BLM

Alton Coal Tract Lease by Application
DRAFT Environmental Impact Statement

KANAB FIELD OFFICE

November 2011

DES-11-51

UTC-040-12-01

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Utah State Office
P.O. Box 45155
Salt Lake City, UT 84145-0155
http://www.blm.gov

IN REPLY REFER TO:
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Dear Reader:

Enclosed is the draft environmental impact statement (Draft EIS) entitled *Alton Coal Tract Lease By Application Draft Environmental Impact Statement*. This document has been developed in accordance with the National Environmental Policy Act of 1969 and the Mineral Leasing Act of 1920, as amended. The Bureau of Land Management (BLM) prepared this document in consultation with several cooperating agencies, including the Office of Surface Mining Reclamation and Enforcement (OSM) and the Utah Department of Natural Resources, Division of Oil, Gas, and Mining. The National Park Service and the U.S. Environmental Protection Agency (EPA) also contributed to this document's preparation. This document takes into account public comments received during the scoping effort as well. The Draft EIS is open for a 60-day review period beginning the date the EPA publishes the Notice of Availability of the Draft EIS in the *Federal Register*.

The BLM has prepared this Draft EIS to analyze and disclose the potential impacts of leasing and mining the coal reserves in the Alton Coal Lease by Application (LBA) tract. The BLM's decision with respect to the LBA tract will pertain only to leasing the tract; however, the potential impacts of mining the tract are analyzed because a coal mine would be a logical extension of a lease. The LBA tract consists of approximately 3,576 acres of land located in Kane County, Utah approximately 0.10 mile south of the town of Alton and 2.9 miles east of U.S. Route 89. The tract is in the BLM Kanab Field Office planning area, which is managed under the *Kanab Field Office Record of Decision and Approved Resource Management Plan* (BLM 2008a).

The public was provided a 90-day scoping period at the beginning of the EIS process to identify potential issues and concerns associated with the Proposed Action. Scoping comments were used to help develop alternatives to the Proposed Action, to guide the analysis of potential effects from leasing and mining the tract, and to identify potential mitigations for inclusion in the Draft EIS. The Draft EIS analyzes two action alternatives: 1) Alternative B (the Proposed Action), and 2) Alternative C: Reduced Tract Acreage and Seasonal Restrictions. Alternative C was developed in response to issues raised during the scoping period. This document analyzes a No Action Alternative, which would be to not offer the lease tract for leasing at this time and to maintain existing land uses in the tract area.

The Draft EIS is not a decision document. Rather, it is a document that will inform the BLM's final decision on whether to hold a competitive lease sale for the tract and, in the event that the BLM decides to offer the tract for competitive leasing, what special stipulations would be attached to the lease. The Draft EIS is being released to inform the public and interested parties of the potential impacts associated with implementing either action alternative.

Comments will be accepted for 60 days following the EPA's publication of the Notice of Availability in the *Federal Register*. The BLM is also publishing a Notice of Availability and Notice of Hearing in the *Federal Register*. All timely comments, postmarked by January 6, 2012, on the Draft EIS will be considered in the preparation of the Final EIS, currently scheduled for release in summer 2012. All substantive comments and information submitted will be summarized and addressed in the Final EIS. Substantive comments are ones that, with reasonable basis, question the accuracy of the information in the Draft EIS, the adequacy of, methodology for, or assumptions used for the environmental analysis, present new information relevant to the analysis, present reasonable alternatives other than those analyzed, and cause changes or revision in one or more of the alternatives. The BLM can best use your comments if received within the review period. Comments received after the end of the 60-day comment period will be considered in preparation of the Final EIS as time permits. Comments may be submitted electronically to the attention of Keith Rigtrup at UT_Kanab_Altoncoal@blm.gov. Please include "Alton Coal Lease Draft EIS" in the subject line of your e-mail message. Comments may be submitted by mail to Alton Coal Tract LBA EIS, Keith Rigtrup, BLM, Kanab Field Office, 318 North 100 East, Kanab, Utah 84741. Comments may also be submitted by fax to (435) 644-4620.

The BLM will host public meetings in Alton, Kanab, Panguitch, Cedar City, and Salt Lake City, Utah to provide an overview of the results of the analysis in the document and to take public comments on the Draft EIS. The public meetings will be announced by the BLM at least 15 days in advance through public notices and local media news releases and mailings. A public hearing will be held at Festival Hall Convention Center, 96 North Main, Cedar City, UT on December 6, 2011 at 6:00 PM. The purpose of the hearing is to receive comments on the proposed coal lease, on the fair market value, on the maximum economic recovery of the federal coal resources in the tract, and on the potential environmental impacts associated with leasing and mining the tract.

Before including your address, telephone number, e-mail address, or other personal identifying information with your comments please be advised that your entire comment, including your personal identifying information, may be made publicly available at any time. Although you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. All submissions from organizations and businesses, and from individuals identifying themselves as representatives or officials of organization or businesses, will be available for public inspection in their entirety.

Printed copies of the Draft EIS are available for review at the following BLM offices:

BLM
Kanab Field Office
318 North 100 East
Kanab, Utah 84741

BLM
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101

The document may also be viewed at the following public libraries:

- Kanab City Library, 374 North Main, Kanab, Utah 84741
- Panguitch Public Library, 25 South 200 East, Panguitch, Utah 84759
- Cedar City Library, 303 North 100 East, Cedar City, Utah 84720
- Salt Lake City Main Library, 210 East 400 South, Salt Lake City, Utah 84111

You may also access the document on the Internet at
http://www.blm.gov/ut/st/en/prog/energy/coal/alton_coal_project.html

If you have any questions or would like to obtain an additional copy of this Draft EIS in either hardcopy or PDF, please contact Keith Rigtrup at (435) 865-3063.

Sincerely,

Harry Barber
Kanab Field Office Manager

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ALTON COAL TRACT LEASE BY APPLICATION
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Bureau of Land Management
Utah State Office

Prepared by
Bureau of Land Management
Kanab Field Office

November 2011

Harry Barber
Kanab Field Office Manager

Alton Coal Tract LBA
Kane County, Utah
Draft Environmental Impact Statement

Lead Agency: U. S. Department of the Interior, Bureau of Land Management

Type of Action:	Draft	(X)	Final	( )
	Administrative	( )	Legislative	( )

Jurisdiction: Color Country District Office, Kanab Field Office, Utah

Abstract: This draft environmental impact statement (Draft EIS) analyzes and discloses the potential environmental effects of leasing and mining the coal reserves in the Alton Coal Lease by Application (LBA) Tract encompassing approximately 3,576 acres of land in Kane County near the town of Alton. The Draft EIS was prepared by the Bureau of Land Management (BLM) in response to Alton Coal Development's LBA for federal coal, which would be recovered using primarily surface-mining methods.

The Proposed Action would include approximately 3,576 acres, of which approximately 2,280 acres are federal surface and mineral estate and 1,296 acres are split estate; private surface estate and federal mineral estate. Recoverable portions of in-place coal reserves would be mined over approximately 25 years using surface-mining methods where the depth of overburden is approximately 200 to 300 feet, and using underground methods where the depth of overburden exceeds approximately 200 to 300 feet. The choice of mining method, however, could vary from the 200- to 300-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal has occurred. Reclamation would be concurrent with mining over the course of the estimated 25-year mine life and would be followed by a potential 10-year reclamation and revegetation monitoring period. The proposed Alton Coal Tract would include centralized and dispersed facilities and the relocation of KFO Route 116. Under the Proposed Action, the tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract.

The Draft EIS also analyzes a No Action Alternative (as required by the National Environmental Policy Act) that would not authorize the leasing of the tract, and one action alternative to the Proposed Action. Under the action alternative (Alternative C), the Alton Coal Tract would be modified to exclude a portion of the tract located near the town of Alton. Further, certain mining activities in the southern portion of the tract would be subject to seasonal restrictions to reduce impacts to the local Greater Sage-grouse population. Under Alternative C, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract.

Five open houses will be held in Alton, Kanab, Panguitch, Cedar City, and Salt Lake City, Utah. The public meetings will be announced by the BLM at least 15 days in advance through public notices and local media news releases and mailings. The purpose of these meetings is to provide information on the proposed coal lease tract and to collect public comment on the adequacy and accuracy of the analysis in the Draft EIS. There will also be a formal public hearing held on December 6, 2011 at 6:00 PM at the Festival Hall Convention Center, 96 North Main, Cedar City, UT. The purpose of the hearing is to receive comments on the proposed coal lease, on the fair market value, and on the maximum economic recovery of the federal coal resources in the tract. Comments will be accepted

until January 6, 2012 for use in development of the Final EIS. Comments may be submitted to Alton Coal Tract LBA EIS, Keith Rigtrup, BLM, Kanab Field Office, 318 North 100 East, Kanab, Utah 84741, or sent to UT_Kanab_Altoncoal@blm.gov. Comments may also be faxed to (435) 644-4620. For information about the proposed coal lease tract or to view the Draft EIS, visit http://www.blm.gov/ut/st/en/prog/energy/coal/alton_coal_project.html.

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EXECUTIVE SUMMARY

ES.1. Executive Summary

ES.1.1. Background

In November 2004, a Lease by Application (LBA) was filed by Alton Coal Development, LLC (ACD) to mine federal coal, using primarily surface-mining methods, near the town of Alton, Utah (Case Number UTU 081895). This application was filed under the regulations at 43 Code of Federal Regulations (CFR) 3425, Leasing on Application. This application includes nearly 2,683 surface acres and approximately 38 million tons of recoverable coal. The Bureau of Land Management (BLM) reconfigured the tract to exclude approximately 40 acres and to include approximately 898 additional acres. Acreage added to the tract during tract reconfiguration was based on the identification of additional recoverable coal reserves not included in the original LBA and on additional surface acreage deemed necessary for mine operations. The Alton Coal Tract LBA (hereafter the Alton Coal Tract or tract), as reconfigured, contains approximately 3,581 surface acres and 44.9–49.1 million tons of recoverable coal reserves.

To process an LBA, the BLM must establish the fair market value of the coal in the tract by evaluating the quantity and quality of the coal reserves. Any subsequent mining plan must achieve maximum economic recovery of the tract's coal resources in the context of applicable laws, regulations, and leasing stipulations (standard and special). In addition, before the BLM can issue a decision to offer a tract for lease, the BLM must fulfill the requirements of the National Environmental Policy Act (NEPA) by evaluating the potential environmental impacts of leasing and mining federal coal.

On November 28, 2006, a Notice of Intent (NOI) to prepare an environmental impact statement (EIS) for the Alton Coal Tract was published in the Federal Register. This EIS has been prepared to evaluate the potential direct, indirect, and cumulative environmental impacts of leasing and recovering the federal coal included in the tract, based on ACD's preliminary plan and reasonable alternatives. The BLM will use the analysis in this EIS to decide whether to a) hold a competitive, sealed-bid lease sale for the tract; b) hold a competitive, sealed-bid lease sale for a modified tract; or c) reject the lease application and not offer the tract for sale at this time. The impacts of mining the coal are considered in this EIS because mining the coal is a logical consequence of issuing a lease. A record of decision (ROD) will be issued, and if the decision is to offer the tract for lease, a sale would be held. If a lease sale is held, the bidding at the sale would be open to any qualified bidder; it would not be limited to the applicant. A lease would be issued to the highest bidder at the sale, provided that the high bid meets or exceeds the fair market value of the coal, as determined by BLM's economic evaluation and if the U.S. Department of Justice (DOJ) determines that there would be no antitrust violations.

In return for receiving a lease, the lessee must pay the federal government a bonus equal to the amount it bids at the time the lease sale is held (the bonus can be paid in five yearly installments), make annual rental payments to the federal government, and make royalty payments to the federal government when the coal is mined. Federal bonus, rental, and royalty payments are equally divided with the state in which the lease is located.

All coal reserves in the Alton Coal Tract are federally owned, though surface ownership is mixed. Under Alternative B (the Proposed Action), approximately 2,280 surface acres of the tract are in federal (BLM) ownership, and 1,296 surface acres are in private ownership (eight different private surface owners). Private surface owners may be qualified to give consent to mine federal minerals under the private surface owner's estate according to 43 CFR 3400.0-5. Surface ownership under Alternative A (No Action Alternative) and Alternative C is also discussed in greater detail in Chapter 2 of the EIS. If this EIS process results in a competitive lease sale for the tract, a final determination of private surface-owner

qualification and private surface-owner consultation would take place prior to leasing. All surface owners have been notified of the Proposed Action. Further, both hardcopy and electronic versions of this EIS have been distributed to surface owners.

ES.1.2. Purpose and Need for Action

The BLM-managed coal leasing program encourages the development of domestic coal reserves. As a result of the leasing and subsequent mining and sale of federal coal resources, the public continues to receive a reliable domestic supply of coal for use in the electric power sector and in the industrial sector. BLM recognizes that the continued extraction of coal is a component of meeting the nation's current and future electrical energy and industrial needs. Therefore, private development of federal coal reserves is integral to the BLM coal leasing program under authority of the Federal Land Policy and Management Act of 1976 and the Mineral Leasing Act of 1920 (MLA), as amended by the Federal Coal Leasing Act Amendments of 1976. The MLA requires that all public lands not specifically closed to leasing be open to lease for the exploration and development of mineral resources. A federal coal lease grants the lessee the exclusive right to obtain a mining permit for, and to mine coal on, the leased tract. This lease is subject to the terms of the lease, the mining permit, and applicable state and federal laws. Before a new leased tract can be mined, the lessee must have their detailed plans approved (in the permit application package [PAP]) to conduct mining and reclamation operations. Further, a primary goal of the Energy Policy Act of 2005 is to add energy supplies from diverse sources, including domestic oil, gas, and coal, as well as hydropower and nuclear power.

Given known technology and technological and demographic trends overall, the United States demand for coal is expected to increase by approximately 0.4% per year through 2035 (DOE/EIA 2010). Though coal-fired power plants are projected to account for less electricity generation in 2035 compared to 2008 (down from 48% in 2008 to 44% in 2035), in the United States, approximately 90% of coal consumption is in the electric power sector, and between 2008 and 2035, total electricity demand in the United States is expected to increase by 30% (DOE/EIA 2010). Furthermore, in Utah, approximately 82% of electrical energy is generated from coal (VandenBerg 2010). Although most (approximately 90%) of the coal consumption in the United States is in the electric power sector, coal is also used (approximately 10% of total demand) in the industrial sector. In the industrial sector, coal is used in the manufacture or production of cement, paper, chemicals, food, primary metals, and coal-based synthetic fuels (coal-to-liquids). It is also used in the industrial sector as a direct source of heat, as a feed stock, as boiler fuel for the production of process steam and electricity, and in the production of coke, which is used as an energy source and as raw material in steel production. Nonelectric power sector demand for coal is expected to slightly decline by 2035, though demand for coal in the emerging coal-to-liquids industry is expected to increase. Most of the projected increase in overall United States demand for coal, therefore, is expected from the electric power sector (DOE/EIA 2010).

According to the Utah Geological Survey (VandenBerg 2010), coal production in Utah decreased by 4.4 million tons (16.8%) between 2006 and 2009 due to mine closures, difficult mining conditions, and unexpectedly low production from several mines. Utah's long-term (50 years and beyond) coal future is shifting because accessible coal reserves are being depleted in the Book Cliffs and Wasatch Plateau coal fields. This makes it necessary for the coal industry to look to other Utah coal fields to meet future demands for coal. Further, most Utah mining companies have leased coal reserves for approximately 10–15 years of production; however, they are having difficulty adding new leases to extend their reserves. As a result, Utah coal production is outpacing tonnage leased (VandenBerg 2010).

ES.1.3. Public Involvement

ES.1.3.1. Public Scoping

The public scoping process was initiated on November 28, 2006 when the BLM published a NOI to prepare an EIS to offer the tract for competitive leasing. Five public scoping meetings followed. Each meeting was conducted in an open house format with BLM and ACD personnel present to answer questions and provide information. Other resources available at the public scoping meetings included informational display boards; one video explaining the conceptual mining and reclamation sequence; one video explaining a potential transportation route, including truck details; and comment forms on which to submit comments at the meetings. Informational display boards and comment forms are available in the Alton Coal Tract LBA EIS Public Scoping Report (SWCA Environmental Consultants [SWCA] 2007b), which was prepared following completion of the scoping process. Copies of the videos are available at the BLM Kanab Field Office (BLM-KFO). The 90-day scoping period closed on February 26, 2007.

ES.1.3.2. Summary of Issues

Issues and concerns raised during the public scoping process were divided into three categories: 1) those to be addressed through implementation and documentation of certain elements of the NEPA process; 2) those to be addressed through analysis of direct, indirect, and cumulative impacts; and 3) those to be addressed through the formulation of alternatives. The substantive issues and concerns are outlined below.

ES.1.3.2.1. LEASING TIMELINE

When is the appropriate time to begin the analysis of the EIS and consideration of leasing? Is it following submission of a detailed mining plan, or following a commitment to mine and sell coal?

ES.1.3.2.2. PREVIOUS DECISIONS AND LEGISLATION AND NEED FOR AN ENVIRONMENTAL IMPACT STATEMENT

Previous studies of coal mining at Alton have been completed. Why is additional environmental analysis required? How would the proposed lease meet the suitability requirements of Surface Mining Control and Reclamation Act (SMCRA) of 1977?

ES.1.3.2.3. BUREAU OF LAND MANAGEMENT'S ROLE AND POLICIES REGARDING PUBLIC LAND USE

What is BLM's responsibility to protect the public lands, while providing for their use and sustainability?

ES.1.3.2.4. SCOPE

Is coal mining on private lands and public (BLM) lands a connected action under NEPA, which would require an analysis in a single EIS?

ES.1.3.2.5. PURPOSE AND NEED

What are the public purposes and needs for this action and how will they affect the eventual decision to offer the tract for leasing or not? How will energy demand affect BLM's decision to lease the tract?

ES.1.3.2.6. ALTERNATIVES

What reasonable alternatives to the applicant's proposal to lease and mine federal coal reserves in the tract should BLM consider?

ES.1.3.2.7. AFFECTED ENVIRONMENT AND IMPACTS ANALYSIS

What would be the effects of the coal mine on the natural and cultural environment in and near the tract and on the human values connected to those resources and their uses?

ES.1.3.2.8. DATA AND EXPERTISE FOR IMPACTS ANALYSIS

What data and scientific literature must be collected and analyzed to ensure an adequate analysis of the effects of the Proposed Action and alternatives?

ES.1.3.2.9. COOPERATING AND CONSULTING AGENCIES

What role will BLM's partners play in the EIS analysis of the Proposed Action and the alternatives?

ES.1.3.2.10. PUBLIC INVOLVEMENT

What opportunities for public involvement should BLM provide to ensure disclosure of information and informed decision making?

ES.1.3.2.11. NATIONAL ENVIRONMENTAL POLICY ACT DECISIONS

What role will local residents play in the decision-making process? How will impacts to Bryce Canyon National Park affect the Alton LBA tract leasing decision?

ES.1.3.2.12. AESTHETIC RESOURCES

What effect would noise created by coal mining and coal truck traffic have on the relative noise levels existing in the area, including the town of Alton, adjacent public lands, and nearby parks and monuments? What effect would the coal mining operation, coal truck traffic, and dust and smoke caused by mining have on the local landscape (scenic quality) and surrounding viewshed? How would lighting for nighttime mining operations affect the darkness of the night sky from key nighttime-sky viewing points such as Bryce Canyon National Park?

ES.1.3.2.13. AIR RESOURCES

How would the development and operation (e.g., construction, heavy equipment use, and transportation of coal) of the coal mine affect local and regional air quality? What effect would deposition of dust and other pollutants produced by mining have on water, wildlife, vegetation, recreation uses, and structures in and adjacent to the mining operations? What contribution would emissions produced from the mining operation, transportation of coal, and ultimate use of the coal add to the cumulative effect of carbon emissions on global warming?

ES.1.3.2.14. CULTURAL RESOURCES

What impact would coal mining and transporting coal have on prehistoric and historic cultural resources in the tract and along transportation routes? How would coal mining and transporting coal impact existing and eligible National Register sites and traditional cultural properties (TCP)?

ES.1.3.2.15. FIRE MANAGEMENT

What impact would coal mining, including truck traffic to transport coal, have on air quality; and how would those changes in air quality affect BLM's ability to conduct prescribed burning in wildland-urban interface (WUI) areas to reduce threats of wildfire? What impact would revegetation required for tract reclamation have on wildland fire frequency and severity?

ES.1.3.2.16. GEOLOGY AND MINERALS

How would coal mining on the tract affect geologic and mineral resources present there? What geologic hazards exist on and near the tract and how would they be affected by mining operations and vice versa? What is the potential for underground coal fires and what are the environmental consequences of an underground fire?

ES.1.3.2.17. HAZARDOUS MATERIALS

What impact would generation, temporary storage, and disposal of hazardous materials (such as those regulated under the Comprehensive Environmental Response, Compensation, and Liability Act, the Superfund Amendments and Reauthorization Act, the Resource Conservation and Recovery Act, and the Toxic Substances Control Act) have on people and the environment?

ES.1.3.2.18. LAND USE AND ACCESS

What impact would development and operation of a coal mine have on local private property values and future development potential of those lands? What effect would coal truck traffic have on private property values along transportation routes (e.g., KFO Route 116 and U.S. Route 89 [US-89])? What impact would development and operation of a coal mine have on the town of Alton (e.g., air quality, aesthetics, water quality, and public health and safety)? How would public lands be used and managed following reclamation of the coal mine?

ES.1.3.2.19. LIVESTOCK GRAZING

How would coal development, mining, and reclamation affect grazing and pasturelands around Alton (e.g., removal of vegetation and restricted access to grazing land for ranchers), and how would that affect short-term and long-term livestock grazing and production? How would road dust and exhaust from passing coal truck traffic affect vegetation growth and palatability of the vegetation for livestock forage?

ES.1.3.2.20. PALEONTOLOGY

How would surface disturbance (e.g., surface mining, road construction, and facilities construction) created by coal mining impact fossils in the tract?

ES.1.3.2.21. PUBLIC HEALTH AND SAFETY

How would coal truck traffic through towns along potential transportation routes affect public safety in those towns and along the travel routes? What risk of injury and adverse health effects would the mine workers and local public face as a result of mine development? (Public Health and Safety issues are addressed in the socioeconomics section of Chapter 4.)

ES.1.3.2.22. SPECIAL DESIGNATIONS

How would coal mining impact the air quality, viewshed, and nighttime sky of Bryce Canyon National Park? How would coal mining impact the resources (air quality, viewsheds, recreation, etc.) of other nearby parks and monuments, including the Grand Staircase-Escalante National Monument; Arches, Canyonlands, and Zion national parks; Kodachrome State Park; and Red Canyon and other public lands? How would the noise and presence of coal truck traffic affect the visitor experience at these parks, monuments, and public lands? (Issues related to special designations are addressed in the aesthetic resources, air resources, and recreation sections of Chapter 4.)

ES.1.3.2.23. SPECIAL STATUS SPECIES

How would development and operation of a coal mine impact special status species and their habitat, including Greater Sage-grouse (*Centrocercus urophasianus*), Utah prairie dog (*Cynomys parvidens*), Burrowing Owl (*Athene cunicularia*), Bald Eagle (*Haliaeetus leucocephalus*), Golden Eagle (*Aquila chrysaetos*), pygmy rabbit (*Brachylagus idahoensis*), Northern Goshawk (*Accipiter gentilis*), Ferruginous Hawk (*Buteo regalis*), Bonneville cutthroat trout (*Oncorhynchus clarkii utah*), and Utah Physa? What effect would noise from coal truck traffic have on special status species? How would wildlife mortality from vehicle collisions affect wildlife populations? (Special status species issues are addressed in the wildlife and special status species section of Chapter 4.)

ES.1.3.2.24. SOCIOECONOMICS

What opportunities for employment would development and operation of the coal mine create? How would development and operation of a coal mine affect local businesses and tourism? How would development and operation of a coal mine affect tax revenues to Kane and Garfield counties? What, if any, additional county services (i.e., ambulance, fire fighting, sheriff, etc.) would be required to support the mine? What effect would coal truck traffic have on tourism and local businesses along potential transportation routes? What are the economic benefits of development and operation of a coal mine? How would development of the tract contribute to the supply of coal available for use in the region?

ES.1.3.2.25. SOILS

What impact would development and operation of a coal mine (including final reclamation) have on productivity of soils, including biological soil crusts? How would coal mining affect farmland productivity? What impact would development and operation of a coal mine have on soil stability and rates of erosion? What effect would road and coal dust and exhaust from mine-related traffic have on soil productivity in proximity to roads in the tract and along potential transportation routes?

ES.1.3.2.26. VEGETATION

How would coal development, mining, and reclamation affect vegetation communities in the tract? What effect would coal mining, including truck traffic to transport coal, have on the introduction and spread of exotic vegetation? What effect would road and coal dust and exhaust from mine-related traffic have on the health and growth of vegetation adjacent to roads in the tract and along potential transportation routes?

ES.1.3.2.27. WATER RESOURCES

What effect would development and operation of a coal mine have on surface-water and groundwater quality and quantity? How would mining operations impact riparian areas and wetlands? How would coal mining affect the possible existence of an alluvial valley floor (AVF) near the town of Alton? How would road and coal dust and vehicle exhaust, resulting from operation of coal trucks, impact the quality of water bodies adjacent to transportation routes?

ES.1.3.2.28. WILDLIFE

What effect would development and operation of a coal mine, including reclamation and coal truck traffic, have on wildlife and their habitat, including nocturnal wildlife?

ES.1.3.2.29. ALTERNATIVES

Should the BLM delay offering the tract for lease until less-impacting extractive processes are developed? What are practical alternatives to surface mining in the tract? The BLM should consider foregoing the coal lease and instead promote development of alternative forms of energy such as solar and wind. How would operations be designed and controlled to prevent the release of unsafe levels of nitrogen dioxide (NO_2)? Coal mining should be designed, and modified if needed, to reduce impacts to Bryce Canyon National Park. What methods of coal transportation (e.g., slurry, rail, and truck) should be considered to reduce impacts to the environment, nearby communities, and public safety? Construction of a power plant next to the mine should be considered as a way to eliminate impacts from coal truck traffic.

ES.1.4. Alternatives

Three alternatives are analyzed in detail in this EIS: Alternative A (No Action), Alternative B (the Proposed Action), and Alternative C (Reduced Tract Acreage and Seasonal Restrictions).

ES.1.4.1. Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the Alton Coal Tract under the Proposed Action or Alternative C would not be approved, the LBA tract would not be offered for competitive lease sale, and the coal included in the LBA tract would not be mined.

Rejection of the application would not affect mining activities on private land adjacent to the tract (i.e., the Coal Hollow Mine). The Coal Hollow Mine consists of approximately 635 acres of land and approximately 5 million short tons of recoverable coal leased from private surface and mineral owners. Average annual coal production is anticipated to be approximately 2 million tons and mining activities are expected to employ approximately 160 persons (100 at the tract and 60 for coal trucking operations); though initial operations and startup would employ much fewer (approximately 16 employees). Rejection of the application would also not affect an anticipated permit application from ACD to mine fee coal on private lands adjacent to the tract to the north.

To compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that the tract would not be mined in the near future if the No Action Alternative is selected. Under the No Action Alternative, the public lands within the tract would continue to be managed in accordance with the *Kanab Field Office Record of Decision and Approved Resource Management Plan* (RMP) (BLM 2008b), hereafter referred to as the KFO RMP. The area would be managed for livestock grazing, recreation (primarily hunting and off-highway vehicle

[OHV] use), and wildlife habitat. Vegetation treatments (wildlife habitat treatments, watershed treatments, livestock rangeland treatments, wildland fire use, fuels treatments, and stewardship contracting) would occur in support of the BLM's Healthy Lands Initiative. Private lands within the tract would continue to be used for livestock grazing, farming, and dispersed recreation (especially hunting).

ES.1.4.2. Alternative B: Proposed Action

Under the Proposed Action, recoverable portions of in-place coal reserves would be mined over approximately 25 years using 1) surface-mining methods where the depth of overburden would be approximately 200 to 300 feet, and 2) underground methods (development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining) where the depth of overburden exceeds approximately 200 to 300 feet. The choice of mining method, however, can vary from the 200- to 300-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. The analysis considers surface disturbance for approximately 200 to 300 feet of overburden removal. These are generally referred to as overburden removal scenarios in the text. Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal has occurred. Reclamation would be concurrent with mining over the course of the estimated 25-year mine life and would be followed by a potential 10-year reclamation and revegetation monitoring period.

BLM independently evaluated the coal resources included in the tract. BLM estimates that the tract under the Proposed Action consists of approximately 59,600,000 tons of in-place coal and that an estimated 44.9–49.1 million tons of coal would be recoverable from the tract. The amount of recoverable coal depends on whether surface-mining methods would be discontinued at approximately 200 feet of overburden removal (44.9 million tons of recoverable coal) or approximately 300 feet of overburden removal (49.1 million tons of recoverable coal). BLM estimates that in areas where coal would be mined by surface-mining methods, approximately 90% of the estimated in-place coal reserves could be recoverable. However, in those portions of the tract that must be mined by underground mining methods, approximately 50% of the in-place coal reserves could be recoverable. These percentage recovery estimates are based on assumptions about the depth to which the use of surface-mining methods is feasible and the extent of the no-coal zone.

Details on mining methods, facilities, reclamation, and operations can be found in Chapter 2 of the EIS.

ES.1.4.3. Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, the Alton Coal Tract would be modified to exclude the northwest portion (Block NW) of the tract located near the town of Alton. Further, certain mining activities in the southern portion of the tract (Block S) would be subject to seasonal restrictions to reduce impacts to the local Greater Sage-grouse population (hereafter generally referred to as sage-grouse). Under Alternative C, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract.

Consistent with the purpose and need for the federal action, the intent of Alternative C is to resolve, in part or in full, the following: issues related to the local sage-grouse population, noise, and visual impacts to the town of Alton, and issues related to conflicting land uses (agriculture versus surface mining). Alternative C may also reduce impacts to other resources such as springs and surface waters, wildlife, soils, public health and safety, paleontological resources, cultural resources, and vegetation.

Under Alternative C, the tract would be modified to exclude Block NW. The modified tract would encompass approximately 3,173 acres, of which approximately 2,280 acres are federal surface and mineral estate and 893 acres are split estate; private surface estate and federal mineral estate. As under the Proposed Action, not all surface estates, private or federal, have coal reserves underlying them.

Under Alternative C, recoverable portions of in-place coal reserves would be mined over approximately 21 years using 1) surface-mining methods where the depth of overburden would be approximately 200 to 300 feet, and 2) underground methods (development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining) where the depth of overburden would exceed approximately 200 to 300 feet. As under the Proposed Action, the choice of mining method, however, can vary from the 200- to 300-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. Per-year coal production and reclamation and revegetation monitoring would be the same as under the Proposed Action with the exception of operations in Block S of the tract where seasonal timing restrictions would apply. Due to these seasonal timing restrictions, the length of time between initiation of the mining process and concurrently occurring reclamation activities would be extended for some pits.

BLM estimates that the tract configuration under Alternative C includes approximately 52.1 million tons of in-place coal and that an estimated 38.1–42.3 million tons of coal would be recoverable from the tract. Percentage coal recovery estimates for surface versus underground mining are the same under Alternative C as they are under the Proposed Action.

Details on mining methods, facilities, reclamation, and operations can be found in Chapter 2 of the EIS.

ES.1.4.4. Permits, Approvals, Regulatory Compliance, Mitigation, and Monitoring

There are certain permits, approvals, and regulatory compliance, mitigation, and monitoring measures that would be required under either action alternative. These are related to 1) compliance with existing local, state, and federal rules and regulations with respect to surface coal mining and 2) special mitigation and monitoring requirements (i.e., special lease stipulations) developed for the tract. See Table 1.2 in Chapter 1 and Table 2.3 in Chapter 2 for a summary of permits, approvals, and regulatory compliance requirements for the successful bidder.

ES.1.4.5. Alternatives Eliminated from Detailed Analysis

Aside from the Proposed Action and Alternative C, 12 alternatives were considered during the course of alternatives development. Each of these was eliminated from detailed analysis in the EIS. Chapter 2, Sections 2.6.1.1 through 2.6.1.12 of the EIS provide descriptions of these alternatives along with the rationale for eliminating each of them from detailed analysis.

In addition to the alternatives eliminated, certain components of the federal action would be independent of the elements of any alternative. In the EIS, these were considered options, any one of which could be chosen in combination with any alternative and would not necessitate changes in the alternative, or vice versa. Those options that were considered but not carried forward for detailed analysis are described in Chapter 2, Section 2.6.2 of the EIS.

ES.1.5. Affected Environment

ES.1.5.1. General Setting

The tract is located in Kane County, Utah approximately 0.10 mile south of the town of Alton and 2.9 miles east of US-89. The tract occurs at approximately 6,900 feet above sea level in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001) of south-central Utah. The tract is located in the Alton Amphitheater between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and approximately 5.0 miles north and northwest of the Grand Staircase-Escalante National Monument. Mean annual precipitation in the town of Alton was approximately 16 inches from 1928 to 2006, and mean annual temperature for this same time period was 60.2°F (2006). The Colorado Plateau province receives most of its precipitation in the form of snow during the winter months; summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (2006). The tract is characterized by a series of low-rising hills and benches cut by the north–south running Kanab Creek and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large open areas of bunchgrass, perennial grasses, and sagebrush interspersed with dense stands of juniper and pinyon pine (*Pinus edulis*). Tall fir trees are apparent on the more rugged mountains to the northwest of the tract. Generally, the vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines.

Under the Proposed Action, the tract includes approximately 3,576 acres of land. All coal resources located within the tract are federally (BLM) owned and managed. Approximately 2,280 surface acres of the tract are under BLM management, and the remaining 1,296 surface acres are under private ownership. Under Alternative C, the tract includes approximately 3,173 acres of land. As under the Proposed Action, all coal resources under this tract configuration are federally (BLM) owned and managed; although, surface ownership is split between the BLM (2,280 acres) and private owners (893 acres). Coal reserves are known to occur beneath approximately 2,152 and 1,856 acres of the tract under the Proposed Action and Alternative C, respectively.

The entirety of the reasonably foreseeable coal haul transportation route also occurs in southern Utah, more specifically in Kane, Garfield, and Iron counties near Alton, Hatch, Panguitch, and Cedar City. The total length of the route is approximately 110 miles. Existing vehicle traffic consists of local residents; tourists to Bryce Canyon National Park, Dixie National Forest, and BLM-administered lands; and commercial truck traffic. Transportation infrastructure associated with the tract and the coal haul transportation route includes numerous unimproved, dirt access roads and two-track trails, KFO Route 116, US-89, State Road (SR) 20, Interstate (I) 15, and SR-56. The Union Pacific Railroad 21-mile branch to the Salt Lake City-Los Angeles line is located west of Cedar City, Utah and is the nearest railroad facility to the tract.

ES.1.6. Environmental Consequences

Table 2.5 in Chapter 2 of this EIS summarizes the potential impacts to each element of the environment under each alternative. Detailed descriptions of the impacts are provided in Chapter 4, along with a discussion of potential mitigation measures, residual impacts, short-term uses versus long-term productivity, and irretrievable and irreversible commitments of resources that would result from implementation of the alternatives. Cumulative impacts to resource values and uses of the tract that would result from implementation of the alternatives are also discussed in Chapter 4. A summary describing the general conclusions of the effects analysis is presented below.

ES.1.6.1. Aesthetic Resources

Increased ambient noise levels, short-term modifications to visual resources, and perceptible increase in nighttime skyglow would occur from the implementation of either action alternative.

ES.1.6.2. Air Resources

Under both action alternatives, emissions of criteria air pollutants (particulate matter $(PM)_{10}$, $PM_{2\ 5}$, nitrogen oxides (NO_x), volatile organic compounds, carbon monoxide (CO), and sulfur dioxide [SO_2]) and hazardous air pollutants (HAP) (benzene, toluene, xylenes, formaldehyde, acetaldehyde, and acrolein) would occur as a result of mining and transporting coal. Based on the near-field modeling results, all air pollutant concentrations resulting from emissions would be within National Ambient Air Quality Standards (NAAQS) under the Proposed Action for the 200-foot overburden removal scenario. For the 300-foot overburden removal scenario, all air pollutant concentrations resulting from emissions would also be within NAAQS, with the exception of PM_{10} ¬(24-hour standard) and NO_2 (annual maximum), which would be violated. Air pollutant concentrations resulting from emissions under Alternative C (both overburden removal scenarios) would also be within NAAQS for all pollutants except PM_{10} (24-hour standard), which would be violated under both overburden removal scenarios, and NO_2 (annual maximum), which would be violated under the 300-foot overburden removal scenario.

Air quality impacts in the far-field (for criteria pollutants as well as visibility) would be within regulatory limits for both action alternatives and both overburden removal scenarios. Nitrogen and sulfur deposition would likewise be below threshold values.

ES.1.6.3. Cultural Resources

Archaeological sites eligible for the National Register would be adversely impacted from the implementation of either action alternative due to surface-disturbing activities associated with mining operations. Underground mining may impact unidentified archaeological sites. Native American traditionally cultural properties would be subject to adverse effects for the life of the mine under either action alternative. The Panguitch Historic District and Utah Heritage Highway 89/Mormon Pioneer Heritage Area (US-89) would be subject to adverse effects for the life of the mine under either action alternative. Sites that are not directly impacted by surface mining or facilities construction would be subject to a greater degree of threat for vandalism, looting, or unintentional destruction due to an increased human presence in the area.

ES.1.6.4. Fire Management

Under either action alternative, vegetation would be removed during mining and construction activities. The revegetation of the disturbed areas would lead to reduced Fire Regime Condition Class (FRCC) ratings. Increased movement to and from the tract by construction equipment and coal haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. Construction of centralized and dispersed facilities could lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation on and adjacent to the tract

ES.1.6.5. Geology and Minerals

Both action alternatives would result in long-term adverse effects to topography, physiography, and stratigraphy. Removal of coal by underground mining methods would cause subsidence on portions of the tract overlying the area of coal removal. There would be a slight fault hazard from underground mining, and a risk to structures occurring on landslide deposits. Impacts to coal resources would occur from the production of recoverable coal over the life of the mine. Oil and gas resources would be unavailable for extraction for the life of the mine.

Because most of the burnt shale deposits in the tract have been or would be mined by the time a decision is made by the BLM on this EIS, direct impacts to burnt shale resources are unlikely. However, if mining operations expose burnt shale in the tract, they would likely be lost as economically recoverable resources because they would be mixed with other overburden during reclamation. If segregated from other overburden sufficiently, they may remain usable.

Salable pediment gravels in the tract would be directly impacted under the Proposed Action due to mixing with other overburden following surface mining.

It is not known how common septarian nodules are in the tract, or if they are present in sufficient density to be economically viable for development. However, any nodules present at or near the surface in areas that would be surface mined would be at risk of burial during reclamation, and therefore may be less accessible for development. The nodules would not be removed and would therefore still be available as a resource, but their development would likely be less economically viable and their concentration in any area would likely be reduced.

ES.1.6.6. Hazardous Materials

Movement to and from the tract by service vehicles and coal haul trucks has the potential to increase the risk of fuel leakage or solid waste spills in the tract and adjacent transportation corridors. Accidental or inadvertent leakages from storage tanks would also be possible. Spills would have adverse effects on soil, water, vegetation, and wildlife resources. Potential impacts would be mitigated through standard operating procedures (SOP) and through the creation of other plans and policies that relate to hazardous materials disposal, transport, and emergency response.

ES.1.6.7. Land Use and Access

Under both action alternatives, lands within the tract would be unavailable for grazing and recreation access during mining activities (life of mine). Agriculture, tourism, and recreation activities would also be prohibited or restricted during the life of the mine.

ES.1.6.8. Livestock Grazing

The action alternatives would result in the temporary loss of forage as a result of restricted access, spread of noxious weeds, and/or decreased palatability from construction dust and the temporary loss of water sources and range improvements, such as fences and cattle guards. In addition, the action alternatives would result in a loss of animal unit months (AUM) within allotments over the life of the mine and reclamation period. Impacts to livestock could occur from mortality from vehicle collisions.

ES.1.6.9. Paleontology

The coal extraction process would result in the permanent removal of fossils from the Dakota Formation and from the Tropic Shale in the tract, resulting in a long-term decrease in the productivity of paleontological resources in the area. It is anticipated that a large number of significant fossils would be destroyed or removed from context, particularly in the Tropic Shale.

ES.1.6.10. Recreation

Both action alternatives would have some adverse effects to recreation resources. Lands available for dispersed recreation would be lost from mining over the life of the mine. Some designated OHV routes would be temporarily removed over the life of the mine. In addition, there would be some indirect adverse effects from displacement of recreational users onto adjacent public lands, which would affect recreational experiences of users on those lands.

ES.1.6.11. Socioeconomics

Implementation of either action alternative would result in an increase to the number of jobs, income, and additional taxes, fee, and payments. There would be an adverse impact to recreation, and adverse impacts to sense of community, social well-being, and tourism-related businesses. There would be impacts to population, housing, public health, safety, and environmental justice populations.

ES.1.6.12. Soils

Implementation of either action alternative would result in disturbance of soil resources through large-scale removal, stockpiling, and replacement of soils during mining. The disturbance (impact) caused by removing and replacing soils would be long term. Most of the impacts (caused by facilities, some roads, etc) would be long-term impacts, persisting for the life of the mine.

ES.1.6.13. Transportation

Either action alternative would result in an increase in commuter traffic and coal truck traffic through Cedar City, Hatch, and Panguitch.

ES.1.6.14. Vegetation

Vegetation would be removed for surface mining, construction, and road relocation under either action alternative. Lands would be susceptible to weed invasion. All disturbed acres would be reclaimed and revegetated after the life of the mine.

ES.1.6.15. Water Resources

Robinson Creek would be relocated, potentially affecting stream function, the associated riparian corridor, and water quality.

Both action alternatives would result in the diversion of runoff to retention ponds, and an associated loss of surface water from evaporation and infiltration would occur. There would be small sediment load into streams from dispersed facilities and road relocation. The loss of in-stream dilution could increase concentrations of total dissolved solids (TDS) over the state water quality standard of 1,200 milligrams per liter (mg/L). Reduced in-stream flows could result in less water available for irrigation downstream. There would be a small risk of surface water contamination from accidental spills on 48–49 miles of stream that is within 100 m of the transportation route. There would also be a small increase in fine particles in streams associated with deposition of fugitive dust and coal dust.

Groundwater would be affected by either action alternative through the use of groundwater for dust suppression, the removal of groundwater as moisture contained in coal, and the evaporation of groundwater exposed in pits.

There would be a direct removal and loss of function of wetlands and impacts to riparian areas due to surface mining and construction of dispersed facilities. Impact to wetlands and riparian areas would include the loss of habitat, loss of water filtration, and destabilization of streambanks.

Because floodplains and probable AVFs occur only within the tract's no coal zone there would be no direct impacts to these water-related features from pits. Both floodplains and AVFs would be adversely affected by the construction of dispersed facilities. Floodplain functions that could be lost include some degree of flood storage and attenuation, groundwater recharge, and erosion prevention. Although ground disturbance would occur in probable AVFs, the essential hydrologic functions of these areas would not be impacted and the physical capability of the land to be irrigated would not be changed.

ES.1.6.16. Wildlife and Special Status Species

Direct and indirect impacts from either action alternative would include habitat fragmentation, alteration, loss, and displacement due to surface disturbance, noise, ground vibration, night lighting, and increased risk of vehicle mortality associated with coal-haul trucks.

ES.1.6.17. Potential Mitigation Measures

Potential mitigation measures are also proposed for individual resources in Chapter 4 of the EIS. Residual impacts that would persist following implementation of mitigation measures are also addressed for each resource in Chapter 4. The selection of these proposed mitigation measures will be decided in the ROD.

ES.1.7. Consultation and Coordination

Initial involvement with respect to BLM's receipt and review of ACD's LBA and details on the public notification, public scoping process, and the cooperating agencies are described above. Chapter 5, Consultation and Coordination, provides further detail on consultation and coordination for the proposed tract and preparation of this EIS.

ES.1.8. Next Steps

The comment period on this Draft EIS will extend for 60 days following the U.S. Environmental Protection Agency's (EPA) publication of the Notice of Availability in the Federal Register. The BLM is also publishing a Notice of Availability and Notice of Hearing in the Federal Register. All timely comments on the Draft EIS will be considered in the preparation of the Final EIS. All substantive comments and information submitted will be summarized and addressed in the Final EIS. The Final EIS will then be completed and a Notice of Availability published in the Federal Register. After a 30-day waiting period, a ROD will be prepared and signed. The ROD, which will be signed by the authorized officer, will document the decisions made regarding the Proposed Action and alternatives. The BLM decision will apply only to public lands.

This EIS is not a decision document. Rather, it is a document that will inform the BLM's final decision on whether to hold a competitive lease sale for the tract and, in the event that the BLM decides to offer the tract for competitive leasing, what special stipulations would be attached to the lease. The EIS is being released to inform the public and interested parties of the potential impacts associated with implementing either action alternative.

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CHAPTER 1. PURPOSE AND NEED

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1.1 Introduction

In November 2004, a LBA was filed by ACD to mine federal coal, using primarily surface-mining methods, near the town of Alton, Utah (Case Number UTU 081895). This application was filed under the regulations at 43 CFR 3425, Leasing on Application. This application includes nearly 2,683 surface acres and approximately 38 million tons of recoverable coal. The Division of Lands and Minerals, Solid Minerals Branch at the BLM Utah State Office reviewed the application and determined that it meets the regulatory requirements for an LBA. However, the BLM reconfigured the tract to exclude approximately 40 acres and to include approximately 898 additional acres. Acreage added to the tract during tract reconfiguration was based on the identification of additional recoverable coal reserves not included in the original LBA and on additional surface acreage deemed necessary for mine operations. The Alton Coal Tract LBA (hereafter the Alton Coal Tract or tract), as reconfigured, contains approximately 3,581 surface acres[1] (Table 1.1) and 44.9–49.1 million tons of recoverable coal reserves. Map 1.1 in Appendix A (Maps) shows the tract in relation to the Town of Alton and other area landmarks. At the time of ACD's LBA submittal, the BLM-KFO was operating under the *Zion Management Framework Plan* (BLM 1982). The BLM-KFO completed a RMP in October 2008 and is now operating the KFO RMP.

To process an LBA, the BLM must establish the fair market value of the coal in the tract by evaluating the quantity and quality of the coal reserves. Any subsequent mining plan must achieve maximum economic recovery of the tract's coal resources in the context of applicable laws, regulations, and leasing stipulations (standard and special). In addition, before the BLM can issue a decision to offer a tract for lease, the BLM must fulfill the requirements of NEPA by evaluating the potential environmental impacts of leasing and mining federal coal (a flow chart summarizing the coal LBA process is provided in Appendix B). On November 28, 2006 a NOI to prepare an EIS for the Alton Coal Tract was published in the *Federal Register*. This EIS has been prepared to evaluate the potential direct, indirect, and cumulative environmental impacts of leasing and recovering the federal coal included in the tract, based on ACD's preliminary plan and reasonable alternatives. The BLM will use the analysis in this EIS to decide whether to a) hold a competitive, sealed-bid lease sale for the tract; b) hold a competitive, sealed-bid lease sale for a modified tract; or c) reject the lease application and not offer the tract for sale at this time. The impacts of mining the coal are considered in this EIS because mining the coal is a logical consequence of issuing a lease. A ROD will be issued and, if the decision is to offer the tract for lease, a sale would be held. If a lease sale is held, the bidding at the sale would be open to any qualified bidder; it would not be limited to the applicant. A lease would be issued to the highest bidder at the sale provided that the high bid meets or exceeds the fair market value of the coal, as determined by BLM's economic evaluation and if the DOJ determines that there would be no antitrust violations. If a lease is issued by the BLM, the lessee must file a PAP with the Utah Department of Natural Resources (UDNR), Division of Oil, Gas, and Mining (DOGM) prior to mine development. The Office of Surface Mining Reclamation and Enforcement (OSM) is responsible for preparing and submitting a mining plan approval package to the Assistant Secretary of the Department of the Interior (DOI), Land and Minerals Management. This would take place after the DOGM receives the PAP. In addition to a PAP, the lessee must also prepare a Resource Recovery and Protection Plan (R2P2) for review by the BLM. The R2P2 is approved by the Assistant Secretary based on a determination by the BLM that the R2P2 achieves maximum economic recovery of the coal reserves. Analyses of the site-specific permit application and mining plan would occur at the time of PAP and

[1] The NOI identified 3,581 acres, more or less, in the tract. However, for reasons described in Table 1.1 and Section 3.1.3, Notes on Data Sources and Tract Acreage, the analysis uses tract acreage of 3,576 acres.

R2P2 submittal. OSM is responsible for any subsequent NEPA compliance, as necessary, to support the decisions of the Assistant Secretary. Authorities and responsibilities of the BLM and other concerned regulatory agencies are described in Section 1.6[2]

Other agencies may use this analysis to assist them in making decisions related to leasing and mining the federal coal in this tract. OSM has primary responsibility to administer federal programs that regulate surface coal mining operations. OSM is a cooperating agency on this EIS and, if the tract is leased, they would use the analysis in this EIS to develop recommendations related to the approval of a mining plan under the MLA. If the tract is leased, DOGM would consider the analysis in the EIS in processing a PAP submitted by the lessee under the SMCRA. As part of the permitting process, DOGM would also require additional data gathering and analysis and other work in accordance with their rules and regulations.

In return for receiving a lease, a lessee must pay the federal government a bonus equal to the amount it bids at the time the lease sale is held (the bonus can be paid in five yearly installments), make annual rental payments to the federal government, and make royalty payments to the federal government when the coal is mined. Federal bonus, rental, and royalty payments are equally divided with the state in which the lease is located.

All coal reserves in the Alton Coal Tract are federally owned, though surface ownership is mixed. Under Alternative B (the Proposed Action; discussed in greater detail in Chapter 2) approximately 2,280 surface acres of the tract are in federal (BLM) ownership and 1,296 surface acres are in private ownership (eight different private surface owners) (Map 1.2; see Table 1.1). Private surface owners may be qualified to give consent to mine federal minerals under the private surface owner's estate[3] according to 43 CFR 3400.0-5. Surface ownership under Alternative A (No Action Alternative) and Alternative C is also discussed in greater detail in Chapter 2. If this EIS process results in a competitive lease sale for the tract, a final determination of private surface-owner qualification and private surface-owner consultation would take place prior to leasing. All surface owners have been notified of the Proposed Action. Further, both hardcopy and electronic versions of this EIS have been distributed to surface owners.

[2] State of Utah coal mine permitting requirements (Coal Mining Rules - Utah Administrative Code Title R645) are available at http://www.rules.utah.gov/publicat/code/r645/r645.htm. They may also be viewed at the main office of the Utah Division of Oil, Gas, and Mining at 1594 West North Temple, Suite 1210, Salt Lake City, Utah 84114.

[3] Under the regula ions under 43 CFR 3400.0-5(gg)(1), (2), and (3) qualified surface owner means the natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who: 1) hold legal or equitable title to the surface of split estate lands; 2) have their principal place of residence on the land, or personally conduct farming or ranching opera ions upon a farm or ranch unit to be affected by surface-mining operations; or receive directly a significant portion of their income, if any, from such farming and ranching operations; and 3) have met the above conditions for a period of at least three years, except for persons who gave written consent less than three years after they met the above requirements. In computing the three year period the authorized officer shall include periods during which title was owned by a relative of such person by blood or marriage if, during such periods, he relative would have met the requirements of this section. A qualified private surface owner is legally qualified to give consent to mine federal minerals under the private surface owner's estate.

Table 1.1. Alton Coal Tract Legal Description and Surface Ownership under the Proposed Action*

Legal Description†	Surface Owner¥	Acres
Township 39 South, Range 5 West, Salt Lake Meridian, Utah		
Section 7, SE¼SW¼ and S½SE¼	3	122
	5	7
Section 18, lots 3 and 4, E ½, E½W½	BLM	357
	3	42
	16	158
	17	3
Section 19, lots 1 through 4, NE¼, E½W½, N½SE¼, SE¼SE¼	BLM	472
	1a	120
Section 20. lots 4 and 5, N½SW¼	BLM	47
	1a	111
Section 30, lots 2 through 4, SW¼NE¼, SE¼NW¼, E½SW¼, W½SE¼	BLM	338
	1a	13
Section 31, lots 1 through 3, NE¼, E½NW¼, NE¼SW¼, N½SE¼	BLM	471
Township 39 South, Range 6 West, Salt Lake Meridian, Utah		
Section 12, SW¼, W½SE¼	Unknown	9
	3	218
	8	16
Section 13, NW¼NE¼, N½NW¼, SE¼NW¼, SE¼	BLM	160
	3	161
Section 24, NE¼, N½NW¼, SE¼NW¼, E½SW¼, N½SE¼, SE¼SE¼	BLM	159
	11	4
	12	313
Section 25, E½NE¼, SW¼NE¼, SE¼	BLM	276
Error†		5
Total Private		**1,296**
Total BLM		**2,280**
Total LBA		**3,581**

* This table also appears in Chapter 2.

† Based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of August 21, 2002 and July 28, 2006

¥ Where the BLM is the surface owner of the parcel this is explicitly noted. Private surface owners are numbered rather than identified by name due to privacy concerns.

‡ The acreages above were calculated using ESRI ArcGIS 9.2 and NAD 1983 UTM Zone 12N coordinate system. The BLM shapefile of coal ownership is georeferenced (in NAD 1983 UTM Zone 12N), but is not survey accurate. ACD provided a hardcopy map (wi h surface ownership and section boundaries), which was scanned and georeferenced to section corners visible on U.S. Geological Survey (USGS) 7.5-minute topographic maps. Polygons were then digitized to encompass/represent each of the legal descriptions above using the BLM shapefile, ACD's georeferenced map, and he USGS 7.5-minute topographic map as references while digitizing. All acreages are approximate and have not been verified by ground surveys. The error is largely a result of the disparate sources for boundary data. Additionally, he ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary. This suggests that one or both of these datasets are approximate and is ano her potential source of error.

Currently, lands in the Alton Coal Tract are managed for wildlife habitat and livestock grazing. The grazing lands consist of agricultural pasturelands, grasslands, and mixed sagebrush and grasses.

BLM estimates that under the Proposed Action, approximately 44.9–49.1 million tons of recoverable coal reserves are present in the tract. Due to shallow overburden in most of the tract, extraction of federal coal reserves would take place using primarily surface-mining methods. Primary surface overburden removal would be accomplished by truck and shovel methods. Scrapers, dozers, and front-end loaders would assist with bench preparation for the larger equipment and would be used for removal of surface overburden, small or relatively shallow coal areas, and topsoil. Scrapers, dozers, and front-end loaders would also be used for storage and return placement of overburden and topsoil for reclamation. Coal recovery would use underground mining methods (e.g., development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining) for coal reserves approximately 200 to 300 feet or more below the surface (depth of overburden). A summary of these underground mining methods is presented in Appendix C along with a list of references for further information. The actual maximum depth of overburden could vary from the approximately 200 to 300 feet discussed here, depending on the actual local coal thickness found, overburden types, overburden (highwall) stability, underground techniques available, operating and capital costs, and coal market economics.

After mining, the land would be reclaimed to ecological site functionality suitable for use by livestock and wildlife. Roads in the tract would remain or be reestablished to support post-mining land use. The methods of mining and reclamation are discussed in greater detail in Chapter 2.

1.2 Purpose and Need for Action

The BLM-managed coal leasing program encourages the development of domestic coal reserves. As a result of the leasing and subsequent mining and sale of federal coal resources, the public continues to receive a reliable domestic supply of coal for use in the electric power sector and in the industrial sector. BLM recognizes that the continued extraction of coal is a component of meeting the nation's current and future electrical energy and industrial needs. Therefore, private development of federal coal reserves is integral to the BLM coal leasing program under authority of the Federal Land Policy and Management Act of 1976 and the MLA, as amended by the Federal Coal Leasing Act Amendments of 1976. The MLA requires that all public lands not specifically closed to leasing be open to lease for the exploration and development of mineral resources. A federal coal lease grants the lessee the exclusive right to obtain a mining permit for, and to mine coal on, the leased tract. This lease is subject to the terms of the lease, the mining permit, and applicable state and federal laws. Before a new leased tract can be mined, the lessee must have their detailed plans approved (in the PAP) to conduct mining and reclamation operations. Further, a primary goal of the Energy Policy Act of 2005 is to add energy supplies from diverse sources, including domestic oil, gas, and coal, as well as hydropower and nuclear power.

Given known technology and technological and demographic trends overall, the United States demand for coal is expected to increase by approximately 0.4% per year through the year 2035 (DOE/EIA 2010). Though coal-fired power plants are projected to account for less electricity generation in 2035 compared to 2008 (down from 48% in 2008 to 44% in 2035), in the United States approximately 90% of coal consumption is in the electric power sector, and between 2008 and 2035, total electricity demand in the United States is expected to increase by 30% (DOE/EIA 2010). Furthermore, in Utah, approximately 82% of electrical energy is generated from coal (VandenBerg 2010). Although most (approximately 90%) coal consumption in the United States is in the electric power sector, coal is also used (approximately 10% of total demand) in the industrial sector. In the industrial sector, coal is used in the manufacture or production of cement, paper, chemicals, food, primary metals, and coal-based synthetic fuels (coal-to-liquids). It is also used in the industrial sector as a direct source of heat, as a feed stock, as boiler fuel for

the production of process steam and electricity, and in the production of coke, which is used as an energy source and raw material in steel production. Nonelectric power sector demand for coal is expected to slightly decline by 2035, though demand for coal in the emerging coal-to-liquids industry is expected to increase. Most of the projected increase in overall United States demand for coal, therefore, is expected from the electric power sector (DOE/EIA 2010).

According to the Utah Geological Survey (VandenBerg 2010) coal production in Utah decreased by 4.4 million tons (16.8%) between 2006 and 2009 due to mine closures, difficult mining conditions, and unexpectedly low production from several mines. Utah's long-term (50 years and beyond) coal future is shifting because currently accessible coal reserves are being depleted in the Book Cliffs and Wasatch Plateau coal fields. This makes it necessary for the coal industry to look to other Utah coal fields to meet future demands for coal. Further, most Utah mining companies have leased coal reserves for approximately 10–15 years of production; however, they are having difficulty adding new leases to extend their reserves. As a result Utah coal production is outpacing tonnage leased (VandenBerg 2010).

1.3 Lead Agency and Cooperating Agencies

The BLM is the lead agency responsible for leasing federal coal lands under the MLA, as amended by Federal Coal Leasing Act Amendments, and is also responsible for the preparation of this EIS under NEPA. Cooperating agencies consist of OSM and the State of Utah (including its agencies).

1.4 Additional Agency Coordination

For the analysis of potential impacts to air resources and night sky darkness, the BLM engaged in additional agency coordination. As a result of scoping comments provided by the EPA, an Air Resources Stakeholder Group was convened to guide the air resources analysis, ensuring that impacts to air resources were properly addressed (see Sections 3.3 and 4.3 for Air Resources). This stakeholder group included the EPA, the OSM, the National Park Service (NPS), the BLM, the State of Utah, and ACD. For the analysis of impacts to night sky darkness, the BLM engaged the NPS Night Sky Program for guidance and input.

1.5 Decisions to be Made

This EIS does not contain final decisions regarding the Proposed Action or alternatives. The primary purpose of this EIS is to provide a full and fair disclosure of environmental impacts and to inform decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. As the lead agency for this EIS, the BLM will document its decisions in a ROD document. These decisions will pertain to actions on BLM-administered lands. OSM and the State of Utah, as cooperating agencies, will make their recommendations and decisions in separate decision documents at a later date if there is a lease sale following the BLM’s ROD. These recommendations and decisions pertain to the OSM’s and State of Utah’s respective permitting responsibilities for actions under their jurisdiction. These agencies have public involvement processes separate from this EIS, per their respective agency policies and other pertinent laws and regulations. Other cooperating and participating agencies that have the expertise needed for the analysis in this EIS or that have permitting responsibilities include the U.S. Fish and Wildlife Service (USFWS), the Utah Department of Transportation (UDOT), the NPS, U.S. Forest Service (USFS) Dixie National Forest, and the EPA. These agencies will also rely on this EIS for their respective needs.

The BLM will document the following decisions in the ROD for this EIS:

- Whether or not to hold a competitive lease sale for the tract as described in the Proposed Action or as described in Alternative C. Not holding a competitive lease sale for the tract, as described in the Proposed Action or action alternatives, is the No Action Alternative.
- If the decision is to hold a competitive lease sale, what special lease stipulations would be attached to the lease. Possible lease stipulations pertain mainly to air resources, cultural resources, grazing, hazardous materials, noise, soils and geology, special status species, paleontological resources, public health and safety, vegetation, visual resources, water resources, and wildlife.

Through this EIS process, the BLM will not make decisions regarding either mining activities for fee coal on adjacent lands or transportation routes that may be used by the successful bidder (in the event of a lease sale) to transport mined coal from the tract to market. Activities related to mining fee coal on lands adjacent to the tract are outside the BLM's jurisdiction and are independent of potential mining activities for federal coal reserves located on the tract, because these activities would occur regardless of BLM's decision with respect to federal coal reserves. If this EIS process results in a decision to hold a competitive lease sale for the tract, decisions related to potential transportation routes for mined coal from the tract to market would reside with the successful bidder and would be dictated by existing transportation routes and coal market conditions. However, the impacts of coal truck traffic on the reasonably foreseeable transportation route (see Section 1.9.2.3 Reasonably Foreseeable Future Actions section in this chapter and Section 2.5.4 Reasonably Foreseeable Coal Loadout Location and Transportation Route in Chapter 2) are assessed in Chapter 4 of this EIS.

1.6 Regulatory Authorities and Responsibilities

The Alton Coal Tract LBA was submitted and will be processed and evaluated under BLM statutory mandates and authority governing federal coal leasing and other federal authorities listed below:

- MLA of 1920, as amended by the Federal Coal Leasing Act Amendments of 1976
- Multiple-use Sustained Yield Act of 1960
- NEPA of 1969, as amended
- Federal Land Policy and Management Act of 1976 (BLM's multiple-use mandate)
- SMCRA of 1977
- Energy Policy Act of 2005

BLM regulates surface coal mining operations primarily to ensure that maximum economic recovery of the coal resource is achieved (43 CFR 3480) while maintaining compliance with other applicable laws and regulations. After a federal coal lease is issued, SMCRA gives OSM primary responsibility to administer programs that regulate the effects of surface coal mining operations. Pursuant to Section 503 of SMCRA, DOGM developed a permanent program authorizing DOGM to regulate surface coal mining operations on nonfederal lands in the State of Utah (30 CFR 944, Utah Program). The Secretary of the Interior approved this program in January 1981. In March 1987, pursuant to Section 523(c) of SMCRA, the Governor of Utah entered into a cooperative agreement with the Secretary of the Interior authorizing DOGM to regulate surface coal mining operations on federal lands in the State of Utah. Pursuant to the cooperative agreement concerning surface-mining operations on federal lands, a federal coal lease holder in Utah must submit a PAP to DOGM for any proposed coal mining and reclamation operations on federal lands in Utah. DOGM reviews the PAP to ensure that it complies with the permitting requirements and that the proposed coal mining operation meets the performance standards of the approved State of Utah program. OSM, BLM, and other federal agencies, as appropriate, review the PAP (provided to them

by DOGM) to ensure it complies with the terms of the coal lease (which are based on the disclosures in this NEPA analysis), the MLA, and other federal laws and their attendant regulations (30 CFR 944.30). If the PAP does comply, DOGM issues the applicant a permit to conduct coal mining operations. OSM recommends approval, approval with conditions, or disapproval of the MLA mining plan to the Assistant Secretary of the DOI, Land and Minerals Management. OSM's recommendation must be based, at a minimum, on

- the PAP, including the R2P2;
- information prepared in compliance with NEPA;
- documentation assuring compliance with the applicable requirements of other federal laws, regulations, and executive orders (EO);
- comments and recommendations or concurrence of other federal agencies, as applicable, and the public;
- the findings and recommendations of the BLM with respect to the R2P2 and other requirements of the lease and the MLA;
- the findings and recommendations of DOGM with respect to the PAP and the state program; and
- the findings and recommendations of OSM with respect to the requirements under Chapter VII Subchapter D, 30 CFR 746.13 (a–g).

If a proposed LBA tract is leased next to an existing adjacent mine, the lessee is required to revise its coal mining permit (following the processes outlined above) and obtain mining plan approval from the Assistant Secretary prior to mining the newly leased coal. As a part of that process, a detailed new plan would be developed to outline how the newly leased lands would be mined and reclaimed. Specific impacts that would occur during the mining and reclamation of the LBA tract would be addressed in the permit approval process, and specific mitigation measures for anticipated impacts would be described in detail at that time.

DOGM enforces the performance standards and permit requirements for reclamation during a mine's operation and has primary authority in environmental emergencies (e.g., accidental spills). OSM retains oversight responsibility for this enforcement. Where federal surface or coal resources are involved, BLM has authority in environmental emergency situations if DOGM or OSM cannot act before environmental harm and damage occurs. The Mine Safety and Health Administration (MSHA) monitors and regulates all safety factors related to coal mining on federal and nonfederal lands. In preparing this EIS, BLM has a responsibility to consult with and obtain the comments and assistance of other state and federal agencies that have jurisdiction by law or that have special expertise with respect to potential environmental impacts.

Several federal, state, and local agencies are involved in the coal leasing and mine permitting process. For mining to occur on the tract, a combination of leases, permits, actions, and plans are required (Table 1.2).

