

CHAPTER 4

CUMULATIVE EFFECTS

INTRODUCTION

Potential cumulative effects of the Proposed Action, Alternative A – Modified Pit Backfill, and No Action Alternative are described in this chapter. Continued operation and reclamation of the Indian Creek Mine as described in Chapter 2 would result in cumulative effects to the environment. A cumulative effect as stated in 40 CFR 1508.7 “...is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency [Federal or non-Federal] or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.”

Cumulative impacts as defined by the Montana Environmental Policy Act include “...collective impacts on the human environment of the proposed action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type” (75-1-220, MCA). Further, “[R]elated future actions may only be considered when these actions are under concurrent consideration by any agency through pre-impact statement studies, separate impact statement evaluations, or permit processing procedures” (75-1-208, MCA).

Results of cumulative effects analyses determine whether an action contributes to impacts associated with other activities in the area. Cumulative impact analyses do not consider potential mitigation for reasonably foreseeable future actions.

This chapter presents descriptions of the collective or additive impacts of combining past, present, and reasonably foreseeable future activities associated with mining and land uses in the vicinity of the Indian Creek Mine. Past, present, and reasonably foreseeable future land uses and man-made and natural occurrences are described in this chapter. Each resource analysis in this section begins with a description of the geographic area considered to be the Cumulative Effects Study Area for that resource and the rationale for the designation. The Cumulative Effects Study Area (Study Area) is typically a unique geographic area specific to individual resources.

The geographic cumulative effects area referred to in this section varies depending on the resource being discussed. **Figure 4-1** depicts the general area for most resources for which cumulative effects have been evaluated.

This analysis incorporates by reference information and analyses contained in the Draft Limestone Hills Training Area Land Withdrawal Legislative Environmental Impact Statement (MTARNG/BLM 2007)

PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIVITIES

Land uses and management activities in the vicinity of the Indian Creek Mine include the following general categories:

- Mining and Mineral Development
- Grazing
- Recreation
- Military Training – UXO Clearance

- Wildlife Management
- Wildfire /Controlled Burns
- Habitat Restoration Projects
- Urbanization (Subdivisions)

MINING AND MINERAL DEVELOPMENT

PAST AND PRESENT ACTIVITIES

Graymont or predecessor companies have been actively mining at the Indian Creek Mine since 1981. Historic dredge and placer mining occurred along Indian Creek east of the Graymont mine complex.

Pegasus Gold (now Apollo Gold) operated the Diamond Hill Mine located upstream from the Indian Creek Mine beginning in 1998. The Diamond Hill Mine is an underground gold mine that was developed in an ephemeral tributary to Indian Creek. Ore from this mine was shipped to Apollo Gold's mill facility located at the Montana Tunnels Mine west of Jefferson City, Montana. The Diamond Hill Mine closed in 2002 and is currently on a care and maintenance schedule.

Graphite and lead mining occurred in the Iron Mask Mine area about 5 miles north of the Indian Creek Mine. The Iron Mask Mine is no longer active. The Park Mine located near the headwaters of Indian Creek was reclaimed under the DEQ Abandoned Mine Reclamation program in 1997.

REASONABLY FORESEEABLE FUTURE ACTIVITIES

Neither BLM nor DEQ have received a Plan of Operations for any future mining activity in the Study Area. Future mining and mineral development in the area would likely be limited to operations at the Indian Creek Mine and

resumption of operations at the Diamond Hill Mine. There are active unpatented claims in the area.

GRAZING

PAST AND PRESENT ACTIVITIES

Livestock grazing has been and continues to be an important land use in the Project area. Multiple grazing allotments have been permitted and administered by BLM over the past several decades. The Study Area contains all, or portions of, three grazing allotments which are summarized in **Table 4-1**.

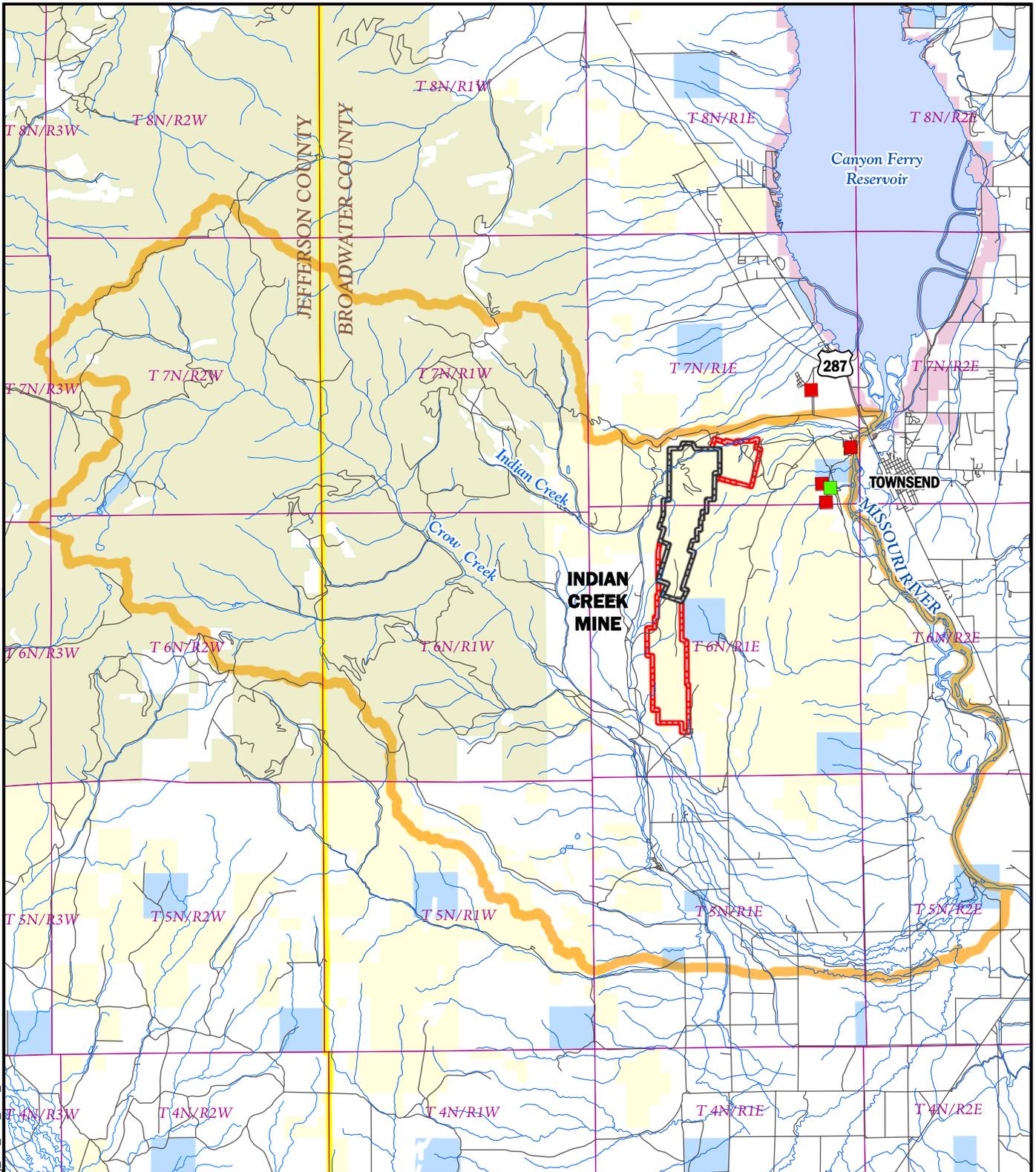
REASONABLY FORESEEABLE FUTURE ACTIVITIES

Congressional approval to withdraw 18,604 acres of public land within the LHTA from BLM administration would transfer responsibility for grazing management on land within the LHTA to MTARNG. Existing grazing allotments would be extended for up to 20 years under the Preferred Alternative for the LHTA (MTARNG 2007).

RECREATION

PAST AND PRESENT ACTIVITIES

No developed recreation sites are located in the vicinity of the Indian Creek Mine. Recreation in the area is managed by BLM in accordance with the Elkhorn Mountains Travel Management Plan. Public land in the area has been and continues to be used for recreation activities including hiking, rock climbing, hunting, and off-road vehicle use. About 8,200 acres of public land in the LHTA have been closed to non-military use due to the potential presence of UXO.



Base Data Source: Montana NRIS GIS Data; Helena National Forest; Broadwater County.

Land Ownership

- | | | | | |
|--|------------------------------------|-----------------------|---------------------------|---|
| | Existing Operating Permit Boundary | Major Subdivision | State of Montana | General Cumulative Effects Study Area Including: Soil, Water, Vegetation, Air; Land Use/Access, Cultural, Geology/Minerals, Noise, and Visual Resources |
| | Proposed Operating Permit Boundary | Minor Subdivision | Bureau of Land Management | |
| | Roads | Bureau of Reclamation | Forest Service | |
| | Streams | | | |

H:\13532 Graymont\1 EIS\5000 GIS\Projects\EIS\Fig_4-2_wild_cum_effects.mxd



U.S. Department of the Interior
Bureau of Land Management
Butte Field Office
Butte, Montana

GENERAL CUMULATIVE EFFECTS STUDY AREA
Indian Creek Mine Expansion - Environmental Impact Statement
Broadwater County, Montana

FIGURE
4-1

Allotment Name/Number	Number of Livestock	Grazing Season (Month/Day)	Total AUMs	Total Acreage ¹
Dowdy Ditch (North & South) No. 20209	20 cattle	5/1 to 6/15	30	5,014
Limestone Hills No. 20273	484 cattle	5/15 to 9/30	1,944	14,085
Indian Creek No. 20233	212 cattle	5/15 – 10/15	344	9,772

¹ Includes federal, state, and private land.

AUMs = Animal Unit Month (Approximately 780 pounds forage [dry weight]).

Source: MTARNG/BLM 2007.

County roads are accessible to all traffic. The MTARNG restricts access on roads within the LHTA when military operations could cause unsafe conditions. All roads east of and including Old Woman's Grave Road are open year-round with periodic designated road closures mid-April through November. With the exception of Indian Creek Road and access roads to Graymont's mining areas, roads passing through the LHTA area west of Old Woman's Grave Road are closed to non-military use at all times.

