstongue, common St. Johnswort and common mullien. Noxious weeds documented in the Nicholson Creek drainage include diffuse and spotted knapweed, sulfur cinquefoil, downy brome, musk thistle, common houndstongue, yellow and orange hawkweed, and common mullien. Noxious weeds documented along the Cow Camp road include diffuse knapweed, sulfur cinquefoil, common houndstongue, bull and Canada thistle, common St. Johnswort, and common mullein. These noxious weeds can compete with native plants, increase soil erosion, reduce land value, increase land management costs, and decrease wildlife and livestock forage. Some species are poisonous to certain plant and animal species. Weeds can be spread by ground disturbance, livestock, wildlife, wind and vehicles. Additional information about vectors of spread can be found in the 2005 FEIS and 2006 Record of Decision for Preventing and Managing Invasive Species (USDA, Forest Service, 2005, 2006). This project was compared in compliance with both the Mediated Agreement for the 1988 Managing Competing and Unwanted Vegetation FEIS and ROD, and the 2005 FEIS and 2006 ROD for

Preventing and Managing Invasive Species. A crosswalk for compliance with both documents, an Integrated Weed Management Plan and other additional information on locations and impacts are located in the analysis file.

Potential Invaders

Potential Invaders are those noxious weed species that are known to exist off NFS lands near the assessment area, along access routes or are documented at the Beal Borrow site or the Kettle River Mill site. These species would have a moderate to high potential to be spread into the project area without mitigation. These sites also have been reported to contain many of the species currently known to exist along Forest Roads 3550, 3575-120 and 3575. The Potential New Invaders include: yellow starthistle *(Centaurea solstitialis)*, dalmation toadflax *(Linaria dalmatica),* and Coast fiddleneck (*Amsinickia intermedia*).

Table III-63: Noxious Weeds Reported on Proposed Buckhorn Mountain Mining Project Sites Off National Forest System Lands

SPECIES	Lower Mine Portal	Upper Portal	Beal Borrow Site	Kettle River Mill	Kettle River Mill Borrow	Kettle River Mill San Poil Crossing	Lower Gold Bowl	OCR 9495	OCR 4895	Hwy 97
Linaria dalmatica				X	X	X		X		X
Centaurea biebersteinii			X		X					X
Centaurea solstitialis			X		X					
Centaurea diffusa			X	X	X			X	X	X
Cynoglossum officinale							X		X	
Hieracium aurantiacum					X	X				
Potentilla recta			X	X	X				X	
Cirsium arevense		X		X	X	X	X			X
Cirsium vulgare		X	X	X	X					X
Hypericum perforatum							X	X	X	
Verbascum thapsus	X	X	X	X				X		X
Amsinickia intermedia							X			X
Carduus nutans							X			

Two Non-listed invasive species have been noted in the Revised Noxious and Non-Native Weed Management Plan for Buckhorn Mountain Project, Sept. 14, 2006. These species Yellow sweetclover *(Melilotus officinalis)* and White sweetclover, *(M. alba)* are not considered noxious on Tonasket Ranger district.

Susceptible Habitat

The susceptibility of plant communities to invasion can be influenced by many factors, including disturbance levels, community structure, resource availability and the biological traits of the invader. Most of the proposed project area falls into the Dry and Non-Forest vegetation group. These two vegetation groups are considered to have a high susceptibility to weed invasion. (USDA Forest Service, 2005).

ENVIRONMENTAL CONSEQUENCES

Alternative A, No Action

Direct and Indirect Effects

This alternative would not implement any new ground disturbing activity that might spread noxious weeds.

Cumulative Effects

Because this project would not be approved, no cumulative effects would occur. However, reclamation of the Project site from impacts of previous exploration and development would begin as soon as feasible as described in previous NEPA documents. There would continue to be a risk of weed spread and introduction of new invaders from vehicles and road maintenance activities. Weeds could spread from these roads onto currently weed free areas and hamper control efforts on existing sites and adjacent lands. Tonasket Ranger District would continue with an integrated weed management program in the area as long as funding was available. This alternative would not increase the potential for spread or the introduction of new invader species as a result of project activity.

Direct and Indirect Effects Common to Action Alternatives

Road Construction, Haul Routes, and Transportation

Road construction or re-construction would occur in all action alternatives. Road design would include a 24 foot road surface with two 2- foot shoulders and a 3 foot ditch. These ditches would be vegetated during the construction process. Seed mixes would be determined by the Forest Service and would include fast growing, aggressive species that would provide competition against noxious weeds.

Cutbanks would be stabilized using grass seed followed with either hydromulch or straw mulch. Strict monitoring of disturbed sites would occur and follow up weed control would be performed by the Forest Service under existing NEPA decisions as necessary.

Vehicle travel from the mine site to the mill and tailings sites and personnel commuting to and from work would not vary substantially between the alternatives. Vehicle movement can increase the spread of noxious weeds when reproductive plant parts become attached to vehicles. Several species of noxious weeds occur along all proposed haul routes, borrow pit locations, and the tailings facility. The likelihood of noxious weeds being transported between sites and along roads is high without mitigation, but low for this project because adequate mitigation measures would be taken to remove seed sources prior to and during operations.

Infiltration Gallery, Conveyance Pipeline, Augmentation Water Line, Power Line, Monitoring Wells, Staff Gauges, Piezometers and Fencing

An infiltration area for treated mine water would be constructed in the vicinity of the junction of Forest Roads 3575-120 and 3575-125. A new access road to the area would be constructed, although most of this area has been previously disturbed and reclaimed.

Approximately 4,500 feet of pipeline and access road would be constructed across National Forest System land resulting in about 6 acres of disturbance. Power lines would be buried in the road beds to minimize new disturbance.

One new water monitoring well, staff guages and several piezometers would be installed in addition to the 7 existing monitoring wells on NFS lands previously installed under existing NEPA decisions. Minimal soil disturbance would occur with installation. A project area fence would be built resulting in about four acres of disturbance in all alternatives. All disturbance would be re-vegetated and monitoring by the Forest Service would ensure early detection of noxious weeds occurring on these sites.

Wildlife Guzzlers

Wildlife guzzlers would be constructed at the headwaters of Ethel and South Fork Bolster Creek on NFS lands. They would be place on hardened surfaces, either old landings or adjacent road surfaces, that are noxious weed free. Wildlife and livestock can transport noxious weed seeds and soil disturbance can occur where animals congregate. Monitoring of these sites would occur to ensure early detection of noxious weeds.

Water Monitoring Sites

New water monitoring sites would be established on Marias or Nicholson Creeks, but these actions would not likely spread noxious weeds because cleaning of off-road equipment and seeding of disturbed soils would be required.

Culvert Replacements

Replacement of an existing culvert in lower Nicholson Creek is proposed as mitigation under Alternatives B, B1 and D and as part of the road reconstruction under Alternative C. Culverts on Marias Creek would be replaced in Alternatives B and B1, and where the 3550-080 road crosses Marias Creek. A culvert on a non-system road that crosses Nicholson creek would also be replaced in all alternatives. These would result in a small amount of soil disturbance which would be seeded to reduce the potential for noxious weeds to establish.

Reclamation

All surface disturbances on National Forest System land or rights-of-way would be reclaimed by one or more of the following: grading, sloping, replacing top soil and revegetating where needed with native species. These reclaiming activities would occur as soon as practical after disturbance has occurred or mining activities are completed. Reclamation activities would reduce the ability of noxious weeds to compete and thus reduce the risk of colonization.

<u>Alternatives B and B1</u>

These alternatives are estimated to result in approximately 57 acres of soil disturbance. The majority of the anticipated disturbance on National Forest System land and rights-of-way would occur on Forest Roads 3550 and 3550-125, and the construction of a new road to the lower portal.

Alternative B1 differs from Alternative B by more extensively reclaiming the new road

between the 3575-120 road and the patented land and paving the lower half-mile of the haul route from County Road 9495 until 150 feet past the first crossing of Marias Creek. Gated road closures would also occur on the Bear Trap Canyon road on Forest Roads 3550 and 3550-122. Reclamation of the new lower portal road would create new soil disturbance at the end of mining, but the prevention measures would minimize the potential for weed spread into this area. Road closures would reduce the risk of spread of some noxious weeds along roads by vehicles. Paving has no effect on noxious weeds. Alternative B1 also proposes to reduce the driveable width of Forest Road 3550 (up to FR 3550-125) and Forest Road 3550-125 up to the DNR land to 17 feet after mine closure. Any disturbance associated with this closure would be seeded to reduce the risk of noxious weed introduction.

Minor amounts of disturbance would occur with the installation of two culverts on Marias Creek road and the creation of wetlands above these two culverts. Canada thistle is a noxious weed that can invade moist sites. There is a risk of this species to inhabit these disturbed sites, but prevention measures would minimize the potential for weed spread into these areas.

Minor amounts of disturbance would occur with the installation of approximately 2 miles of fencing along the Marias Creek road, 4 watering troughs, 3 water gaps, a corral, and several gates and cattle guards with associated fences. Disturbed areas would be seeded with fast growing, competitive grass species to aid in prevention of new weed establishment.

This route would have the most new road construction of the 3 proposed routes, so the highest probability of spreading noxious weeds into new areas. It would have less miles of road widening than Alternative C, the Nicholson Route and more miles of National Forest System roads and rights-of-way impacted than Alternative D.

There is a risk of noxious weed introduction or spread of existing sites with Alternatives B and B1 because much of the proposed activities fall into vegetation groups with high susceptibility to weed invasion. However, weed invasiveness is not static over time or space. Management activity, weed species and ecosystem health must all be considered in determining the severity of risk (Inglis, et al. 1996). While project activities would create disturbances, management of disturbed sites for this project would include mitigation measures such as preventing weed spread by washing off-road equipment, immediately seeding disturbance, diligent and continuous monitoring to ensure early detection and appropriate control measures. Therefore the risk of noxious weeds dominating these disturbed sites would be low. Based on this analysis the effects of noxious weeds are not significant.

Alternative C

This alternative uses the Nicholson Creek route (Forest Roads 3575, 3575-150, 3575-100, 3575-120) including 0.6 miles of new construction on NFS lands and 12.4 miles of reconstruction on NFS lands and rights-of-way.

This route would have the least amount of new construction and the most miles of road widening, resulting in approximately 65 acres of soil disturbance. Paving would occur from the Toroda Creek road to the first cattle guard past the Forest boundary on FS road 3575. Paving has no affect on noxious weeds.

A fence around Grass Lake would be constructed to reduce livestock impacts to the riparian area. This would aid in reducing soil disturbance and noxious weed introduction in this area.

A livestock corral would be constructed in Unit 11 of Nicholson Salvage I. Livestock can transport noxious weed seeds in hair or feces. There is a risk of introducing new noxious weeds into this area or increasing existing weed populations.