Table 1.2. Federal, State, and Local Leasing and Permitting Requirements

Agency	Lease/Permit/Action/Plan
Federal	
BLM	Coal lease R2P2 Exploration drilling permit

Table 1.2. Federal, State, and Local Leasing and Permitting Requirements

Agency	Lease/Permit/Action/Plan
OSM	Preparation of MLA mining plan approval document SMCRA oversight
DOI, Office of the Secretary	Approval of mining plan (the R2P2)
Mine Safety and Health Administration	Safety permit and mine ID number Ground control plan Major impoundment ID numbers (based on impoundment size criteria) Explosives use and storage permit
Bureau of Alcohol, Tobacco, and Firearms	Explosives manufacturer's license Explosives use and storage permit
Federal Communications Commission	Radio permit: ambulance Mobile relay system radio license
U.S. Army Corps of Engineers	Authorization of impacts to wetlands and other waters of the U.S.
U.S. Department of Transportation	Hazardous waste shipment notification
USFWS	Consultation on potential impacts to federally listed species under the Endangered Species Act (ESA)
Federal Aviation Administration	Radio tower permits
State	
DOGM	Coal mine permit Exploration drilling permit
Utah State Engineer's Office	Stream alteration permit
Utah Division of Air Quality	Air approval order
Utah Division of Water Quality	Utah Pollutant Discharge Elimination System permit
Local	
Kane County	Conditional use permit Road relocation agreement

1.7 Relationship to Policies, Plans, and Programs

In addition to the federal acts listed under the previous section, guidance and regulations for managing and administering public lands, including the federal lands in the tract, include the following:

- 40 CFR 1500 (Protection of Environment),
- 43 CFR 1601 (Planning, Programming, Budgeting),
- 43 CFR 3400 (Coal Management; specifically, Leasing on Application Regulations, 43 CFR 3425.1), and
- The KFO RMP (BLM 2008b)

Specific guidance for processing applications is provided in BLM's *Competitive Coal Leasing Handbook H-3420-1* (BLM 1986). In developing this EIS, BLM's *NEPA Handbook H-1790-1* (2008e) was used.

To the extent that the Proposed Action and alternatives are consistent with federal law and regulations, they must also be as consistent as possible with other plans concerning the administration of the public lands in question. BLM must coordinate the Proposed Action and alternatives with the land-use planning and management programs of other federal departments and agencies and of the State of Utah and affected local governments.

Other than BLM land-use planning, no other federal land-use plans apply to the Proposed Action and alternatives. The State of Utah does not maintain planning documents nor do they conduct planning processes relating to the Proposed Action and alternatives. However, the Proposed Action and alternatives would be consistent with the State of Utah Public Lands Policy and Coordination Office's position on 1) uses of public lands for multiple-use, sustained-yield, natural resource extraction, 2) support of the specific plans, programs, processes, and policies of state agencies and local governments, and 3) development of the solid mineral resources of the state as an important part of the state economy and of local regions in the state (Utah Code Section 63-38d-401). Kane County has a land-use ordinance (Kane County 1998) in place, which dictates allowable land uses in designated zones. According to the land-use ordinance, most of the Alton Coal Tract is located on lands zoned by Kane County as agricultural. The land-use ordinance indicates that surface and underground mines are not allowed in agriculturally zoned areas; however, zone modifications are permitted following established procedures subject to Kane County Planning Commission approval (Kane County 1995). A zone change to permit surface and underground mining on the tract would be consistent with the position of the Kane County Commission supporting natural resource extraction in the county. Further, the *Kane County General Plan* indicates that natural resources have historically been the base of the county's economy and that environmentally responsible mineral exploration and development on BLM-administered lands should be facilitated (1998a). Finally, the Kane County Commission has submitted a formal letter to ACD and DOGM expressing support for ACD's proposed operation for adjacent fee coal. The Garfield County General Plan and general plan amendment (2007a) indicate that the county economy is based largely on government, tourism, manufacturing, and agriculture (ranching). The county supports "aggressively pursuing coal and other mineral resource development," including "the highest economically allowable development" of the Alton Coal Field and other regional coal reserves (Five County Association of Governments [FCAOG] 2007a). Finally, the Town of Alton completed a master plan in 1981 (1981) in which development of the Alton Coal Field, including the tract analyzed in this EIS, is recognized as a likely future scenario. The plan notes that coal development could result in a significant increase in the local population and that this could have an adverse effect on the quality of life in Alton. Goals and policies described in the plan do not specifically reference coal development; although, a desire to attract light industry of a low polluting or nonpolluting nature is expressed. Alton's current town council

generally looks favorably on coal development in the area, as evidenced by a formal letter of support for mining operations on fee coal lands adjacent to the tract and by their willingness to work with ACD on implementing these mining operation plans (e.g., leasing water rights and working cooperatively on a regular basis to assist with components of the proposed operation such as road relocations and the construction of short haul routes around the Town of Alton).

1.7.1 Department of Justice Consultation

In the event of a competitive lease sale, but prior to issuance of a lease, the BLM will solicit the opinion of the DOJ on whether the planned lease issuance creates a situation inconsistent with federal antitrust laws. The DOJ is allowed 30 days to make this determination. If the DOJ does not respond in writing within 30 days, the BLM may proceed with issuance of the lease.

1.8 Conformance with Existing Land-use Plans and Bureau of Land Management Coal Planning Screening Procedures

1.8.1 Conformance with Bureau of Land Management Land-use Planning

The Federal Land Policy and Management Act and Federal Coal Leasing Act Amendments require that lands considered for leasing be included in a comprehensive land-use plan and that leasing decisions be in conformance with that plan. The KFO RMP currently governs and addresses the leasing of federal coal in the BLM-KFO, including portions of Kane County and Garfield County. Coal leasing is addressed under Minerals and Energy, Areas Unsuitable for Surface Coal Mining, decisions MIN-9, MIN-10, and MIN-11. Decision MIN-9 identifies the locations and acreage determined to be unsuitable for surface mining and surface operations incident to an underground mine. Through the resource management planning process, the tract is not included in that area determined to be unsuitable. Decision MIN-10 states that additional areas could be found unsuitable based on site-specific analysis. Finally, decision MIN-11 states that mining plans for surface-mining disturbance would incorporate erosion-control stipulations as per SMCRA regulations. Decisions in the KFO RMP do not allow mining where coal unsuitability criteria apply unless the lessee can show that mining would not adversely affect the value that is to be protected. Following a federal decision to lease and securing a federal lease, the successful bidder would also be required to comply with DOGM's coal mine permitting process.

The KFO RMP includes a *Final Coal Unsuitability Report* (2008b) indicating that the tract does not meet any of the coal unsuitability criteria under 43 CFR 3461 and is therefore made available for further coal leasing consideration (following decision MIN-9). However, site-specific unsuitability determinations for some criteria (Criteria 2, 3, 9, 15, 16, 18, and 19) were deferred until an application to lease was filed (following decision MIN-10). A summary of the coal unsuitability findings from the BLM-KFO planning process is presented below. With application of the coal unsuitability criteria and conditions to protect the environment (to be determined through this EIS), the decision to lease coal under either action alternative analyzed in this document would be in conformance with the KFO RMP (BLM 2008b). For purposes of the analysis, it is assumed that a waiver, exception, or modification would be granted with respect to KFO RMP decisions concerning Greater Sage-grouse. This is discussed in greater detail under Unsuitability Criterion Number 15 in the Application of Unsuitability Criteria section of this chapter.

1.8.1.1 BUREAU OF LAND MANAGEMENT COAL PLANNING SCREENING

The major land-use planning decision that the BLM must make concerning federal coal resources in the Alton area is a determination of which federal coal lands are acceptable for further consideration for leasing. There are four screening procedures that the BLM uses to identify these coal lands. These screening procedures require the BLM to

- estimate development potential of the coal lands;
- apply the unsuitability criteria listed in 43 CFR 3461;
- make multiple land-use decisions that may eliminate federal coal deposits from consideration for leasing to protect other resource values; and
- consult with surface owners who meet the criteria outlined in 43 CFR 3400.0-5(gg)(1) and (2).

Only those federal coal lands that pass these screens are given further consideration for leasing. In 2007 the BLM began the process of applying the four screens to federal coal lands in Kane and Garfield counties by estimating development potential of coal lands (screening procedure 1) and applying the unsuitability criteria listed in 43 CFR 3461 (screening procedure 2). A *Final Coal Unsuitability Report* is contained in the KFO RMP (2008b). The results of this report are included as Appendix D. Screening procedure 3 is being conducted as part of this EIS analysis, whereas screening procedure 4 would be conducted prior to issuing the ROD and holding a lease sale if BLM decides to hold a lease sale for the tract. Each coal planning screening procedure, as it applies to the tract, is discussed in further detail in the following four sections.

1.8.1.1.1 Estimate Development Potential of the Coal Lands

Under the first coal screening procedure, a coal tract must be located in an area that has been determined to have coal development potential [43 CFR 3420.1-4(e) (1)]. The tract meets this criterion and is in the area identified as having coal development potential—as noted by the BLM in the *Final Coal Unsuitability Report* in the KFO RMP (2008b).

1.8.1.1.2 Application of Unsuitability Criteria

The second coal screening procedure requires the application of the 20 unsuitability criteria listed in 43 CFR 3461.5. These coal unsuitability criteria have been applied to the known recoverable coal resource areas for the Alton, Kaiparowits, and Kolob coal fields. No lands included in or adjacent to the tract were found to be unsuitable for mining during the application of the unsuitability criteria as part of the KFO RMP (BLM 2008b); however, as indicated above, site-specific unsuitability determinations for Criteria 2, 3, 9, 15, 16, 18, and 19 were deferred until receipt of an LBA.

Unsuitability Criterion Number 2 states that federal lands within rights-of-way (ROW) or easements, or federal lands within surface leases for residential, commercial, industrial, or other public purposes, on federally owned surface shall be considered unsuitable. At this time, no acres are determined to be unsuitable based on this criterion. Further, a lease may be issued for areas where this unsuitability criterion applies if the surface management agency determines that the type of coal development in question would not interfere with the purpose of the ROW or easement; or if the ROW or easement was issued for a purpose for which it is not being used; or if the parties involved in the ROW or easement agree, in writing, to leasing; or if it is impractical to exclude the area due to the location of coal and method of mining and the area or use can be protected through stipulations.

Unsuitability Criterion Number 3 states that lands within 100 feet of the outside line of the ROW of a public road shall be considered unsuitable for surface coal mining, with certain exceptions. One of the

exceptions allows surface coal mining in the ROW and buffer zone for a public road if a) the regulatory authority (or the appropriate public road authority designated by the regulatory authority) allows the public road to be relocated or closed after providing public notice and opportunity for a public hearing, and b) after finding in writing that the interests of the affected public and landowners would be protected [30 CFR 761.11(d) and 43 CFR 4361.5(c) (iii)].

As shown on Map 1.2, portions of KFO Route 116 traverse the tract. At this time, Kane County has not given formal approval to relocate this road; therefore, the exception does not yet apply in this case. Consequently, the BLM has determined that the portions of the tract that include KFO Route 116 and a 100-foot buffer zone on either side of the road are considered unsuitable for mining at this time under Unsuitability Criterion Number 3; however, an exception is likely, as explained below. Although lands within the KFO Route 116 ROW and associated buffer zone are now determined to be unsuitable for mining, they are included in the tract. If the tract is leased, but relocation of KFO Route 116 is not approved and the unsuitability determination remains in place, including these lands in the tract would allow recovery of all the mineable coal adjacent to and outside of the KFO Route 116 buffer zone. It would also comply with the coal leasing regulations, which do not allow leasing in less than 10-acre aliquot parts. Coal recovery in the tract would be reduced in the event that KFO Route 116 was not relocated.

If the decision (as a result of this EIS) is to offer the tract for competitive leasing, the successful bidder, Kane County, and the BLM would work on a plan to relocate KFO Route 116, which would allow recovery of the coal underlying the road and the buffer zone. If the road relocation is approved, the exception to Unsuitability Criterion Number 3 would be applicable and the unsuitability determination for the coal underlying KFO Route 116 and the associated buffer zone could be reconsidered. If a permit to relocate the road is approved, including these lands in the tract would allow recovery of the coal underlying KFO Route 116 and its associated buffer zone. A stipulation stating that “no mining activity may be conducted within the KFO Route 116 100-foot buffer zone until a permit to move the road is approved” would be attached if a lease is issued for the tract. The exclusion of the coal underlying KFO Route 116 and its associated buffer zone from mining activity by lease stipulation honors the finding of unsuitability for mining under Unsuitability Criterion Number 3.

Other public roads, in addition to KFO Route 116, may exist in the tract. Unsuitability Criterion Number 3 would apply to these roads in the same way that it applies to KFO Route 116 once a determination of road status (public or not) is made.

Unsuitability Criterion Number 9 states that the following are of essential value: a) federally designated and proposed critical habitat for listed, threatened, or endangered plant and animal species, and b) habitat for threatened or endangered plant and animal species (as determined by the USFWS and the surface management agency). This criterion then states that areas where threatened and endangered plant and animal species have been scientifically documented shall be considered unsuitable. However, a lease may be issued and mining operations may be approved if, after consultation with the USFWS, the USFWS determines that the mining activity is not likely to jeopardize the continued existence of the listed species, its critical habitat, or both. According to the *Final Coal Unsuitability Report* contained in the KFO RMP (2008b) the BLM would inventory coal areas for threatened and endangered species as part of any leasing-related EIS analysis. Based on the analyses conducted and documented in this EIS, the conditions necessary to meet this unsuitability criterion are not present, and the area, therefore, remains suitable.

Unsuitability Criterion Number 15 states that the following shall be considered unsuitable: federal lands that the surface management agency and the state jointly agree are habitat for resident species of fish, wildlife, and plant species also of high interest to the state and that are essential for maintaining these high interest species. Examples of lands that serve a critical function for these species include but are not

limited to 1) active dancing and strutting grounds for Greater Sage-grouse, Sharp-tailed Grouse (*Tympanuchus phasianellus*), and Prairie Chicken (*T. cupido*); 2) winter ranges crucial for mule deer (*Odocoileus heminonus*), pronghorn antelope (*Antilocapra americana*), and Rocky Mountain elk (*Cervus canadensis*); 3) migration corridors for elk; and 4) extremes of range for plant species.

Greater Sage-grouse dancing and strutting grounds exist adjacent to the tract. Further, Greater Sage-grouse nesting/brood rearing and winter habitat exists on portions of the tract. The KFO RMP (2008b) includes the following decisions with regard to Greater Sage-grouse habitat management:

- SSS-54: All surface-disturbing activities would be prohibited within 0.5 mile of Greater Sage-grouse leks on a year-round basis. Oil and gas leasing would be open subject to major constraints (no surface occupancy).
- SSS-55: Allow no surface disturbing or otherwise disruptive activities within 2.0 miles of Greater Sage-grouse leks from March 15 to July 15 to protect nesting and brood rearing habitat. Oil and gas leasing would be open subject to controlled surface use and timing stipulation.
- SSS-56: Allow no surface disturbing or otherwise disruptive activities within Greater Sage-grouse winter habitat from December 1 to March 14. Oil and gas leasing would be open subject to controlled surface use and timing stipulations.
- SSS-57: Exceptions, modifications, or waivers to decisions SSS-54, SSS-55, and SSS-56 may be granted on a case-by-case basis.

As a result of decisions SSS-54, SSS-55, and SSS-56 a decision to lease would not be in conformance with the KFO RMP. However, for purposes of analysis in this EIS, it is assumed that an exception, modification, or waiver would be granted in the event of a lease. Appendix 3 of the KFO RMP describes the mechanisms by which exceptions, waivers, or modifications would occur (Table 1.3).

The tract also includes known pygmy rabbit habitat, and individuals have been observed on the tract. The KFO RMP includes the following decisions with regard to the management of pygmy rabbit habitat:

- SSS-60: Apply restrictions (e.g., avoidance or mitigation) to surface-disturbing and disruptive activities on a case-by-case basis in occupied and potential pygmy rabbit habitat for protection of this species and its associated habitat. Site-specific NEPA documentation would address restrictions around pygmy rabbit habitat.

In conformance with the KFO RMP, Section 4.17 of this analysis addresses impacts to and restrictions around pygmy rabbit habitat.

Unsuitability Criterion Number 16 states that the following shall be considered unsuitable for all or certain stipulated methods of coal mining: federal lands in riverine, coastal, and special floodplains (100-year floodplains) on which the surface management agency determines that mining could not be undertaken without a substantial threat or loss of life or property. Section 4.17 of this analysis indicates that mining on the tract could be undertaken without a substantial threat or loss of life or property, and therefore the area remains suitable for mining under this criterion.

Unsuitability Criterion Number 18 states that federal lands with National Resource Waters, as identified by states in their water quality management plans ("High Quality Waters" in the State of Utah), and a buffer zone on federal lands 0.25 mile from the outer edge of the far banks of the water, shall be considered unsuitable. However, the buffer zone may be eliminated or reduced in size where the surface management agency determines that it is not necessary to protect the National Resource Waters. According to the *Final Coal Unsuitability Report* contained in the KFO RMP (2008b) Kanab Creek and tributaries from the irrigation diversion at the confluence with Reservoir Canyon to its headwaters are designated Category 1 High Quality Waters. These waters are located upstream of the tract and would not

be affected by mining activities on the tract. The analyses in Section 4.17 indicate that Kanab Creek and Robinson Creek are the only waterways in the tract. Neither of these is considered High Quality Waters in this location and therefore the area remains suitable for mining under this criterion.

Table 1.3. Conditions for Exceptions, Waivers, or Modifications with Respect to Decisions SSS-54 through SSS-56 in the Kanab Field Office Resource Management Plan

KFO RMP Decision	Applicable Area	Conditions for Exceptions, Waivers, or Modifications
SSS-54	Within 0.5 mile of a Greater Sage-grouse lek	**Exception**: An exception may be granted by the field manager if the operator submits a plan that demonstrates that impacts from the Proposed Action can be adequately mitigated.
		Waiver: A waiver may be granted if there are no active lek sites in the leasehold and it is determined the lek sites have been completely abandoned or destroyed or occur outside the current defined area, as determined by the BLM.
		Modification: The field manager may modify the boundaries of the stipulation area if 1) portions of the area do not include lek sites, 2) the lek sites have been completely abandoned or destroyed, or 3) occupied lek sites occur outside the current defined area, as determined by the BLM.
SSS-55	Within 2.0 miles of a Greater Sage-grouse lek in the nesting and brood-rearing habitat from March 15 to July 15	**Exception**: An exception could be granted if surveys determine that the Greater Sage-grouse leks in nesting and brood-rearing habitat are not occupied. An exception may also be granted by the field manager if the operator submits a plan that demonstrates that impacts from the Proposed Action can be adequately mitigated or it is determined the lek sites are not active.
		Waiver: A waiver may be granted if it is determined the habitat no longer exists or has been destroyed.
		Modification: The field manager may modify the boundaries of the stipulation area if portions of the area do not include habitat or are outside the current defined area, as determined by the BLM.
SSS-56	Within Greater Sage-grouse winter habitat from December 1 to March 14	**Exception**: An exception could be granted if surveys determine that the Greater Sage-grouse leks in winter habitat are not occupied, and that snow depths in the area allow continued sage-grouse use. An exception may also be granted by the field manager if the operator submits a plan that demonstrates that impacts from the proposed action can be avoided, sufficiently minimized, or adequately mitigated.
		Waiver: A waiver may be granted if it is determined the habitat no longer exists or has been destroyed.
		Modification: The field manager may modify the boundaries of the stipulation area if portions of the area do not include habitat or are outside the current defined area, as determined by the BLM.

Unsuitability Criterion Number 19 states that the following shall be considered unsuitable where mining would interrupt, discontinue, or preclude farming: federal lands identified by the surface management agency (in consultation with the state in which they are located) as AVFs according to the definition in Section 3400.0-5(a) of this title, the standards in 30 CFR 822, the final AVF guidelines of OSM when published, and approved state programs under SMCRA. Also, when mining federal land outside an AVF would materially damage the quantity or quality of water in surface or groundwater systems that would supply AVFs, the land shall be considered unsuitable. The presence of an AVF in or near the tract would not necessarily preclude mining. According to the regulations at 30 CFR 822 the operator of a surface coal mine must:

- minimize disturbances to the hydrologic balance by preserving throughout the mining and reclamation process the essential hydrologic functions of an alluvial valley floor [AVF] not within the tract, and
- minimize disturbances to the hydrologic balance within the tract by reestablishing throughout the mining and reclamation process the essential hydrologic functions of alluvial valley floors [AVFs].

Further, statutory exclusions listed in 30 CFR 822.12 for surface-mining prohibitions where surface mining would interrupt, discontinue, or preclude farming include

- where the premining [pre-mining] land use of an alluvial valley floor [AVF] is undeveloped rangeland…not significant to farming;
- where farming on the alluvial valley floor [AVF] that would be affected by the surface coal mining operation is of such small acreage as to be of negligible impact on the farm's agricultural production;
- any surface coal mining and reclamation operation that, in the year preceding August 3, 1977, (i) produced coal in commercial quantities and was located within or adjacent to an alluvial valley floor [AVF]; or (ii) obtained specific permit approval by the State [state] regulatory authority to conduct surface coal mining and reclamation operations within an alluvial valley floor [AVF]; and
- any land that is the subject of an application for renewal or revision of a permit issued pursuant to the Act [SMCRA] which is an extension of the original permit, insofar as (i) the land was previously identified in a reclamation plan submitted under either part 780 or 784 of this chapter [30 CFR], and (ii) the original permit area was excluded from…[the protection of surface-mining prohibitions because the land was in operation before 1977].

Though initial, reconnaissance-level mapping of AVFs has occurred in the Alton area, according to the *Final Coal Unsuitability Report* contained in the KFO RMP (2008b), a more detailed investigation became necessary following the submittal of the Alton Coal Tract LBA and the initiation of this EIS process. This investigation includes an additional reconnaissance-level study (Appendix E) to determine potential AVFs according to OSM regulations and guidance. Impacts to potential AVFs, as identified in this reconnaissance study, are discussed in Chapter 4. If BLM decides to offer the tract for competitive leasing and a lease is issued, a more detailed study of potential AVFs would be required as part of the permitting process under SMCRA and State of Utah coal mine permitting requirements.

All potential AVFs (57 acres) present on the tract occur in the no-coal zone (an area of the tract where no coal is present; additional discussion of the no-coal zone is provided in subsequent sections of the EIS) and would not be directly affected by pit disturbance. However, direct impacts would result from construction of dispersed facilities and relocation of KFO Route 116. Potential AVFs make up 5% of the total no-coal zone available for dispersed facilities (1,131 acres). Assuming that impacts from dispersed facilities (160 acres) are proportional, 8 acres of potential AVFs would be impacted due to the temporary loss of unconsolidated deposits suitable to flood-irrigated agriculture. The 8 acres affected by dispersed facilities and roads would be rehabilitated upon completion of mining, restoring the function of the potential AVF. Thus, due to the absence of coal, small acreage affected, and temporary nature of the disturbance, at this time none of the tract would be considered unsuitable for surface mining under this criterion.

1.8.1.1.3 Multiple Land-use Conflict Analysis

The third coal screening procedure, a multiple land-use conflict analysis, must be completed to identify and "eliminate additional coal deposits from further consideration for leasing to protect resource values of a locally important or unique nature not included in the unsuitability criteria," in accordance with 43 CFR 3420.1-4(e)(3). The KFO RMP (2008b) addresses seven types of multiple land-use conflicts: recreational conflicts, wildlife conflicts, livestock grazing conflicts, water resource conflicts, air resource conflicts, cultural resource conflicts, and paleontological resource conflicts. The land-use conflict analysis, largely contained in the KFO RMP (2008b), did not result in the proposed elimination of coal deposits in the tract from further consideration for leasing. The impacts analyses in this EIS represent an additional multiple land-use conflict analysis addressing, but not limited to, the seven types of multiple land-use conflicts included in the KFO RMP (2008b).

1.8.1.1.4 Surface Owner Consultation

The fourth coal screening procedure requires consultation with surface owners who meet the criteria outlined in 43 CFR 3400.0-5(gg)(1), (2), and (3) (See footnote on page 1-2). No federal coal lands in the tract have been eliminated from further consideration for leasing due to qualified surface owner conflicts at this time. If the decision is to hold a lease sale for the tract, the BLM will review the surface ownership in the tract prior to issuing the ROD and holding the lease sale, and qualified, private, surface owners will be provided the opportunity to express their preference for or against surface mining of federal coal under their private surface estate. All surface owners have been notified of the Proposed Action and offered the opportunity to participate in the preparation of this EIS. Further, both hardcopy and electronic versions of this EIS have been distributed to surface owners.

1.9 Scope of this Environmental Impact Statement

This EIS analyzes and discloses the environmental impacts of the Proposed Action (Alternative B), a No Action Alternative (Alternative A), and a reasonable range of alternatives to the Proposed Action (i.e., Alternative C). It does so at a level of detail that allows the lead agency decision maker to make an informed decision regarding implementation of any one of the alternatives. This EIS also serves to disclose the potential impacts of these alternatives to the public, other agencies, and interested stakeholders (e.g., nonprofit organizations representing interests of local and nonlocal constituents, businesses interested in or affected by the Proposed Action and alternatives, and nonprofit trade associations interested in or affected by the Proposed Action and alternatives). Accordingly, this EIS assesses the direct, indirect, and cumulative impacts of each alternative. The alternatives identify mitigation measures necessary to reduce or eliminate impacts. Throughout this EIS process, the BLM will continue to solicit and incorporate public input into the alternatives formulation and analysis process. This EIS provides additional analysis required for conformance with the KFO RMP (2008b) and meets the requirements of the DOI secretarial decision document, *Petition to Designate Certain Federal Lands in Southern Utah Unsuitable for Surface Coal Mining* (DOI 1980b).

The scope of this EIS is largely characterized by the issues raised during the public and agency (BLM internally, as well as other state and federal agencies) scoping process and by past, present, and reasonably foreseeable future actions. The issues and past, present, and reasonably foreseeable future actions are summarized below in Section 1.9.1 and Section 1.9.2, respectively.

1.9.1 Issues Raised During Public Scoping

Issues were identified through consideration of comments from the public and from federal, state, and local agencies interested in and/or potentially affected by the Proposed Action and alternatives. Public comments were solicited during the public scoping process, which is described below.

1.9.1.1 THE PUBLIC SCOPING PROCESS

The public scoping process was initiated on November 28, 2006 when the BLM published a NOI to prepare an EIS to offer the tract for competitive leasing. Five public scoping meetings followed. These were held at the locations and on the dates identified in Table 1.4. Each meeting was conducted in an open house format with BLM and ACD personnel present to answer questions and provide information. Other resources available at the public scoping meetings included informational display boards; one video explaining the conceptual mining and reclamation sequence; one video explaining a potential transportation route, including truck details; and comment forms on which to submit comments at the meetings. Informational display boards and comment forms are available in the *Alton Coal Tract LBA EIS Public Scoping Report* (SWCA 2007b) prepared following completion of the scoping process. Copies of the videos are available at the BLM-KFO. The 90-day scoping period closed on February 26, 2007.

Table 1.4. Public Scoping Meeting Dates, Times, and Locations

Date	Time	City	Address
January 30, 2007	5:00–8:00 pm	Alton	Alton Town Hall 11 South 100 West, Alton, Utah 84710
January 31, 2007	5:00–8:00 pm	Kanab	Kanab City Library 374 North Main Street, Kanab, Utah 84741
February 1, 2007	5:00–8:00 pm	Panguitch	Triple C Arena 50 East 900 North, Panguitch, Utah 84759
February 6, 2007	5:00–8:00 pm	Cedar City	Cedar City L brary 303 North 100 East, Cedar City, Utah 84720
February 7, 2007	5:00–8:00 pm	Salt Lake City	Salt Lake City Public Library 210 East 400 South, Salt Lake City, Utah 84111

1.9.1.2 SUMMARY OF ISSUES

Issues and concerns raised during the public scoping process were divided into three categories: 1) those to be addressed through implementing and documenting certain elements of the NEPA process; 2) those to be addressed through analysis of direct, indirect, and cumulative impacts; and 3) those to be addressed through the formulation of alternatives. The substantive issues and concerns, along with the chapter (or chapters) of the document in which they are addressed, are outlined below. A complete list of comments received during the scoping period (and their dispositions) can be found in the *Alton Coal Tract LBA EIS Public Scoping Report* (SWCA 2007b).

1.9.1.2.1 National Environmental Policy Act Process

This section summarizes the substantive issues and concerns (i.e., those that require analysis in the NEPA process) related to the NEPA process that were identified through the public scoping process. These issues underscore the importance of implementing and documenting (in this document and/or in the administrative record) certain elements of the NEPA process to ensure full public disclosure. The chapter (or chapters) of the document where each issue is (or are) addressed are provided in italics following each bullet.

1.9.1.2.1.1 Leasing Timeline

- When is the appropriate time to begin the analysis of the EIS and consideration of leasing? Following submission of a detailed mining plan? Following a commitment to mine and sell coal? (*Chapter 1 Introduction, Chapter 2 Proposed Action and Alternatives*)

1.9.1.2.1.2 Previous Decisions and Legislation and Need for an Environmental Impact Statement

- Previous studies of coal mining at Alton have been completed. Why is additional environmental analysis required? (*Chapter 1 Introduction, Chapter 2 Proposed Action and Alternatives*)
- How will the proposed lease meet the suitability requirements of SMCRA? (*Chapter 1 Introduction, Chapter 2 Proposed Action and Alternatives*)

1.9.1.2.1.3 Bureau of Land Management's Role and Policies Regarding Public Land Use

- What is BLM's responsibility to protect the public lands, while providing for their use and sustainability? (*Chapter 1 Introduction, Chapter 2 Proposed Action and Alternatives*)

1.9.1.2.1.4 Scope

- Is coal mining on private lands and public (BLM) lands a connected action under NEPA requiring analysis in a single EIS? (*Chapter 1 Introduction, Chapter 2 Proposed Action and Alternatives*)

1.9.1.2.1.5 Purpose and Need

- What are the public purposes and needs for this action and how will they affect the eventual decision to offer the tract for leasing or not? (*Chapter 1 Introduction*)
- How will energy demand affect BLM's decision to lease the tract (*Chapter 1 Introduction*)?

1.9.1.2.1.6 Alternatives

- What reasonable alternatives to the applicant's proposal to lease and mine federal coal reserves in the tract should BLM consider? (*Chapter 2 Proposed Action and Alternatives*)

1.9.1.2.1.7 Affected Environment and Impacts Analysis

- What would be the effects of the coal mine on the natural and cultural environment in and near the tract, and the human values connected to those resources and their uses? (*Chapter 4 Environmental Consequences*)

1.9.1.2.1.8 Data and Expertise for Impacts Analysis

- What data and scientific literature must be collected and analyzed to ensure an adequate analysis of the effects of the Proposed Action and alternatives? (*Chapter 4 Environmental Consequences*)

1.9.1.2.1.9 Cooperating and Consulting Agencies

- What role will BLM's partners play in the EIS analysis of the Proposed Action and the alternatives? (*Chapter 1 Introduction*)

1.9.1.2.1.10 Public Involvement

- What opportunities for public involvement should BLM provide to ensure disclosure of information and informed decision making? (*Chapter 1 Introduction, Chapter 5 Consultation and Coordination*)

1.9.1.2.1.11 National Environmental Policy Act Decisions

- What role will local residents play in the decision-making process? (*Chapter 1 Introduction*)
- How will impacts to Bryce Canyon National Park affect the LBA tract leasing decision at Alton? (*Chapter 2 Proposed Action and Alternatives, Chapter 4 Environmental Consequences*)

1.9.1.2.2 Direct, Indirect, and Cumulative Impacts from the Proposed Action and Alternatives

This section summarizes the substantive issues and concerns related to impacts analysis that were identified through the public scoping process. These issues were used to determine which resources to address in the EIS and to what level of analysis. Past, present, and reasonably foreseeable future actions (summarized in Section 1.9.2) were also used in determining resources to address and at what level of analysis. Substantive issues and concerns related to impacts analysis are listed below.

1.9.1.2.2.1 Resources and Uses Covered by Supplemental Authorities

Potential impacts to resources and uses addressed by supplemental authorities are of concern during the NEPA process (2008e). For the Alton Coal EIS scoping process the BLM considered potential impacts to 17 resources and uses covered by supplemental authorities:

- Water Quality (surface and ground)
- Wetlands and Riparian Zones
- Farmlands, Prime and Unique
- Air Quality
- Rangeland Standards
- Cultural Resources
- Threatened and Endangered Species
- Paleontological Resources
- Wild and Scenic Rivers
- Hazardous Material and Waste
- Migratory Birds
- Floodplains
- Areas of Critical Environmental Concern
- Wilderness Areas and Wilderness Study Areas (WSA)
- Native American Trust resources
- Environmental Justice
- Native American Religious Concerns

Wild and scenic rivers, wilderness areas and WSAs, Native American trust resources, and areas of critical environmental concern would not be affected by the Proposed Action and alternatives and are therefore not analyzed in detail in this EIS. Impacts on the remaining 13 resources and uses covered by supplemental authorities are analyzed in this EIS. Impacts on rangeland health standards are analyzed under the components of the standards (e.g., vegetation, soil, water, and air) but are not discussed in a section under that heading. The issues and concerns listed below are addressed in Chapter 4 Environmental Consequences.

1.9.1.2.2.2 Issues and Concerns Regarding Impacts on Resources and Uses

Aesthetic Resources

- What effect would noise created by coal mining and coal truck traffic have on the relative noise levels existing in the area, including the town of Alton, adjacent public lands, and nearby parks and monuments?
- What effect would the coal mining operation, coal truck traffic, and dust and smoke caused by mining have on the local landscape (scenic quality) and surrounding viewshed?
- How would lighting for nighttime mining operations affect the darkness of the night sky from key nighttime-sky viewing points such as Bryce Canyon National Park?

Air Resources[4]

- How would development and operation (i.e., construction, heavy equipment use, transportation of coal, etc.) of the coal mine affect local and regional air quality?
- What effect would deposition of dust and other pollutants produced by mining have on water, wildlife, vegetation, recreation uses, and structures in and adjacent to the mining operations?
- What contribution would emissions produced from the mining operation, transportation of coal, and ultimate use of the coal add to the cumulative effect of carbon emissions on global warming?

Cultural Resources

- What impact would coal mining and transporting coal have on prehistoric and historic cultural resources in the tract and along transportation routes?
- How would coal mining and transporting coal impact existing and eligible National Register sites and TCPs?

Fire Management

- What impact would coal mining, including truck traffic to transport coal, have on air quality; and how would those changes in air quality affect BLM's ability to conduct prescribed burning in WUI areas to reduce threats of wildfire?
- What impact would revegetation required for tract reclamation have on wildland fire frequency and severity?

Geology and Minerals

- How would coal mining on the tract affect geologic and mineral resources present there?
- What geologic hazards exist on and near the tract and how would they be affected by mining operations and vice versa?
- What is the potential for underground coal fires and what are the environmental consequences of an underground fire?

[4] As a result of scoping comments provided by EPA, an Air Resources Stakeholder Group (including EPA, OSM, NPS, BLM, OSM, the State of Utah, and ACD) was convened to guide the air resources analysis, ensuring that air resources impacts were properly addressed. See Sections 3.3 and 4.3 for Air Resources.

Hazardous Materials

- What impact would generation, temporary storage, and disposal of hazardous materials (such as those regulated under the Comprehensive Environmental Response, Compensation, and Liability Act, the Superfund Amendments and Reauthorization Act, the Resource Conservation and Recovery Act, and the Toxic Substances Control Act) have on people and the environment?

Land Use and Access

- What impact would development and operation of a coal mine have on local private property values and future development potential of those lands?
- What effect would coal truck traffic have on private property values along transportation routes (KFO Route 116, US-89, etc.)?
- What impact would development and operation of a coal mine have on the town of Alton (e.g., air quality, aesthetics, water quality, and public health and safety)?
- How would public lands be used and managed following reclamation of the coal mine?

Livestock Grazing

- How would coal development, mining, and reclamation impact grazing and pasturelands around Alton (i.e., removal of vegetation, restricted access to grazing land for ranchers, etc.), and how would that affect short-term and long-term livestock grazing and production?
- How would road dust and exhaust from passing coal truck traffic affect vegetation growth and palatability of the vegetation for livestock forage?

Paleontology

- How would surface disturbance (i.e., surface mining, road construction, facilities construction, etc.) created by coal mining impact fossils in the tract?

Public Health and Safety (Discussed under Socioeconomics in Chapter 4)

- How would coal truck traffic through towns along potential transportation routes affect public safety in those towns, and along the travel routes?
- What risk of injury and adverse health effects would the mine workers and local public face as a result of mine development?

Special Designations (Discussed under Aesthetic Resources, Air Resources, and Recreation in Chapter 4)

- How would coal mining impact the air quality, viewshed, and nighttime sky of Bryce Canyon National Park?
- How would coal mining impact the resources (air quality, viewsheds, recreation, etc.) of other nearby parks and monuments, including the Grand Staircase-Escalante National Monument; Arches, Canyonlands, and Zion national parks; Kodachrome State Park; and Red Canyon and other public lands?
- How would the noise and presence of coal truck traffic affect the visitor experience at these parks, monuments, and public lands?

Special Status Species (Discussed under Wildlife and Special Status Species in Chapter 4)

- How would development and operation of a coal mine impact special status species and their habitat, including Greater Sage-grouse, Utah prairie dog, Burrowing Owl, Bald Eagle, Golden Eagle, pygmy rabbit, Northern Goshawk, Ferruginous Hawk, Bonneville cutthroat trout, and Utah *Physa*?
- What effect would noise from coal truck traffic have on special status species? How would wildlife mortality from vehicle collisions affect wildlife populations?

Socioeconomics

- What opportunities for employment would development and operation of the coal mine create?
- How would development and operation of a coal mine affect local businesses and tourism?
- How would development and operation of a coal mine affect tax revenues to Kane and Garfield counties? What, if any, additional county services (i.e., ambulance, fire fighting, sheriff, etc.) would be required to support the mine?
- What effect would coal truck traffic have on tourism and local businesses along potential transportation routes?
- What are the economic benefits of development and operation of a coal mine?
- How would development of the tract contribute to the supply of coal available for use in the region?

Soils

- What impact would development and operation of a coal mine (including final reclamation) have on productivity of soils, including biological soil crusts?
- How would coal mining affect farmland productivity?
- What impact would development and operation of a coal mine have on soil stability and rates of erosion?
- What effect would road and coal dust and exhaust from mining-related traffic have on soil productivity in proximity to roads in the tract and along potential transportation routes?

Transportation

- What effect would coal truck traffic for transporting coal to market have on traffic conditions along the transportation route?

Vegetation

- How would coal development, mining, and reclamation affect vegetation communities in the tract?
- What effect would coal mining, including truck traffic to transport coal, have on the introduction and spread of exotic vegetation?
- What effect would road and coal dust and exhaust from mining-related traffic have on the health and growth of vegetation adjacent to roads in the tract and along potential transportation routes?

Water Resources

- What effect would development and operation of a coal mine have on surface-water quality and quantity?

- What effect would development and operation of a coal mine have on groundwater quality and quantity?
- How would mining operations impact riparian areas and wetlands?
- How would coal mining affect the possible existence of an AVF near the town of Alton?
- How would road and coal dust and vehicle exhaust, resulting from operation of coal trucks, impact the quality of water bodies adjacent to transportation routes?

Wildlife

- What effect would development and operation of a coal mine, including reclamation and coal truck traffic, have on wildlife and their habitat, including nocturnal wildlife?

1.9.1.2.3 Alternatives Formulation

This section summarizes the comments provided in the public scoping process that specifically refer to or specifically indicate the need for the development of alternatives to the Proposed Action. Issues summarized above (Sections 1.9.1.2.1 and 1.9.1.2.2) were also considered in the alternatives development process along with past, present, and reasonably foreseeable future action discussed in Section 1.6.2.

Chapter 2 provides a complete description of the alternatives analyzed in detail, and those alternatives considered but eliminated from detailed analysis. A brief rationale for the dismissal of alternatives is provided there.

1.9.1.2.3.1 Decision to Lease

- Should the BLM delay offering the tract for lease until less-impacting extractive processes are developed?

1.9.1.2.3.2 Mining Methods and Coal Production

- What are practical alternatives to surface mining in the tract?

1.9.1.2.3.3 Alternative Sources of Energy

- The BLM should consider foregoing the coal lease and instead promote development of alternative forms of energy such as solar and wind.

1.9.1.2.3.4 Air Quality

- How would operations be designed and controlled to prevent the release of unsafe levels of NO_2?

1.9.1.2.3.5 Special Designations

- Coal mining should be designed, and modified if needed, to reduce impacts to Bryce Canyon National Park.

1.9.1.2.3.6 Transportation

- What methods of coal transportation (e.g., slurry, rail, truck) should be considered to reduce impacts to the environment, nearby communities, and public safety?
- Construction of a power plant next to the mine should be considered as a way to eliminate impacts from coal truck traffic.

1.9.2 Past, Present, and Reasonably Foreseeable Future Actions

This section lists past, present, and reasonably foreseeable future actions in and near the tract. These past, present, and reasonably foreseeable future actions will be used to guide the analysis of cumulative impacts of the Proposed Action and alternatives. A more detailed discussion of these actions can be found in Section 4.18, Cumulative Impacts.

1.9.2.1 PAST ACTIONS

- Historical uses of tract lands and surrounding lands (such as livestock grazing, hunting, coal exploration and production, mineral material extraction, paleontological prospecting, and coalbed methane [CH_4] exploration)
- Vegetation treatments
- ROWs for roads and utilities and road and utility construction

1.9.2.2 PRESENT ACTIONS

- Sand and gravel development
- Livestock grazing
- Big game hunting operations
- Road relocations and utility ROWs
- Tourist and local traffic use of Johnson Canyon Alton Amphitheater Scenic Backway
- Surface-mining operations at the Coal Hollow Mine for private fee coal (approximately five million tons) on 636 acres of privately owned land adjacent to the tract (see Maps 1.1 and 1.2)
- Construction and use of haul roads for transporting coal from the Coal Hollow Mine to KFO Route 116 north of the town of Alton
- Use of an existing transportation route US-89 to SR-20 to I-15 to Iron Springs along U.S. Route 56 for transporting coal from the Coal Hollow Mine to market
- Dispatch, fueling, and washing facilities related to coal haulage for the Coal Hollow Mine

1.9.2.3 REASONABLY FORESEEABLE FUTURE ACTIONS

- Surface-mining operations for private fee coal on approximately 378 acres of private, surface-owned land adjacent to the tract to the north (see Maps 1.1 and 1.2)
- Future energy corridor development related to the *West Wide Energy Corridor Programmatic EIS*
- Development of wind energy
- Construction of a Garkane Energy 138-kilovolt transmission line in Garfield County, Utah between the towns of Tropic and Hatch
- Construction of the Lake Powell pipeline
- Construction of the Jackson Flat Reservoir
- Vegetation treatments including but not limited to prescribed fire, herbicide applications, and mechanical thinning and grubbing
- Coalbed CH_4 exploration
- Oil and gas exploration (seismic exploration) and development
- Mining alabaster and Septarian nodules

- Sand and gravel production
- Building stone collection
- Motorized travel on existing roads and trails
- Clay development

1.10 Consultation and Coordination

Initial involvement with respect to BLM's receipt and review of ACD's LBA and details on the public notification, public scoping process, and the cooperating agencies are described above. Chapter 5, Consultation and Coordination, provides further detail on consultation and coordination for the proposed tract and preparation of this EIS.

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CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

CHAPTER 2 PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

NEPA requires the consideration and evaluation of a practical range of reasonable alternatives that meet the federal action's purpose and need while minimizing or avoiding environmental impacts. A practical range of reasonable alternatives is formulated to address issues and concerns raised by the public and agencies during scoping. The alternatives represent other means (methods, processes, locations, times, sequences, etc.), besides the Proposed Action, of satisfying the stated purpose and need for the federal action. Reasonable alternatives are defined by the Council on Environmental Quality as those that are technically, economically, and environmentally practical and feasible. NEPA also requires the evaluation of a No Action Alternative. If unreasonable alternatives or alternatives that do not meet purpose and need are suggested, a detailed analysis of these alternatives is not required. However, the rationale for eliminating them from detailed analysis must be explained.

In this EIS, three alternatives are analyzed in detail: Alternative B (Proposed Action Alternative), Alternative C (Reduced Tract Acreage and Seasonal Restrictions), and Alternative A (No Action). Several other alternatives were identified and considered but were eliminated from detailed analysis. These alternatives are described in Section 2.6 along with the rationale for eliminating them from detailed analysis.

LBA tracts are nominated for leasing by companies with an interest in acquiring a lease but, as described in Chapter 1, the LBA process is, by law and regulation, an open, public, competitive sealed-bid process. If the Alton Coal Tract LBA (hereafter referred to as the Alton Coal Tract or tract) is offered for lease, the applicant for that tract may or may not be the highest bidder when the lease sale is held and therefore may not be the successful bidder. Further, if a decision is made to hold a competitive lease sale and a lease is issued, the lessee must obtain mine plan approval and a permit to conduct coal mining operations, including a detailed mining and reclamation plan, before mining can begin on the tract. As discussed in Chapter 1, this mining and reclamation plan and overall PAP would undergo detailed review by state and federal agencies as part of the approval process. The detailed PAP of any successful bidder, the applicant or otherwise, would be required to conform to the stipulations and conditions attached to the lease through the land-use plan and to conform to the decision that would follow this EIS. The conceptual mining and reclamation plans described in this EIS, for both the Proposed Action and Alternative C, are not final plans, but represent reasonably foreseeable development for use in analyzing the potential environmental consequences of issuing a lease for the tract.

The Alton Coal Tract is located in Kane County, Utah approximately 0.10 mile south of the town of Alton and 2.9 miles east of U.S. Route 89 (US-89). A map of the tract in relation to surrounding towns, highways, existing and potential fee coal areas, and other area landmarks is presented in Map 1.1. Under both the Proposed Action and Alternative C, tract configurations contain a mix of federal surface and mineral estate and split estate (private surface and federal minerals) lands. Private surface owners with lands included in the tract under either tract configuration may meet the requirements listed under 43 CFR 3400.0-5(gg)(1), (2), and (3) to be qualified surface owners[5] and are therefore considered to be legally

[5] Under the regula ions under 43 CFR 3400.0-5(gg)(1), (2), and (3) qualified surface owner means the natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who: 1) hold legal or equitable title to the surface of split estate lands; 2) have their principal place of residence on the land, or personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface-mining operations; or receive direc ly a significant portion of their income, if any, from such farming and ranching operations; and 3) have met the above conditions for a period of at least three years, except for persons who gave written consent less than three years after they met the above requirements. In computing the three year period the authorized officer shall include periods during which title was

qualified to give consent to mine federal minerals under their private estates. A final determination of surface-owner status and qualified surface-owner consultation would occur prior to issuance of the ROD and leasing if the tract is offered for leasing. In the event that one or more of the qualified surface owners would not consent to leasing, the related land (or lands) would be removed from the tract prior to holding a lease sale. However, based on patent records (available through the BLM Utah State Office), some surface owners may not have the authority, based on the congressional act[6] under which land was transferred from federal to private ownership, to refuse access to their private surface for purposes of coal mining. A final determination of surface-owner rights to refuse access to coal resources under their private surface estates would occur prior to leasing, if the tract is offered for leasing. For purposes of the EIS analysis it is assumed that, in the event of a lease sale, all private surface estates under which coal deposits are present would be mined.

As indicated in Chapter 1, some of the coal reserves in the tract under either configuration (Proposed Action or Alternative C) are not currently considered recoverable because KFO Route 116 traverses the proposed tract. Under SMCRA, the approval of surface-mining operations on lands within 100 feet of the outside line of the ROW for a public road requires a process resulting in a final decision by DOGM or the public road authority (43 CFR 3461; Unsuitability Criterion Number 3). As discussed in Chapter 1, Section 1.8.1.1.2, the coal underlying KFO Route 116 and underlying a buffer zone extending 100 feet on either side of the outer edges of the road is currently considered unsuitable for mining. However, if the decision is to offer the tract for competitive leasing, the successful bidder, Kane County, and the BLM would work on a plan to relocate KFO Route 116, which would allow recovery of the coal underlying the road and its buffer zone. The Proposed Action and Alternative C assume that an agreement to relocate the road would be reached (KFO Route 116 relocation is discussed under each alternative in Chapter 4). Two-track roads traversing private land and routes located on BLM-administered land are also present on the tract. The EIS analysis assumes that these roads would be closed for the duration of active mining operations and that they would be replaced following completion of successful mining and reclamation activities. Temporary two-track roads and routes, which would be reclaimed following mining, may be constructed during active mining operations to allow access as necessary for private land owners and permittees (see Section 2.5.2). The estimated cost to a successful bidder for relocating KFO Route 116 and for replacing two-track roads on private land and routes on BLM-administered land would be considered by the BLM in the fair market value determination for the tract. To be successful, a bidder must pay fair market value for the tract.

The Alton Coal Tract under either configuration also includes an area where no coal is present due to erosion or past coal fires (Personal Communication, Powell 2008). This is known as the no-coal zone. Although these lands would not be mined, they are included in each tract configuration to 1) allow maximum economic recovery of all the mineable coal that lies adjacent to the no-coal zone, 2) comply with the coal leasing regulations that do not allow leasing of fewer than 10-acre aliquot parts, 3) provide additional surface acreage deemed by the BLM to be reasonably necessary to conduct mine operations, and 4) allow for habitat enhancement within the tract in close proximity to areas that would be mined.

Under either the Proposed Action or Alternative C, coal would be mined from one coal seam, referred to as the Smirl Coal Zone. The Smirl Coal Zone has an average thickness of 15.3 feet based on 25 cored drill holes over the tract. Coal quality and thickness are both variable over the tract. Some coal quality information is included in Section 3.6 of this document. The Bald Knoll Coal Zone is also present in the tract but is not proposed for mining in the lease application. According to the applicant, ACD, the quality and quantity of coal in the Bald Knoll Coal Zone within the tract is insufficient to be recoverable.

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owned by a relative of such person by blood or marriage if, during such periods, he relative would have met the requirements of this section. A qualified private surface owner is legally qualified to give consent to mine federal minerals under the private surface owner's estate.

[6] Private surface estates within the tract were originally granted to private surface owners under either 35 Stat., 844 (March 3, 1909), 36 Stat., 583 (June 22, 1910), or 39 Stat., 862 (December 29, 1916).

2.2 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the Alton Coal Tract under the Proposed Action or Alternative C would not be approved, the LBA tract would not be offered for competitive lease sale, and the coal included in the LBA tract would not be mined.

Rejection of the application would not affect mining activities on private land adjacent to the tract (i.e., the Coal Hollow Mine). The Coal Hollow Mine consists of approximately 635 acres of land and approximately five million short tons of recoverable coal leased from private surface and mineral owners. Average annual coal production is anticipated to be approximately 2 million tons and mining activities are expected to employ approximately 160 persons (100 at the tract and 60 for coal trucking operations); though initial operations and startup would employ much less (approximately 16 employees). Rejection of the application would also not affect an anticipated permit application from ACD to mine fee coal on private lands adjacent to the tract to the north. These fee coal areas are depicted in relation to the tract under the Proposed Action in Map 1.2 and under Alternative C in Map 2.1.

To compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that the tract would not be mined in the near future if the No Action Alternative is selected. Under the No Action Alternative, the public lands within the tract would continue to be managed in accordance with the KFO RMP. The area would be managed for livestock grazing, recreation (primarily hunting and OHV use), and wildlife habitat. Vegetation treatments (wildlife habitat treatments, watershed treatments, livestock rangeland treatments, wildland fire use, fuels treatments, and stewardship contracting) would occur in support of the BLM's Healthy Lands Initiative. Private lands within the tract would continue to be used for livestock grazing, farming, and dispersed recreation (especially hunting).

Selection of the No Action Alternative would not preclude leasing and mining of this tract sometime in the future. To consider leasing and mining this tract in the future, another LBA would have to be submitted and another NEPA process would need to be conducted.

2.3 Alternative B: Proposed Action

Under the Proposed Action, the Alton Coal Tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The boundaries of the tract would be reasonably consistent with the tract reconfiguration completed by the BLM after ACD's original LBA submittal (see Map 1.2).

2.3.1 Location and Overview

The tract under the Proposed Action encompasses approximately 3,576 acres, of which approximately 2,280 acres are federal surface and mineral estate and 1,296 acres are split estate; private surface estate and federal mineral estate (Map 1.2 depicts private and BLM surface within the tract under the Proposed Action). However, not all surface estates, private or federal, have coal reserves underlying them (Map 1.2 also depicts the approximate extent of the coal line within the tract). The legal description of the tract under the Proposed Action is contained in Table 2.1. The land description and acreages are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of August 21, 2002 and July 28, 2006.

Table 2.1. Alton Coal Tract Legal Description and Surface Ownership under the Proposed Action*

Legal Description†	Surface Owner¥	Acres
Township 39 South, Range 5 West, Salt Lake Meridian, Utah		
Section 7, SE¼SW¼ and S½SE¼	3	122
	5	7
Section 18, lots 3 and 4, E ½, E½W½	BLM	357
	3	42
	16	158
	17	3
Section 19, lots 1 through 4, NE¼, E½W½, N½SE¼, SE¼SE¼	BLM	472
	1a	120
Section 20. lots 4 and 5, N½SW¼	BLM	47
	1a	111
Section 30, lots 2 through 4, SW¼NE¼, SE¼NW¼, E½SW¼, W½SE¼	BLM	338
	1a	13
Section 31, lots 1 through 3, NE¼, E½NW¼, NE¼SW¼, N½SE¼	BLM	471
Township 39 South, Range 6 West, Salt Lake Meridian, Utah		
Section 12, SW¼, W½SE¼	Unknown	9
	3	218
	8	16
Section 13, NW¼NE¼, N½NW¼, SE¼NW¼, SE¼	BLM	160
	3	161
Section 24, NE¼, N½NW¼, SE¼NW¼, E½SW¼, N½SE¼, SE¼SE¼	BLM	159
	11	4
	12	313
Section 25, E½NE¼, SW¼NE¼, SE¼	BLM	276
Error†		5
Total Private		**1,296**
Total BLM		**2,280**
Total LBA		**3,581**

* This table also appears in Chapter 1.

¥ Where the BLM is the surface owner of the parcel this is explicitly noted. Private surface owners are numbered rather than identified by name due to privacy concerns.

† Based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of August 21, 2002 and July 28, 2006

‡ The acreages above were calculated using ESRI ArcGIS 9.2 and NAD 1983 UTM Zone 12N coordinate system. The BLM shapefile of coal ownership is georeferenced (in NAD 1983 UTM Zone 12N), but is not survey accurate. ACD provided a hardcopy map (wi h surface ownership and section boundaries), which was scanned and georeferenced to section corners visible on USGS 7.5-minute topographic maps. Polygons were then digitized to encompass/represent each of the legal descriptions above using the BLM shapefile, ACD's georeferenced map, and the USGS 7 5-minute topographic map as references while digitizing. All acreages are approximate and have not been verified by ground surveys. The error is largely a result of the disparate sources for boundary data. Additionally, he ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary. This suggests that one or both of these datasets are approximate and is another potential source of error.

Under the Proposed Action, recoverable portions of in-place coal reserves would be mined over approximately 25 years using 1) surface-mining methods where the depth of overburden would be approximately 200 to 300 feet, and 2) underground methods (development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining; Appendix C) where the depth of overburden would exceed approximately 200 to 300 feet. The choice of mining method, however, can vary from the 200- to 300-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. (The analysis considers surface disturbance for surface mining up to approximately 200 to 300 feet of overburden removal. These are generally referred to as overburden removal scenarios in the text.) Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal has occurred. Reclamation would be concurrent with mining over the course of the estimated 25-year mine life and would be followed by a potential 10-year reclamation and revegetation monitoring period.

BLM independently evaluated the coal resources included in the tract. BLM estimates that the tract under the Proposed Action consists of approximately 59.6 million tons of in-place coal and that an estimated 44.9–49.1 million tons of coal would be recoverable from the tract. The amount of recoverable coal depends on whether surface-mining methods would be discontinued at approximately 200 feet of overburden removal (44.9 million tons of recoverable coal) or approximately 300 feet of overburden removal (49.1 million tons of recoverable coal). BLM estimates that in areas where coal would be mined by surface-mining methods, approximately 90% of the estimated in-place coal reserves could be recoverable. However, in those portions of the tract that must be mined by underground mining methods, approximately 50% of the in-place coal reserves could be recoverable. These percentage recovery estimates are based on assumptions about the depth to which the use of surface-mining methods is feasible and the extent of the no-coal zone.

2.3.2 Preliminary Mine Plan

This section describes, on a conceptual level, the mining and reclamation plans that would be used to mine and reclaim lands within the tract under the Proposed Action. The conceptual mining and reclamation plans described here are not final plans but represent reasonably foreseeable development for use in analyzing the potential environmental consequences of issuing a lease for the tract.

2.3.2.1 MINING METHODS AND MINE FACILITIES[7]

It is anticipated that approximately 1,993–2,395 acres of surface disturbance would occur in the tract under the Proposed Action. Under the Proposed Action, all acres of surface disturbance are reported as a range that coincides with the application of surface-mining methods up to between 200 and 300 feet of overburden removal. Employing surface-mining methods only up to 200 feet of overburden removal would result in the smaller quantity of disturbed acres while employing surface-mining methods up to 300 feet of overburden removal would result in the greater quantity of disturbed acres.) Of this, 1,750–2,152 acres would be the result of surface-mining operations (pit disturbance). Centralized facilities associated with mining activities on the tract would be located for the life of the mine on approximately 36 acres of BLM-administered land within the tract's no-coal zone (see Map 1.2). These facilities would include an office, maintenance shop, equipment wash bay, oil and fuel storage tanks, oil and fuel storage containment, truck unloading and coal sizing area, coal stockpile area, and truck loadout area. Dispersed facilities necessary to conduct mining operations would include temporary light-use roads and haul roads,

[7] Under the Proposed Action, an external overburden disposal area may be required, as described in Sec ion 2.4.2.1, if a company other than ACD were the successful bidder. ACD would not require an external overburden disposal area under the Proposed Action due to fee coal leases hey have already obtained adjacent to the tract that would allow them to start mining operations on the tract without creating a new pit that is not adjacent to an existing open pit.

electrical poles and lines, various temporary ponds and water-control structures, temporary topsoil and overburden stockpiles, and temporary berms and screens. These facilities would be moved on a regular basis based on the mining sequence and would result in approximately 160 acres of disturbance. Dispersed facilities would be sited to avoid disturbances to cultural resources, wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not possible to avoid disturbances to these areas, mitigation measures would be prescribed.

Where the depth of overburden is approximately 200 to 300 feet or less, surface-mining methods would be used to mine in-place coal reserves. Topsoil removal with suitable heavy equipment, such as rubber-tired scrapers, would proceed ahead of overburden removal. Whenever possible, direct placement of topsoil in a reclamation area would be conducted but, due to scheduling, some topsoil would be temporarily stockpiled. Overburden removal would be conducted using equipment such as trucks and shovels. Other equipment used during overburden removal and backfilling would include dozers, scrapers, excavators, front-end loaders, graders, and water trucks. To confine disturbance to the active mine blocks, as overburden is removed, most of it would be directly placed into areas where coal has already been removed. According to DOGM rules and regulations, as part of the PAP for a permit to conduct mining operations, overburden is pre-sampled to verify that it is suitable for reclamation. Material found to be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents, such as adverse pH levels) would either be removed and treated, or adequately covered with suitable overburden material prior to grading and top-soiling. Most replaced overburden would be graded to approximate original contour (AOC), plowed, and finally top-soiled. In locations where the AOC cannot be achieved, a variation from AOC would be requested in the PAP and would require approval from DOGM and the land management agency or private landowner. Elevations consistent with an approved post-mining topography (PMT) plan would be established as soon as reasonably possible. Under certain conditions, the PMT may not be immediately achievable. This would occur if there is an excess of material that may require temporary stockpiling, if there is insufficient material available from current overburden removal operations, or if future operations could redisturb an area previously mined. Vegetation would be reestablished with a BLM or private landowner approved seed mix that is consistent with the post-mining land use. At any one time, active mining operations (open surface-mining pits from which coal is being removed, areas where topsoil and overburden are being removed, or both) would involve approximately 120 acres (one open pit). The depth of an open pit from which coal is being removed would be up to approximately 300 feet, and highwall length would be up to 600 feet. An additional 120 acres or more would be in some stage of reclamation (overburden replacement and top-soiling, grading to approved PMT, or seedbed beginning).

Where the depth of overburden is approximately 200 to 300 feet or more, underground mining methods would be used to mine in-place coal reserves. This would account for approximately 717 to 412 acres located in the northeastern section of the tract[8]. For underground mining, the use of methods such as development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining would be anticipated. For descriptions of these underground mining methods and references for further information see Appendix C.

Following coal removal, trucks would transport coal from the open pit to the centralized facilities for sizing, temporary stockpiling, and eventual placement on trucks for transport to market. This process would likely involve loading unsized coal into a hopper, which would then feed coal into a feeder breaker evening the flow of coal to the conveyor belt. The conveyor belt would lead to a crusher that would size

[8] If surface mining operations were discontinued at approximately 200 feet of overburden removal, a greater acreage of the tract would be mined using underground mining methods (717 acres). If surface mining operations continued to approximately 300 feet of overburden removal, fewer acres of the tract would be mined using underground mining methods (412 acres). These acreage figures describe the total area within the tract where coal recovery would occur due to underground mining methods. Also see Maps 1.2 and 2.1.

coal to the appropriate dimensions for sale and delivery to market. After sizing, coal would be moved to a temporary stockpile (approximately 50,000 tons would be stockpiled at any one time) via a stacker (an inclined conveyor belt) before being placed on coal trucks via a feeder system. Each truck would carry approximately 42 tons of coal.

2.3.2.2 POST-MINE RECLAMATION

If the BLM decides to hold a competitive lease sale, the successful bidder would develop a site-specific, detailed mining and reclamation plan in consultation with DOGM. The reclamation portion of this plan would include specifications for grading the surface to an acceptable PMT, replacement of salvaged topsoil to an acceptable depth over suitable overburden, and reestablishment of vegetation for the determined post-mining land use.

The successful bidder would be required to post a reclamation performance bond with the State of Utah for all areas physically disturbed by mining operations. This would ensure that the operator complies with all the reclamation requirements of the DOGM Mining and Reclamation Plan Permit[9] and that reclamation requirements are met. Once mining and reclamation operations have been completed, the successful bidder would follow reclamation bond-release procedures specified by DOGM. The reclamation bond would be fully released after a 10-year period (post-completion of permanent reclamation operations) on stable reclaimed land where revegetation standards have been met. DOGM would release the full reclamation performance bond after strict reclamation standards have been met and after the public has been provided an opportunity to comment.

Prior to reseeding, compacted areas would typically be plowed or chiseled to loosen compacted soils. Plowing or chiseling promotes water infiltration, soil aeration, and root penetration. This would be done when soils are at an optimum moisture content and are loose and friable, to promote shattering of compacted soils, but to avoid pulverizing the soil into powder. Seedbed preparation would be conducted immediately prior to seeding to prepare a firm seedbed conducive to proper seed placement, provide for moisture retention, break up dried and hardened surface soil, and eliminate weeds. It is anticipated that chiseling would be sufficient because it leaves a surface smooth enough to accommodate a tractor-drawn drill seeder but rough enough to catch broadcast seed and trap moisture and runoff. An alternative to the use of chiseling is to spread topsoil using a low ground pressure dozer, which would minimize compaction of the soil, leaving a suitable surface for seeding.

The seed mix used for revegetation on federal land would include a diverse mix of suitable native and non-native perennial grasses, forbs, and shrubs in accordance with a BLM-approved revegetation seed mix. On these lands, reclamation would most likely require an attempt to reestablish native and non-native vegetation communities suitable for the post-mining land use. Establishment of reclamation species would be designed to support post-mining land use by stabilizing the soil, providing livestock and wildlife forage, and providing thermal, nesting, and parturition cover for wildlife. On private land, revegetation would most likely involve the reestablishment of pre-mining agricultural vegetation in accordance with directives from private landowners and local, state, and federal regulations, as applicable[10]. In general, reclamation operations would use weed-free seed and equipment, methods that are appropriate for local rainfall and soil conditions, and methods that have been successfully used for revegetation at other, similar mines. On federal land, special consideration of post-mining habitat establishment for sagebrush obligate species would be performed in coordination with DOGM, Utah Department of Wildlife Resources (UDWR), and the BLM.

9 State of Utah coal mine permitting requirements (Coal Mining Rules - Utah Administrative Code Title R645) are available at http://www.rules.utah.gov/publicat/code/r645/r645.htm. They may also be viewed at the main office of the DOGM at 1594 West North Temple, Suite 1210, Salt Lake City, Utah 84114.

10 Revegetation would occur in accordance with the approved post-mining land use. Private landowners can change their minds in regard to the post-mining land use, and hence revegetation species and composition, but a DOGM process must be followed for approvals.

Fall and spring seeding would occur to take advantage of available moisture. During final reclamation and return of the site to direct federal management (as specified in the approved PAP), the successful bidder would obtain necessary authorizations from the appropriate regulatory agencies for final bond release and to properly reclaim and abandon facilities. In general, reclamation operations would follow BLM, DOGM, and OSM best management practices (BMP) for land use, including reclamation and would be described in detail in the PAP for the successful bidder.

2.3.2.3 WATER REQUIREMENTS

Assuming 2 million tons of coal production per year, approximately, 8,112,000 gallons (25 acre-feet) of water per year would be used for dust suppression and equipment washing. Water would be provided from groundwater accumulated in open coal pits, or from existing or newly drilled water wells in or near the tract. ACD currently has rights to 50 acre-feet of groundwater acquired from the Town of Alton. The successful bidder, if other than ACD, would need to negotiate for these water rights. ACD has not obtained rights to any surface waters within the watershed. If wells are used, water would most likely be transported by a pump and piping system. This system would consist of waterlines connected to a storage tank. The system would maintain the water level in the tank that would then be used to load one to three water trucks for use in dust suppression. The pipe length would be shortened, extended, and rerouted as needed to provide water to the active mining area. In addition to this system, water (groundwater) may also be used from the excavated areas when water is available at these locations. The water would be used by installing a pump attached to a stand pipe at the water retention location. The pump and stand pipe would then be used to load the water trucks from the retention area. This system would be used whenever practicable. All water sources would be permitted by the Utah Division of Water Quality and the Utah State Engineer's Office, as necessary.

2.3.2.4 BLASTING

Blasting operations (shooting operations) would be conducted in compliance with DOGM and the Bureau of Alcohol, Tobacco, and Firearms' rules and regulations. To make the general public aware of blasting operations, the blasting schedule would be published (as blasting requirements are identified) in accordance with DOGM regulations and requirements at Utah Administrative Code R645-301-524, Blasting and Explosives. The blasting schedule would be published in the local and regional newspapers. This notice would also be mailed to the residents of the Town of Alton, including any residences located within 0.5 mile of the tract. In accordance with DOGM blasting regulations, at least 30 days prior to blasting, all residents or owners of dwellings or structures within 0.5 mile of the permit area would receive instructions on how to request a pre-blasting survey. Pre-blasting surveys would be conducted as requested and seismographic recordings of blasting operations would be completed. Pre-blasting surveys would determine the condition of dwellings or structures and would document any pre-blasting or existing damage and other physical factors that could reasonably be affected by blasting operations. For surface blasting incident to underground mining and reclamation activities, local government and residents within 0.5 mile of the blasting site would receive notification as required by 30 CFR 817.64; however, pre-blasting surveys would only be required if 5 pounds of explosives (or more) are used (Utah Administrative Code R645-301-524.300).