Other recreation related activities include:

- Projects by the USFS to reconstruct and relocate trails to enhance accessibility and avoid private property; and
- Joint effort between BLM and USFS on road stabilization projects in the Elkhorn Mountains.

REASONABLY FORESEEABLE FUTURE ACTIVITIES

Recreational activities would continue at current levels in the area. Surface management of the LHTA by the U.S. Army Corps of Engineers may result in modification to some current access to specific locations within the area. Periodic designated road closures (described above) from mid-April through

November would continue. Roads passing through the LHTA area west of Old Woman's Grave Road would likely remain closed to non-military use at all times.

Projects included in the Elkhorn Implementation Group Program of Work would likely continue as reasonably foreseeable future activities depending on availability of funding.

MILITARY TRAINING – UXO CLEARANCE

PAST AND PRESENT ACTIVITIES

Limestone Hills Training Area (LHTA)

The LHTA, located near Townsend, Montana, has supported the military mission of the MTARNG from the 1950s to the present (**Figure 3-1**). In 1984, the U.S. Department of the Interior, BLM granted the MTARNG a 30-year right-of-way to use BLM-administered public land within the LHTA for military purposes under specific terms and conditions.

The LHTA is used for military training exercises approximately 140 days per year during the period mid-April through November. The LHTA is not used for military training exercises from December 1 to mid-April each year. This annual non-training period was requested by FWP to protect big game wildlife habitat.

The current right-of-way agreement between BLM and MTARNG allows the following military practices on the LHTA:

- Firing of armored tanks, mortars, howitzers, and support weapons, including live ammunition;
- Helicopter training and firing of associated weapons with live ammunition;
- Infantry maneuvers and firing exercises, including small arms, grenades, and mortars;
- Training various support groups, usually involving a bivouac, perimeter defense, and small arms fire;
- Equipment maintenance and testing exercises;
- Construction and maintenance of improvements – all existing improvements and all planned improvements approved by past permits are authorized; and
- MTARNG is authorized to extract material from a community gravel pit. Large withdrawals of material from the pit must be confirmed with BLM.

The LHTA provides 18,604 acres for MTARNG to train mechanized infantry, armor, aviation, artillery, and cavalry units. Training occurs on one or more of 17 designated live-fire ranges and a dismounted training area. The frequency of use of each range varies from year to year as some are used more than others to meet the military mission.

UXO Clearance

As a result of training exercises, portions of the LHTA have been contaminated with unexploded ordnance (UXO). UXO is ordnance that failed to detonate fully upon impact after being fired. Details regarding the UXO status and management protocols are described in the Limestone Hills Training Area Land Withdrawal Draft Legislative Environmental Impact Statement (MTRNG/BLM 2007)

Past live-fire training has resulted in ordnance and explosives contamination of public land now encumbered by unpatented mining claims controlled by Graymont. Graymont has a permit to mine limestone authorized by DEQ and BLM with a provision that mining cannot proceed past the 2.75-inch rocket safety fan line until the area is cleared of ordnance and explosives hazards. The 2.75-inch rocket safety fan line shown on **Figure 2-1** demarcates the boundary between active mining operations permitted by DEQ and BLM and the area potentially contaminated with UXO.

Because the Department of Defense prohibits exploration, drilling, and mining on the surface of UXO contaminated land, MTARNG initiated a clearing activity on mining claims considered to be high priority by Graymont. This high priority UXO clearance area is within a BLM-instituted closure area, west of Old Woman's Grave Road, and is currently under the safety control of MTARNG. The purpose of the clearance activity is to remove the ordnance and explosives hazard to allow mining by Graymont. Any mining that would occur in this area depends upon successful completion of UXO clearance as determined by the Department of Defense Explosive Safety Board.

Clearance information is transmitted to BLM, which then informs Graymont that operations can proceed in the cleared area. Approximately 75 acres have been cleared of UXO contamination south of the rocket safety fan line and mining is occurring in that area (**Figure 2-1**).

REASONABLY FORESEEABLE FUTURE ACTIVITIES

The right-of-way agreement between BLM and MTARNG expires March 26, 2014. To continue military use of public land within the LHTA, the U. S. Department of the Army (Army) must apply to withdraw federal land in the LHTA in accordance with the Engle Act of 1958, which requires an Act of Congress for military withdrawals encompassing more than 5,000 acres.

BLM Instruction Memorandum No. 91-283 states that any land for which the military is likely to have UXO, chemical munitions, or other similar hazardous materials, or where long-term exclusive use of the land is required for public safety or national security reasons, may be authorized for use only by public land withdrawal. The Army on behalf of the MTARNG has proposed to withdraw 18,604 acres of public land within the LHTA from BLM administration. The Army proposes that the Department of the Interior and Congress transfer administrative responsibility of all public land within the LHTA to the Army as a land withdrawal for military training use by the MTARNG. Under the Engle Act, withdrawal of public land within the LHTA would be subject to the condition that all minerals, including oil and gas, remain under the jurisdiction of the Secretary of the Interior (BLM) and administered under applicable public mining and mineral leasing laws.

Reasonably foreseeable future activities would likely include a continuation of military training exercises and UXO clearance operations at current levels. Administration of surface resources would be transferred to the U.S. Army Corps of Engineers.

URBANIZATION

PAST AND PRESENT ACTIVITIES

Broadwater County has experienced marked expansion in the last 5 years. Recent population growth in the County and its impact on services and infrastructure was reported in a study conducted on County Government in 2006:

“The needs of the county, however, have changed since 1995. Population is increasing rapidly, population patterns are shifting, and citizen demands for services are rising. The population increase of 3% in the past 5 years is placing heavy new demands on county government to provide urban services such as roads, law enforcement, and refuse disposal. To effectively respond to these growing needs, county government must modify its structure and authority” (Broadwater County Local Government Study Commission, Final Report, August 18, 2006).

Sixteen new subdivisions have been or are currently under construction in the county. Subdivisions are classified by the county planning office as Major (> 5 lots) and Minor (< 5 lots). Five subdivisions are currently pending approval, approved, or under construction in close proximity to the proposed mine area boundary (**Figure 4-1**). These include:

- Indian Creek Estates Major - Northeast of current Graymont Indian Creek Plant - 60 Total Lots (30 A+B Lots for development);

- Riverview Heights Major - East of current Graymont Indian Creek Plant 29 Lots;
- V-K Minor - East of current Graymont Indian Creek Plant - 13 Lots;
- Deer Path Major - East of current Graymont Indian Creek Plant - 7 Lots; and
- Riverview Estates Major - East of Current Graymont Indian Creek Plant - 6 Lots.

Other Broadwater County Major Subdivisions (greater than 5 lots) approved, under construction, or pending approval include:

- Antelope Acres – 24 lots;
- Antelope Estates – 18 lots;
- Grandview Manor – 57 lots;
- Lazy HM Estates- 26 lots;
- Spruce Grove - 70 lots;
- Furman - 17 lots;
- Muffley Estates - 10 lots;
- Muffley No. 2 - 7 lots;
- Mountain West Estates - 19 lots;
- Elkhorn - 14 lots; and
- Valley Heights - 52 lots.

REASONABLY FORESEEABLE FUTURE ACTIVITIES

According to the Montana Department of Commerce, Census and Economic Information Center, it is estimated the State of Montana will experience a total increase in population of 33 percent from the year 2000 to 2030. It is also anticipated the population group 65 years of age and over will increase 112 percent for the same period.

The total population of Broadwater County is expected to increase 47 percent from 2000 to 2030. For the same period, the county will also experience an increase in the age group 65 and over of 166 percent.

Land in the Study Area is currently owned or administered by the following groups:

- Public land administered by Bureau of Land Management – 65,139 acres
- Public land administered by Bureau of Reclamation – 47 acres
- Public land administered by Forest Service – 160,593 acres
- Public land administered by State of Montana – 12,505 acres
- Private land – 155,779 acres

Public land in the Study Area administered by BLM supports a variety of current and reasonably foreseeable future uses including farming, ranching, and grazing. Public land administered by the Bureau of Reclamation supports similar current and future uses in addition to recreation and land management. National Forest System land in the Project area supports recreation and wildlife management.

Private property in the area supports livestock grazing, residential housing, commercial enterprise, and agriculture. Broadwater County currently has no zoning rules or regulations pertaining to new construction or land use associated with private property.

WILDLIFE MANAGEMENT

PAST AND PRESENT ACTIVITIES

The Elkhorn Mountains are managed in partnership with the Beaverhead-Deerlodge and Helena National Forests, Butte Field office of BLM, and FWP as the Elkhorn Cooperative Management Area. In 1992, these agencies

agreed to cooperatively manage all federal public land in the Elkhorns with emphasis on management of diverse and healthy wildlife and fish habitats. An Elkhorn Working Group consisting of about 20 private citizens and agency representatives was formed to develop collaborative recommendations related to wildlife/livestock management strategies in the Elkhorns. Projects completed by the agencies in the Crow Creek and Indian Creek drainages include acquisition of the Iron Mask Ranch, reintroduction of bighorn sheep, and stream restoration of a portion of Indian Creek.

The Iron Mask Ranch, located northwest of Townsend on the east flank of the Elkhorn Mountains, was acquired by BLM in 2007. The acquisition resulted in 5,548 acres being placed into public ownership. The ranch provides critical winter range for elk, bighorn sheep, and year-round habitat for elk, antelope, mule deer, and white-tailed deer.

Bighorn sheep were transplanted into the Indian Creek/Crow Creek area of the Elkhorn Mountains in the winters of 1996, 1997, and 2000. These sheep successfully reproduced and established primary winter ranges in the Crow Creek and Indian Creek drainages. Some sheep are present in the Study Area year-round. Wintering bighorn sheep may occur anywhere in the Study Area, but are most often associated with limestone ridges and mountain mahogany/shrub habitats (MTARNG/BLM 2007). During winter 2007-2008 bighorn sheep in the area contracted pneumonia resulting in a loss of approximately 95 percent of the herd. A FWP aerial survey in March 2008 revealed 19 bighorn sheep remaining from a population estimated at 220 animals (Carlson 2008).