There is a higher risk of noxious weed introduction or spread of existing sites with Alternative C over Alternative B, B1 and D, because much of the proposed activities fall into vegetation groups with high susceptibility to weed invasion and more acres of noxious weeds are known to occur along this route than along the Marias Creek and Cow Camp routes. Additionally, more acres of disturbance would occur under this alternative than in Alternatives B, B1, and D. However, weed invasiveness is not static over time or space. Management activity, weed species and ecosystem health must all be considered in determining the severity of risk. (Inglis, et al. 1996). While project activities would create disturbances, management of disturbed sites for this project would include mitigation measures such as preventing weeds spread by washing off road equipment, timely seeding of disturbance, diligent and continuous monitoring to ensure early detection and appropriate control measures. Therefore the risk of noxious weeds dominating these disturbed sites would be low. Based on this analysis the effects to noxious weeds are not significant.

Alternative D

This alternative uses the Cow Camp to Pontiac Ridge Road route (Forest Road 3575-120). This route would be approximately 3.7 miles in length from the patented land to the County Road. Slightly over 0.6 miles of new construction and 3.1 miles of reconstruction are planned across National Forest System lands and rights-of-way.

This alternative would result in the least amount of soil disturbance (26 acres) of the action alternatives. Paving would occur on Forest Road 3575-120 road the County Road to State land, a distance of approximately 1.3 miles. Paving has no affect on noxious weeds.

There is a lower risk of noxious weed introduction or spread of existing sites with Alternative D over Alternatives B, B1 and C. However, much of the proposed activities fall into vegetation groups with high susceptibility to weed invasion. Fewer acres of noxious weeds are known to occur on National Forest System lands along the proposed route where new construction and reconstruction would take place in Alternative D. Additionally, fewer acres of disturbance would occur with this alternative than in Alternatives B, B1, and C. However, weed invasiveness is not static over time or space. Management activity, weed species and ecosystem health must all be considered in determining the severity of risk (Inglis, et al. 1996). While project activities would create disturbances, management of disturbed sites for this project would include mitigation measures such as preventing weed spread by washing off road equipment, immediately seeding disturbance, diligent and continuous monitoring to ensure early detection and appropriate control measures. Therefore the risk of noxious weeds dominating these disturbed sites would be low. Based on this analysis the effects to noxious weeds are not significant.

Cumulative Effects for All Action Alternatives

Cumulative effects analysis covers the haul routes on National Forest System lands, County roads, Beal Borrow site and the Kettle Mill site. This analysis also includes associated

activities including the infiltration gallery, pipelines, utility lines, fencing, corral and water troughs, culvert installation and the creation of wetlands. The effects on noxious weeds covers past actions dating back 10 years, ongoing actions and reasonably foreseeable future actions that have been proposed at this point in time. Noxious weed monitoring by the Forest Service would occur for five years following the closure of the project. Water Quality monitoring would occur for a longer period of time and therefore monitoring of those sites for noxious weeds would continue as long as necessary. A complete list of past, present and reasonable foreseeable future actions are listed at the beginning of this chapter. Only those activities that affect noxious weeds are considered in this cumulative effects analysis. Because effects on noxious weeds are wide spread, this cumulative effects analysis extends to the Beal Borrow site, Kettle River Mill site and surrounding area.

Past Actions

Past actions that have affected noxious weeds and would have overlapping impacts with proposed haul routes and associated actions are included in the following discussion.

Several past projects have been completed in the analysis watersheds. These include timber sales between 1960 and the present on National Forest System lands and near by DNR lands. The vegetation management practices primarily removed vegetation using methods ranging from generating created openings to removing a limited amount of crown closure. Ground disturbance occurred from these activities that lead to the introduction or spread of noxious weeds. Many noxious weed populations on NFS lands have undergone Integrated Weed Management (IWM) through previous decisions.

Past mining activity dating back to the 1920s and the Crown Resource/Battle Mountain Gold exploration and pre-development activities, starting in 1988 and continuing to the present caused disturbance that could have increased the risk of new weed introductions and the spread of existing populations. The Crown Resource/Battle Mountain Gold explorations sites, prior to this year's development drilling have been reclaimed and noxious weeds have undergone integrated weed management as part of reclamation.

Past road construction, reconstruction, and culvert replacement has caused areas of disturbance and opened travel corridors to noxious weed invasion. Re-vegetation along roads has occurred and noxious weeds have been treated under existing NEPA decisions.

Road closures from the Crown Jewel Mine and Nicholson Timber Sales have occurred. These closures benefited noxious weed control efforts by reducing the risk of spread occurring from vehicles.

Grazing has occurred throughout the project area, as well as throughout the analysis watersheds on private and public lands. Past grazing has likely led to the introduction or spread of noxious weeds.

Reasonably Foreseeable Future and Ongoing Actions

Foreseeable future and ongoing actions that have the potential to have overlapping effects to noxious weed management to the Buckhorn Access Project include livestock grazing, fuels reduction on Washington State DNR land, reconstruction of Toroda Creek road, recreational activities, firewood gathering, use of gravel from non-NFS lands on NFS roads and noxious weed treatments described in the 1997 and 2000 Integrated Weed Management

Environmental Assessments. Mitigation and prevention practices for noxious weeds would be included in activities planned on National Forest System lands.

The known noxious weed sites within the Buckhorn Access Project assessment area on National Forest administered lands have been or are scheduled for herbicide application and follow up hand pulling under the existing Forest Weed EAs. The existing levels of noxious weeds on existing roads can be expected to continue through the next ten years, with or without the Buckhorn Access Project. All roads can serve as pathways for noxious weeds to invade. The current weed condition along roads is not likely to increase as a result of the proposed Buckhorn Access Project because mitigation and prevention measures would be implemented. Washington State DNR and Okanogan County Road Department and Noxious Weed Control Board implement noxious weed control practices on their projects and roads. If control can be achieved through the treatment methods prior to ground disturbance within the sites, the risk of spread would be minimized. The mitigation measures implemented under this project would have a beneficial cumulative effect by reducing the risk of spread and introduction of new populations even further. Weed control in the Buckhorn Access Project area would benefit control efforts that have occurred in other areas within the watershed by reducing weed populations that could be spread into adjacent areas. An overall reduction of cost for early treatment and control could occur. Therefore, these reasonably foreseeable future actions are not expected to substantially increase noxious weed species.

The proponent has proposed to use gravel material from two different rock sources. One source would be from the Beal Borrow site located on private land along the Kettle River Road. A second source, also on private land belonging to Bob Tollefson, is located south of County Road 9480 near the Pontiac Ridge Road (4895). The Beal Borrow Site is known to have several species of noxious weeds (Muscari 2004). The Tollefson's site was inspected by the District Botanist in September 2006, who determined the gravel to be weed free. Because noxious weeds exist at the Beal Borrow site, there is a risk of introducing these species onto the national forest at the project sites, although this potential is minimized because the Forest Service is requiring noxious weed free gravel to be used. At both sites, topsoil would be removed and stockpiled away from the gravel source. At the Beal Borrow site an estimated 12 to 24 inches of topsoil may be removed to get to the weed free gravel. The other known noxious weed populations on private lands that are part of the Buckhorn Mine project (see Table III-63 above) may have potential to spread on to NFS lands as a result of ore haul and other traffic between the mill and the mine, but this potential is low because of the mitigation measures required in Chapter II and because if they are introduced, treatment would occur under the existing Integrated Weed Management decisions.

Deferred maintenance of roads 3575-120 and 3575-140 occurred in September through November 2006 to facilitate the mine construction and transportation of equipment and supplies to the mine site. Gravel for this road project came from the Stotts pit in Curlew, Washington. This gravel has been analyzed by Washington State Department of Agriculture for the presence of noxious weed seeds and none were found. Maintenance of this road is expected to occur throughout the life of the project. Any additional gravel used would likely be inspected for the presence of noxious weeds. Any disturbed areas along this road would be seeded with noxious weed free seed and monitoring would occur to ensure early detection of new weed introductions and control measures implemented as needed. No change in the current condition of noxious weeds is expected as a result of road maintenance and future use.

Ongoing and future livestock grazing would occur throughout the project area, as well as throughout the analysis watersheds on private land and National Forest System lands in the Cedar, Ethel and Gold allotments. The risk of spread would continue along stock trails at water troughs, or other watering sites. Soil compaction would continue on traveled stock trails and driveways thus reducing the stability of native plant populations. Weak ecosystems are more easily replaced by nonnative noxious weeds. Grazing has led to the introduction and spread of weeds. Weeds can attach themselves to or be ingested by livestock and spread. Little change in current noxious weed populations is expected in the project area because of the proposed Buckhorn Access Project.

Firewood gathering has occurred in the past and continues to occur. Firewood gatherers sometimes drive off roads, and can spread weeds on the undercarriage of their vehicles.

Ongoing recreational use in the vicinity of the Buckhorn Access Project area could increase the risk of introducing new noxious weed species and spread of existing patches. Visitors to National Forest System lands increase the risk of introducing new invader species to the area. Hunting, hiking and Off Road Vehicle use have the highest potential for spreading noxious weeds.

Some roads that were closed by previous projects have been breached in the project area, and these roads would be re-closed as they are discovered during regular road maintenance activities which would reduce potential noxious weed invasion on those roads although this may make noxious weed control efforts more difficult because spread would not be as easily detected for early treatment.

Future soil disturbing activities on private land (Wauconda Quarry), power lines, and County road including reconstruction of Toroda Creek Road, would continue to contribute to cumulative effects on noxious weeds in the analysis area, although weeds spread would continue to be controlled under existing integrated weed management decisions on National Forest System lands. Okanogan County would also likely control noxious weeds along County rights-of-way as long as funding was available.

The Little Nicky Timber Sale on DNR land is utilizing Forest Roads 3575 and 3575-040 for hauling. The timber sale would create additional soil disturbance and haul would increase the risk of weed introduction onto National Forest System lands that are down valley from the sale area. This route would be used in Alternative C, so both have potential to spread noxious weeds.

The proposed future actions associated with the Buckhorn Mine may increase noxious weeds in the short term, but mitigation and prevention measures would be implemented to reduce the likelihood of new invasions or spread of existing populations.

Water quality monitoring would continue for many years following closing of the project. This would occur several times per year and would involve one vehicle. Other vehicle travel would also occur on forest roads. Therefore the risk from long term monitoring would be no greater than normal vehicle travel within the area.

Water monitoring wells and their access roads would be decommissioned at the end of the monitoring period. Soil disturbance that would occur with these activities would be seeded to

prevent erosion and niches for noxious weeds to invade. Decommissioning these access roads would prevent future vehicle travel that could introduce noxious weeds into the area.

Ability to meet objectives of the proposed weed control projects

Eradication of noxious weed species could take place but these species could possibly spread more during the course of this project. Use of mitigation measures such as washing off road equipment, seeding disturbed areas, early detection and appropriate control methods would reduce the likelihood of introduction or amount of spread. Planned road closures would decrease opportunities for new invader species to become established in the closure areas and would prevent existing populations from being spread by vehicles. Established populations of bull and Canada thistle are expected to invade disturbed areas such as burn piles and be treated under existing integrated weed management decisions.

Based on this analysis the effects to noxious weeds from any of the proposed project activities and in combination with other past, present and reasonably foreseeable future actions are not significant.