There would be two basic types of blasts (shots): 1) overburden shots for shovels or other equipment and 2) coal shots. As a safety measure, shots would be designed to minimize flyrock, airblast (noise), ground vibration, emissions of NO_x, and PM with particulates of 10 micrometers or less (PM_{10}), 2.5 micrometers or less ($PM_{2.5}$), or both. The area would also be well marked and monitored prior to and immediately following a shot. Airblast and ground vibration due to blasting operations would be at or below the MSHA's maximum limits and emissions of NO_x, and PM would be controlled to maintain compliance with NAAQS.

2.3.2.5 LIGHTING FOR NIGHTTIME OPERATIONS

Lighting during nighttime operations would consist of one to three portable light towers, four to six fixed-position light poles, and equipment lighting. Portable light towers would be diesel powered with four lights (1,000 watts each) per tower. Each portable light tower would be approximately 30 feet tall and would be moved in accordance with the mining sequence. Fixed position light poles would consist of one 250-watt lamp per pole and would be permanently located near the centralized mine facilities. Lamps on portable light towers and fixed-position light poles would be oriented approximately 30 degrees from the horizontal down toward the ground. Equipment lighting would come from head lights, brake lights, and other safety lighting on the heavy equipment used for mining operations. The following is an estimate of ranges for the quantity of equipment that may be used during nighttime operations:

- Shovels or other loaders: 1–2
- Backhoes/front-end loaders: 1–3
- Bulldozers: 2–5
- Haul trucks: 3–10
- Graders: 1–2
- Light vehicles: 2–6
- Mechanic trucks: 1–4
- Fuel trucks: 1–2
- Water trucks: 1–2

In addition, miscellaneous lighting such as interior building lights and flashlights would commonly be used at the site.

2.3.2.6 POWER GENERATION

Electrical power generation for mining operations would be supplied through a combination of diesel generators. Fixed position, heavy equipment operations located at the centralized facilities (hopper, feeder breaker, conveyor belt, crusher, stacker, and truck feeder) would require 2–3 megawatts of power supplied by one generator. An additional generator would likely be required on-site as a back up in the event that prolonged generator maintenance or repair renders another generator temporarily unusable. Additional power (500 kilowatts to 1 megawatt) would be required for offices, fixed position light poles, maintenance shop, equipment wash bay, etc. One generator would be used to supply this power.

The generator configuration and precise specifications would be determined at the time of permitting and detailed mine planning if the tract is offered for lease. All generators would use ultra low sulfur diesel fuel (15 parts per million [ppm] of sulfur) and be equipped with EPA Tier 4 emissions controls. Generator mufflers would be construction grade (reducing noise emissions approximately 15 decibels), residential grade (reducing noise emissions approximately 25 decibels), or critical grade (reducing noise emissions approximately 35 decibels).

Electrical power from existing or upgraded local power systems could be an alternative power source but would be analyzed separately if determined to be pursued. Obtaining power from existing or upgraded local power systems is not considered reasonably foreseeable at this time (see Section 2.6.2.3, Power Generation Options).

2.3.2.7 HAZARDOUS MATERIALS AND HAZARDOUS AND SOLID WASTE

Potentially hazardous materials anticipated to be used or produced during the implementation of the Proposed Action fall into the following categories:

- Liquid wastes
- Fuels: gasoline (potentially containing benzene, toluene, xylene, methyl tert-butyl, ether, and tetraethyl lead) and diesel fuel

- Coolants and antifreezes
- Lubricants: grease (potentially containing complex hydrocarbons and lithium compounds) and motor oil
- Paints
- Solvents
- Solid wastes

Solid waste that would be produced at the surface-support facilities and throughout the tract may include floor sweepings, shop rags, lubricant containers, welding rod ends, metal shavings, worn tires, packing material, used filters, and office and food wastes. Portable toilets would be provided for mine employees near areas of active mining and reclamation. Waste from these would typically be removed by a portable toilet service company according to a regular schedule. Permanent toilet facilities would be located at the surface support facilities. These would involve sealed containment tanks (as opposed to septic systems) pumped as necessary to remove wastes.

Maintenance and major oil changes for most moveable equipment would take place inside the maintenance shop. Used oil would be contained and disposed of or recycled in accordance with guidelines administered by the Utah Department of Environmental Quality's Division of Solid and Hazardous Waste. Mobile fuel trucks would be used to service and fuel mine equipment in the tract, as appropriate. All fuel storage facilities and equipment would be constructed and operated in accordance with all applicable state and federal regulations.

All solid and liquid wastes would be contained, stored, and disposed of in accordance with applicable local, state, and federal rules and regulations. Specific containment, storage, and disposal techniques would depend on the type and quantity of waste according to applicable rules and regulations. Typically, nonhazardous solid and liquid waste would be contained on-site in dumpsters and transported periodically to a landfill. Any hazardous solid or liquid wastes would typically be separated and stored in appropriately labeled (according to type of waste) barrels that meet the requirements in the Resource Conservation and Recovery Act. Barrels would typically be stored temporarily under cover before being hauled to a hazardous waste disposal facility. A spill prevention plan and other plans would also be required (see Table 2.3 in Section 2.5.1.7).

2.3.2.8 NORMAL OPERATING HOURS

Under the Proposed Action, it is anticipated that mining operations would occur 24 hours per day, five to seven days per week, and 52 weeks per year. The total number of operating days per year would be approximately 260–365.

2.3.2.9 SIGNAGE

To facilitate health and safety requirements to the general public, all public access would be restricted and precluded within the tract for the life of the mining operation. An entrance identification sign would be posted and maintained at all major entrances into the area. The signs would contain the name, address, and telephone number of the operator, the name of the local authorized agent, the DOGM permit number of the operation, and notification of restricted access. Safety signs for the public would be used where appropriate, though no fencing would be erected.

2.3.2.10 ESTIMATED EMPLOYMENT REQUIREMENTS

Under the Proposed Action, approximately 160 workers would be required to conduct mining operations. Approximately 100 of these workers would be employed at the tract and would be conducting mining operations. The remaining 60 workers would be engaged in transporting mined coal from the tract to market. It is assumed that mine employees would come primarily from Alton and surrounding towns located within approximately one to two hours (driving time) of the tract. These would include Kanab, Mt. Carmel, Orderville, Glendale, Hatch, Panguitch, Circleville, Kingston, Junction, Cedar City, Tropic, Enoch, Parowan, Paragonah, La Verkin, Hurricane, Henryville, and Escalante. Mine employees would be expected to commute to and from the work site using their private vehicles. No housing would be provided for mine employees at or near the tract.

2.3.2.11 TRAFFIC ESTIMATES

Under the Proposed Action, there would be an estimated 153 trucks travelling daily to and from the tract and reasonably foreseeable coal loadout location (the transportation route and loadout location are described in Section 2.5.4 Reasonably Foreseeable Coal Loadout Location and Transportation Route). Loaded trucks, specifically designed to reduce loss of coal dust and larger coal particles while traveling, would carry approximately 42 tons of coal each.

Traffic would also be generated from employee commuting and service operations. Employees would commute from their homes to the tract according to the normal operating hours detailed in Section 2.3.2.8. Service operations would include delivery of diesel fuel and machine and equipment parts (daily or weekly), servicing of portable toilets (weekly or biweekly), servicing of permanent toilet facilities (monthly or bimonthly), removal of waste oil (weekly or biweekly), and incidental service operations such as delivery of office supplies (bi-weekly or monthly) as necessary.

2.3.2.12 KANAB FIELD OFFICE ROUTE 116 RELOCATION

To comply with the rules and regulations of SMCRA, portions of KFO Route 116 within the tract would need to be relocated so that no surface disturbance occurs within 100 feet on either side of the outside line of the road. Relocation of the road would allow the successful bidder to mine in-place coal reserves currently underlying portions of the road and the 100-foot buffer zone on either side of the road. This EIS analysis assumes that an agreement to relocate the road would be reached if the BLM decides to hold a competitive lease sale for the tract. Mining would be feasible without relocating KFO Route 116; however, the total amount of recoverable coal would be reduced if KFO Route 116 were not relocated.

Under the Proposed Action, KFO Route 116 would be relocated, wherever possible, within the tract to a no-coal or recovered coal zone. While relocating the road to the no-coal zone or the recovered coal zone, the road would be sited to avoid disturbances to cultural resources, wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not possible to avoid disturbances to these areas, mitigation measures would be prescribed. Access for and impacts to private landowners would also be considered while relocating the road. Under the Proposed Action, the northwestern portion of the tract (Block NW) would contain a 0.8-mile stretch of KFO Route 116. It is assumed that this stretch of the road would be relocated onto previously mined surface within this portion of the tract, according to the mining sequence. It is also assumed that relocation of KFO Route 116 would be temporary and that it would be replaced in the approximate original (current) roadbed following mining.

2.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, the Alton Coal Tract would be modified to exclude Block NW (see Map 2.1). Further, certain mining activities in the southern portion of the tract (Block S) would be subject to seasonal restrictions to reduce impacts to the local Greater Sage-grouse population (hereafter generally referred to as sage-grouse). Under Alternative C, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.1.

Consistent with the purpose and need for the federal action, the intent of Alternative C is to resolve, in part or in full, the following: issues related to the local sage-grouse population, noise, and visual impacts to the town of Alton, and issues related to conflicting land uses (agriculture versus surface mining). Alternative C may also reduce impacts to other resources such as springs and surface waters, wildlife, soils, public health and safety, paleontological resources, cultural resources, and vegetation.

2.4.1 Location and Overview

The modified tract would encompass approximately 3,173 acres, of which approximately 2,280 acres are federal surface and mineral estate and 893 acres are split estate; private surface estate and federal mineral estate (Map 2.1 depicts private and BLM surface within the modified tract). As under the Proposed Action, not all surface estates, private or federal, have coal reserves underlying them (Map 2.1 also depicts the approximate extent of the coal line within the tract). The legal description of the modified tract under Alternative C is in Table 2.2. The land description and acreages are based on the BLM Status of Public Domain and Mineral Titles approved Coal Plats as of August 21, 2002 and July 28, 2006.

Under Alternative C, recoverable portions of in-place coal reserves would be mined over approximately 21 years using surface-mining methods where the depth of overburden is approximately 200 to 300 feet, and using underground methods (development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining) where the depth of overburden exceeds approximately 200 to 300 feet. The choice of mining method, however, can vary from the 200- to 300-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal has occurred. Reclamation would be concurrent with mining over the course of the estimated 21-year mine life and would be followed by a potential 10-year reclamation and revegetation monitoring period. Although reclamation would be concurrent with mining, due to seasonal timing stipulations required under Alternative C for Block S of the tract, the length of time between initiation of the mining process and concurrently occurring reclamation activities would be extended for some pits.

Table 2.2. Legal Description of the Modified Alton Coal Tract under Alternative C

Legal Description[†]	Surface Owner[¥]	Acres
Township 39 South, Range 5 West, Salt Lake Meridian, Utah		
Section 7, SE ¼SW¼, S½SE¼;	3	122
	5	7
Section 18, lots 3 and 4, E½, E½W½;	BLM	357
	3	42
	16	158
	17	3
Section 19, lots 1 through 4, NE¼, E½W½, N½SE¼, SE¼SE¼;	BLM	472
	1a	120
Section 20. lots 4 and 5, N½SW¼;	BLM	47
	1a	111
Section 30, lots 2 through 4, SW¼NE¼, SE¼NW¼, E½SW¼, W½SE¼;	BLM	338
	1a	13
Section 31, lots 1 through 3, NE¼, E½NW¼, NE¼SW¼, N½SE¼;	BLM	471
Township 39 South, Range 6 West, Salt Lake Meridian, Utah		
Section 13, SE¼;	BLM	160
Section 24, NE¼, N½NW¼, SE¼NW¼, E½SW¼, N½SE¼, SE¼SE¼;	BLM	159
	11	4
	12	313
Section 25, E½NE¼, SW¼NE¼, SE¼.	BLM	276
Error[‡]		5
Total Private		**893**
Total BLM		**2,280**
Total LBA		**3,178**

[†] Based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of August 21, 2002 and July 28, 2006

[¥] Where the BLM iys the surface owner of the parcel this is explicitly noted. Private surface owners are numbered rather than identified by name due to privacy concerns.

[‡] The acreages above were calculated using ESRI ArcGIS 9.2 and NAD 1983 UTM Zone 12N coordinate system. The BLM shapefile of coal ownership is georeferenced (in NAD 1983 UTM Zone 12N), but is not survey accurate. ACD provided a hardcopy map (with surface ownership and section boundaries), which was scanned and georeferenced to section corners visible on USGS 7.5-minute topographic maps. Polygons were then digitized to encompass/represent each of the legal descriptions above using the BLM shapefile, ACD's georeferenced map, and the USGS 7.5-minute topographic map as references while digitizing. All acreages are approximate and have not been verified by ground surveys. The error is largely a result of the disparate sources for boundary data. Additionally, the ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary. This suggests that one or both of these datasets are approximate and is another potential source of error.

BLM independently evaluated the coal resources included in the tract. They estimate that under Alternative C, the tract includes approximately 52.1 million tons of in-place coal and that an estimated 38.1–42.3 million tons of coal would be recoverable from the tract. The amount of recoverable coal depends on whether surface-mining methods would be discontinued at 200 feet of overburden removal (38.1 million tons of recoverable coal) or 300 feet of overburden removal (42.3 million tons of recoverable coal). BLM estimates that in areas where coal would be mined by surface-mining methods, approximately 90% of the estimated in-place coal reserves would be recoverable. However, in those portions of the tract that must be mined by underground mining methods, approximately 50% of the in-

place coal reserves would be recoverable. These percentage recovery estimates are based on assumptions regarding the depth to which the use of surface-mining methods is feasible and the extent of the no-coal zone.

2.4.2 Preliminary Mine Plan

This section describes, on a conceptual level, the mining and reclamation plans that would be used to mine and reclaim lands within the tract under Alternative C. The conceptual mining and reclamation plans described here are not final plans but represent reasonably foreseeable development for use in analyzing the potential environmental consequences of issuing a lease for the tract.

Post-mine reclamation, water requirements, blasting, lighting for nighttime operations, power generation, hazardous materials and hazardous and solid waste, normal operating hours, signage, estimated employment requirements, and traffic estimates would be the same under Alternative C as under the Proposed Action. Therefore, these components of the preliminary mine plan for Alternative C are not described below (see Sections 2.3.2.1–2.3.2.12 for these descriptions).

2.4.2.1 MINING METHODS AND MINE FACILITIES

It is anticipated that approximately 1,662–2,064 acres of surface disturbance would occur in the tract under Alternative C. As under the Proposed Action, under Alternative C all acres of surface disturbance are reported as a range that coincides with the application of surface-mining methods up to between 200 and 300 feet of overburden removal. Employing surface-mining methods only up to 200 feet of overburden removal would result in the smaller quantity of disturbed acres, whereas employing surface-mining methods up to 300 feet of overburden removal would result in the greater quantity of disturbed acres. Of this, 1,454–1,856 acres would be the result of surface-mining operations (pit disturbance). Centralized facilities associated with mining activities on the tract would be located in the same area, occupy the same acreage (36 acres), and include the same items as the Proposed Action (see Section 2.3.2.1; see Maps 1.2 and 2.1). Dispersed facilities necessary to conduct mining operations would also be the same as the Proposed Action (see Section 2.3.2.1), including avoidance criteria, though acres (135 acres) of disturbance would differ due to the differing size of the tract. Underground mining would occur on approximately 717 to 412 acres in the northeastern section of the tract depending on whether surface-mining methods would be discontinued at 200 or 300 feet of overburden removal (see footnote 4 above for additional information on acreage of underground mining).

Mining methods employed under Alternative C would be the same as those under the Proposed Action (see Section 2.3.2.1). However, due to seasonal timing restrictions described in Section 2.4.2.3 (Sage-grouse Timing Restrictions), and as a result of the need for two simultaneously open pits, Alternative C would likely involve a greater quantity of heavy equipment and an external overburden disposal area (EODA) occupying approximately 40–60 acres (depending on mining sequence and depth of overburden) located on BLM-administered land. The EODA is an area where overburden, after excavation, is permanently stockpiled. It is often required when a new pit is opened that is not adjacent to an existing pit into which overburden would otherwise be placed as part of the concurrent mining and reclamation process. At any one time, active and suspended (due to seasonal timing restrictions) mining operations (open surface-mining pits from which coal is being removed, areas where topsoil and overburden are being removed, or both) would involve an estimated 240 acres (two pits). The depth of open pits from which coal is being removed would be up to approximately 300 feet, and highwall length would be up to 600 feet. An additional 240 acres or more would be in some stage of reclamation (overburden replacement and top-soiling, grading to approved PMT, or seedbed beginning).

2.4.2.2 KANAB FIELD OFFICE ROUTE 116 RELOCATION

As under the Proposed Action, to comply with the rules and regulations of SMCRA, portions of KFO Route 116 within the tract would need to be relocated so that no surface disturbance occurs within 100 feet on either side of the outside line of the road. Relocation of the road would allow the successful bidder to mine in-place coal reserves currently underlying portions of the road and the 100-foot buffer zone on either side of the road. This EIS analysis assumes that an agreement with Kane County to relocate the road would be reached if the BLM decides to hold a competitive lease sale for the tract. Mining would be feasible without relocating KFO Route 116; however, the total amount of recoverable coal would be reduced if KFO Route 116 were not rerouted.

Under Alternative C, as under the Proposed Action, KFO Route 116 would be relocated, wherever possible, within the tract in the no-coal zone or the recovered coal zone. While relocating the road to the no-coal zone or the recovered coal zone, the road would be sited to avoid disturbances to cultural resources, wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not possible to avoid disturbances to these areas, mitigation measures would be prescribed. Access for and impacts to private landowners would also be considered while relocating the road. It is assumed that relocation of KFO Route 116 would be temporary and that it would be replaced in the approximate original (current) roadbed following mining.

Unlike the Proposed Action, under Alternative C, road relocation (0.8 mile) would not be required for the stretch of KFO Route 116 that traverses Block NW because this portion of the tract is excluded from Alternative C (see Map 2.1).

2.4.2.3 SAGE-GROUSE TIMING RESTRICTIONS

Under Alternative C, timing restrictions would be in place for Block S to reduce impacts to the local sage-grouse population. Data show that a lek site occurs on adjacent private property and that birds from this population use this portion of the tract during the nesting and brooding period. Under this alternative, no surface-disturbing activities would be allowed within 0.5 mile of the lek during the lekking period (February 15–March 15). Likewise, no surface-disturbing activities would be allowed in general under this alternative on Block S during the local sage-grouse's nesting and brooding period (March 15–July 15). As described in Section 2.4.2.1, this timing restriction would likely alter mining activities as compared to the Proposed Action.

2.5 Management and Considerations Common to Each Action Alternative

There are a number of management prescriptions and other considerations common to each action alternative. These items are common to each action alternative for one or more of the following reasons: 1) they are already required by law or regulation for purposes of leasing and/or mining; 2) they are BMPs or management techniques that could be readily applied to reduce impacts regardless of alternative; 3) they were developed to address issues specific to the tract and could be readily applied to reduce impacts regardless of alternative; 4) they pertain to actions and/or plans already occurring and/or over which BLM has no jurisdiction; and 5) they pertain to BLM decisions related to the tract that are independent of decisions with respect to the Proposed Action or Alternative C (i.e., BLM decisions regarding the Proposed Action or Alternative C would not necessitate changes to decisions related to these items and vice versa).

Management and considerations common to each action alternative that are discussed in this section consist of

- permits, approvals, regulatory compliance, mitigation, and monitoring (Section 2.5.1)
- two-tracks and routes within the tract (Section 2.5.2);
- potential short haul routes (Section 2.5.3); and
- reasonably foreseeable coal loadout location and transportation route (Section 2.5.4).

2.5.1 Permits, Approvals, Regulatory Compliance, Mitigation, and Monitoring

There are certain permits, approvals, and regulatory compliance, mitigation, and monitoring measures that would be required under either action alternative. These are related to 1) compliance with existing local, state, and federal rules and regulations with respect to surface coal mining and 2) special mitigation and monitoring requirements (i.e., special lease stipulations) developed for the tract. See Table 1.2 in Chapter 1 and Table 2.3 below for a summary of permits, approvals, and regulatory compliance requirements for the successful bidder.

2.5.1.1 LEASES

A federal coal lease would be required of the lessee to access and remove coal from the tract. Under either action alternative, the surface ownership of the tract is mixed (federal and private). The successful bidder would need to obtain private surface lease agreements from private surface owners to access leased federal coal reserves underlying private surface owners' lands. Tables 2.1 and 2.2 (see Sections 2.3.1 and 2.4.1) identify the number of private landowners and the acreage of private surface by legal description for the Proposed Action and Alternative C, respectively.

2.5.1.2 MINE PERMIT

The successful bidder would need to submit a PAP to DOGM to obtain a permit to mine federal coal from the tract. The PAP would provide a comprehensive and detailed description of proposed mining activities, including resource protection and mitigation measures developed in coordination with DOGM and other state and federal agencies. Some of these resource protection and mitigation measures are identified in this EIS analysis, though others may be identified in the permitting process. The PAP serves as a platform for the development of air quality, water quality and appropriation, and wetland and stream alteration permits potentially required from state and federal agencies.

2.5.1.3 RESOURCE RECOVERY AND PROTECTION PLAN

The MLA requires that before conducting any federal coal development or mining operations on a federal coal lease, the operator must submit to, and have approved by the BLM, a R2P2. The R2P2 would describe how the proposed operation would meet the MLA requirements for due diligent development, production, resource recovery and protection (i.e., effective recovery of the federal coal reserves), continued operation, maximum economic recovery, and compliance with the rules detailed in 43 CFR 3480 for the life of the mine. The successful bidder would mine the leased tract according to the approved plan, respective lease terms, and appropriate rules and regulations.

The initial R2P2 would be approved by the Assistant Secretary of the DOI, Lands and Minerals Management following recommendations from OSM and following R2P2 and MLA determinations (i.e., approvals) by the BLM. Subsequent approvals of R2P2 modifications would be issued by BLM unless the OSM determines that the modification requires further approval by the Assistant Secretary (30 CFR 746.18).

2.5.1.4 AIR QUALITY

An air quality permit would be required from the Utah Division of Air Quality (UDAQ). The permit would address allowable particulate and other emission levels and would stipulate mechanisms to be used to control emissions. As part of the air quality permit a dust control plan would be developed and implemented.

2.5.1.5 WATER QUALITY AND APPROPRIATION

The Utah Division of Water Quality would review the storm discharge permit application (Utah Pollution Discharge Elimination System (UPDES) section of the PAP), and if the plan conforms and complies with applicable rules and regulations, specific environmental permits would be issued. The Utah State Engineer's Office would review specific applications to install monitoring and production wells, and would issue permits and appropriations in accordance with the successful bidder's needs and available water resources. Installation, use, and maintenance of monitoring and production wells would be at the mine operator's expense.

2.5.1.6 WETLAND AND STREAM CHANNEL ALTERATION

Approximately 62.8 acres of wetlands are assumed to be present in Block NW of the tract. Preliminary field assessments in the fall of 2007 and summer of 2008 (SWCA 2007a; Collins 2008b: Appendix F) (Collins 2008b: Appendix F; SWCA 2007b: Appendix F) resulted in an estimate of approximately 37.5 acres of wetland with wet meadow characteristics (Map 2.2 and Appendix F); however, the larger figure is used in the analysis because a complete wetland delineation on the tract has not been performed. For purposes of analysis, these wetlands are assumed to be jurisdictional. In the event of a lease sale, a wetlands delineation conducted by a certified wetlands delineator would need to be performed as part of the mine permitting process, including Clean Water Act (CWA), Section 404 permit approval by the U.S. Army Corps of Engineers (USACE). Modifications to Lower Robinson Creek (for placement of facilities), one or two road crossings of Lower Robinson Creek, and one or two road crossings of Kanab Creek (the number of crossings would depend on specific mining sequence and specific alignment of the rerouted KFO Route 116) would require stream alteration permits from the Utah State Engineer's Office. The permit applications would be reviewed by USACE for compliance with applicable rules and regulations. Permits would be issued by the State of Utah if the application meets the criteria.

2.5.1.7 REGULATORY COMPLIANCE, MITIGATION, AND MONITORING

SMCRA and Utah State law require surface coal mines to collect extensive baseline information and to implement extensive monitoring programs and mitigation measures. Monitoring programs and mitigation measures that are required by regulation are considered to be part of any action alternative for the tract. If BLM issues a lease, an approved PAP for mining operations on the tract would be required before mining operations could be conducted. The major mitigation and monitoring measures that are required by state or federal regulation are summarized in Table 2.3. Those measures that are applicable to the mining operation under any action alternative would be implemented, as necessary, and they have been incorporated into the analysis. Standard and special lease stipulations that have been identified at this time have also been incorporated into the action alternatives. They are also summarized in Table 2.3.

Table 2.3. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Stipulations

AIR RESOURCES	

Federal, State, and Local Requirements	• Monitor on-site air quality for PM_{10}.
	• Monitor off-site ambient PM_{10}
	• Conduct on-site compliance inspections.
	• Periodically monitor airblast frequency levels (conducted by operator), establish ground vibration limits before blasting plan is approved and is monitored by seismograph or scaled-distance equation; and keep records of on-site blasting for three years.
	• Conduct dispersion modeling of mining plans for annual average particulate pollution impacts on ambient air.
	• Employ particulate pollution control technologies.
	• Employ work practices designed to minimize fugitive particulate emissions.
	• Use EPA-mandated or state-mandated Best Available Control Technology, which may include the following:
	  ○ Watering or using chemical dust suppression on haul roads and exposed soils
	  ○ Promptly mulching and revegetating exposed soils
	  ○ Using high efficiency baghouse dust collection systems or passive enclosure containment systems, or atomizers/foggers on the crusher, conveyor transfer, storage bin and train loadout, meeting a standard of 0.01 grain per dry standard cubic foot of exit volume
	  ○ Watering of active work areas
	  ○ Putting in place a reclamation plan to minimize surface disturbances subject to wind erosion;
	  ○ Graveling of access roads with subsequent watering or chemical treatment for dust abatement to meet air quality standards
	  ○ Limiting haul truck speeds
	  ○ Limiting material drop heights for shovels
	• Implement voluntary and required measures to avoid exposing the public to NO_2 from blasting clouds, including the following:
	  ○ Notifying neighbors and employees at least 24 hours prior to initial blasting according to an approved blasting schedule
	  ○ Publishing the blasting schedule in a newspaper at least 10 days prior to initial blasting, and distributing copies of the blasting schedule to local governments and public utilities and residents within 0.5 mile of the permit area (republishing every 12 months or more frequently if the schedule changes)
	  ○ Notifying each person within the permit area who resides or works within a 0.5-mile radius of the permit area of the blasting schedule and the meaning of the signals used in the blasting
	  ○ Timing blasts to avoid temperature inversions and to minimize inconvenience to neighbors
	  ○ Closing public roads, when appropriate, to protect the public
	  ○ Minimizing blast sizes
	  ○ Posting signs on all entrances to the permit area from public roads or highways

Standard and Special Lease Stipulations	• Ultra low sulfur diesel fuel (15 ppm of sulfur) in generators • U.S. EPA Tier 4 emissions controls on generators

Table 2.3. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Stipulations

ALLUVIAL VALLEY FLOORS	
Federal, State, and Local Requirements	• Identify all AVFs within or adjacent to the permit area (DOGM). • Determine significance to agriculture of all identified AVFs affected by mining (DOGM). • Protect downstream AVFs during mining. • Restore essential hydrologic function of all AVFs affected by mining. • Monitor to determine restoration of essential hydrologic functions of any declared AVFs.
Standard and Special Lease Stipulations	• None identified at this time.
COAL	
Federal, State, and Local Requirements	• Achieve maximum economic recovery of the coal resources within the tract (MLA and BLM coal leasing regulations). • Successful bidder inspections and reporting to the BLM
Standard and Special Lease Stipulations	• None identified at this time.
CULTURAL RESOURCES AND NATIVE AMERICAN CONCERNS	
Federal, State, and Local Requirements	• Conduct Class I and III surveys to identify cultural properties on all state and federal lands and on private lands affected by federal undertakings. • Consult with the state historic preservation office to evaluate eligibility of cultural properties for the National Register of Historic Places (NRHP). • Consult with state historic preservation office to evaluate effects of the federal action on historic properties. • Avoid or recover data from significant cultural properties identified by surveys, according to the approved cultural resources mitigation plan. • Notify appropriate federal personnel if historic or prehistoric materials are uncovered during mining operations. • Instruct employees of the importance of and regulatory obligations to protect cultural resources. • Consult Native American tr bes with known interest in this area of leasing action and request for help in identifying potentially significant religious or cultural sites. • Comply with Native American Graves Protection and Repatriation Act. • Monitor and mitigate according to the approved cultural resources mitigation plan.
Standard and Special Lease Stipulations	• None identified at this time.

Table 2.3. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Stipulations

GEOLOGY AND MINERALS	
Federal, State, and Local Requirements	• Identify and selectively place or mix chemically or physically unsuitable overburden materials to minimize adverse effects to vegetation or groundwater. DOGM requires analysis in advance of mining to detect unsuitable overburden. • Restore topography to AOC.
Standard and Special Lease Stipulations	• None identified at this time.
GROUNDWATER QUALITY	
Federal, State, and Local Requirements	• Evaluate cumulative impacts to water quality associated with proposed mining. • Replace existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quality. • Monitoring wells serve to track water quality in overburden, coal, interburden, underburden, and backfill.
Standard and Special Lease Stipulations	• None identified at this time.
GROUNDWATER QUANTITY	
Federal, State, and Local Requirements	• Evaluate cumulative impacts to water quantity associated with proposed mining. • Replace existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quantity. • Monitoring wells serve to track water levels in overburden, coal, interburden, underburden, and backfill.
Standard and Special Lease Stipulations	• None identified at this time.
HAZARDOUS AND SOLID WASTE	
Federal, State, and Local Requirements	• Dispose of solid waste and sewage according to approved plans. • Store and recycle waste oil. • Maintain files containing Material Safety Data Sheets for all chemicals, compounds, and/or substances used during the course of mining and reclamation. • Ensure that all production, use, storage, transport, and disposal of hazardous materials is in accordance with applicable existing or hereafter promulgated federal and state government requirements. • Comply with emergency reporting requirements for releases of hazardous materials as established in the Comprehensive Environmental Response, Compensation, and Liability Act (or Superfund) of 1980, as amended. • Prepare and implement spill prevention control and countermeasure plans, spill response plans, inventories of hazardous chemical categories pursuant to Section 312 of the Superfund Amendments and Reauthorization Act of 1986, as amended. • Prepare emergency response plans. • Conduct no specific monitoring other than that required by regulations and response plans as described.
Standard and Special Lease Stipulations	• None identified at this time.

Table 2.3. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Stipulations

LAND USE	
Federal, State, and Local Requirements	• Suitably restore reclaimed areas for historic uses (grazing and wildlife). • Monitor controlled grazing prior to bond release evaluation (also see vegetation monitoring requirements). • Obtain a special use permit from Kane County to mine lands currently zoned as agricultural.
Standard and Special Lease Stipulations	• None identified at this time.
NOISE	
Federal, State, and Local Requirements	• Protect employees and local members of the community from hearing loss. • Conduct MSHA inspections.
Standard and Special Lease Stipulations	• None identified at this time.
PALEONTOLOGICAL RESOURCES	
Federal, State, and Local Requirements	• Notify appropriate federal personnel if potentially significant paleontological sites (significant large vertebrate specimens) are discovered during mining, and halting mining in that portion of the mine until the specimen(s) can be collected with accepted scientific techniques.
Special Lease Stipulations	• Monitor spoils heaps in the active portion of the mine twice a week during operations to locate and collect significant fossils as they appear. • Establish a fund (available through a competitive granting process to academic institutions, museums, federal, state, local, or other qualified parties) in the amount of $100,000 for research on the same types of resources on adjacent public lands.

Table 2.3. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Stipulations

SAGE-GROUSE	
Federal, State, and Local Requirements	• See section 1.8.1.1.2; for purposes of analysis in this EIS it is assumed that an exception, modification, or waiver would be granted in the event of a lease. Lease stipulations detailed below would apply.

Standard and Special Lease Stipulations	• Create or enhance nesting and brooding habitat on BLM-administered land within the tract in the no-coal zone (habitat creation/enhancement area identified as Block Sa in maps).
	• Following short- and medium-term mitigation and habitat reclamation measures, including the following:
	  ○ Reclaiming to AOC and seeding with sagebrush and grasses based on approved ecological site descriptions
	  ○ Using livestock in the post-mining stage in the same areas as pre-mining to maintain approximate pre-mining vegetation conditions
	  ○ Where practicable, avoiding intact sagebrush stands for storing mining generated spoil and topsoil stockpiles
	  ○ Locating operations to create the least possible disturbance to sage-grouse and sage-grouse habitat
	  ○ Clearing young juniper from intact sagebrush stands
	  ○ Cutting back juniper woodlands surrounding intact sagebrush stands
	• On Block S of the tract, following long-term mitigation and habitat reclamation measures, including the following:
	  ○ Creating range sites based on approved ecological site descriptions (conditions for the growth of grasses, forbs, and sagebrush) for reclamation purposes
	  ○ Planting bare root or potted sagebrush and bitterbrush transplants in identified sites to accelerate shrub reestablishment
	  ○ Seeding/planting in the fall
	• Remove juniper and pinyon seedlings found in reclaimed areas until full release of the reclamation bond.
	• Conduct post-reclamation surveys for undesirable/ invasive plant species on an annual basis.
	• Begin monitoring in the next growing season after fall seeding/planting and monitor until reclamation goals are achieved.
	• Monitor reclamation sites to assess habitat reclamation success.
	• Radio-collar and monitor bird population (currently within the Alton area) throughout the year to assess bird survival, nest site and nest success, brood-rearing sites, and key winter habitat areas.

SOCIOECONOMICS	
Federal, State, and Local Requirements	• Pay royalties and taxes as required by federal, state, and local regulations. • Survey and report to document volume of coal removed.
Standard and Special Lease Stipulations	• None identified at this time.

Table 2.3. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Stipulations

SOIL	
Federal, State, and Local Requirements	• Salvage soil suitable to support plant growth for use in reclamation. • Protect soil stockpiles from disturbance and erosional influences. • Selectively place suitable topsoil on the graded backfill overburden surface to meet guidelines for vegetation root zones. • Order one soil survey to establish baseline conditions of fertility and soil type and to establish topsoil depth. • Sample regraded overburden for compliance with root zone criteria. Soil sampling of replaced topsoil would be used to determine amendments to be added prior to seeding.
Standard and Special Lease Stipulations	• None identified at this time.
SURFACE WATER	
Federal, State, and Local Requirements	• Build and maintain sediment control ponds or other devices during mining. • Restore approximate original drainage patterns during reclamation. • Restore stock ponds and playas during reclamation. • Conduct necessary UPDES storm water discharge permitting. • Monitor storage capacity in sediment ponds. • Monitor quality of discharges through the UPDES permit. • Monitor streamflow and water quality in selected springs within and adjacent to the tract.
Standard and Special Lease Stipulations	• None identified at this time.
THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE SPECIES	
Federal, State, and Local Requirements	• Survey for threatened, endangered, proposed, and candidate species and their habitat. • Avoid disturbance of identified habitat for threatened, endangered, proposed, and candidate species (see above for sage-grouse). • Restore habitat for threatened, endangered, proposed, and candidate species in areas disturbed by mining. • See Wildlife Resource section below. • Conduct baseline and annual wildlife monitoring surveys.
Standard and Special Lease Stipulations	• None identified at this time.
TOPOGRAPHY AND PHYSIOGRAPHY	
Federal, State, and Local Requirements	• Restore to approved AOC. (Any variances to AOC would be provided in a plan to DOGM and must be approved.) • Check as-built versus approved topography with each annual report (DOGM).
Standard and Special Lease Stipulations	• None identified at this time.

Table 2.3. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Stipulations

TRANSPORTATION FACILITIES	
Federal, State, and Local Requirements	• Relocate existing public roads, if necessary, in accordance with specific agreement between road authority, surface management agency, and coal lessee.
Standard and Special Lease Stipulations	• None identified at this time.
VEGETATION	
Federal, State, and Local Requirements	• Permanently revegetate reclaimed areas according to a comprehensive revegetation plan using approved reclamation seed mixtures consisting of suitable native and non-native species. • Reclaim 20% of reclaimed area with native shrubs at a density of one per square meter. • Control erosion on reclaimed lands prior to seeding with final seed mixture using mulching, cover crops, or other approved measures. • Chemically and mechanically control weed infestation. • Directly haul topsoil wherever possible. • Selectively plant shrubs in riparian areas. • Plant sagebrush. • Create depressions and rock piles. • Use special planting procedures around rock piles. • Post reclamation bond covering the cost of reclamation. • Monitor revegetation growth and diversity until release of final reclamation bond (minimum 10 years). • Monitor erosion to determine need for corrective action during establishment of vegetation. • Use grazing exclosures and vegetation monitoring during revegetation evaluation to determine suitability for post-mining land uses.
Standard and Special Lease Stipulations	• None identified at this time.
VISUAL RESOURCES AND NIGHT SKY	
Federal, State, and Local Requirements	• Restore landscape character during reclamation through returning to AOC and revegetation with suitable native and non-native species.
Special Lease Stipulations	• Employ minimization measures to reduce impacts to night sky, such as directing lighting toward the ground to reduce skyglow during nighttime mining operations.

Table 2.3. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Stipulations

WETLANDS	
Federal, State, and Local Requirements	• Identify all wetlands that would be affected by mining. • Identify jurisdictional wetlands (USACE). • Replace all jurisdictional wetlands that would be disturbed by mining. • Replace functional wetlands as required by surface managing agency, surface landowner, and/or DOGM. • Monitor reclaimed wetlands using the same procedures used to identify pre-mining jurisdictional wetlands.
Standard and Special Lease Stipulations	• None identified at this time.
WILDLIFE	
Federal, State, and Local Requirements	• Restore pre-mining topography to the maximum extent possible. • Plant a diverse mixture of grasses, forbs, and shrubs in configurations beneficial to wildlife. • Design fences to permit wildlife passage. • Follow power transmission pole guidance from Avian Power Line Interaction Committee (2005). • Increase habitat diversity by creating rock clusters and shallow depressions on reclaimed land. • Use appropriate plantings along reclaimed drainages. • Replace drainages, wetlands, and AVFs disturbed by mining. • Enforce appropriate vehicle speed limits to minimize mortality. • Instruct employees not to harass or disturb wildlife. • Follow approved raptor mitigation plans such as USFWS Utah Field Office Guidelines for Raptor Protection from Human and Land-use Disturbances (USFWS 1999). • Conduct baseline and annual wildlife monitoring surveys. • Monitor for migratory bird species of management concern in Utah.
Standard and Special Lease Stipulations	• None identified at this time.

If impacts that are not addressed by the existing required mitigation measures (see Table 2.3) are identified during the NEPA process, the BLM can require potential mitigation measures, in the form of stipulations on the lease, within the limits of its regulatory authority. In general, the levels of mitigation and monitoring required for surface coal mining by SMCRA and Utah State law are more extensive than those required for other surface-disturbing activities; however, concerns may periodically be identified that are not normally monitored or mitigated under existing procedures. These concerns would be addressed by DOGM under the requirements of the ongoing five-year permit review process.

2.5.2 Two-tracks and Routes within the Alton Coal Tract

Besides KFO Route 116, other roads exist within the tract, including routes on BLM-administered land and two-track roads located on private land (see Maps 1.2 and 2.1). Routes located on BLM-administered land and overlying coal reserves would either be temporarily closed or relocated (following avoidance criteria previously detailed) during active mining operations to allow for full recovery of coal resources in these areas. Following mining, these routes would be replaced in accordance with the travel plan in the land-use plan, and any temporary routes created would be reclaimed. Two-track roads located on private land and overlying coal reserves would be closed during active mining operations. Permanent or temporary relocation of these roads would be determined in consultation with the private land owner. This EIS analysis assumes that two-track roads located on private land would be closed during active mining operations and replaced in their preexisting locations and conditions following completion of mining and reclamation.

2.5.3 Reasonably Foreseeable Potential Short Haul Route (tract to Kanab Field Office Route 116 North of Alton)

One reasonably foreseeable potential short haul route exists for transporting coal from the tract to KFO Route 116 north of the town of Alton (Map 2.3). This route would traverse private surface on Block NW south of Alton, and would then head north across private surface and connect with KFO Route 116 west of Alton. This short haul route is described as reasonably foreseeable because it is already planned for potential use by the applicant (ACD) for moving mined coal from the Coal Hollow Mine, adjacent to the tract, to KFO Route 116 west of Alton. If the BLM decides to hold a competitive lease sale for the tract and a lease is issued to ACD, it is reasonably foreseeable that ACD would continue to use this short haul route while mining coal reserves contained in the tract. A successful bidder other than ACD may use a different short haul route between the tract and KFO Route 116 west of Alton. Given that BLM lacks the ability to predict the plans of a successful bidder other than ACD, attempting to guess at other potential short haul routes that may be used by a successful bidder other than ACD would be speculative and, therefore, in this EIS, no consideration is given to these routes. In the event of a competitive lease sale, if the final short haul route differs such that impacts are created that are not addressed here, additional NEPA analysis would be required.

2.5.4 Reasonably Foreseeable Coal Loadout Location and Transportation Route

Transportation of mined coal reserves from the tract to market would be dictated by existing roads and market conditions at the time of sale of mined coal. Construction and use of a rail loadout at Iron Springs, approximately 11 miles west of Cedar City, Utah, is currently the reasonably foreseeable loadout location. The transportation of coal to the rail loadout location would occur via KFO Route 116 continuing north through the town of Alton, north on US-89, west on SR-20, and finally south on I-15 exiting at exit number 59 in Cedar City. This approximately 110-mile route is currently the reasonably foreseeable

transportation route linking the tract and the loadout. Map 2.4 shows the rail loadout location and the transportation route. The loadout location and transportation route, as described, are reasonably foreseeable because they are already planned for use by the applicant (ACD) for moving mined coal from the Coal Hollow Mine, adjacent to the tract, to market. If BLM decides to hold a competitive lease sale and a lease is issued to ACD, it is reasonably foreseeable that they would continue to use this rail loadout and transportation route while mining coal reserves contained in the tract. A successful bidder other than ACD may use a different loadout location, transportation route, or both, to move mined coal from the tract to market. Given that BLM cannot predict the plans of a successful bidder other than ACD, the following would be speculative: attempting to guess at loadout location (or locations), transportation route (or routes), or both, that may be used by a successful bidder other than ACD. Therefore this EIS gives no consideration to other potential loadout locations and transportation routes.

In the event of a competitive lease sale, if the final loadout location and transportation route differ such that impacts are created that are not addressed here, additional NEPA analysis would be required.

2.6 Alternatives and Options Considered but Eliminated From Detailed Analysis

The BLM reviewed several potential alternatives and options during the course of alternatives development. Based on technical, economic, and environmental factors, as well as legal and regulatory constraints, and in light of past, present, and reasonably foreseeable future actions, none of these alternatives or options was carried forward for detailed analysis in this EIS. The rationale for eliminating each alternative (Section 2.6.1) and option (Section 2.6.2) from further analysis is discussed below.

2.6.1 Alternatives Considered but Eliminated from Detailed Analysis

Aside from the Proposed Action and Alternative C, 12 alternatives (Alternatives D through O below) were considered during the course of alternatives development. Each of these was eliminated from detailed analysis in the EIS. Sections 2.6.1.1 through 2.6.1.12 provide descriptions of these alternatives along with the rationale for eliminating each of them from detailed analysis.

2.6.1.1 ALTERNATIVE D: ALTON COAL DEVELOPMENT'S ORIGINAL LEASE BY APPLICATION SUBMITTAL

As indicated in Chapter 1, in November 2004 ACD submitted an LBA (Case Number UTU 081895) to mine federal coal, using primarily surface-mining methods, near the town of Alton, Utah. This LBA submittal contained nearly 2,683 surface acres and approximately 38 million tons of recoverable coal (Map 2.5 shows the original LBA submittal). Due to 1) the identification of additional recoverable coal reserves not included in the LBA, as submitted; 2) additional surface acreage BLM deemed necessary for mine operations; and 3) the need to exclude the Alton cemetery (to comply with regulations under 43 CFR 3461), the BLM reconfigured the tract to include approximately 898 additional surface acres and approximately 11 million additional tons of recoverable coal. The tract as reconfigured is the Proposed Action. Due to reasons as described, ACD’s LBA as submitted was not carried forward for detailed analysis. Other tract configurations based on ACD’s original LBA submittal were considered to address issues. Each of these was also eliminated from detailed analysis. Descriptions of these alternatives along with the rationale for eliminating each of them from detailed analysis are contained in Sections 2.6.1.8 (Alternative K) and 2.6.1.9 (Alternative L).

2.6.1.2 ALTERNATIVE E: NO SURFACE MINING

An alternative suggested during public scoping identified mining of coal reserves in the tract by use of underground recovery methods. BLM reviewed the feasibility of this alternative and determined that anticipated surface cover (shallow overburden over much of the tract composed largely of unconsolidated material) within the tract would not facilitate this mining method over most of the tract. Furthermore, underground mining methods would significantly reduce the recovery rate of coal in the tract (from 90% to 50%) where shallow overburden facilitates surface-mining methods.

Where overburden exceeds approximately 200 to 300 feet, it is anticipated that underground mining methods would be employed to recover in-place coal reserves. Overburden exceeds 200 to 300 feet over approximately 717 to 412 acres of the tract. This is the point at which underground mining methods would become more feasible than surface-mining methods, depending on economic conditions. The technical feasibility of underground mining would need to be evaluated at the time that surface mining may no longer be an economic option.

2.6.1.3 ALTERNATIVE F: POSTPONE LEASING DECISION UNTIL COMPLETION OF THE KANAB FIELD OFFICE RESOURCE MANAGEMENT PLAN REVISION

This alternative would postpone a competitive lease sale until completion of the KFO RMP. Postponing a competitive lease sale would allow the BLM to carry forward any alternatives in their RMP revision process that would result in designation of some or all of the tract and surrounding lands as unsuitable for surface mining or surface effects from underground mining.

This alternative is not necessary to preserve options for decisions in the RMP process because the RMP process is now complete and the area in and near the tract as defined in this EIS is considered suitable for surface mining and surface effects from underground mining under the KFO RMP. The *Final Coal Unsuitability Report* contained in the KFO RMP (2008b) determined that the lands in question are suitable for surface mining and surface effects from underground mining based on most of the coal unsuitability criteria under 43 CFR 3461. Some coal unsuitability criteria (Criteria 2, 3, 9, 15, 16, 18, and 19) were left undetermined in the *Final Coal Unsuitability Report* (2008b). These criteria are addressed in this EIS. Further, other coal unsuitability analyses have been performed on this area and have determined that the area is suitable for surface mining and surface effects from underground mining. See the DOI's secretarial decision document entitled, *Petition to Designate Certain Federal Lands in Southern Utah Unsuitable for Surface Coal Mining* (DOI 1980b).

2.6.1.4 ALTERNATIVE G: POSTPONE LEASING DECISION UNTIL MORE ENVIRONMENTALLY FRIENDLY COAL MINING PRACTICES ARE AVAILABLE

This alternative is based on the speculative assumption that more environmentally friendly coal mining practices will be developed in the foreseeable future, and that the use of these methods for mining in-place coal reserves contained in the tract would significantly reduce the impacts of mining.

Although more environmentally friendly coal mining techniques and practices may be developed, the timeline for the development of these potential techniques is unknown at this time. To establish a date for postponement of a competitive lease sale would therefore be speculative and the chosen date would be arbitrary. Furthermore, the degree to which potentially more environmentally friendly mining techniques would reduce impacts is not known because these mining methods have not been developed, or even

proposed. To assume that more environmentally friendly mining methods would significantly reduce the impacts of mining coal from the tract would also be speculative.

2.6.1.5 ALTERNATIVE H: CONSTRUCT A COAL-FIRED POWER PLANT NEXT TO THE TRACT

An alternative suggested during the public scoping period identified the construction of a coal-fired power plant next to the tract as a way to eliminate impacts due to the transportation of coal resources from the tract to market. This alternative would not meet the purpose and need (see Section 1.2) for the Proposed Action and alternatives and was therefore eliminated from detailed analysis in this EIS. A coal lease obtained from the BLM makes coal available for leasing but does not place constraints on its ultimate use or the location of that use. Further, considering approval of the construction and operation of a coal-fired power plant next to the tract would be outside of the framework established for this EIS when ACD submitted the Alton Coal Tract LBA to lease and mine federal coal reserves. ACD's application does not include a proposal to construct or operate a coal-fired power plant as a part of their proposal to lease and mine federal coal reserves.

Also, the total environmental impacts of Alternative H would be greater than the impacts of transportation of coal from the tract to the reasonably foreseeable rail loadout facility. This is particularly true because coal-fired power plants generally require more coal on a yearly basis than would be produced from the tract, which would likely mean that additional coal would need to be transported to the area.

2.6.1.6 ALTERNATIVE I: PROMOTE THE DEVELOPMENT OF ALTERNATIVE SOURCES OF ENERGY

Under this proposed alternative, the BLM would choose not to offer the tract for competitive leasing. Instead, the BLM would promote the development of alternative sources of energy, such as wind and solar, on lands contained within the tract as well as elsewhere within the KFO. This alternative does not meet the purpose and need (see Section 1.2) for the Proposed Action and alternatives and was therefore eliminated from detailed analysis in this EIS. In a similar manner as considering the construction of a coal-fired power plant next to the tract, foregoing coal leasing in favor of the development of alternative sources of energy would be outside the framework established for this EIS when ACD submitted their LBA to lease and mine federal coal reserves in the tract. ACD's application did not include a proposal to develop alternative sources of energy on the LBA tract or elsewhere in the KFO. A primary goal of the Energy Policy Act is to add energy supplies from diverse sources. If an alternative energy proposal were received, a separate NEPA analysis would be conducted.

2.6.1.7 ALTERNATIVE J: COAL TRANSPORTATION ALTERNATIVES

During the public scoping period, one reasonably foreseeable transportation route was presented to the public (Iron Springs' rail loadout via US-89, SR-20, and I-15; see Map 2.4 and Section 2.5.4 for a map and description, respectively). Due to concerns regarding transportation impacts along this route, several transportation alternatives were suggested. The BLM considered these alternatives and eliminated them from detailed analysis for the reasons outlined in the bulleted list below.

- Due to operations at the Coal Hollow Mine adjacent to the tract, approximately 153 coal truck round-trips would already be taking place on existing area roads and highways. Approval of the lease and mining on the tract would not result in new traffic impacts but would extend the life over which these impacts occur.

- Decisions regarding the transportation of coal from the tract to market are dictated by market conditions and the intended use of the coal resource at the time of mining and sale of coal. Limiting the ability of the successful bidder to efficiently deliver coal resources to market would not fully meet the purpose and need for the Proposed Action and alternatives because leasing and mining the coal is intended to meet market needs wherever they occur.
- Coal trucks and loads used by the successful bidder would be required to meet state and federal guidelines and regulations. Coal trucks would be legally permitted to use any road or highway not already restricted from truck traffic. Any decision to limit or curtail the use of these roads by trucks (coal trucks or otherwise) is regulated by Kane, Garfield, and Iron counties and UDOT, and it is outside the scope of this EIS and the BLM's jurisdiction.

A decision to lease on the part of the BLM would not approve any particular transportation route. This EIS presents an analysis of reasonably foreseeable impacts from reasonably foreseeable activities to meet NEPA hard-look disclosure requirements. The elimination of transportation alternatives from detailed analysis in this EIS does not mean that transportation impacts are not addressed. These impacts are addressed in detail in Chapter 4, Environmental Consequences.

During the public scoping period, transportation of coal by slurry or conveyor was also suggested. The BLM eliminated each of these alternatives from detailed analysis because they are not reasonable for the following reasons: 1) the volume of coal to be recovered from this LBA tract would not justify the large expenditures to implement either of these alternatives; 2) construction and operation of slurry lines or a large conveyor system would disturb more acreage, create more visual intrusion, and result in an overall increase in environmental consequences as compared to trucking of coal; and 3) slurry lines and conveyor systems are difficult to move once constructed, their construction as an alternative to any potential trucking routes would require that customers for the mined coal be identified prior to the conclusion of the EIS process, including putting agreements in place to ensure that markets identified now would continue to be viable at the completion of the EIS process.

2.6.1.8 ALTERNATIVE K: TRACT MODIFICATIONS TO ADDRESS CONCERNS RELATED TO GREATER SAGE-GROUSE AND BIG GAME

During the public scoping period, impacts to sage-grouse and big game were expressed as concerns. To address these concerns, BLM considered alternatives to the Proposed Action that removed portions of the tract known to be used by the local sage-grouse population according to recently collected radio collar data. Under one alternative (Alternative K1), Block NW and Block S were removed from the tract (Map 2.6). Another alternative (Alternative K2), based in part on the LBA as submitted by ACD, would remove a small portion of Block NW and another small portion of Block S from the tract (Map 2.7). Both of the blocks eliminated under Alternative K2 are within the no-coal zone. This alternative would also place timing restrictions on mining operations conducted by the successful bidder (no surface disturbance in Block NW and Block S from March 15 to July 15 and no surface disturbance within 0.5 mile of the existing, nearby lek during the lekking period, February 15 to March 15). To address big game concerns, the BLM considered requiring the successful bidder to leave buffers between forage and cover wherever possible.

Alternative K1 was eliminated from detailed analysis in the EIS due primarily to the fact that removal of Block NW and Block S from the tract would create a situation in which the remaining portion of the tract (Block C) would be sandwiched between two fee coal areas to which ACD already has access. This would effectively make an otherwise competitive bidding process noncompetitive; this tract configuration would essentially create an alternative 'tailor made' for ACD. Further, assuming that ACD would be the successful bidder, this alternative would eliminate approximately 19,000,000 tons (approximately 40%) of the coal reserves from the tract. For any other successful bidder, this alternative would eliminate

approximately 26,000,000 tons (approximately 57%) of coal from the tract. More coal would be eliminated from the tract for any successful bidder other than ACD because ACD would be able to mine coal through the boundaries of the tract adjacent to the fee coal areas (due to the existing access they would have from adjacent fee coal areas). Any other bidder would be required to keep mining operations within the tract boundaries (i.e., highwalls created for surface-mining operations would be able to abut but not cross fee coal area boundaries), translating into lower recovery rates of coal reserves within the tract for any other bidder. Eliminating these two blocks would also create a potential coal bypass issue whereby coal reserves in these blocks would not be economically recoverable in the future as stand-alone, separate lease tracts. Maximum economic recovery of the coal resource is a BLM directive that must be balanced against the need to address other issues, concerns, and regulatory requirements. However, given that any successful bidder must comply with special lease stipulations developed for the tract, in addition to already existing and hereafter promulgated regulations to reduce impacts on the environment, the complete elimination of these two blocks from the tract to address potential resource impacts is not justified at this time. A variation on Alternative K1 is considered in detail as part of Alternative C (see Section 2.4).

The tract configuration as described under Alternative K2 was not carried forward for detailed analysis in the EIS primarily because it does not represent a meaningful change from the tract configuration under the Proposed Action. The tract configuration under Alternative K2 would only be reduced by approximately 241 acres (7%) compared to the Proposed Action. Also, projected total surface disturbance under Alternative K2 would be approximately 17 acres (0.7%) less than that projected under the Proposed Action. Further, Block S is a good candidate for proposed on-site mitigation measures for sage-grouse and other sagebrush-dependent species, and it makes more sense to retain this block under all alternatives for this purpose than to eliminate it. Except for those restrictions that would also apply to Block NW, surface disturbance timing restrictions described under this alternative were carried forward for detailed analysis as part of Alternative C (see Section 2.4).

To address concerns related to impacts to big game and big game habitat, BLM considered a requirement that the successful bidder leave buffers between big game forage and cover wherever possible. This alternative was eliminated from detailed analysis because it would have limited utility given the large range used by big game, because similar habitat exists in substantial acreages adjacent to the tract, and because of the likelihood that these buffers would not be used by big game in such close proximity to mining operations.

2.6.1.9 ALTERNATIVE L: TRACT MODIFICATIONS TO ADDRESS CONCERNS RELATED TO KANAB CREEK AND POSSIBLE ALLUVIAL VALLEY FLOORS

During the alternatives development process, alternatives intended to reduce potential impacts to Kanab Creek and possible AVFs were considered. One alternative (Alternative L1) would require the successful bidder to mine the central-western portion of the tract (Block Central Western North [CWN] and Block Central Western South [CWS]) from west to east and to remove from the tract that portion of the tract in the no-coal zone to the east of these two blocks (Map 2.8). Another alternative (Alternative L2) would remove the central-western portion (Blocks CWN and CWS, including the no-coal zone) from the tract altogether (Map 2.9). Neither of these alternatives was carried forward for detailed analysis in the EIS.

First, neither alternative would provide a benefit to water quality that would be substantially greater than the water quality protection measures already required by law and regulation. Further, Alternative L1 would create more impact than the Proposed Action or Alternative C by requiring that light-use roads be routed within the LBA around the central portion (no-coal zone) of the tract rather than across this area, therefore increasing the length of the road and not eliminating road stream crossings (either way one to

two road stream crossings would be required). Additionally, Alternative L2 would likely result in the bypass of the coal contained in Block CWS (and perhaps CWN as well) because this coal would become isolated and is not present in quantities great enough (approximately 1,900,000 tons and 1,200,000 tons for Block CWS and CWN, respectively) to be economically recoverable as a separate, stand-alone lease tract.

2.6.1.10 ALTERNATIVE M: MAXIMIZE FLEXIBILITY OF MINING OPERATIONS

Under this proposed alternative, the tract configuration and preliminary mine plan would be the same as under the Proposed Action. However, no avoidance criteria (outside of that required by existing law and regulations) would be in place for siting of centralized or dispersed facilities, and the successful bidder would be allowed to disturb (pit disturbance) up to 360 acres of land prior to beginning reclamation activities. The purpose of this alternative was to maximize flexibility in mining operations for the successful bidder and, therefore, to increase maximum economic recovery of the coal resource. This alternative was eliminated from detailed analysis in the EIS because it did not provide a more comprehensive benefit than the Proposed Action in terms of meeting purpose and need. In other words, this alternative would result in more adverse impacts than the Proposed Action without resulting in a substantial increase in maximum economic recovery of the coal resource.

2.6.1.11 ALTERNATIVE N: NITROGEN DIOXIDE EMISSIONS CONTROL MEASURES

Comments provided during the scoping period suggested that BLM should consider measures to ensure that unsafe levels of NO_2, which may be emitted as a result of blasting and engine exhaust, are not released to the environment. During the alternatives development process, BLM considered including NO_2 control measures in one or more alternatives. However, due to measures already required by existing laws and regulations (see Table 2.3) to control NO_2 emissions, BLM did not carry any of these alternatives forward for detailed analysis. Emission control measures for NO_2 provided under any alternative would not provide a substantially greater benefit in terms of preventing NO_2 emissions than preventative measures already required.

2.6.1.12 ALTERNATIVE O: RESTRICT MINING OPERATIONS TO DAYLIGHT HOURS

To eliminate the potential for skyglow and impacts to the quality of night skies near the tract, BLM considered an alternative that would restrict mining activities to daylight hours only. This alternative was not carried forward for detailed analysis because mining and transporting 2 million tons of coal annually, during daylight hours only, would result in greater impacts than allowing nighttime operations. This is because the successful bidder would need to increase equipment use, increase the number of pits open at one time, and increase the volume of trucks required to deliver coal to market. Further, in terms of reduced skyglow and quality of night skies near the tract, the benefits of this alternative as compared to allowing nighttime operations would be limited because lighting requirements for nighttime mining operations would already be limited in nature, and minimization measures would be required, as described in Table 2.3. The gain in reduced skyglow by restricting mining operations to daylight hours would not compensate for increased adverse impacts as described.

2.6.2 Options Considered but Eliminated from Detailed Analysis

Certain components of the federal action would be independent of the elements of any alternative. In the EIS, these were considered options, any one of which could be chosen in combination with any alternative and would not necessitate changes in the alternative, or vice versa. Those options that were considered but not carried forward for detailed analysis are described below.

2.6.2.1 KANAB FIELD OFFICE ROUTE 116 RELOCATION OPTIONS

Under SMCRA the approval of surface-mining operations on lands within 100 feet of the outside line of the ROW for a public road requires a process resulting in a final decision by DOGM or the public road authority. At this juncture the coal underlying KFO Route 116, and underlying a buffer zone extending 100 feet on either side of the outer edges of the road, is currently considered unsuitable for mining. However, this EIS analysis assumes that an agreement to relocate the road would be reached. During the alternatives development process, several options for addressing SMCRA requirements with respect to KFO Route 116 were considered. These included the following:

- Option A: Permanently rerouting KFO Route 116 around (outside) the tract on adjacent lands
- Option B: Permanently closing KFO Route 116 without establishing an alternate, replacement route
- Option C: Closing KFO Route 116 for the duration of mining activity and reestablishing the road in its original (current) roadbed following mining activity

These options were eliminated from detailed analysis in the EIS for one or more of the following reasons: 1) Kane County would not agree to the proposed option; 2) the proposed option would result in more impacts than KFO Route 116 relocation options being considered for detailed analysis within the alternatives, without providing substantially greater benefit; 3) the proposed option would permanently or for a substantial period of time (the life of the mine) cut off access to private lands, public rangelands, or both; and 4) SMCRA would not allow the option if it were chosen.

2.6.2.2 TWO-TRACKS AND ROUTES WITHIN THE TRACT

In addition to KFO Route 116, two-tracks on private land and routes on BLM-administered land exist within the tract. The BLM considered permanently closing routes on BLM-administered land. However, such closures would permanently restrict access to these lands by permittees and would eliminate routes used for recreation. Given the current frequent use of these routes by these users (especially permittees), BLM could not justify permanent closure. Further, some of the routes that would be closed under this option would restrict access of private landowners to their private surface estates.

2.6.2.3 POWER GENERATION OPTIONS

Approximately 2–3 megawatts of electrical energy output would be required at any one time for mining operations on the tract under either the Proposed Action or Alternative C (see Section 2.3.2.6). In addition to the use of diesel-powered generators to supply this energy, which is considered in detail, supplying power via a transmission line (three possible points of origin) or a combination of diesel-powered generators and a transmission line was considered. Transmission line options considered were as follows:

- Option A: Creating a transmission line extension from US-89 at the junction with KFO Route 116 near the town of Alton to the tract
- Option B: Creating a transmission line extension from Kanab to the tract
- Option C: Creating a transmission line extension from Todd’s Junction in Garfield County to the tract

Option A was not carried forward for further analysis because this transmission line extension would only be able to supply the mine operation with approximately 500 kilowatts of energy, approximately 17%–25% of the power needed to operate the mine. Under this scenario, the successful bidder would need to use generators to meet the remaining energy needs (75%–83%) of the mine. The quantity of electrical energy that could be supplied under this option would not justify the cost of investing in construction of the transmission line given the need to continually use diesel-powered generators to supply most of the energy.

Option B was not carried forward for further analysis due to the high cost of transmission line construction ($15,000,000–$20,000,000, according to estimates provided by Garkane Energy), and the fact that this option would only provide approximately 1 megawatt of energy for mining operations (approximately 33%–50% of the power needed to operate the mine). According to estimates provided by ACD, the cost of transmission line construction would never be paid back over the life of the mine; conducting mining operations solely with the use of diesel-powered generators is estimated to be cheaper over the life of the mine than transmission line construction. Also, under this option, the successful bidder would still need to use diesel-powered generators to supply 50%–67% of the energy required for mining operations.

The reasonably foreseeable Garkane Energy 138-kilovolt transmission line between Tropic and Hatch would create an opportunity to supply power to the mining operation via a transmission line originating at Todd's Junction (Option C). According to estimates provided by Garkane Energy, this transmission line would be able to supply 2–3 megawatts of energy to the tract, and the cost of transmission line construction would be a fraction of that under Option B. This option would be viable assuming that 1) the ongoing NEPA process related to the construction of the Garkane Energy 138-kilovolt transmission line between Tropic and Hatch results in construction of a line; 2) the successful bidder, in coordination with Garkane Energy, could obtain ROWs across all private land, as necessary, between Todd's Junction and the tract in a timely fashion (or at all); 3) Garkane Energy could guarantee that 2–3 megawatts of energy would be supplied to the tract for the projected life of the mine; and 4) there would be limited time lag (no more than one year) between the beginning of mine operations and the completion of transmission line construction. If any one of the aforementioned assumptions were violated, this option would no longer be viable. For this reason, it would be speculative to consider this as an option in this EIS, and it was therefore eliminated from detailed analysis.

2.7 Comparison of Alternatives

The following tables (Table 2.4 and Table 2.5) compare the No Action Alternative, Proposed Action, and Alternative C. Table 2.4 contains a summary comparison of the alternatives and Table 2.5 contains a summary comparison of direct and indirect impacts. The tables are presented to give a concise summary of the alternatives in a comparative form. The environmental consequences are fully analyzed in Chapter 4, Environmental Consequences. Under NEPA, all federal agencies are required to provide a detailed statement on:

- the direct and indirect environmental impacts of the Proposed Action and alternatives to the Proposed Action, including the No Action Alternative;
- any adverse environmental impacts that cannot be avoided;
- the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity;
- any irreversible and irretrievable commitments of resources; and
- the cumulative impacts of the action, when added to other past, present, and reasonably foreseeable future actions.