Other wildlife management related projects in the Elkhorns include:

- Elkhorn Mountains Westslope Cutthroat Trout Restoration Program - a cooperative effort supported by FWP, Helena National Forest, BLM, and Montana Trout Unlimited to reintroduce westslope cutthroat trout to selected streams throughout the Elkhorn Mountains;
- Aerial surveys on elk, bighorn sheep, mule deer, antelope, and mountain goats conducted by FWP in Hunting District 380 to support hunting season quotas for each species;
- Coordination by FWP with respective landowners of 20 Block Management Areas consisting of over 100,000 acres; and
- The North Elkhorn National Network Research Project funded by the U.S. Forest Service to inventory and monitor key breeding bird species and cavity nesting species for baseline trends.

Various habitat restoration projects have been implemented to enhance or reclaim habitat for selected species. Specific projects are described in the *Habitat Restoration Projects* section of this chapter.

REASONABLY FORESEEABLE FUTURE ACTIVITIES

The Iron Mask Ranch acquisition was the focus of the Elkhorn Conservation Initiative, launched in 2003, by the Rocky Mountain Elk Foundation, USFS, BLM, and FWP. The goal of the initiative is to bring communities, landowners, and hunters together in a 5-year effort to protect and enhance at least 20,000 acres of wildlife habitat in the Elkhorn Mountains.

Evaluation of the possibility of conducting the second phase of the Lower Indian Creek Stream Restoration Project from the end of the Phase I section to the confluence with the Missouri River has been underway since 1999, with a test project to be conducted in 2008.

Aerial wildlife surveys and the Block Management Program would continue, whereas species specific studies would likely terminate at a predetermined date or upon exhaustion of funding.

WILDFIRE/CONTROLLED BURNS

PAST AND PRESENT ACTIVITIES

Since 2000, four fires have occurred in the Study Area, burning a total of 258 acres as shown on (Figure 4-2).

- July 2000 – 84 acres;
- September 2005 – 52 acres;
- July 2006 – 21 acres; and
- July 2006 – 101 acres.

These fires resulted from mandatory use of tracer ordnance during military training exercises in the LHTA (Wheeler 2008). Following the 2006 fires, the MTARNG constructed a fire break around the High Explosive Impact Area. The fire break is 5.3 miles in length by 20 feet in width and disturbed approximately 13 acres (MTARNG 2008).

REASONABLY FORESEEABLE FUTURE ACTIVITIES

Wildfires will continue to be an important component of land management for public and private landowners. Potential for wildfires to continue in the Study Area has been reduced by construction of a fire break around the High Explosive Impact Area.

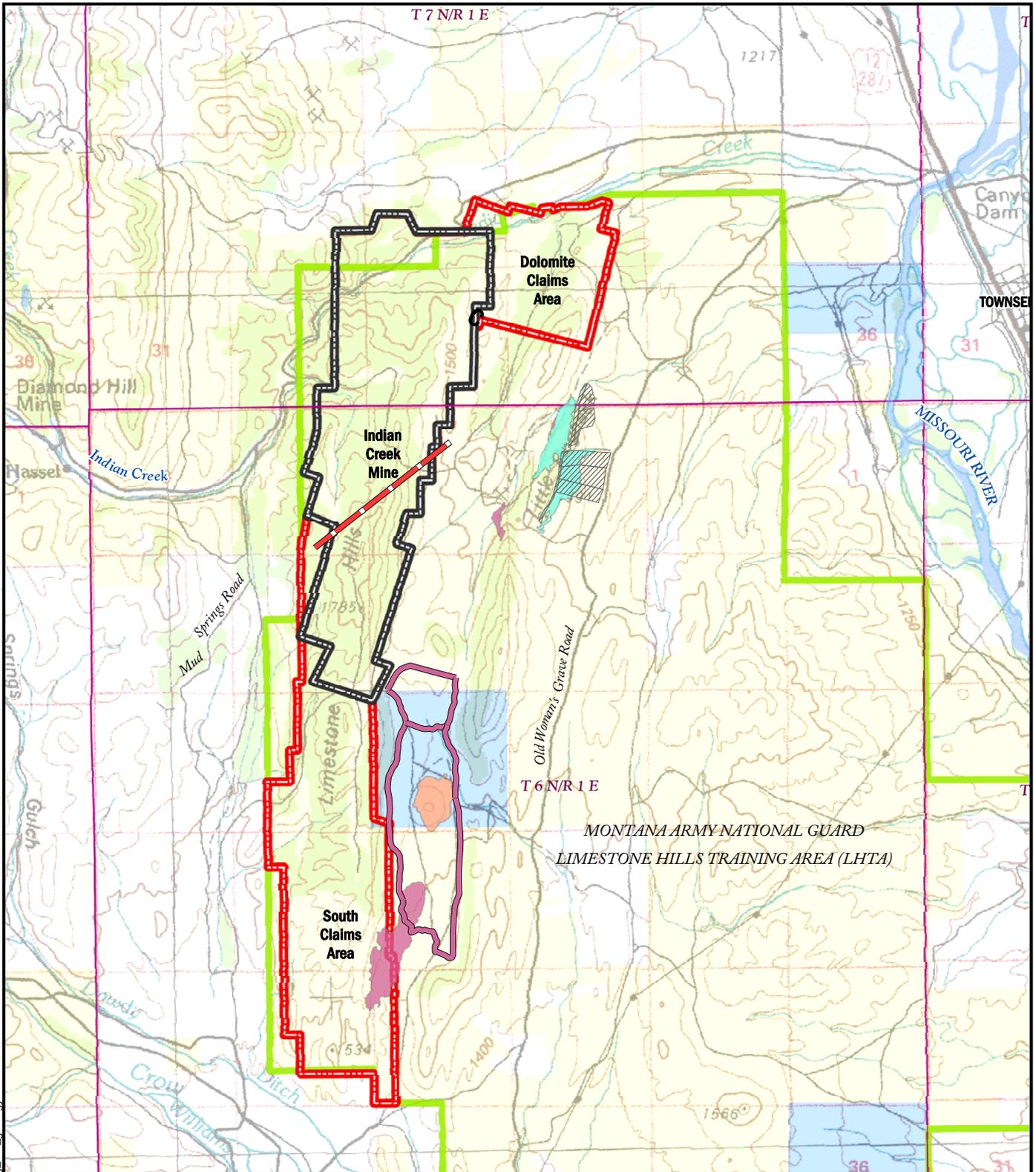
HABITAT RESTORATION PROJECTS

PAST AND PRESENT ACTIVITIES

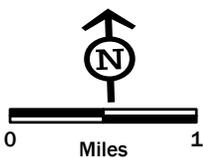
As a first step toward management of the Elkhorn ecosystem, the BLM, USFS, and FWP undertook a landscape level inventory of the components and a study of the landscape level changes. The Landscape Analysis, completed in 1992, provided the agencies a common vision and a solid foundation for establishing overall annual work priorities. Each year the Implementation Group develops a program of work for approval by the Elkhorn Steering Committee.

Since its inception the Elkhorn Implementation Group has developed and implemented numerous projects, some of which are ongoing (USFS 2006). A summary of habitat restoration related projects and objectives include:

- Elkhorn Initiative – a cooperative (BLM, USFS, and FWP) effort coordinated with the Rocky Mountain Elk Foundation to enhance wildlife habitat in the Elkhorns through land adjustments, habitat projects, and acquisitions. Coordinate with private landowners to enhance bighorn sheep and elk habitat in order to reduce impacts of wildlife on private land. Ongoing projects include prescribed burns, fence and water development projects, and noxious weed treatments.
- Iron Mask Acquisition – Phase I completed in 2006; completion of acquisition.



Data Source: USGS 2006, Townsend 30x60 Preliminary Geologic Map.



- Existing Operating Permit Boundary
- Proposed Operating Permit Boundary
- Existing LHTA Boundary
- Fire Break - 2006
- 2.75 Rocket Fan Line
- Fall 2006 Reseeded Areas

Wild Fires

- July 2000
- September 2005
- July 2006

Land Ownership

- State of Montana
- U.S. Bureau of Land Management

H:\13532 Graymont\EIS\5000 GIS\Projects\EIS\Fig. 3-1_geology.mxd



U.S. Department of the Interior
Bureau of Land Management
Butte Field Office
Butte, Montana

WILD FIRES AND RESEEDED AREAS
Indian Creek Mine Expansion - Environmental Impact Statement
Broadwater County, Montana

FIGURE
4-2

- Integrated Weed Management Program – baseline data collection and monitoring to develop a digitized weed map for the Elkhorn Mountains. Coordinate weed management priorities with private landowners and respective county weed management areas.
 - Private Landowner Coordination and Vegetation Enhancement – Complete 1st phase of the Rattlesnake and Prairie Gulch private land prescribed burns.
 - Vegetation and Range Utilization Study – results of the 3-year study to be included in the 2007 Program of Work.
 - Elkhorn Mountains Westslope Cutthroat Trout Restoration Program – Introduction of trout into South Fork Crow Creek, Little Tizer Creek, and Crazy Creek.
 - Update the Landscape Analysis to include data from past accomplishments, data collected from the Vegetation and Range Utilization Study and Fire History Study to provide a database for cataloging and tracking implementation and effectiveness, and identify a comprehensive restoration plan involving fuel treatments, commercial and non-commercial thinning, riparian enhancement, and weed treatments.
 - Compile and submit grant proposals to various private organizations and public agencies to support acquisitions, noxious weed treatments, and other habitat restoration projects.
 - Elkhorn Fire Plan – Implement fire plan affecting fire management on 80,000 acres.
- In October 2006, the MTARNG contracted a study to determine the extent of curl-leaf mountain mahogany within the LHTA and reseed previously burned areas with a mixture of shrubs (DBEC, Inc. 2007). Approximately 103 acres were broadcast seeded with a mixture of the following shrubs:
- Big sagebrush;
 - Rubber rabbitbrush;
 - Curl-leaf mountain mahogany;
 - Skunkbush sumac; and
 - Woods' rose.