Inventoried Roadless and Unroaded/Undeveloped Character

The section below summarizes the affected environment information, along with the direct indirect and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Inventoried Roadless and Unroaded Areas Report, by Forest Environmental Coordinator Jan Flatten dated November 20, 2006 located in the project file. Additional information relating to inventoried roadless and unroaded areas is also located in the project file.

AFFECTED ENVIRONMENT

The Buckhorn Access Project is located in what is commonly known as the “Buckhorn Block” of the Tonasket Ranger District of the Okanogan and Wenatchee National Forests and the Republic Ranger District of the Colville National Forest. The National Forest System lands within this block total about 31,780 acres; the block is spatially separated from other blocks of the Forest and surrounded entirely by private or State lands or the Canadian border.

Inventoried Roadless Areas

The Jackson Creek Inventoried Roadless Area (IRA) lies entirely within the Buckhorn Block. According to the information contained in the 2000 Roadless Area Conservation FEIS, this IRA is approximately 10,800 acres in size, 7,800 of which are on the Okanogan National Forest. These acres are higher than those shown in the Okanogan National Forest Land and Resource Management Plan (Forest Plan, 1989), Appendix C. Forest Plan Revision is currently underway, which will likely adjust these numbers again.

The Okanogan Forest Plan indicates that the Jackson Creek Roadless Area is relatively small in size and is surrounded by major roads that would make it difficult to manage as wilderness. Placing boundaries on readily identifiable features would greatly decrease the size of the area. Old road grades and the remains of an old mill and cabins from old logging operations are found within the IRA but old road beds are nearly obscured and the mill site and cabins have deteriorated to the point that they are no longer obtrusive signs of human use. More recent observations indicate that several roads within the area analyzed in the

2000 Forest Service Roadless Area Conservation FEIS were currently driveable. No additional unroaded or undeveloped National Forest System land surrounds the Jackson IRA because of past roading or harvesting. The area has only moderate opportunity for solitude or primitive recreation because of its small size, gentle open south slopes and nearby roads. Opportunities for challenge are few.

Unroaded/Undeveloped Areas

Two large unroaded and undeveloped areas are found within the Buckhorn Block near proposed activities. The Coogan area lies south of the Marias Creek road and the Marias-Nicholson Ridge area lies between the Marias and Nicholson Roads. The Okanogan LRMP inventoried the Marias-Nicholson Ridge area as "roaded natural" and most of the Coogan areas as "semi-primitive" recreation opportunity spectrum. The Coogan area includes about 2,745 acres of unroaded and undeveloped land. It is characterized by a ridge bisecting the area southeast to northwest. The area is bounded on the north by the Marias Creek road, Forest Road 3550-085 and harvest units; on west by Forest Road 3550-080 and harvest units; on the south by private and DNR lands, harvest units and Forest Road 3550-080; and on the east by private lands and the Toroda Creek road. The area was inventoried as mostly semi-primitive non-motorized in the Okanogan Forest Plan, although roading and harvest units from Bat Canyon west have changed this to a roaded natural and modified setting. This remaining area is small in size because of these past management activities and is surrounded by roads making wilderness management difficult. This interior area has not been subject to past timber and harvest activities, so it retains its natural integrity, appearance and surroundings. Range improvements do not detract from natural integrity, appearance and surroundings, although some recreationists object to the sight and smell of cattle use. However the opportunity for solitude, primitive recreation and challenge are limited due to its small size and proximity to roads.

The Marias-Nicholson Ridge unroaded/undeveloped area is the area between Marias and Nicholson Creeks and totals about 3,465 acres (areas connected by less than ½ mile were excluded because of impacts to manageability, boundaries, and solitude). It also is characterized by a ridge bisecting the area southeast to northwest. The area is bounded on the north by Nicholson Creek, Forest Roads 3575-015 and 3575-125, and harvest units; on the west by the 3550-115 road and a harvest unit; on the south by Marias Creek road; and on the east by private and DNR lands. The area was inventoried as roaded natural recreation opportunity setting in the Okanogan Forest Plan, and remains in that condition today. Like the Coogan area, this Marias-Nicholson Ridge area is small in size because the area is surrounded by harvest units and/or roads on three sides, and private or State land on one side, making wilderness management difficult. Also like the Coogan area, this interior area has not been subject to past timber or harvest activities, so it retains its natural integrity, appearance and surroundings. Range improvements do not detract from natural integrity, appearance and surroundings, although some recreationists object to the sight and smell of cattle use. However the opportunity for solitude, primitive recreation and challenge are limited due to its small size and proximity to roads.

The area west of Buckhorn Mountain has been suggested by some as a potential wilderness area. This area is laced by roads, cutting the area into small areas less than 1,000 acres in size. Inventory criteria in the Forest Service Handbook, 1909.12, Chapter 70 for areas less than 5,000 acres cannot be met because natural conditions cannot be preserved due to existing roads, the areas are not "self contained ecosystems" like an island, they are not contiguous to existing wilderness or primitive areas, and they contain improved roads

maintained for travel by passenger vehicles. This area west of Buckhorn Mountain will not be further discussed.

ENVIRONMENTAL CONSEQUENCES

Additional effects regarding these areas can be found in the wildlife section of the Buckhorn Access Project.

Alternative A

No project activities would take place so there would be no effects to either the IRA or the unroaded/undeveloped areas.

Effects on the Jackson Creek Roadless Area

Effects Common to All Action Alternatives

None of these alternatives result in the cutting of trees or construction or reconstruction of roads in the Jackson Creek IRA. All road reconstruction on the Nicholson Creek road in Alternative C would take place outside of the inventoried roadless area boundary. Therefore this project is consistent with the Forest Service Roadless Area Conservation FEIS and Rule and the interim directive relating to activities in roadless areas (ID 1920-2006-1).

Direct/Indirect Effects of Alternatives B, B1 and D

No activities would occur that would impact the Jackson Creek IRA. Employee traffic could increase slightly on the Nicholson Creek road just outside the IRA boundary, but it would not likely be noticeable from other existing traffic on the road. Most employee traffic would likely use the shorter routes up the Marias Creek from the east and Cow Camp roads from the south and west. No impacts to future wilderness manageability, natural integrity, appearance and surroundings, or opportunities for solitude, primitive recreation or challenge are anticipated.

Direct/Indirect Effects of Alternative C

There would be substantially increased traffic along the Nicholson Creek road, directly adjacent to the IRA, from ore haul, supply trucks, and employee traffic. This traffic would not impact future wilderness manageability, natural integrity, or appearance of the IRA, but it would change the surroundings on the western edge of the roadless area from a roaded natural setting to roaded modified for the life of the project (13-15 years, although most disturbance is only for about 10 years). Although the opportunity for primitive recreation and challenge would be unchanged, solitude in the Cedar Creek drainage of the IRA area would be changed from moderate to low, in areas near the Nicholson Creek road. Visitors to this portion of the IRA would easily hear noise from the Nicholson Creek road, and dust may impact the westerly 300 feet or so of the drainage along Nicholson Creek road. About 91 acres of the Jackson Creek IRA are within 500 feet of the Nicholson Creek road and noise impacts within that area would be substantial. Outside of the 500 foot zone, noise impacts would be slight. Once the project is completed, opportunity for solitude would revert to moderate.

Cumulative Effects on Jackson IRA All Alternatives

This cumulative effects analysis considers the effects within the Jackson Creek IRA for the life of the project. Effects of past actions in the Jackson IRA are described in the affected environment information above. Except for the impacts described above in the direct and indirect effects section, the parts of the Buckhorn Mountain Project located on private and DNR lands would not have any impact on the Jackson IRA. Ongoing recreation traffic would not have much potential to noticeably increase dust and noise. The only other activity that could potentially have indirect impacts to the Jackson IRA that could add cumulatively is the Little Nicky Timber Sale currently underway by the Washington State Department of Natural Resources (DNR) in Sections 22 and 27 of T.40N., R.31E. The State is harvesting 2.2 million board feet of timber from 232 acres within these sections. The project constructed about one mile of road in 2005, and timber is being hauled out Forest Road 3575-040 and 3575. No direct impacts would occur to the Jackson Creek IRA from this project, but it's likely that the sights and sounds of timber falling, yarding and hauling would overlap with the sound of haul occurring on the Nicholson Creek road under Alternative C. Aerial photos show some evidence of past harvest or roading in this area, although other portions of this area retain a semi-primitive setting so the Little Nicky project would change these semi-primitive settings (similar to the adjacent Jackson IRA) to a roaded natural setting where harvest and roading has not yet occurred. Because the of the magnitude of the ore haul and other traffic on National Forest System lands, it's unlikely the additional noise from Little Nicky would be noticeable above that created by the access project.

Livestock grazing has affected the Jackson IRA through vegetative changes, livestock trails and droppings and the construction of livestock improvements, and grazing is expected to continue. No other activities that would impact roadless character are planned for these areas at this time, so no other cumulative effects are expected.

Effects to Unroaded/Undeveloped Areas

Direct/Indirect Effects

Alternatives B and B1

There would be substantially increased traffic along the Marias Creek road, directly adjacent to the Coogan and Marias-Nicholson Ridge areas, from ore haul, supply trucks, and employee traffic. Visitors would see and hear substantially increased traffic 7 days a week during most daylight hours, although there may be times when traffic on weekends is reduced. In, addition, three water troughs with pipeline would be installed near the southern boundary of the Marias-Nicholson Ridge area, which would add more evidence of human activity in this area. Although these areas are both well below the usual 5,000 acre threshold for wilderness consideration, this traffic would not impact future wilderness manageability, natural integrity, or appearance, but it would change the surroundings on the northern edge of the Coogan area, and southern edge of the Marias-Nicholson Ridge area from a roaded natural setting to roaded modified for the life of the project (13-15 years, although most disturbance is only for about 10 years), and change the natural appearance in the vicinity of the water troughs. Although the opportunity for primitive recreation and challenge would be unchanged, solitude in both areas would be decreased, particularly on the slopes facing the Marias Creek road. Visitors to these areas would hear noise from the Marias Creek road, see the water troughs, and would be impacted by dust in the northern most portion of the Coogan area and the southern most portion of the Marias-Nicholson Ridge area, except the

lowest 0.5 mile where paving would reduce dust impacts under Alternative B1. Once the project is completed, opportunity for solitude would revert to pre-existing conditions, and the area would return to a roaded natural setting.

Alternative C

There would be substantially increased traffic along the Nicholson Creek road, north of the Marias-Nicholson Ridge area, from ore haul, supply trucks, and employee traffic. However most of the Marias-Nicholson Ridge area is spatially separated from the Nicholson Creek road by ¼ to ¾ miles, which would eliminate most impacts. Visitors to the most northeasterly portion of the area would see and hear substantially increased haul traffic Monday through Saturday during most daylight hours, although there may be times when haul traffic is reduced on Saturday. No haul traffic would affect visitors on Sundays, and no supply traffic (except for infrequent, unplanned shortages) would affect visitors to this area on weekends (employee traffic would still occur). Although this area is below the usual 5,000 acre threshold for wilderness consideration, this traffic would not impact future wilderness manageability, natural integrity, or appearance of the area, but it would change the surroundings in the most northeasterly portion of the area from a roaded natural setting to roaded modified for the life of the project (13-15 years although most disturbance is only for about 10 years). Although the opportunity for primitive recreation and challenge would be unchanged, solitude in the northeastern portion of this area would be decreased. Visitors on the north side of the ridge could hear noise from the Nicholson Creek road. Paving in this alternative is unlikely to reduce dust to visitors, since it is only planned for the Forest Service rights-of-way through private lands on the lower 2.4 miles of the road. Once the project is completed, opportunity for solitude would be revert to pre-existing conditions, and the area would return to a roaded natural setting.