Table 2.4. Summary Comparison of Alternatives

Item	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
Recoverable Coal Reserves (short tons)[*]	0	44,900,000–49,100,000[#]	38,100,000–42,300,000
Federal Mineral Lease (acres)[†]	3,581	3,581	3,178
Private Surface Lease (acres)[‡]	1,296	1,296	893
Federal Surface Lease (acres)	2,280	2,280	2,280
Projected Annual Coal Production (short tons)	0	2,000,000	2,000,000
Projected Mine Life (years)	0	25	21
Projected Surface Disturbance from Pits (acres)	0	1,750–2,152	1,454–1,856
Projected Surface Disturbance from Centralized Facilities (acres)	0	36	36
Projected Surface Disturbance from Dispersed Facilities (acres)	0	160	135
Projected Surface Disturbance from KFO Route 116 Relocation	0	47 (17 actual road + 30 ROW)	37 (13 actual road + 24 ROW)
Total Projected Surface Disturbance (acres)	0	1,993–2,395	1,662–2,064
Projected Surface Disturbance During Active Mining (acres/number of pits)[§]	0	120/1	240/2
Projected Permanent Disturbance from EODA (acres/number of EODAs)	0	0/0[¶]	40–60/1
Projected Area of Underground Mining Operations[x]	0	717–412	717–412
Projected Area of Surface Impacts Due to Subsidence (acres)[**]	0	513–211 (+166-109 outside the tract)	513–211 (+166-109 outside the tract)
Projected Annual Water Use (Gallons)	0	8,112,000	8,112,000
Projected Power Needs (megawatts) and Method of Delivery	0	2–3 diesel-powered generators	2–3 diesel-powered generators
Normal Operating Hours (hours/days per week/days per year)	0/0/0	24/6/312	24/6/312
Projected Number of Employees	0	160	160
Projected Truck Traffic (truck roundtrips per day between the tract and the loadout location)	0	153	153
Special Timing Restrictions in Place for Block S	n/a	None	February 15–March 15 (lekking); March 15–July 15 (nesting/brooding)

[*] Under the No Action Alterna ive, coal present (approximately 59,600,000 tons) would not be mined, and therefore these coal resources would not represent coal reserves.

[#] Where a range of tons, acres, or other units is provided this reflects the range between approximately an average of 200 and 300 feet of overburden removal where surface mining would occur under the Proposed Action and Alternative C. Deeper coals would be removed using underground mining methods.

[†] Federal mineral lease acres represent the total acres present in the tract whether or not they are leased. Private surface and federal surface acres do not add to total federal mineral lease acres due to errors explained in Table 2.1.

[‡] Private surface lease acres represent the total private surface acres present in he tract whether or not they would be leased.

[§] This refers to areas with open surface-mining pits from which coal is being removed and/or areas where topsoil and/or overburden is being removed.

[¶] If BLM decides to hold a competi ive lease sale for the tract under the Proposed Action, and there is a successful bidder other than ACD, one EODA would be required under this alternative.

[x] The projected area of underground mining operations is calculated as the approximate location where underground coal recovery would begin to the tract boundary. The range of acres provided corresponds to the range of potential overburden removal from 200 feet (with 717 acres underground mined) to 300 feet (with 412 acres underground mined).

[**] See Chapter 4 Section 4.6 Geology and Minerals for a further explanation of surface impacts due to subsidence.

Impacts can be beneficial or adverse, and can be a primary result of an action (direct) or a secondary result (indirect). They can be permanent (irreversible), long term (occurring or remaining after the cessation of coal mining and during, or continuing, into the period following the reclamation and monitoring period), or short term (the period when the development of the mine and the mining of coal would occur). The level of impacts may also vary. The basis for conclusions regarding significance are the criteria set forth by the Council on Environmental Quality (40 CFR 1508.27) and the professional judgment of the specialists doing the analyses. Impacts can be significant during mining but be reduced to less-than-significant levels following completion of reclamation or mitigation. Definitions of the magnitude of impacts associated with the No Action Alternative, the Proposed Action, and Alternative C are presented, as appropriate, in Chapter 4, Environmental Consequences. A summary of impacts is provided in Table 2.5.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
4.2	**Aesthetic Resources–Noise**	No impacts to aesthetic resources (noise) would occur under the No Action Alternative.	Increased ambient noise levels within and near the tract and along the coal haul transportation route would occur for the life of the mine (25 years) under the Proposed Action.	Increased ambient noise levels within and near the tract and along the coal haul transportation route would occur for the life of the mine, except that under Alternative C, the noise associated with mining would be located further from the town of Alton and the life of the mine would be 21 years.
	Aesthetic Resources–Visual Resources	No impacts to aesthetic resources (visual) would occur under the No Action Alternative.	Under the Proposed Action, short-term modifications would occur to the basic elements of form, line, color, and texture from surface-mining disturbances and presence of facilities. If the 120-acre tracks of coal are removed and rehabilitated, the existing character of the landscape would be gradually restored. The level of change to the landscape would be consistent with visual resource management (VRM) Class IV objectives.	Impacts would be the same as those described under the Proposed Action, except that a greater acreage of visual contrasts at any one time would result during mining operations and fewer total acres would be disturbed.
	Aesthetic Resources–Night Sky	No impacts to aesthetic resources (night sky) would occur under the No Action Alternative.	There would be a perceptible increase in nighttime skyglow from artificial lighting used during mining operations under the Proposed Action. This effect would persist for 25 years. Potential skyglow visible from Yovimpa Point within Bryce Canyon National Park would be less than that produced by several small towns in the general area. Additionally, potential skyglow visible from Brian Head Peak outside of Cedar Breaks National Monument would be much less than skyglow produced by St. George and Cedar City, Utah.	Impacts would be the same as those described under the Proposed Action, except that the effect would persist for 21 years.
4.3	**Air Resources–PM_{10}**	Under the No Action Alternative, no impacts with respect to PM_{10} would occur as a function of mining. Existing and future emissions sources would result in concentrations of PM_{10} within the NAAQS.	Under the Proposed Action, existing and future emissions sources would result in concentrations of PM_{10} within the NAAQS for the 200-foot overburden removal scenario; however, concentrations may exceed the NAAQS for the 300-foot overburden removal scenario.	Under Alternative C, existing and future emissions sources may result in concentrations of PM_{10} exceeding the NAAQS for both overburden removal scenarios.
	Air Resources–$PM_{2.5}$	Under the No Action Alternative, no impacts with respect to $PM_{2.5}$ would occur as a function of mining. Existing and future emissions sources would result in concentrations of $PM_{2.5}$ within the NAAQS.	Under the Proposed Action, existing and future emissions sources would result in concentrations of $PM_{2.5}$ within the NAAQS.	Under Alternative C, existing and future emissions sources would result in concentrations of $PM_{2.5}$ within the NAAQS.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
	Air Resources–NO_x	Under the No Action Alternative, no impacts with respect to NO_x would occur as a function of mining. Existing and future emissions sources would result in concentrations of NO_x within the NAAQS.	Under the Proposed Action, existing and future emissions sources would result in concentrations of NO_x within the NAAQS for the 200-foot overburden removal scenario; however, concentrations may exceed the NAAQS for the 300-foot overburden removal scenario.	Under Alternative C, existing and future emissions sources would result in concentrations of NO_x within the NAAQS for the 200-foot overburden removal scenario; however, concentrations may exceed the NAAQS for the 300-foot overburden removal scenario.
	Air Resources–Volatile Organic Carbons (VOC)	Under the No Action Alternative, no impacts with respect to VOC would occur as a function of mining. Existing and future emissions sources would continue to have impacts.	Under the Proposed Action, VOC emissions would be small compared to regional sources. Impacts with respect to VOC would be well within regulatory limits.	Under Alternative C, VOC emissions would be small compared to regional sources. Impacts with respect to VOC would be well within regulatory limits.
	Air Resources–CO	Under the No Action Alternative no impacts with respect to CO would occur as a function of mining. Existing and future emissions sources would result in concentrations of CO within the NAAQS.	Under the Proposed Action, existing and future emissions sources would result in concentrations of CO within the NAAQS.	Under Alternative C, existing and future emissions sources would result in concentrations of CO within the NAAQS.
	Air Resources–SO_2	Under the No Action Alternative no impacts with respect to SO_2 would occur as a function of mining. Existing and future emissions sources would result in concentrations of SO_2 within the NAAQS.	Under the Proposed Action, existing and future emissions sources would result in concentrations of SO_2 within the NAAQS.	Under Alternative C, existing and future emissions sources would result in concentrations of SO_2 within the NAAQS.
	Air Resources–CO_2	Under the No Action Alternative no impacts with respect to CO_2 would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to CO_2.	Under the Proposed Action impacts with respect to CO_2 would occur as a function of mining. There currently is no measure as to the acceptability of these impacts. Existing and future emissions sources would continue to have impacts with respect to CO_2.	Under the Alternative C impacts with respect to CO_2 would occur as a function of mining. There currently is no measure as to the acceptability of these impacts. Existing and future emissions sources would continue to have impacts with respect to CO_2.
	Air Resources–Hazardous Air Pollutants (Benzene, Toluene, Xylenes, Formaldehyde, Acetaldehyde, and Acrolein)	Under the No Action Alternative no impacts with respect to HAPs would occur as a function of mining. Existing and future emissions sources would continue to have impacts.	Under the Proposed Action the potential emissions of HAPs would be well below threshold exposure levels. No adverse impacts are anticipated.	Under Alternative C the potential emissions of HAPs would be well below threshold exposure levels. No adverse impacts are anticipated.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
	Air Resources– Near-field Visibility	Under the No Action Alternative no impacts with respect to visibility would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to visibility.	Under the Proposed Action the maximum impacts inside of Bryce Canyon National Park from a potential mine plume would be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.	Under Alternative C the maximum impacts inside of Bryce Canyon National Park from a potential mine plume would be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.
	Air Resources– Far-field Visibility	Under the No Action Alternative no impacts with respect to visibility would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to visibility.	Under the Proposed Action the extinction changes are within the acceptable range.	Under Alternative C the extinction changes are within the acceptable range.
	Air Resources– Deposition	Under the No Action Alternative no impacts with respect to deposition would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to deposition.	Under the Proposed Action impacts for sulfur and nitrogen deposition are below the minimum green line value in all cases.	Under Alternative C impacts for sulfur and nitrogen deposition are below the minimum green line value in all cases.
	Air Resources– Greenhouse Gases	Under the No Action Alternative no impacts with respect to greenhouse gases (GHG) would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to GHG.	Under the Proposed Action, annual GHG emissions (CO_2) would be approximately 0.015% of estimated 2008 global GHG emissions.	Under Alternative C, annual GHG emissions (CO_2) would be approximately 0.015% of estimated 2008 global GHG emissions.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
4.4	**Cultural Resources**	No impacts to cultural resources, beyond those that occur due to existing uses of the area, would occur under the No Action Alternative. In addition, management of cultural resources on BLM-managed lands within the tract would continue at the discretion of the BLM under the KFO RMP.	Under the Proposed Action, 69 or 70 archaeological sites elig ble for the NRHP would be completely or partially removed by pit disturbance. In addition, the following would occur under this alternative: • Four NRHP-eligible archaeological sites would be completely or partially destroyed by construction of centralized facilities. • As many as two NRHP-eligible archaeological sites would be completely or partially destroyed by the relocation of KFO Route 116. • Approximately five NRHP-eligible archaeological sites would be completely or partially destroyed by the construction of dispersed facilities. • Underground mining could impact previously unidentified archaeological sites through subsidence. • An unknown number of previously unidentified archaeological sites could be impacted by pit disturbance, construction of centralized or dispersed facilities, or KFO Route 116 relocation. • Sites not directly impacted by surface mining or facilities construction would be subject to indirect effects from vandalism, looting, or unintentional destruction for the 25-year mine life. • Native American TCPs would be subject to adverse effects to their integrity of setting, feeling, and association due to visual, auditory, and other atmospheric impacts from mining activity for the 25-year mine life. • Panguitch Historic District and Utah Heritage Highway 89/Mormon Pioneer Heritage Area would be subject to adverse effects to their integrity of setting, feeling, and association due to an incremental increase in coal truck traffic for the 25-year mine life	Under Alternative C, 63 NRHP-eligible archaeological sites would be completely or partially destroyed by pit disturbance. In addition, the following would occur under this alternative: • Four NRHP-eligible archaeological sites would be completely or partially destroyed by construction of centralized facilities. • As many as two NRHP-eligible archaeological sites would be completely or partially destroyed by the relocation of KFO Route 116. • Approximately five NRHP-eligible archaeological sites would be completely or partially destroyed by the construction of dispersed facilities. • Underground mining could impact previously unidentified archaeological sites through subsidence. • An unknown number of previously unidentified archaeological sites could be impacted by pit disturbance, construction of centralized or dispersed facilities, or KFO Route 116 relocation. • Sites not directly impacted by surface mining or facilities construction would be subject to indirect effects from vandalism, looting, or unintentional destruction for the 21-year mine life. • Native American TCPs would be subject to adverse effects to their integrity of setting, feeling, and association due to visual, auditory, and other atmospheric impacts from mining activity for the 21-year mine life. • Panguitch Historic District and Utah Heritage Highway 89/Mormon Pioneer Heritage Area would be subject to adverse effects to their integrity of setting, feeling, and association due to an incremental increase in coal truck traffic for the 21-year mine life.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
4.5	**Fire Management**	No impacts to fire management would occur under the No Action Alternative.	Under the Proposed Action, approximately 1,815–2,217 acres of vegetation would be removed during mining and construction activities, which would result in the greatest risk of human-caused wildfires of all the alternatives. The revegetation of this entire acreage with suitable native and non-native species and the suppression of cheatgrass (*Bromus tectorum*) would lead to reduced FRCC ratings in these areas. 6.5 miles of new roads would be constructed due to the relocation of KFO Route 116. This increase in new road would result in an increased risk of human-caused wildfires from construction activities. The construction of centralized and dispersed facilities on 196 acres under the Proposed Action could lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation. In addition, increased movement to and from the tract by construction equipment and coal-haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. An estimated 153 coal-haul vehicle round-trips per day are expected.	Impacts would be similar to those described under the Proposed Action, except that approximately 1,515–1,917 acres of vegetation would be removed during mining and construction activities and 4.6 miles of new roads would be constructed due to the relocation of KFO Route 116. This is more than the No Action but fewer than the Proposed Action. There would be an overall greater risk of human-caused wildfires compared to the No Action but a lesser risk compared to the Proposed Action due to fewer acres disturbed and a shorter time period when activities would take place (21 years instead of 25 years). The construction of centralized and dispersed facilities on 171 acres under Alternative C could lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation. In addition, increased movement to and from the tract by construction equipment and coal-haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. An estimated 153 coal-haul vehicle round-trips per day are expected.
4.6	**Geology and Minerals**	No impacts to geological or mineral resources would occur from surface mining under the No Action Alternative.	Under the Proposed Action, changes in topography, physiography, and stratigraphy would result from 1,750–2,152 acres of surface mining.	Under Alternative C, changes in topography, physiography, and stratigraphy would result from 1,454–1,856 acres of surface mining.

Table 2.5. Summary of Impacts

Section Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
	No impacts to geological or mineral resources would occur from underground mining under the No Action Alternative.	Under the Proposed Action, subsidence and changes to stratigraphy would result from 513 to 211 acres of underground mining.	Impacts would be the same as those described under the Proposed Action.
	No impacts to geological or mineral resources would occur from subsidence under the No Action Alternative.	Under the Proposed Action, subsidence would occur within 513 to 211 acres within the tract. Approximately 166–109 acres of subsidence would occur within the angle of influence outside the tract.	Impacts would be the same as those described under the Proposed Action.
	No fault hazards from underground mining would occur under the No Action Alternative.	Slight fault hazard would occur from underground mining under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
	No impacts to geological or mineral resources would occur from landslides under the No Action Alternative.	A risk to structures would occur on or near landslide deposits under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
	No coal would be removed under the No Action Alternative.	Removal of 44.9–49.1 million tons of coal would occur under the Proposed Action.	Removal of 38.1–42.3 million tons of coal would occur under Alternative C.
	Under the No Action Alternative, no impacts to geological or mineral resources would occur from fluid mineral removal due to high fluid mineral potential.	Decreased likelihood of fluid mineral removal due to mining activities would occur under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
	No impact to burnt shale would occur under the No Action Alternative.	Possible burial of burnt shale resources would occur under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
	No impact to gravel would occur under the No Action Alternative.	Possible burial of gravel resources would occur under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
	No impact to septarian nodules would occur under the No Action Alternative.	Possible damage of burial of septarian nodules would occur under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
	Underground coal fires have the potential to occur through spontaneous combustion. Historical reviews and site visits have not shown any indication of past coal mine fires near the Alton Coal Tract.	Underground coal fires have the potential to occur through spontaneous combustion. Historical reviews and site visits have not shown any indication of past coal mine fires near the Alton Coal Tract. There is an increased risk of coal fires under the Proposed Action due to more coal being exposed to oxygen. Surface mining has occurred in the Alton Coal Tract in the past, and there is no evidence of fires during mining.	Impacts would be the same as those described under the Proposed Action.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
4.7	**Hazardous and Solid Waste**	No Impacts to hazardous and solid waste would occur under the No Action Alternative.	Under the Proposed Action, movement to and from the tract by service vehicles and coal-haul trucks would have the potential to increase the risk of fuel leakage or solid waste spills in the tract and adjacent transportation corridors. Accidental or inadvertent leakages from storage tanks would also be poss ble. Spills would have adverse effects on soil, water, vegetation, and wildlife resources. Potential impacts would be mitigated through SOPs and through the creation of other plans and policies that relate to hazardous materials disposal, transport, and emergency response.	Impacts would be the same as those described under the Proposed Action with the following exceptions. The acreage of dispersed facilities constructed would be fewer than under the Proposed Action, and therefore the associated risks, such as fuel leakage and storage tank leakage, would be smaller under this alternative. Mining activities under this alternative would take place over the course of 21 years, which is four years shorter than under the Proposed Action.
4.8	**Land Use and Access**	Land uses would continue in their current condition under the No Action Alternative.	Under the Proposed Action, 2,280 acres of federal land and 1,296 acres of private land would be unavailable for grazing and recreation access during mining activities (life of mine). Agriculture, tourism, and recreation activities would also be prohibited or restricted during the 25-year mine life.	Under Alternative C, 2,280 acres of federal land and 893 acres of private land would be unavailable for grazing and recreation access while mining activities were occurring. Impacts would be slightly fewer than the Proposed Action with 403 fewer acres available for mining. Agriculture, tourism, and recreation activities would also be proh bited or restricted during the 21-year mine life.
4.9	**Livestock Grazing**	No impacts would occur to grazing from the No Action Alternative. Grazing would continue in its current condition.	Impacts under the Proposed Action would consist of the temporary loss of forage as a result of restricted access, spread of noxious weeds, and/or decreased palatability from construction dust on 1,733–2,135 acres; the temporary loss of water sources and range improvements, such as fences and cattle guards; the loss of 3,220 AUMs within seven allotments over the life of the mine and reclamation period; and livestock mortality from vehicle collisions.	Impacts under Alternative C would be the same as the Proposed Action, except that there would be restricted access for 31 years, resulting in impacts to 290 fewer vegetation acres and 368 fewer AUMs.
4.10	**Paleontology**	No impacts to paleontological resources would occur under the No Action Alternative.	Impacts to paleontological resources under the Proposed Action could occur on approximately 1,750–2,152 acres of land that would be disturbed for pits, 196 acres of disturbance for centralized and dispersed facilities, and 17 acres of disturbance to relocate KFO Route 116. Impacts would include destruction/loss of paleontological resources in situ as well as educational opportunities arising from discovery.	Impacts to paleontological resources under Alternative C could occur on approximately 1,454–1,856 acres of land that would be disturbed for pits, 171 acres of disturbance for centralized and dispersed facilities, and 13 acres of disturbance to relocate KFO Route 116. Adverse impacts would include destruction/loss of paleontological resources in situ. Beneficial impacts would include educational opportunities arising from discovery.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
4.11	**Recreation**	Recreation would not be impacted as a function of mining under the No Action Alternative. Presently occurring land uses would continue to interact with recreation trends in the analysis area under this alternative.	The Proposed Action would result in a loss of 3,581 acres of lands available for dispersed recreation from mining over the 25-year mine life. This represents 0.4% of all lands available for big game hunting in the Paunsaugunt Plateau Management Area (PPMA). Approximately 13 miles of designated OHV routes would be temporarily removed over the life of the mine, representing a 0.7% decrease in OHV routes within the BLM KFO. In addition, displacement of recreational users onto 92,573 acres of adjacent public lands would affect recreational experiences of users on those lands. Approximately 3.9% of the recreation analysis area would be directly or indirectly affected by mine-related actions.	Alternative C would result in a loss of 3,178 acres of lands available for dispersed recreation from mining over the 21-year mine life. This represents 0.3% of all lands available for big game hunting in the PPMA. Impacts to OHV routes would be the same as the Proposed Action. In addition, displacement of recreational users onto 92,573 acres of adjacent public lands would affect recreational experiences of users on those lands. Approximately 3.4% of the recreation analysis area would be directly or indirectly affected by mine-related actions.
4.12	**Socioeconomics**	Socioeconomic conditions would be similar to current conditions under the No Action Alternative.	The Proposed Action would result in 160 direct jobs, 320 indirect jobs, $6.5 million in annual wages, $1.49 to $1.57 billion total recovery value, $186.62 to $197.30 million total royalty revenue; and $93.31 to $98.64 million royalty revenue disbursed to the State of Utah. Additional taxes, fees, and payments would result, based on production amount. The Proposed Action would result in adverse impacts to: known recreation uses in the area (hunting and OHV use); current sense of community, social well-being, and tourism-related businesses; population, housing, and public health and safety; and environmental justice populations.	Socioeconomic impacts would be similar to the Proposed Action. However, shortening the life of the mine by four years would result in an approximately 17% decrease in revenues, taxes, fees and payments. Alternative C would result in $1.25 to $1.32 billion total recovery value, $103.44 to $111.43 million total royalty revenue, and $78.38 to $82.11 million total revenue disbursed to the State of Utah.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
4.13	**Soils**	No impacts to soils would occur under the No Action Alternative.	Under the Proposed Action, 1,993–2,395 acres of soils would be disturbed by surface mining and by the construction of related facilities and roads. Of this total, 1,750–2,152 acres of soil resources would be disturbed by surface mining, and 243 acres would be disturbed by related activities, including the construction of centralized and dispersed facilities, the relocation and construction of roads, and the grading of road ROWs. Impacts under the Proposed Action would be considerably greater than would occur under the No Action Alternative due to the large-scale removal and replacement of soils that would occur during proposed surface-mining operations (which would not occur under the No Action Alternative). Surface-mining activities under the Proposed Action would drastically disturb soil resources through the large-scale removal, stockpiling, and replacement of soils during surface mining. A total of 1,750–2,152 acres of soils would be removed to its full depth where surface mining takes place, and topsoil and suitable subsoil would be stockpiled for reclamation. The disturbance (impact) caused by removing and replacing soils, as described above, would be long term. Most of the impacts (caused by facilities, some roads, etc.) would be long-term impacts, persisting for the life of the mine.	Under Alternative C, 1,662–2,064 acres of soils would be disturbed by surface mining and the construction of related facilities and roads. Of this total, 1,454–2,484 acres of soil resources would be disturbed by surface mining, and 208 acres would be disturbed by other related activities, including the construction of centralized and dispersed facilities, the relocation and construction of roads, and the grading of road ROWs. Impacts under Alternative C would be of the same nature as under Proposed Action, but to a lesser degree.
4.14	**Transportation**	No impacts to transportation would occur under the No Action Alternative.	There would be a 2% increase in commuter traffic and coal truck traffic through Cedar City. Additional coal truck traffic would cause a 4% increase in traffic through Hatch and Panguitch.	Impacts would be the same as those described under the Proposed Action, except that the life of the mine would be 21 years instead of 25 years.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
4.15	**Vegetation**	No impacts to vegetation would occur under the No Action Alternative.	Under the Proposed Action, 1,733–2,135 acres would be removed by surface mining (of the 3,555 acres of vegetation in the tract). In addition, approximately 47 acres of vegetation would be removed for the relocation of KFO Route 116, approximately 36 acres of vegetation would be removed for centralized facilities, and approximately 160 acres of vegetation would be removed for dispersed facilities. Under the Proposed Action, the acres of land suscept ble to weed invasion would be increased by a range of 1,563–2,640 acres, and all disturbed acres would be reclaimed and revegetated during the 25-year mine life and a 10-year restoration period.	Impacts under Alternative C would the same as those described under the Proposed Action, but to a lesser degree. Under Alternative C, 1,454–1,856 acres would be removed by surface mining (of the 3,161 acres of vegetation in the tract). In addition, approximately 36 acres of vegetation would be removed for the relocation of KFO Route 116, approximately 36 acres of vegetation would be removed for centralized facilities, and approximately 135 acres of vegetation would be removed for dispersed facilities. Under Alternative C, the acres of land susceptible to weed invasion would be increased by a range of 1,875–2,615 acres, and all disturbed acres would be reclaimed and revegetated during the 21-year mine life and a 10-year restoration period.
4.16	**Water Resources–Stream channel**	No stream relocation would occur under the No Action Alternative.	Under the Proposed Action, 0.49–0.81 mile of Robinson Creek would be relocated, potentially affecting stream function, associated riparian corridor, and water quality.	Impacts would be the same as those described under the Proposed Action.
	Water Resources–Surface water	No change in surface water quality or quantity would occur under the No Action Alternative.	Under the Proposed Action, runoff from 1,750 to 2,152 acres would be diverted to retention ponds. Associated loss from evaporation and infiltration would range from 29 to 35 acre-feet per year. In addition, small sediment load to streams would occur from dispersed facilities and road ROW, and a loss of in-stream dilution could increase concentration of TDSs over state water quality standard of 1,200 mg/L. Under the Proposed Action, reduced in-stream flows could result in less water available for irrigation downstream. In addition, a small risk of surface water contamination from accidental spills to 48–49 miles of stream that are within 100 m of the transportation route could occur, as well as a small increase in fine particles in streams associated with deposition of fugitive dust and coal dust.	Under Alternative C, runoff from 1,454 to 1,892 acres would be diverted to retention ponds. Associated loss from evaporation and infiltration would range from 24 to 30 acre-feet per year. All other impacts would be the same as those described under the Proposed Action, except for a shorter period of time.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
	Water Resources–Groundwater	No change in groundwater quality or quantity would occur under the No Action Alternative.	Under the Proposed Action, there would be a loss of 25 acre-feet of groundwater per year used for dust suppression for 25 years (625 acre-feet total), a loss of 200–300 acre-feet per year of water as coal moisture for 25 years (4,600–6,900 acre-feet), and a groundwater loss of 116 acre-feet per year due to evaporation in pits for 25 years (2,668 acre-feet). Groundwater loses would be up to approximately 6% of the total estimated groundwater available in the zone from which groundwater would be extracted for use in mining operations.	Under Alternative C, there would be a loss of 25 acre-feet of groundwater per year used for dust suppression for 21 years (525 acre-feet), a loss of 200–300 acre-feet of water as coal moisture for 21 years (3,800–5,700 acre-feet), and a groundwater loss of 233 acre-feet per year due to evaporation in pits for 21 years (4,427 acre-feet). Groundwater loses would be up to approximately 6% of the total estimated groundwater available in the zone from which groundwater would be extracted for use in mining operations.
	Water Resources–Wetlands, Riparian Areas, Floodplains, and Alluvial Valley Floors	No impacts to wetlands, riparian areas, floodplains, or AVFs would occur under the No Action Alternative.	There would be a direct removal and loss of function to 55.5 acres of wetlands under the Proposed Action. In addition, impacts would occur to 6.7–10 acres of riparian area and 8.0 acres of floodplain/AVFs due to construction of dispersed facilities; impacts to these areas would include loss of habitat, destabilization of streambanks, flood plain storage and attenuation, water filtration, and groundwater recharge.	There would be no impact on wetlands under Alternative C. Under Alternative C, impacts would occur to 6.3–9.6 acres of riparian area and 7.2 acres of floodplain/AVFs due to construction of dispersed facilities; impacts to these areas would include loss of habitat, destabilization of streambanks, flood plain storage and attenuation, water filtration, and groundwater recharge.
	Water Resources–Subsidence	No impacts to water resources would occur from subsidence under the No Action Alternative.	Under the Proposed Action, subsidence would occur on 513 to 211 acres within the tract. Approximately 166–109 acres of subsidence would occur within the angle of influence outside the tract. Potential subsidence-related water resources impacts include potential changes to surface drainage and deterioration of surface-water quality as well as changes to groundwater levels, flow, and quality	Impacts would be the same as those described under the Proposed Action.

Table 2.5. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
4.17	**Wildlife**	No Impacts to wildlife, as a function of mining the tract, would occur under the No Action Alternative.	Direct and indirect impacts under the Proposed Action would occur to wildlife and special status species from habitat fragmentation, alteration, loss, and displacement due to surface disturbance, noise, ground v bration, night lighting, and increased risk of vehicle mortality associated with approximately 153 coal-haul truck round-trips per day. In addition, surface mining, infrastructure, and road development would remove 1,975–2,377acres (56%–67%) of wildlife and special status species habitats within the 3,555-acre tract. Approximately 36 acres of habitats would be disturbed for the relocation of KFO Route 116. Mining activities under the Proposed Action would occur 24 hours a day and six days a week over the 25-year mine life. All disturbed acres would be reclaimed and revegetated concurrently with mining and over the 10-year restoration period.	The nature of impacts under Alternative C would be the same as under the Proposed Action but would differ in acreages and timing. Direct impacts under this alternative would occur from the removal of 1,650–2,052 acres (52%–65%) of wildlife and special status species habitats within the 3,161-acre tract. Approximately 44 acres would be disturbed for the relocation of KFO Route 116. In addition, mining activities would occur 24 hours a day and six days a week over the 21-year mine life. All disturbed acres under this alternative would be reclaimed and revegetated concurrently with mining and over the 10-year restoration period.

CHAPTER 3. AFFECTED ENVIRONMENT

CHAPTER 3 AFFECTED ENVIRONMENT

3.1 Introduction

This chapter presents the existing environment, including the cultural, physical, biological, social, and economic resources, values, and uses, which would be affected by the Proposed Action and alternatives. The affected area consists of the Alton Coal Tract (hereafter generally referred to as the tract) and the reasonably foreseeable coal haul transportation route, as identified in the Interdisciplinary Team Analysis Record Checklist (Appendix G) and presented in Chapters 1 and 2 of this impact statement. This chapter provides the baseline for comparison of impacts and consequences described in Chapter 4. Management issues identified by the BLM, public scoping, and interdisciplinary analysis of the area have guided the material presented herein.

3.1.1 General Setting

The tract is located in Kane County, Utah approximately 0.10 mile south of the town of Alton and 2.9 miles east of U.S. Route 89 (US-89). The tract occurs at approximately 6,900 feet above sea level in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001) of south-central Utah. The tract is located in the Alton Amphitheater between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and approximately 5.0 miles north and northwest of the Grand Staircase-Escalante National Monument. Mean annual precipitation in the town of Alton was approximately 16 inches from 1928 to 2006, and mean annual temperature for this same time period was 60.2 degrees Fahrenheit (F) (2006). The Colorado Plateau province receives most of its precipitation in the form of snow during the winter months; summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (2006). The tract is characterized by a series of low-rising hills and benches cut by the north–south running Kanab Creek and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large open areas of bunchgrass, perennial grasses, and sagebrush interspersed with dense stands of juniper and pinyon pine. Tall fir trees are apparent on the more rugged mountains to the northwest of the tract. Generally, the vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines. A map of the tract in relation to surrounding towns, highways, existing and potential fee coal areas, and other area landmarks is presented in Map 1.1.

Under the Proposed Action, the tract includes approximately 3,576 acres of land. All coal resources located within the tract are federally (BLM) owned and managed. Approximately 2,280 surface acres of the tract are under BLM management, and the remaining 1,296 surface acres are under private ownership. Under Alternative C, the tract includes approximately 3,173 acres of land. As under the Proposed Action, all coal resources under this tract configuration are federally (BLM) owned and managed; although, surface ownership is split between the BLM (2,280 acres) and private owners (893 acres). Coal reserves are known to occur beneath approximately 2,152 and 1,856 acres of the tract under the Proposed Action and Alternative C, respectively.

The entirety of the reasonably foreseeable coal haul transportation route (hereafter referred to simply as the coal haul transportation route) also occurs in southern Utah, more specifically in Kane, Garfield, and Iron counties near Alton, Hatch, Panguitch, and Cedar City. The total length of the route is approximately 110 miles (see Map 2.4). Existing vehicle traffic consists of local residents; tourists to Bryce Canyon National Park, Dixie National Forest, and BLM-administered lands; and commercial truck traffic. Transportation infrastructure associated with the tract and the coal haul transportation route includes

numerous unimproved, dirt access roads and two-track trails, KFO Route 116, US-89, SR-20, I-15, and SR-56. The Union Pacific Railroad 21-mile branch to the Salt Lake City-Los Angeles line is located west of Cedar City, Utah and is the nearest railroad facility to the tract.

3.1.2 Supplemental Authorities and Other Resources, Values, and Uses Brought Forward for Analysis

Decisions related to the tract could affect supplemental authorities as listed in BLM's NEPA Handbook H-1790-1 (2008e) in addition to other resources, values, and uses identified during public and agency scoping. Table 3.1 lists the supplemental authorities and other resources, values, and uses brought forward for analysis. Some supplemental authorities and other resources, values, and uses identified during public and agency scoping were not brought forward for detailed analysis. These are also listed in Table 3.1, including a brief explanation for their omission from the EIS analysis.

Table 3.1. Supplemental Authorities and other Resources, Values, and Uses Considered for the Alton Coal Environmental Impact Statement

Analysis Element (supplemental authority)*	Brought Forward for Analysis	Explanation/Rationale
Aesthetic resources (soundscape, visual resources, and nighttime lighting)	Yes	Potentially affected
Air resources (air quality) (42 United States Code [USC] 7401 et seq.)	Yes	Potentially affected
Cultural resources (Native American religious concerns) (16 USC 470; 42 USC 1996)	Yes	Potentially affected
Fire management	Yes	Potentially affected
Geology and minerals	Yes	Potentially affected
Hazardous materials and hazardous and solid waste (43 USC 6901 et seq.; 43 USC 9615)	Yes	Potentially affected
Land use and access	Yes	Potentially affected
Livestock grazing (rangelands)	Yes	Potentially affected
Paleontology	Yes	Potentially affected
Prime and unique farmlands (30 USC 1201 et seq.	No	Not present
Recreation	Yes	Potentially affected
Socioeconomics (social and economic conditions, public health and safety, environmental justice) (EO 12898)	Yes	Potentially affected
Soils	Yes	Potentially affected
Transportation	Yes	Potentially affected
Vegetation and special status plant species (invasive and noxious weeds; forests; threatened, endangered, and candidate species; State of Utah and BLM Utah sensitive species)	Yes	Potentially affected
Water Resources (surface-water quality and quantity, groundwater quality and quantity, wetlands/riparian areas, floodplains, AVFs) (EO 11990)	Yes	Potentially affected
Wildlife and special status animal species (threatened, endangered, and candidate species; State of Utah and BLM Utah sensitive species; migratory birds, fish habitat) (50 CFR 600; 67 *Federal Register* 2376, January 17, 2002)	Yes	Potentially affected
Wilderness areas, WSAs, and non-WSAs with wilderness characteristics (43 USC 1701 et seq.; 16 USC 1131 et seq.)	No	Not present

Table 3.1. Supplemental Authorities and other Resources, Values, and Uses Considered for the Alton Coal Environmental Impact Statement

Analysis Element (supplemental authority)*	Brought Forward for Analysis	Explanation/Rationale
Wild and scenic rivers (16 USC 1271)	No	Not present
Areas of critical environmental concern (43 USC 1701 et seq.)	No	Not present
Native American Trust Resources	No	Not present

* Items (those brought forward for analysis) as listed under the heading "Analysis Element" correspond to section headings in Chapters 3 and 4 of this EIS. These may be the same as the supplemental authorities listed in (BLM 2008e) but not in all cases. Where headings have been changed or combined, the corresponding supplemental authori ies and/or the component sections are listed in parentheses. Potential impacts to specially designated areas (such as Bryce Canyon National Park, Cedar Breaks National Monument, and Grand Staircase-Escalante National Monument) are considered under the resource areas of concern for these areas—aesthetic resources, air resources, and recreation.

An analysis area has been identified for each analysis element to analyze potential impacts on the resource. Although analysis areas may differ between resources, the analysis area is generally defined as the outermost boundary of an area that encompasses potential direct and indirect impacts that may result from the No Action Alternative, the Proposed Action, and Alternative C. The analysis area for each resource brought forward for analysis is defined and described in the sections specifically addressing that resource.

3.1.3 Notes on Data Sources and Tract Acreage

Data and information used to describe the affected environment were gleaned from a variety of sources including internet sources, peer reviewed literature, government agency documents, current and historic permitting documents, and documents reporting the results of studies and data collection efforts completed for the EIS in specific. Key government agency documents from which data and information were extracted include larger scale planning documents, particularly the *Kanab Field Office Proposed Resource Management Plan and Final Environmental Impact Statement* (2008a) and the KFO RMP (2008b), previous EISs completed for the area (DOI 1980a, c), and smaller reports published by State of Utah and federal agencies (i.e., reports providing data and descriptions of particular resources). Documents included in the Coal Hollow PAP and reports completed by S. Petersen (2006, ACD 2008; Appendix 3), E. Petersen (Petersen Hydrologic 2007), and P. Collins (ACD 2008: Appendix 3) were also used for applicable data and information given the proximity of this mine to the tract. A variety of data and information was also gathered from a PAP submitted by Utah International Incorporated (UII) to DOGM in July 1987. In this PAP, UII proposed to mine an area including the Alton Coal Tract. Finally, seven "on the ground" studies have been completed for the affected area (tract and transportation route) in support of analyses specific to this EIS:

- a traffic study on the coal haul transportation route (Fehr and Peers 2008) (Appendix H);
- a reconnaissance-level vegetation community and habitat type study (SWCA 2007a: Appendix F) (Appendix F);
- a reconnaissance-level potential AVF study (Petersen Hydrologic 2008) (Appendix E); and
- a reconnaissance-level potential, jurisdictional wetland study (Collins 2008b: Appendix F);
- a detailed survey for sandloving penstemon (Collins 2008a: Appendix F);
- a night sky darkness impact study (Dark Sky Partners 2009; Appendix I); and
- an air resources dispersion modeling impact study (MESI 2010; Appendix K)

The NOI published in the *Federal Register* (Volume 71, Number 228, Tuesday, November 28, 2006) noting the BLM's intent to prepare an EIS for the tract indicates a tract acreage of "3,581.27 acres more or less." In this analysis, a tract acreage of approximately 3,576 acres is used rather than the approximately 3,581.27 acres listed in the NOI. As explained in Table 1.1 and 2.1 in Chapters 1 and 2, respectively, the tract acreage was refined and determined for analysis using a variety of sources for boundary data, such as hardcopy maps provided by ACD, the USGS 7.5-minute topographic map for the area, and a BLM shapefile of coal ownership. As a result of combining these relatively disparate sources of spatial data, and given that data sources are not survey accurate, approximately 5.0 acres of error was detected (hence a tract acreage of 3,576 acres rather than 3,581). Furthermore, the ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary.

3.2 Aesthetics Resources

Aesthetic resources are elements of the human environment that are perceived and enjoyed by people surrounding the Alton Coal Tract and along the coal haul transportation route. The area of analysis for aesthetic resources possesses aesthetic qualities that are characterized by a visually diverse, rural landscape with few signs of modern development. Aesthetic resources are commonly considered visual resources, or things that are potentially seen with the naked eye. Because of the nature of the proposed action, aesthetic resources also include things that can be heard. The existing aesthetic resource conditions described in this EIS consist of the soundscape (natural sounds), visual resources (landscape), and the night sky (darkness).

3.2.1 Soundscape

The soundscape of an area is made up of both natural and human-created sounds. Sound occurs as a result of vibrations radiating through air, water, or solid objects. For the purposes of this section, noise is regarded as unwanted or nuisance sound. Exposure to prolonged, high levels of noise can result in temporary or permanent hearing loss or tinnitus (a ringing or roaring in the ears), and can also present safety issues. Although noise is known to have an effect on wildlife health and behavior, this section considers sound and noise levels as they relate to the human environment. For further information on wildlife and wildlife habitat within the area of analysis, refer to Section 3.17 Wildlife and Special Status Species. Humans experience sound based on frequency and amplitude. Frequency is defined as the number of pressure variations per second in the air. It is expressed in hertz (Hz). Humans can generally hear sound in the 20- to 20,000-Hz range. Amplitude is the volume of a sound and is expressed in decibels (dB). The threshold of human hearing is 0 dB. Decibels are measured on a logarithmic scale. A change in sound level of 10 dB is perceived by the average person as doubling (or halving) the level of loudness. Because the human ear perceives sounds differently at low frequencies than at high frequencies, measured sound levels may be adjusted to correspond to human hearing. The A-weighted decibel (dBa) is the adjusted unit of sound used to describe the human response to noise from industrial and transportation sources, including mining activities. Sound levels and characteristic impressions of common noise sources and environments are presented in Table 3.2.

Table 3.2. Common Sound Levels

Noise Source	Sound Level* (dBa)	Characteristic Impression	Relative Loudness†
Jet takeoff (50 feet)	140	Threshold of pain	64 times as loud
Rock concert near stage, jet takeoff (200 feet)	120	Uncomfortably loud	16 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Heavy diesel truck or motorcycle (25 feet)	90	–	2 times as loud
Garbage disposal (2 feet)	80	Moderately loud	Reference loudness
Vacuum cleaner (10 feet)	70	–	1/2 as loud
Light auto traffic (25 feet)	50	Quiet	1/8th as loud
Living room, bird calls	40	–	1/16th as loud
Library	30	Very quiet	–
Acoustic test chamber	10	–	–

Source: EPA 1974.
*For comparison purposes, the threshold of hearing is 0 (zero) dB.
† Relative loudness is the human judgment of different sound levels.

Although dBa indicates the level of noise at a single specific point in time, noise levels within a soundscape vary continuously and include sounds from a variety of sources. This variation can be accounted for using the equivalent continuous noise level (Leq). The Leq is the dBa average over time. Because of the greater sensitivity to noise levels at night, 10 dBa are added to any nighttime sounds before calculating a 24-hour average.

The soundscape is the area of analysis for noise because it could be affected by changes in noise or vibration levels occurring in the tract. Because noise and vibration from blasting activities may extend several miles or more, and noise from heavy machinery and coal haul trucks would extend a few hundred feet or less, the analysis area will vary under different aspects of mining operations. The area of analysis consists of the town of Alton; ranches adjacent to the tract, to Dixie National Forest, and to Bryce Canyon National Park; and the coal haul transportation route. Noise impacts would only occur where there are sensitive noise receptors to hear it.

Sensitive noise receptors are human-occupied locations and uses within a soundscape that are subject to stress, annoyance, and interference from noise. They consist of residential areas, hospitals, libraries, recreation areas, churches, and parks. The proposed tract is rural and sparsely populated. Sensitive noise receptors in the area of analysis are backcountry recreation opportunities on the Dixie National Forest, Bryce Canyon National Park, and BLM-KFO lands; the rural, residential area of Alton; and family ranches southeast of the tract. Receptors within Bryce Canyon National Park are 13.5 or more miles away from the proposed tract. Receptors on Dixie National Forest are 1.0–4.0 miles away from the tract. Residents of Alton and nearby ranches exist within 0.1 mile from the tract (the northwest portion of the tract, or Block NW) and within 2.0 miles of the location of centralized facilities. Sensitive noise receptors along the coal haul transportation route include schools, churches, hotels, parks, rental cabins, trails, residences, and recreation areas. These receptors occur in various locations within 40 feet of the coal haul transportation route.

3.2.1.1 AMBIENT AND EXISTING NOISE LEVELS

On September 15 and 16, existing, outdoor sound levels were measured at seven points in and near the town of Alton: three points in Alton, one point in Hatch, and three points in Panguitch. Measurements were recorded for each location on environmental noise data sheets (SWCA 2008). Locations were selected to be representative of sensitive noise receptors and existing noise levels within the area of analysis. The elements of sound along the entire coal haul transportation route, from the tract to the Iron Springs loadout, vary from day to night, and vary across seasons. Typical noise sources include motorized vehicle traffic, ranch machinery, aircraft traffic overhead, and wind.

In the town of Alton, sound levels were measured at three separate locations adjacent to surface streets in the town (Map 3.1). Five-minute to 15-minute measurements were used to determine an average. Average daytime levels ranged from 41 dBA Leq at the southern end of Alton to 55 dBA Leq within the town at the corner of 100 West and 100 North.

In the town of Hatch, the sound level was measured at one location, 50 feet from the centerline of US-89, on the northeast side of a church (see Map 3.1). The average daytime level was recorded at 64 dBA Leq over a period of 15 minutes.

In the town of Panguitch, the sound level was measured at three separate locations (see Map 3.1). The first was 40 feet from the centerline of Main Street. The sound level at this site was recorded for 24 hours from a sound meter placed 10 feet above ground level on a utility pole. The 24-hour average was 67 dBA Leq. The two remaining measurements were taken for 15 minutes from locations adjacent to surface streets within the town. Average daytime levels at both locations were 64 dBA Leq.

3.2.1.2 ENVIRONMENTAL PROTECTION AGENCY NOISE STANDARDS

The Noise Control Act of 1972 recognizes that uncontrolled noise can lead to impacts to the health and welfare of the nation's population. The act further declares that it is the policy of the United States to promote an environment free from noise that jeopardizes the health or welfare of the nation's population (EPA 1974). In 1974 the EPA released a document identifying a 24-hour exposure level of 70 Ldn (day-night sound level) as the level of environmental noise to prevent measurable hearing loss over a lifetime (EPA 1974). The same document identified levels of 55 dB outdoors and 45 dB indoors to prevent annoyance.

The Quiet Communities Act of 1978 promotes the development of state and local noise control programs. There is no state or local noise control program in the area of analysis; therefore, standards established by the EPA and the Mining Safety and Health Administration (MSHA) will be applied.

3.2.1.3 MINING SAFETY AND HEALTH ADMINISTRATION NOISE AND AIRBLAST STANDARDS

Hearing loss has been a health risk faced by many mine workers. In 1999 MSHA published new health standards for occupational noise exposure. These standards apply to all surface and underground metal, nonmetal, and coal mines. The purpose of these mandatory standards is to prevent occupational, noise-induced hearing loss among miners. The standards establish several circumstances where mine operators must take action (30 CFR 62.130). They are as follows:

- If miners are exposed to 85 dBa or more over an 8-hour period, they are required to enroll in a hearing protection program.
- If miners are exposed to 90 dBa or more over an 8-hour period, they must use feasible engineering and administrative controls to reduce noise levels.

- If miners are exposed to 105 dBA or more over an 8-hour period, they must ensure that they use both ear plug and earmuff-type hearing protectors.
- Miners must not be exposed to sound levels exceeding 115 dBa at any time.

3.2.2 Visual Resources

Visual resources (the landscape) consist of landform (topography and soils), vegetation, bodies of waters (lakes, streams, and rivers), and human-made structures (roads, buildings, and modifications of the land, vegetation, and water). These elements of the landscape can be described in terms of their form, line, color, and texture. Normally, the more variety of elements in a landscape, the more interesting or scenic the landscape becomes, if the elements exist in harmony with each other. The BLM manages landscapes for varying levels of protection and modification, giving consideration to other resources values and uses and the scenic quality of the landscape.

The visual analysis area consists of lands where potential alteration of the landscape from the proposed tract may be discerned. It consists of areas within and adjacent to the tract, the Grand View and Paunsaugunt Trails on the Dixie National Forest, and the town of Alton (Map 3.2). Because viewpoints from Bryce Canyon National Park occur outside the viewshed of the tract, it is not considered part of the area of analysis. Additionally, because no landscape change along the coal haul transportation route is proposed, it is not considered part of the visual analysis area.

3.2.2.1 CHARACTERISTIC LANDSCAPE

The tract lies in the Alton Amphitheater south of the town of Alton in Kane County, Utah, between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and the Gray Cliffs of the western edge of the Grand Staircase-Escalante National Monument to the south. The tract is characterized by a series of low-rising hills and benches cut by the north–south running Kanab Creek, and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large, open areas of bunchgrass; perennial grass, forbs, and shrubs; and gray-green sagebrush interspersed with dense stands of darker green juniper and pinyon pine (see Section 4.15 for a full description of vegetation resources in the tract). Tall fir trees are apparent on the more rugged mountains to the northwest. Vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines.

The landscape of the tract has been partially modified by human development and activities. Dirt roads, dispersed ranches, agricultural fields, barbed wire fence lines, and large blocks of vegetation treatments have resulted in changes to the landscape of the tract. The graded dirt road (KFO Route 116) is a reddish tan band that traverses north–south along the length of the tract. Several ranches and homes surrounded by large cottonwood trees are located east of KFO Route 116 outside the southeastern edge of the tract. Green fields and meadows occur south of Alton and in the low-lying areas between the tract and the foothills of the Paunsaugunt Plateau. Barbed wire fences lined with tall, decadent sagebrush and rabbitbrush dissect the tract in various directions. Up to 700 acres, or 20% of the tract, has undergone mechanical vegetation treatments. Large, geometric vegetation treatment areas where trees and shrubs have been mechanically knocked over occur throughout the tract, leaving down, grayish white trunks and limbs interspersed with minimal grasses and shrubs. The geometric lines of the agricultural fields and vegetation treatments are large, and they are not readily apparent from locations within the tract. However, they are visible from the elevated viewpoints along the Dixie National Forest trails on the Paunsaugunt Plateau.

Although the tract has been modified by the activities described above, the setting is natural and remains largely undeveloped with few visible buildings and structures. Tree-covered mountains and white-, tan-,

and red-colored cliffs border the tract to the north and east. In the background, east of the tract, the bright, colorful, and jagged cliffs of the Paunsaugunt Plateau on the Dixie National Forest increase the sense of a natural and undeveloped landscape.

3.2.2.2 VISUAL RESOURCE MANAGEMENT OBJECTIVES

Through the land-use planning process, BLM sets objectives for the management of landscape preservation and change. All lands are placed into one of four classes that identify the degree of acceptable landscape change or alteration, giving consideration to the scenic value of the landscape and other resource values and uses of the land. Class I objectives are established in areas where no landscape change is desired. Class IV objectives are set for landscapes where the BLM manages for uses that will result in substantial landscape changes (e.g., mining, energy development, wind farms). Classes II and III allow for varying degrees of landscape preservation and change in between Classes I and IV.

The VRM class objectives for the tract were established in the KFO RMP (2008b). Lands in the tract have been allocated to VRM Class IV management objectives (Map 3.3). The 1,296 acres of private land in the tract is not managed under any VRM class objectives. The objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view and may be the major focus of viewer attention.

3.2.3 Nighttime Lighting and the Extent of Skyglow

A natural lightscape is defined by the NPS Air Resources Division as “a place or environment characterized by the natural rhythm of sun and moon cycles, clean air, and of dark nights that are unperturbed by artificial lights” (NPS 2008d). Dark night skies are a part of the everyday experience of residents of Alton as well as part of the experience and expectation of visitors seeking recreation opportunities at NPS-managed lands. Bryce Canyon National Park has long been considered a leader in the protection and interpretation of dark skies. Park management also emphasizes the preservation of dark skies and astronomy through an extensive interpretive program, hosting dozens of astronomy educational programs throughout the year, including an annual astronomy festival held in late June.

The area of analysis for skyglow includes the tract’s surrounding lands that could be affected by changes in artificial lighting occurring from the Proposed Action and alternatives. Because lighting can disperse through the atmosphere and may extend further than 12 miles, the analysis area consists of the town of Alton, Dixie National Forest, Bryce Canyon National Park, Cedar Breaks National Monument, and Zion National Park. Because mine-related traffic would occur along existing roads associated with the coal haul transportation route and would be intermittent and in motion, no attempt was made to model lighting produced, and the coal haul transportation route is not considered in the area of analysis for skyglow.

There are several methods available for measuring skyglow and for measuring the brightness of night skies. Amateur astronomers use limiting magnitude to measure the brightness of the night sky. Limiting magnitude describes the faintest stars that can be seen with the unaided eye. Amateur astronomers compare the night sky to a star chart with known magnitudes. Limiting magnitude is then determined by the faintest star from the chart that is visible to the naked eye. Site-specific data on the darkness of the night skies over the tract were not available; therefore, the brightness of the night sky is based on the known limiting magnitude and night sky observations from Bryce Canyon National Park and Cedar Breaks National Monument. The night skies from viewpoints in Bryce Canyon National Park (e.g., Rainbow and Yovimpa points) have a limiting magnitude rating of 7.4. They are judged by NPS employees to be as dark as world class astronomical research locations (NPS 2008a). These dark night skies are the result of good air quality, low humidity, high elevation, and minimal sources of light pollution and skyglow.

Night sky conditions have been recorded by the NPS from both Yovimpa Point in Bryce Canyon National Park and from Brian Head Peak near Cedar Breaks National Monument (Personal Communication, Moore 2008). Night sky conditions are also recorded from both the east entrance and Lava Point within Zion National Park. Due to its proximity to St. George, Utah and Las Vegas, Nevada, night skies are brighter at Zion National Park than at Bryce Canyon National Park and Cedar Breaks National Monument. Additionally, most of Zion National Park is at a lower elevation and occurs within steep-walled canyons, minimizing the amount of potential light pollution that would be visible from the tract. Any perceived change in night sky conditions at Zion National Park would be less when compared with existing conditions.

Yovimpa Point is located near the southern end of Bryce Canyon National Park and is approximately 13 miles from the tract. From Yovimpa Point, there are apparent increases in night sky brightness resulting from natural air glow and from artificial light sources from 11 towns and cities surrounding the park, including Alton, Utah as well as Fredonia and Page, Arizona. In the area of sky opposite the tract, there is no apparent increase in skyglow from artificial light sources observed from Yovimpa Point. The greatest source of skyglow observed from Yovimpa Point comes from Cedar City, Utah approximately 48 miles the northwest of the tract (Dark Sky Partners 2009: Appendix I).

Brian Head Peak is located approximately 1.0 mile north of Cedar Breaks National Monument and 26.5 miles northwest of the tract. It has greater night sky brightness than that visible from Yovimpa Point. The night sky brightness comes primarily from the artificial light sources of Cedar City and St. George, Utah. The zenith of the night sky above Brian Head Peak appears approximately 6% brighter than under natural conditions, with brightness increasing closer to the horizon toward Cedar City and St. George. In addition, there are up to seven other cities and towns generating visible light domes surrounding Brian Head Peak (Dark Sky Partners 2009).

Amateur astronomers can qualitatively rank the brightness of the night sky using the Bortle Dark-Sky Scale, a numeric nine-level measure of the night sky brightness of a specific location (Table 3.3) (Bortle 2001). Under optimal conditions, Bryce Canyon National Park is assumed to have a Bortle Dark-Sky rating Class 3, equaling that of a typical, rural sky. Because there are few sources of artificial light between the park and the tract, it is further assumed that the tract is a Bortle Dark-Sky rating Class 3.

Light pollution is defined as the illumination of the night sky caused by artificial light sources (Bortle 2001). Effects of light pollution consist of a decrease in the visibility of stars and other natural night sky features, as well as disruption to natural lightscapes. Light pollution is caused by artificial light sources that are directed upward or sideways. Light then scatters throughout the atmosphere resulting in skyglow. Other factors that influence skyglow consist of humidity, snow cover, cloud cover, and increased PM in the air. Another form of light pollution is the glare that results from direct lighting.

Artificial light sources in the area of analysis include residential, commercial, and some street lighting from the Tropic, Hatch, Alton, as well as campgrounds and other developed facilities within Bryce Canyon National Park and Dixie National Forest. Because there are so few sources of light pollution, the night skies in the area of analysis are some of the darkest skies in the continental United States (NPS 2008a).

3.2.3.1 LIGHTSCAPE MANAGEMENT OBJECTIVES

The BLM does not set management objectives for night skies and lightscapes through the land-use planning process. The NPS will preserve, to the greatest extent possible, the natural lightscapes of parks. The NPS also works with park visitors, neighbors, and other agencies to prevent and minimize the intrusion of artificial lights on the night skies of national parks (NPS 2008d). Natural skyglow does occur, and can result from such things as moonlight, the Milky Way, low clouds, and airglow. Airglow is the emission of light from the Earth's upper atmosphere. NPS's policy is to consider the best 20% of night sky conditions, as recorded during night sky monitoring, when evaluating action alternatives.

Table 3.3. Bortle Dark-Sky Scale

Class	Title	Naked Eye Limiting Magnitude	Description
1	Excellent dark sky site	7.6–8.0	Zodiacal light, gegenschein, zodiacal band visible; M33 direct vision naked-eye object; Scorpius and Sagittarius regions of the Milky Way cast obvious shadows on the ground; airglow is readily visible; Jupiter and Venus affect dark adaptation; surroundings basically invisible.
2	Typical truly dark site	7.1–7.5	Airglow weakly visible near horizon; M33 easily seen with naked eye; highly structured summer Mi ky Way; distinctly yellowish zodiacal light bright enough to cast shadows at dusk and dawn; clouds only visible as dark holes; surroundings still only barely visible silhouetted against the sky; many Messier globular clusters still distinct naked-eye objects.
3	Rural sky	6.6–7.0	Some light pollution evident at the horizon; clouds illuminated near horizon, dark overhead; Milky Way still appears complex; M15, M4, M5, M22 distinct naked-eye objects; M33 easily visible with averted vision; zodiacal light striking in spring and autumn, color still visible; nearer surroundings vaguely visible.
4	Rural/ suburban transition	6.1–6.5	Light pollution domes visible in various directions over the horizon; zodiacal light is still visible, but not even halfway extending to the zenith at dusk or dawn; Milky Way above the horizon still impressive, but lacks most of the finer details; M33 a difficult averted vision object, only visible when higher than 55°; clouds illuminated in the directions of the light sources, but still dark overhead; surroundings clearly vis ble, even at a distance.
5	Suburban sky	5.6–6.0	Only hints of zodiacal light are seen on the best nights in autumn and spring; Mi ky Way is very weak or invis ble near the horizon and looks washed out overhead; light sources visible in most, if not all, directions; clouds are noticeably brighter than the sky.
6	Bright suburban sky	5.1–5.5	Zodiacal light is invis ble; Milky Way only visible near the zenith; sky within 35° from the horizon glows grayish white; clouds anywhere in the sky appear fairly bright; surroundings easily vis ble; M33 is impossible to see without at least binoculars; M31 is modestly apparent to the unaided eye.
7	Suburban/ urban transition	5.0 at best	Entire sky has a grayish white hue; strong light sources evident in all directions; Milky Way invis ble; M31 and M44 may be glimpsed with the naked eye, but are very indistinct; clouds are brightly lit; even in moderate-sized telescopes the brightest Messier objects are only ghosts of their true selves.
8	City sky	4.5 at best	Sky glows white or orange (you can easily read without additional lighting); M31 and M44 are barely glimpsed by an experienced observer on good nights; even with telescope, only bright Messier objects can be detected; stars forming familiar constellation patterns may be weak or completely invisible.
9	Inner city sky	4.0 at best	Sky is brilliantly lit with many stars forming constellations invis ble and many weaker constellations invisible; aside from Pleiades, no Messier object is visible to the naked eye; only objects to provide fairly pleasant views are the Moon, the Planets, and a few of the brightest star clusters.

Source: Adapted from Bortle 2001.

3.3 Air Resources

The air quality of a given airshed or region is determined by the topography, meteorology, location of air pollutant sources, and type, quantity, and combination of air pollutants. The calculated or measured concentrations of various pollutants are compared to established standards to evaluate the impact of a given source on regional air quality.

The following sections address the local weather and climate, the air quality regulatory requirements, and the air quality of the air resources analysis area (i.e., the near-field and far-field modeling domains as depicted in Map 3.4).

3.3.1 Climate and Weather

Utah's weather and climate are governed by altitude, latitude, and major mountain chains. These three characteristics also affect the dispersion potential of air emissions. In general, the main chain of the Rocky Mountains provides a barrier from cold Arctic weather, whereas the Sierra Nevada and Cascade mountains often prevent low-level, Pacific-storm moisture from reaching Utah. The proximity of the tract to the Wasatch Range and Plateau strongly influences its weather. The prevailing winds of the Pahvant Range and the Tushar and Brian Head mountains are westerly, and storms moving into Utah from the west encounter the south-central mountains. This mountainous terrain causes the air to rise and cool (orographic lifting), which squeezes out moisture that would otherwise pass over the area. These mountain chains also act as barriers to air mass flow and are responsible for the aridity of areas east of the mountains, which are characterized by hot, dry summers and cold, dry winters.

Synoptic (large scale) flow dominates the airflow on the mesa all along the Wasatch Plateau. In the absence of strong prevailing winds, wind movement within the valleys, canyons, and gulches is extremely complex. The terrain features suggest that there is a daily exchange of downslope and upslope flows oriented along the valley axis, which are controlled by surface heating and cooling. Downslopes (i.e., drainage flows) last longer and occur during the evening, night, and early morning hours, whereas upslope flows occur mid-day, when temperatures are at their high. Significant diurnal drainage flows can be expected along the south-central mountains. Drainage flows (slope and valley winds) commonly occur with local topographical features and may be accompanied by temperature inversions.

Daily and annual air temperatures vary considerably throughout the area and can vary greatly depending on elevation, as evidenced by monitoring data. Temperature recorded near the tract has annual, mean daily highs and lows ranging from 60.0°F to 31.1°F, respectively. July is the hottest month, with mean daily highs and lows ranging from 82.2°F to 50.0°F, respectively (Western Regional Climate Center 2010). At a higher elevation nearby, the recorded annual, mean daily temperature at Bryce Canyon National Park is 40.6°F and the annual normal highs and lows range from 54.6°F to 26.6°F. July is the hottest month with a mean daily temperature of 62.5°F, with mean daily highs and lows ranging from 78.3°F to 46.6°F (National Oceanic and Atmospheric Administration [NOAA] 2004).

Average annual precipitation in the area is 16.6 inches (Western Regional Climate Center 2010). This value compares well with the Bryce Canyon National Park data, which show average annual precipitation of 16.4 inches (NOAA 2004).

Complete weather data at the tract are not available. Data recorded at the Cedar City Station, located at the airport in Cedar City, Utah approximately 43 miles northwest of the tract, are considered representative of the tract's location (Personal Communication, UDAQ 2008). These data comprise

the only complete weather dataset available for air dispersion modeling near the tract and the coal haul transportation route. Cedar City is warmer than Alton and has an annual, mean daily temperature of 50.5°F, with annual, normal highs and lows ranging from 64.4°F to 36.5°F. July is the hottest month with a mean daily temperature of 73.6°F, with mean daily highs and lows ranging from 89.4°F to 57.8°F (NOAA 2004).

Wind data collected from Cedar City indicate that prevailing winds are from the south-southwest. A representative windrose is shown in Figure 3.1. A distinct bimodal trend is not apparent at this location.

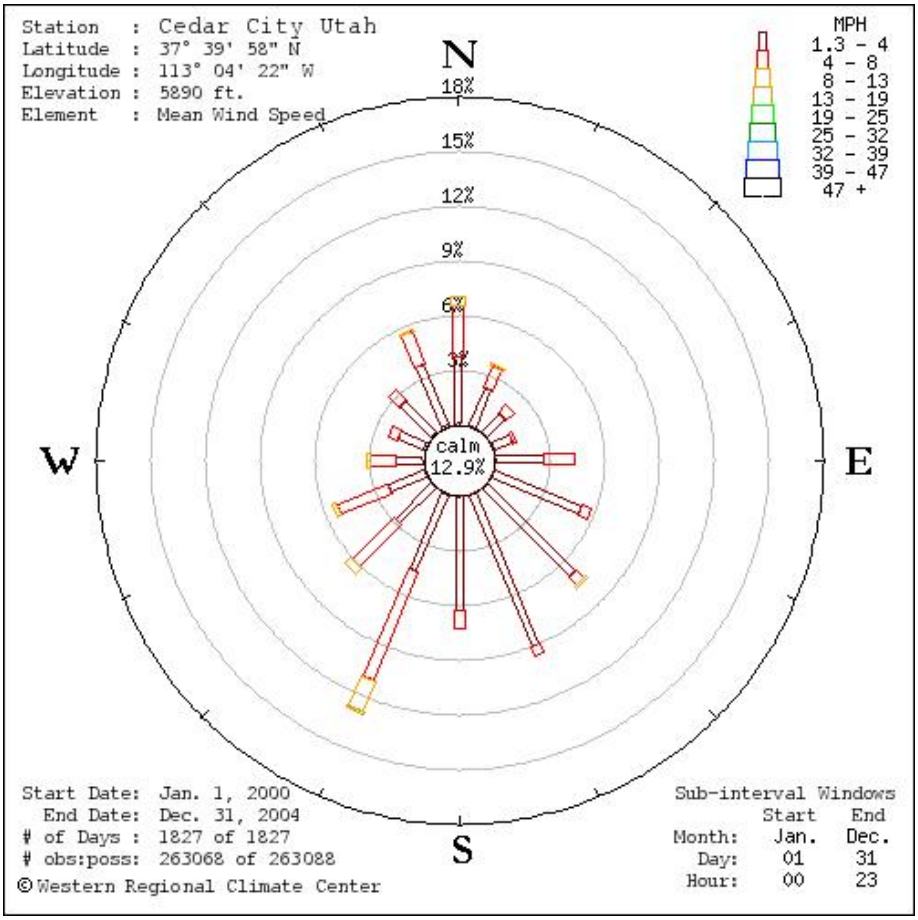

Figure 3.1. Windrose generated from Cedar City weather data (Community Environmental Monitoring Program 2011).

3.3.2 Regulatory Requirements

3.3.2.1 NATIONAL AMBIENT AIR QUALITY STANDARDS

EPA established NAAQS for six pollutants known as "criteria" pollutants. They are CO, NO_2, ozone (O_3), lead (Pb), SO_2, and PM. PM is defined as fine particulates with a nominal aerodynamic diameter of 10 micrometers or less (PM_{10}), and fine particulates with a nominal aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$). The primary standards for the criteria pollutants are health-based standards. They are set at levels to protect the health of the most sensitive individuals in the population: the very young, the very old, and those with respiratory problems or other ailments. The EPA also established secondary standards for the criteria pollutants. These are the quality of life standards that are the same as

the primary standards or less stringent than the primary standards. All of the standards are expressed as concentration and duration of exposure, and most address both short-term and long-term exposure. NAAQS for the criteria pollutants are presented in Table 3.4 (40 CFR 50.1–50.17).