REASONABLY FORESEEABLE FUTURE ACTIVITIES

Habitat restoration projects undertaken by BLM, USFS, and FWP would involve management of vegetative communities including grassland, shrubland, forests and woodland, riparian vegetation, and noxious weeds. Most of the projects developed by the Elkhorn Implementation Group (listed above) will likely continue.

Grassland and Shrubland

Due to the lack of periodic fires, partially in response to decades of successful fire suppression efforts, grasslands are becoming woodland or shrubland, and many shrubland areas are being converted to woodland. Conifer encroachment into these habitats is occurring at a rate of over 600 acres annually. Under the current Resource Management Plan (BLM 1984) vegetation treatments (prescribed burns) would occur on about 525 acres annually.

Forests and Woodlands

Treatments in these habitat types are designed to mimic pre-fire suppression conditions and promote healthy, diverse forest ecosystems and wildlife habitat. Smaller diameter thinning along with low intensity understory burning would occur in seedling, pole, and some medium (9 to 15 inch diameter) sized trees to open the canopy and allow understory vegetation to become re-established. Under the current Resource Management Plan (BLM 1984) vegetation treatments would occur on approximately 500 acres annually.

Under the Helena National Forest Plan (USFS 1986), timber in Elkhorn Management Unit No. 1 (includes lower Crow and Indian creeks) is classified as unsuitable and would only be harvested as a management tool to maintain and enhance elk winter range.

Riparian Types

Riparian areas occur throughout all forest types, grassland, and shrubland and have experienced many of the same effects of long-term fire suppression. Some riparian habitats have been degraded due to historic grazing, mining, timber harvest, and road construction. Treatments in riparian areas focus on re-establishing willows, aspen, and cottonwood stands as well as other riparian vegetation to move towards pre-fire suppression stem densities in conifer stands. Under the current Resource Management Plan (BLM 1984), BLM would manage 3,270 acres of riparian and associated upland vegetation in streamside management zones and mechanically treat or prescribe burn 3 acres annually to restore communities to properly functioning condition.

Noxious Weeds

Treatment of noxious weed infestations is dependent on the amount of disturbance

proposed by other management actions as well as the number of designated open roads. Treatments would include, but not be limited to, hand-pulling; chemical spray; use of biological agents such as insects, goats, or sheep; cultural treatments such as modifying timing or intensity of other management activities; and public education. Changing grazing management or prescription grazing would also be used as a treatment and could include changing the season of use, intensity of use, or type of livestock.

Under the current Resource Management Plan (BLM 1984), BLM would treat a minimum of 2,000 acres annually.

RESOURCE ASSESSMENTS

AIR QUALITY

Air pollutant sources within the Study Area include existing mining operations and other background sources. Emissions from mining include criteria air pollutants, such as particulate matter less than 10 microns (PM₁₀) and gaseous emissions (nitrogen oxides, sulfur dioxide, and carbon monoxide). Background emission sources include fugitive dust from traffic on unpaved roads, windblown dust, agricultural activities, and a railroad load-out facility.

Mining and processing operations at the Indian Creek Mine are regulated under Air Quality Permit No. 1554-16 issued by DEQ. This permit establishes air emission levels that meet air quality standards which are protective of human health and the environment.

Cumulative Effects Study Area

The Cumulative Effects Study Area for Air Quality encompasses the eastern slopes of the Elkhorn Mountains, Indian Creek Mine area and load-out facility, and the City of Townsend. This area was selected for the geographic study area

for cumulative effects because it represents an area in which other sources of air emissions (if present) could combine with emissions from the Indian Creek Mine.

Cumulative Effects

No cumulative effects have been identified for Air Resources as a result of implementation of the Proposed Action or Alternative A – Modified Pit Backfill in the Project area. No emission sources are located within the Cumulative Effects Study Area that would combine with emissions from mining and ore processing operations. Emissions from the Indian Creek Mine are in compliance with the air quality permits held by Graymont.

GEOLOGY AND MINERALS

Effects of mining on geology and mineral resources under the Proposed Action and Alternative A – Modified Pit Backfill include excavation and relocation of rock materials from the natural setting and removal of limestone and dolomite ore from the Project area. Movement and disposition of rock materials in terms of volume and location varies by mine pit within the permit area. Approximately 55 million tons of ore and 13 million tons of overburden would be removed during the proposed mine expansion.

Potential sedimentation of run-off water and release of trace elements is the primary issue associated with excavation and disposal of rock materials in the mining process. These issues are described in the *Water Resources* section of Chapter 3 and this chapter.

Cumulative Effects Study Area

The Cumulative Effects Study Area (Study Area) for geology and mineral resources is the combination of the existing and proposed mine permit areas depicted on **Figures 2-1, 2-2, and**

2-3, respectively, and incorporates past, present, and reasonably foreseeable mining activity over a 50-year period within the Indian Creek drainage.

Cumulative Effects

Cumulative impacts that could result from extraction of the mineral resource are primarily associated with relocating approximately 1 million tons of ore and overburden annually, of which 37- 45 percent is sold as lime product. Reasonably foreseeable future activity associated with existing permitted mine disturbance would continue at this rate for approximately 15 years. Proposed expansion of the Indian Creek Mine would include mining and processing at current rates over an additional 35 years for a total 50-year mine life.

Past, present, and reasonably foreseeable impacts associated with development of geologic resources include historic placer operations along Indian Creek; development and operation of the Diamond Hill Mine; sand and gravel removal from a community gravel pit within the LHTA for range maintenance; building and maintenance of Indian Creek Road; and planned subdivision developments northeast of the Study Area. The volume of rock and soil removed during past mining activity and placed in waste rock dumps or as spent placer tailing has not been quantified.

The cumulative effects of excavation, processing, and relocation of rock associated with mining and road building include release of sediment to watersheds, release of dust to air, and release of trace metals to groundwater and surface water sources. No quantification is available for these releases from historic and past mining activity. The primary environmental receptor potentially affected by mining, road building, and other land disturbing activities is water resources (groundwater and surface

water). Quality of groundwater and surface water in the Cumulative Effects Study Area is described in the *Water Quantity and Quality* section of Chapter 3.

WATER QUANTITY AND QUALITY

Water resources in the Study Area include surface water (streams, rivers, springs, and seeps) and groundwater. Principal drainages include Indian and Crow creeks. These sources of surface water support livestock, wildlife, fish, aquatic animals, birds, and vegetation and are hydrologically connected to some groundwater systems. Surface water is not used at the mine. Storm water is and would continue to be collected from disturbed areas using ditches and detention ponds. If discharge from any detention pond occurs during storm events, it would be from an agency-approved storm water outfall.

Use of groundwater from aquifers in the Study Area includes mining, domestic, stock water, irrigation, and other uses. Groundwater pumped from wells at the Indian Creek Mine is used for dust control, mineral processing, and potable uses. The proposed north mine pit in the Dolomite Claims Area would intercept groundwater. There is no current or planned discharge of groundwater from the mine site. Any groundwater encountered in the Dolomite Claims north mine pit may be used for dust control or other mine-related purposes. Some limited drawdown of groundwater may occur around the Dolomite Claims pit area during mining operations. The north mine pit would be partially backfilled at closure to avoid development of a pit lake. Some nitrates from blasting residues on rock may be introduced to groundwater in the local area.

Cumulative Effects Study Area

The Cumulative Effects Study Area for water resources encompasses surface water and groundwater in the vicinity of existing and proposed mine expansion areas associated with the Indian Creek Mine and historic and inactive mining that has occurred on upper reaches of Indian Creek. The Study Area includes Indian Creek from its headwaters to the confluence with the Missouri River near Townsend and Crow Creek from the National Forest Boundary to the confluence with the Missouri River near Toston.

This geographic area was selected as the Cumulative Effects Study Area for water quantity and quality because potential effects of the Proposed Action and Alternatives on water resources could combine with other land use activities to impact watersheds that encompass the Indian Creek Mine area. The Indian Creek and Crow Creek watersheds are the primary drainages that encompass the Project area.

Cumulative Effects

Cumulative effects to water quantity and quality could result from wildfire, livestock grazing, proposed expansion of the Indian Creek Mine, and other possible construction activities including Alternative A – Modified Pit Backfill. The Diamond Hill Mine, located in the upper Indian Creek drainage, maintains a valid operating permit but has ceased operations and is not expected to contribute impacts to water quantity or quality in the Indian Creek drainage.

Historic placer operations along and in Indian Creek have altered the original stream channel. Stream rehabilitation projects have been initiated along Indian Creek to restore stability of the creek.

Cumulative impacts to water quantity and quality are primarily associated with potential sediment loading in surface water run-off resulting from mining and other land-disturbing activities. This could affect lower portions of Indian Creek and/or Crow Creek to their confluence with the Missouri River. As described previously, only run-off water from the Indian Creek Mine that exceeds the capacity of detention ponds would discharge off-site under an agency-approved storm water permit. Other types of best management practices (e.g., silt fences, straw bales, run-off control ditches) are used at the mine site to reduce sediment levels in run-off water.

Sediment from historic placer mining has resulted in redistribution of fines in the original creek channel to other locations within the drainage. The fine sediment bedload in Indian Creek in areas where placer mining occurred has been deposited in locations where stream energy has limited affect on bedload movement. Some sediment is entrained by stream flow on an annual basis in response to spring run-off.

Potential increases in sedimentation to the nearby streams could add to sediment loading from other areas subject to livestock grazing, wildfires, and/or construction activities. Present and reasonably foreseeable land disturbing activities in the Study Area include subdivision development northeast of the Study Area and sand and gravel operation from a community gravel pit within the LHTA. Aggregate from this gravel pit is used for range maintenance and building and maintenance of the Old Woman's Grave Road. No information or data exist to quantify the contribution of sediment from roads, burned areas, grazing allotments, or gravel pit operations to area drainages.

No trace elements are predicted to be released from proposed mine expansion at the Indian Creek Mine. Contribution of trace metals from other historical mining and natural sources

within the Indian Creek watershed is expected to continue into the future.

Groundwater drawdown could occur in the vicinity of the Dolomite Claims north mine pit area during operations at the Indian Creek Mine. No other reasonably foreseeable activities in the Study Area, however, are expected to result in cumulative groundwater drawdown effects.