Alternative D

Neither the Coogan nor Marias-Nicholson Ridge areas would be impacted by any activities under this alternative.

Cumulative Effects

This cumulative effects analysis considers the effects within the Coogan and Marias-Nicholson Ridge Unroaded Areas for the life of the project (13-15 years). Effects of past actions are described in the affected environment information above. Except for the impacts described above in the direct and indirect effects section, the parts of the Buckhorn Mountain Project located on private and DNR lands would not have any impact on these areas. Ongoing recreation traffic would not have much potential to noticeably increase dust and noise. The DNR's Little Nicky Timber Sale would have no effect on the Coogan area. Because of spatial separation between the Marias-Nicholson Ridge area and the Nicholson Creek route and Little Nicky area, cumulative noise effects are unlikely in the Marias-Nicholson Ridge area, except at its most northeast corner (Section 26). In section 26 it may be possible to hear log trucks in addition to construction and haul traffic from the access project. The south facing slopes of the Little Nicky area have sporadic vegetation which would allow sound to travel further. The Nicholson Creek road would be paved adjacent to this area, so no cumulative dust impacts are expected, except during road reconstruction. During road construction, it's unlikely that the DNR would be able to haul on the road, so no cumulative effects are expected.

Road closures under Alternative B1 would not effect the Coogan area since the closure area is spatially separated from the Coogan area, and administrative access would still be granted on those roads.

Livestock grazing has affected both areas though vegetative changes, livestock trails and droppings and the construction of livestock improvements, and grazing is expected to continue. Some roads that were closed by previous projects have been breached in the project area, and these roads would be re-closed as they are discovered during regular road maintenance activities. If any of these are within or directly adjacent to the unroaded area, closure may improve the unroaded character or expand the area with unroaded character. No other activities that would impact unroaded and undeveloped character are planned for these areas at this time, so no cumulative effects are expected.

Cultural Resources

The section below summarizes the affected environment information, along with the direct, indirect and cumulative effects from the Buckhorn Access Project, as analyzed in the Buckhorn Access Project Cultural Resources Report, by Forest Archaeologist, Powys Gadd, dated January 8, 2007 located in the project file. Additional information relating to cultural resources, including Section 106 Reports, and consultation and concurrence documentation is located in the project file.

AFFECTED ENVIRONMENT

On the Okanogan National Forest cultural resources are districts, sites, buildings, structures and objects that contain evidence of past human activities. Traditional cultural properties (TCP), defined as resources of traditional cultural significance, are included as well. The Forest is responsible for the management of cultural resources that are listed or are eligible for listing on the National Register of Historic Places (NRHP) (36 CFR 800; E.O. 11593). Such resources are known as historic properties and they are given consideration in planning for federally licensed, permitted, approved or funded undertakings. Properties that are documented but not yet evaluated for nomination or listing on the NRHP are managed as eligible. Sites that have been determined ineligible require no further management consideration.

Cultural resource investigations associated with the development of the Buckhorn Mine began in 1990 as part of the Crown Jewel Mine project and to date more than 20 cultural resource reports have been produced and 52 cultural resources have been documented on private, Forests Service, Bureau of Land Management and State lands within a one mile buffer of the mine, 0.25 mile of proposed haul roads, and at proposed borrow and tailing disposal sites. Site types include mine complexes (Myers Creek Mining District), cabins, trash dumps, prospect pits, adits, prehistoric lithic scatters, culturally modified trees, a ceremonial site and traditional cultural property, a grave marker and a former military facility. These surveys and sites are summarized in the SDEIS Historic and Archaeological Discipline Report (WADOE 2005).

As it relates to this analysis specifically, the area of potential effect (APE) on Forest Service-managed-land has been defined as 15.6 miles of Forest Service system roads in the Marias Creek and Nicholson Creek drainages (includes easements), a 354-acre block to accommodate new road construction and road reroutes within the Marias Creek drainage,

and the locations proposed for the project boundary fence, the infiltration gallery, the underground utility conduits (power lines, data lines, telephone lines) plus access roads to these facilities and locations where various mitigation measures are proposed.

Previous inventories by Archaeological and Historical Services (AHS) had included the locations currently proposed for the mine project fence, the underground utility conduits (power lines, data lines, telephone lines) plus access roads to these facilities. Therefore, recent surveys (2004 to the present) are focused on the areas comprising Alternatives B, B1, C, and D. Cultural resource investigations since 2004 were conducted by archaeologist David Harder of Plateau Investigations (Harder 2005, 2006a, 2006b; Harder and Hannum 2006) and by Forest Service archaeologists and cultural resource technicians (Gadd 2005;Hughes 2005, 2006a,2006b,2006c). Investigations involving field surveys have overlapped some of the areas inventoried for cultural resources in 1990 and 1994 by AHS (Galm 1990; Luttrell 1990, 1994), while other investigations involved a review of relevant literature only. In 2005 Harder completed a traditional cultural property (TCP) study which involved an extensive literature review and an interview and field visit with a Colville elder. Harder's TCP research was completed in accordance with a permit issued by the Tribal Historic Preservation Officer (THPO) for the Colville Confederated Tribes. No TCPs were identified in the APE.

Harder's field survey work was completed in accordance with a permit issued under the authority of the Archaeological Resources Protection Act (ARPA) and issued by the Okanogan National Forest. His investigations are closely coordinated with the Forest's Heritage Program Manager. Field survey methods have included block survey using pedestrian transects spaced 30 meters apart, inspection of up to 60 meters either side of proposed and existing road alignments, and shovel testing at select locations. In 2004 Harder inventoried a 717-acre block in the Marias Creek drainage area, to accommodate existing and new road construction. This included 28 acres of private land, 339 acres of State land and 354-acres of National Forest System land. Roughly 6.6 miles of Forest Roads 3550 and 3550-120 (6.3 miles on FS and 0.3 mile of private) and 0.7 mile of road in Bear Trap Canyon were inventoried with up to 60 meters of inspection either side of road centerlines. Harder surveyed 13 miles of the Nicholson Creek road system (Forest Roads 3575, 3575-150, 3575-100 and 3575-120) in a similar manner.

While Harder's survey was underway, the 8.5-acre site of the proposed infiltration gallery and new monitoring well was inventoried by Forest Service cultural resource technician Brad Hughes (Hughes 2005). The area was close to the boundary surveyed for cultural resources by Galm and Luttrell in the 1990s and it was re-inspected to insure coverage. No cultural resources were located at the site proposed for the infiltration gallery or monitoring well.

In 2006 Harder and Hannum surveyed and tested at three water gap locations along Marias Creek. They also surveyed and tested along FR 3550 (near the junction of FR 3550 and County Road 9495) where reconstruction of FR 3550, and a power line right-of-way within the Forest Service easement are planned[95]. Hughes' 2006 inventories included a proposed fence right-of-way from an existing corral off Forest Road 3550-080 road east along Marias Creek; a proposed fence right-of-way from Forest Road 3550-122 to Forest Road 3550 and along Forest Road 3550 to its junction with Forest Road 3550-125; a fence around a riparian

[95] The DEIS included cumulative effects analysis included a stream enhancement project that would have lined Marias Creek with an impermeable barrier on Kinross' private land at the base of Marias Creek. This proposal was dropped at the recommendation of WDFW.

wetland; a monitoring well; staff gauges and piezometers locations; three water trough locations; a pipeline route to water troughs located on the north side of Forest Road 3550; a proposed fence around Grass Lake; three proposed culvert replacements or removals; guzzler sites in the headwaters of Ethel Creek, Gold Creek, South Fork Bolster Creek, and North Fork Bolster Creek and culvert replacements near the junctions of FR 3550 and the 3550-080 road and FR 3575 and the 3575-100 road.

Harder's 2005 and Harder and Hannum's 2006 inventories and research to date resulted in the documentation of four historic sites and one site with both historic and prehistoric components (Table III-64). The Roosevelt Adit was also documented in the 1990s by Galm and Luttrell. The Wheaton site located on private land at the junction of County Road 9495 and FR 3550 was documented and tested in 2006. Testing resulted in the identification of a buried prehistoric component. The site had been determined eligible for the National Register of Historic Places by the Forest Service and the State Historic Preservation Officer (SHPO). Proposed activity in the vicinity of the Wheaton site has been designed to avoid impacts to the site. Where the site extends into the Forest Service easement along FR 3550, the Forest Archaeologist recommended a determination of no adverse affect for riparian planting, and the Washington State Historic Preservation Officer (SHPO) concurred with this finding.

Consultation on this project has been completed with both the Tribal Historic Preservation Officer for the Confederated Colville Tribes and SHPO.

Table III-64: Cultural Resources in the APE

Site Name/Type	NRHP Eligibility	Alternative
Homestead	Eligible	Alt. C
Cow Camp ranch complex	Not Eligible	Alt. B, B1, C,D
Road segment (1.25 miles)	Not Eligible	Alt. C
Roosevelt Adit	Not Eligible	Alt. B, B1, C, D
Wheaton Site	Eligible	Alt. B, B1

ENVIRONMENTAL CONSEQUENCES

Effects Common to All Alternatives

Regardless of the alternative selected, all five historic sites would be indirectly affected by the project. Vibration from heavy trucks may increase the rate of site deterioration and an increase in the number of people in the area may lead to vandalism and looting at the homestead on the Nicholson Creek Rd (FR 3575) or the lithic scatter on the Toroda Creek Road (CR 9495). The waterline to the water augmentation sites would pass through the Roosevelt Adit area, but would not affect it. No alternative would have an adverse effect on any site under NHPA, except Alternative C, although concurrence by SHPO on the site along the Nicholson Creek road was contingent on appropriate mitigation for that site. No TCPs would be affected or impacted because none were identified in the project area.

Direct and Indirect Effects

Alternative A

Under this alternative the five historic sites documented would continue to deteriorate naturally.

Alternatives B and B1

One cultural resource site known locally as Cow Camp is located on private land in the APE. The site has been determined ineligible for the National Register of Historic Places because it lacks physical integrity. Forest Road 3575-120 and the new access road to patented land cross through the site but as an ineligible resource the site would not be affected by road use.

The project fence, utility line, and monitoring well locations were inventoried for cultural resources in 1990 and 1994 (Galm 1990; Luttrell 1990, 1994). While numerous historic sites were documented during the surveys, no cultural resources are present where the fence, utility lines, and wells are proposed. No cultural resource were located by Hughes in 2005 or 2006.