Table 3.4. Environmental Protection Agency National Ambient Air Quality Standards, Significant Impact Levels, and Recorded Concentrations

Pollutant	Standard Value[a, f]	Significant Impact Levels[f]	Recorded Concentration[c]	Location[c]
CO				
8-hour average	9 ppm (10 mg/m^3)[b]	500 µg/m^3	1 ppm (1,150 µg/m^3) (estimate)	Kane County
1-hour average	35 ppm (40 mg/m^3)[b]	2,000 µg/m^3	1 ppm (1,150 µg/m^3) (estimate)	
NO_2				
Annual arithmetic mean	0.053 ppm (100 µg/m^3)[b]	1 µg/m^3	17 µg/m^3 (estimate)	Kane County
1-hour average	0.1 ppm (188 µg/m^3)[b]		n/a	
O_3				
1-hour average	0.12 ppm (235 µg/m^3)[b, g]	n/a	n/a[g]	Canyonlands National Park[d]
8-hour average	0.075 ppm (effective 5/27/2008)		0.072 ppm	
Pb				
Quarterly average	1.5 µg/m^3	n/a	0.08 µg/m^3	Magna, Salt Lake County[i]
PM_{10}				
Annual arithmetic mean	Revoked[e]	n/a	23 µg/m^3	UDAQ
24-hour average	150 µg/m^3 5 µg/m^3		72 µg/m^3	
$PM_{2.5}$				
Annual arithmetic mean	15 µg/m^3	n/a[h]	2.8 µg/m^3 [j]	Bryce Canyon [j]
24-hour average	35 µg/m^3 [e]	n/a[h]	9.5 µg/m^3 [j]	
SO_2				
Annual arithmetic mean	0.03 ppm (80 µg/m^3)[b]	1 µg/m^3	5 µg/m^3 (estimate)	Kane County[c]
24-hour average	0.14 ppm (365 µg/m3)[b]	5 µg/m^3	10 µg/m^3 (estimate)	
1-hour average	75 ppb		n/a	
3-hour average (secondary standard)	0.5 ppm (1,300 µg/m^3)[b]	25 µg/m^3	20 µg/m^3 (estimate)	

[a] CO=primary standard; NO_2, O_3, Pb, and PM=primary and secondary standards; SO_2 = annual arithmetic mean.
Mean and 24-hour average are primary standards, 3-hour average is a secondary standard.
ppm=parts per million; ppb=parts per billion.

[b] Parenthetical value is an approximate equivalent concentration in micrograms per cubic meter.

[c] Data from UDAQ, Personal Communication, 2008; UDAQ 2010. PM_{10} value is from the UDAQ state permitting for the Coal Hollow Mine.

[d] Data from NPS 2008b. The recorded value is based on the 4th high.

[e] Effective December 17, 2006.

[f] The 1-hour NO_2 NAAQS became effective April 12, 2010. The final 1-hour SO_2 NAAQS was signed June 2, 2010.

[g] Data from 40 CFR 50.1–50.17. Applies only in limited areas; as of June 15, 2005, EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact areas. The tract is not in an Early Action Compact area.

[h] Data from *Federal Register* 2007. The EPA proposed hree options for developing significant impact levels for $PM_{2.5}$. The rule has not been promulgated.

[i] Data from EPA 2005.

[j] Data from NPS 2008c. $PM_{2.5}$ background is from the Bryce Canyon National Park IMPROVE Site. The most recent 3-year average design values are from 2008.

When a designated air quality area or airshed within a state exceeds a NAAQS, that area may be designated as a "nonattainment" area. Areas with levels of a criteria pollutant below the health-based standard are designated as "attainment areas." It is possible for a geographic area to be an attainment area for one criteria pollutant, but a nonattainment area for another. To determine whether an area meets the NAAQS, air-monitoring networks have been established and are used to measure ambient air quality. Monitoring sites, by design, are located in areas where high concentrations within a region are expected to occur. The Utah air quality map shows the monitoring station locations within the State of Utah (Map 3.5).

3.3.2.2 CLASS I AREAS AND CLASS II AREAS

Clean air designations were established under the federal Clean Air Act (CAA) Title I, Part C, Prevention of Significant Deterioration (PSD) of Air Quality. Generally, the Class I air quality and land-use classification is the designation for clean, pristine airsheds and would permit little or no development, and the Class II designation is applied to all other clean airsheds (in attainment of the NAAQS) where development is permitted under state authority. Class I areas include national parks larger than 6,000 acres, national wilderness areas larger than 5,000 acres, and international parks and national memorial parks larger than 5,000 acres. Except for fires and wind erosion, the only potential for adverse air quality impacts in Class I areas is from anthropogenic pollutants transported into these areas by large-scale winds, local winds, or both. Areas in the United States that have ambient air quality concentrations greater than those specified in the NAAQS are designated as nonattainment areas; the remainder of the country is designated Class II.

3.3.2.3 PREVENTION OF SIGNIFICANT DETERIORATION

In addition to the NAAQS discussed above, the EPA promulgated PSD regulations to further protect and enhance air quality. The PSD regulations use an incremental approach and are intended to help maintain good air quality in areas that attain the national standards and to provide special protections for national parks. These increments establish the maximum increase in pollutant concentration allowed above a baseline level. Complete consumption of an increment would impose a restriction to growth for the affected area. It does not necessarily indicate an adverse health impact. PSD permits are required for major, new stationary sources of emissions that emit 250 tons (100 tons for some specific sources) or more per year of an air pollutant. Increment consumption for major sources is tracked by the State of Utah as permits are issued. The maximum allowable PSD increments over baseline are in Table 3.5.

Table 3.5. Prevention of Significant Deterioration of Air Quality Increments: Maximum Allowable Increase (μg/m^3)

Pollutant	Averaging Time	Class I	Class II
PM_{10}	24 hour	8	30
$PM_{2.5}$	Annual	n/a[a]	n/a[a]
	24 hour	n/a[a]	n/a[a]
SO_2	Annual	2	20
	24 hour	5	91
	3 hour	25	512
NO_2	Annual	2.5	25

Table 3.6 presents the PSD baseline dates triggered for the entire State of Utah.

Table 3.6. Prevention of Significant Deterioration Baseline Dates for the State of Utah

	SO_2	PM_{10}	NO_2
Major sources	August 17, 1979	August 17, 1979	April 21, 1988
Minor sources	April 1, 1990	April 1, 1990	April 21, 1988

3.3.2.4 AIR QUALITY-RELATED VALUES

Federal land managers identified air quality-related values (AQRV) to be protected in federal areas such as national parks and national forest Class I areas. AQRVs are scenic, cultural, physical, biological, ecological, or recreational resources that may be affected by a change in air quality, as defined by the federal land manager. Specific AQRVs of concern are dependent on a number of variables, including the evolving state of the science, project-specific pollutants, site-specific management concerns, and the existing condition of the AQRVs. Refer to the Existing Air Quality section for a discussion of specific AQRVs: visibility, acid rain, flora, and fauna.

3.3.2.5 GLOBAL CLIMATE CHANGE

Scientific investigation and discussion continue to address the rise in global mean temperatures, the possible causes of this rise, and whether a warming trend will continue. GHGs have been identified as a possible contributor to the rise in global mean temperatures. Ongoing scientific research has identified the potential impacts of anthropogenic (from human activities) GHG emissions and changes in biologic carbon sequestration on the global climate. Through complex interactions on a regional and global scale, these changes are thought to cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat radiated by the earth back into space, much as glass traps heat over a greenhouse.

GHGs absorb infrared radiation and trap its heat in the atmosphere. Many gases exhibit GHG properties; some occur naturally, such as carbon dioxide (CO_2), CH_4, water vapor, ozone, and nitrous oxide (N_2O). Others are synthetic, such as chlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Some of the naturally occurring GHGs are also produced by anthropogenic activities. The study of global climate change is complex because there are many factors that may contribute to changes in the earth's temperature, including the emission of GHGs, as well as the earth's ability to remove these gases from the atmosphere through mechanisms such as photosynthesis and ocean uptake. Analysis of climatic change comprises several factors, including GHG emissions, land-use management practices, and the albedo effect (i.e., the cycle of increased temperature resulting from the increased absorption of normally reflected light).

The predominant GHGs emitted in the United States are CO_2, CH_4, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. In the United States, anthropogenic GHG emissions come primarily from burning fossil fuels. Energy-related CO_2 emissions from the combustion of petroleum, coal, and natural gas accounted for 81% of total United States anthropogenic GHG emissions in 2008. "Although the industrial sector is the largest consumer of energy (including direct fuel use and purchased electricity), the transportation sector emits more CO_2 because of its near-complete dependence on petroleum fuels" (DOE/EIA 2010).

Anthropogenic CH_4 emissions from landfills, coal mines, oil and natural gas operations, and agriculture account for 11% of United States emissions. Nitrous oxide emitted through fertilizers, burning fossil

fuels, and from industrial and waste management processes accounts for 4% of total emissions. Several human-made gases account for 3% of the total (DOE/EIA 2010).

GHG inventories are usually reported in terms of "CO_2 equivalents" to account for the relative global warming potential (GWP), or a given pollutant's ability to trap heat. For example, CH_4 has a GWP of 21, meaning it is 21 times more effective at trapping heat than CO_2. Nitrous oxide has a GWP of 310, meaning it is 310 times more effective at trapping heat than CO_2. Hydrofluorocarbons range from 140 to 11,700 GWP, whereas perfluorinated compounds range from 6,500 to 9,200 GWP.

There are many regional sources that may contribute to global climate change, including those sources presented in Table 3.7. It is likely that all of the sources discussed above for the United States would be found near the tract or within the State of Utah.

3.3.3 Existing Air Quality

3.3.3.1 BACKGROUND AIR QUALITY AND REGIONAL SOURCES

Existing air quality near the tract is expected to be typical of undeveloped regions in the western United States. Limited data collected in typical undeveloped areas indicate that ambient pollutant levels are usually near or below measurable limits. Locations vulnerable to decreasing air quality include areas adjacent to surface-disturbing activities, such as energy and mineral development projects, farm tilling, and local population centers affected by residential emissions.

Data from the 2010 UDAQ statewide emissions inventory report for Kane County and Utah are shown in Table 3.7. The report summarizes criteria pollutant levels in tons per year by source type. The data illustrate that emissions in Kane County are a small percentage of statewide totals.

The greatest sources of NO_x and PM_{10} in Kane County are onroad mobile sources (automobiles and trucks traveling on established roads) and area sources (small mobile and stationary sources such as gas stations or woodburning).

Local sources of air pollution include automobiles, trains, generators, and woodburning stoves and fireplaces (in the winter). These sources typically generate CO, NO_2 and other NO_x, VOCs, and PM_{10}. Additionally, ozone, a highly reactive form of oxygen, typically forms when NO_x and VOC emissions from these sources react with sunlight on hot, still days. With the removal of leaded gasoline in the marketplace, and the absence of industries such as nonferrous smelters and battery plants, airborne-lead pollution is not an issue of concern in the area. In fact, lead is currently monitored only in Salt Lake County, Utah (EPA 2005).

The tract is classified as attainment for all criteria pollutants. No state monitoring stations exist near the tract. Background air quality levels are derived from several sources, as identified in the footnotes of Table 3.4. Concentrations are also presented in Figure 3.2.

Table 3.7. 2008 Summary of Emissions by Source (tons per year) for Kane County and Utah

Location	Source	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
Kane County	Area source	1,509.07	40.96	749.32	273.39	23.53	474.97
	Nonroad MOBILE	2,115.78	83.81	23.25	21.53	3.17	720.69
	Onroad MOBILE	3,185.58	500.94	458.26	59.16	1.46	270.27
	Point source	0.00	0.00	0.00	0.00	0.00	0.00
	Biogenics	9,133.20	0.00	0.00	0.00	0.00	47,897.91
	Wildfires	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**15,943.63**	**625.71**	**1,230.83**	**354.08**	**28.16**	**49,363.84**
Utah Total	Area source	45,711.40	8,008.52	46,766.83	12,914.13	1,036.83	45,339.83
	Nonroad MOBILE	152,516.84	23,451.76	1,828.75	1,714.86	1,179.24	24,254.28
	Onroad MOBILE	463,537.10	61,634.05	37,136.78	3,111.18	247.15	31,672.98
	Point source	21,100.69	84,755.71	11,696.12	4,023.05	28,550.43	8,805.91
	Biogenics	136,583.55	0.00	0.00	0.00	0.00	754,396.36
	Wildfires	7,258.96	206.66	878.31	790.48	0.00	1,239.96
	Total	**826,708.55**	**178,056.72**	**98,306.79**	**22,553.70**	**31,013.65**	**865,709.32**
Kane County Percentage of Utah		1.9%	0.4%	1.3%	1.6%	0.1%	5.7%

Source: UDAQ 2010.

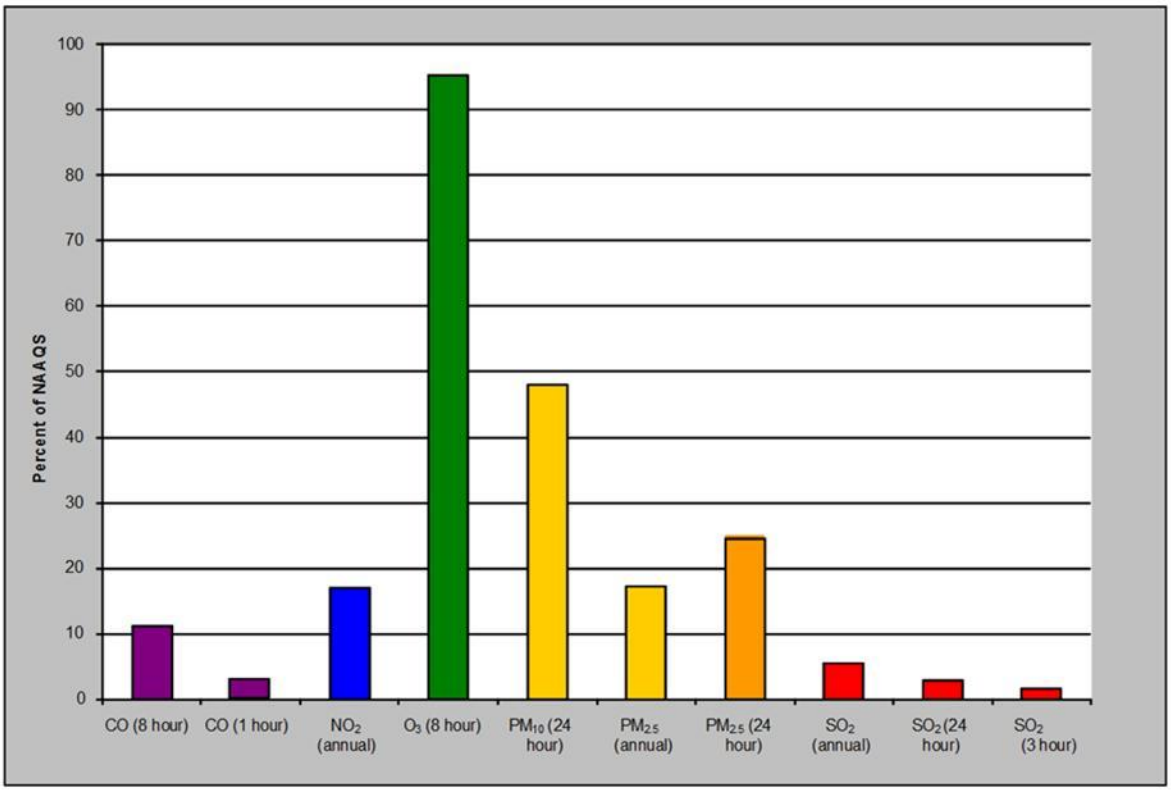

Figure 3.2. Background concentrations of criteria pollutants.

The location of the tract is designated as a Class II area for the criteria pollutants. There are several Class I and sensitive Class II parks near the tract, including Bryce Canyon, Zion, Capital Reef, and Grand Canyon national parks (all Class I), and Grand Staircase-Escalante National Monument (Class II). The closest Class I area is Bryce Canyon National Park, which is approximately 16.1 km (10 miles) from the tract. There are many regional sources that may impact the Class I areas near the tract. Table 3.8 lists point source emissions sources within 50 km (31 miles) of the Class I areas with emissions greater than PSD thresholds (emissions greater than 250 tons per year of an air pollutant), as they existed during a 1996 study with available updates noted in the table. PSD sources have the potential for significant impact, and more restrictive permitting requirements are generally imposed. No additional PSD sources were found as part of this air quality analysis. The largest contributors to air pollutant emissions in the region are power plants and generating stations (Western Regional Air Partnership 1996).

Table 3.8. Sources Near the National Park Class I Areas: Bryce, Zion, Capitol Reef, Grand Canyon (Western Regional Air Partnership 1996 except as noted)

Facility (Class I area in parentheses)	Emissions (tons per year)				
	VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Carbon Power Plant Helper, Utah (Capitol Reef)[1]	18	3,380	6,765	221	38.8
Chemical Lime Co. Nelson Lime Plant, Arizona (Grand Canyon)	16.9	719	122.2	355.7	188.5
El Paso Natural Gas Co. Environmental AF, Arizona (Grand Canyon)	975.6	2,556.4	0.5	0	0
El Paso Natural Gas Company Flagstaff Co, Arizona (Grand Canyon)	28.9	1,068.2	0.2	0	0
El Paso Natural Gas Company Hackberry Co, Arizona (Grand Canyon)[2]	14.2	461.0	0.3	10.7	0
El Paso Natural Gas Company Williams Com, Arizona (Grand Canyon)	19.6	1,508.4	0.6	0	0
Hunter Power Plant, Castle Dale, Utah (Capitol Reef)[1]	130	19,869	7,029	1,226	583.2
Huntington Power Plant, Huntington, Utah (Capitol Reef)[1]	82	11,198	13,714	1,067	341.8
Intermountain Generation Station (Delta, Utah) (Capitol Reef)	0.4	19,688.3	3,758.8	100.5	19.0
Moab Compressor Station, Moab, Utah (Capitol Reef)	17.1	470.4	0	2.3	2.3
Navajo Power Plant, Page, Arizona (Bryce, Zion, Capitol Reef, Grand Canyon)[3]	196.4	34,744	3,843	1,560.7	708.1
Phoenix Cement Portland Cement Plant, Arizona (Grand Canyon)	0	2,628.3	196.5	179	94.9
Reid Gardner, Nevada (Bryce, Zion, Grand Canyon)	49.8	14,288.3	3,547.1	874.1	874.1
Transwestern Pipeline Company, Arizona (Grand Canyon)	59.1	1,319.9	1.1	2	1.4

[1] Data from USFS 2009. VOC, NO_x, SO_2, and PM_{10} emissions updated.
[2] Data from EPA 2009. OC, NO_x, SO_2, and PM_{10} emissions updated.
[3] Data from Sourcewatch 2009. O_x and SO_2 emissions updated with 2006 emissions data.

The Coal Hollow Mine has not yet received a state construction permit. The proposed emissions are presented in Table 3.9. Based on the potential emissions, the facility would not be a major emissions source under the PSD or Title V programs. This mine would not be in operation during the operation of the tract.

Table 3.9. Coal Hollow Mine Potential to Emit

Emissions (tons per year)					
VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO
5.5	26.1	31.5	75.65	10.5	9.1

3.3.3.2 VISIBILITY

Visibility is the degree to which the atmosphere is transparent to visible light. It is an important air quality value, particularly in scenic and recreational areas. Scenic vistas in most United States parklands can be diminished by haze, which reduces contrast, dilutes colors, and reduces the distinctness or visibility of distant landscape features. Visibility degradation in national park lands and forests is a consequence of broader, regional-scale visibility impairment from visibility-reducing particles and their precursors often carried long distances to these remote locations.

Sulfates, organic matter, elemental carbon (soot), nitrogen compounds, soil dust, and their interaction with water cause most anthropogenic visibility impairment. The causes and severity of visibility impairment vary over time and from one place to another, depending on weather conditions, sunlight, and the size and proximity of emission sources.

Visibility protection requirements are included in EPA PSD regulations, which require protection of AQRVs for Class I areas. These AQRV impacts are subjective and intended to be used as guidelines for assessing potential project impacts and not as definitive regulatory thresholds. A change in contrast of not more than 10% at sensitive view areas is considered acceptable, as described in the existing FLAG guidance. Impacts greater than 10% are noted, and further investigation may be initiated. Unlike NAAQS standards and PSD increments, however, an exceedance of the 10% threshold does not, by itself, cause a project to be halted. As discussed in the previous section, the Bryce Canyon, Zion, Capital Reef, and Grand Canyon national parks (all Class I) and the Grand Staircase-Escalante National Monument (Class II) are near tract.

The State of Utah has addressed both visibility and regional haze in the Class I areas in two state implementation plans. The *Utah State Implementation Plan Section XVII Visibility Protection* report (UT 1993) addresses visibility protection of Utah's natural features and uses a two-phased approach. The first phase implements a visibility monitoring strategy and considers direct plume impacts on visibility from proposed new sources. The second phase addresses the development of a long-term plan to show progress toward national visibility protection goals. This document is still in force but has not been revised since 1993.

More current information is available in the recently revised *Utah State Implementation Plan Section XX Regional Haze* (UT 2008). This document contains measures addressing regional haze visibility impairment to ensure that the state makes reasonable progress toward national goals. The state has implemented long-term strategies to reduce regional haze resulting from various air pollution sources. For most Class I Areas in the region, stationary source NO_x and PM emissions are not considered a major contributor to visibility impairment on the average 20% best and 20% worst days; although, on some of the worst days, nitrates and PM are the main components of visibility impairment. Pollutant projections affecting regional haze, as identified in the state implementation plan, include the following:

- 33% decrease in Utah sources and 53% decrease in SO_2 emissions for the nine states in the Grand Canyon Visibility Transport Commission (GCVTC) between 1996 and 2018
- 36% decrease in Utah sources and 57% decrease in NO_x emissions for the nine states in GCVTC between 1996 and 2018
- 38% decrease in Utah sources and 31% decrease in $PM_{2.5}$ emissions for the nine states in GCVTC between 1996 and 2018
- Visibility improvement for the 20% best and worst days for each of the Class I areas (Bryce Canyon, Zion, Capitol Reef, and the Grand Canyon) between 1996 and 2018

The State of Utah's reductions in SO_2 are primarily due to that state's long-term strategy for stationary sources of SO_2. Reductions in NO_x and $PM_{2.5}$ have resulted from the implementation of new federal engine standards and fuel standards; although, stationary source NO_x emissions are projected to increase by 4% between 1996 and 2018. Although stationary source PM emissions are projected to increase, they likely cause less than 2% of the regional visibility impairment.

3.3.3.3 ACID DEPOSITION

Air pollution is produced when acid chemicals are incorporated into rain, snow, fog, or mist. This pollution is generally referred to as acid rain or acid deposition. Atmospheric deposition of air pollutants can increase the acidity of soils and water resources. The acid in the rain comes from sulfur oxides (SO_x), NO_x, products of burning coal and other fuels, and from certain industrial processes. Title IV of the Clean Air Act set a goal of reducing annual SO_2 emissions by 10 million tons below 1980 levels. To achieve these reductions, the law requires a two-phase tightening of the restrictions placed on fossil fuel-fired power plants.

Measurements of atmospheric deposition are currently being taken in Class I areas of Grand Canyon and Bryce Canyon national parks by the National Acid Deposition Program. The *2005 Annual Performance Report: Air Quality in National Parks* (NPS 2005) indicates the rates of atmospheric deposition of nitrogen and sulfur in rain are relatively low in Bryce Canyon National Park, but are elevated above natural conditions. Trends analysis shows that nitrogen deposition has no statistical trend and that sulfur deposition has slightly decreased between 1995 and 2004. The Grand Canyon trends analysis shows a degrading trend for both nitrogen and sulfate for the same period.

Kane County does not have significant sources of acid rain; however, there are significant, nearby regional power plants that are listed in Table 3.8. Regional acid rain sources in Utah include the Carbon Power Plant (Phase II acid rain source that has been issued a Phase I acid rain permit by the EPA for early NO_x reduction), the Hunter Power Plant (Phase II acid rain source), the Huntington Power Plant (Phase II acid rain source), and the Intermountain Generation Station (Group I, Phase II acid rain source) (UDAQ 2009). The acid rain provisions for these facilities refer to coal-fired utility units that are subject to an acid rain emission limitation or reduction requirement for SO_2 under the Clean Air Act. Although there are significant acid rain sources in the region, the tract would not considered a significant acid rain source.

3.3.3.4 FLORA AND FAUNA

Pollutant emissions from larger point sources may impact flora and fauna at the Class I areas; however, the sensitivity of ecosystem response to increased pollutant emissions from these particular sources is not well documented. Because emissions from the tract would be a small percentage of the existing regional sources, an in-depth review of these regional sources was not performed.

3.3.3.5 GENERAL CONFORMITY

To eliminate or reduce the severity and number of NAAQS violations in nonattainment areas and to achieve expeditious attainment of the NAAQS, the EPA promulgated the Conformity Rule (40 CFR 6, 51, 93). The Conformity Rule applies to federal actions and environmental analyses, in nonattainment areas, completed after March 15, 1994. This rule contains a variety of substantive and procedural requirements to show conformance with both the NAAQS and state implementation plans. The nonattainment/maintenance areas in Utah (UT 2010) are as follows:

- $PM_{2.5}$: part of Utah County; part of Cache County in Utah, and Franklin County in Idaho; and Salt Lake, Davis, and parts of Weber, Box Elder, and Tooele counties are nonattainment.
- PM_{10}: Salt Lake and Utah counties and Ogden (Weber County) are nonattainment. Redesignations are pending for all three locations.

- SO_2: Salt Lake and Tooele counties (above 5,600 feet) are nonattainment. Redesignation is pending for Salt Lake County.
- CO: Ogden City (maintenance area redesignated in 2001); Salt Lake City (maintenance area redesignated in 1999); and Provo and Orem in Utah County (maintenance area redesignated 2006).
- Ozone: Davis and Salt Lake counties (maintenance areas redesignated 1997).

The tract is located in Kane County. This county is in attainment of the NAAQS for all criteria pollutants, as defined under the EPA.

3.3.3.6 GREENHOUSE GASES

Climate change analyses comprise several factors, including GHGs (which include CH_4 and CO_2), land-use management practices, and the albedo effect (reflectivity of the surface, by vegetation or water). The tools necessary to quantify incremental climatic impacts of specific activities associated with those factors are presently unavailable (i.e., existing climate prediction models are not at a scale sufficient to estimate potential impacts of climate change within the analysis area). Research on how GHG emissions influence global climate change and associated effects has focused on the overall impact of emissions from aggregate regional or global sources. GHG emissions from single sources are small relative to aggregate emissions, and GHGs, once emitted from a given source, become well mixed in the global atmosphere and have a long atmospheric lifetime. The climate change research community has not yet developed specific tools for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. Also, scientific literature that addresses the climate effects of individual, facility-level GHG emissions has not been identified. The current tools for simulating climate change generally focus on global and regional-scale modeling. Global and regional-scale models lack the capability to represent important small-scale processes. As a result, confidence in regional- and sub-regional-scale projections is lower than at the global scale. There is thus limited scientific capability in assessing, detecting, or measuring the relationship between emissions of GHGs from a specific single source and any localized impacts. As a consequence, impact assessment of effects of specific anthropogenic activities cannot be performed. Additionally, specific levels of significance have not yet been established. Therefore, climate change analysis for the purpose of this document is limited to accounting for and disclosing the factors that contribute to climate change. Qualitative and/or quantitative evaluations of potential contributing factors within the planning area are included where appropriate and practicable.

3.4 Cultural Resources

Investigations to identify and evaluate cultural resources in the Alton Coal Tract were conducted in 2005 and 2008 by Montgomery Archaeological Consultants, Inc. on behalf of ACD (Stavish 2007, 2008a), and supplemental work was conducted by the BLM-KFO in 2007 (Zweifel 2007). This documentation satisfied the identification phase of Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and implementing regulations at 36 CFR 800. The cultural resources identified during these investigations consist of prehistoric and historic archaeological sites. A detailed cultural resource management plan (CRMP) will be developed for archaeological resources in the tract. The CRMP will outline the testing and mitigation that would be implemented in the event that either the Proposed Action or Alternative C is adopted (Personal Communication, Stavish 2008c).

Additional cultural resources that may be affected by mine-related actions include the Panguitch Historic District, which is listed on the NRHP, and Utah Heritage Highway 89 (also known as US-89) with its associated Mormon Pioneer Heritage Area.

3.4.1 Regional Overview

The tract lies in the Grand Staircase section of the Colorado Plateau Semidesert Province (Stokes 1986). An overview of the region's geology and soils, particularly with regard to the impact of surficial and bedrock units on the distribution of cultural resources in the area, is presented as Appendix C of the Montgomery Archaeological Consultants, Inc. 2005 inventory report (Lamm 2005 in Stavish 2007). The two most prominent geologic units in the region are alluvium and Tropic Shale. The 2005 report describes the possible natural impacts to cultural resources distributed on the alluvium. These include the localized slope failure or collapse of arroyo walls, the piping of finer grained sediments, the entrenching of drainages, and the potential for buried sites. Potential impacts to cultural resources distributed across the Tropic Shale include localized slope failure, surficial creep and slope wash on steeper slopes, and erosion of weathered bedrock on steep to gentle slopes. Moreover, the vertical erosion of in-situ sediments on the Tropic Shale may also distort the integrity of buried cultural resources.

3.4.1.1 CURRENT LAND USES AND IMPACTS

Current land uses in the Alton Amphitheatre and Sink Valley include farming, ranching, and mining. Over 20% of the land in the tract consists of agricultural lands, whereas cattle and other livestock graze on private farmlands and on BLM-managed pasturelands. Historic coal mining has also been conducted in the area, and three historic archaeological resources have been recorded: the Smirl Mine (42Ka4017), the Jacob A. Sorenson Mine (42Ka4019), and the Alton Mine (42Ka4091). The remnants of these mines have since been reclaimed by ongoing activities, and no evidence of their existence was documented during the 2005 cultural resource inventory (Stavish 2007).

3.4.2 Known Cultural Resources

3.4.2.1 CULTURAL-HISTORICAL OVERVIEW

A detailed review of the region's culture history and associated references is provided in Stavish (2007, 2008b). Nonetheless, it is useful to recap that human occupation of the region is represented by the Paleoindian, Archaic, Formative, Protohistoric, and Historic cultural periods, possibly beginning as early as 11,500 years before present (BP) or earlier. Recorded sites in the tract likely date from the Early Archaic (beginning ca. 7800 BP) through Historic periods, and also include evidence for Middle and Late Archaic, Anasazi, Fremont, Numic (or Southern Paiute) activities and occupations.

3.4.2.2 ARCHAEOLOGICAL SITES IDENTIFIED IN THE TRACT

Details of the previously conducted cultural resource surveys in the tract, all of which have been inventoried as part of the development of the CRMP, are provided in Stavish (2008b). A total of 132 archaeological sites has been identified in the tract; Table 3.10 provides a list of these sites (from Stavish 2007; Zweifel 2007; Stavish 2008a).

Table 3.10. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA1267	Multicomponent	Eligible	BLM	Numic lithic scatter and historic trash dump
42KA1313	Prehistoric	Eligible	BLM	Archaic, Anasazi Pueblo II, Numic temporary camp
42KA1314	Prehistoric	Eligible	BLM	Southern Paiute temporary camp, lithics, ground stone, ceramics
42KA2038	Prehistoric	Eligible	BLM	Southern Paiute
42KA2039	Prehistoric	Eligible	BLM	Late Archaic, Numic
42KA2040	Prehistoric	Eligible	Private	Southern Paiute lithic and pottery scatter
42KA2041	Prehistoric	Eligible	BLM, Coal Hollow	Anasazi, Southern Paiute
42KA2043	Prehistoric	Eligible	BLM, Coal Hollow	Numic lithic scatter
42KA2044	Prehistoric	Eligible	BLM, Coal Hollow	Archaic temporary camp
42KA2045	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA2047	Prehistoric	Eligible	BLM	Lithic scatter
42KA2048	Prehistoric	Eligible	BLM	Lithic scatter
42KA2049	Prehistoric	Eligible	BLM	Early Archaic lithic scatter
42KA2050	Multicomponent	Eligible	BLM	Archaic lithic scatter and historic herder camp
42KA2051	Prehistoric	Eligible	BLM, Private	Lithic scatter
42KA2052	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA2055	Prehistoric	Eligible	BLM	Archaic, Fremont, Southern Paiute
42KA2056	Prehistoric	Eligible	BLM	Fremont, Numic temporary camp
42KA2057	Prehistoric	Eligible	BLM	Anasazi, Southern Paiute
42KA2058	Multicomponent	Eligible	BLM	Late Archaic Lithic and Historic trash dump
42KA2059	Prehistoric	Eligible	BLM	Lithic scatter
42KA2065	Prehistoric	Eligible	BLM	Archaic, Anasazi, Fremont, Southern Paiute
42KA2066	Prehistoric	Eligible	BLM	Lithic scatter
42KA3097	Prehistoric	Eligible	Other fee coal, private	Archaic, Anasazi, Southern Paiute lithic scatter
42KA3115	Prehistoric	Eligible	Private	Temporary camp. Lithic scatter
42KA3168	Prehistoric	Eligible	BLM	Anasazi artifact scatter
42KA3169	Prehistoric	Eligible	BLM	Anasazi, Paiute, Lithic and ceramic scatter with hearths
42KA3170	Prehistoric	Eligible	BLM	Anasazi lithic scatter
42KA3171	Prehistoric	Eligible	BLM	Anasazi temporary camp. Lithic scatter
42KA3172	Prehistoric	Eligible	BLM, Coal Hollow	Southern Paiute temporary camp. Lithic scatter, ceramics

Table 3.10. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA3174	Prehistoric	Eligible	BLM	Temporary camp. Lithic scatter, ground stone
42KA3175	Prehistoric	Eligible	BLM	Southern Paiute temporary camp. Lithic scatter, ground stone
42KA6072	Prehistoric	Not Elig ble	Private	Lithic scatter
42KA6073	Prehistoric	Eligible	Private	Lithic scatter
42KA6074	Prehistoric	Eligible	Private	Lithic scatter
42KA6075	Prehistoric	Eligible	Private	Lithic scatter
42KA6076	Prehistoric	Eligible	Private	Lithic scatter
42KA6077	Prehistoric	Not Elig ble	Private	Lithic scatter
42KA6078	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6079	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6080	Prehistoric	Eligible	BLM, other fee coal	Archaic, Numic temporary camp
42KA6081	Prehistoric	Eligible	BLM, private	Lithic scatter
42KA6082	Historic	Not Elig ble	Private	Corral
42KA6083	Prehistoric	Eligible	BLM	Lithic scatter
42KA6084	Prehistoric	Eligible	BLM	Southern Paiute
42KA6085	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6086	Historic	Not Elig ble	BLM, private	Bridge
42KA6087	Prehistoric	Eligible	BLM	Lithic scatter
42KA6088	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6089	Prehistoric	Eligible	BLM	Temporary camp
42KA6090	Prehistoric	Eligible	BLM	Temporary camp
42KA6091	Prehistoric	Eligible	BLM	Early Archaic temporary camp
42KA6092	Prehistoric	Eligible	BLM	Lithic scatter
42KA6093	Prehistoric	Eligible	Private	Lithic scatter
42KA6094	Prehistoric	Eligible	BLM	Early Archaic lithic scatter
42KA6095	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6096	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6097	Prehistoric	Eligible	BLM	Lithic scatter
42KA6098	Prehistoric	Eligible	BLM	Temporary camp
42KA6099	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6100	Prehistoric	Not Elig ble	BLM	Archaic lithic scatter
42KA6101	Prehistoric	Eligible	BLM	Lithic scatter
42KA6102	Prehistoric	Eligible	BLM	Lithic scatter
42KA6103	Prehistoric	Eligible	BLM	Lithic scatter
42KA6104	Prehistoric	Eligible	Coal Hollow, private	Archaic lithic scatter
42KA6109	Prehistoric	Eligible	BLM, Coal Hollow	Lithic scatter

Table 3.10. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA6110	Prehistoric	Eligible	BLM	Lithic scatter
42KA6111	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6112	Prehistoric	Eligible	BLM	Lithic scatter
42KA6113	Multicomponent	Eligible	BLM	Lithic scatter, Historic trash dump
42KA6114	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6115	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6116	Prehistoric	Eligible	BLM	Lithic scatter
42KA6117	Prehistoric	Eligible	BLM	Fremont lithic scatter
42KA6118	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6119	Prehistoric	Eligible	BLM	Lithic scatter
42KA6120	Prehistoric	Eligible	BLM	Lithic scatter
42KA6121	Prehistoric	Eligible	BLM	Lithic scatter
42KA6122	Prehistoric	Eligible	BLM	Lithic scatter
42KA6123	Prehistoric	Eligible	BLM	Lithic scatter
42KA6125	Prehistoric	Eligible	BLM	Lithic scatter
42KA6126	Prehistoric	Eligible	BLM, Coal Hollow	Anasazi, Southern Paiute temporary camp
42KA6127	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6128	Prehistoric	Eligible	BLM	Lithic scatter
42KA6129	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6130	Prehistoric	Eligible	BLM	Lithic scatter
42KA6131	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6132	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6133	Prehistoric	Eligible	BLM	Lithic scatter
42KA6134	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6135	Multicomponent	Eligible	BLM	Southern Paiute, Historic trash scatter
42KA6136	Prehistoric	Eligible	BLM	Lithic scatter
42KA6137	Prehistoric	Eligible	BLM	Lithic scatter
42KA6138	Prehistoric	Eligible	BLM	Late Archaic, Southern Paiute
42KA6139	Prehistoric	Eligible	BLM	Temporary camp
42KA6307	Prehistoric	Eligible	Private	Lithic scatter
42KA6351	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6352	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6353	Prehistoric	Eligible	BLM	Lithic scatter
42KA6354	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6357	Prehistoric	Eligible	BLM	Archaic, Southern Paiute temporary camp
42KA6360	Prehistoric	Eligible	BLM	Archaic, Late Prehistoric lithic scatter
42KA6361	Prehistoric	Eligible	BLM	Archaic lithic scatter

Table 3.10. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA6477	Prehistoric	Eligible	Private	Lithic scatter
42KA6478	Prehistoric	Not Elig ble	Private	Lithic scatter
42KA6479	Prehistoric	Eligible	Private	Lithic scatter
42KA6480	Prehistoric	Eligible	Private	Archaic lithic scatter
42KA6481	Prehistoric	Eligible	Private	Lithic scatter
42KA6482	Prehistoric	Eligible	Private	Lithic scatter
42KA6483	Historic	Not Elig ble	Private	Camp
42KA6484	Historic	Not Elig ble	Private	Dugout and corral and trash scatter
42KA6485	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6486	Prehistoric	Eligible	Private	Anasazi, Fremont
42KA6487	Historic	Not Elig ble	Private	Trash scatter
42KA6488	Prehistoric	Eligible	Private	Lithic scatter
42KA6489	Historic	Not Elig ble	Private	Enclosure
42KA6490	Prehistoric	Eligible	Private	Lithic scatter
42KA6491	Prehistoric	Eligible	Private	Lithic scatter
42KA6492	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6493	Prehistoric	Eligible	BLM, private	Anasazi, Protohistoric artifact scatter
42KA6494	Multicomponent	Eligible	Private	Middle Archaic, Anasazi, Protohistoric, Euro-American
42KA6495	Prehistoric	Eligible	Private	Virgin Anasazi Pueblo II rockshelter and artifact scatter
42KA6496	Prehistoric	Eligible	Private	Lithic scatter
42KA6497	Prehistoric	Eligible	Private	Archaic, protohistoric lithic scatter
42KA6498	Prehistoric	Eligible	Private	Lithic scatter
42KA6499	Multicomponent	Eligible	Private	Middle Archaic, Euro-American
42KA6500	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6501	Prehistoric	Eligible	Private	Lithic scatter
42KA6502	Prehistoric	Eligible	Private	Lithic scatter
42KA6503	Prehistoric	Not Elig ble	Private	Lithic scatter
42KA6504	Prehistoric	Not Elig ble	Private	Lithic scatter
42KA6505	Prehistoric	Eligible	Coal Hollow, private	Late Archaic, Anasazi artifact scatter

Most archaeological sites (95%) identified in the tract are prehistoric, or contain prehistoric components and consist of lithic scatters from stone tool production, use, and maintenance. Table 3.11 provides a summary of the general cultural association of these sites (historic, prehistoric, or both, i.e., multicomponent) and their NRHP-eligibility assessment. Most recorded sites (81%) are eligible for the NRHP and are considered significant resources in terms of their potential to yield important historic or prehistoric information.

Table 3.11. Summary of Archaeological Site Types in the Tract

Cultural Association	Eligible	Not Eligible	Total
Historic	0	6	6
Multicomponent	7	0	7
Prehistoric	100	19	119
Total	**107**	**25**	**132**

Many of the recorded prehistoric and multicomponent sites contain components that can be associated with individual cultural periods or phases. Table 3.12 presents the numbers of such cultural components (i.e., occupations that date to an individual period or phase) that have been identified at sites recorded in the tract; because more than one component can be present at a site, the total number of components listed here is greater than the total number of sites in Tables 3.10 and 3.11 above.

Table 3.12. Identified Prehistoric Components at Archaeological Sites Recorded in the Tract

	Archaic	Anasazi	Fremont	Numic	Unknown	Total
Eligible	30	18	5	26	53	132
Not elig ble	1	0	0	0	18	19
Total	**31**	**18**	**5**	**26**	**71**	**151**

3.4.2.3 CULTURAL RESOURCES ALONG THE COAL HAUL TRANSPORTATION ROUTE

In addition to impacts to archaeological sites in the tract, impacts to cultural resources along the coal haul transportation route under the Proposed Action (see Map 2.4) must also be analyzed. Such resources include the Panguitch Historic District, which is listed on the NRHP, and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area.

The Panguitch Historic District is roughly bordered by 500 North, 400 East, 500 South, and 300 West. The portion of the coal haul transportation route through Panguitch that follows Center Street from 400 East to Main Street and then follows Main Street to 500 North would be in the historic district (Map 3.6). The district is significant for its association with the early settlement of Panguitch, originally an isolated pioneer outpost, and with the subsequent economic development of the area, which has focused on ranching and tourism (NPS 2006). It is also significant for its intact concentration of historic buildings, many of which are made from a characteristic, locally manufactured red brick.

The Utah Heritage Highway 89 and Mormon Pioneer Heritage Area were established by the National Heritage Areas Act of 2006 (S. 203 [109th] 2006). The portion of this area through which the coal haul transportation route would pass would consist of the town of Alton, the roads that connect Alton to US-89, and the US-89 corridor to its junction with SR-20, including the communities of Hatch and Panguitch. The heritage area was established in recognition of the role that Mormon settlement played in the Euro-American colonization of the west and, among other things, in opening up "vast amounts of natural resources, including coal, uranium, silver, gold, and copper" (S. 203 [109th] 2006). As a legislatively established heritage area, the board of directors of the Utah Heritage Highway 89 Alliance is authorized to receive federal funds for purposes such as conserving, interpreting, and developing the historical,

cultural, natural, and recreational resources in the heritage area, and expanding, fostering, and developing heritage businesses and products relating to the cultural heritage of the heritage area.

3.4.3 Native American Consultation

Initial consultation regarding the tract has taken place with the Kaibab Paiute, Southern Paiute, Hopi, Ute, Zuni, and Navajo tribes (Personal Communication, Zweifel 2008). Cultural and religious concerns could arise among the tribes should archaeological resources be identified in the tract. If resources are identified, consultation with tribes would occur. The tribes would review the CRMP as part of the consultation process. Based on their review of the CRMP, additional input to the structure and process of the CRMP may result. Other considerations such as possible effects to TCPs would also be incorporated into the CRMP, as necessary. TCPs can include, but are not limited to, natural landscape features, natural resource harvesting and processing areas, trails, and archaeological sites.

3.5 Fire Management

The *Southern Utah Support Area Fire Management Plan* acts as the primary strategic document for fire management on and adjacent to the Alton Coal Tract. The overlying goal of the fire management plan is to describe specific actions authorized on the public lands to protect life and ensure public safety, to target resource goals and objectives, to reduce fuel loads, and to achieve and maintain healthy, functioning ecosystems (BLM 2005a). Protection of human life, including the lives of firefighters committed to an incident, is the mandated priority for all fire management activities.

In the fire management plan, land management areas are established. These areas are called fire management units (FMUs) and are defined by objectives, topographic features, access, protected values, political boundaries, fuel types, or major fire regimes. These units have dominant management objectives and have preselected fire management strategies assigned to accomplish these objectives. The tract is located entirely in the Glendale Bench FMU (Map 3.7). The Glendale Bench FMU encompasses 118,618 acres, 67,423 of which are under BLM management. Approximately 2,280 acres of the FMU on the tract is on public lands.

3.5.1 Area Overview and Fire History

The tract occurs in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001). Precipitation in the FMU averages approximately 14–18 inches of water per year, as modeled by the Parameter-elevation Regressions on Independent Slopes Model (PRISM) from 1961 to1990 (2004b). Most of this precipitation is in the form of snow during the winter months. Summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (2006).

The weather and fuel structure in the tract provide an opportunity for ignition from frequent summer storms. Lightning accounts for at least 78% of fire starts in the BLM-KFO area. Careless smoking, vehicle exhaust, escaped agricultural burning, and unattended campfires account for most human-caused fires in the Glendale Bench FMU. Sparking from vehicles or construction equipment is also responsible for starting some fires (2004b). Naturally occurring fires are widely distributed in terms of frequency and severity.

Sensitive resources in the FMU that could be affected by wildfire include greater sage-grouse lekking and brood-rearing habitat, deer and elk crucial summer ranges, the upper Kanab Creek watershed, and archeological resources. Unplanned wildfire may also affect communication sites, private residences, range improvements, special status species habitat, power lines, dispersed recreation opportunities, and ROWs (2005a).

3.5.2 Wildland Urban Interface

Wildland fires pose the greatest threat to community residents, property, and firefighters when they occur in, or spread into, the WUI. WUIs are commonly defined as geographic areas where human habitation and developments intermix with wildland or vegetative fire (2007a). The Southwest Utah Regional Wildfire Protection Plan (RWPP) does not consider the town of Alton as a state-identified community at risk of wildfire. However, the RWPP does identify WUI areas immediately west of Alton, along the length of US-89, as well as the Spencer Bench, Spencer Cliff Estates, and Stout Canyon area. The RWPP risk assessment identifies a high wildfire risk in these areas (FCAOG 2007b), which include portions of the coal haul transportation route.

3.5.3 Fire Management Objectives and Planning Efforts

3.5.3.1 FIRE REGIME CONDITION CLASS

FRCC is an interagency, standardized tool for determining the degree of departure of an area or landscape from its historic to its present conditions (i.e., fire frequency in the area), including the effects of fire suppression and invasive species invasion. Assessing FRCC can help guide management objectives and set priorities for treatments. FRCC was assigned to classify vegetation on public lands in the state through review of cover types identified by Utah GAP Analysis (Edwards et al. 1995) and elevation ranges (2008b). FRCCs are defined as follows:

- **FRCC 1:** Fire regimes are within a historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range. Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
- **FRCC 2:** Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components (soil, vegetation structure, species composition, alteration of nutrient cycles, hydrologic regimes) is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased), which results in moderate changes to one or more of the following: fire size, intensity, and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range. Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
- **FRCC 3:** Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, and severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range. Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments, before fire can be used to restore the historical fire regime.

The dominant vegetation communities in the tract area are pinyon-juniper woodland, sagebrush/grassland, and treated sagebrush/grassland (Table 3.13). Annual and perennial grasses (pastureland), mountain brush, meadow wetlands, riparian, and rabbitbrush vegetation communities are also found in the tract. Acreages of vegetation and FRCC are presented in Table 3.13 and in Map 3.8.

Table 3.13. Acreages of Vegetation and Fire Regime Conditions Class in the Fire Management Unit/Tract

Vegetation Community	Acreage	Percentage of the Tract*	FRCC
Pinyon-juniper woodland	1,430.0	40.2%	3
Sagebrush/grassland	860.2	24.1%	3
Sagebrush/grassland (treated)	749.1	20.9%	3
Annual and perennial grasses (pastureland)	324.1	9.1%	3
Mountain brush	62.8	1.8%	3
Meadow	62.8	1.8%%	3
Riparian	55.3	1.5%	3
Rabbitbrush	10.7	0.3%	3
Total	**3,555.0**	**99.4%**	

*Unvegetated areas consist of 4.1 acres of open water and 17.4 acres of roads, or approximately 0.6% of the 3,576.6-acre tract.

3.5.3.2 DESIRED WILDLAND FIRE CONDITION

Desired wildland fire condition (hereafter referred to as the desired condition) is the description of the desired condition of a vegetative community as it relates to its susceptibility from severe fire effects (e.g., the loss of key ecosystem components such as soil, vegetation structure, species; or the alteration of key ecosystem processes such as nutrient cycles and hydrologic regimes).

The general desired condition is to have ecosystems that are at a low risk of losing ecosystem components following a wildland fire and that function within their historical range. A healthy ecosystem at low risk of losing key ecosystem components following a wildland fire would be considered at optimum desired condition.

In terms of desired condition outside the WUI, the trend is to move to a lower FRCC using the least intrusive method possible. In other words, the desired condition would involve moving lands in FRCC 3 to FRCC 2 and lands in FRCC 2 to FRCC 1. When feasible, this would occur through fire and nonfire treatments where wildland fire use is the preferred method of treatment. Inside the WUI, the general desired condition is less potential for values to be threatened by wildland fire, usually through modification of fuels. Therefore, because all of the lands in the tract fall in FRCC 3, the trend would be to move them to FRCC 2.

Fire management actions authorized for wildland fire activities, prescribed fire and nonfire fuel treatments, and emergency stabilization and restoration are based on desired condition. The Utah land-use plan amendment for fire and fuels management addresses specific fire management objectives for each major vegetation community, and is designed to progress toward desired condition of public lands.

3.5.3.3 PLANNED FIRE MANAGEMENT PROJECTS ON AND ADJACENT TO THE TRACT

The Glendale Bench FMU, which contains the tract in its entirety, has a resource objective emphasis. Fire management actions would include full fire suppression in some target vegetation communities, nonfire fuel treatments, and prescribed fire. Using acreage limitations prescribed by the FMU, appropriate management response is used to accomplish vegetation conversion using natural fire ignitions. The prescribed appropriate management response for the Glendale Bench FMU includes achieving the objectives in pinyon-juniper woodland, and sagebrush/grassland areas described below.

In the Glendale Bench FMU, large acreages of pinyon-juniper woodland and sagebrush/grassland are targeted for improvements using fire management. However, the FMU also contains areas where suppression is critical to protect communities, private property, and sensitive natural resources. Treatments would convert pinyon-juniper woodland to sagebrush/grassland communities. Sagebrush treatment would create a diversity of age classes in the sagebrush vegetation community. Resource objectives would be met by improving habitat for deer, sage-grouse, and other species, including special status species. Planned treatment acres in this FMU are as follows:

- Pinyon-juniper: Convert 15,000 acres to sagebrush grassland over the course of 10 years (plan released in 2004) using natural fire, prescribed fire, and mechanical treatment.
- Juniper: Convert 5,000 acres to sagebrush grassland over the course of 10 years (plan released in 2004) using natural fire, prescribed fire, and mechanical treatment.
- Sagebrush: Using mechanical methods, create a mosaic of age classes in the sagebrush and sagebrush perennial grassland vegetation communities on approximately 2,000 acres over the course of 10 years (plan released in 2004).

Fire management strategies in the area would use full fire suppression to protect human communities and private property in the FMU. When possible, fire suppression strategies would be developed in accordance with sage-grouse habitat guidelines so that less than 20% of sage-grouse habitat is disturbed in a single year. Ponderosa pine (*Pinus ponderosa*) vigor and reproduction would be improved by reducing competition by pinyon and juniper trees by using prescribed fire, nonfire fuels treatments, or both.

3.6 Geology and Minerals

3.6.1 Regional Overview and Assessment Area

The Alton Coal Tract is part of the Alton Coal Field, which is located between the Kaiparowits Coal Field to the east and the Kolob Coal Field to the west. The tract is located east of Long Valley and southwest of the Paunsaugunt Plateau. The geology, geologic history, stratigraphy, and structure of the tract have been described by Doelling and Graham (1972a) and Tilton (2001) and are summarized in this section, along with geologic hazards, mineral resources potentially present in or near the tract, and underground coal fires.

3.6.2 Local Geology

3.6.2.1 TOPOGRAPHY AND PHYSIOGRAPHY

The tract is characterized by bench and slope topography. Topographic relief in the region is approximately 3,000 feet, with elevations ranging from approximately 9,300 feet on top of the Paunsaugunt Plateau to approximately 6,500 feet in the Kanab Creek valley bottoms.

The tract is located southwest of the Paunsaugunt Plateau in the Alton Amphitheater, which is typified by broad, gently rolling hills and valleys and landforms with isolated bedrock outcrops. The western portion of the tract is transected by Kanab Creek, which runs north to south. The tract also includes the Robinson Creek drainage, which runs east to west.

In 1983 OSM reported that there are potential AVFs located in the Alton Coal Field. Further, a reconnaissance-level survey was conducted on the tract in spring 2008 and confirms the presence of potential AVFs in portions of the tract (Petersen Hydrologic 2008). See Section 3.16 for more information regarding AVFs.

3.6.2.2 STRATIGRAPHY

The geologic stratigraphy of the region in and near the tract consists of Jurassic, Cretaceous, and Quaternary age deposits of (from oldest to most recent) Navajo Sandstone, Carmel Formation, Dakota Formation, Tropic Shale, Straight Cliffs Formation, Wahweap and Kaiparowits formations, Claron Formation, and Quaternary deposits (see Figure 3.3 for a stratigraphic cross section of the area). The stratigraphy in and immediately adjacent to the tract includes the Dakota Formation, the Tropic Shale, the Straight Cliffs Formation, and various Quaternary deposits. In the Dakota Formation, two regionally important coal zones are present. These include the Smirl Coal Zone, which is located near the upper formational contact with the Tropic Shale, and the Bald Knoll Coal Zone, which is located approximately 200 feet below the Smirl Coal Zone near the base of the Dakota Formation (see Figure 3.3). The Bald Knoll Coal Zone is not of interest in this analysis because it would not be mined and, therefore, it is not further discussed.

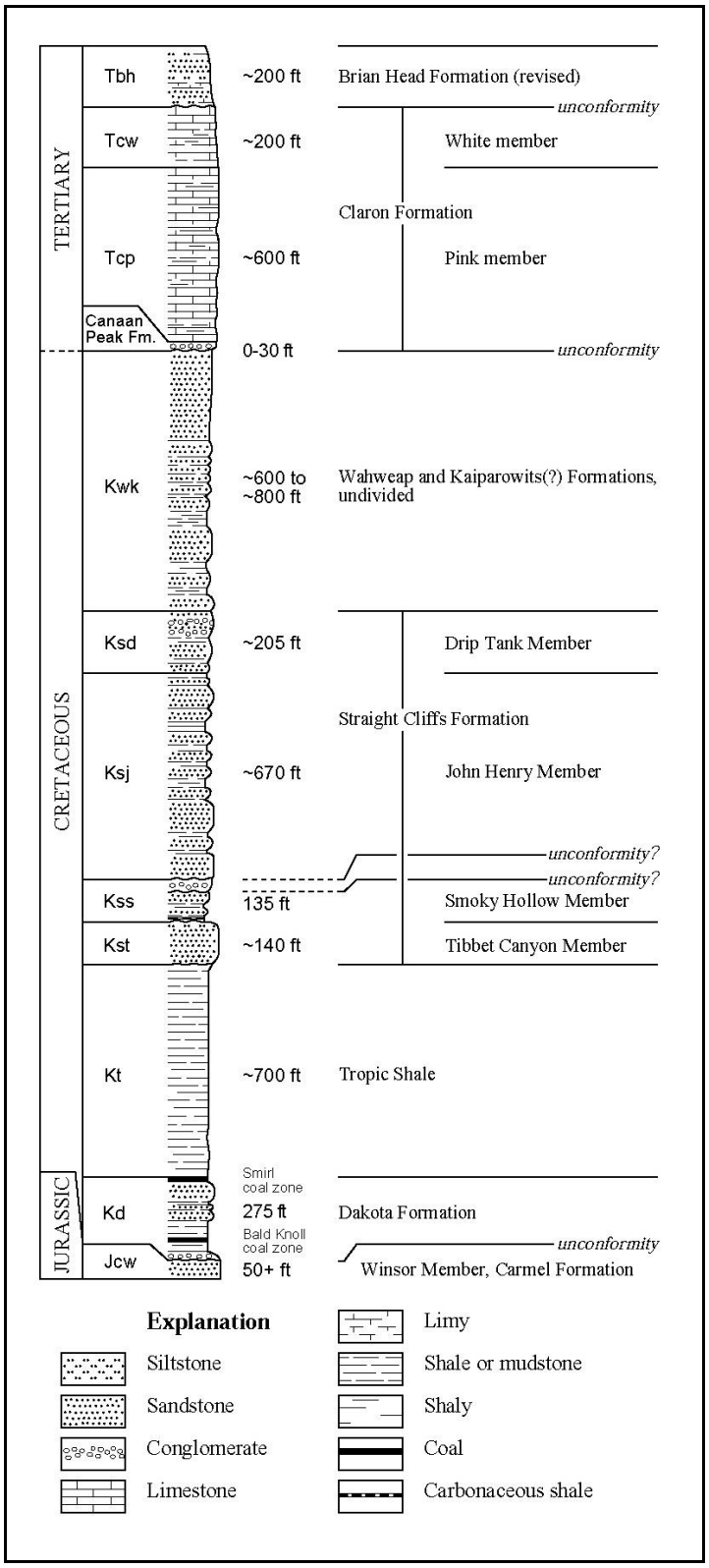

Figure 3.3a. Stratigraphic cross section of the stratigraphy in western Kane County (Part 1 of 2) (Tilton 2001)

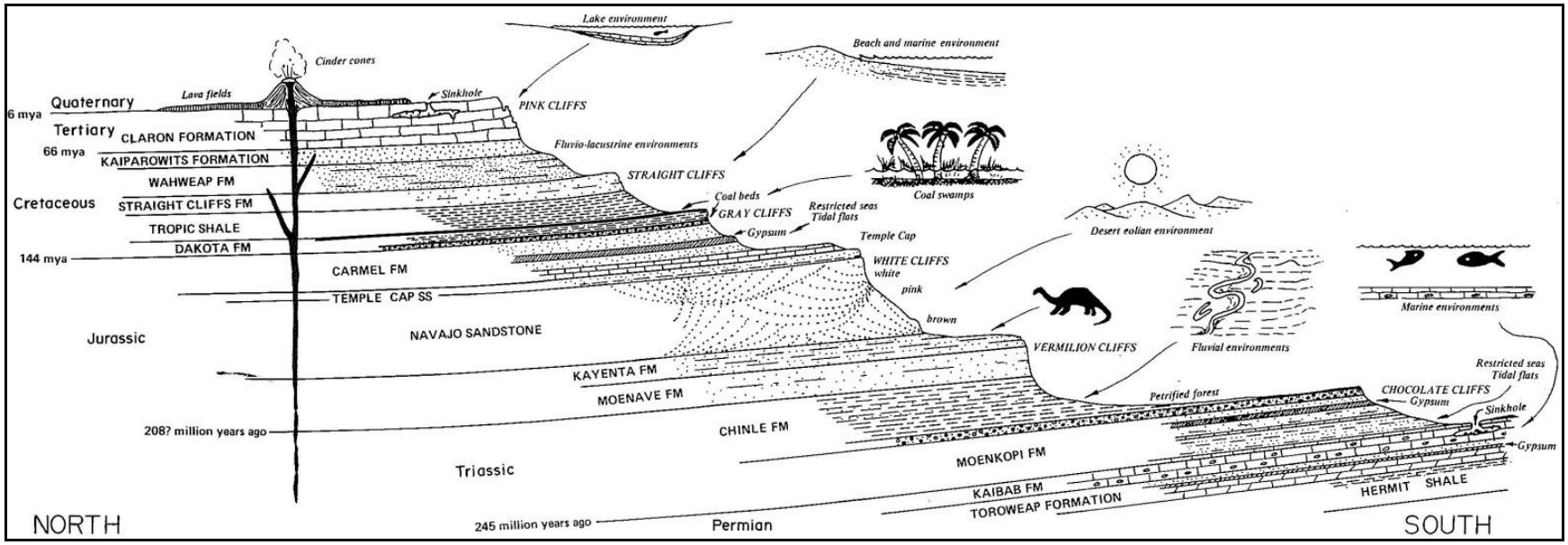

Figure 3.3b. Stratigraphic cross section of the stratigraphy in western Kane County (Part 2 of 2). (Doelling et al. 1989)

The degree of exposure of these formations depends primarily on the amount of weathering and erosion that has resulted in changes to the physical geology of the area over geologic time. The results of these geologic processes for the area are shown in Map 3.9. The Dakota Formation and Tropic Shale dominate the geology of the tract.

In areas where it has not been weathered or eroded, the Dakota Formation has a maximum thickness of approximately 275 feet. The Dakota Formation consists of alternating mudstone and sandstone layers with associated coal, bentonite, and conglomerate. The physical character and makeup of the Dakota Formation suggests marine and nonmarine depositions, including shallow subtidal, shoreface, distal coastal plain, and stream channel components. The Dakota Formation is a poor source of producible water because of its intricate interlayering, lensing, and interfingering of permeable and impermeable beds.

In areas where it has not been weathered or eroded, the Tropic Shale marine unit has a maximum thickness of approximately 700 feet. Marine fauna are locally visible, including ammonites and oysters. See Section 3.10 for more information on fossil resources in the area. In the tract, the Tropic Shale has mostly weathered and eroded to where the thickness ranges from zero to tens of feet. The Tropic Shale consists predominantly of gray and carbonaceous silty shale and claystone with a few marine sandstone beds located mostly in its upper layer. The Tropic Shale typically weathers at the surface to a clayey soil that forms gentle slopes. The Tropic Shale acts as an impermeable layer that does not yield significant water or transmit significant water to the Dakota Formation (ACD 2008). Springs form in areas where the sandstone of the Straight Cliffs Formation or pediment gravel overlay the Tropic Shale (1987).

The Straight Cliffs Formation has four members. Immediately adjacent and north-northeast of the tract, these members have eroded. The Straight Cliffs Formation has been downdropped on the east side of the Bald Knoll Fault, creating the steep hillsides that border the east and northeast tract boundaries. The members consist primarily of sandstone and mudstone—with sandstone composing approximately 75% of the total composition—and erode to form cliffs and steep slopes above the Tropic Shale.

There are many delineated units of the Quaternary system. The units that are exposed in the tract consist of alluvium and landslide deposits. Alluvium fills the Kanab Creek, Robinson Creek, and other minor drainages. The alluvium, therefore, transects the entire north to south tract boundaries and expands to varying widths from the east to west tract boundaries. The alluvium ranges from 0 to 50 feet thick, but is up to 140 feet thick along the eastern margins of Sink Valley outside the tract (DOI 1980a).

The landslide unit is located along the northeastern perimeter of the tract. It is characterized by unconsolidated knolls with deposits of mud and sand, and large blocks of sandstone. This unit is formed primarily from gravity-transported slide debris of the Straight Cliffs Formation and is less than or equal to 100 feet thick. AVFs are discussed in the water resources section.

The pediment gravel deposits are typically located on gentle hills formed on the Tropic Shale. The gravels are poorly sorted and composed of cobbles and pebbles from the Canaan Peak and Claron formations.

3.6.3 Geologic Hazards

3.6.3.1 FAULTS

There are two major fault zones near the tract: the Sevier fault zone located 1–2 miles west of the tract and the Paunsaugunt fault zone located approximately 15 miles east of the tract. Both of these fault zones generally trend to the northeast and are considered normal faults with the downdropped block on the west.

Displacements along the Sevier fault zone are approximately 1,000–2,000 feet, and along the Paunsaugunt fault zone, displacements are 100–800 feet (Doelling et al. 1989).

Three smaller, generally north–south trending local faults occur between the Sevier and Paunsaugunt fault zones: Sink Valley Fault, Bald Knoll Fault, and Sand Pass Fault. The Sink Valley Fault runs parallel and along the southeastern boundary of the tract with displacements on the order of tens of feet. The Bald Knoll Fault is located 1.5–2.0 miles east of the tract, and the Sand Pass Fault is located 2.0–3.0 miles west of the tract, each with less than 650 feet of displacement.

Seismic activity reports from two University of Utah seismograph stations in the region (Kanab and East Kanab) show that the region has not experienced significant, recent seismic activity. In the last few years there have been clusters of earthquake activity with magnitudes up to approximately 3.6 on the Richter Scale (Arabasz et al. 2006; University of Utah 2008).

The region surrounding the tract is located on the edge of the intermountain seismic belt (Personal Communication, Pechmann 2008). According to the USGS National Seismic Hazard Maps (USGS 2008), the region has a 2% probability of exceeding a peak horizontal acceleration of between 20% and 30% due to gravity. This is not a negligible or a high level of seismic hazard compared to other areas in Utah (such as the Wasatch Front), but it is above the 10% of gravity that is often assumed to be the threshold for damage to weak construction, such as unreinforced masonry buildings (Personal Communication, Pechmann 2008). The coal mining process often induces seismic events due to subsidence and forces due to the removal of coal and overburden. However, the National Seismic Hazard Maps do not include mining-induced seismicity in their hazard ratings.

3.6.3.2 ACID-FORMING AND TOXIC-FORMING MATERIALS

Typical acid-forming materials in western coal mine environments consist of inorganic sulfide minerals, including pyrite and marcasite. Exposure to air and water may oxidize sulfur-bound compounds, causing the release of hydrogen (H+) ions in water, thus decreasing pH (creating acidic conditions). UII and ACD conducted geochemical analysis in the area in 1987 (1987) and 2007–2008 (2008), respectively. The results from both surveys indicate that the acidic-forming potential is low for the tract because 1) the concentration of sulfur species is low, 2) the concentration of naturally neutralizing calcium carbonate is high, and 3) most of the sulfur species present are organic based, and therefore do not typically contribute to forming acidic conditions. USGS reports low levels of Mercury, Thorium, and Uranium within Alton coals, but reports these levels to be of low concern.

Selenium was not detected in any of the samples from the adjacent Coal Hollow Mine permit area, and concentrations of water-extractable boron were low (i.e., less than 3 mg/kg in all samples analyzed). Based on the geochemical analyses referenced above, acid-forming and toxic-forming materials that could result in the contamination of surface-water or groundwater supplies in the tract are generally not present (Petersen Hydrologic 2007).

Acid-forming and toxic-forming materials are not expected to represent a geologic or mineral hazard under the Proposed Action and will not be carried forward for detailed analysis in Chapter 4.

3.6.3.3 RADON

Radiation, as found in radon gas, comes from the natural (radioactive) breakdown of uranium in soil, rock, and water. ACD (2008) conducted a radon survey and showed no hazardous concentrations of radon in the adjacent Coal Hollow Mine permit area. Furthermore, Doelling et. al. (1989: Plate 5) showed that the tract area did not have areas of “above background radiation” or uranium deposits.