Reasonably foreseeable future activity associated with the existing permitted Indian Creek Mine disturbance would continue for approximately 15 years. Proposed expansion of the Indian Creek Mine would include mining and processing at current rates over a 50-year mine life.

SOIL RESOURCES

Information on soil resources in the Study Area is developed on a planning level or project specific basis through soil surveys. Surveys are conducted at various levels of intensity depending on the use proposed. Soil data collected to support planning and evaluation of the Proposed Action and Alternative A – Modified Pit Backfill are described in the *Soil Resources* section of Chapter 3 and includes the chemical and physical properties, distribution and extent of each soil type (**Figure 3-5**), and suitability rating of the soil for reclamation.

Cumulative Effects Study Area

The Cumulative Effects Study Area (Study Area) for soil resources (**Figure 4-1**) encompasses the existing and proposed mine expansion permit areas and watersheds that drain the Project area. The Study Area includes the headwaters of Indian and Crow creeks to the confluence with the Missouri River. This Study Area is based on natural and manmade impacts to soil resources that result in soil movement or loss and changes in soil fertility and

productivity combined with the Proposed Action and Alternatives that could impact other resources (e.g., surface water).

Cumulative Effects

Soil resources are cumulatively impacted through land disturbance by mining, fire, agriculture, recreation, and a variety of other natural and man-caused activities within the Study Area. These impacts are described in terms of the type of impact and the number of acres affected. Consideration is also given to the amount of those acres likely to be reclaimed.

Mining, military training, UXO clearance, and livestock grazing are expected to continue as major activities in the Study Area and impacts to soil resources from wildfire in the area would also continue to occur. Impacts from these activities include loss of soil productivity due to changes in soil chemical and physical properties (sterilization due to fire); water and wind erosion; and changes to structure and associated properties resulting from compaction.

Historically, several wildfires have occurred in the Study Area, creating additional regional impacts to soil. Although other soil characteristics are altered, soil loss due to erosion is commonly of greatest concern. In burned areas, soil is commonly exposed and susceptible to erosion by wind and water. Movement of soil from burn areas is dependent on weather conditions, duration of exposure, and success of seeding efforts, and/or volunteer seeding to re-establish vegetation. Empirical data are not available to report the amount of soil movement or loss that has historically occurred as a result of wildfires.

Mine construction and development practices in the Study Area include salvaging and stockpiling soil for use in reclamation. Soil salvage occurs

immediately following clearing and grubbing of the surface area and the time period between exposure of bare mineral soil to wind and water erosion is minimized. Soil movement is most evident from stockpiles of soil prior to establishment of cover crops. Once cover crops are established, soil movement from the surface of stockpiles is minimized. Standard practice is to install berms at the toe of each stockpile to collect soil that may move from the face of the stockpile. This soil is captured and returned to the stockpile, limiting loss of soil.

Wind and water erosion can initiate soil movement during the soil redistribution phase of reclamation. This period occurs prior to establishment of vegetation on the reclaimed area. Standard practice involves the use of best management practices to control and minimize sediment movement until vegetation is established. Best management practices include silt fences, straw bales, run-off control ditches, sediment ponds, and other sediment trapping devices which allow soil to be captured and returned to the reclaimed area minimizing soil loss.

Reclamation associated with current mining activities and reseeding of burned areas would mitigate soil movement and productivity loss. Soil salvaged and used in reclamation is expected to return to pre-mining productivity once vegetation is established and soil nutrient cycling is restored. Seeding and revegetation of areas that have been burned would reduce soil movement and loss. Habitat restoration projects including channel rehabilitation along Indian Creek have reduced the contribution of soil loss associated with past placer mining activities.

Data that quantify cumulative soil movement that results in soil loss in the Study Area from all land uses (e.g., mining, roads, wildfire burn areas, grazing) are not available. As described above, soil movement in response to any of the

land disturbing activities or phenomena is site specific, weather dependent, and subject to the timing and success of rehabilitation efforts. Soil movement that could result in impacts to water quality is site specific and dependent on the proximity of a site to surface water. No data are available that provide quantification of sediment load to area streams from historic mining, livestock grazing, and wildfire.

VEGETATION RESOURCES

The cumulative effects discussion for vegetation focuses on changes in dominant plant communities that affect habitat for wildlife (e.g., mountain mahogany/juniper types). Mining activities, wildfire, and livestock grazing combined with displacement of native species by invasive species are the primary factors that have altered the structure, composition, and ecology of plant communities in the Study Area.

Cumulative Effects Study Area

The Cumulative Effects Study Area for vegetation includes the area encompassed by the Indian Creek Mine and watersheds that drain the Project area. Impacts to vegetation (mining, wildfire, military training, and grazing) associated with land use activities in the Indian Creek and Crow Creek drainages could result in exposure of bare mineral soil which can be mobilized through water and wind erosion. Potential cumulative impacts to vegetation include past, present, and reasonably foreseeable mining developments, use of the LHTA by the Montana Army National Guard, grazing of public and private land, subdivision developments, wildfire, and noxious weed invasion.

Cumulative Effects

Cumulative effects on vegetation would result from proposed expansion of the Indian Creek

Mine, wildfires, livestock grazing, military training exercises, subdivision development, and displacement of native species by noxious weeds. Past, present, and reasonably foreseeable activities affecting vegetation in the Study Area are ongoing mining operations at the Indian Creek Mine, wildfires, livestock grazing, military training exercises by MTARNG in the LHTA, and displacement of native species by noxious weeds.

Shrub and savannah habitat types are the most difficult to reclaim and require long periods of time (i.e., several decades) before reclaimed areas resemble similar undisturbed habitats. Enhanced revegetation efforts may reduce the recovery time; nevertheless, a relatively short return to current conditions would be unlikely in shrub and habitat types affected by proposed mine expansion or implementation of Alternative A – Modified Pit Backfill.

Livestock grazing in the Study Area would likely continue at current levels. Season of use and carrying capacity of grazing allotments in the Study Area would not change.

Military training exercises minimally affect vegetation as activities are confined to small areas, and traffic is restricted to existing roads. Wildfire is an occasional unintended consequence of training activities as evidenced by an ordnance-triggered wildfire in the southern portion of the LHTA Impact Area in 2006. This fire burned about 100 acres of sagebrush/grassland habitat. Long periods of time (10 to 15 years) are typically required for trees and shrubs to voluntarily reestablish in burned areas. About 100 acres of burned area were seeded with a variety of shrubs in October 2006.

Development of subdivisions in and near the Study Area would reduce habitat available for wildlife and livestock grazing.

Special Status Species

One known population of lesser rushy milkvetch and up to 19 known plants of sword townsendia may be affected by reasonably foreseeable future activities associated with proposed expansion of the Indian Creek Mine. Cumulative impacts to rushy milkvetch and sword townsendia are unlikely to occur from past, present, or reasonably foreseeable MTARNG activities. Wildfire is a potential cumulative impact in the Study Area. Lesser rushy milkvetch has been observed regenerating from burn sites within 1 year (Trainor 2007).

Sword townsendia occurs in sparsely vegetated limestone gravels and outcrops where minimal fuels would typically prevent intense fires. This type of habitat provides limited recreational opportunities and therefore, potential effects that could result from recreational activities are minimal. In addition, the population of sword townsendia lies within the LHTA and/or mine permit area and as such, access to this population is controlled. It is unlikely that any cumulative effects would occur to special status plant species.

Invasive, Non-native Species

After establishment of the desired plant community and Graymont has met the goals and objectives of reclamation, active management and control of weeds by Graymont would end. Activities that disturb soil and vegetation (e.g., other mining operations, military training exercises, UXO clearance, grazing, subdivisions, and wildfires) open niches for invasive plant colonization, provide a means of seed transport along roadways and trails, and would increase the potential for noxious weeds to invade reclaimed areas from uncontrolled sources located in adjacent areas.

TERRESTRIAL WILDLIFE

Cumulative Effects Study Area

The Cumulative Effects Study Area (Study Area) for terrestrial wildlife includes the Elkhorn Mountains, the Elkhorn Wildlife Management Unit, and wildlife winter ranges in the Limestone Hills as shown on **Figures 4-3, 4-4, and 4-5**. This Study Area was selected based on the multi-agency management prescription for the Elkhorn Mountains.