Cultural resource surveys were completed in 2006 for culvert replacement , an extension of the fence at the existing Marias Creek corral, for wildlife guzzler locations in the vicinity of Ethel Creek and South Fork Bolster Creek; for three water troughs, pipelines to the troughs and an associated well north of Forest Road 3550 (Marias Creek). Cultural resource consultation for piezometers and staff gauges occurred but no survey was determined necessary because of previous survey in the general area and the limited potential for impacts to cultural resources (Hughes 2006a, 2006b, 2006c). Survey and shovel testing for the presence or absence of cultural resources was conducted at three water gap locations and near the junction of FR 3550 and County Road 9495 where road reconstruction, power line installation in the FR 3550 right-of-way, and riparian planting are planned (Harder and Hannum 2006; Harder 2006a, 2006b). Harder and Hannum's survey and testing resulted in the documentation of the Wheaton historic site and in the identification of an archaeological component of the site. Proposed activities in the vicinity of the archaeological component are designed to avoid impacts to the site. All other locations for mitigation-relation features were inventoried for cultural resources between 1990 and 2005 (Gadd 2005).

The pipeline to Roosevelt Adit and to the new water trough for water augmentation, plus the water trough itself, were previously surveyed and would result in no effect to cultural resources. Some of the piezometer and staff gauge areas were surveyed previously; surveys for others were determined unnecessary by the Forest Archaeologist because their size and location would cause no effect to cultural resources. Additional cultural resource surveys were completed in 2006 at guzzler locations in the vicinity of Ethel Creek and South Fork Bolster Creek and for the fence around Grass Lake. The culvert replacement locations in Nicholson Creek were inspected by the Hughes in 2006 (Hughes 2006a, 2006b, 2006c). All other locations for mitigation-relation features were inventoried for cultural resources between 1990 and 2005 (Gadd 2005).

Alternative C

One cultural resource site known locally as Cow Camp is located in the APE. The site has been documented and because it is lacking physical integrity, it has been determined ineligible for the National Register of Historic Places. Forest Road 3575-120 and the new access road to patented land cross through the site but the site is ineligible and would not be affected by road use.

The west end of Forest Road 3575-150 was inventoried in 1990 (Galm 1990) and again by Harder in 2004 and 2005. Harder documented two historic sites within the easement of

Forest Road 3575. One of the sites is a homestead on private land and the other is a historic segment (1.25 miles) of the Nicholson Creek road (Forest Road 3575).

The homestead is eligible for the National Register of Historic Places. Located just off the edge of the road prism, improvements would likely damage/destroy structural features and subsurface archaeological deposits that may provide clues to the site's history and function. As such, selection of this alternative would adversely affect characteristics that qualify the site for listing on the National Register of Historic Places. If this alternative is selected mitigation for the adverse effect would be required. Appropriate mitigation would be developed in consultation with the property owner, the Colville Confederated Tribes, and the State Historic Preservation Officer.

The historic segment of the Nicholson Creek Road (FR 3575) was documented (Harder 2005) and has since been determined ineligible for the National Register. As such, its significance would not be affected by road improvement or use.

The pipeline to Roosevelt Adit and to the new water trough for water augmentation, plus the water trough itself, were previously surveyed and would result in no effect to cultural resources. Some of the piezometer and staff gauge areas were surveyed previously; surveys for others were determined unnecessary by the Forest Archaeologist because their size and location would cause no effect to cultural resources. Additional cultural resource surveys were completed in 2006 at guzzler locations in the vicinity of Ethel Creek and South Fork Bolster Creek and for the fence around Grass Lake. The culvert replacement locations in Nicholson Creek were inspected by the Hughes in 2006 (Hughes 2006a, 2006b, 2006c). All other locations for mitigation-relation features were inventoried for cultural resources between 1990 and 2005 (Gadd 2005).

Alternative D

One cultural resource site known locally as Cow Camp is located in the APE. The site has been documented and because it is lacking physical integrity, it has been determined ineligible for the National Register of Historic Places. Forest Road 3575-120 and the new access road to patented land crosses through the site but as an ineligible resource, the site would not be affected by road use.

The pipeline to Roosevelt Adit and to the new water trough for water augmentation, plus the water trough itself, were previously surveyed and would result in no effect to cultural resources. Some of the piezometer and staff gauge areas were surveyed previously; surveys for others were determined unnecessary by the Forest Archaeologist because their size and location would cause no effect to cultural resources. Additional cultural resource surveys were completed in 2006 at guzzler locations in the vicinity of Ethel Creek and South Fork Bolster Creek. The culvert replacement location in Nicholson Creek was inspected by the Hughes (Hughes 2006a, 2006b, 2006c). All other locations for mitigation-relation features were inventoried for cultural resources between 1990 and 2005 (Gadd 2005).

<u>Cumulative Effects Common to All Alternatives</u>

This cumulative effects analysis is spatially limited to the overlapping effect of the Buckhorn Access Project, with the effects of the Buckhorn Mountain (Mining) project, and other activities that may cause vibration disturbance, looting or vandalism of the cultural resources affected by the Buckhorn Access Project. Once activities relating to the Buckhorn Access

Project cease, cumulative effects would cease, so the time boundary for cumulative effects is the length of time until reclamation is completed.

Cultural resource surveys associated with the Buckhorn mine began in 1990 and to date more than 20 cultural resource reports have been produced and 53 cultural resources have been documented within a one mile buffer of the mine, 0.25 mile of proposed haul roads, and at proposed borrow and tailing disposal sites. Of those sites, the homestead site (PI-NC-01) on the Nicholson Creek road (Alternative C) and the Wheaton site near the junction of FR 3550 and County Road 9495 (Alternatives B and B1) may be the most susceptible to long-term effects.

Activities planned in the vicinity of the archaeological component of the Wheaton site include reconstruction of FR 3550, power line installation within FR 3550, installation of a fish-friendly culvert under County Road 9495, fencing, noxious weed treatment and riparian planting within the Forest Service easement along FR 3550. Reconstruction of FR 3550 and placement of the utility line in the road (FR 3550), riparian planting and fence construction have been designed to avoid impacts to the Wheaton site altogether. Riparian planting has been designed to utilize planting stock that would not necessitate digging to the depth of the archaeological site. These activities would be monitored by a professional archaeologist during and after the work is completed. The historic component of the Wheaton site is visible from County Road 9495 and FR 3550 and it would remain susceptible to looting and vandalism. The fish-friendly culvert is an Okanogan County road project separate from the Buckhorn Mine project. Harder surveyed and tested the culvert location and did not find any cultural material. As such, replacement of the existing culvert with a fish-friendly culvert would have no effect on the Wheaton site provided all excavation is confined to existing fill.

The homestead on the Nicholson Creek road (Alternative C) would remain susceptible to looting and vandalism because of its high visibility. Vibration and compaction from traffic along the Nicholson and the Toroda roads could continue to contribute to each site's deterioration.

All other sites would be avoided, except Cow Camp, which is ineligible, but would be subjected to indirect effects such as dust and vibration from traffic and mining operations. Increased use of the area by people would increase the likelihood of looting and vandalism because the sites are visible to more people than in the past. Undiscovered cultural resources are likely but would remain undocumented unless threatened by an action. Buildings and structures that are less than 50 years old would become "historic" cultural resources as time passes and as such, they would need documentation, evaluation and potential mitigation as time passes.

Although other sites have been located in and around the area, none would be impacted by Buckhorn Access Project activities, so no cumulative effects would occur. None of the other past, present or reasonably foreseeable future actions listed at the beginning of this chapter would affect these resources.

Other Required Disclosures

SOCIO-ECONOMIC EFFECTS

The project socio-economic effects of the Buckhorn Access Project have all be documented previously in this chapter under the transportation, scenery, recreation, noise, air quality sections, and in the section on environmental justice and civil rights below.

Some residents in the area are concerned that the general quality of life might change as a result of large-scale industrial development in the area. These concerns include the possibility that non local people coming to work on the project would not "fit in" with established residents. The economic stimulus provided by the project is viewed by some as an opportunity to preserve the local lifestyle and customs of area residents as well as their livelihoods. Social values among other residents differ. An activity that may benefit one group may be seen as an adverse impact to another.

During the comment period on the preliminary EA that was published on this project prior to switching to an EIS, one person raised the concern about impacts to property values. The IDT leader called Jim White, the chief appraiser for Okanogan County to discuss the potential impacts of increased traffic, improved access and utilities to property values. According to Mr. White, it is difficult to determine the effects of increased traffic and improved access on property values. Values are based on market value, but Okanogan County hasn't found any correlation between increased traffic or improved access and property values. The noise and dust from the increased traffic could decrease property values, and improved access could increase property values, but these are not possible to quantify. Utilities would increase value, but the residents along these roads already have electrical and phone service.

Department of Ecology's DSEIS identifies significant impacts to law enforcement and fire control agencies as a result of the project. The Forest Service is responsible for fire fighting on the National Forest System lands affected by this project, and does not consider this impact to be significant. The District maintains a standing initial attack crew that would respond to fire emergencies, and does not plan to increase the size of that crew. The Forest Service has a cooperative agreement with Okanogan County for patrol of National Forest System lands, and also maintains its own law enforcement officer in Republic. The Forest Service road portion is about half the haul route in Alternatives B and B1, most of the haul route in Alternative C and very little of the haul route in Alternative D within Okanogan County. Speeds are substantially lower than the non-Forest portion of the haul route and public traffic is less than on County roads and accidents are less likely.

SOCIAL GROUPS, CIVIL RIGHTS AND ENVIRONMENTAL JUSTICE

Civil Rights would not be affected by the Buckhorn Access Project. The impacts on low-income persons residing in the area and on Hispanic populations in Okanogan County are not expected to be disproportionately high or adverse.

Executive order 12898 (59 Fed. Reg 7629, 1995) directs Federal agencies to identify and address, as appropriate, any disproportionately high and adverse human health or environmental effects on minority populations and low-income populations.

The private lands surrounding the project area are primarily white, but have a high percentage of low income individuals. In addition, the analysis area is located near the Colville Indian Reservation, on land that was originally part of the Reservation, but returned to the United States Government (commonly referred to as the "north half"). The Confederated Tribes of the Colville Indian Reservation retained gathering, hunting and fishing (with inferred water) rights. The analysis area is also near traditional use areas of the Yakama Indian Nation. Many Native Americans have a rural lifestyle that is reliant on a

clean and healthy environment, and the Forest is important in providing religious or spiritual settings, and hunting, gathering and fishing opportunities.

The Tribal governments for the Confederated Tribes of the Colville Indian Reservation and Yakama Nation were contacted during scoping; the Yakama Nation did not express any concerns over the project. Although the Colville Tribal government unanimously voted to oppose the mining project in November 2006, the Tribal Government has not raised any concerns to the Forest Service about the project, although individual Tribal members have raised issues (see issues in Chapter I and Appendix F, Response to Comments: Tribal). Consultation about this project occurred throughout project planning and has been completed with the Confederated Tribes. On December 20, 2006, the Forest Service received a consultation letter from the Tribal Heritage Preservation Office stating: "Please note at the outset that this letter is intended only to comment on the adequacy of steps taken by the US Forest Service (USFS) in complying with Section 106 of the National Historic Preservation Act. Nothing herein should be construed as providing any kind of approval or support by the Confederated Tribes of the Colville Reservation (also known as the 'Colville Confederated Tribes [CCT]') for the Buckhorn Mountain project."