The drill hole analysis completed by Applied Geotechnical Engineering Consultants (2007) for the adjacent Coal Hollow Mine indicates that there is no significant radon gas is present in the Smirl Coal Zone in that location (Applied Geotechnical Engineering Consultants Inc 2007). Assuming that the Smirl Coal Zone within the Alton Coal Tract is similar to this zone within the Coal Hollow Mine area, no geologic hazard from radon is anticipated to occur under the Proposed Action because no unusual concentrations would be intercepted or released by mining activities on the tract. In addition, the surface mine would be naturally ventilated ("open air") during the mining process and any underground mining would also be ventilated according to DOGM and MSHA regulations and procedures. Therefore, Radon will not be carried forward for detailed analysis in Chapter 4.

3.6.3.4 LANDSLIDE

Quaternary landslide deposits composed of mud, sand, and blocks of sandstone are present in and adjacent to the tract (see Map 3.9). One area of landslide deposits is present east of the tract below the Straight Cliffs Formation. The thickness of the landslide deposits locally ranges from a few feet to more than 100 feet. The landslide deposits generally sustain more plant growth (usually oaks) than the surrounding undisturbed land because of the deposits ability to hold water (Tilton 2001).

3.6.4 Mineral Resources

3.6.4.1 LEASABLE MINERALS

3.6.4.1.1 Coal

The tract is located in the Alton Coal Field. The tract contains approximately 46 million tons of recoverable coal in the Dakota Formation. The coal that would be mined is present as a single coal seam approximately 15 feet thick, referred to as the Smirl Coal Zone. Overburden above the Smirl Coal Zone ranges from 20 to 300 feet thick with an average thickness of 100 feet. It is composed primarily of Tropic Shale and Quaternary deposits (both described above).

The average quality of the coal in the Smirl Coal Zone is summarized in Table 3.14. The inherent moisture content of the coal is approximately 13%. Higher percentages of moisture lower the heating efficiency of coal. Ash content of coal is the noncombustible residue left after coal is burnt. The percentage of ash in the original weight for coal in the tract is approximately 10%. The fixed carbon percentage for the coal is approximately 50%, which is nonvolatile carbon minus ash. The volatile matter in coal refers to the components of coal, other than moisture, that are liberated at high temperatures in the absence of air. The fixed carbon content of the coal is the carbon found in the material that is left after volatile materials are driven off. These compounds include long-chain and aromatic hydrocarbons. The percentage of volatile matter of this coal is approximately 39%. The sulfur content of the coal is approximately 1.13%, which is lower than the average of 2%–3% for this type of coal (high-volatile subbituminous B). The lower the sulfur content is in coal, the less sulfur is emitted into the air during the burning of coal, and hence, the less sulfuric acid is formed. The coal in the Smirl Coal Zone has a heat content approximately 20 million British thermal units (BTU) per ton (10,019 BTUs per pound).

Table 3.14. Average Quality of the Coal in the Smirl Coal Zone

Thickness (feet)	Moisture (%)	Ash (%)	Fixed Carbon (%)	Volatile Matter (%)	Sulfur (%)	BTU/ton
15.3	13	10	50	39	1.13	~ 20 million (10,019 BTUs/pound)

Source: ACD 2004.

3.6.4.1.2 Oil and Gas

There is an oil and gas lease (UTU-079271) that includes the northeast area of the tract and extends to the area north and east of the tract (east of the Sink Valley Fault where the Straight Cliff Formation is exposed; see Map 3.9). In general, the BLM classifies this area as high potential for oil and gas development (2008b), and there are a handful of existing leases near the tract. Given the coal deposits (both the Smirl Coal Zone and the Bald Knoll Coal Zone) in the area, there is also a potential for the occurrence of coalbed CH_4; though there are no existing proposals to develop this resource.

3.6.4.2 SALABLE MINERALS

3.6.4.2.1 Burnt Shale

The geological map for the tract shows three gravel resource sites in Sections 13, 24, and 31, Township 30 South, Range 6 West (see Map 3.9). The BLM-KFO reports that these are authorized community pits that are open to the public for purchase of burnt shale aggregate. Most of these pits have been in operation since the late 1970s and are nearly depleted. Other known burnt shale resources exist west of the tract. Recent interest in the development of these resources has been shown.

3.6.4.2.2 Gravel

As mentioned in the stratigraphy section above, there are pediment gravels in the tract. These gravel deposits are derived mostly from the erosion of the Claron and Canaan Peak formations and consist of quartzite pebbles and cobbles. These deposits are considered to be salable by the BLM.

3.6.4.3 LOCATABLE MINERALS

3.6.4.3.1 Septarian Nodules

Septarian nodules are geode-like concretions containing angular cavities or cracks, or septaria. The nodules are often valued by collectors, and occur in the Tropic Shale near the tract. The nodules in the region are thought to be of high (gem) quality, and are considered a locatable resource.

According to the *Kanab Field Office Final Analysis of the Management Situation* (AMS) active mining for septarian nodules is occurring on leases in the Mount Carmel area southwest of the tract. Development potential is rated moderate in areas where Tropic Shale is present, as in the Alton tract (BLM 2005b). However, as no surveys or studies have been done on the tract for septarian nodules it is unknown how common these nodules are in the tract, or if they are present in sufficient density to be economically viable for development.

3.6.5 Underground Coal Fires

According to (Stracher 2007) spontaneous combustion is the most significant cause of fires in coal mines. An increase in the temperature of coal occurs when the coal is exposed to air. A reaction occurs between the coal and the air in a solid-gas process that involves the reaction of oxygen. Provided there is an adequate supply of oxygen, a process called *runaway ignition* can occur. Runaway ignition is when the heat raises the temperature of the coal, which changes the rate of oxidation. If unchecked, this process can grow exponentially and subsequently initiate a fire. If the generated heat is quickly dissipated, the risk of spontaneous combustion decreases.

Coals of lower BTU rank are more susceptible to spontaneous combustion than coals of higher rank. The coal in the Alton Coal Tract has an average of 10,019 BTUs per pound, which is lower than other coal fields in Utah (Jahanbani 1998). Even higher rank, eastern coals have ignited either by spontaneous combustion or other sources once exposed to atmospheric oxygen.

Coal ignitions due to spontaneous combustion in surface mines or surface coal stockpiles do occur but are readily accessible and manageable. Mine operators have financial and environmental incentives to quickly and effectively control any ignitions that may occur in surface mines or surface coal stockpiles. However, underground fires near surface coal mines have proven to be troublesome because the fires generally cannot be controlled or extinguished. This is a particular problem in the eastern United States where higher population density means towns and structures can be, and have been, directly affected because the towns are directly above the coal seams.

Underground coal fires can also be attributed to mine-related activities such as cutting and welding, electric work, use of explosives, smoking, or any activity that could provide ignition. Other activities that do not provide a spark but can increase the risk for spontaneous combustion include the movement of heavy machinery and vehicles that have the potential to create fractures in the coal seam, which leads to increased oxygen circulation. In addition, fires can be caused after abandonment of the mine when humans provide ignition of the coal through other means.

A historical review of the coal history prepared by Doelling and Graham (1972b) and site visits have not shown any indication of past coal mine fires near the tract. Also, past mining of the Smirl Coal Zone in the tract and surrounding areas has occurred at very shallow depths, with more exposure of the coal to atmospheric oxygen.

3.7 Hazardous Materials and Hazardous and Solid Waste

3.7.1 Existing Sources of Hazardous Materials and Hazardous and Solid Waste On and Adjacent to the Tract

Hazardous materials are defined as any material that may pose a hazard to human health or the environment, because of its quantity, concentration, or physical or chemical characteristics. Hazardous materials include flammable or combustible material, toxic material, corrosive material, oxidizers, aerosols, and compressed gases. Solid waste includes garbage; construction debris; commercial refuse; sludge from water supply or waste treatment plants, or air pollution control facilities; and other discarded materials. Hazardous materials discussed in this section include hazardous chemicals, hazardous substances, and hazardous wastes, and are defined below according to the EPA (2010).

- Hazardous chemical: An EPA designation for any hazardous material requiring a Material Safety Data Sheet (MSDS) under OSHA's Hazard Communication Standard. Such substances are capable of producing fires and explosions or adverse health effects like cancer and dermatitis.
- Hazardous substance: Any material that poses a threat to human health and/or the environment. Any substance designated by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or is otherwise released into the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive.
- Hazardous waste: By-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or appears on special EPA lists.

Coal mining and subsequent transportation activities would necessitate the presence of hazardous materials at the Alton Coal Tract. Primarily, these materials would include fuels, lubricants, and solvents. See Section 2.3.2.7 for a list of hazardous materials anticipated for the tract. Potential sources of hazardous or solid waste on the tract would include hazardous substances, petroleum products, and/or solid waste associated with coal mining and transportation activities. Currently there are no hazardous materials or solid wastes present on the tract.

3.8 Land Use and Access

3.8.1 Land Status and Ownership

Primary land uses within and adjacent to the Alton Coal Tract include tourism, farming, livestock grazing, and dispersed recreation, including hunting. See Sections 3.9 Livestock Grazing and 3.11 Recreation for details on these specific land uses. The *Kane County, Utah General Plan* describes the area as, "some of the most remote and rugged lands in the continental United States" (FCAOG 1998a). The plan has not allowed for significant development in the area. There are no commercial buildings, facilities, or private residences within the tract. However, the nearest residential community is the town of Alton, whose population is approximately 140 (Utah Department of Workforce Services [UDWS] 2010a). Alton is located immediately north of the northern tract boundary. There are no state lands within or immediately adjacent to the tract. The closest parcel of SITLA land is 1 mile northwest of the tract. Map 1.1 illustrates the location of the tract in relation to some of the private and federal land ownerships in the area.

Access to the tract is from US-89, approximately 2.9 miles west of the tract. This highway is the major thoroughfare for the area, serving as a route for tourist traffic to public lands, including Bryce Canyon National Park, Dixie National Forest, BLM-managed lands, and Grand Staircase-Escalante National Monument. For details regarding transportation along portions of US-89, refer to Section 3.14 Transportation and Appendix H.

3.8.1.1 PRIVATE LANDS AND EXISTING LAND USES ON AND ADJACENT TO THE TRACT

All coal reserves within the tract are federally owned, though surface ownership is mixed. Approximately 1,296 surface acres of the tract are in private ownership, including eight different private surface owners. Landowners have been notified of the tract and will be included throughout the EIS process. Private land uses in the tract and surrounding land include farming, livestock grazing, and dispersed recreation, including hunting. Land use specifically in Alton has traditionally been for homes, farming, and livestock grazing. There have not been any official classifications of land use or zoning ordinances to enforce the use of land; however, the land has been generally classified into four areas: residential, church, agriculture, and recreation (FCAOG 1981). Two-track roads also exist throughout the tract for recreational use and for private landowner access to private surface lands.

3.8.1.2 FEDERAL LANDS AND EXISTING LAND USES ON AND ADJACENT TO THE TRACT

The BLM-KFO consists of 2,847,200 acres, of which the BLM manages approximately 554,000 acres (approximately 20%). All coal reserves within the tract are federally owned. Approximately 2,280 surface acres of the tract are in federal (BLM) ownership, representing 0.4% of the total area managed by BLM-KFO. Dominant land uses in the tract include livestock grazing and recreation (primarily backcountry motorized travel and sightseeing, OHV use, and hunting).

3.8.2 Land-use Planning and Management

3.8.2.1 FEDERAL

Land-use planning for public lands in the area allocates the land to many uses, including mining, grazing, and recreation (BLM 2008b). No coal production has occurred in Kane or Garfield counties since 1971, and there are presently no coal leases in the boundaries of the BLM-KFO (BLM 2008b).

Dixie National Forest lands near the tract are managed for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, and viewing nature, wildlife, and geologic features. Currently the forest is being managed under the forest plan that was signed in 1986. Revisions to the forest plan are currently on hold.

As discussed in Chapter 1, some of the coal reserves in the tract are not currently considered recoverable because KFO Route 116 traverses the tract. Under SMCRA, the approval of surface-mining operations on lands within 100 feet of the outside line of the ROW for a public road requires a process resulting in a final decision by DOGM or the public road authority. In the event of a lease sale, Kane County and the BLM would temporarily relocate KFO Route 116 during the life of the mine. Once mining operations are complete, the temporary road location would be reclaimed, and the original route would be reconstructed according to requirements specified in R645-103-234–R645-103-234.400 for relocation of public roads.

3.8.2.2 LOCAL

The entire tract lies within the northwestern section of Kane County. Approximately 90% of Kane County lies in federal ownership (FCAOG 1998a). Historically, Kane County lands have been used for agriculture (predominantly farming and livestock grazing), and according to the *Kane County, Utah General Plan* (FCAOG 1998a), much of the land within and adjacent to the tract is currently zoned for agricultural use.

Garfield and Iron counties are adjacent to Kane County to the north and west, respectively. These counties include areas for tourism and recreation. It is anticipated that coal mined from the tract would be transported through these counties for delivery to market (see Section 2.5.4 Reasonably Foreseeable Coal Loadout Location and Transportation Route). Further, public travel is frequent through these counties, specifically to access federal lands near the tract (Bryce Canyon National Park, Dixie National Forest, BLM-administered lands, and Grand Staircase-Escalante National Monument). Both the Kane County and Garfield County general plans identify transportation infrastructure as an important investment due to their contribution to tourism travel in the area. The Garfield County plan indicates that the roads in the area are in fair condition partly due to insufficient funds to properly maintain and renovate them. For a detailed description of travel and transportation in the area please see Section 3.14 Transportation and Appendix H.

The town of Alton desires to remain a rural/agricultural area. To retain this, agricultural uses (i.e., animals, gardening, and farming) will be permitted on residential lots, with reasonable limitations provided. Future areas of growth will be planned to minimize impact on community resources and to be consistent with the best use of the land surrounding Alton (FCAOG 1981).

3.9 Livestock Grazing

3.9.1 Regional Overview

Grazing in the Alton Coal Tract is administered by the BLM in accordance with the *Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah* (BLM 1997). These standards and guidelines were instituted for all Utah rangelands and are based on ecological principles that underlie the sustainable production of rangeland resources. With regard to rangeland health, the following four conditions must be present on BLM-administered public lands:

- Watersheds are in, or making significant progress toward, properly functioning physical condition, including their upland, riparian–wetland, and aquatic components; soil and plant conditions support infiltration, soil moisture storage, and the release of water that are in balance with climate and landform and maintain or improve water quality, and timing and duration of flow.
- Ecological processes, including the hydrologic cycle nutrient cycle, and energy flow, are maintained, or there is significant progress toward their attainment, in order to support healthy biotic populations and communities.
- Water quality complies with State water quality standards and achieves, or is making significant progress toward achieving established BLM management objectives such as meeting wildlife needs.
- Habitats; are, or are making significant progress toward being, restored or maintained for federal threatened and endangered species, federal proposed, Category 1 and 2 federal candidate and other special status species. (BLM 2007)

Section 3 of the Taylor Grazing Act of 1934, as amended, authorizes livestock grazing on BLM-administered public lands.

3.9.2 Allotments on and Adjacent to the Tract

Seven grazing allotments encompass 2,143 acres of the tract (Table 3.15; Map 3.10); two occur completely within the tract and five occur partially within the tract. The Alton and Cove (Alton) allotments occur completely within the tract. The allotments that occur partially within the tract are the Isolated Tracts, Levanger Lakes, Robinson Creek, Syler Knoll, and Upper Sink Valley allotments. These allotments are used exclusively for cattle grazing; they are not used to graze horses or sheep (BLM 2008a).

Table 3.15. Grazing Allotment Acres and Animal Unit Months in the Alton Coal Tract

Allotment	Total Federal Acres	Acres Within the Tract*	Percentage of Allotment in the Tract†	Total AUMs Allocated to Livestock	Calculated AUMs in Tract‡
Alton	392	388.5	99%	5	5
Cove (Alton)	158	155.9	99%	10	10
Isolated Tracts	1,028	243.9	24%	65	15
Levanger Lakes	872	196.3	23%	33	7
Robinson Creek	524	208	40%	24	10
Syler Knoll	442	363.5	82%	6	5
Upper Sink Valley	4,806	586.7	12%	311	38
Total	**8,222**	**2,143**	**26%**	**454**	**118**

* Acres are approximations subject to up to 5 acres of error as a result of potential misalignment of datasets at different scales.
† Percentage of each allotment in the tract has been rounded to the nearest whole number.
‡ Calculated by multiplying the total AUMs allocated to livestock by the percentage of the allotment in the tract.

The carrying capacity of a livestock grazing allotment is defined in terms of AUMs. In general terms, an AUM is the amount of forage needed to sustain one cow and her calf for one month. In specific terms, an AUM is a standardized measurement of the amount of forage necessary to sustain one cow unit (or its equivalent) for one month (approximately 800 pounds of usable air-dried forage), or the amount of forage necessary to sustain one 1,000-pound animal for one month.

Table 3.15 shows the total acres and percentage for each allotment that occurs partially or completely within the tract. The table also includes the total AUMs that are allocated to livestock in each allotment, and the calculated number of AUMs within the tract. The number of AUMs in the tract was calculated by multiplying the total AUMs allocated to livestock within the allotment by the percentage of the allotment within the tract. Calculated AUMs in the tract may or may not be properly represented because the AUMs in these allotments are typically found in concentrated areas due to the pinyon-juniper invasion. As pinyon-junipers encroach into shrub-steppe vegetation communities and outcompete forbs, grasses, and shrubs for resources, fewer acres of high quality forage are available for livestock consumption within allotments. However, because the rate and extent of juniper encroachment across allotments over the life of the tract cannot be determined, it is conservatively assumed that AUMs (forage) are evenly distributed throughout the allotments.

3.10 Paleontology

The Alton Amphitheatre is located below the west rim of the Paunsaugunt Plateau, immediately east of the Sevier fault zone. In general, the geological column in this portion of the Colorado Plateau (Foster et al. 2001) is highly fossiliferous in the Upper Triassic (Chinle Formation), Lower and Middle Jurassic (Moenave, Kayenta, and Carmel formations), and Upper Cretaceous (Dakota, Tropic, Straight Cliffs, Wahweap, and Kaiparowits formations). The tract would be located primarily in the Tropic Shale (53.5%), Dakota Formation (20.3%) and Alluvium (21.2%); the remaining 5% would be located in landslide deposits or areas where no data are available. Uppermost Cretaceous and Paleogene units (Canaan Peak, Pine Hollow, Grand Castle and Claron formations) are only sparsely fossiliferous due to the high energy or highly destructive weathering conditions that pervaded for most of that time. The fossil record of these units, whether highly or sparsely fossiliferous, is highly significant, and several of the formations, including the Chinle, Moenave, Wahweap and Kaiparowits formations, are justifiably famous

for their vertebrate fossil fauna. The geological column in the area records a succession of semiarid to arid terrestrial environments, with intertounging, shallow marine units in the early and middle Mesozoic, tropical, humid coastal plain conditions in the Late Cretaceous (Eaton 1991; Titus et al. 2005), and low elevation, intermontane basins during the latest Cretaceous and Paleogene. The fossil faunas and floras reflect this succession, and the tropical humid coastal plain deposits contain the highest fossil biomass. Recent work in the Kaiparowits Basin immediately to the east has demonstrated that the Alton Amphitheater contains one of the most complete Late Cretaceous (73–100 million years ago) terrestrial fossil records known in the world (Eaton et al. 1999). Surveys in the sparsely vegetated badlands of the central and southern Kaiparowits Plateau have uncovered the remains of dozens of new species of marine reptiles, dinosaurs, mammals, crocodylians, turtles, lizards, fish, and other taxa (Eaton et al. 1999; Nydam 1999; Gates 2004; Titus et al. 2005) making this resource world class. Paleontological resources in the Dakota and Tropic Shale formations are highly fossiliferous, consisting mainly of well known invertebrate fossils such as gastropods and cephalopods (Hamblin 2006). Located only 35 miles to the west, the greater Alton area holds potential for similar, significant Late Cretaceous fossil resources.

3.10.1 Paleontological Resources

The Alton Amphitheatre is underlain entirely by Late Cretaceous-age through Eocene-age sedimentary bedrock (Tilton 2001). In ascending order, these are the Dakota (target formation for coal mining), Tropic, Straight Cliffs, Wahweap, and Claron formations. A review of the Proposed Action in Chapter 2 shows that only the Dakota Sandstone and the Tropic Shale would be significantly impacted by the installation, operation, and maintenance of the mine. Both of these units have produced significant fossils in the immediate area near the town of Alton. The Dakota Formation yields an abundant and diverse lower and middle, Cenomanian terrestrial vertebrate fauna, of which only the mammals have been described (Eaton 1993, 1995). Many of the specimens reported in these papers were recovered from the Alton Amphitheatre or immediately nearby, and clearly support the resource potential of the Dakota Formation. Fish, turtles, crocodylians, squamates, and dinosaurs are also known to occur in the Dakota Formation. The Tropic Shale similarly yields a robust, highly significant vertebrate fauna (Gillette et al. 2001; Albright et al. 2002, 2007a, b). However, most of what is known about the formation has been gleaned from the Kaiparowits Plateau. Two partial plesiosaurs have been recovered near the town of Alton, one in the Ford Pasture area approximately 15 km southeast of Alton (A. Titus, unpublished data) and one in the Muddy Creek septarian mine approximately 20 km southwest of Alton (Gillette et al. 1999). A third isolated paddle bone, probably a humerus, was observed west of Trail Canyon (A. Titus, unpublished data); it was not collected. In addition to the marine fauna, the partial remains of an ornithischian dinosaur were collected from the Tropic Shale in the area of Muddy Creek, east and south of the tract.

Field inventories conducted in 2006 by the BLM found the Tropic Shale in the area around the southern margin of the tract to be highly fossiliferous (A. Titus, unpublished data). Unusual features were noted and consist of rare, articulated fish remains and the existence of limestone mounds that may represent cold CH_4 seeps active in the Cretaceous (sourced from the Smirl Coal Zone). Upper Cenomanian ammonites and other invertebrates of the *Euomphaloceras septemseriatum*, *Eumophaloceras costatum*, *Burroceras irregulare*, and *Neocardioceras juddi* ammonoid biozones are locally common and exceptionally well preserved in three dimensions inside of limestone concretions that weather out of the shale. The ammonoid taxa found in the Alton area are considered significant because three-dimensional, well preserved specimens are rarely found in stratigraphically younger, amminoid biozones of North America, such as the biozones present in the Alton area. In spite of the quality and abundance of fossil specimens that occur in the Tropic Shale in the Alton area, exposures of the formation are generally poor; soil and plant cover is extensive; and colluvium from the overlying Straight Cliffs and Grand Castle formations forms debris fans over much of the formation's areal extent. Therefore, the likelihood of discovering one of these limestone concretions before they have been damaged, altered or destroyed by

natural processes is relatively low. Based on nearby areas where the Dakota Formation and the Tropic Shale are better exposed, the following resource occurrence patterns can be expected out of the Dakota Formation:

- The lower gravely member of the Dakota Formation is mostly barren of fossils except for reworked specimens of large, petrified conifer logs (probably sourced from the Morrison or Chinle formations) and Paleozoic invertebrate fossils in clasts derived from the Sevier Thrust Belt. These are not of any particular scientific significance and would not require mitigation, although local petrified wood collectors do value the wood as a hobby material.
- The middle member of the Dakota Formation contains common plant, invertebrate, and vertebrate fossils. The distribution of the vertebrate fossils, which are the most significant from a protection perspective, is random and uncommon in overbank pond mudstone and less random and more concentrated in the basal layers of sandstone channel deposits. Large sections of turtle shells, bivalve and gastropod concentrations, ganoid fish scales, and scattered crocodylian teeth and bones are the most obvious remains in such channel deposits. However, bulk sampling and careful study of the resulting concentrates show a much more diverse fauna that includes dinosaur, lizard, and mammalian remains.
- The upper member of the Dakota Formation is abundantly fossiliferous; however, the fauna is dominantly nearshore marine and aquatic in nature. The vertebrate fauna is dominated by isolated shark teeth and poorly preserved, boney fish remains. Plant fossils associated with the Smirl Coal Zone have been observed to be very well preserved in the Skutumpah Creek area, and potential for well preserved vertebrates and soft bodied invertebrates in the coal zone is high even though no Konservat-Lagerstatte-type preservation has been previously observed in the Alton area.

The Tropic Shale is not formally divided into members, but it can informally be divided into three zones (intervals) in the Alton area, a lower siderite dominated interval, a middle highly fossiliferous carbonate concretionary interval, and an upper, poorly fossiliferous concretionary interval. They are as follows:

- The lower interval is approximately 7–8 m thick and immediately overlies the Smirl Coal Zone. Although fossiliferous, this lower interval has not yielded anything but poorly preserved ammonites and bivalves of the *Vascoceras diartianum* Ammonoid Biozone. Large specimens of the heavily ribbed ammonite *Calycoceras naviculare* are not uncommon, but they are nearly all crushed.
- The middle interval is characterized by calcite concretions 0.3–0.5 m in diameter and contain an abundant and well preserved benthic and nektic fauna. Ammonites and other mollusks are the dominant fauna, but crustaceans, corals, annelids, shark teeth, bony fish remains, and marine reptile skeletons also occur. Ammonites of the *Euomphaloceras septemseriatum* biozone (next zone above that of *V. diartianum*) are widespread and well preserved over much of North America. Although this zone's ammonites, including *Metoicoceras geslinianum*, *Sciponoceras gracile*, *Worthoceras vermiculum*, *Placenticeras cumminsi*, and *Eumophaloceras septemseriatum*, are common and very well preserved in the Alton area, they have no special scientific value outside of the local region. Hobby collectors do place great value on these fossils as objects of aesthetic beauty and wonder.

- The upper interval is characterized by three-dimensional ammonite fossils from the zones above the *E. septemseriatum* (middle) interval that are generally uncommon in North America, being well known from only a handful of places. Just south of the tract, on the east side of the Sink Valley, three-dimensional specimens of ammonites from the *Euomphaloceras costatum*, *Euomphaloceras* n. sp., *Burroceras irregulare*, and *Neocardioceras juddi* Ammonoid Biozones were collected in succession (Titus 2002). This is a very rare occurrence and is one of only three places in North America where this can be observed. It is thought that the presence of unusually high levels of coal-sourced CH_4 in the sediment during the fossilization process may have helped catalyze the excellent preservation of this succession (Titus 2002). Vertebrates are not particularly common in this interval. However, perfectly preserved three-dimensional fish fossils in this interval have been collected from the *Euomphaloceras costatum* zone in the Ford Pasture area of the BLM-KFO. The overlying Turonian sediments contain concretions, but these are generally poorly fossiliferous or contain poorly preserved fossils. To the east, this interval has the highest potential for marine reptiles. Unfortunately, there are not enough data to model their abundance in the Alton area even though their presence is certain given the finds at Muddy Creek and Ford Pasture. Higher levels in the Tropic Shale and Straight Cliffs Formation are fossiliferous but would not be impacted by activities outlined in the Proposed Action or alternatives and therefore are not reviewed.

Potential also exists for Late Pleistocene fossil resources in older alluvial and/or pluvial deposits; however, there are no good age constraints on alluvial fill in the Alton Sink and therefore no way to accurately assess potential. A similar setting near Skutumpah Creek, approximately 15 km to the southeast, yielded a partial proboscidean skeleton (cf. *Mammuthus columbi*) that was excavated by the Museum of Northern Arizona; therefore, it is likely that the floors on the alluvial fill are old enough to contain pre-Holocene vertebrate megafauna.

3.11 Recreation

Southwestern Utah offers a variety of recreation opportunities in varying terrain, including mountains, desert, forests, canyons, rivers, and lakes. Major recreation attractions are Bryce Canyon National Park, Dixie National Forest, and Grand Staircase-Escalante National Monument, and several scenic highways and backways. A number of developed and semideveloped campgrounds, day-use areas, back country roads, and trails exist for recreational use in the area. The analysis area for recreation (defined below) is managed by the BLM, NPS, USFS, UDWR, counties, and local municipalities.

The recreation resources analysis area for the Alton Coal Tract consists of the tract, linear features such as roads and OHV trails affected by mine-related activities, and all adjacent lands within a 5-mile radius of the tract (Map 3.11). A 5-mile radius (encompassing approximately 92,573 acres) was chosen on the assumption that recreational users affected by mining activities would move to lands that provide similar recreation opportunities that are immediately adjacent to the tract. Outside the 5-mile radius, additional recreation activities, areas, and opportunities were identified to describe the indirect and cumulative impacts of the alternatives. These areas were identified from BLM and USFS land-use plans, NPS general management plans, UDWR management areas, discussions with BLM, USFS, and UDWR resource specialists, and county and municipality plans.

3.11.1 Bureau of Land Management Recreation Opportunities, Management Objectives, and Experiences

BLM manages the tract and adjacent areas as part of an extensive recreation management area (ERMA) for undeveloped and dispersed recreation opportunities. ERMA objectives include providing for visitor health and

safety, limiting user conflict, and protecting resource values, with no activity-level planning required. Therefore, actions within ERMAs would generally be implemented directly from land-use planning decisions. Dispersed camping is allowed throughout the recreation analysis area, which is managed as VRM Class IV, allowing for landscape modifications (see Section 3.2 Aesthetic Resources). OHV use is permitted on designated routes on BLM-managed lands within the analysis area. There are approximately 92 miles of routes available for OHV use within the recreation analysis area. Of the 92 miles, approximately 13 miles of routes are in the tract: 11 miles on BLM-managed land and 2 miles on private land. The BLM manages lands within the analysis area for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, competitive events, and viewing nature, wildlife, and geologic features. No other recreational trails or facilities are located on BLM-managed lands within the recreation analysis area.

BLM also manages the Grand Staircase-Escalante National Monument. The monument was established in 1996 and is located approximately 10 miles southeast of the analysis area. No portion of the monument is within the analysis area. However, it is expected that some recreation users, such as hunters, if displaced, would relocate their activities to similar ecological systems on the monument. Approximately 600,000 users visit Grand Staircase-Escalante National Monument each year. Areas within the monument adjacent to the analysis area are managed as an Outback Zone (BLM 1999) for undeveloped and self-reliant visitor experiences. Visitor facilities would be provided only for locations needed for resource protection. Most of the monument adjacent to the analysis area is managed as a VRM Class II and III.

Within the KFO, the BLM manages approximately 25,579 acres within the analysis area. In the KFO RMP all 25,579 acres within the analysis area are managed as an ERMA. Under the RMP, ERMAs provide for a range of undeveloped and dispersed recreation opportunities. Very little recreational use occurs on BLM-managed lands within the analysis area, with hunting being the predominant recreation activity. BLM does not have visitor use numbers for recreational activities occurring within the analysis area.

3.11.2 U.S. Forest Service Recreation Opportunities, Management Objectives, and Experiences

The Dixie National Forest has 17,397 acres in the recreation analysis area. The existing Dixie National Forest Land and Resource Management Plan (Dixie National Forest Plan) manages USFS lands within the analysis area as semiprimitive, nonmotorized zones and semiprimitive, motorized zones on the Recreation Opportunity Spectrum (ROS) (USFS 1986). Semiprimitive, nonmotorized zones are settings that have primitive roads or trails that are not open to motorized use. These zones are generally at least 2,500 acres in size and are between 0.5 and 3.0 miles from all roads, railroads, or trails with motorized use. Access to these zones is by nonmotorized trails, nonmotorized primitive roads, or cross-country. The analysis area contains a natural-appearing environment and has a high probability of solitude.

Semiprimitive, motorized zones are managed in a similar manner as the semiprimitive, nonmotorized zones. The only difference is that the semiprimitive motorized zone allows the use of motorized access on trails and roads within the area.

Dixie National Forest lands within the analysis area are managed for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, and viewing nature, wildlife, and geologic features.

There is limited motorized access to Dixie National Forest lands within the analysis area. Few roads access these locations and therefore, little recreation use occurs in these areas. Existing recreational facilities on nearby Dixie National Forest lands include the nonmotorized, 78-mile-long, Grand View trail that runs from the Thunder Mountain trailhead to the Sheep Creek trailhead. The Paunsaugunt OHV trail system also runs

through Dixie National Forest lands near the analysis area. Dixie National Forest does not maintain visitor use information for lands near the analysis area.

Portions of the Dixie National Forest within the analysis area are managed under several management prescriptions (recreation, wood production and utilization, and livestock grazing) developed in the Dixie National Forest Plan. Management prescriptions are distinct from ROS zones in that they are intended to provide management guidelines for many different types of uses on the Dixie National Forest, and not just recreational use.

Approximately 12,070 acres of the analysis area is in the recreation management prescription. This management prescription provides guidelines for a broad range of outdoor recreation activities that meet recreational demands, and allows for a broad range of low-cost, dispersed recreation opportunities.

Approximately 4,470 acres of the analysis area are in the wood production and utilization management prescription. This management prescription is designed to manage for wood and fiber production. However, along forest roads, the USFS manages the area for a semiprimitive, motorized experience and a semiprimitive, nonmotorized experience in nonroaded areas within the zone.

Finally, approximately 855 acres of the analysis area are in the livestock grazing management prescription. This management prescription is designed to manage for intensive livestock grazing. The prescription also allows for dispersed recreation, with opportunities ranging from semiprimitive, nonmotorized to roaded natural on the ROS.

3.11.3 Bryce Canyon National Park Recreation Opportunities, Management Objectives, and Experiences

Bryce Canyon National Park is located approximately 13.5 miles east of the tract. The park is open year-round and over the past five years, annual park attendance has averaged roughly 1.5 million visitors. The NPS provides visitors with numerous opportunities to explore the landscape and experience a relaxing, peaceful encounter in the outstanding natural setting of Bryce Canyon National Park.

Although Bryce Canyon National Park is located outside the recreation analysis area, roads to the park may be affected by mine-related actions and some recreational settings may be affected by mine operations (see Section 3.2 Aesthetic Resources for more information on visual resources and nightscapes; see Section 3.3 Air Resources for more information on visibility).

Over 99% of the park is managed for recreational activities. The Bryce Canyon National Park General Management Plan (NPS 1987) provides approximately 37% (13,325 acres) of the park as the natural environmental subzone, where lands are managed for preservation of natural features and no development is allowed. Approximately 62% (22,325 acres) of the park is managed as the wilderness subzone, where lands are managed to retain eligibility for wilderness designation in accordance with criteria developed for wilderness designation under the Wilderness Act of 1964. The remainder of the park (185 acres) is managed for preservation of historic features and development of facilities for park management.

Recreation use in Bryce Canyon National Park includes hiking, backpacking, camping, cross-country skiing, photography, picnicking, and viewing nature, wildlife, and geologic features. Hunting is not allowed in Bryce Canyon National Park.

3.11.4 Utah Department of Wildlife Resources Recreation Opportunities, Management Objectives, and Experiences

The UDWR manages hunting and fishing in Utah. The tract is located in UDWR's PPMA. This management area (approximately 957,122 total acres in size) is open to all small-game hunting; hunting for mule deer and elk is managed through a permit system. The UDWR manages big game hunting in the PPMA as a trophy hunting area, with high buck-to-doe ratios for mule deer. Combined with limited hunting permits, the area is also popular for wildlife viewing of trophy mule deer, particularly because the area is between high visitation sites, such as Bryce Canyon National Park and Grand Staircase-Escalante National Monument.

For the 2007 hunting season, approximately 180 mule deer permits were issued for the PPMA. The UDWR allocated approximately 34 permits for archery only, 50 permits for muzzleloader only, and 96 permits for any weapon. In 2007 success rates for mule deer ranged from 68% for archery to 78% for muzzleloader and any weapon permits, with 100% of all permits being used.

Also in 2007, approximately 33 elk permits were issued for the management area, with nine permits allocated to archery only, five permits for muzzleloader only, and 19 permits for any weapon. The 2007 success rates for elk ranged from 17% for archery only to 45% for any weapon. The muzzleloader-only success rate was 20%. Approximately 97% of all 2007 tags were used in the PPMA.

There are no data on the number of hunters using the PPMA for hunting other species (predominantly small game), but UDWR believes most small-game hunters are from nearby communities (Personal Communication, Aoude 2008).

Finally, Upper Kanab Creek has a small rainbow trout fishery, but no fishing occurs on or near the tract (Personal Communication, Hadley 2008).

The tract falls within a cooperative wildlife management unit (CWMU). A CWMU is a hunting area consisting primarily of private lands. Its management involves cooperation with public agency land managers to manage healthy and diverse populations of big game animals. The CWMU is 55,000 acres and ranges in elevation from 5,500 feet to 9,000 feet. Public hunting is permitted from June through December (CWMU 2008). Within the Alton CWMU, 21 deer permits and four elk permits are issued each year. According to the CWMU contact, the tract does not fall within prime CWMU deer or elk habitat, and over the past 20 years, there have been no deer or elk kills in the proposed tract (Personal Communication, Heaton 2009).

3.11.5 Designated Highways Recreation Opportunities, Management Objectives, and Experiences

The National Scenic Byways Program was established under the Intermodal Surface Transportation Efficiency Act of 1991, and reauthorized in 1998 under the Transportation Equity Act for the 21st Century. Under the program, the U.S. Secretary of Transportation recognizes certain roads as National Scenic Byways or "All-American Roads" based on their archaeological, cultural, historic, natural, recreational, and scenic qualities. There are 126 such designated byways in 44 states. The Federal Highway Administration manages the National Scenic Byways system to maintain the defined qualities of a designated road segment as a scenic byway. Utah scenic byways are managed by the Utah Office of Tourism and are also managed to maintain the defined qualities of a designated road segment as a state scenic byway

Mine-related activities would result in the use of several transportation corridors that have been designated as scenic byways and that lead to recreation areas. US-89 is designated as a State of Utah scenic byway from the

intersection with SR-12 south to the City of Kanab. It is also known as the Mount Carmel Scenic Byway and is designated as a National Heritage Highway. The road provides access to the Dixie National Forest and BLM-managed lands within the recreation analysis area.

SR-12 is another designated scenic byway. It has been designated as an All-American Road, a state scenic byway, and a national forest byway. The road accesses portions of Dixie National Forest, Bryce Canyon National Park, Grand Staircase-Escalante National Monument, and Kodachrome Basin State Park. The road is popular for sightseers and visitors to Bryce Canyon and Capitol Reef national parks. The East Fork of the Sevier Scenic Byway (SR-12) travels south from SR-12 through the Sevier River Valley with the Paunsaugunt Plateau west of the byway and the Pink Cliffs to the east. The byway follows the river the entire way, passing Tropic Reservoir about halfway. From US-89, 9 miles east of Kanab, the Johnson Canyon/Alton Amphitheatre Scenic Backway first passes through portions of the Grand Staircase-Escalante National Monument, including the vermillion cliffs, then climbs into the white cliffs. The Alton road spur of the byway travels north to Alton and provides better views of the pink cliffs, the Alton Amphitheater, and extinct volcanoes. The Alton road then loops northeast rejoining US-89 north of Glendale.

3.11.6 Transportation and Recreation

Recreationists currently use portions of the coal haul transportation route (see Section 2.5.4) for sightseeing, travel, or both to and from other recreation destinations described here. A transportation study (Fehr and Peers 2008) evaluates the existing condition of traffic on this route. The results of this study detailing the affected environment for transportation are included in Section 3.14 Transportation.

3.11.7 Other Recreation Opportunities, Management Objectives, and Experiences

Garfield and Kane counties both have management plans that provide direction for management of various activities within both counties. The Garfield County management plan has not completed the section regarding recreation management at this time. In the management plan, the county states that the "management direction for the Resource/Resource Use (Recreation) will be completed, subject to public comment, and adopted at some point in the future" (FCAOG 2007a). However, the plan does establish land-use management areas, including several recreation areas ranging from wilderness to developed recreation. According to the plan, areas around the tract are managed as Recreation II zones. Recreation II zones provide for the following:

> Motorized and nonmotorized recreation activities such as driving for pleasure, viewing scenery, picnicking, fishing, snowmobile riding, and cross country skiing are possible. Motorized travel may be restricted to designated routes to protect the physical and biological resources. Visual resources are managed so that management activities maintain or improve the quality of recreation opportunities. Management activities are not evident, remained visually subordinate, or may be dominant, but harmonize and blend with the natural setting. Landscape rehabilitation is used to restore landscapes to a desirable visual quality. Enhancement aimed at increasing positive elements of the landscape to improve visual variety is also used. Dispersed recreation is only lightly managed, and management prescriptions are generally limited to situations necessary to maintain ecological stability and visual objectives of the management area. These lands are generally managed for VRM Class III (FCAOG 2007a).

The *Kane County, Utah General Plan* (FCAOG 1998a) does not provide specific management direction for all recreation within the county. Much of the land within and adjacent to the tract is managed for agriculture. The agriculture zone does not provide any management prescriptions for recreation. However, the plan does provide for management direction relating to recreational use of federal public

lands within the county. It contains a request for federal agencies to provide for multiple recreation uses in Kane County by maintaining existing amenities and providing new recreation sites for the public's enjoyment. It also contains a request for agencies to pursue motorized and nonmotorized public access opportunities and to collect, review, and analyze data on recreation use within the county.

3.12 Socioeconomics

3.12.1 Demographic Overview

In accordance with NEPA, this analysis of the local social and economic conditions addresses the relationships between the Alton Coal Tract and the communities it may affect. The following characterization of current social and economic conditions describes demographics, employment, income, fiscal and budgetary information, and community facilities in the region that could be affected by coal mining activities related to the tract.

The analysis area for social and economic resources (the tract's socioeconomic study area, or SESA) includes Kane, Garfield, and Iron counties. Although the tract is located in Kane County, 0.10 miles south of the town of Alton, impacts to the surrounding counties will be analyzed given the projected truck transportation and potential number of employees that may commute from surrounding counties.

3.12.1.1 SOCIAL SETTING

Presently, Kane, Garfield, and Iron counties are a collection of rural communities characterized by pastoral landscapes, open space, and small town qualities. Many of the area residents are of the Church of Jesus Christ of Latter Day Saints pioneer heritage and are prideful of the values, customs, and culture that have resulted from their historical connections (1998). Many of the area's residents are interested in maintaining a rural lifestyle and a quality environment that has been so much a part of their past. According to the Garfield County General Plan the county is committed to protecting the "custom, culture, and welfare of Garfield County's visitors and residents while providing for the conservation, use and/or enjoyment of its resources" (2007a).

With large percentages of lands under public ownership, many members of communities primarily within Kane and Garfield counties are very interested in public land-use management decisions. Because federal and state governments manage more than 95% of the land in Kane and Garfield counties, residents believe that much of the county's potential wealth is tied to its public lands. Therefore, county leaders are interested in developing cooperative working relationships with government agency managers (2007a). Although Iron County has a greater percentage of lands under private ownership (29%), the social values and issues are similar to Kane and Garfield counties. According to the Iron County Local Planning Summary, their primary goal is to "retain control of the issues which effect [affect] the County's custom, culture and economic stability" (Utah Governor's Office of Planning and Budget 2003).

3.12.1.2 POPULATION AND HOUSING

Due to the aridity, ruggedness, and isolation of the Alton Coal Tract, the overall population of the SESA is quite sparse. Garfield County has a population density of fewer than 0.9 people per square mile; Kane County has 1.5 people per square mile; and Iron County has more than 10.2 people per square mile (much higher than Garfield and Kane counties but much lower than the state average of 27.2 people per square mile).

Despite the small population relative to the geographic size of the counties, the population rates have steadily increased in recent years. Kane County's population has increased 23% since 1990 to 6,740 in 2009. The increase is attributed to consistent in-migration (more people moving into the county than out). The annual increase in Kane County is relatively low (1.2%). The town of Alton reported 142 people in 2009, a 34% increase from 1990. The largest city in Kane County is Kanab, with a population of 3,804 (UDWS 2010a). See Table 3.16 for county populations.

Garfield County, located directly north of Kane County, has experienced similar in-migration growth patterns. The population has steadily increased (24.5%) since 1990 to 5,149 in 2009. The population in Garfield County increased 2.1% from 2008 to 2009. The cities with the largest populations are also the areas experiencing the greatest amount of growth. These cities (populations in parentheses) are Panguitch (1,502), Escalante (757), and Tropic (472) (UDWS 2008a).

Iron County's population is nearly eight times higher than Kane and Garfield counties and has expanded rapidly in recent years. However, the population growth slowed dramatically in 2009. The county's annual growth rate of 1.0% ranked below the statewide average growth rate of 1.5%. Overall, the county's population has increased 55.6% since 1990 to 46,825 residents in 2009. Cedar City maintains the bulk of the county's residents with a 2009 population of 29,144 (UDWS 2010b).

Table 3.16. Population Characteristics of the Alton Coal Tract Socioeconomic Study Area

	1990	2000	2009	Percentage Change Since 1990
Kane County	5,169	6,046	6,740	23.3%
Garfield County	3,890	4,735	5,149	24.5%
Iron County	20,789	33,779	46,825	55.6%
State of Utah	1,722,850	2,233,169	2,2,757,779*	37.5%
Town of Alton	93	134	142	34.5%

Source: U.S. Census Bureau 2000b; UDWS 2008c; UDWS 2008a; UDWS 2008b.
*Population data are from 2008.

With regard to housing, property values are often a concern of local residents when considering changes to existing land uses in their community. Scoping comments for the Alton Coal EIS reflect concern over a decrease in property value with the introduction of a mine in the area. In general, the value of a residential property is primarily influenced by the taxes levied on the property. Property tax revenue helps fund state and local government budgets with regard to operating budgets as well as school and fire districts. Counties use property tax revenue to fund court systems, sherriff's departments, transportation projects, and emergency services.

Property tax impacts could occur near the proposed mine due the physical change in land use and the concentration of mining activities in and around the Alton Coal Tract; as such, existing property values within Kane County (the county in which the mine would be located) are evaluated here. State of Utah numbers will be given for comparative purposes. In 2009, the average estimated residential sales price was $185,262 and the primary residential tax rate was 0.004854 in Kane County. The effective tax rate equals the total residential taxes charged divided by the total residential market values. The average property tax paid in Kane County in was $899. In 2009, the statewide average estimated residential sales price was $206,150, and the primary effective tax rate was 0.005910. The average property tax payment was $1,169 in (Utah State Tax Commission 2007). Second-home ownership is a difficult-to-measure yet important trend occurring in southern Utah. The challenge of tracking second-home ownership is to accurately disclose the percentage and valuation of new second-home permits versus permits for new houses for full-time residents. Because Kane County would likely be the only county in the SESA impacted by the tract due to proposed location of the mine, inquiries regarding second-home ownership were made only to Kane County. Although no official record currently exists, the Kane County Assessor reports that more than half of the homes in Kane County are second homes. Most of those homes are concentrated on Cedar Mountain (Little 2009).

Recent studies have indicated that second homes are typically built based on scenic beauty and recreation potential. A Colorado-based study reported the 95% of second-home owners selected their homes based on scenery, and 91% cited recreation opportunities as being important amenities that influence their decision (Venturoni et al. 2005). Initially, the construction of new second homes may be beneficial because they increase the local property tax base. However, a high concentration of second homes may also be problematic for local residents because they could increase the cost of living for local residents by increasing property taxes. There is a potential for conflict within communities between second-home owners and full-time residents because full-time residents often desire to diversify their economic base, become less dependent on tourism, and meet the basic needs of the community with respect to affordable housing and education (2008d).

3.12.1.3 EMPLOYMENT AND INCOME

The labor market in the SESA has been subject to the impacts of the slowing economy in recent years. The unemployment rates within the SESA and across the state have risen dramatically. With a 2009 unemployment rate of 6.6 in 2009, Utah's unemployment rate is the highest it has been in more than 20 years (UDWS 2010b). Job losses have been prevalent across a range of industries, but have been most heavily concentrated around the construction and manufacturing industries. See Table 3.17 for characteristics of the SESA's labor force.

Table 3.17. Labor Force Characteristics of the Alton Coal Tract Socioeconomic Study Area in 2009

	Labor Force	Employed	Unemployed	Percentage Unemployment Rate
Kane County	3,522	3,280	242	6.9%
Garfield County	2,866	2,594	272	9.5%
Iron County	20,795	19,155	1,693	7.9%
State of Utah	1,364,495	1,274,788	89,706	6.6%

Sources: UDWS 2007; 2008c; 2008a; 2008b; 2010b.

The distribution of employment by industry sector in the SESA appears in Table 3.18. Throughout the area, the government is the predominant employer, with just under 25% of residents per county employed in this industry sector. The leisure and hospitality sector also accounts for numerous jobs in the area. Garfield County has the highest percentage (37%) of residents employed in the leisure and hospitality sector. One of the largest employers in Garfield County is Ruby's Inn. Other tourism-based employers in the county include Bryce Canyon Resort, Offshore Marina, Bryce Canyon Pines, and the New Western Motel. In Kane County, where 29% of the workforce is employed in the leisure and hospitality sector, Aramark (Lake Powell Resorts) is one of the largest employers. Best Friends Animal Sanctuary is also one of the largest employers and hosts more than 20,000 visitors a year (Best Friends Animal Society 2008). Iron County maintains fewer jobs (12%) in the leisure and hospitality sector. However, the Utah Shakespearean Festival held at Southern Utah University draws thousands of tourists to Iron County annually. Currently, mining and natural resource development accounts for 71 jobs (less than 1% of jobs) in the entire SESA.

Table 3.18. Employment and Percentage Share by North American Industry Classification System Industry Sector in 2009

	Kane County	Garfield County	Iron County	Total per Sector
Natural resources and mining	6	9	56	71
	0.0%	*0.4%*	*0.4%*	*0.3%*
Construction	100	51	1,636	1,787
	5.8%	*2.3%*	*10.5%*	*8.3%*
Manufacturing	108	44	1,728	1,880
	3.6%	*1.9%*	*11.0%*	*8.8%*
Trade/transportation utilities	427	243	3,155	3,825
	14.3%	*10.8%*	*20.2%*	*17.8%*
Information	15	131	137	283
	0.5%	*5.8%*	*0.9%*	*1.3%*
Financial activities	123	29	783	935
	4.1%	*1.3%*	*5.0%*	*4.7%*
Profess/business services	45	17	1,305	1,367
	1.5%	*0.8%*	*8.3%*	*6.4%*
Education/health/ social services	115	263	1,566	1,944
	3.8%	*11.6%*	*10.0%*	*9.0%*
Leisure/hospitality (tourism)	874	834	1,923	3,631
	29.1%	*37.0%*	*12.3%*	*17.0%*
Other services	442	15	341	798
	14.8%	*0.6%*	*2.1%*	*3.7%*
Government	743	621	4,334	5,698
	24.8%	*28.0%*	*27.7%*	*26.0%*
Total	**2,996**	**2,258**	**15,648**	**21,436**

Sources: UDWS 2008c; 2008a; 2008b.

From 2007 to 2008, the average monthly wage increased slightly in the SESA despite the lean job markets. Despite this increase, the average monthly income in each county in the SESA is substantially lower than the state average (Table 3.19). The low wages are attributed to the high percentage of lower-paying, seasonal, tourism-related jobs in Kane and Garfield counties and to a large working student population in Iron County.

Table 3.19. Alton Coal Tract Socioeconomic Study Area Income and Wages in 2008

	Kane County	Garfield County	Iron County	State of Utah
Total personal income (millions)	$210.0	$127.7	$1,023.0	$82,890.1
Per capita income	$32,102.0	$27,770.0	$23,147.0	$30,291.0
Average monthly nonfarm wage	$2,094.0	$2,008.0	$2,218.0	$3,121.0

Sources: UDWS 2008c; 2008a; 2008b.

3.12.1.4 TOURISM

As mentioned in the Recreation section of Chapter 3, there are numerous recreation and tourism opportunities near the tract. Bryce Canyon National Park, Dixie National Forest, and Grand Staircase-Escalante National Monument are major tourist attractions in the area. Visitors to the area contribute to the local economy via direct spending, tourism-related employment, and tourism-based tax revenues. Tourism tax revenues are derived from local tax revenues from traveler spending, transient room tax, restaurant tax, car rental tax, and gross taxable retail sales. In general, spending by travelers in the SESA has fluctuated in recent years. The fluctuations in traveler spending are attributed to the weakening in the United States economy since 2007. Since 2007 spending by travelers in Kane and Garfield Counties has increased by 8.4% and 18.0%, respectively. Spending by travelers in Iron County decreased 5.2% from 2007 to 2008 (Utah Office of Tourism 2009). Table 3.20 reflects travel and tourism contributions in 2008.

Table 3.20. Alton Coal Tract Socioeconomic Study Area Tourism Profile 2008

	Kane County	Garfield County	Iron County
Spending by travelers (millions)	$75.4	$72.0	$99.2.0
Travel and tourism-related employment	705	708	1,412.0
Local tax revenue from traveler spending (000s)	$7,193.9	$6,873.0	$9,468.1
State ranking (spending by travelers per county)	12th	14th	9th

Source: Utah Office of Tourism 2009.

Within the SESA, there are numerous tourism-based businesses (Bed and Breakfasts, resorts, hotels, etc.) to accommodate visitors who are in the area to visit the national parks and other tourist destinations. According to local residents, tourism and recreation are the primary industries located on the coal haul transportation route. Locals have also reported a growing number of bicycling and motorcycling tours and OHVs along US-89.

Individuals who participated in the scoping process reported that tourists to the area contribute significantly to the local economy. Although it is difficult to predict exactly how much tourists spend in an area on a given day, previous researchers have developed some estimates. A 1994 survey by Utah State University economists estimated visitor spending for southern Utah in general and for three wilderness areas and one WSA in southern Utah (Keith and Fawson 1995). Table 3.21 summarizes this study (visitors include general leisure visitors, business visitors, and recreationists to these four areas).

Table 3.21. Spending Estimates for Visitors to Southern Utah and Visitors to Southern Utah Wilderness Areas and Wilderness Study Areas

	Expenditures Per Person Per Day (2010 dollars)
All visitors to southern Utah	$91
Visitors to three southern Utah wilderness areas and one WSA	$24–$33

Source: Kei h and Fawson 1995.

Notes: Original data in 2001 dollars for southern Utah visitors and 1994 dollars for Utah wilderness area visitors. Adjusted to 2010 dollars using Consumer Price Index inflation values.

Southern Utah visitors are divided into those visiting for leisure purposes (74%) and hose visiting for business purposes (26%).

The three Utah wilderness areas surveyed are Box-Death Hollow (Garfield County), Dark Canyon (San Juan County), and Paria Canyon (Kane County). Grand Gulch (San Juan County) is a WSA. These four areas in southern Utah are considered multi-day backpacking venues; therefore, the expenditures estimate may not be representative of day-use spending. Day-use spending can be higher because recreation day-use visitors may, for example, stay in motels, eat in restaurants, and purchase from local retailers. Also, these four areas are a mix of designated wilderness and WSAs.

Although the public lands within the SESA are not marketed, they do provide an economic and social value to local residents and tourists. Even if no money changes hands, visitors to the area and local residents find value and benefit by the presence of public lands because they provide satisfaction and unique opportunities. With specific regard to the SESA, the public lands that surround the town of Alton and other small communities contribute to the area's rural, small-town feel. The local residents enjoy the area because of the pristine beauty and opportunities for solitude that the public lands provide. According to newer residents in towns in the SESA, the area's peaceful lifestyle and slow pace was an attraction (FCAOG 2007b). Thus, the public lands are of value to local residents and the tourist who enjoy the area.

Typically, nonmarket valuations have been used to estimate the monetary value individuals place on public lands. Nonmarket valuations view public lands in terms of their on-site value and their "passive" use or their off-site value. Economists have used data collected from actions or survey responses of visitors, homebuyers, and the public to simulate market conditions and elicit measures of value (BLM 2008g). The nonmarket value is the value received by the users and is above and beyond what they received for their direct expenditures. Table 3.22 presents average on-site use values for selected recreation activities that resemble public use activities near the Alton Coal Tract.

Table 3.22. Average Nonmarket Use Values of Recreation on Public Land from Existing Studies of Activities in the Intermountain Area

Recreation Type	Value Per Person Per Activity Day (2010 dollars)
Biking	$71
Camping	$29
Float boating	$49
General recreation	$17
Hiking	$36
Picnicking	$29
Sightseeing	$15
Wilderness recreation	$15
Wildlife viewing	$39

Source: BLM 2008f.

Notes: Original data are in 1996 dollars and have been adjusted here to 2010 dollars using the Consumer Price Index inflation rate. All values are rounded to the nearest dollar. Data are median values from existing studies. The Intermountain area is considered USFS Regions 1–4. General recreation is a composite of recreation opportuni ies at a site with a measure for the site, not a specific activity.

In contrast to the on-site valuation of public lands, it is important to understand the passive-use valuation of public lands. Passive-use studies measure the satisfaction of knowing that undeveloped, primitive public land is simply "there" and will be preserved. A passive-use valuation study of Utah wilderness, completed more than 15 years ago, found that Utah residents placed an economic value of $72 per household (in 2006 dollars) on the preservation of the 2.7 million acres of designated wilderness in Utah (2008f). Although the lands within the proposed Alton Coal Tract and surrounding areas are not designated wilderness areas, the example has been given to demonstrate the economic value of undeveloped, primitive landscapes. Although the economic value for passive use on public lands not containing a high level of wilderness characteristics would almost certainly be less than $72 per 2.7 million acres, the exact value households are willing to pay is unknown.

3.12.2 Government and Public Finance

3.12.2.1 REGIONAL COAL PRODUCTION

In 2008, Utah was ranked as the 14th highest coal-producing state with 24.3 million tons of coal being produced in mines throughout Utah (State of Utah 2009). Most Utah coal production occurs in Carbon, Emery, and Sevier counties. According to the BLM, no coal production has occurred in Kane and Garfield counties since 1971 (2008f). However, 53% of the state's estimated recoverable coal can be found in Kane County and 20.6% in Garfield County (Utah Geological Survey 2008). Iron County has 1.7% of the state's coal reserves with no coal mining currently occurring in the county.

In fiscal year 2008, the sales value of coal produced in Utah was more than $380 million dollars. Of the total sales value, more than $22 million was reported in royalty revenues. Of the $22 million, $12.0 million was disbursed to Utah. Bonus payment totaled $661,980.59 million in fiscal year 2008 (Bureau of Ocean Energy Management, Regulation and Enforcement 2010). ACD does not currently contribute any property taxes or royalties to the federal, state, or local government because they do not own or lease the land in the tract.

3.12.2.2 PERMANENT COMMUNITY IMPACT FUND BOARD

The Permanent Community Impact Fund Board (CIB) provides loans and/or grants to state agencies and subdivisions of the state that are or may be socially or economically impacted, directly or indirectly, by mineral resource development on federal lands. Projects eligible for funding include planning, construction, and maintenance of public facilities as well as provision of public services. Between fiscal years 2005 and 2009, Kane County received a total of $16,279,213 CIB funding ($2,050,213 in grants and $14,229,000 in loans). Of the 25 total projects funded by CIB, five were in the town of Alton. Garfield County received a total of $15,067,895 in funds ($4,700,895 in grants and $10,367,000 in loans). Iron County received at total of $13,577,750 in CIB funding ($546,750 in grants and $13,031,000 in loans) (Utah Department of Community and Culture 2009).

3.12.3 Public Health and Safety

3.12.3.1 TRANSPORTATION

Principal transportation routes in the SESA are US-89, SR-14, SR-20, and I-15. US-89 runs from north to south through the towns of Panguitch, Hatch, and Kanab, and serves as the main access road to south-central Utah including such national parks Bryce Canyon and Zion.

UDOT has five roadway improvement projects along US-89 scheduled for completion in the next five years according to the *Statewide Transportation Improvement Plan 2008–2013*. The projects include construction of a passing lane from Milepost 88.3 to 89.1 (estimated cost: $1.4 million) and partial realignment and pavement rehabilitation from 300 North in Kanab to Kanab Creek Bridge (estimated cost: $10 million). In Garfield County, intersection improvements at US-89 and SR-14 (Long Valley Junction) are underway (estimated cost: $16 million) and road widening along US-89 is projected (estimated cost: $9 million) (UDOT 2008).

In Kane, Garfield, and Iron counties, the county governments are responsible for ongoing road maintenance and repair. Special service districts undertake capital construction projects financed primarily by CIB funds. Local government assistance for road improvements includes Class B and Class C Road Funds programs as well as federal and state aid for specified projects.

3.12.3.2 LAW ENFORCEMENT

The Kane County Sherriff's Department employs 12 full-time law enforcement officers. They provide law enforcement services to the unincorporated areas of Kane County and several contract communities, including Alton. Kanab and Big Water have their own police departments.

Garfield County has one county sheriff, three deputy sheriffs, two Panguitch City police officers, two Utah Highway Patrol troopers, and one Escalante police officer. The sheriff's office has 21 volunteers from Panguitch, eight from Bryce Valley, and 19 from Escalante (FCAOG 1998b).

The Iron County Sherriff's Department has 33 full-time officers, 18 of which are patrol officers. The department provides law enforcement to the unincorporated areas of the county and small cities including Summit, Paragonah, Kanarraville, and Newcastle. The jail is operated by the Iron County Sherriff's Department and employs 45 officers, one full-time bailiff, and five officers are part-time bailiffs. Several cities in Iron County have their own police departments, including Cedar City, Enoch, Parowan, and Brian Head. Southern Utah University in Cedar City also has its own police department (Personal Communication, Evans 2008).

Crime in Kane County is considerably lower than the average for the State of Utah. In 2005, the crime rate per 1,000 people in Kane County was 11.77 (73 total index crimes) and Utah's crime rate per 1,000 was 40.35 (99,650 total index crimes). Index crimes are crimes against persons or property. There were 316 arrests made in Kane County in 2005. Larceny was the most reported crime with 44 reports, and aggravated assault was the second most reported crime with 17 reports. There were zero homicides and two reported rapes in the county in 2005 (Utah Department of Public Safety 2005).

Garfield County's crime rate per 1,000 was 34.23. The index crime rate in 2005 was 153. The county had 116 reports of larceny. There were zero homicides and two reported rapes in 2005 (Utah Department of Public Safety 2005).

The crime rate per 1,000 in Iron County was 28.24. The index crime rate in 2005 was 1,082. Larceny was also the most reported crime in Iron County with 753 reports. Approximately 1,656 arrests were made in the county. There was one homicide and 14 reported rapes in 2005 (Utah Department of Public Safety 2005).

3.12.3.3 FIRE PROTECTION

Kane County has nine fire departments, including one located in the town of Alton. The Alton fire department has two fire trucks, zero paid fire fighters, and two volunteers (FCAOG 2007b).

Garfield County has 11 fire departments. Most fire departments are staffed by volunteers and have no paid firefighters; with the exception of Boulder Fire Department which has 14 paid firefighters and zero volunteers. The number of fire trucks per department range from one to four and the types of trucks range from structure and brush trucks, wildland trucks, Type 1 through 3 engines, and water tender trucks.

Iron County has nine fire departments operated primarily by volunteers. The Cedar City Fire Department has four paid employees and 35 active volunteers. The range and types of fire trucks available in Iron County are similar to those in Garfield County.

3.12.3.4 HEALTHCARE

Within the SESA, there are three hospitals that provide 24-hour emergency care and physician staffing. Kane County Hospital in Kanab is a 38-bed facility with two full-time physicians. Garfield Memorial Hospital in Panguitch is a 20-bed facility with three full-time physicians. Valley View Medical Center in Cedar City (Iron County) is a 48-bed facility (Hospital-Data.com 2008). Garfield Memorial and Valley View are operated by Intermountain Health Care. All three hospitals accept Medicaid and Medicare patients. There are also hospitals with 24-hour emergency services in St. George (approximately 100 miles south of Alton) and Richfield (approximately 115 miles north of Alton). These hospitals are equipped to handle acute medical and trauma conditions, and air transport via Air-Med (University of Utah) or Life Flight (Intermountain Health Care) can provide emergency service to hospitals further away.

Numerous Intermountain Health Care healthcare clinics are available in the SESA, including Panguitch, Cedar City, Circleville, Escalante, Cannonville, and Orderville. The clinics provide family and internal medicine, pediatrics, lab, x-ray services, and so on.

3.12.3.5 AMBULANCE

Ambulance services are provided via local counties. Kane County Ambulance is operated out of Kanab. Garfield County Ambulance is located in Panguitch. Iron County Ambulance is located in Parowan.

3.12.4 Environmental Justice

3.12.4.1 EXECUTIVE ORDER BACKGROUND AND REGULATORY GUIDANCE

“Environmental justice” refers to the fair and equitable treatment of individuals regardless of race, ethnicity, or income level, in the development and implementation of environmental management policies and actions. In February 1994, President Clinton issued EO 12898, Federal Actions to Address Environmental Justice in Minority and Low Income Populations. The objective of this EO is to require each federal agency to “make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low income populations” (EO 12898).

Convened under the auspices of the EO, the Interagency Working Group defines Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut and other nonwhite persons as minority populations. Low-income populations are defined as persons living below the poverty level based on their total income. In 2007, the poverty threshold for a family of four was $21,386 according to the U.S. Census Bureau (U.S. Census Bureau 2008a).

The EPA has not specified what percentage of the population can be characterized as “significant” in order to define an environmental justice population. Therefore, for the purposes of this analysis, a conservative approach is taken in identifying potential environmental justice populations—it is assumed that if the affected area minority and/or poverty status populations are more than 1.5 times the percentage of the reference area (in this case, the State of Utah), there is likely an environmental justice population of concern. For example, if a statewide American Indian population is 9%, then any county in which the American Indian population is 13.5% or higher would be considered as having a potential environmental justice population.

3.12.4.2 RACE AND ETHNICITY

Overall, the SESA has a greater percentage of whites and a lower percentage of other races than the State of Utah as a whole. Also, the state population as a whole has more than double the Hispanic population of Kane, Garfield, and Iron counties. Information regarding racial and ethnic composition within the SESA is provided in Table 3.23. Because more recent population estimate data from the U.S. Census Bureau are not available for race and ethnicity, as it is for the general population, census data from the 2000 Census are used to illustrate racial and ethnic composition.

As stated earlier, a county is considered as having a potential disadvantaged population if the population that falls within the category equals or exceeds 1.5 times the percentage of the state as a whole. As indicated in Table 3.23, the American Indian, Eskimo or Aleut population is 1.75 times greater than the reference population (State of Utah). Because the Iron County American Indian population exceeds the 1.5 times the reference population threshold by one quarter of a percent, an impacts analysis will be carried forward in Chapter 4.

Table 3.23. Racial and Ethnic Composition of the Socioeconomic Study Area and State of Utah

Location	Percentage of Total Population					
	White	Black	American Indian, Eskimo, or Aleut	Asian or Pacific Islander	Other/Two or More Races	Hispanic/ All Races
Garfield County	95.0%	0.2%	1.8%	0.4%	1.5%	2.9%
Iron County	93.0%	0.4%	2.2%	1.0%	1.7%	4.1%
Kane County	96.0%	0.0%	1.6%	0.2%	1.4%	1.4%
State of Utah	89.2%	0.8%	1.3%	2.4%	2.11%	9.0%

Source: U.S. Census Bureau 2000a.