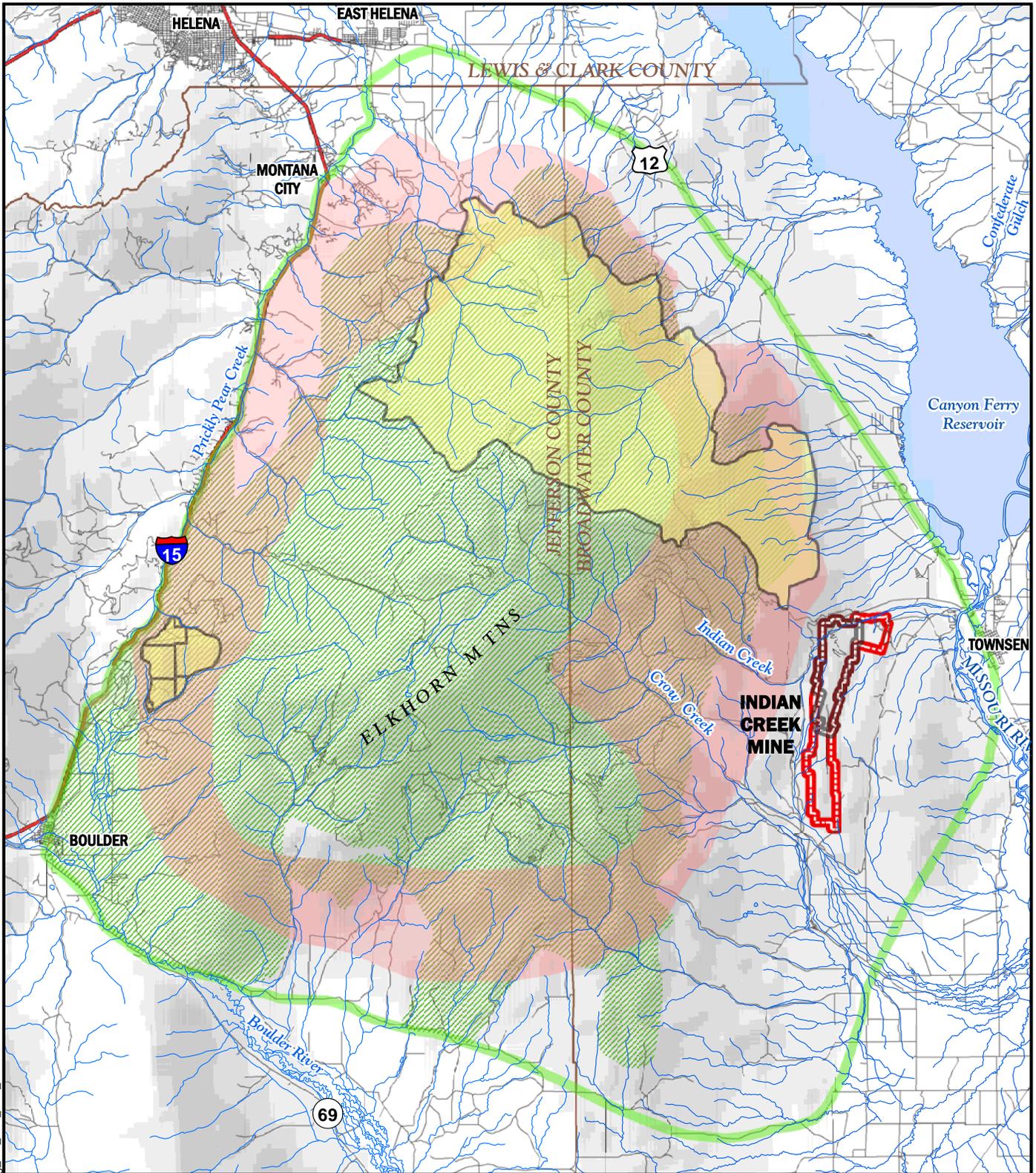
Cumulative Effects

Past, present, and reasonably foreseeable future activities that could affect wildlife and their habitats in the Study Area include suppression of wildfires; wildfires; use of the LHTA for military training activities; grazing; hunting and other recreational use; mining and associated activities at the Graymont Mine; UXO clearance; loss of habitat through construction and use of roads and military facilities; development of residential housing, and displacement of native species by invasive noxious weeds. Development of the Elkhorn Cooperative Management Area would enhance future work in the area to improve wildlife habitat.

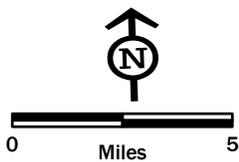
Elk

The Study Area contains approximately 135,000 acres of elk fall and winter habitat (**Figure 4-3**). Past, present, and proposed mining activities would remove approximately 1,200 acres (0.9 percent) of this habitat within the Study Area.

Management by the Elkhorn Cooperative Wildlife Management Unit would continue to develop management strategies compatible with livestock grazing and wildlife. Seasonal road closures, livestock grazing management, controlled burns to improve wildlife habitat, and other habitat improvement practices such as



Base Data Source: Montana NRIS GIS Data



- Streams
- Other Roads
- Interstate
- Existing Operating Permit Boundary
- Proposed Operating Permit Boundary
- Wildlife Cumulative Effects Boundary
- Historic Large Fires
- Elk Winter Range
- Elk Summer Range

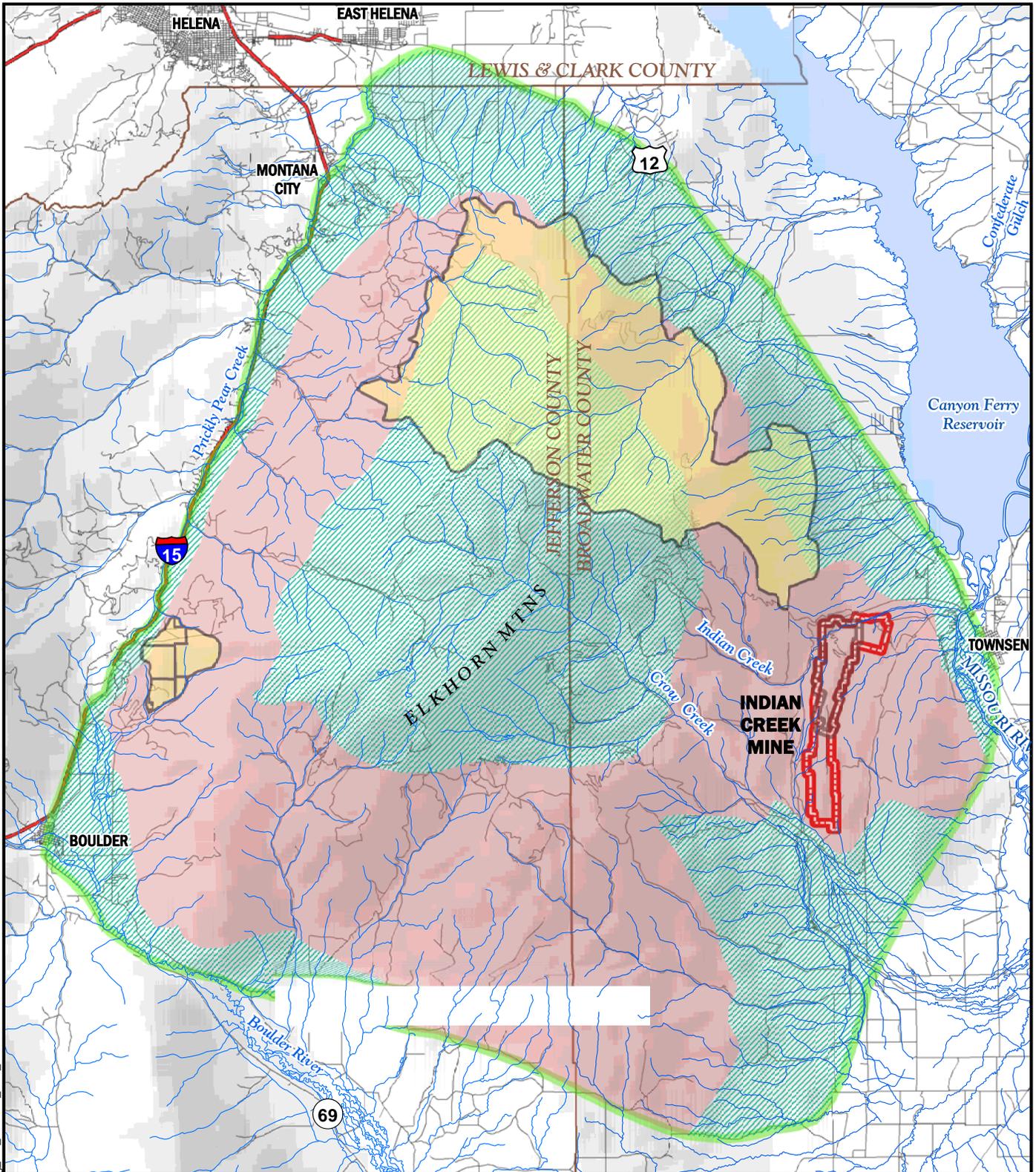
H:\13532 Graymont EIS\5000 GIS\Projects\EIS\Fig_4-3_ELK_cum_effects.mxd



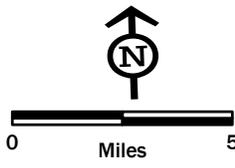
U.S. Department of the Interior
Bureau of Land Management
Butte Field Office
Butte, Montana

ELK HABITAT CUMULATIVE EFFECTS
Indian Creek Mine Expansion - Environmental Impact Statement
Broadwater County, Montana

FIGURE
4-3



Base Data Source: Montana NRIS GIS Data



- Streams
- Other Roads
- Interstate
- Existing Operating Permit Boundary
- Proposed Operating Permit Boundary
- Mule Deer Yearlong Range (Non-Migratory)
- Mule Deer Winter/Yearlong Range
- Wildlife Cumulative Effects Boundary
- Historic Large Fires

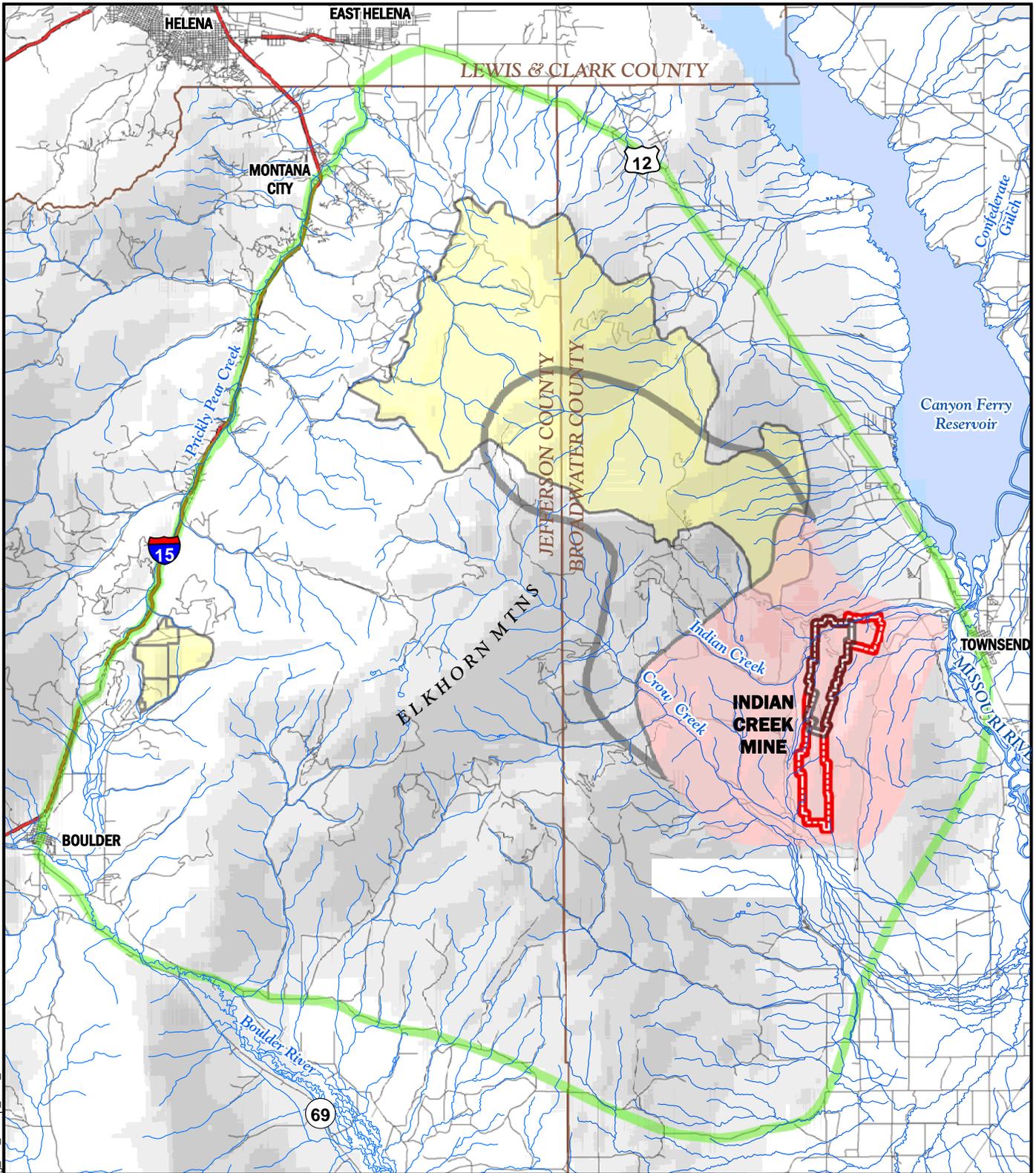
H:\13532 Graymont EIS\5000 GIS\Projects\EIS\Fig. 4-4_MDEER_cum_effects.mxd