The impacts on members of the Confederate Tribes of the Colville Reservation could be disproportionately higher and adverse due to the Colville Tribes' distinct cultural practices and hunting, gathering, and fishing rights in the North Half, including the vicinity of the project, although these same impacts would occur to all hunters, fisherman and recreationists who use this area. Colville Tribal members would not likely want to hunt, fish or gather on lands directly adjacent to the haul route because of the traffic, dust and noise. Additionally big game may avoid areas directly adjacent to the route, and fish habitat may be degraded (see wildlife and aquatic sections earlier in this chapter). However, the area impacted represents less than 1% of the total acreage of federal lands available for tribal hunting, gathering, and fishing within the North Half and therefore represents a low total impact. Only one Indian Allotment is present within two miles of the proposed project. The perception among some members of the Colville Confederated Tribes is that the proposed project would result in the contamination of fish and wildlife with heavy metals, which could discourage members from exercising their rights in this portion of the North Half. No ore or waste rock potentially containing heavy metals would be permanently stored on Federal, State or private lands in the Buckhorn Block and all ore processing would occur at the existing mill over by Republic, Washington. Process tailings would be stored in a lined and monitored impoundment at that facilities. Any mine water or surface water that has contacting ore, waste rock or other potentially hazardous materials would be recycled or treated to State standards set by the NPDES permit before returning to the environment (effects on water, fish, wildlife and hunting are previously displayed in this chapter).

The effects of the proposed action on civil rights and minority communities would be minimal. Employment would be created by the proponent, which may provide jobs for current low income populations.

Proposed haul routes are not planned through communities that have high Hispanic or Native American populations. The most probable access routes off National Forest System lands would be County Roads 4895, 9480 and 9495 for supplies, and County Road 9495 for haul in Alternative B, B1 and C, and County Roads 4895, 9480 and 9495 for Alternative D. According to the State of Washington's FSEIS for the Buckhorn Mountain (Mining) Project, haul routes would continue on Ferry County Roads 502 and 501, then south on Highway 21 to the mill by Republic, Washington. According to the 2000 U.S. Census, people living in the

towns and census tracts affected by these haul and supply routes are primarily white (84-97%), with small populations of American Indian (2-4%), or other races (1-8%). Individuals living at or below the poverty level in these towns and census tracts range from 17-28 percent, well above the State and National averages, 11 and 12 percent respectively.

The noise and disturbance from the Buckhorn Access Project activities would likely temporarily displace recreational activity, but would affect all people who recreate in the area, not just Hispanics, Native Americans or low income populations. Project activity could temporarily displace hunting, fishing and gathering activities of Tribal members (see discussion below under American Indian Treaty Rights). There would be minor temporary impacts to the utilization of the subsistence rights that the members of the Colville Tribe current exercise (e.g. hunting, fishing, and gathering) due to changes in habitat from these activities and a small amount of area not available at any given time due to ongoing activities. The effects on hunting, gathering and fishing opportunities can be derived from the effects on wildlife, plants, water and fish earlier in this chapter.

Providing access across National Forest System lands rights-of-way has the potential to disproportionately affect low income populations, given the high poverty rate in the census tracts. Cumulatively, when considered with the haul off National Forest System lands from the Buckhorn Mountain (Mining) project, access does have the potential to disproportionately adversely affect low-income populations off National Forest System lands. No other alternatives exist to access Buckhorn Mountain that would not result in effects to low income individuals because the surrounding census tracts all have higher percentages of low income individuals. Residents above the poverty level would be affected in the same way and for the same length of time as low income individuals. Given the low percentage of minorities in these census tracts, minorities would not be disproportionately affected. Civil liberties would not be affected by any alternative.

The proposed action would not have disparate effects on any consumers, minority groups, women, civil rights, or social/ethnic groups, except as previously noted.

AMERICAN INDIAN RIGHTS

The Buckhorn Access Project analysis area lies within the ceded portion of the Colville Indian Reservation commonly known as the “Old North Half.” None of the proposed alternatives would conflict with Executive Order provisions. Portions of the former North Half of the Colville Reservation would not be available during construction, operations, and restoration (approximately 10-15 years). This would not affect American Indian subsistence rights under the Executive Order for traditional hunting, fishing or gathering. About 74 acres of land would be fenced off from public and Tribal use, which when added cumulatively to the patenting of 220 acres of formerly public lands, equates to about 294 acres of land not available to the public and Tribal members during the life of the project (13-15 years). This mine project fence as well as other ancillary facilities associated with the project are necessary and reasonably incident to operations authorized by the 1872 Mining Law. The fence is needed to:

- provide for public safety, and
- to meet air quality standards (the mine is required to meet State air quality standards at the “property boundary” which in this case is the mine fence line).

No fisheries are found within the fence boundary. Because the fence would be passable by wildlife, fencing off the area would not result in changes in deer or other big game populations, and Tribal members would still be able to hunt on National Forest System lands that surround the fence. Effects to deer from the entire project are disclosed in the wildlife section of this EIS. Gathering by Tribal members could not occur within the fenced boundary while the fence is in place but based on surveys, it does not appear this area supports many populations of plants important to Tribal members. Impacts to cultural plants from the entire project are disclosed in the botany section of this EIS. In all, this fence would enclose less than 1% of the public and former public lands from the original "North Half" of the reservation until reclamation is complete. Forest Service activities would actually increase downstream stream flows, although because of the mine on private lands, overall, stream flows would either remain the same, or decrease or increase slightly depending on the time or year. The effects to fish from sedimentation, salts and stream flow changes and other activities on NFS lands are disclosed in the Hydrology and Aquatics sections of this EIS.

FLOODPLAINS AND WETLANDS

Impacts to designated floodplains or wetlands are discussed in the previous Hydrology and Aquatics sections of this EIS, including information on compliance with Executive Orders 11988 and 11990.

PRIME RANGE LAND, FARM LAND, and FOREST LAND

The Buckhorn Access Project area does not contain any prime forest (see Forest Vegetation section of this EIS), range or farm lands. Therefore, none of the alternatives would have any effect on prime forest, range or farm lands.

WILD AND SCENIC RIVERS

No wild or scenic rivers are located within the project area. The Forest Plan did not recommend any of the streams in the project area for inclusion in the Wild and Scenic River System. An eligibility analysis was completed in 2000 for the Forest; none of the creeks in the project area were found to be potentially eligible.

RELATIONSHIP BETWEEN SHORT TERM USES AND LONG-TERM PRODUCTIVITY

Construction of the mine related facilities and road would be a short-term use of National Forest System lands. As noted in the Soils and Forest Vegetation sections earlier in this chapter, some land would be taken out of long-term timber productivity as a result of widening Forest Road 3550 and new road construction. Alternatives B and B1 would result in a loss of productivity on 39 acres, Alternative C on 55 acres and Alternative D on 17 acres. After ten years, approximately two acres of these would be returned to productive land through reclamation of the road between Cow Camp in Section 30 and Crown/Kinross's land in Section 24, but the remaining land is not likely to regain its former productivity. As noted in the Aquatic section earlier in this Chapter, aquatic habitat would also likely be degraded for 3 years after road construction and reconstruction and may result in the loss of some individuals, but this would not likely result in any trends toward Federal listing.

POTENTIAL MINE EXPANSION

No information or data indicate economic mineralization in the skarn north or west of the proposed mine area which would cause the proposed mine to expand in that direction. While it is possible that during mining the Proponent could explore adjacent areas for potential replacement reserves, the Proponent has not made any proposals to the Forest Service for such exploration. It would be highly speculative to try and guess what the results of such exploration might be. It is possible that future exploration by the proponent, or other individuals or companies may occur and may find additional, substantial developable gold reserves in the near-Project area.

Because such discovery or potential mine expansion would be highly speculative without details regarding the location, scope, or nature of such a development, meaningful effects analysis is not possible. At this time, it is highly speculative and therefore not reasonably foreseeable.

The present mining and ore transport proposal is based on a set gold market value and ore cut-off grade. Change in either factor could result in mining or transport of more or less ore. Any change in the proposed operations would be reviewed on its merits and may or may not require a revised NEPA analysis depending on the scope and magnitude of changes.

ACCIDENTS AND SPILLS – TRANSPORTATION SPILLS

The chemical reagents and fuels considered to be hauled over National Forest roads in large quantities, yearly, are as follows:

- Cement/lime/fly ash – 12,000 tons;
- Diesel fuel – 500,000 gallons;
- Gasoline – 4,000 gallons;
- Lubricants (oils and greases) – 85,000 gallons;
- Anti-freeze – 1,800 gallons;
- Propane – 130,000 gallons;
- Ammonium nitrate (explosives) – 730 tons; and
- Magnesium chloride (brine) - 20,000 gallons.

The risk of accidental spills during transportation is related directly to the number of miles that the materials are transported and the safety measures that are employed by the transporter. A discussion of the transportation network on National Forest System lands is contained in the Transportation section of this chapter.

The following applies to National Forest land and rights-of-ways; based on preliminary work done by Shaw Environmental, Inc. in the draft Transportation Report (Shaw, 2004a) the maximum total estimated number of hazardous materials spills proximate to waterways on the Marias Creek access route (Alternatives B and B1) over the life of the project is 0.12 (1 chance of a spill in 833). The maximum total estimated number of hazardous materials spills proximate to waterways on the new lower portal access road (all action alternatives) over the life of the project is practically zero since there is only one crossing of a stream. The maximum total estimated number of hazardous materials spills proximate to waterways on the Nicholson Creek haul route (Alternative C) over the life of the project is similar to

Alternatives B and B1 since the miles proximate to streams is similar. The maximum total estimated number of hazardous materials spills proximate to waterways on Forest Road 3575-120 (Alternative D) over the life of the project is none since there is no waterway proximate to this road. Accident rates are based on a two-lane road and would be far higher if the project proceeded with a one-lane road. These estimates exclude roads off National Forest System lands and rights-of-ways such as along Toroda Creek road (Alternatives B, B1, and C) and along Millard/Beaver/Toroda Creek road (Alternative D).

The impact from a transportation related spill on National Forest System land and rights-of-ways would depend on a number of conditions including:

- Accident severity and volume of the spill;
- Integrity of the transport containers;
- Chemical and physical properties of the material being transported;
- Clean-up response time and effectiveness;
- Weather conditions;
- Local soil and vegetation types;
- Proximity of the accident or spill to a stream; and
- Volume of the receiving water.

Materials in solid form would generally be less mobile in the event of a spill than liquids and easier to clean up. Assuming a rapid and effective response, solid materials would be less likely than liquids to impact ground and surface waters, unless spilled directly into a stream or wetland. Liquids spilled or leaked during transportation could impact surface waters via the following pathways:

- Direct spillage into water;
- Overland flow or runoff from spills adjacent to streams or wetlands; or
- Transport of dissolved material in ground water into streams or wetlands.

The supply access roads on National Forest land would be in-sloped toward the ditch so viscous liquid spills would generally move toward the inside ditch line and be captured by stormwater control structures before they could reach streams or wetlands.