Notes: Population is broken out by both race and ethnicity because Hispanics can be of any race.

3.12.4.3 POVERTY RATES

The second element of environmental justice is the potential for disproportionate impacts on populations living below the poverty level. The number of people in Garfield and Kane counties living below the poverty line in 2005 was slightly lower than the state average (10.4% and 10.0%, respectively, versus 10.5%). Kane County and Garfield County poverty trends show a slight decrease over time, and rates remain similar to the state average. In 2005, the poverty level established by the U.S. Census Bureau for a family of four was $19,971, and in that year 10.4% or 635 people in Kane County and 12.0% or 546 people in Garfield County were living below the poverty level (U.S. Census Bureau 2008b). Iron County poverty rates are higher than Kane and Garfield counties and consistently higher than the state average. In 2005, Iron County had 5,758 people living below the poverty level. Table 3.24 reflects poverty rates within Kane, Garfield, and Iron counties and the State of Utah in 2000 and 2005 for comparative purposes. It should be noted that the most recent published U.S. Census poverty rate data for counties with a population fewer than 21,000 is from 2005. Because Kane and Garfield County populations do not exceed 21,000 more recent (2009) poverty data do not exist. Therefore, 2005 data from the SESA and the State of Utah will be used to examine the most up-to-date poverty rates.

Because the poverty rates of Kane and Garfield counties do not exceed the state average of 10.5%, and because Iron County's poverty rate is higher (15.4%) than the state average but is not greater than 1.5 times the percentage of the state, there are no environmental justice populations that are likely to be affected by coal mining activities on the tract as mentioned above, and this section will not be carried forward into Chapter 4.

Table 3.24. Poverty Rates within the Alton Coal Tract Area and in the State of Utah

	2000		2005	
	Percentage	Number	Percentage	Number
Garfield County	12.0%	546	10.0%	435
Iron County	15.1%	5,123	15.4%	5,758
Kane County	11.5%	687	10.4%	635
State of Utah	8.8%	198,434	10.5%	254,761

Source: U.S. Census Bureau 2008b.

3.13 Soils

Soils are the medium for plant growth and provide nourishment for nearly all terrestrial organisms. They support a number of vegetation and animal communities in the Alton Coal Tract. The following section describes the soils that occur in the tract, as categorized by the soil survey conducted as part of the 1987 UII PAP (UII 1987). The soil conditions described below are shown on Maps 3.12 and 3.13. Soils in the tract are derived primarily from sedimentary geologic deposits that occur throughout the region, including the Tropic Shale (61% of the tract) and Dakota Sandstone (16% of the tract) deposits (UII 1987). A variety of soil types exists in the tract, including highly saline and highly erodible soils (UII 1987). Soils that are highly saline, highly erodible, and have low water-holding capacity (drought intolerant) may be especially vulnerable to impacts and may be harder to reclaim or restore after disturbance. Certain biological soil crust communities significantly protect some soils from wind and water erosion. Disturbance of biological soil crusts affects most soils, but depending on the type of soil and biotic community, some are affected more than others.

3.13.1 Sensitive Soils

Sensitive soils have characteristics that make them more susceptible to impacts or more difficult to restore or reclaim after disturbance. These characteristics consist of moderate to high salinity, low nutrient levels, high runoff potential, and limitations to grazing, susceptibility to high wind or water erosion; or occurring on very steep slopes that are more susceptible to erosion. In this EIS, a sensitive soils designation refers to highly erodible soils, saline soils, drought intolerant soils, sodic soils, shallow soils (limited rooting depth), alkaline soils, and biological soil crusts. Sensitive soils are difficult to reclaim or restore, and once disturbed, the impact is usually long term. Table 3.25 shows the risk factors used to determine the sensitivity of soil units mapped for the UII PAP in 1987 (UII 1987). The table shows the specific factors used to determine the risk of rehabilitation restrictions for soils in the tract. Table 3.26 shows the number of acres in the tract that are at risk for restricted soil rehabilitation due to a number of restrictive soil features.

Table 3.25. Soil Rehabilitation Restrictions and Reclamation Risks

Factors	High Risk	Moderate Risk	Low Risk	Restrictive Feature
Erodibility				
Water erosion hazard (from 1987 Survey)[1]	High	Moderate	Slight to Moderate	Water erosion hazard
Limits on Reclamation				
Available water capacity (inches)[2]	<4	4–6	>6	Droughty soils
Salinity[3] (mmhos/cm; surface layer)[4]	>16	8–16	<8	Excess salt
Sodium adsorption ratio[5] (surface layer)[4]	>13	4–13	<4	Excess sodium
Depth to C horizon (inches)[4]	<10	10–20	>20	Rooting depth
A kalinity (pH of surface layer)[4]	>9.0	7.8–8.9	<7.8	Excess alkalinity

[1] Water erosion hazard was rated for bare soil areas based on inherent soil characteristics, such as texture, permeability, soil aggregate stability, and strength of soil structure.

[2] Maximum value for the range of available water capacity for the soil layer given as inches of water per 36 inches of soil.

[3] Maximum value for the range in soil salinity; mmhos/cm is a measure of electrical conductivity that is used to describe soil salinity.

[4] Draft parameters developed by the BLM's National Science and Technology Center, SSURGO soils mapping.

[5] Maximum value for the range in sodium adsorption ratio; sodium adsorption ratio is a measure of the ratio of the sodium to the calcium and magnesium in a soil.

Table 3.26. Acres (and percentage) of the Alton Coal Tract At Risk of Restricted Soil Rehabilitation

Restrictive Feature	High Risk	Moderate Risk	Low Risk
Erodibility			
Water erosion hazard	843 (23.6%)	2,515 (70.3%)	218 (6.1%)
Limits on Reclamation			
Droughty soils	627 (17.5%)	182 (5.1%)	2,768 (77.4%)
Excess salt	0 (0.0%)	0 (0.0%)	3,577 (100.0%)
Excess sodium	4 (0.1%)	0 (0.0%)	3,498 (97.8%)
Rooting depth (shallow soils)	2,872 (80.3%)	693 (19.4%)	12 (0.3%)
Excess a kalinity	0 (0.0%)	416 (11.6%)	3,161 (88.4%)

Notes: Because some soil units had missing data, risk factors may not total to 100% of the tract acreage.

3.13.1.1 WATER-EROSIVE SOILS

Water-erosive soils have naturally high rates of erosion; however, the erosion rates are easily accelerated by surface-disturbing activities. A total of 843 acres of water-erosive soils occurs on the tract (23.6% of the tract). A soils' potential for water erosion was estimated based on inherent soil characteristics such as soil texture, permeability, aggregate stability, and the strength of the soil structure (UII 1987). Observations of erosion in mapped soil units were also used to determine their risk for erosion. Accelerated erosion forms rills and gullies, and can contribute to excess sedimentation in streams and reservoirs. In addition, erosion reduces natural revegetation and the effectiveness of vegetation restoration efforts by removing topsoil, washing away plant seeds and propagules, and burying or damaging existing plants.

3.13.1.2 DROUGHT-INTOLERANT SOILS

Certain soil types are more sensitive to negative impacts during drought conditions. A number of soil units on the tract have a low available water capacity due to soil structure and composition (UII 1987); thus, these high risk soils and their associated vegetation may be severely affected by drought. Severe drought may adversely affect the production of perennial vegetation. Soils at high risk for poor reclamation occur over 627 acres, or 17.5%, of the tract. Areas at moderate risk occur over an additional 182 acres, or 5.1% of the tract. Areas with a low risk occur over 2,768 acres, or 77.4% of the tract.

3.13.1.3 SALINE SOILS

Soil salinity can influence the downstream effects of erosion and the reclamation potential of an area's soils. Highly saline soils limit the diversity of vegetation species that can be established on a site, and at very high levels, they may inhibit the establishment of even halophytic (salt-loving) plants. Erosion of saline soils impacts the water quality of downstream watersheds. Highly saline soils are soils with electrical conductivity levels of greater than 16 mmhos/cm. Moderately saline soils fall between 8 and 16 mmhos/cm. The tract contains only soils with electrical conductivity levels of less than 8 mmhos/cm, or low salinity.

3.13.1.4 SODIC SOILS

High sodium levels can affect the reclamation potential of disturbed soils by inhibiting the establishment of vegetation. Four acres (or 0.1%) of the Alton Coal Tract are highly sodic, or have a sodium adsorption ratio of greater than 13 mmhos/cm. The rest of the tract has low risk of sodic soils, or a sodium adsorption ratio of less than 4 mmhos/cm.

3.13.1.5 SHALLOW SOILS

A shallow topsoil layer (or A horizon) limits a plant's ability to root deeply. It may inhibit an area's restoration potential because of its limited depth, water holding capacity, and nutrients available for plant establishment. Rooting depth, or depth to the C horizon of the soil, affects restoration potential because plant root growth does not occur below the upper (A and B) soil horizons. The C horizon of the soil is characterized by unweathered parent material and generally does not support the biological activity necessary for soil development. It is assumed for this analysis that soils with an A horizon of less than 10 inches are at high risk for poor reclamation (based on draft parameters developed by the BLM's National Science and Technology Center). These soils occur over 2,872 acres, or 80.3%, of the tract. Areas at moderate risk (or with a rooting depth of 10–20 inches) occur over an additional 693 acres, or 19.4% of the tract. Areas with a low risk (a rooting depth greater than 20 inches) occur over 12 acres, or 0.3% of the tract.

3.13.1.6 ALKALINE SOILS

Alkalinity refers to soil pH. High pH, or an alkaline condition, generally limits a plant's ability to establish itself. A number of soil units on the tract are moderately alkaline (UII 1987). Approximately 416 acres of the tract have moderately alkaline conditions (11.6%), and 3,161 acres (88.4%) have a low risk of reclamation restriction due to alkalinity.

3.13.1.7 BIOLOGICAL SOIL CRUSTS

Some of the dominant vegetative communities in the tract, such as pinyon-juniper and sagebrush communities, have evolved with the presence of biological soil crusts. Biological soil crusts are made up of mats or filaments of cyanobacteria, lichens, and mosses. Development of biological soil crust is strongly influenced by soil texture, soil chemistry, and soil depth. Crusts are more developed in shallow, sandy, nonsaline soils. Biological soil crusts play a major role in reducing water and wind erosion and in preventing the establishment of invasive annual grasses (BLM 2001a). They fix atmospheric nitrogen and carbon, retain soil moisture, and provide surface cover. Crust composition and level of abundance can be used to determine the ecological history and condition of a site (BLM 2001a).

Loss of biological soil crust leads to reduced soil productivity, decreased plant cover and vigor, and increased wind and water erosion. Severity, size, frequency, and timing of a surface-disturbing activity affect the degree of impacts to biological soil crusts. Fine-textured soils have faster crust recovery rates than coarse-textured soils (BLM 2001a).

The distribution of soil crusts in the tract is unknown. Approximately 2,760 acres (77.1%) of the tract has soils associated with pinyon-juniper vegetation, which is often associated with biological soil crusts. An additional 513 acres (14.3%) of the tract has soils associated with sagebrush, which is also associated with soil crusts.

3.14 Transportation

3.14.1 Regional Overview

Existing vehicle traffic in and near the tract and coal haul transportation route consists of local residents; tourists to Bryce Canyon National Park, the Dixie National Forest, and public lands; and commercial truck traffic. Transportation infrastructure associated with the tract and coal haul transportation route would include numerous unimproved, dirt access roads and two-track trails, KFO Route 116, US-89, SR-20, I-15, and SR-56. The Union Pacific Railroad 21-mile branch to the Salt Lake City-Los Angeles line is located west of Cedar City, Utah. It is the nearest railroad facility to the tract. Current transportation facilities along the coal truck haul route can be found in Appendix H.

3.14.2 Existing Traffic Conditions on the Coal Haul Transportation Route

Existing traffic conditions for both roadways and intersections along the coal haul transportation route are quantified using a level of service (LOS) measurement. LOS is a measure of the quality of service on transportation infrastructure and generally indicates the level of traffic congestion. LOS on two-lane highways is a reflection of traffic flow conditions, average speed, and average time spent following other vehicles. LOS at intersections reflects the amount of congestion and delay experienced by motorists at intersections. LOS is rated on a scale of A (the best) to F (the worst). LOS-A on roadways occurs where

traffic flows are at or above posted speed limits and where drivers have complete mobility between lanes. LOS-A at intersections occurs when drivers take less than 10 seconds to pass through an intersection. LOS-F occurs when the vehicle traffic flow exceeds the road segment capacity (Fehr and Peers 2008). Table 3.27 includes a description of LOS-A through LOS-F (Fehr and Peers 2008).

Table 3.27. Intersection Level of Service Descriptions

Level of Service	Description of Traffic Conditions
A	Free Flow/Insignificant Delay Extremely favorable progression. Individual users are virtually unaffected by others in the traffic stream.
B	Stable Operations/Minimum Delays Good progression. The presence of other users in the traffic stream becomes noticeable.
C	Stable Operations/Acceptable Delays Fair progression. The operation of individual users is affected by interactions with others in the traffic stream.
D	Approaching Unstable Flows/Tolerable Delays Marginal progression. Operating conditions are noticeably more constrained.
E	Unstable Operations/Significant Delays Can Occur Poor progression. Operating conditions are at or near capacity.
F	Forced Flows/Unpredictable Flows/Excessive Delays Unacceptable progression with forced or breakdown of operating conditions.

Source: Fehr and Peers 2008.

KFO Route 116 is the main graded dirt road that travels north–south through the tract. It becomes a paved, two-lane road from the town of Alton west to US-89. LOS data are not available for KFO Route 116. US-89 is a north–south highway that passes through the towns of Hatch and Panguitch. Most of US-89 is a two-lane highway, with passing lanes on steep climbs and a four-lane section in Panguitch. The speed limit is posted at 60 or 65 miles per hour (mph), except in Hatch and Panguitch where it is reduced to 40 mph and 35 mph, respectively. Four of the intersections in the transportation area of analysis occur on US-89 at SR-14, SR-12, south of SR-20, and SR-20. SR-12 is the main access road from US-89 east to Red Canyon (in the Dixie National Forest) and to Bryce Canyon National Park. None of these intersections have traffic signals.

SR-20 is an east–west state road that connects US-89 and I-15. SR-20 is a paved, two-lane road with a climbing lane on steep sections approaching the summit. The speed limit is posted at 60 mph from the junction with US-89 and the steep upgrade, 35 mph going over the summit, and 65 mph from the summit to I-15.

I-15 is a four-lane, divided, interstate freeway that runs north–south through Utah. Along the coal haul transportation route, I-15 has posted speed limits of 75 mph from SR-20 to Cedar City.

SR-56 is an east–west state road from Cedar City to the Nevada state line. SR-56 varies from four lanes through Cedar City to two lanes outside the city. The only intersection with a traffic signal along the coal haul transportation route occurs at I-15 and SR-56. SR-56 has a posted speed limit of 45 mph on the coal haul transportation route.

Existing conditions along the coal haul transportation route consist of low volumes of traffic generally moving at free-flow speeds. Haul route segments along US-89 and SR-20 operate at LOS-C or better during weekday and weekend traffic in both directions. LOS-C occurs on roadways at or below capacity

where posted speed limits are easily maintained, but the ability to pass or change lanes is not always assured. The existing LOS along the directional segments of I-15 and SR-56 was not measured as part of the Fehr and Peers study (Fehr and Peers 2008).

Existing conditions at intersections along the coal haul transportation route include low delays per vehicle and little to no congestion. The four unsignalized intersections along US-89 operate at LOS-A during peak morning and peak evening hours. Although LOS was not measured on directional segments of I-15 and SR-56, the signalized intersection at SR-56 and I-15 operates at LOS-C or better during peak morning and peak evening hours (Fehr and Peers 2008).

A 2003–2005 study of vehicle accidents across the coal haul transportation route was prepared by UDOT (Fehr and Peers 2008). The study considered the following four segments of the haul route: US-89/SR-20 junction, US-89/SR-20 to SR-20/I-15 junction, SR-20/I-15 to I-15/SR-56 junction, and SR-56/I-15 to milepost 61 junction. The study shows that 74.1% of accidents across all four segments during the study period were single-vehicle accidents. Single-vehicle accidents along the haul route were wildlife or domestic animal related, or involved drivers running off the road because of excessive speed, weather, falling asleep, and driving under the influence. Most multi-vehicle accidents involved rear-end crashes from following too closely, and sideswipe crashes from attempting to pass under unsafe conditions (Fehr and Peers 2008).

3.15 Vegetation

3.15.1 Regional Overview

Kane County is located in the Colorado Plateau Semidesert Province (USFWS 1996) of south-central Utah. The Alton Coal Tract occurs in the semiarid foothills of this ecoregion (Woods et al. 2001). Vegetation communities on the tract are typical of what is found in the surrounding Colorado Plateau region, namely pinyon-juniper woodlands, sagebrush shrublands, and mountain brush communities. Details of vegetation communities in the tract are presented in the sections below.

Mean annual precipitation in the town of Alton was approximately 16 inches from 1928 to 2006, and mean annual temperature for this same period was 60.2°F (Western Regional Climate Center 2006). The Colorado Plateau province receives precipitation in a bimodal pattern; precipitation occurs in the form of snow during the winter months and in the form of monsoonal storms in late summer (West and Young 2000). The Alton area also receives its annual precipitation in a bimodal pattern (Western Regional Climate Center 2006). The climate of the Colorado Plateau supports plant species that are physiologically adapted to withstand drought and heat, such as through leaf texture, surface-area, and specialized photosynthetic processes (Willson et al. 2008).

Vegetation on public lands in the tract is managed by the BLM in accordance with the KFO RMP (BLM 2008b). Vegetation treatment and management on public lands would provide measures to maintain or improve the overall health of vegetation communities (BLM 2008b). Specific management for vegetation would target forests and woodlands, uplands, and riparian and wetland communities through implementation of controls on noxious and invasive weed species and application of *Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah* (BLM 1997). Vegetation treatments would consist of prescribed fire, mechanical, chemical and biological treatments, woodland product removal, and wildland fire.

3.15.2 Vegetation Communities in the Tract

Vegetation communities in the tract are pinyon-juniper woodland, mountain brush, meadow, rabbitbrush, riparian, sagebrush/grassland, and sagebrush/grassland (treated) (USFWS 1996). Pinyon-juniper woodlands include transition zones between this and other communities; pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush combinations also occur under this heading. Agricultural pastures on private surface lands are also found in the tract. Ecologists surveyed the tract in fall of 2007 to determine the specific locations and acreages of these communities (Table 3.28; Map 3.14). The tract had also been previously surveyed by Mt. Nebo Scientific in 2007. Descriptions of these vegetation communities and lists of dominant species are presented in the sections below.

Table 3.28. Acreages of Vegetation Communities in the Alton Coal Tract

Vegetation Community	Acres	Percentage of the Tract*
Pinyon-juniper woodland	1,430.0	40.2%
Pinyon-juniper/mountain brush	438.8	–
Pinyon-juniper/sagebrush	506.0	–
Pinyon-juniper/sagebrush/mountain brush	485.2	–
Sagebrush/grassland	860.2	24.1%
Sagebrush/grassland (treated) †	749.1	20.9%
Annual and perennial grasses	324.1	9.1%
Mountain brush	62.8	1.8%
Meadow	62.8	1.8%
Riparian	55.3	1.5%
Rabbitbrush	10.7	0.3%
Total	**3,555.0**	**99.4%**

*Unvegetated areas consist of 4.1 acres of open water and 17.4 acres of roads, or approximately 0.6% of 3,576.6 acres in the tract.

†Mechanically treated to remove encroaching pinyon pine and Utah juniper and seeded to restore forb and grass cover.

3.15.2.1 PINYON-JUNIPER WOODLAND

Pinyon-juniper woodland (1,430 acres) accounts for the greatest percentage of land in the tract (40%). For the purposes of the reconnaissance surveys, all vegetation communities with pinyon pine or Utah juniper (*Juniperus osteosperma*) trees as a dominant component of the overstory are considered to belong to the pinyon-juniper woodland community or one of its combinations (i.e., pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, or pinyon-juniper/sagebrush/mountain brush).

Understory species in pinyon-juniper woodlands include shrubs, grasses, and forbs that are also commonly found in other vegetation communities in the tract. Shrub species include black sagebrush (*Artemisia nova*), Gambel oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*), alder-leaf mountain mahogany (*Cercocarpus montanus*), wild crab apple (*Peraphyllum ramosissimum*), antelope bitterbrush (*Purshia alcinatio*), broom snakeweed (*Gutierrezia sarothrae*) and snowberry (*Cercocarpus oreophilus*). Grass and forb species include slender wheatgrass (*Elymus trachycaulus*), daisy (*Erigeron* spp.), buckwheat (*Eriogonum* spp.) and fescue (*Festuca* spp.). Cacti species include prickly pear (*Opuntia* spp.) and echinocactus (*Echinocereus* spp.).

3.15.2.2 MOUNTAIN BRUSH

Mountain brush accounts for 62.8 acres (1.8%) of land in the tract and occurs mainly in ravines and hillsides. Gambel oak is the dominant overstory species in this community. Understory shrubs identified in this community are black sagebrush, big sagebrush (*Artemisia alcinatio*), basin big sagebrush (*Artemisia alcinatio* var. *alcinatio*), mountain big sagebrush (*Artemisia alcinatio* var. *vaseyana*), rubber rabbitbrush (*Ericameria nauseosus*), Utah juniper, Rocky Mountain juniper (*Juniperus scopulorum*), pinyon pine, antelope bitterbrush, Woods' rose (*Rosa woodsii*), and snowberry. Grass and forb species in this community are crested wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), and prickly pear cactus (*Opuntia* spp.).

3.15.2.3 ANNUAL AND PERENNIAL GRASSES

Agriculture is practiced, or has historically been practiced, on 324 acres (9.1%) of private surface land in the northern half of the tract. Plant species identified in the annual and perennial grasses community are crested wheatgrass, black sagebrush, California brome (*Bromus carinatus*), smooth brome, thistle (*Cirsium* spp.), rubber rabbitbrush, orchardgrass (*Dactylis glomerata*), intermediate wheatgrass (*Elymus hispidus*), slender wheatgrass, Russian wheatgrass (*Elytrigia juncea*), curlycup gumweed (*Grindelia squarrosa*), broom snakeweed, and Indian ricegrass (*Stipa hymenoides*). Wheatgrasses (*Elymus* spp.) and crested wheatgrass were the dominant plants encountered during reconnaissance surveys.

3.15.2.4 MEADOW

The meadow vegetation community accounts for 62.8 acres (1.8%) of land near the northern end of the tract. Vegetation in the meadow community consists of hydrophytic plants such as wiregrass (*Juncus arcticus*), small-wing sedge (*Carex microptera*), Missouri iris (*Iris missouriensis*), foxtail barley (*Hordeum jubatum*), and seaside arrowgrass (*Triglochin alcinat*). Canada thistle (*Cirsium arvense*), a Utah state-listed noxious weed, is also located in this vegetation community.

Hydrologic resources in this part of the tract are likely runoff from agriculture practices in the northwestern part of the tract. It is likely that areas within this community would be considered wetland; however, no formal delineations have been done. Based on surveys of the vegetation, soils, and hydrology of the area conducted in November 2007, and June and July 2008 (Collins 2008b: Appendix F); this vegetation community is assumed to be a jurisdictional wetland for purposes of analysis.

3.15.2.5 RABBITBRUSH

The rabbitbrush vegetation community occurs on 10.7 acres (0.3%) of the tract. This community is similar in structure and vegetative composition to the sagebrush/grassland vegetation community but also includes four-wing saltbush (*Atriplex canescens*) and a greater concentration of rubber rabbitbrush. This community occurs in some areas adjacent to riparian communities in the tract.

3.15.2.6 RIPARIAN

This vegetation community accounts for 55.3 acres of land along streams in the tract. This community represents 1.5% of the total land in the tract. Species such as willows (*Salix* spp.), cottonwoods (*Populus* spp.), Russian olive (*Elaeagnus angustifolia*), and tamarisk (*Tamarix* spp.) occur in the overstory of the tract's riparian communities. Understory species include wiregrass and saltgrass (*Distichlis spicata*) and weedy species such as curlycup gumweed and broom snakeweed (SWCA 2007b). A portion of the understory is disturbed (SWCA 2007b).

3.15.2.7 SAGEBRUSH/GRASSLAND

The sagebrush/grassland vegetation community accounts for 860.2 acres (24.1%) of land in the tract. Black sagebrush is the dominant shrub species in this community, with some big sagebrush and rabbitbrush plants also included in the shrub stratum. A few small Utah junipers and pinyon pines are occasional components of this community. Understory species include crested wheatgrass, California brome, cheatgrass, foxtail barley, thistle, slender wheatgrass, western wheatgrass (*Elymus smithii*), Sandberg bluegrass (*Poa secunda*), broom snakeweed, Palmer's penstemon (*Penstemon palmeri*), and flixweed (*Syssimbrium* spp.).

3.15.2.8 SAGEBRUSH/GRASSLAND (TREATED)

This vegetation community accounts for 749.1 acres (20.9%) in the tract. Dominant species are similar to those identified in the sagebrush/grassland vegetation community and include black sagebrush, big sagebrush, and rubber rabbitbrush in the shrub stratum. Utah juniper, pinyon pine, and Gambel oak are also present in this stratum, although these species are not dominant. Understory species in this community are broom snakeweed, Russian wildrye, slender wheatgrass, thistles, cheatgrass, California brome, Palmer's penstemon, crested wheatgrass, and yarrow (*Achillea millefolium*).

The ground in this community is covered partially with chipped remnants of Utah juniper and pinyon pine trees. These trees were removed during past prescription fuels treatments, chipped on-site, and broadcasted over the immediate area (Personal Communication, Gubler 2008).

3.15.3 Invasive and Noxious Weeds

All non-native plant species identified during 2007 field reconnaissance surveys are listed in Table 3.29. This list includes invasive, noxious, and introduced weed species. Most of these species occur in disturbed sites such as private annual and perennial grasses communities and where vegetation treatments have occurred.

Table 3.29. Introduced, Invasive, and Noxious Weed Species Identified in the Alton Coal Tract

Common name	Scientific name	Status*	Location
Canada thistle	*Cirsium arvense*	Noxious	Meadow
Cheatgrass	*Bromus tectorum*	Invasive	Sagebrush
Common mullein	*Verbascum thapsus*	Invasive	Sagebrush/grassland (treated)
Crested wheatgrass	*Agropyron cristatum*	Introduced	Sagebrush and annual and perennial grasses
Intermediate wheatgrass	*Elymus hispidus*	Introduced	Annual and perennial grasses
Kentucky bluegrass	*Poa pratensis*	Native and introduced infra-taxa	Sagebrush and mountain brush
Orchardgrass	*Dactylis glomerata*	Introduced	Annual and perennial grasses
Small burnet	*Sanguisorba minor*	Introduced	Sagebrush/grassland (treated)
Tall tumble mustard	*Sisymbrium altissimum*	Invasive	Sagebrush/grassland (treated)

* Data from U.S. Department of Agriculture [USDA] 2008, Whitson 1996.

Introduced species are those that are not native to the lower 48 states. Many of the introduced species on this list, such as crested wheatgrass and intermediate wheatgrass, are forage plants brought intentionally to the United States for use as livestock feed. The USDA plants database (USDA 2008) was used to determine introduced statuses.

Invasive weeds are mostly introduced plant species that are able to spread faster than neighboring native species by being better equipped to take advantage of available water, sunlight, and nutrients. There are no federal or state lists of invasive weeds; the text *Weeds of the West* (Whitson 1996) was used to determine invasiveness statuses. Cheatgrass, tall tumble mustard, and common mullein are invasive weeds that occur in various communities in the tract.

Noxious weeds are plant species that have been formally recognized by federal, state, or county governments to pose serious risks to the economy of an area. The State of Utah has 19 listed noxious weed species. One of the Utah noxious weed species, Canada thistle, has been identified in the tract. A few individuals of this species are located in the meadow vegetation community in the northwest section of the tract.

3.15.4 Special Status Species

Two BLM-listed special status species (sandloving penstemon [*Penstemon ammophilus*] and slender camissonia [*Camissonia exilis*]), three Utah rare plants (Paria breadroot [*Pediomelum pariense*], Ruth's sphaeromeria [*Sphaeromeria ruthiae*], Charleston Mountain violet [*Viola charlestonensis*]) (Utah Native Plant Society 2007), and one federally listed threatened species (Jones cycladenia [*Cycladenia humilis* var. *jonesii*]) are known to occur in Kane County, Utah at elevations similar to elevations in the tract. Surveys for suitable habitat for these species were done in November 2007, August 2008, and September 2008 (Appendix F). During the November 2007 surveys, it was determined that habitat for many of these species does not exist on the tract. Potential habitat for sandloving penstemon and Ruth's sphaeromeria was identified. Sandloving penstemon is a BLM sensitive species that occurs on sandy soils derived from Navajo sandstone in ponderosa pine, oak (*Quercus* spp.), Douglas fir (*Pseudotsuga menziesii*), mountain mahogany, bigtooth maple (*Acer grandidentatum*), and mixed shrublands. Surveys for sandloving penstemon were conducted in May 2008. Neither the plant nor its habitats were found during these surveys, and there is a low probability that the species occurs in the tract (Collins 2008a: Appendix F). Ruth's sphaeromeria is a Utah rare plant ((Utah Native Plant Society 2007) that occurs in oak and mountain mahogany vegetation communities on Navajo sandstone. Surveys for Ruth's sphaeromeria were conducted in September 2008. Based on the survey results, there is a low probability that this species occurs in the tract. Because there are no special status plant species in the tract, they are not discussed in Chapter 4.

3.16 Water Resources

The Alton Coal Tract is located in the upper reaches of the Kanab Creek watershed, a sub-drainage to the Colorado River. The Kanab Creek watershed drains approximately 1,512,091 acres that include the tract, the towns of Alton and Kanab, Utah, and Fredonia, Arizona (Map 3.15). The watershed covers an elevation range from approximately 2,100 feet at the confluence with the Colorado River to 9,345 feet at the headwaters of Kanab Creek, which originates upstream of the tract on the Paunsaugunt Plateau. Kanab Creek flows in a south-southwesterly direction through the tract and downstream into Arizona. Within the Kanab Creek watershed, the tract is located in the lower portions of the following three sub-watersheds: Lower Robinson Creek, Kanab Creek below Reservoir Canyon, and Sink Valley Wash. These three sub-watersheds have a combined area of 47,040 acres. The tract makes up 8% of these three sub-watersheds and 0.25% of the entire Kanab Creek watershed.

The tract is located within an arid region where the average annual precipitation is approximately 12 inches per year in the lower elevations. Precipitation in the Kanab Creek basin increases with elevation and can exceed 40 inches per year in the upper elevations. Most precipitation occurs as snow.

The only tributary to Kanab Creek within the tract is Lower Robinson Creek. This creek originates from small canyons in the foothills of the Paunsaugunt Plateau east of the tract and flows east to west through the middle of the tract. Flows in Lower Robinson Creek are minimal. Stream flows have not been observed in Lower Robinson Creek at monitoring stations SW-4 and SW-101 (Map 3.16), except during periods of spring runoff or large precipitation events. In addition to the arid climate, the low flow conditions of Lower Robinson Creek are also attributable to the fact that it is a losing stream, which loses flow to alluvial deposits under its channel. In addition, the creek crosses a north-south trending ridge of Tropic Shale located along the Sink Valley fault that tends to divert water flowing through this alluvium along the fault and into shallow aquifers in Sink Valley rather than diverting it downstream. Although flows are not generally observed along most of Robinson Creek, minor flows are measured below a seepage location at monitoring station SW-5, where the creek meets Kanab Creek (see Map 3.16). Petersen Hydrologic (2007) reports that the small discharge usually present at SW-5 is derived from the seepage of alluvial groundwater into the Lower Robinson Creek stream channel, and discharges where the stream channel intersects the relatively impermeable Dakota Formation.

Groundwater resources within and adjacent to the tract are present in shallow, low-producing aquifers in alluvial sediments, the Tropic Shale, and the Dakota Formation. The first significant water-bearing stratum beneath the tract from which appreciable quantities of groundwater can be produced is from the Navajo Sandstone aquifer. However, the Navajo Sandstone aquifer is more than 1,000 feet below the surface, and the cost of well construction and pumping likely prohibit local access to this groundwater resource.

Other water-related features that occur within the tract are riparian areas, probable wetlands, floodplains, and AVFs.

3.16.1 Surface-water Resources

3.16.1.1 SURFACE-WATER OCCURRENCE AND USE

Kanab Creek and Lower Robinson Creek are the dominant surface-water features within the tract. Lower Robinson Creek is a tributary to Kanab Creek; their confluence is located on the western border of the tract. Through most of the tract the main stem of Kanab Creek is categorized in the National Hydrography Dataset as a perennial stream that has flow throughout the year. However, observed flow in Kanab Creek is highly dependent on climate and upstream water use and has been observed to run very low (less than 0.1 cubic feet per second [cfs]) through the tract during the summer (Petersen Hydrologic 2007). Robinson Creek is an intermittent stream throughout the tract with flow occurring primarily during large precipitation events and spring runoff (Petersen Hydrologic 2007) and Map 3.16).

The primary use of surface water in Kanab Creek and its tributaries is irrigation and stock watering. Irrigation in Alton makes up a significant portion of this use (Petersen Hydrologic 2008). In addition to snow melt and storm runoff, Kanab Creek is also fed by a spring located directly south of the town of Alton (the discharge rate for this spring is unknown). These spring waters flow southward and enter Kanab Creek in the northwest quarter of Section 24, Township 39 South, Range 6 West. In this area Kanab Creek is diverted into transmission ditches that store the water in earthen ponds for irrigation. Irrigation in the area is predominantly conducted with sprinklers, although some flood irrigation is also used. Flood irrigated lands are found in the Kanab Creek Valley below the confluence with Lower Robinson Creek and just south of the town of Alton (Petersen Hydrologic 2008).

3.16.1.2 STREAM PROPER FUNCTIONING CONDITION

The natural drainage channels associated with Kanab Creek and Lower Robinson Creek are susceptible to downcutting and mass wasting (Petersen Hydrologic 2007). Petersen Hydrologic (2007) reports that there are up to several tens of feet of downcutting below the surrounding topography throughout large portions of these channels. Petersen Hydrologic also reports that there is headcutting in the Sink Valley Wash and active erosion and collapse of the steep arroyo walls along Robinson Creek. Kanab Creek is a deeply incised arroyo channel with steep walls lining the creek bed where the stream has downcut into nearby sediment (Cordova 1981). As recently as 2005, landslides along the arroyo faces of Kanab Creek have been reported as a natural slope-failure slide (Lund 2005). Kanab Creek, Lower Robinson Creek, and Sink Valley Wash all experience downcutting during large precipitation events, creating near-vertical streambanks. These streambanks are unstable and result in mass wasting of sediment into the channel. The movement of large quantities of sediment during spring melt and large precipitation events modifies the stream channel on a regular basis. The deteriorated condition of the stream channel is largely attributed to historic land-management practices and the natural erosive properties of the soil and geology in this area (Petersen Hydrologic 2007). Along the creek margin, where lower slopes make it possible, cottonwood and willow trees along with sagebrush and grasses grow in a limited riparian area, thereby stabilizing the streambank in these areas. As defined by the BLM's Proper Functioning Condition Assessment protocol (BLM 2008e) and based on a field assessment conducted in November 2010 the functional rating of Upper Kanab Creek is "Proper Function Condition" whereas the functional rating of Lower Robinson Creek is "Functional – At Risk".

3.16.1.3 SURFACE-WATER HYDROLOGY

Around the tract, most of the annual runoff volume in streams draining the mountainous areas occurs during spring and early summer as a result of snowmelt and precipitation onto saturated soils. The highest peak discharge commonly occurs during summer monsoonal storm events, which produce short bursts of intense precipitation. The total mean annual runoff from the Upper Kanab Creek basin into Arizona is approximately 50,000 acre-feet (Cordova 1981). Stream flows generally peak during March, but may vary from year to year depending on local weather conditions and yearly snowpack. Summer and early fall baseflow is typically much lower than spring conditions, except when infrequent storm-produced flows occur. Flows in the lower elevation streams are generally more variable than are flows originating in the mountainous region. The flows are influenced by lowland snowmelt as well as rainstorms during the remainder of the summer and fall. These streams are more likely to have little or no flow during the late summer and early winter. The closest USGS gaging station to the tract is located downstream north of Kanab, Utah (Station No. 09403600, see Map 3.16). The closest National Climatic Data Center (NCDC) weather station to the tract is located in the northern portion of the town of Alton, Utah (NCDC Alton Station No. 420086, see Map 3.16). Figure 3.4 shows Kanab Creek discharge from the USGS gaging station and precipitation recorded at the NCDC Alton Station from July 2000 to July 2010. Although the precipitation and stream discharge measurements were not taken within the tract, they are approximately representative of the relationship between rainfall and stream flow in the tract area.

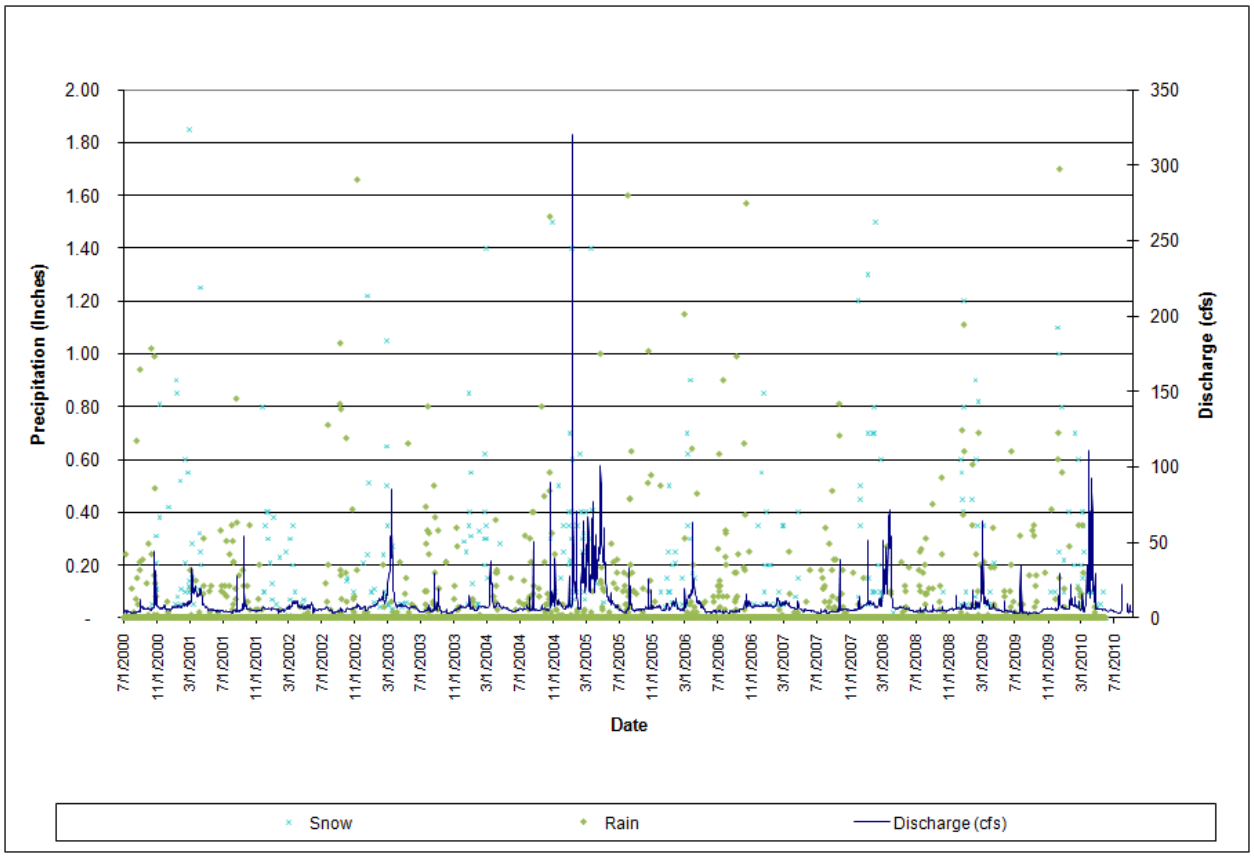

Figure 3.4. Precipitation at National Climatic Data Center Alton Station No. 420086 and Kanab Creek Discharge at U.S. Geological Survey gaging station No. 09403600 from July 2000 to July 2010.

Discharge in the upper reaches of Kanab Creek, including tributaries that flow through the tract, is generally seasonal. Most of the water in Kanab Creek upstream of the town of Alton is diverted for irrigation, leaving low flows in Kanab Creek downstream of the town of Alton and through the tract (Petersen Hydrologic 2008). It is common for Kanab Creek to have little or no discharge south of the tract during much of the year.

Flow data have been collected by Petersen Hydrologic on a quarterly basis since 2005 at three monitoring sites on Kanab Creek. These monitoring stations include, from upstream to downstream, SW-1, SW-3, and SW-2. Flows have also been collected at a fourth monitoring site (SW-5) located on Lower Robinson Creek before it enters Kanab Creek (see Map 3.16). Figure 3.5 shows the flows measured at each station along Kanab Creek between 2005 and 2007; flows entering Kanab Creek from Lower Robinson Creek ranged from 0 to 0.9 cfs during this period.

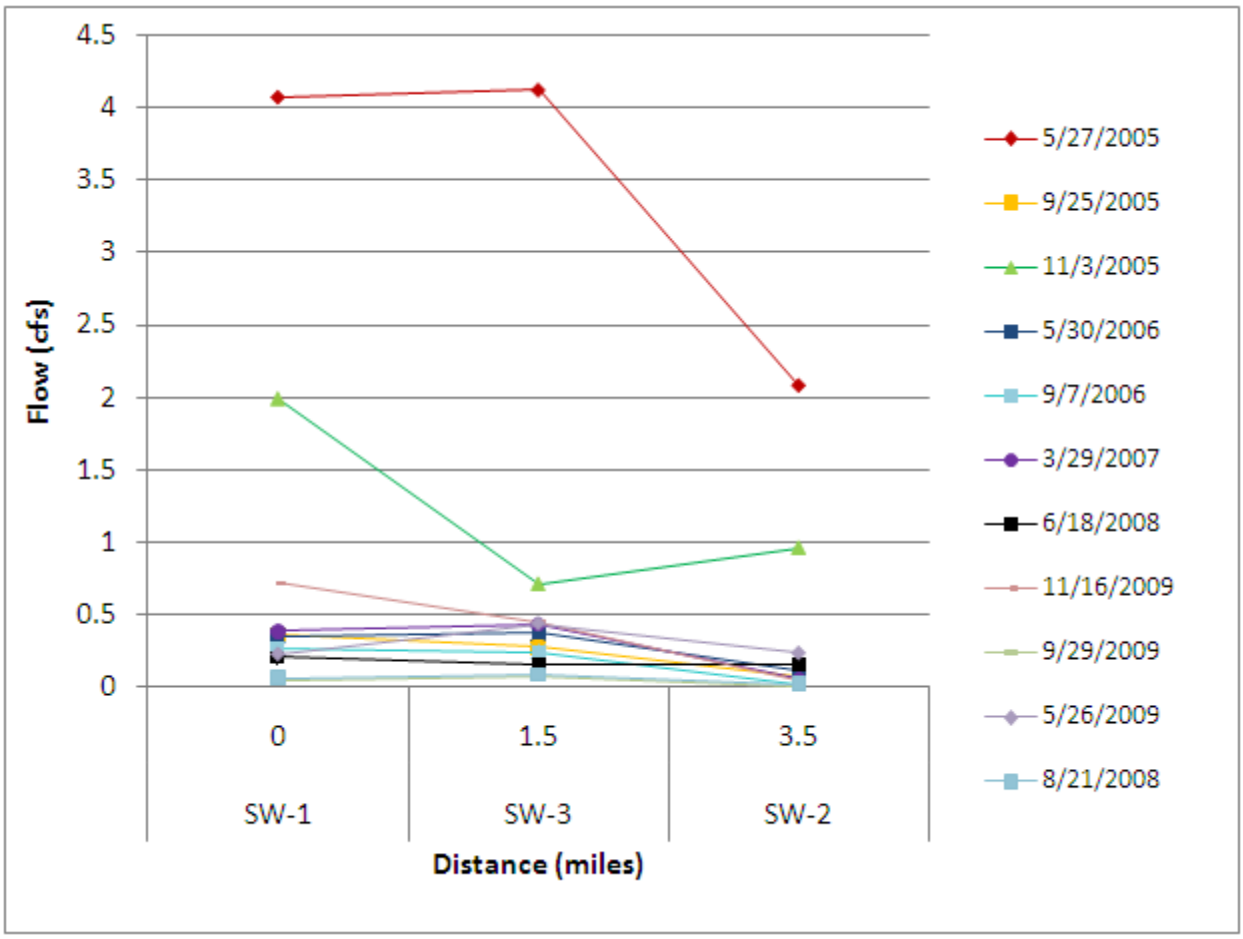

Figure 3.5. Discharge (flow) at surface-water monitoring sites in the Alton Coal Tract, 2005–2009 (Utah Division of Oil, Gas, and Mining 2010). Distance starts at the first upstream monitoring station (SW-1) (Petersen Hydrologic 2007). See Map 3.16 for location of monitoring stations.

It is apparent in Figure 3.5 that flows in Kanab Creek generally decrease from SW-1 to SW-3. The decrease in flows between SW-3 and SW-2 are due to a combination of factors including 1) irrigation diversions located approximately a half mile downstream from SW-3, 2) lack of local or regional recharge to the shallow aquifer sufficient to sustain baseflow (a losing stream), and 3) loss of water to evapotranspiration. It is common for Kanab Creek to have little or no discharge south of the tract during much of the year. Therefore, flows in Kanab Creek at the tract's southern boundary are minimal or nonexistent for most of the year.

The other potentially significant surface-water resource near the tract is flows exiting from Sink Valley Wash. Surface-water flows exiting Sink Valley Wash near the tract's southeastern edge are also intermittent with flow occurring only during spring melt or large precipitation events (see Table 3.30).

Table 3.30. Flows Measured at SW-9 in Sink Valley Wash

Date	Flow (cfs)
01/13/1988	0.00
02/16/1988	1.70
03/24/1988	0.00
06/17/2005	0.00
09/24/2005	0.00
11/03/2005	0.00
03/30/2006	0.02
05/29/2006	0.00
06/18/2006	0.00
12/20/2006	0.00
03/29/2007	0.00
06/20/2007	0.00
09/30/2007	0.00
12/29/2007	0.00
03/21/2008	0.41
03/22/2008	0.00
6/17/2008	0.00
8/20/2008	0.00
12/30/2008	0.00
3/18/2009	0.00
5/24/2009	0.00
9/29/2009	0.00
11/18/2009	0.00
3/30/2010	0.02

Source: Petersen Hydrologic 2008.

3.16.1.4 SURFACE-WATER QUALITY

The State of Utah has designated the following three beneficial uses to the surface waters found in the tract (Kanab Creek below the confluence with Reservoir Canyon and Lower Robinson Creek): secondary contact recreation (2B), nongame fish and associated food chains (3C), and agricultural water supply (4).

Secondary contact recreation (2B) refers to uses where full immersion does not occur, such as boating and wading. Waters designated for secondary contact recreation are required to maintain low bacteria counts to maintain healthy conditions for recreational users. Waters designated for nongame fish and associated food chains (3C) are required to exhibit appropriate levels of dissolved oxygen, temperature, Ph, and other parameters needed to support aquatic life. Waters designated as agricultural water supply (4) (including irrigation and livestock watering) are required to be suitable for the irrigation of crops or as water for livestock. As such, they are required to meet general surface-water quality criteria for TDS, a common measure of salinity and various metals such as lead and cadmium.

Water-quality criteria are specific to designated beneficial uses; they include both numeric limits for individual pollutants or conditions and narrative descriptions of desired conditions. Section 303(d) of the CWA requires each state to submit a list to the EPA every two years identifying waters that fail state water-quality standards. The waters identified on the 303(d) list are known as impaired waters. None of the water bodies in the tract are listed on the 2008 303(d) list of impaired waters. However, outside the tract, the lower portion of Kanab Creek (17.6 miles), from the Utah-Arizona state line north to Four-mile Hollow (13 miles north of Kanab, Utah), is listed on the 2008 list of impaired waters for exceedances of the TDS standard (1,200 mg/L for irrigation water use).

A summary of current (2005–2010) water quality data for streams in the tract is contained in Table 3.31. This table also presents the applicable state water-quality standards for each constituent. These data were obtained for eight sites in or near the tract from a DOGM water-quality database (DOGM 2008b). These data indicate exceedances of state water quality standards for nitrate, TDS, and temperature. The maximum nitrate value of 4.2 mg/L was collected on September 27, 2007 at Site RID-1 in Robinson Creek (see Map 3.16). This sample represents the only exceedance of the state water-quality standard for nitrate of 4.0 mg/L. The maximum recorded TDS value of 3,429 mg/L was collected at site SW-101 in Robinson Creek on May 6, 2010. Of the 98 TDS values recorded at sites in and around the tract, 31% exceed the state standard of 1,200 mg/L. The temperature criterion of 27 degrees for warm-water fisheries was exceeded at Robinson Creek on June 18, 2008. No other surface water-quality parameters recorded in or around the tract exceed state water-quality standards.

Although there is no longer a state standard for total suspended solids, the maximum values recorded in and around the tract are very high. The maximum recorded TSS value near the tract is 22,752 mg/L at SW-101 on March 18, 2009. Similarly high values were recorded at the same location on 3/21/2008 (13,404 mg/L) and on 3/30/2010 (9,020 mg/L).

The State of Utah has established a threshold indicator value of 0.05 mg/L total phosphorus concentration in streams and rivers as a trigger for further, in-depth assessment of water body condition and needs. This indicator value applies to recreation use in the watershed. Total phosphorus exceedances of the designated beneficial use threshold (0.05 mg/L) occur routinely in surface waters in and around the tract, with 93% of data showing total phosphorus concentrations greater than 0.05 mg/L.

Table 3.31. Summary of Utah Division of Oil, Gas, and Mining Water Quality Data in and Around the Alton Coal Tract

	Average	Maximum	Minimum	State Standard	Associated Beneficial Use
Temperature (°C)	11.6	27.4	–	27	3C
Ph	8.4	9.05	7.6	6.5–9	2B, 3C, 4
Dissolved oxygen (mg/L)	8.2	12.1	5.6	3.0*	3C
Total suspended solids (mg/L)	949.8	22,752	2.5	None	–
Nitrate and nitrite as N (mg/L)	1.6	4.2	0.03	4.0	2B
Total phosphorus (mg/L)	0.52	2.94	0.05	0.05†	2B
TDS (mg/L)	883	3,429	127	1,200.0	4

*One-day minimum standard.

†Threshold value.

3.16.2 Groundwater

3.16.2.1 GROUNDWATER OCCURRENCE AND USE

Shallow groundwater resources beneath the tract are present in alluvial sediments, the Tropic Shale, and the Dakota Formation. However, most of these shallow groundwater resources are not supportive of a readily developable groundwater resource due to low permeability of the associated geologic units. Based on estimates provided by Petersen (Personal Communication 2010), approximately 10,000 acre-feet of groundwater are available in the zone (generally alluvial sediments) from which groundwater resources would be extracted for use in mining operations on the tract. The first significant quantities of groundwater underlying the tract are from the deep Navajo Sandstone aquifer.

On a regional scale, groundwater from the Navajo Sandstone is used for domestic, agricultural, and municipal wells. This groundwater also provides baseflow to springs and streams in the region. However, the Navajo Sandstone aquifer is not tapped by any wells in or adjacent to the tract. Within the tract, the depth of the Navajo Sandstone ranges from approximately 1,300 feet to 2,450 feet below land surface (see Figure 3.3). Therefore, the groundwater resources available in the Navajo Sandstone aquifer are not reasonably available for development near the tract because of the high costs of well construction and groundwater pumping.

3.16.2.2 GROUNDWATER HYDROLOGY

Aquifer properties and groundwater resources beneath the Alton Coal Field have been investigated through extensive drilling, hydrogeologic characterization, and surface and groundwater monitoring (Doelling and Graham 1972a; 1987; Petersen Hydrologic 2007).

The tract is located at the base of a valley, along the north-south axis of Kanab Creek, where shallow aquifers could support stream flows during periods of peak runoff. During these periods of peak runoff, areas along Kanab Creek could be considered groundwater discharge zones. The principal recharge areas to the shallow aquifers are located outside the tract on Paunsaugunt Plateau. Groundwater in the bedrock stratigraphic sequence of the Paunsaugunt Plateau east of the tract are located large distances laterally and topographically up-gradient of the tract. Local recharge to shallow aquifers occurs as diffuse infiltration through the unsaturated zone during precipitation events. This would likely occur in up-gradient areas along mountain fronts and loosing stream reaches. The clayey surface sediments in the valleys limit the potential for vertical recharge to groundwater systems.

The complex geology and structure (faults and folds) of the Alton Coal Field forms a complex hydrogeologic setting vertically and laterally across and adjacent to the tract. In general, the vertical hydrogeologic units consist of unconsolidated clay, silt, sand, and gravel alluvial sediments that have been deposited near drainages and overlay the relatively impermeable Tropic Shale. The hydrogeology below the Tropic Shale consists predominately of low-permeability shaley strata interbedded with lenticular (lens-like), fine- to medium-grained sandstones of the Dakota Formation. The Smirl Coal Zone, which is located at the top of the Dakota Formation near the contact with the Tropic Shale, is reported to have a moisture content of approximately 13% (2004).

Laterally within the tract, the alluvium deposits range from a thin covering to a thicker covering of 10 feet or more. However, east of the southeastern border of the tract in Sink Valley, the alluvium deposits approach a thickness of 50 feet, and are reported to be 120–140 feet thick along the eastern edge of Sink Valley (Petersen Hydrologic 2007). The alluvium deposits in Sink Valley are also capped by a thick sequence (up to 60 feet) of clay material. Also unique to Sink Valley is the presence of the Tropic Shale along its margins that creates a hydrogeologic boundary which, in essence, creates a “bathtub” within the

valley (UII 1987). Furthermore, Sink Valley is located at the base of numerous drainages (Petersen Hydrologic 2007) that are recharged from the Paunsaugunt Plateau. Therefore, numerous springs and wells are located in Sink Valley Wash, a groundwater discharge area. See Section 3.16.3 for discussion of AVFs.

Another groundwater discharge area is located in the most northwest portion of the tract, just south of the town of Alton. In this area, a flowing spring is present. Saturated soils are also present north of the spring. However, these saturated soils are believed to be from irrigation sub-flows off irrigated fields south of the town of Alton, rather than groundwater discharge.

No other springs or seeps with measurable discharge have been identified in the tract. Furthermore, no water supply wells are known to exist in either the Tropic Shale or the Dakota Formation in the tract, demonstrating the inability of these formations to transmit useful quantities of water to wells. Due to the low permeability of these units, groundwater from the Tropic Shale and Dakota Formation does not contribute measurable baseflow to streams in the tract (Petersen Hydrologic 2007). Groundwater recharge in the area is from precipitation and percolation to shallow aquifers with little value. In addition, the Navajo Sandstone aquifer is effectively isolated from the proposed mining areas in the tract by more than 1,000 feet of low-permeability rock strata of the Dakota and Carmel formations. These formations contain large thicknesses of low-permeability shales, siltstones, mudstones, and bentonite. Therefore, the Navajo Sandstone aquifer would not be impacted by mining operations in the tract and is not further evaluated.

3.16.2.3 GROUNDWATER QUALITY

Groundwater-quality data are available for 11 wells and 26 springs located near the southeastern border of the tract. All of these sampling sites are within or near Sink Valley Wash (see Map 3.16), and are not representative of groundwater conditions in the entire tract. Groundwater-quality data for the 11 wells and 26 springs are listed in Table 3.32 for select parameters. These data are summarized from data obtained from the DOGM water quality database.

Groundwater quality data for TDS are available for six wells and 10 spring monitoring sites located near the southeastern border of the tract. All of these sampling sites are within or near Sink Valley Wash. The average TDS concentrations measured in groundwater from wells and springs in Sink Valley Wash are 623 and 394 mg/L, respectively. These concentrations are well below the state standard for irrigation and stock watering. Groundwater collected from a well (Y-36) completed in the Smirl coal seam had a TDS concentration of 1,320 mg/L. This TDS result slightly exceeds the state standard for irrigation; however, only one sample result was available. The average selenium concentration measured in groundwater from all wells and springs was less than laboratory detection limits (typically 0.001–0.02 mg/L). The average boron concentration measured in groundwater from all wells and springs was 0.2 mg/L.

Table 3.32. Summary of Selected Groundwater Quality Data Adjacent to the Alton Coal Tract

Groundwater Source	Parameter	Minimum	Maximum	Average
Wells located in Sink Valley Wash alluvium	Ph	7.0	8.0	7.4
	Conductivity (µS/cm)	602	2,680	910
	TDS (mg/L)	378	2,060	623
Wells located in Lower Robinson Creek	Ph	6.6	7.9	7.2
	Conductivity (µS/cm)	1,622	5,490	3,365
	TDS (mg/L)	1,172	5,208	3,197
Well located in the Smirl Coal Seam of Sink Valley Wash	Ph	7.2	7.9	7.6
	Conductivity(µS/cm)	1,320.0	1,320.0	1,320.0
	TDS (mg/L)	784.0	815.0	800.0
Springs located in Sink Valley Wash alluvium	Ph	7.0	9.1	7.6
	Conductivity (µS/cm)	482	4,150	1,045
	TDS (mg/L)	381	1,182	662
Springs located in Lower Sink Valley Wash	Ph	7.0	7.8	7.5
	Conductivity(µS/cm)	686	2,470	1,662
	TDS (mg/L)	394	594	518

Notes: Wells located in Sink Valley Wash alluvium include the following sites: C5-130, LS-15, LS-60, LS-85, SS-15, SS-30, Y-102, Y-61.

Wells located in Lower Robinson Creek include the following sites: LR-45 and UR-70.

Alluvium Sink Valley Wash Springs include the following sites: Sorenson Spring, SP-14, SP-15, SP-16, SP-17, SP-18, SP-19, SP-20, SP-21, SP-22, SP-23, SP-24, SP-25, SP-26, SP-28, SP-29, SP-30, SP-31, SP-32, SP-33, SP-35, SP-6, and SP-8.

Lower Sink Valley Wash Springs include the following sites: SP-3, SP-34, SP-4.

3.16.3 Wetlands, Riparian Areas, Floodplains, and Alluvial Valley Floors

3.16.3.1 WETLANDS

Approximately 62.8 acres of wetlands are assumed to be present in Block NW of the tract. Preliminary field assessments in the fall of 2007 and summer of 2008 (SWCA 2007b: Appendix F; Collins 2008b: Appendix F) resulted in an estimate of approximately 37.5 acres of wetland with wet meadow characteristics (see Map 3.17 and Appendix F) however the larger figure is used in the analysis because a complete wetland delineation on the tract has not been performed. For purposes of analysis, this area is considered to be a jurisdictional wetland. A jurisdictional wetland is a wetland subject to regulation by USACE under Section 404 of the CWA (i.e., it is within USACE “jurisdiction”).

The wetlands present in Block NW are, based on the preliminary field assessments, characterized by hydrophytic vegetation including wire grass, small-wing sedge, and Missouri iris. Further, based on a small number of sample holes, soils in the wetland area exhibit characteristics typical of hydric (wetland) soils. Wetland hydrology data were not gathered during preliminary field investigations. However, based on aerial photograph examinations coupled with field observations, it appears that the water supporting the wetland area is primarily a result of irrigation runoff from the agricultural fields directly north and adjacent to the wetlands. Other natural sources of water to the wetlands, such as springs or seeps, were not observed during preliminary field assessments, although springs are known to be present in the area.

3.16.3.2 RIPARIAN AREAS

There are approximately 55.3 acres of riparian area on the tract (approximately 1.5% of the total tract area) largely along Kanab Creek and Lower Robinson Creek (see Map 2.2). Species such as willows, cottonwoods, Russian olive, and tamarisk occur in the overstory of the tract riparian communities. Understory species include wiregrass and saltgrass as well as disturbed-area weedy species such as curlycup gumweed and broom snakeweed (2007a).

3.16.3.3 FLOODPLAINS

Approximate floodplain locations and extents within and adjacent to the tract were assessed as part of the reconnaissance-level AVF investigation conducted by Petersen (Petersen Hydrologic 2008) that is described in Section 3.16.3.4 below. Petersen's investigation indicated that map-able floodplains within the tract are located adjacent to Kanab Creek in the no-coal zone (see US.3). The total acreage of this floodplain area within the tract is approximately 57 acres. Petersen's study area for the AVF investigation included areas adjacent to the tract as well. Kanab Creek north and south of the tract boundary also has an associated map-able floodplain in addition to lower Sink Valley Wash southeast of the tract. The total approximate acreage of floodplains outside of the tract defined in the AVF investigation is approximately 476 acres.

Floodplains are protected by EO 11988. This EO requires federal agencies to take action to reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains.

3.16.3.4 POTENTIAL OCCURRENCE OF ALLUVIAL VALLEY FLOORS

Areas identified as AVFs are subject to special mining considerations and protections under the SMCRA. The intent of these special considerations is to protect certain alluvial valleys that are of special importance to farming in the arid and semiarid western United States (west of the 100th meridian). Accordingly, it is useful to delineate areas that may possibly be determined to be AVFs in future mine permitting activities.

Under the governing State of Utah coal mining rules (R645-302; Special categories and areas of mining), if AVFs are present in or adjacent to a proposed mining area, special rules apply to coal mining in these areas. The special rules are generally more restrictive and reclamation requirements are more stringent for AVF areas than for other areas. Specifically, mining in or adjacent to an AVF is prohibited except where it can be shown that mine-related activities will not 1) interrupt, discontinue or preclude farming on AVFs, or 2) cause material damage to the quantity of water in surface or underground water systems that supply AVFs. Statutory exclusions from these considerations are granted where the pre-mining land use of an AVF is undeveloped rangeland which is not significant to farming, or where farming on the AVF that would be affected is of such small acreage as to be of negligible impact on a farm's production. An exclusion is also granted where significant mining at an operation occurred within or adjacent to an AVF prior to August 3, 1977.

A reconnaissance-level AVF investigation was conducted on the tract in spring of 2008 by Erik Petersen (Petersen Hydrologic, 2008, see Appendix E for the complete report). This study was intended to provide baseline information concerning potential AVFs occurring on and adjacent to the tract. The performance of detailed, site-specific AVF studies typically involves the collection and analysis of large amounts of data, and requires considerable effort and expense. Consequently, where necessary, detailed, site-specific AVF studies are typically performed during the permitting stage of mine development rather than at the leasing stage when the successful bidder and detailed mine plans are unknown.

The identification criteria used to delineate probable AVFs in the reconnaissance study were based on the information provided in *Alluvial Valley Floor Identification and Study Guidelines* published by the OSM (OSM 1983). Although the concept of an AVF may have a technical meaning to a geologist, in the context of

SMCRA, an AVF is a regulatory term that has been defined in statute and clarified in legislative history, court decisions, regulations, and ongoing administrative decisions (OSM 1983). The AVF identification criteria established by SMCRA and outlined by OSM were strictly adhered to in the reconnaissance investigation. These delineation criteria are summarized below.

The SMCRA definition of an AVF is based on agricultural water use and the surficial geologic characteristics of a stream valley. An AVF is defined by SMCRA as:

> The unconsolidated stream-laid deposits holding streams with water availability sufficient for sub-irrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff or slope wash, together with talus, or other mass-movement accumulations and windblown deposits. (30 U.S.C. 1234-1328)

Regulations, judicial review, and administrative decisions have expanded and clarified the statutory definition as follows (OSM 1983):

- The geologic criteria of an AVF are understood to be
  - a topographic valley with a continuous perennial, intermittent, or ephemeral stream channel running through it; and
  - those surface landforms that are either floodplains or terraces if these landforms are underlain by unconsolidated deposits; and
  - within that valley, those side-slope areas that can reasonably be shown to be underlain by alluvium, and which are adjacent to floodplain or terrace landform areas.
- The water availability criteria are met if
  - water is available by surface-water irrigation or sub-irrigation and is being or has successfully been used to enhance production of agriculturally useful vegetation; or
  - surface water is available in sufficient quantities to support agricultural activities.

Additionally, stream valleys which do not have any agricultural importance or whose importance is not related to the greater water availability of the valleys are not AVFs (OSM 1983).

Any areas meeting all the geologic criteria and one of the water availability criteria are considered probable AVFs for the purposes of initial, reconnaissance-level identification (OSM 1983).

Based on the reconnaissance-level identification study criteria outlined above, six probable AVF areas were identified (see Map 2.2). The delineations of these six probable AVF areas were determined based on 1) specific water availability criteria for each area, 2) the physical capability and historical extent of flood irrigation of the land in each area, and 3) the presence or absence of flood plain and terrace geomorphic features in each area. Those areas that satisfied the geologic and water availability criteria were delineated as probable AVF areas in the reconnaissance investigation. Areas not meeting both criteria were excluded as probable AVFs. The six areas identified as probable AVFs in the tract area are situated along the Kanab Creek and Sink Valley Wash drainages (see Map 2.2).These areas encompass those lands within the study area that appear to have the greatest likelihood for being potential AVFs (probable AVFs in OSM parlance). The total acreage of probable AVFs in the study area is approximately 533 acres. Of this, approximately 57 acres of probable AVFs occur within the tract. Approximate floodplain acreages and locations described above are the same as approximate acreages and locations of probable AVFs described here. See Appendix E for a more detailed description of the investigation conducted and the study results.

3.17 Wildlife and Special Status Species

The wildlife and special status species addressed in this section consist of animal species that are 1) federally listed as threatened, endangered, or candidate; 2) Utah BLM state director's sensitive species; 3) UDWR sensitive species; 4) wildlife species managed by the UDWR; or 5) wildlife species protected under other federal or state laws or conservation agreements. The federal ESA of 1973 (Public Law 93-205, as amended) provides protection to federally listed species from actions that may jeopardize their existence. This could occur through direct harm; activities resulting in increased stress during critical life history stages such as nesting, migration, or wintering; loss or degradation of critical habitat; or loss or degradation of occupied or potential habitats. Fish and wildlife habitats are generally managed according to the guiding principles outlined by the BLM *Wildlife 2000*, *The Riparian-Wetlands Initiative for the 1990s*, *A Strategy for Future Waterfowl Habitat Management on Public Lands* and other species- and habitat-specific direction such as the *National Sage-Grouse Habitat Conservation Strategy* (BLM 2004a), and the KFO RMP (BLM 2008c).