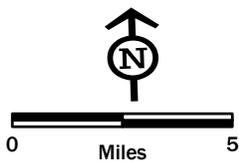
U.S. Department of the Interior
Bureau of Land Management
Butte Field Office
Butte, Montana

MULE DEER HABITAT CUMULATIVE EFFECTS
Indian Creek Mine Expansion - Environmental Impact Statement
Broadwater County, Montana

FIGURE
4-4



Base Data Source: Montana NRIS GIS Data



- Streams
- Other Roads
- Interstate
- Existing Operating Permit Boundary
- Proposed Operating Permit Boundary
- Wildlife Cumulative Effects Boundary
- Historic Large Fires
- Spring, Summer, Fall Range
- Yearlong Range

H:\13532 Graymont EIS\5000 GIS\Projects\EIS\Fig. 4-5_sheep_cum_effects.mxd



U.S. Department of the Interior
Bureau of Land Management
Butte Field Office
Butte, Montana

BIGHORN SHEEP HABITAT CUMULATIVE EFFECTS
Indian Creek Mine Expansion - Environmental Impact Statement
Broadwater County, Montana

FIGURE
4-5

rangeland seeding with desirable plant species, fuel reduction to remove encroaching conifers, and weed control would benefit various species of wildlife.

Acquisition by BLM of the Iron Mask Ranch to the north of Graymont's operations in the Elkhorn Mountains would preserve important big game winter range and year-round habitat. Measures to improve habitat quality may be implemented in the future, and management of livestock to prevent conflicts with wildlife and wildlife habitat would benefit wildlife species in the cumulative effects area.

Development of subdivisions in and near the Study Area would affect wildlife through direct loss of habitat, displacement due to human activities, and habituation of wildlife to humans, which can cause management problems (e.g., wildlife damage to landscape plants, aggressive actions toward people and pets, attraction of predators, and increased collisions with vehicles). Proposed and existing subdivisions in the cumulative effects area are outside of habitat typically used by elk and would have negligible cumulative impact on this species.

Since 1988, wildfires have burned approximately 46,983 acres of elk summer range and 21,051 acres of winter range in the larger Elkhorn Mountain complex. Typically, wildfires remove woody fuels and open tree and shrub canopies resulting in increased growth of understory grasses and forbs. Wildfires have resulted in increased amounts of herbaceous forage available to elk and other wildlife species, but have reduced amounts of some trees and shrubs that are killed and do not sprout after fires. Reductions in tree density on summer/fall habitat can decrease security cover, making elk more vulnerable during the hunting season. Over the past 25 years, fire has improved habitat quality for elk in the Study Area by removing encroaching conifers and increasing the forage base.

A study of livestock and elk interactions in the Elkhorn Mountains (Ecosystem Research Group 2006) found that livestock and elk use overlap occurs on lower slopes that receive spring elk use and summer cattle use; however, when use by cattle does not exceed moderate levels, elk benefit from this foraging niche overlap because grass grazed in summer grows more vigorously the following spring. Other studies conducted in the Elkhorn Mountains and the Mount Haggin Wildlife Management Area by FWP have found that vegetation has responded favorably to moderate livestock grazing associated with rest-rotation grazing systems (Ecosystem Research Group 2006). Although there are strong diet similarities between elk and cattle, it does not appear that livestock grazing is having a detrimental effect on elk populations in the Study Area.

Recreation (e.g., hunting, hiking, rock climbing, mountain biking, cross-country skiing, and off-road vehicle use) could displace wildlife, especially if these activities take place on big game winter ranges when animals are present. During winter, big game animals are stressed due to cold and limited food supplies, and human activities would cause them to flee and could result in increased winter mortality or lower birth rates the following year.

Mule Deer

Mule deer are present in the Study Area year round, but their numbers increase during winter. The Study Area has approximately 196,000 acres of mule deer winter range and year-round habitat (**Figure 4-4**). Existing and proposed mining activity would affect approximately 2,000 acres (1 percent) of mule deer winter range and year-round habitat in the Study Area. Mountain mahogany, an important winter food for deer, is present on about 2,500 acres in and near the Limestone Hills (Graymont 2007a). Existing and proposed mine expansion would affect about 18 percent of

mountain mahogany in the Study Area. This loss of habitat could temporarily reduce the capacity of the Study Area to support mule deer.

Impacts to mule deer could result from military use of LHTA. Noise from explosives could displace animals from habitats when training exercises are taking place from mid-April through November; however, during this period, there is sufficient security habitat to accommodate displaced animals and impacts would be negligible. Exploding ordnance could also start fires that burn shrub and tree habitats that provide important winter forage and thermal cover for mule deer and bighorn sheep.

Development of subdivisions in and near the Study Area would affect wildlife through direct loss of habitat, displacement due to human activities, and habituation of wildlife to humans, which can cause management problems (e.g., wildlife damage to landscape plants, aggressive actions toward people and pets, attraction of predators, and increased collisions with vehicles). Three subdivisions are in mule deer winter range near Townsend (Deer Path, Riverview Estates, and V-K). These subdivisions would remove 226 acres of mule deer winter range in the cumulative effects area. It is likely that deer would become accustomed to the subdivisions and inhabit areas close to residences and become management problems. The management option of hunting to control deer numbers often is not feasible near subdivisions.

Since 1988, wildfires have burned approximately 29,000 acres of mule deer summer/year-round range and 23,000 acres of winter range. Because some shrubs (e.g., mountain mahogany and sagebrush) and trees (e.g., Rocky Mountain juniper and limber pine) in the Study Area are killed by fire, habitat quality for mule deer, especially on winter range, has been reduced on areas exposed to severe burn intensities. Mule deer forage primarily on shrubs in winter and

reductions of mountain mahogany and sagebrush as a result of fire could reduce habitat quality for deer; however, other species important to mule deer (e.g., rubber rabbitbrush and skunkbush sumac) vigorously resprout and reseed following fires and may be enhanced by periodic fires. Because mule deer are adapted to a range of habitats and forage plants and several species of plants have evolved over a range of fire regimes, it is unlikely that fires in the Study Area have had a discernable adverse effect on mule deer.

Fires have been widespread in the Study Area over the last 25 years, and encroachment of conifers into grasslands and increased densities of conifers in woodlands have reduced the amount of forage and overall ecological condition for big game animals, including mule deer. Ecosystem Research Group (2006) reported approximately 2,900 acres of conifer encroachment on rangeland in the Elkhorn Mountains. Although wildfires may have reduced amounts of shrubs important to foraging mule deer, fires have also helped control conifer encroachment onto big game ranges. Fire suppression over the last century has been important in contributing to the proliferation of conifers at the interface of montane conifer communities and down slope grassland and shrub communities that typically provide mule deer winter range.

Noxious weeds have also reduced the ecological condition of mule deer winter range in the Study Area. Ecosystem Research Group (2006) stated that other than conifer encroachment, noxious weeds pose the greatest threat to ecological condition and productivity of habitats in the Elkhorn Mountains.

Grazing allotments on public land administered by the Forest Service and BLM would not likely have adverse effects on mule deer. During summer, mule deer eat a variety of shrubs and

forbs, whereas cattle graze mostly on grass. There is little competition for forage between livestock and mule deer. On winter range, mule deer are highly dependent on shrubs. Typically, cattle do not browse extensively on important mule deer foods such as rubber rabbitbrush, mountain mahogany, skunkbush sumac, and sagebrush. Grazing is typically for 4 to 5 months in spring, summer, and fall on BLM and Forest Service grazing allotments. Mule deer and livestock would not occupy the same habitats during winter.

Bighorn Sheep

The Study Area has approximately 40,500 acres designated as bighorn sheep winter range and year-round habitat (**Figure 4-5**). The Proposed Action would disturb approximately 2,020 acres (5 percent).

Since 1988, wildfires have burned approximately 19,120 acres of bighorn sheep summer/year-round range and 1,589 acres of winter/year-round range. Because some shrubs and trees in the Study Area are killed by fire, habitat quality for bighorn sheep, especially on winter range, could be reduced by frequent fires; however, like mule deer, bighorn sheep eat rubber rabbitbrush, skunkbush sumac, and other species enhanced by fire. It is unlikely that fires have adversely affected bighorn sheep given the diversity of forage species present on winter range in the Study Area.

Development of subdivisions would not affect bighorn sheep habitat. All proposed and existing subdivisions are outside of bighorn sheep summer/year-round and winter habitat.