Spills of the following materials are discussed below:

- Ammonium nitrate (explosives);
- Cement/fly ash/lime;
- Petroleum products;
- Magnesium chloride (brine, dust suppressant); and
- Lignin derivates (dust suppressant).

These type of accident scenarios are not predicted to occur due to the mitigation measures that would be employed. The type of mitigation measures to be employed are discussed in the Management and Mitigation section of Chapter II including:

- A Transportation Spill Response Plan where suppliers of hazardous materials would be required to submit spill response plans to the Proponent which describe the procedures, equipment, and personnel which would be used in case of a spill. The goal of this measure is to prevent spills/accidental releases, and if a release occurs, minimize the impact with quick responses, trained personnel, and appropriate,

readily accessible clean up equipment (mitigation measure SP-2). This is consistent with INFISH standard and guideline RA-4.

- A Fuel Storage and Other Hazardous Substances Plan which requires storage of petroleum products in approved tanks and outside Riparian Habitat Conservation Areas. This measure also requires reporting of all releases of reportable quantities, directly or indirectly, because of the Proponent's operations (mitigation measure SP-1). This is consistent with INFISH standard and guideline RF-2.
- The Proponent would also ensure that appropriate spill response and materials handling training would be given to employees and provided to local sheriffs departments, fire departments, and appropriate administering agencies (mitigation measure SP-4).
- Mitigation measure SP-1 in Chapter II requires that all fuel and other petroleum products that are stored on National Forest System land during construction activities be stored in approved tanks and outside of Riparian Habitat Conservation Areas; all construction equipment, such as trucks, be fueled at least 200 feet outside of the 300 foot Riparian Habitat Conservation Area (RHCA) along Marias and Nicholson Creeks; non-mobile equipment, equipment which can not be moved outside the RHCA in under 10 minutes, have absorbent pads place below the machine prior to fueling to catch any drips or spills; and if the total oil or oil products storage exceeds 1,320 gallons in containers of 55 gallons or greater, on National Forest land or right-of-ways, the Proponent is required to prepare a Spill Prevention Control and Countermeasure Plan. This is consistent with INFISH standard and guideline RA-4.

These measures would be highly effective in preventing spills, responding to spills, and cleaning up any spills that occur.

Ammonium Nitrate (Explosives)

Ammonium nitrate, the primary explosive to be used for the project may be transported in solid form (small beads or prills) or as packaged water-resistant emulsion. The former is a commonly used form of agricultural fertilizer. Nitrate is considered toxic to mammals only under reducing conditions when ingested. This situation would be unlikely since there would be human presence until clean-up is completed.

Nitrate is considered toxic to aquatic biota only in high concentrations (EPA, 1986). Lethal thresholds for freshwater fish range from 420 to 2,000 mg/L. This situation could occur if sufficient amounts were spilled directly into a stream. Likely lake effects would be a resultant algal bloom due to the introduction of the nitrate into a body of water.

In the event of an accident and spill, the anticipated effects would be very minor and remediation would revolve around containment and cleanup of the undissolved portion of the ammonium nitrate prills.

Small quantities of other, non-ANFO-based explosives would also be transported on the supply route.

Cement, Lime, and Fly Ash

Cement is toxic to fish when exposed to levels of 92 ppm for 28 minutes, or 198 ppm for 10 minutes. Since this material is not very water soluble and would be transported in dry form, adverse effects would be minimal if an accidental spill were to occur. Sills on the road or adjacent to the road, but not in the stream could be cleaned up with little residual effect. Even if directly spilled into water the effects would tend to be localized compared to a liquid spill. Fly ash and lime are similar to cement in texture, alkalinity and cementitious properties.

Petroleum Products (including Propane)

Accidents involving petroleum products could cause both short- and long-term adverse effects to aquatic organisms if a spill reaches a stream. Since most of these materials are transported as liquids in bulk tanks, there is a high potential that a spill into water could be of sufficient volume to result in multiple effects to the environment. The duration of the impacts would depend heavily on the location of the spill and the response time to initiate containment and begin clean-up. These products may form explosive mixtures with air and containers may explode if heated. These type of accident scenarios are not predicted to occur due to the mitigation measures to be employed. Sediment control structures are integrated into haul road design and would tend to localize and inhibit off-site movement of spilled vehicle petroleum products resulting from accidents.

A spill into a stream such as Marias Creek, Nicholson Creek, or Toroda Creek could spread the petroleum products (fuel) a considerable distance downstream if containment measures, such as placement of oil booms, installation of temporary dikes, removal of the fuel source, etc., are not initiated quickly. There would likely be adverse impacts to aquatic life, riparian and wetland areas, and possibly water fowl. There could also be effects to personal property and contamination of domestic and irrigation water supplies that are in close proximity to the streams. The magnitude of the effects would depend on the volume of petroleum products spilled, the location of the accident, the time of year (spring run-off or fall low flows), and the time required to initiate containment. The time required to initiate containment and clean-up would depend on the location and availability of spill response personnel, materials, and equipment.

Once clean-up was completed, the affected habitats would likely recover relatively rapidly, though monitoring of surface and ground water would continue for a period of time.

Magnesium Chloride

Magnesium chloride occurs naturally as brine when sea water is concentrated by evaporation or from industrial by-products prepared from magnesium ammonium chloride hexahydrate. Water quality impacts are generally negligible if a buffer zone exists between treated areas and water. Salts are readily mobile in the environment and would reach streams within 100 feet of the road (see Hydrology section earlier in this chapter) but generally not in great enough quantities or concentrations to affect aquatic organisms.

Fresh water aquatic impacts may develop at chloride concentrations as low as 400 parts per million (ppm) for trout and up to 10,000 ppm for other aquatic species (refer to the aquatic section above). Since magnesium chloride is a salt, at high enough concentrations, it can

inhibit growth or kill local plant species. Some tree species particularly susceptible to salts include pines, hemlocks, spruce, maples, popular, and ash.

The initial application rate of magnesium chloride as a dust suppressant is planned at 30% solution. A spill of 3,000 gallons (the usual capacity for trucks operating on these roads) directly into a stream such as Marias Creek, Nicholson Creek, or Toroda Creek could spread the magnesium chloride a considerable distance downstream and into the Kettle River if containment measures, such as installation of temporary dikes or removal of the source, etc., are not initiated quickly. There would likely be adverse impacts to aquatic life, riparian and wetland areas, and possibly water fowl. There could also be effects to personal property and temporary contamination of domestic and irrigation water supplies that are in close proximity to the streams. The magnitude of the effects would depend on the volume of magnesium chloride spilled, the location of the accident, the time of year (spring run-off or fall low flows that effect dilution rates), and the time required to initiate containment. The time required to initiate containment and clean-up would depend on the location and availability of spill response personnel, materials, and equipment A spill of 3,000 gallons directly into Marias, Nicholson, or Toroda Creek could affect aquatic species downstream to the Kettle River and temporarily for a short distance down the Kettle River until the solution was diluted to below aquatic life standards.

Accidents involving magnesium chloride could cause both short- and long-term adverse effects to aquatic organisms if a spill reaches a stream. Since magnesium chloride would be utilized as a liquid during application to roads as a dust suppressant, there is a high potential that a spill directly into water could be of sufficient volume to result in multiple effects to the environment. This type of accident scenario is not predicted to occur because of the low speed limits, the general distance of roads from streams, in-sloping of the road so spills onto the road would travel down the ditch to a relief culvert, the ability of the silt fence to capture and spread part of the spill, and the mitigation measures to be employed.

Once clean-up was completed, the affected aquatic habitats would recover relatively rapidly.

Lignin Derivatives

Lignin derivatives are a by-product of the paper industry. It comes as a dry product in powdered form that is mixed approximately 1 pound to 100 gallons of water and then sprayed or as a liquid with a typical application of 50% residual concentrate applied undiluted or mixed 1 to 1 with water. Water quality impacts are generally negligible if a buffer zone exists between treated areas and water.

Fresh water aquatic impacts may develop if spilled into water since it can bind with oxygen in the water that is needed by the aquatic community. There generally are no plant impacts.

A spill of 3,000 gallons directly into a stream such as Marias Creek, Nicholson Creek, or Toroda Creek could spread the lignin derivates a considerable distance downstream and into the Kettle River if containment measures, such as installation of temporary dikes or removal of the source, etc., are not initiated quickly. There would likely be adverse impacts to aquatic life. There could also be effects to personal property and temporary contamination of domestic and irrigation water supplies that are in close proximity to the streams. The magnitude of the effects would depend on the volume of lignin derivates spilled, the location of the accident, the time of year (spring run-off or fall low flows), and the time required to initiate containment. The time required to initiate containment and clean-up

would depend on the location and availability of spill response personnel, materials, and equipment A spill of 3,000 gallons directly into Marias, Nicholson, or Toroda Creek could affect aquatic species downstream to the Kettle River and temporarily for a short distance down the Kettle River until the solution was diluted below state standards.

Accidents involving lignin derivates could cause both short- and long-term adverse effects to aquatic organisms if a spill reaches a stream. Since lignin derivatives would be utilized as a liquid during application to roads as a dust suppressant, there is a high potential that a spill directly into water could be of sufficient volume to result in effects to the environment. The duration of the impacts would depend heavily on the location of the spill and the response time to initiate containment and begin clean-up. This type of accident scenario is not predicted to occur because of the low speed limits, the general distance of roads from streams, in-sloping of the road so spills onto the road would travel down the ditch to a relief culvert, the ability of the silt fence to capture and spread part of the spill, and the mitigation measures to be employed.

Once clean-up was completed, the affected habitats would likely recover relatively rapidly depending on the time of year and spill amounts.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL OF ALTERNATIVES

The principle energy products used on the project would be petroleum products (non-renewable) and electricity for mining equipment, motor vehicles and ore extraction. The petroleum products would consist primarily of diesel fuel.

According to the Amended Plan of Operations (Crown Resources, 2004), power requirements for the mine would be approximately 2.1 megawatts (MW) of installed capacity averaging 1.4 MW of usage. Only a very small portion of this power would be used on National Forest System lands, mostly relating to instrumentation and lighting for the dosing tank. Total electrical load and resulting population growth is projected to increase kilowatt hours sold for the Okanogan PUD by approximately 5 to 10 percent during peak years of operation. Added population and housing growth could increase the combined load of Ferry County PUD and Okanogan County PUD by less than an additional 1 percent. The electrical load would not vary by alternative.

Fossil fuels used during the construction, operation/transportation and restoration phases of the Buckhorn Access Project would result in an irreversible resource commitment of fossil fuel resources. The proponent has estimated that about 1.1 million gallons of petroleum products would be required annually for the operations of the mine and ore haul to the mill, and this would not vary much by alternative. Alternative C has a longer route than Alternatives B and B1 across NFS lands, while Alternative D has a much shorter route across NFS lands, but when considered with haul across County and State roads to the mill, the distances vary by less than 13 percent. Cumulatively, Alternatives B and B1 have the shortest haul route between the mine and mill, and therefore result in the least amount of fuel (see Transportation cumulative effects earlier in this chapter). Supply deliveries and employee transportation would utilize additional petroleum products. With relation to national and global petroleum reserves, the energy consumption associated with the proposed action would be insignificant.