Recreation (e.g., hunting, hiking, rock climbing, mountain biking, cross-country skiing, and off-road vehicle use) and military training operations could displace wildlife, especially if these activities take place on winter ranges when animals are present. Human activities that

would cause bighorn sheep to flee would stress animals and could result in increased winter mortality or lower birth rates.

Under the Draft Butte BLM Resource Management Plan – Alternative B (BLM 2007), no new domestic sheep/goat grazing allotments would be allowed in occupied bighorn sheep habitat or within a 5-mile buffer. This measure would help prevent transmission of disease from domestic animals to bighorn sheep. However, 1,200 sheep would remain on the Limestone East Grazing Allotment. Contact between domestic sheep and bighorn sheep could occur on this allotment and spread disease to the bighorn populations, which could increase bighorn sheep mortality.

Pronghorn Antelope

A few pronghorn antelope are present in the Study Area at lower elevations on flats north of Townsend from spring to fall. Impacts to pronghorns from wildfire have been minimal as most fires have burned in areas with more woody fuels. Livestock grazing probably has had little effect on pronghorns as diets of pronghorns are mostly forbs and shrubs, whereas cattle prefer grasses. Sixteen subdivisions in the Study Area have the potential to adversely affect pronghorn habitat on the relatively flat land between Townsend and East Helena. Construction of homes and fences would remove forage for pronghorns and restrict pronghorn movements. Human activities including unrestrained dogs would displace pronghorns away from residences.

LAND USE, ACCESS, AND TRANSPORTATION

Cumulative Effects Study Area

The Cumulative Effects Study Area for land use, access, and transportation includes the area encompassing the LHTA, subdivisions accessed

by the Indian Creek Road, the railroad load-out facility, and U.S. Highway 12/287. This area was selected for cumulative effects analysis based on the existing transportation system in the vicinity of the Project area, access routes that connect to the primary access route to the Project area, and land tracts located immediately adjacent to the Project area whose ownership and use may conflict or have additive effects on these resources. The Cumulative Effects Study Area for grazing is the same as shown on **Figure 3-7**.

Cumulative Effects

Grazing

Grazing is projected to continue at current levels within the allotments located in the Cumulative Effects Study Area. According to the BLM MRB Survey and Allotment Tabulation Record, mine expansion would result in loss of carrying capacity on 524 acres of the Limestone Hills Grazing Allotment, 775 acres of the Dowdy Ditch Allotment, and about 11 acres in the Indian Creek Allotment. These records are available at the BLM Butte Field Office. Grazing on mine-related disturbance areas would be lost until revegetation and forage production are comparable to adjacent land.

Recreation

Increased development of private land, increased recreational use, and continued mining and military training activities would increase land management intensity for activities such as weed control and fire fuel management. Potential increases in mine development and expansion and recreational use could result in conflicts between military and nonmilitary uses of the LHTA.

Access

Increased subdivision in the Indian and Crow Creek drainages could preclude some access routes, historically used across private land, to public land. Public roads currently used to access public land would not be affected.

Transportation

Future traffic load on the Indian Creek Road is expected to increase as a result of subdivision development on land north of the road. Mine traffic along the road is expected to remain at current levels.

NOISE

Cumulative Effects Study Area

The primary sources of noise that would combine with noise from the Indian Creek Mine are military training activities at the LHTA. The cumulative effects study area (Study Area) for noise encompasses the proposed mine expansion area, the LHTA, and private land around the mine that is being subdivided.

Cumulative Effects

Cumulative effects from the construction and operation of the Proposed Action and/or Alternative A – Modified Pit Backfill include the combination of noise sources from the mine as the South Claims and Dolomite Claims areas are developed and other existing noise sources. Noise from existing quarry operations in the North Claims Area would be reduced as mining operations move south into the South Claims Area. Noise from the crusher located in the North Claims Area would continue. In addition to mine operations and equipment, other noises, such as natural sources, airplane noise, noise from recreational activities, traffic along Indian Creek Road, and ongoing weapons

training at the LHTA, are present in the South Claims and Dolomite Claims areas and would continue into the future. Noise due to the Proposed Action and Alternative A is described in Chapter 3 – Noise.

VISUAL RESOURCES

Visual resources are evaluated within the context of BLM's Visual Resource Management program. This program has established categories of visual elements throughout the area administered by the Butte Field Office. BLM reviews proposed projects for compliance with this program.

Cumulative Effects Study Area

The Cumulative Effects Study Area for visual resources includes the eastern slopes of the Elkhorn Mountains lying west and northwest of Townsend. Key observation points are located along public access points or areas frequented by the public. The rationale for selecting this geographic area is the relationship between mining level disturbance (creation of mine pits, overburden disposal areas, haul roads, and ancillary mine facilities that modify the natural landscape) and the viewshed from various points where public access is established.

The Study Area is predominately located in a Visual Resource Management (VRM) Class IV area under BLM's VRM program. Management activities that require major modification to the existing character of the landscape are allowed in Class IV areas. The level of change to the characteristic landscape can be high. Management activities (e.g., developments) may dominate the view and be the major focus of viewer attention. Impacts of these activities are minimized through careful location, minimal disturbance, and repeating the basic elements

(form, line, color, and texture). Class IV allows substantial modifications of the landscape but places emphasis on mitigation, where possible, of those impacts.

Cumulative Effects

Current and future mine development within the Study Area would not exceed the visual prescriptions of the VRM Class IV designation. Reclamation measures are required for mine disturbances, and reclamation would occur on current and future mining activities at the Indian Creek Mine. Visual contrast associated with certain mining facilities would remain after reclamation, including rock faces of some pit highwalls, overburden dump faces, and haul roads. Visual contrasts in form, line, and color created by rock faces and slopes would remain in the post-mining landscape until vegetation (grasses and shrubs) is established, creating a mosaic of color and texture blending with the surrounding landscape. Rock and slope faces associated with overburden dumps would appear similar to bare ridges, talus slopes, and cliffs in adjacent areas. Mitigation of all visual impacts from mine development may not be possible, but the severity could be minimized through project design and implementation of Alternative A – Modified Pit Backfill.

Other land use activities or conditions within these viewsheds have affected and would continue to affect the visual characteristics of the landscape. Burned areas (range fires), electrical transmission lines, pipeline corridors, highways and roads, and livestock grazing affect the natural landscape to varying degrees and at varying seasons and duration. These land use activities and natural phenomena are expected to continue to affect visual elements of the landscape into the future.

SOCIAL AND ECONOMIC RESOURCES

Cumulative Effects Study Area

The Cumulative Effects Study Area for social and economic resources is Broadwater County. The rationale for selection of this Study Area is outlined below:

- The Indian Creek Mine is located in Broadwater County.
- Residential patterns of mining company employees determine where they are likely to spend their salaries. In 2005, 25 of 27 Graymont employees lived in Broadwater County (MTARNG/BLM 2007), and it is reasonable to assume the ratio is similar among the 2007 workforce and that many of the contract workers also live in the county and would continue to do so in conjunction with the life-of-mine expansion.

Cumulative Effects

Socioeconomic issues that could have an additive or cumulative effect when coupled with life-of-mine expansion include population growth, employment levels, and tax revenues.

Population Trends and Demographic Characteristics

There are no reasonably foreseeable future projects in the Study Area that would likely result in additional workers or their families moving into the area. Subdivisions in the Silos area, the area north of Winston, and near the Indian Creek Mine may continue to grow. These areas are primarily bedroom communities for Helena. Development of these subdivisions would likely increase demands on local government services and schools.

Employment

Reasonably foreseeable activities in the Study Area would not likely affect employment levels at the Indian Creek Mine and Quarry Services as production levels are not expected to increase to a level that would require additional employees. Employees needed for other new projects in Broadwater County would primarily come from the Services sector.

Tax Revenues

The reasonably foreseeable projects planned in the Study Area would not likely contribute significantly to the Broadwater County tax base, with the exception of residential property taxes generated from the various proposed and approved subdivisions (e.g., Missouri Rendezvous, Rolling Glen). Improvements at the Silos Recreation Area would be primarily on public land. Growth in Broadwater County may create new businesses, which in turn would increase the tax base.

In 2006, Graymont paid over \$77,200 in net proceeds tax to Broadwater County. Graymont was the only contributor to net proceeds tax revenue for Broadwater County in 2005 (BCPB 2003). None of the other reasonably foreseeable activities in the Study Area would generate additional state Resource Indemnity Trust Tax fund or county (net proceeds) revenues.

CULTURAL RESOURCES

Cumulative Effects Study Area

The Cumulative Effects Study Area and Area of Potential Effect for cultural resources include the existing and proposed operating permit boundary for the Indian Creek Mine. The Study Area lies between Old Woman's Grave Road

on the east, Mud Springs Road on the West, Indian Creek Road on the north, and Crow Creek Road on the south.

Cumulative Effects

When sites that have been determined eligible for the National Register are threatened by an action, the preferred mitigation measure is avoidance. Whenever possible, mining-related facilities are redesigned to avoid eligible sites or specific cultural resources; however, avoidance is not always possible. In such cases, excavation of eligible sites by archaeologists is undertaken to preserve the resource and preclude adverse effects. Archaeologists prepare mitigation plans for submittal to BLM that include a scope of work and specific scientific issues to be addressed as a result of the excavation. BLM submits plans to the State Historic Preservation Office for consultation. Upon final approval by BLM excavation and field work commence in accordance with the approved plan.

Historical and culturally important sites are subject to erosion, vandalism, and burial. Some previously unknown sites or artifacts are exposed as a result of erosion or manmade disturbance. Discovery and recognition of historically and culturally important sites or artifacts is also a function of timing.

In some cases, erosion and manmade disturbance have removed or modified sites and/or artifacts to the extent that the integrity of the site is lost, and therefore, interpretation of the site cannot be made. Erosion and manmade disturbance can also result in burial of sites such that no surficial evidence is available to allow identification of the site(s).

As a consequence of natural processes and manmade disturbances, the number and importance of cultural and historic sites and artifacts in the Study Area is not quantifiable.

The number and type of sites that have been recorded through recent surveys in the Study Area provide the only cultural and historical information on which to assess cumulative effects.