POSSIBLE CONFLICTS WITH FEDERAL, REGIONAL, STATE, LOCAL AND TRIBAL LAND USE PLANS, POLICIES AND CONTROLS

The Okanogan National Forest Land and Resource Management Plan (1989) guides management on National Forest System lands in this area. Information relating to how the project meets standards and guidelines in that plan are presented throughout this chapter. This project does include several amendments to those standards and guidelines, as presented in Chapter II of this document, the effects of which are analyzed in this affected environment/environmental consequences chapter. Effects relating to other Federal and State laws are also analyzed throughout this chapter. Information relating to Tribal impacts is disclosed in the Heritage, Environmental Justice and American Indian Rights sections above.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

There are no known significant irreversible, or irretrievable commitments of resources connected with the proposed action, although some such commitments would occur. Fossil fuel needed for operations and transportation associated with this project would be irreversible loss (see Energy section above). Approximately 36 (Alternatives B/B1), 52 (Alternative C) and 14 (Alternative D) acres of timber and riparian vegetation land would be converted to use as a road which would be an irretrievable effect of timber production and wildlife habitat.

UNAVOIDABLE IMPACTS

Each section above documents the unavoidable impacts associated with the project. Table III-65 below summarizes these impacts:

Table III-65: Unavoidable Impacts

Resource	Impact
Soils	Soil compaction and erosion from road construction and reconstruction.
Hydrology	Sediment production from road construction and reconstruction. Cumulative impacts on water quality, although State standards met. Cumulative impact on water quantity.
Wetlands	Loss of wetland habitat, except Alternative D
Aquatic	Sediment production from road construction and reconstruction and loss of aquatic habitat. Cumulative impacts on water quality, although State standards met. Cumulative impact on water quantity.
Air Quality	Fugitive dust and emissions from ore haul.
Noise	Noise from construction, ore haul and other traffic.
Scenery	Visibility of traffic headlights.
Recreation	Noise, traffic and dust adjacent to construction sites and ore haul routes; recreationists likely to avoid those areas.
Wildlife	Noise and traffic adjacent to construction sites and ore haul routes; wildlife likely to avoid those areas. Wildlife that do not avoid the area may be disturbed, injured or killed.
Forest Vegetation	Loss of productive forest land from road construction and reconstruction.
Botany	Loss of plants or plant productivity as a result of road construction and reconstruction, dust and salts.
Range	Range management changes. Some cows may be injured or killed along haul routes, although mitigation would minimize.
Noxious Weeds	Weeds likely to be brought in on vehicles, but promptly treated.

Resource	Impact
Roadless and Unroaded Character	Areas adjacent to haul routes would temporarily lose their solitude during construction and operations, but solitude would return post-project.
Cultural Resources	Homestead site cannot be avoided in Alternative C. The road design would avoid adversely impacting the lithic scatter in Alternatives B and B1. Aquatic mitigation design on private lands also avoids cumulatively adversely impacting lithic scatter. Possible vibration, looting or vandalism impacts to resources along roads.
Tribal Impacts	Some land on north-half taken out of production or unavailable for hunting, fishing and gathering during construction, operations and reclamation. Areas adjacent to haul routes likely to be avoided by Tribal members because of disturbance from noise, dust and traffic.

SUMMARY OF CUMULATIVE EFFECTS

The table below summarizes the detailed cumulative effects presented in the resource effects earlier in this chapter.

Table III-66: Summary of Cumulative Effects by Resource Area

Resource	Cumulative Effects
Transportation	Road construction has occurred over the past 90 years in the Buckhorn Block. Total cumulative road density in Buckhorn Block is essentially the same in all alternatives, although open road density by management area is lowest in Alternative B1 as a result of road closures in Bear Trap Canyon. Road construction and reconstruction with the access project would result in a well maintained road but would increase maintenance costs after the project is completed (although Alternative B1 would have the least increase because of narrowing of the usable road surface at the end of the project). Deferred maintenance under the 2006 road use permit to Crown/Kinross improved portions of Forest Roads 3575-120 and 3575-140 in advance of the access project. Conflicts are possible with Little Nicky Timber Sale haul with road reconstruction under Alternative C. Cumulative haul route distance and adverse grade from mine to mill are lowest with Alternatives B, B1 and C. Adverse grade for Alternative D hauling through Curlew to the mill outside Republic is the same as Alternatives B, B1 and C, but would increase about 50% for a route hauling over Wauconda Summit.
Soils	Past actions have created irretrievable compacted surfaces along roads, to which an additional 36, 52 or 14 acres of road disturbance would be added cumulatively on NFS lands in Alternatives B/B1, C and D, respectively. Alternative D would create the least new compacted surfaces when only considering National Forest System lands and right-of-ways, but greater disturbance when including all lands between the mine and the mill.
Hydrology	Past actions have resulted in changes in groundwater hydrology and Buckhorn Mountain (mine) Project would further alter groundwater hydrology through dewatering. Buckhorn access project would fully or partially offset dewatering impacts in Nicholson and Marias Creeks by infiltration and augmentation of treated mine water depending on the season and location. Myers Creek surface water impacts would be mitigated by installation of wildlife guzzlers. Buckhorn Mountain (mine) Project includes compensatory aquatic mitigation to offset impacts in Myers Creek, but down in valley off NFS lands. Chloride levels are currently low in creeks and could increase up to 88 ppm in Alternatives B, B1 and D, and up to 116 ppm in Alternative C in Nicholson Creek as a result of treated mine water being infiltrated and augmented on NFS lands and use of magnesium chloride on roads when considered cumulatively with discharge at Gold Bowl on private lands.

Resource	Cumulative Effects
Hydrology (continued)	Chloride levels could increase up to 147 ppm in Alternative B, 123 ppm in Alternative B1 from treated mine water being augmented on NFS lands plus dust suppression, and up to 9 ppm in Alternatives C and D in Marias Creek from treated mine water being augmented on NFS lands, which is with standards.
Wetlands	The 9-acre wetlands would be impacted by both access road project and mine dewatering on private lands. Less than 0.1 acres of this wetland would be removed from road construction, but flows to this wetland would be maintained during the growing season through infiltration and augmentation of treated mine water during July, August and September in all alternatives.
Aquatics	Sediment levels from past activities, primarily road construction, are above levels for quality fish habitat in some reaches of Marias and Nicholson Creeks. Alternatives B, B1 and C would add small amounts of sediment to creeks. Best management practices and mitigation would be required to minimize potential sediment delivery to creeks. Other projects such as County road reconstruction, culvert replacements and may also add sediment to creeks. Cumulative chloride levels in Nicholson and Marias Creek would remain below the chronic and well below the acute thresholds for aquatic life.
Air Quality	Changes in visibility in Class 1 Airsheds would be very slight, and similar under all action alternatives when the Buckhorn Mine Project and Buckhorn Access Project are considered cumulatively. Tons of TSP/PM10 produced on National Forest System lands and rights-of-way would be greatest under Alternative C, and least under Alternative D. Because of paving under Alternative B1, this alternative would create less TSP/PM10 Alternative B. When non-paved County roads are considered, the least impacts would be under Alternative B1, followed by Alternative B, followed with similar impacts from Alternatives C and D when considering the Curlew route for haul.
Noise	Noise impacts are the same for all action alternatives as they relate to the Beal borrow site. Noise impacts to recreation and dispersed recreation camp sites would be greatest under Alternative C and least under Alternative D since more dispersed sites would be impacted and more hunting related activity would be impacted by Alternative C. The cumulative impact of haul, supply, and employee traffic noise to residents from the mine site to the junction of Forest Road 3575 and Toroda Creek (common point on haul route) would be the least under Alternatives B and B1 (12 residences effected), than Alternative D (24 residences effected) and Alternative C (9 residences effected). Even though more residences would be affected in Alternatives B and B1, the effects on 5 residences would be “substantial” to “very serious” under Alternative C and only slight in Alternatives B and B1.
Scenery	Visual impacts would be similar under all action alternatives and would primarily concern the visibility of the patented mine site, the use of the Beal borrow site, and the Little Nicky Timber Sale. All action alternatives would meet the maximum modification standard on National Forest System land.
Recreation	Cumulative impacts to recreation use and dispersed recreation camp sites would be greatest under Alternative C and least under Alternative D since more dispersed sites would be impacted and more hunting related activity would be impacted by Alternative C. Some hunters may move to other areas and some hunters may decrease the number of days that they hunt.
Wildlife	Very little habitat would be removed cumulatively and most of the impacts would be compensated for through the purchase and placement of conservation easements on privately owned parcels of land. The greatest cumulative impact would be primarily disturbance between haul route from access project and mining activities from the mine project.

Resource	Cumulative Effects
Wildlife (Continued)	Wildlife would likely to avoid both areas and redistribute to other undisturbed areas of the Buckhorn Block. The closure of the Bear Trap Canyon area under Alternative B1 has a positive benefit to most wildlife species and thus impacts to wildlife habitat would be less under this alternative than other action alternatives. Alternative B has greater impacts as modeled by the gray wolf and wolverine assessment model security habitat; mule deer winter range habitat disturbance; late successional forest, non-winter habitat; late succession non-winter security habitat; and riparian non-winter habitat models than Alternatives C and D.
Forest Vegetation	97, 113 and 75 acres of forest vegetation removed cumulatively under Alternatives B/B1, C and D.
Botany	No cumulative effects on threatened or endangered species under any alternative. Dewatering impacts from the mine would be offset by water augmentation and infiltration during the growing season, but habitat would be lost above the augmentation and infiltration sites and in the Myers Creek drainage where no augmentation or infiltration would occur. Fencing Marias Creek in Alternatives B and B1 would keep cattle from damaging sensitive plant habitat along this creek.
Range	220 acres were removed from allotments as a result of patenting, with an additional 74 acres removed during the life of the project as a result of the project fence. Little impact to forage availability is expected because little grazing occurs inside the fenced areas. Impacts to permittees operation mitigated in Alternatives B and B1 through fencing, water development, and communication requirements.
Noxious Weeds	Past actions resulting in ground disturbance such as road construction, timber sales, grazing and recreation have spread noxious weeds into the Buckhorn Block. These weeds have been or are scheduled to be treated under the existing integrated weed management decisions. The Access Project is likely to spread weeds from the mine site, Beal borrow site, mill and from weeds along non-NFS haul routes. Weeds on NFS lands would promptly be treated under existing Integrated weed management decisions so no noxious weed spread from NFS lands is expected. Weeds on private and DNR managed lands would be treated by the Proponent under a Noxious Weed Control Plan approved by the State/Counties.
Roadless and Unroaded Character	Noise and disturbance under Alternative C in the Jackson Creek IRA as result of the access project may overlap with the Little Nicky Timber Sale on DNR lands, and in the northern section of the Marias-Nicholson Ridge Unroaded/Undeveloped area, but impacts would be short term since harvest and haul on the Little Nicky Timber Sale would likely to be completed in 2007.
Heritage	Vibration, looting and vandalism could potentially impact eligible sites as a result of increased traffic from the access project in addition to other traffic and recreation on roads.

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