3.17.1 Regional Overview

Wildlife and special status species with suitable habitats on or adjacent to the tract or coal haul transportation route are listed in Table 3.33. The tract and coal haul transportation route are located in the northwestern corner of Kane County, the western edge of Garfield County, and the eastern half of Iron County. The assessment areas considered in this analysis include the Alton Coal Tract as defined under each action alternative, and the coal haul transportation route. The status and habitats of listed species were obtained from the BLM, from the Utah Conservation Data Center (UDWR 2008), and from wildlife surveys conducted in 2007 and 2008. (Appendix F lists the wildlife and special status animal species eliminated from detailed analysis and any reasons the species were not analyzed.)

Table 3.33. Wildlife and Special Status Animal Species with Potential to Occur on the Tract and/or Coal Haul Transportation Route

Common Name (*scientific name*)	Status
Federally Listed Species	
Utah prairie dog (*Cynomys parvidens*)	Federally Threatened
Sensitive Species	
Allen's big-eared bat (*Idionycteris phyllotis*)	BLM Sensitive, SPC
Arizona toad (*Bufo microscaphus*)	BLM Sensitive, SPC
Bald Eagle (*Haliaeetus leucocephalus*)	SPC
Big free-tailed bat (*Nyctinomops macrotis*)	BLM Sensitive, SPC
Black Swift (*Cypseloides niger*)	BLM Sensitive, SPC, PIF
Bonneville cutthroat trout (*Oncorhynchus alcina utah*)	BLM Sensitive, CS
Burrowing Owl (*Athene cunicularia*)	BLM Sensitive, SPC
Desert sucker (*Catostomus alcina*)	SPC
Ferruginous Hawk (*Buteo regalis*)	BLM Sensitive, SPC

Table 3.33. Wildlife and Special Status Animal Species with Potential to Occur on the Tract and/or Coal Haul Transportation Route

Common Name (*scientific name*)	**Status**
Fringed myotis (*Myotis thysanodes*)	BLM Sensitive, SPC
Golden Eagle (*Aquila chrysaetos*)	SPC
Greater Sage-grouse (*Centrocercus urophasianus*)	BLM Sensitive, SPC
Kit fox (*Vulpes macrotis*)	SPC
Leatherside chub (*Gila copei*)	BLM Sensitive, SPC
Lewis's Woodpecker (*Melanerpes lewis*)	BLM Sensitive, SPC
Long-billed Curlew (*Numenius americanus*)	BLM Sensitive, SPC
Northern Goshawk (*Accipiter gentilis*)	BLM Sensitive, CS
Pygmy rabbit (*Brachylagus idahoensis*)	BLM Sensitive, SPC
Short-eared Owl (*Asio flammeus*)	BLM Sensitive, SPC
Spotted bat (*Euderma maculatum*)	BLM Sensitive, SPC
Three-toed Woodpecker (*Picoides tridactylus*)	BLM Sensitive, SPC
Townsend's big-eared bat (*Corynorthinus townsendii*)	BLM Sensitive, SPC
Virgin spinedace (*Lepidomeda mollispinis*)	CS
Western toad (*Bufo boreas*)	SPC
Wildlife Species	
Mule deer (*Odocoileus heminonus*)	UDWR Managed
Pronghorn antelope (*Antilocapra americana*)	UDWR Managed
Rocky Mountain elk (*Cervus alcinatio*)	UDWR Managed
Migratory and Nonmigratory Bird Species	
Bendire's Thrasher (*Toxostoma bendirei*)	BOCC, PIF
Black-chinned Sparrow (*Spizella atrogularis*)	BOCC
Black-throated Gray Warbler (*Dendroica nigrescens*)	BOCC, PIF
Brewer's Sparrow (*Spizella breweri*)	BOCC, PIF
Broad-tailed Hummingbird (*Selasphorus platycercus*)	PIF
Gambel's Quail (*Callipepla gambelii*)	PIF
Gray Vireo (*Vireo vicinior*)	BOCC, PIF
Loggerhead Shrike (*Lanius ludovicianus*)	BOCC
Lucy's Warbler (*Vermivora luciae*)	PIF
Mountain Plover (*Charadrius montanus*)	BOCC, PIF
Northern Harrier (*Circus cyaneus*)	BOCC
Peregrine Falcon (*Falco alcinatio*)	BOCC
Pinyon Jay (*Gymnorhinus cyanocephalus*)	BOCC

Table 3.33. Wildlife and Special Status Animal Species with Potential to Occur on the Tract and/or Coal Haul Transportation Route

Common Name (*scientific name*)	Status
Prairie Falcon (*Falco mexicanus*)	BOCC
Red-naped Sapsucker (*Sphyrapicus nuchalis*)	BOCC
Sage Sparrow (*Amphispiza belli*)	BOCC, PIF
Swainson's Hawk (*Buteo swainsoni*)	BOCC
Virginia's Warbler (*Vermivora virginiae*)	BOCC, PIF

Notes:

SPC = Wildlife Species of Concern (UDWR 2008).

CS = Species receiving special management under a conservation agreement to preclude the need for federal listing (UDWR 2008).

BOCC = Birds of Conservation Concern (USFWS 2002).

PIF = Utah Partners in Flight Priority Species (Parrish et al. 2002).

Vegetation on the tract is primarily pinyon-juniper woodland, sagebrush/grassland, and sagebrush/grassland (treated) (pinyon pine and Utah juniper cover has been mostly removed) (see the vegetation communities map in Chapter 3). Table 3.34 shows land-cover acreages and associated wildlife and special status animal species. These land-cover types are based on a vegetation community survey of the tract conducted in fall 2007 (2007a). As indicated in Table 3.34, there is considerable overlap in the habitat associations of the species addressed in this section. See the Vegetation section of Chapter 3 for a detailed description of the vegetation communities presented in Table 3.34. See Table 3.35 for migratory bird habitat associations on the tract and along coal haul transportation route.

Table 3.34. Land-cover Acreages in the Alton Coal Tract and Associated Wildlife and Special Status Animal Species

Cover Type	Associated Wildlife and Special Status Animal Species	Acres	Percentage of Tract
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, elk, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	1,430.0	40.0%
Sagebrush/grassland	Burrowing Owl, e k, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-grouse, kit fox, Long-billed Curlew, mule deer, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	860.2	24.1%
Sagebrush/grassland (treated)	Burrowing Owl, e k, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-grouse, kit fox, Long-billed Curlew, mule deer, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	749.1	20.9%
Annual and perennial grasses	Elk, Ferruginous Hawk, Long-billed Curlew, mule deer, Short-eared Owl	324.1	9.1%
Mountain brush	Elk, Ferruginous Hawk, Lewis's Woodpecker	62.8	1.8%
Meadow (wetland)	Elk, mule deer, western toad	62.8	1.8%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, e k, Lewis's Woodpecker, Northern Goshawk, western toad	55.3	1.5%
Rabbitbrush	Burrowing Owl, e k, Ferruginous Hawk, Golden Eagle, Greater Sage-grouse, kit fox, pygmy rabbit, Short-eared Owl, spotted bat	10.7	0.3%
Bedrock, cliff, and canyon	Allen's big-eared bat, Black Swift, big free-tailed bat, Golden Eagle, fringed myotis, spotted bat, Townsend's big-eared bat	0.0	0.0%

Table 3.34. Land-cover Acreages in the Alton Coal Tract and Associated Wildlife and Special Status Animal Species

Cover Type	Associated Wildlife and Special Status Animal Species	Acres	Percentage of Tract
Open water	Black swift, Bonneville cutthroat trout, desert sucker, leatherside chub, virgin spinedace	4.1	<0.1%
Roads	None	17.4	0.5%
Total		**3,576.5**	**100.0%**

The sagebrush/grassland (treated) cover type and the sagebrush/grassland cover type differ in that 1) sagebrush/grassland contains an occasional Utah juniper or pinyon pine, and 2) understory species composition and grass/forb cover may be reduced in sagebrush/grassland (treated) due to the presence of chipped tree remnants. However, any reduction in value for wildlife species following treatment would temporary, and some wildlife species would use these disturbed areas in the interim due to the more open landscape and production of understory species.

Land-cover types described for the tract and coal haul transportation route differ for several reasons: 1) land cover was based on detailed vegetation community surveys for the tract, 2) land cover was based on Southwest Regional Gap Analysis Project (SWReGAP) coverage for the coal haul transportation route, and 3) land-cover types are not identical between the tract and coal haul transportation route. Vegetation community surveys were not conducted along the coal haul transportation route because SWReGAP analysis was deemed to be sufficient for assessment and quantification of habitat areas. Land cover adjacent to the 110-mile proposed coal haul transportation route is primarily sagebrush habitats (39.0%) and developed areas (38.7%). Table 3.35 lists land cover, vegetation acreages, and the special status animal and wildlife species associated with each cover type.

Table 3.35. Land-cover Miles Adjacent to the Coal Haul Transportation Route and Associated Wildlife and Special Status Animal Species

Cover Type	Associated Wildlife and Special Status Animal Species	Miles	Percentage of Route
Agriculture	E k, Ferruginous Hawk, Long-billed Curlew, mule deer, pronghorn, Short-eared Owl	7.3	6.6%
Bedrock, cliff, and canyon	Allen's big-eared bat, black swift, big free-tailed bat, fringed myotis, spotted bat, Townsend's big-eared bat	1.0	0.9%
Developed*	None	42.6	38.8%
Grassland (native and invasive grasses/forbs)	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Long-billed Curlew, mule deer, pronghorn, Short-eared Owl, Utah prairie dog	0.1	0.1%
Open water	Black Swift, Bonneville cutthroat trout, desert sucker, leatherside chub, virgin spinedace	0.1	0.1%
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, elk, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	9.9	9.0%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Northern Goshawk, Western toad	<0.1	<0.1%
Sagebrush	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-grouse, kit fox, mule deer, pronghorn, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	43.0	39.2%

Table 3.35. Land-cover Miles Adjacent to the Coal Haul Transportation Route and Associated Wildlife and Special Status Animal Species

Cover Type	Associated Wildlife and Special Status Animal Species	Miles	Percentage of Route
Salt desert scrub	Big free-tailed bat, Burrowing Owl, Ferruginous Hawk, Golden Eagle, kit fox, long-billed Curlew, pronghorn, Short-eared Owl, spotted bat	0.1	0.1%
Shrub steppe	Burrowing Owl, elk, Ferruginous Hawk, Golden Eagle, Greater Sage-grouse, kit fox, Long-billed Curlew, pronghorn, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat, Utah prairie dog	3.5	3.2%
Woodland-shrubland	Black Swift, elk, Ferruginous Hawk, Lewis's Woodpecker, Three-toed Woodpecker	2.2	2.0%
Total		**109.8**	**100.0%**

* Developed land cover is composed of open space and low-intensity development (i.e., human-modified land cover such as lawns and parks), and medium-to-high-intensity development (i.e., roads, other paved surfaces, and structures).

3.17.2 Wildlife Occurring on the Tract and Coal Haul Transportation Route Assessment Areas

Crucial summer habitat for mule deer and crucial summer and yearlong substantial habitats for Rocky Mountain elk are present on the tract and/or coal haul transportation route. Crucial winter and crucial yearlong pronghorn habitats occur along the coal haul transportation route. Suitable habitat for fish, amphibians, raptors, other resident birds, and neotropical migratory birds is also present on or adjacent to the tract and coal haul transportation route. The tract is located within UDWR's PPMA. The area encompasses approximately 894,000 acres and is managed as a trophy-hunting unit.

3.17.2.1 MULE DEER

Mule deer are widespread in Utah, but are present in the greatest densities in shrublands on rough, broken terrain with abundant browse and cover. Deer migrate into the same areas every winter, regardless of forage availability or condition. Winter range habitat consists primarily of shrub-covered, south-facing slopes and often coincides with areas of concentrated human use and occupation (BLM 2008c). Sagebrush serves as primary forage for mule deer during the winter season. Mule deer summer range habitat types include spruce/fir, aspen, alpine meadows, and large grassy parks located at higher elevations. Crucial and high-value mule deer habitats exist in the western portions of Kane County and throughout Garfield County (BLM 2008c). There are 3,577 acres of crucial mule deer summer range on the tract. Mule deer habitats adjacent to the coal haul transportation route consist of 89.7 miles of crucial winter habitat (81.5% of the route), 28.5 miles of crucial summer habitat (25.9% of the route), 14.5 miles of yearlong substantial value habitat (13.2% of the route), and 2.8 miles of substantial value winter habitat (2.5% of the route).

3.17.2.2 ELK

The Rocky Mountain elk is a generalist that inhabits grasslands, woodlands, riparian, shrub, sagebrush, and pinyon-juniper habitats (UDWR 2008). There are 3,505.7 acres of crucial summer habitat and 71.7 acres of yearlong substantial value habitat on the tract. Elk habitats adjacent to the coal haul transportation route consist of 53.5 miles of crucial winter habitat (48.6% of the route) and 11.5 miles of crucial summer habitat (10.5% of the route).

3.17.2.3 PRONGHORN ANTELOPE

In Utah, pronghorn antelope prefer desert, grassland, and sagebrush habitats (UDWR 2008). Suitable pronghorn habitats in sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses exist on 1,946.8 acres (54.4%) of the tract. However, there are no UDWR-designated pronghorn habitat areas on the tract. Pronghorn habitats adjacent to the coal haul transportation route consist of 54.0 miles of crucial yearlong habitat (49.1% of the route) and 5.9 miles of crucial winter habitat (5.3% of the route).

3.17.3 Special Status Species Occurring on the Tract and Coal Haul Transportation Route Assessment Areas

3.17.3.1 GREATER SAGE-GROUSE

The Greater Sage-grouse is dependent on sagebrush-dominated habitats (*Artemisia* species, especially *A. alcinatio*) with an understory of forbs and grasses and associated wet meadow habitat (Gregg et al. 1993; Connelly et al. 2000). The species distribution is closely associated with that of sagebrush due to the sage-grouse's use of sagebrush for food, thermal cover, and/or breeding habitats throughout the year. Range-wide, Greater Sage-grouse numbers have declined approximately 50%, and available habitats have declined approximately 60% from historic levels (Beck et al. 2003). Population declines are primarily due to habitat loss, habitat fragmentation, and reduced habitat quality from urban expansion, conversion of habitats to agriculture, and alteration of habitats by invasive species that reduce habitat quality by reducing herbaceous forage and/or increasing the frequency and intensity of ground fires (2002; Bosworth 2003; 2005). The species' sagebrush steppe habitats and associated herbaceous understory have been reduced by improper grazing, invasive plant species, altered fire regimes, pinyon-juniper encroachment, and oil and gas industry expansion (2005). Pinyon-juniper woodland encroachment into sagebrush habitats has reduced the quality and quantity of sagebrush stands and contributed to a range-wide decline in sage-grouse abundance (Connelly et al. 2004). Other specific threats to the species are limited distribution, West Nile virus, and predation by invasive animal species (Connelly et al. 2004; UDWR 2005). Fences can also pose a threat to sage-grouse as vertical barriers, collision risks, and raptor perches (Curtis and Frey 2007). The Alton sage-grouse population has experienced high mortality from predation, with a relatively large number of sage-grouse known to have been killed by predators since 2005 (Curtis and Frey 2007). Increasing predation by non-native predators (domestic pets, red foxes, raccoons) and native ravens is of concern (Frey et al. 2006).

In Utah, Greater Sage-grouse are present in scattered populations north and west of the Colorado River (2002) on approximately 40% of their historic range (Beck et al. 2003). The Alton sage-grouse population is very small (estimated at 30–40 birds), and exclusively uses the Alton–Sink Valley sage-grouse lek (courtship display site) and nesting, brood-rearing and wintering habitats in the Alton–Sink Valley area (Personal Communication, Frey 2009). The Alton–Sink Valley sage-grouse lek is the southernmost active Greater Sage-grouse lek in North America (Curtis and Frey 2007; BLM 2008b). Because sage-grouse exhibit high fidelity to lekking and nesting sites (Fischer et al. 1993), lek counts are widely used to estimate local population size (Connelly et al. 2004). The historic (pre-settlement) size of the Alton sage-grouse population is not known, but is believed to have never been large (Personal Communication, Frey 2009). Lek count data since 1955 indicate fluctuations in male grouse attendance at the Alton–Sink Valley lek, with declines in lek attendance in 2002 and 2003 (presumably in response to extreme drought in the region) and an upturn in lek attendance in 2005 (Frey et al. 2006). Lek attendance at the Alton–Sink Valley lek declined from approximately 20 males in 1984 to 11 males in 2005 (Frey et al. 2006). The local population is estimated at approximately three times the male lek count. In 2008, the maximum Alton–Sink Valley lek count was 12 males (Personal Communication, Frey 2009).

There are three inactive Greater Sage-grouse leks south of the Alton–Sink Valley lek at Skutumpah and Ford Pasture. These historic leks have been inactive for 10–15 years and may represent the southern limit of the species' range (Personal Communication, Frey 2009). The closest active lek to the Alton–Sink Valley lek is the Heut's Ranch lek, approximately 6 miles north of Alton, which contains an estimated 40 males, or approximately 120 sage-grouse total. There is bird movement from Heut's Ranch to the Alton–Sink Valley lek, but no other source of genetic exchange with the Alton sage-grouse population is known. Relatively large numbers of sage-grouse (60–70) visit Alton–Sink Valley in winter, but they do not stay and breed with the Alton population, and the source of these birds is not known (Personal Communication, Frey 2009). Because of its small size, the Alton–Sink Valley population is highly susceptible to extirpation from environmental or demographic stochastic events, such as severe drought or disease outbreak, respectively (Personal Communication, Frey 2009). Specific threats to the Alton sage-grouse population include West Nile virus, increasing predation, severe drought, habitat loss, or a combination of these events.

The Alton sage-grouse population occurs within the 5 million-acre Color Country sage-grouse management area in south-central Utah (UDWR 2002). The *Color Country Adaptive Resource Management Sage-grouse Conservation Plan* (Frey et al. 2006) was produced as a result of the *2002 Utah Greater Sage-grouse Strategic Management Plan* (UDWR 2002) to assess the status of the Color Country sage-grouse population. In March 2005, radio tracking of individual birds, annual lek counts, and vegetation monitoring were implemented as part of a joint effort by the BLM, UDWR, Utah State University Extension, and Southern Utah University to assess the size of and year-round habitat use by the Alton sage-grouse population (Frey et al. 2006). The Alton sage-grouse study coincided with sagebrush habitat restoration efforts by the BLM (see below).

The Greater Sage-grouse is a sagebrush-obligate species that requires contiguous sagebrush-dominated habitats (Connelly et al. 2004). In Utah, nesting sage-grouse have been demonstrated to prefer sagebrush more than 16 inches (40 cm) tall and 15%–50% canopy cover of tall grasses and other concealing vegetation (Connelly et al. 2004). These conditions are consistent with mature, well-developed sagebrush communities. Range-wide, sage-grouse use other sagebrush-dominated habitats and forage in riparian, wet meadow, and agricultural habitat types during the summer nesting and brood-rearing season, and are dependent on mature sagebrush stands for forage and shelter in winter (Connelly et al. 2004). The Alton sage-grouse population uses sagebrush-steppe, agricultural, pinyon-juniper woodland, and riparian habitats in the Alton–Sink Valley area; however, the quality of sagebrush habitats has been reduced due to pinyon-juniper encroachment and loss of understory forbs and grasses. In fall 2005, the BLM removed 99% of pinyon-juniper trees on 1,700 acres in the Alton–Sink Valley area and seeded the treated area with forbs and grasses to restore sagebrush-steppe habitat (Frey et al. 2006). The treatments resulted in increased forb and grass cover and increased use of treated areas by sage-grouse in summer and fall. Sage-grouse had a mixed response in their use of treated habitats in spring and winter (Frey 2008). Curtis and Frey (2007) found Alton sage-grouse to occur in greater numbers in treated habitats compared to other vegetation types ($p<0.05$), and in greater numbers in sagebrush than in agricultural fields or pinyon-juniper/sagebrush vegetation.

Greater sage-grouse occupy rabbitbrush, sagebrush/grassland, and sagebrush/grassland (treated) habitats on approximately 1,620 acres (45%) of the tract, and sagebrush and shrub steppe habitats along 47 miles (42%) of the coal haul transportation route. The species is also known to use annual and perennial grasses and meadow (wetland) habitats on 324 acres (9%) and 53 acres (1.5%), respectively, in Block NW. There are no known lekking habitats on the tract. Sage-grouse appear to nest exclusively in sagebrush habitats adjacent to the Alton–Sink Valley lek based on the fact that no radio-collared females nested outside of this area (Curtis and Frey 2007). Nesting habitats include sagebrush/grassland, and sagebrush/grassland (treated) habitats in the southeastern portion of the tract (Block S). Summer brood-rearing habitats include sagebrush/grassland, sagebrush/grassland (treated), annual and perennial grasses in the southern portion of the tract, and grassland and meadow habitats in the northern portion of the tract. During summer brood-rearing season, approximately one third of nesting females move their chicks from nesting habitats to horse pastures and wetlands north of the tract (Curtis and Frey 2007). Wintering habitats include all habitat types on the tract.

3.17.3.2 PYGMY RABBIT

The pygmy rabbit requires dense, tall stands of sagebrush (*Artemisia* spp., especially *A. alcinatio*) with sandy or alluvial soils that are conducive to burrowing (Bosworth 2003). Population densities vary in response to habitat quality, but the habitat or environmental factors that cause population fluctuations are poorly understood (Green and Flinders 1980). The species is believed to have declined from historic levels in response to reduced habitat quality and quantity. Habitat loss and degradation are primarily due to changes in fire regimes, land conversion for development and agriculture, livestock grazing, and weed invasions (Bosworth 2003).

The pygmy rabbit is known to occur on the tract and coal haul transportation route. The species occurs in rabbitbrush, sagebrush/grassland, and sagebrush/grassland (treated) habitats on approximately 1,620 acres (45%) of the tract, and on sagebrush and shrub steppe habitat along 47 miles (42%) of the coal haul transportation route.

3.17.3.3 UTAH PRAIRIE DOG

The Utah prairie dog is endemic to southwestern Utah in the southern Bonneville Basin and in central Utah at high elevations (Bosworth 2003). Critical habitat has not been designated for the species. A recovery plan was completed for the Utah prairie dog in 1991 (USFWS 1991), and the Utah Prairie Dog Interim Conservation Strategy was completed in 1997 (Utah Prairie Dog Implementation Team 1997). The UDWR initiated a translocation program in 1972 to move Utah prairie dogs from private lands to areas of historical occupancy on public lands. The prairie dog translocation program has become a key element in Utah prairie dog management and recovery, and is authorized by the USFWS under the ESA.

Prairie dog habitats consist of continuous grassland and other vegetation on flat plains (BLM 2008c). Succulent vegetation is crucial for Utah prairie dog survival during drought (Crocker-Bedford and Spillett 1981). Populations have declined dramatically from historic levels to the current total of 3,500–6,000 adults (Bosworth 2003). The primary threat to the species is direct habitat loss from development and agricultural use (Bosworth 2003). Bubonic plague (2005) and sylvatic plague can cause dramatic population fluctuations, and poisonings and shootings have affected populations in some areas (Bosworth 2003). Populations of Utah prairie dog are not present on the tract or on BLM-managed lands elsewhere in Kane County, but populations are known to exist along the coal haul transportation route. Suitable Utah prairie dog habitat occurs in sagebrush, grassland, and shrub steppe habitats adjacent to US-89, SR-20, I-15, and SR-56 along approximately 47 miles (43%) of the coal haul transportation route. The USFWS has established a 350-foot buffer as the range within which normal behavior of individual Utah prairie dogs may be disrupted by noise or human presence (Personal Communication, Fox 2010). Known Utah prairie dog colonies occur within 350 feet of the coal haul transportation route on 640 acres and are estimated to contain approximately 309 prairie dogs, or 6.1% of the total known Utah prairie dog population within the West Desert and Paunsaugunt Recovery Units (UDWR 2010).

3.17.3.4 KIT FOX

The kit fox inhabits the western United States and northern Mexico, but is not widely abundant in Utah (UDWR 2008). The species prefers sparsely vegetated greasewood, shadscale, or sagebrush-dominated habitats (Bosworth 2003), and has the potential to occur on the tract and along the coal haul transportation route. The kit fox's specific distribution is not known, but high- and substantial-value habitats exist on or near the western portion of the coal haul transportation route in Iron County (UDWR 2008). Suitable habitats consist of sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush habitats on 1,620 acres (45%) of the tract, and on sagebrush and shrub steppe habitats along 47 miles (43%) of the coal haul transportation route.

3.17.3.5 BAT SPECIES

Five bat species have suitable habitats on the tract and coal haul transportation route. These bat species occupy a variety of habitats, but their ecological needs are fundamentally the same and consist of secure roosting sites and insect prey. Reductions in the prey base from pesticide use, disturbance of roost sites, and mine closures are the primary threats to bat species (2005). The species addressed here use rocky cliffs, crevices, or outcroppings as roost sites. However, caves or mines in any habitat may be used as a roosting site. Bat roost sites in cliff and canyon habitats do not exist on the tract, but do exist along approximately 1 mile (1%) of the coal haul transportation route. Some bat species are also known to use stream and riparian habitats, which are quantified within 100 feet of the coal haul transportation route based on the maximum likely distance that coal could be transported from the route.

Allen's big-eared bat occurs in Garfield and Kane counties (2005). The species prefers riparian areas dominated by cottonwood and willow trees, forested mountain areas, and pinyon-juniper habitats (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat, suitable roosting and foraging areas occur in pinyon-juniper woodland and riparian habitats on 1,485 acres (42%) of the tract and along 10 miles (9%) of the coal haul transportation route. There are approximately 38.3 acres of riparian habitat within 100 feet of the route.

The **big free-tailed bat** inhabits rugged, rocky terrain, and roosts in rock crevices and cliff faces (Foster et al. 1996). The species forages in desert scrub and riparian habitats. In addition to roosting habitat in cliff and canyon habitat types along the coal haul transportation route, foraging habitats exist in riparian habitat on 55 acres (1.5%) of the tract and in salt desert scrub along 0.1 mile (0.1%) of the route. There are approximately 38.3 acres of riparian habitat within 100 feet of the route.

The **fringed myotis** is associated with rocky outcroppings, cliffs, and canyons (Bosworth 2003), and are known to use sagebrush and grasslands as foraging habitats (Foster et al. 1996). In addition to suitable roosting sites in cliff and canyon habitat, foraging habitats for this species include sagebrush/grassland and sagebrush/grassland (treated) habitats on 1,609 acres (45%) of the tract, and in sagebrush and grassland habitats along 43 miles (39%) of the coal haul transportation route.

The **spotted bat** is associated with deep, narrow, rocky canyons with precipitous cliffs and crevices in cliff walls. The species is known to use open sagebrush or desert scrub as foraging habitat (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat, foraging habitats for this species include sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush habitats on 1,620 acres (45%) of the tract, and sagebrush, shrub steppe, and salt desert scrub along 47 miles (43%) of the coal haul transportation route.

Townsend's big-eared bat occurs in sagebrush steppe, pinyon-juniper, and other habitat types with caves or mines for roost sites (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat, foraging habitat for this species occurs in pinyon-juniper woodland, sagebrush/grassland, and sagebrush/grassland (treated) habitats on 3,039 acres (85%) of the tract, and in sagebrush, pinyon-juniper woodland, and shrub steppe along 56 miles (51%) of the coal haul transportation route.

3.17.3.6 RAPTOR SPECIES

Habitat needs for raptors include nesting sites, foraging areas, and roosting or resting sites. Roosting generally occurs in riparian areas and on cliff faces. Potential nesting and roosting sites occur in riparian habitats on approximately 55 acres (1.5%) of the tract, and in cliff and canyon habitats along approximately 1 mile (0.9%) of the coal haul transportation route. Cliff and canyon habitat does not occur on the tract. Stream and riparian habitats occur on approximately 38.3 acres within 100 feet of the coal haul transportation route (the maximum likely distance that coal could be transported from the route).

Habitat loss and disturbance to nest sites, reduction of the prey base, electrocution from power lines, and environmental contaminants are the primary threats to raptor species (Parrish et al. 2002). In addition to the six raptor species addressed here, migratory raptor species are discussed in the Migratory Birds section.

The **Bald Eagle** winters in Utah along rivers, streams, lakes, reservoirs, ponds, and sewage lagoons within riparian or sub-montane woodlands (Bosworth 2003). There are no active breeding sites in Garfield, Kane, or Iron counties (Bosworth 2003). Riparian areas on the tract and coal haul transportation route, quantified above, could provide wintering habitat for this species.

The B**urrowing Owl** prefers sagebrush steppe, desert scrub, and other shrub-dominated habitats with abandoned animal burrows for nesting sites (Bosworth 2003). Suitable nesting and foraging habitats in sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush occur on 1,620 acres (45%) of the tract, and in sagebrush, shrub steppe, grassland, and salt desert scrub habitats along 47 miles (43%) of the coal haul transportation route.

The **Ferruginous Hawk** forages in grasslands, agricultural lands, mixed shrub habitats, and on the periphery of pinyon-juniper forests. Breeding occurs in pinyon-juniper and juniper shrub habitat assemblages and sagebrush steppe (Walters and Sorensen 1983). Suitable nesting and foraging habitats occur in pinyon-juniper woodland, sagebrush/grassland, sagebrush/grassland (treated), annual and perennial grasses, mountain brush and rabbitbrush on 3,437 acres (96%) of the tract, and in pinyon-juniper woodland, sagebrush, agriculture, shrub steppe, woodland-shrubland, grassland and salt desert scrub along 66 miles (60%) of the coal haul transportation route.

The **Golden Eagle** nests in cliff habitats and forages in high desert scrub (Parrish et al. 2002). Suitable foraging habitats in sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush occur on 1,620 acres (45%) of the tract, and in sagebrush, shrub steppe, and salt desert scrub along 47 miles (43%) of the coal haul transportation route.

The **Northern Goshawk** prefers mountain forest and riparian habitats and is a year-round resident of Utah (UDWR 2008). Winter foraging and roosting habitats occur in pinyon-juniper woodlands on 1,430 acres (40%) of the tract. Potential nesting habitats are limited to riparian habitats on 55 acres (1.5%) of the tract, and 38.3 acres within 100 feet of the coal haul transportation route.

The **Short-eared Owl** is a ground nester that inhabits arid grasslands, croplands, cold desert shrub, and sagebrush-rabbitbrush habitats (Bosworth 2003). The species may migrate or remain as a year-round resident in Utah (UDWR 2008). Suitable foraging and nesting habitats in sagebrush/grassland, sagebrush/grassland (treated), annual and perennial grasses, and rabbitbrush occur on 1,944 acres (54%) of the tract, and in sagebrush, agriculture, shrub steppe, grassland, and salt desert scrub along 54 miles (49%) of the coal haul transportation route.

3.17.3.7 MIGRATORY BIRD SPECIES

Migratory birds require nesting and brooding habitat, nonbreeding foraging and resting habitat, habitat along migratory routes, and wintering habitat. Neotropical migratory bird populations are in decline due to habitat fragmentation, habitat loss and modification, urban expansion, loss of nonbreeding habitats and habitats along migratory routes, and brood parasitism (Parrish et al. 2002).

In addition to migratory and nonmigratory bird species addressed in the sections above, 11 migratory bird species have potential to occur on the tract or coal haul transportation route. These species are listed in Table 3.36. Seven nonmigratory species—Gambel's Quail, Loggerhead Shrike, Northern Harrier, Peregrine Falcon, Pinyon Jay, Prairie Falcon, and Sage Sparrow—are also included due to their status as

USFWS birds of conservation concern (USFWS 2002) and their potential to occur on the tract or along the coal haul transportation route. As indicated in Parrish et al. (2002), a tally of the bird species associated with a habitat type provides a coarse estimate of the habitat's relative importance to migratory birds. Riparian, wetland, agriculture, and desert scrub are particularly important as breeding and wintering migratory bird habitats (Parrish et al. 2002). The habitat associations in Table 3.36 are approximate because the habitats presented in Parrish et al. (2002) do not directly correspond to the cover types presented here. Grassland, rabbitbrush, and open water cover types are not included in the table because either migratory or birds of conservation concern species do not occur in the cover type, or the bird species that do occur in those habitats are covered elsewhere in Section 3.17. Table 3.36 does not include migratory or nonmigratory bird species covered elsewhere in this section.

Table 3.36. Migratory Bird Habitat Associations by Habitat and Cover Type on the Alton Coal Tract and Coal Haul Transportation Route

Habitat Type*	Tract Cover Type	Transportation Route Cover Type	Associated Migratory Bird Species
Agriculture	Annual and perennial grasses	Agriculture	Peregrine Falcon, Prairie Falcon, Swainson's Hawk
Cliff	n/a	Bedrock, cliff, and canyon	Peregrine Falcon, Prairie Falcon
Low desert scrub High desert scrub	n/a	Salt desert scrub	Bendire's Thrasher, Black-chinned Sparrow, Brewer's Sparrow, Gambel's Quail, Loggerhead Shrike, Lucy's Warbler, Mountain Plover, Northern Harrier, Prairie Falcon, Sage Sparrow
Lowland riparian	Riparian	Riparian	Broad-tailed Hummingbird, Gambel's Quail, Lucy's Warbler, Peregrine Falcon
Mountain shrub Northern oak	Mountain brush	Woodland-shrubland	Black-throated Gray Warbler, Gray Vireo, Virginia's Warbler
Pinyon-juniper	Pinyon-juniper woodland	Pinyon-juniper woodland	Black-throated Gray Warbler, Gray Vireo, Loggerhead Shrike, Virginia's Warbler
Shrub steppe	Sagebrush/grassland, Sagebrush/grassland (treated)	Sagebrush, shrub steppe	Brewer's Sparrow, Sage Sparrow
Wetland	Meadow (wetland)	n/a	Northern Harrier

Sources: Parrish et al. 2002; 2008a, UDWR 2008.

3.17.3.8 OTHER BIRD SPECIES

The **Black Swift** is very rare in Utah with no confirmed nesting sites in Garfield, Kane, or Iron counties (Parrish et al. 2002; Bosworth 2003). The species only nests near or behind waterfalls, and no potential breeding sites are known to exist on the tract or within 100 feet of the coal haul transportation route. The species is migratory, arriving in Utah in late May or early June and remaining as late as October (Parrish et al. 2002). The Black Swift feeds exclusively on flying insects, and may forage over rivers and streams up to 25 miles from nesting colonies (Parrish et al. 2002). Loss of nesting habitat due to reduction or loss of water flow, reduced prey base due to pesticide use, and direct disturbance to nesting sites are the primary causes of reduced distribution and declining populations (Parrish et al. 2002). Foraging habitat may occur in association with riparian areas on 55 acres (1.5%) of the tract and on 38.3 acres of the coal haul transportation route.

Lewis's Woodpecker is a cavity nester that breeds in ponderosa pine habitats, but may also use riparian cottonwoods or mountain shrub habitats (Parrish et al. 2002). The species eats insects during breeding season, and nuts and berries in fall and winter (Ehrlich et al. 1988). Lewis's Woodpecker inhabits open habitats with widely spaced trees and an understory of grasses and shrubs to provide insect prey and plant

forage (Parrish et al. 2002). Loss of habitat due to tree removal and changes in forest structure as well as grazing by livestock are the primary threats to the species (Parrish et al. 2002). Secondary breeding habitat may occur in pinyon-juniper woodland, riparian, and mountain brush habitats on 1,548 acres (43%) of the tract, and in pinyon-juniper woodland and woodland-shrubland habitats along 12 miles (11%) of the coal haul transportation route. In addition, there are approximately 38.3 acres of riparian habitat within 100 feet of the coal haul transportation route.

The **Long-billed Curlew** is a migrant and summer resident in Utah that requires short grass and bare-ground breeding habitats with shade and abundant small vertebrate prey (Pampush 1980; Parrish et al. 2002). Uncultivated rangelands and pastures support most of the breeding population in Utah. Loss and modification of breeding habitats and predation by foxes and domestic pets are the primary threats to the species and have caused dramatic population declines. Breeding habitats include pasture, meadow, and sagebrush/grassland. Suitable breeding habitats include sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses on 1,933 acres (54%) of the tract, and in agriculture, shrub steppe, grassland, and salt desert scrub habitats along 11 miles (10%) of the coal haul transportation route.

The **Three-toed Woodpecker** is a cavity nester that breeds and winters in high-elevation coniferous forests in Utah (Parrish et al. 2002). The species requires coniferous trees (living and dead) to support its prey of wood-boring insect larvae, but may also use mixed forest habitats (Hill et al. 2001). Populations fluctuate in response to bark beetle outbreaks. Tree removal and fire suppression that remove standing dead trees are the primary threat to the species (Parrish et al. 2002). Suitable breeding and foraging habitats are limited to woodland-shrubland habitats along approximately 2.2 miles (2%) of the coal haul transportation route. No suitable coniferous forest habitat occurs on the tract.

3.17.3.9 AMPHIBIAN SPECIES

The **Arizona toad** is present in Kane County with most of its Utah distribution concentrated to the west in the Virgin River basin in Washington County (2005). In Utah, this species inhabits juniper-dominated habitats and low-elevation riparian habitats near permanent or semipermanent water bodies (Bosworth 2003). The Arizona toad lays eggs on the bottoms of shallow, slow-moving streams. Threats to this species include loss of native vegetation and riparian corridors (2005) as well as water withdrawals (Bosworth 2003). Suitable habitats in pinyon-juniper habitats near water bodies and riparian habitats occur on a maximum of 1,430 acres (40%) of the tract. In addition, there are approximately 38.3 acres of riparian habitat within 100 feet of the coal haul transportation route.

The **western toad** inhabits montane areas in riparian, shrub, mixed conifer, and aspen-conifer habitats associated with permanent bodies of water, and breeds in small bodies of water and along creeks and rivers (Bosworth 2003). Suitable western toad habitat in meadow wetlands and riparian habitat occurs on 118 acres (3%) of the tract. In addition, there are approximately 38.3 acres of riparian habitat within 100 feet of the coal haul transportation route.

3.17.3.10 FISH SPECIES

No special status fish species are known to occur on the tract or in water bodies intersected by the coal haul transportation route. Because special status fish species and their habitats do not occur within or below the Virgin River system and Bonneville Basin where the Alton tract and coal haul transportation route would occur, these species have been eliminated from further analysis.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

CHAPTER 4 ENVIRONMENTAL IMPACTS

4.1 Introduction

In accordance with 40 CFR 1502.16, this chapter presents the anticipated environmental consequences of the actions proposed under each of the alternatives described in Chapter 2:, Alternative A (No Action), Alternative B (Proposed Action Alternative), and Alternative C.

For the purposes of this document, an environmental impact is defined as a change in the quality and/or quantity of a given resource due to a modification in the existing environment resulting from decisions related to the Alton Coal Tract (hereafter also referred to as the tract). Impacts may be beneficial or adverse, may be direct or indirect, and may be permanent or temporary in a long-term or short-term duration. Unless otherwise specified, "short-term" is the period when the development of the mine and the mining of coal would occur. Under the Proposed Action, this would be approximately 25 years, and under Alternative C, this would be approximately 21 years. "Long-term" effects are defined as those effects that would occur or remain after the cessation of coal mining and during, or continuing into the period following, the reclamation and monitoring period (also referred to as the bond release period). Long-term effects would occur for 25–35 (or more) years under the Proposed Action beginning with the onset of mine development. Under Alternative C, long-term effects would occur for 21–31 (or more) years beginning with the onset of mine development. Impacts may vary in degree from a slightly discernible change in the environment to a total change in the environment. The significance of these impacts is determined using the criteria set forth by the Council on Environmental Quality (40 CFR 1508.27) and the professional judgment of the specialists doing the analyses. Impact significance may range from negligible to substantial and may be significant during mining but reduced to less than significant following reclamation. The context where impacts occur can be local, regional, and national.

Impacts on private land are analyzed because the tract under both action alternatives includes split estate lands. In the tract, where the surface estate is privately owned, the minerals beneath the surface estate are administered by the BLM. These lands are therefore eligible for inclusion in the tract and analysis of impacts to them is required to comply with NEPA. Likewise, where the surface estate is owned and administered by the BLM, the subsurface estate is also administered by the BLM, and these lands are also included in the tract and analyzed in this EIS.

4.1.1 Types of Effects

Direct and indirect effects (also referred to as impacts) are the primary and secondary results, respectively, of the No Action Alterative, the Proposed Action, or Alternative C. Direct impacts are caused by the action and occur at the same time and place. An example of a direct impact would be the removal of vegetation as part of the surface mining process on the tract. Indirect impacts from an action occur later in time and/or are removed in space. An example of an indirect impact would be an increase in recreational use on adjacent undisturbed and unrestricted land due to the direct impact of disturbing and/or precluding access on recreation lands in the tract. The impact analysis area for direct and indirect impacts can vary between the resources analyzed. However, at a minimum, the tract is in the impact analysis area for all resources, with the exception of transportation, which primarily considers the coal haul transportation route in the analysis of impacts. The coal haul transportation route is also considered in the impact analysis area for direct and indirect impacts to other resources, such as aesthetics (namely noise), air resources, cultural resources, hazardous materials and hazardous and solid waste, recreation, socioeconomics, water resources, and wildlife and special status species. Sections 4.2 through 4.17

describe the direct and indirect impacts of the No Action Alternative, the Proposed Action, and Alternative C for each resource brought forward for analysis in this EIS.

Cumulative impacts result from the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts may result from individually minor, but collectively significant actions occurring over a period of time (40 CFR 1508.7). The cumulative impact assessment area (CIAA); a list and descriptions of other past, present, and reasonably foreseeable future actions; and the cumulative impact analysis for each resource are contained in Section 4.18 Cumulative Impacts. Impacts resulting from surface-mining operations on the adjacent Coal Hollow Mine and an additional potential private mine area north of the Coal Hollow Mine (see Map 1.1) are addressed in the cumulative impacts section. See Section 4.18 for a complete list of actions, including the private coal mines, which are analyzed in the cumulative impact analysis.

Unavoidable adverse impacts would result from the Proposed Action or Alternative C after the application of potential mitigation measures. Potential mitigation measures are intended to reduce impacts that are not already incorporated into the action alternatives as existing regulatory requirements (i.e., under State of Utah, federal, and or local law and standard or special lease stipulations) and that may be applied to further reduce impacts following the results of the impact analysis. Unavoidable adverse impacts may be permanent or may eventually subside or no longer result in adverse conditions over time. When unavoidable adverse impacts are permanent, the impacts are characterized as irreversible. Irreversible impacts are disclosed separately and described below.

The relationship between the short-term use of the environment or resource versus long-term productivity as it relates to the extraction of coal and resource-use sustainability are intertwined with direct and indirect effects. The mining of 44.9–49.1 million (Proposed Action) or 38.1–42.3 million (Alternative C) tons of coal from the tract would be a short-term use of the environment that would provide benefits in terms of the various potential uses of the coal resource in society. Following a lease sale, should BLM decide (as a result of this EIS) to offer the tract for competitive leasing, DOGM would have to permit mining on the tract prior to the beginning of mining activities. The permitting process is designed to 1) protect the long-term productivity of resources after the cessation of mining and 2) ensure that impacts to resources occurring during the mining process are minimized to the extent possible in the context of an economical, primarily surface-mining operation. Mining would alter many resources' ability to function naturally in the short term; however, the required topsoil salvaging and replacement, topographic recontouring to AOC, and revegetation (including seeding and, in some locations, planting seedlings) would promote the following long-term resource effects:

- Soil productivity reestablishment
- Native and suitable non-native vegetation reestablishment
- Wildlife and wildlife habitat rehabilitation
- Livestock grazing use
- Groundwater, surface water, and watershed function and stabilization
- Recreational use

Based on the analysis in this chapter, following mining activities the function of these resources and resource uses is expected to return to a condition approximating pre-mining conditions. To provide a clear context of the relationship between short-term use of the environment and long-term productivity, further discussions of these relationships are presented in each resource impact analysis section in this chapter.

Irreversible and irretrievable commitments of resources (in other words, irreversible and irretrievable impacts) are also disclosed in the impact analysis section for each resource. Irreversible impacts are those impacts that would result in changes to the environment that cannot be reversed, reclaimed, or repaired. An example of an irreversible impact would be the removal of coal from the tract. Once the in-place coal reserves present in the tract are removed, they can never be replaced or reclaimed. Irretrievable impacts, on the other hand, are those impacts that result in the temporary loss or degradation of the resource for a period of time. An example of an irretrievable impact would be the removal of vegetation from the tract as part of the mining process. During mining operations, the impact of vegetation removal would be irretrievable until the reclamation process is complete. Following reclamation, vegetative cover would be restored to the area.

Where possible, effects are quantified primarily through the use of geographical information systems (GIS) applications that allow for calculations of surface disturbance over portions of the tract under the Proposed Action and Alternative C, and through modeling and other analyses that provide estimates of loads, concentrations, noise and light levels, acres, and other measurable quantities.

4.1.2 Required Regulatory Actions, Mitigation and Monitoring Measures, and Lease Stipulations

All mining and reclamation operations would comply with SMRCA, Utah statutes, and BLM standard and special lease stipulations developed for the tract. This impacts analysis considers all standing measures required by federal, State of Utah, and local regulatory authorities as part of the Proposed Action and Alternative C. Table 2.3 in Chapter 2 presents a table summarizing the existing, required State of Utah, federal, and local mitigation and monitoring requirements inherent to the Proposed Action and Alternative C. This table also includes the required standard and special lease stipulations that would be inherent to the Proposed Action and Alternative C. Required regulatory actions, mitigation and monitoring measures, and lease stipulations particular to each resource are also identified in the impacts analysis section under each resource.

4.1.3 General Analytical Assumptions, Guidelines, and Notes

This EIS assumes that all required regulatory actions, mitigation and monitoring measures, and lease stipulations identified in Table 2.3 would be successfully implemented in the effectiveness limits of the measures undertaken. If such measures were not implemented, additional adverse impacts could occur. Additional assumptions that apply to all resource values and uses relate to 1) the analysis of impacts as a result of the placement of dispersed facilities on the tract and 2) the relocation of KFO Route 116 in the tract.

Because the exact location of dispersed facilities is not known at this time, the analysis of impacts as a result of the placement of dispersed facilities on the tract involved a set of assumptions that allowed for conservative estimates of the expected impacts. The estimated acreage necessary for dispersed facilities under each alternative (listed below and in Table 2.4 in Chapter 2 and tables in various resource sections) was provided by ACD based on experience and industry standards. Under the No Action Alternative, it was assumed that no dispersed facilities would be required because no mining would occur on the tract under this alternative. Under the Proposed Action it was assumed that

- dispersed facilities would include such items as water control structures (diversion ditches, sedimentation ponds, etc.), temporary light use roads (direct mine use and for transporting coal from areas of active mining to the centralized facilities), and temporary stockpiles of topsoil and/or overburden;
- dispersed facilities would require approximately 160 acres of land;

- dispersed facilities would be located wholly in the no-coal zone;
- acres of vegetation community type (or soil type, etc.) disturbed by dispersed facilities would be proportional to the percentage of each vegetation type in the no-coal zone;
- it would not be possible to avoid disturbance in established avoidance areas (sagebrush/grass communities and riparian areas); and
- standard mitigation measures would be required (e.g., BMPs) as part of the Proposed Action to reduce or eliminate impacts.

Analysis assumptions under Alternative C are the same as those described for the Proposed Action except that dispersed facilities would require approximately 135 acres of land under Alternative C.

As with dispersed facilities, the exact location of the KFO Route 116 relocation is not known at this time; therefore, the analysis of impacts from the KFO Route 116 relocation involved a set of assumptions that allowed for conservative estimates of the expected impacts. These assumptions allowed for the creation of a theoretical/conceptual road alignment used to generate acres of disturbance figures and to determine possible impacts due to this aspect of the mining operation. Under the No Action Alternative, it was assumed that no road relocation would be required because no mining would occur on the tract under this alternative. Under the Proposed Action it was assumed that

- the relocation of KFO Route 116 would be temporary (for the life of mine), and the road would be reestablished in its approximate original roadbed following mining;
- the temporary alignment of the relocated KFO Route 116 would generally be north–south because the current alignment of KFO Route 116 is generally north–south;
- the temporary relocation of KFO Route 116 would occur wholly in the no-coal zone except in the northwestern portion of the tract (Block NW). In Block NW, the road would be temporarily relocated onto previously mined surface prior to reestablishment in the approximate original roadbed following mining of this block (the road relocation in Block NW would only be for the life of mining operations in this portion of the tract);
- the temporarily relocated KFO Route 116 would be 100 feet from the pit disturbance line and centralized facilities;
- the temporarily relocated KFO Route 116 would take the shortest distance from point of departure from the existing road to point of reconnection with the existing road in the confines of the other assumptions listed;
- the temporary relocation of KFO Route 116 would avoid sagebrush/grass communities and riparian areas (defined as a 330-foot buffer on streams as per BLM riparian policy) to the extent possible;
- the temporary relocation of KFO Route 116 would occur on slopes of 30% or less only;
- standard mitigation measures would be required (e.g., BMPs) as part of the Proposed Action during road construction and maintenance for the life of the temporary road (life of mine);
- the temporary relocation of KFO Route 116 would occur within a 66-foot-wide ROW with a 24-foot-wide road surface;
- two stream crossings would be required (one for Robinson Creek and one for Kanab Creek) in addition to crossings of washes;
- appropriate culverts would be installed at stream crossings;
- road base materials (gravel and other rock) would come from on-site where available and from off-site otherwise.

Analysis assumptions under Alternative C are the same as those described for the Proposed Action, except that Block NW is not included in the tract configuration under Alternative C.

For purposes of analysis for certain resources, it was necessary to make additional assumptions particular to that resource analysis. These assumptions are listed and explained in the impacts analysis section for each resource, where they apply.

Impacts analyses generally considered pit disturbance as a total acreage of disturbance for the life of the mine under each alternative. It is important to note that pit disturbance would not occur all at one time. It would occur on a continuing basis concurrent with reclamation. This approach was taken primarily because the exact mine sequence is unknown at this time. As described in Chapter 2, under the Proposed Action at any one time, active mining operations (open surface-mining pits from which coal is being removed and/or areas where topsoil and overburden are being removed) would involve approximately 120 acres (1 open pit). An additional 120 acres or more would be in some stage of reclamation (overburden replacement and top-soiling, grading to AOC, or seedbed beginning). Under Alternative C, at any one time, active and suspended (due to seasonal timing restrictions) mining operations would involve an estimated 240 acres (2 pits). An additional 240 acres or more would be in some stage of reclamation.

Surface-disturbing impacts (513 to 211 in the tract plus 166 to 109 acres outside the tract[11]) resulting from subsidence in the portion of the tract that would be underground mined (approximately 717 to 412 acres) are considered primarily with respect to the analysis of geology and minerals (see Section 4.6) and water resources (see Section 4.16). For most resources, subsidence is not factored into calculations of surface disturbance because vegetation removal, soil removal, or overburden removal would not occur. No reclamation would occur in this area of the tract either, except for activities to eliminate or repair damage being done to other resources (for example, water resources).

Finally, in the impacts analysis, acres of impact are generally reported as a range. This is because surface mining would occur up to between approximately 200 and 300 feet of overburden removal (a range), and the approximate extent of overburden removal translates directly into the approximate extent of impact as a result of surface mining operations. Unless otherwise noted, where a range in acres of impact is provided, it corresponds to the range of overburden removal herein explained (also see Chapter 2). Further, where a range of acres that would be underground mined is provided, the larger acreage typically precedes the lesser acreage. These figures are reported in this fashion to remain consistent with the convention used elsewhere in the EIS of reporting the range of impacts that would occur as a result of surface mining up to approximately 200 to approximately 300 feet of overburden removal. The greater acreage subject to underground mining corresponds to 200 feet of overburden removal because less surface mining on the tract (i.e., only up to 200 feet of overburden removal, rather than 300 feet) would result in more underground mining (larger underground mining acreage). Likewise, the lesser acreage subject to underground mining corresponds to 300 feet of overburden removal because more surface mining on the tract (i.e., up to 300 feet of overburden removal, rather than 200 feet) would result in less underground mining (smaller underground mining acreage). See Maps 1.2 and 2.1 for a depiction of the approximate locations where surface mining would cease in the 200-foot and 300-foot overburden removal scenarios under each action alternative.

4.1.4 Notes on Data Sources and Tract Acreage

Data and information used to analyze impacts were gleaned from a variety of sources including internet sources, peer reviewed literature, government agency documents, current and historic permitting documents, and documents reporting the results of studies and data collection efforts completed for this EIS in specific. Greater detail related to these sources is provided in Chapter 3, Section 3.1.

[11] Two sets of acres numbers are used. One relates to underground mining acres, and the other is surface related due to subsidence, which is a portion of the underground mining.

As explained in Table 1.1 and 2.1 in Chapters 1 and 2, respectively, and reiterated in Section 3.1, in this analysis, a tract acreage of approximately 3,576 acres is used rather than the approximately 3,581.27 acres listed in the NOI. For an explanation of the reason for this 5-acre difference, see Table 1.1, Table 2.1, or Section 3.1.

4.2 Aesthetics Resources

The area of analysis for aesthetic resources consists of the Alton Coal Tract, the town of Alton, Dixie National Forest, Bryce Canyon National Park, and BLM-managed lands adjacent to the tract. Additionally, lands adjacent to the coal haul transportation route are analyzed for impacts to noise-sensitive receptors. Three different alternatives are analyzed in this section and each alternative presents a varying degree of impacts to aesthetic resources in the area of analysis. Each alternative considers different tract boundaries and levels of mining allowed. When impacts from elements of the Proposed Action and alternatives are similar, their effects are discussed together. Both adverse and beneficial impacts are discussed in this section. Additionally, both direct and indirect impacts are discussed.

Aesthetic resources would be impacted in the short term during the active mining period (life of the mine). In the case of noise and night sky conditions, resources would return to current conditions immediately upon conclusion of the active mining period. In the case of visual resources, conditions would be returned to a more natural landscape during both the active mining period (through ongoing reclamation) and the post-mining reclamation (10 years). Through the evaluation of aesthetic resources (sound, visual resources, and night skies), it was concluded that each have different thresholds for impacts to become significant. Those thresholds are described in more detail below.

4.2.1 Regulatory Framework

There are no state or local noise ordinances in place for the tract. The EPA, however, has defined standards to prevent hearing loss. The EPA has identified a 24-hour exposure level of 70 Ldn as the level of environmental noise to prevent measurable hearing loss over a lifetime (EPA 1974). The EPA further identified levels of 55 dBa outdoors and 45 dBa indoors to prevent annoyance to noise-sensitive receptors.

The MSHA also has health standards to prevent hearing loss. Under MSHA standards, mine employees are never permitted to be exposed to noise levels of 115 dBa or greater. MSHA requires exposure to noise levels between 85 and 115 dBa to be mitigated through hearing protection programs and personal protective equipment.

The Federal Land Policy and Management Act of 1976 requires that the BLM periodically prepare and update its land-use plans. In that process, the agency establishes objectives for management of visual resources, or landscape protection and change. The public lands in the tract are managed under VRM Class IV objectives. The objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view and may be the major focus of the viewer’s attention.

There are no legal or regulatory requirements with respect to skyglow. The KFO RMP does not prescribe any specific surface stipulations for management and protection of aesthetic resources in the tract. However, based on the analysis, the successful bidder would be required to employ skyglow minimization measures for nighttime mining operations. These would consist of:

- utilizing 250-watt metal halide lamps producing 25,000 lumens each, contained in fully shielded fixtures for fixed-position light poles (or equipment and measures that would further minimize skyglow as a result of these lights); and
- utilizing 1,000-watt metal halide lamps producing 110,000 lumens each and typically aimed at 30 degrees below the horizon, though at times (less than 10% of the time) directed straight sideways toward the horizon (or equipment and measures that would further minimize skyglow as a result of these lights).

4.2.2 Soundscape

The analysis of impacts to noise-sensitive receptors near the tract is an assessment of the changes in ambient noise levels caused by the Proposed Action and alternatives. Noise-sensitive receptors consist of residences, hospitals, libraries, recreation areas, churches, and similar locations. Noise-sensitive receptors only consider noise as it relates to the human environment. For a discussion of the impacts to wildlife health and behavior from changes in ambient noise levels caused by the Proposed Action and alternatives, refer to Section 4.17. Three different alternatives are analyzed in this section, and each alternative presents a varying degree of impacts to noise-sensitive receptors near the tract. Each alternative considers different tract sizes as well as different seasonal operational restrictions. Alternative C was developed in part to address concerns over impacts to noise-sensitive receptors in the town of Alton.

There are several management prescriptions and considerations common to both action alternatives that would have impacts on noise-sensitive receptors, including regulatory permit requirements such as MSHA inspections, short haul routes, and the coal loadout location and coal haul transportation route.

MSHA inspections would ensure that the mine is in compliance with the health standards set to minimize the risk of hearing loss among mine employees. Direct protection of the health and safety of mine employees resulting from MSHA inspections would occur under both action alternatives through the duration of the mining operation.

Ambient noise levels would increase as a result of coal truck traffic on the short haul route out of the tract. Impacts to noise-sensitive receptors would vary depending on the final short haul route selected. Locating the short haul route through the town of Alton would result in increases in ambient noise levels from truck traffic that would exceed 70 Ldn at noise-sensitive receptors. If the short haul route were through the town of Alton, noise-sensitive receptors within 40 feet of the route would include private residences and a church. Exceeding 70 Ldn increases the risk of measurable hearing loss and would therefore result in significant impacts. Moving the short haul route to avoid the town of Alton would reduce the risk of measurable hearing loss to a level less than significant.

Noise-sensitive receptors along the coal haul transportation route are located in the towns of Hatch and Panguitch. The coal haul transportation route average daily traffic (ADT) on US-89 through Hatch and Panguitch is currently 4,100 vehicles per day consisting of between 21% and 25% heavy trucks (Fehr and Peers 2008). This would increase to between 25% and 29% heavy trucks under the action alternatives. The ADT on SR-56 through Cedar City is 10% heavy trucks. This would increase to 12% under the action alternatives. Increases in ambient noise levels from coal truck traffic at

noise-sensitive receptors through Hatch and Panguitch are expected to exceed the 55 dBa necessary to prevent annoyance, particularly between 10:00 p.m. and 7:00 a.m. However, they would not exceed the 70 Ldn that would increase the risk of measurable hearing loss and therefore significant impacts, because the noise-sensitive receptors are located far enough (40–50 feet or more) from US-89 and SR-56 to reduce traffic noise levels.

4.2.2.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, ACD's application to lease the coal included in the tract would not be approved, and the coal included in the tract would not be mined. Rejection of the application would not affect permitted mining activities on private land adjacent to the tract (the Coal Hollow Mine). No impacts to noise-sensitive receptors from increases in ambient noise levels would occur from the No Action Alternative.

Under the No Action Alternative, the current land uses would continue, including livestock grazing, backcountry driving, hunting, and vegetation treatments to maintain and enhance livestock forage, wildlife habitat, and watershed condition. These uses would result in a continued sound level of less than 50 Leq, which is within EPA standards to prevent annoyance to noise-sensitive receptors.

4.2.2.2 ALTERNATIVE B: PROPOSED ACTION

In addition to the management prescriptions and considerations common to the action alternatives, the following actions would be implemented under the Proposed Action and would result in impacts to noise-sensitive receptors.

- Heavy equipment, consisting of dozers, scrapers, excavators, front-end loaders, graders, and water trucks, would used be during surface-mining operations in the tract.
- Diesel generators would be used to power all necessary facilities, temporary and permanent light sources, and other facilities.
- Coal haul trucks would travel in the tract.
- A conveyer belt and crusher would be used in processing excavated coal.
- Blasting operations would occur in the mine area.

Ambient noise levels in and near the tract would increase as a result of heavy equipment use and coal truck traffic in the tract. Impacts to noise-sensitive receptors would vary depending on the location of active mining operations during the 25-year mine life. Airblast and ground vibration due to blasting operations would be at or below MSHA maximum limits and would not reach a level of significance. Increases in ambient noise levels at noise-sensitive receptors from the actions listed above would occur, but due to distance from the source, they would remain below the 55 dBa necessary to prevent annoyance. Although the cause of the noise would be different under the Proposed Action than with the No Action Alternative, the resultant effect on levels of noise to noise-sensitive receptors would be the same under both alternatives—less than the 55-dBa level that would create annoyance.

4.2.2.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

In addition to the management prescriptions and considerations common to the action alternatives and additional actions described under the Proposed Action, the tract would be reduced in size under Alternative C to exclude areas closest to the town of Alton, and the life of the mine would be 21 years rather than 25. Because surface mine operations, including blasting, would occur a greater distance from noise-sensitive receptors in Alton, increases in ambient noise levels would be less than those described

under the Proposed Action, and would not reach a level of significance. When comparing the levels of noise resulting from implementation of Alternative C to the noise created by continuation of existing uses under No Action, the resultant level of noise to noise-sensitive receptors would be the same under both alternatives—less than the EPA standard of annoyance.

4.2.3 Visual Resources

The analysis of impacts to visual resources is an assessment of changes to the landscape caused by the Proposed Action and alternatives. The landscape near the tract is composed of landforms, water body, vegetation, and human modifications to the land. Those modifications include structures and changes to the land, water, and vegetation.

For each alternative, the analysis is three tiered. The first level of analysis consists of a discussion of changes to the landscape in the tract, resulting from the actions prescribed under each alternative. The second level of analysis consists of an assessment of impacts resulting from those same actions as seen from seven key observation points (KOPs) in and near the tract. The KOPs are critical viewpoints of typical landscapes in the tract that have been selected to represent the views of disturbances throughout the life of the mine and that are encountered by the greatest number of people. The third level of analysis consists of an assessment of whether the proposed changes to the landscape would meet the BLM's objectives for management of visual resources, as prescribed in the KFO RMP (BLM 2008b). The location and rationale for the selection of KOPs are identified below. Significant impacts would occur where the results of the Proposed Action and alternatives do not meet BLM objectives.

4.2.3.1 KEY OBSERVATION POINTS

Seven KOPs were identified to represent typical views of the tract to residents of Alton and visitors to the surrounding area. The KOPs were selected to geographically represent views of the entire tract, to represent views from places where the greatest number of people reside, and to represent views of people traveling through the area (Map 3.2; Appendix J).

KOP 1 is located on KFO Route 116 on the east side of the town of Alton. This location represents panoramic views of the northern area of the tract as seen by residents of Alton, and as seen by visitors traveling through Alton heading south on KFO Route 116.

KOP 2 is located at the south end of Main Street in the town of Alton. From this location, the view is south, and looks on the area proposed for underground mining activities. This location represents views of Alton residents and views of ranchers working in agricultural fields between Alton and the tract. The views from this KOP are of agricultural fields directly south of Alton and include the mountains and rolling hills across the tract. Views are wide open and panoramic, with few obstructions.

KOP 3 is located at the north end of Main Street in the town of Alton. From this location, the view is south and east and looks on a larger portion of the area proposed for mining activities compared to KOP 2. The views from this KOP are of structures in Alton and include the mountains and rolling hills across the tract. The homes, trees, and fence lines of Alton occur in the foreground. The rolling hills in the tract and surrounding mountains are in the middle ground and background. Views are generally wide open, but include some obstructions in the town of Alton.

KOP 4 is located along KFO Route 116 south of Alton. From this location, the view is to the north and west and looks on the broad sweeping hills of the tract. Sagebrush and sparse juniper dominate the foreground. The rugged horizon line of the surrounding low mountains and the Paunsaugunt Plateau are in the middle ground and background. This location represents the views of people traveling north on KFO Route 116 through the tract.

KOP 5 is located at a road junction along KFO Route 116 south of Alton. From this location, the view is to the south and looks on the broad sweeping hills of the tract. Low sagebrush, a narrow drainage channel, fence lines, patchy stands of juniper, and the curving road are in the foreground. The low and rugged horizon line of the Paunsaugunt Plateau occurs in the middle ground and background. This location represents the views of people traveling south from Alton on KFO Route 116 through the tract.

KOP 6 is located at a cattle guard and fence line along KFO Route 116 south of Alton. From this location, the view is to the north and looks on the Town of Alton and the tree-covered alluvial fans sweeping down into the tract. Juniper post fence lines in various directions and the curving road are in the foreground. The homes and taller trees in the Town of Alton occur in the middle ground. Background views are of distant low rising mountains. This location represents the views of people traveling north toward Alton on KFO Route 116 through the tract.

KOP 7 is located along KFO Route 116 at the far southern edge of the tract. From this location, the view is to the north and looks on the broad open meadows and tree-covered hills of the southern portion of the tract (Block S). Fence lines, homesteads, and the curving road are in the foreground. The fans and washes descending from the Paunsaugunt Plateau appear in the middle ground. Background views are of the steeper, rugged plateau itself. This location represents the views of people traveling into the tract from the south on KFO Route 116.

A visual contrast rating worksheet (BLM Form 8400-4) was prepared to analyze the effects that the proposed tract would have on the characteristic landscape, as viewed from each KOP. The analysis looked at the actions that would have the most potential to affect (change) the landscape under the action alternatives (Proposed Action and Alternative C). Those actions include surface-mining operations, installation of centralized facilities, installation of dispersed facilities, relocation of KFO Route 116, and surface rehabilitation. The analysis also looks at the actions that would continue under the No Action Alternative and how they affect the landscape. Under the No Action Alternative, existing uses and management actions would continue, including livestock grazing, back country driving, hunting, and vegetation treatments to maintain or improve livestock forage, wildlife habitat, and watershed condition, and to reduce unwanted wildfire. This analysis provides for comparison between the action alternatives and the No Action Alternative. See Appendix J for visual contrast ratings and site photographs.

4.2.3.2 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, ACD’s application to lease the coal included in the tract would not be approved, and the coal included in the tract would not be mined. The characteristic landscape of the tract would remain unchanged by mining.

Under this alternative, however, existing uses would continue. Under the KFO RMP (BLM 2008b), the BLM would continue to implement vegetation treatments in pinyon-juniper and sagebrush vegetation communities. Removal of pinyon and juniper trees and decadent sagebrush would create changes in the form of each vegetation community, introducing openings in continuous stands of vegetation. The growth of shrubs and grasses in the openings of pinyon-juniper woodlands and creation of mixed-age stands of sagebrush would introduce variety in the form, texture, and color of the vegetation communities. It would also introduce noticeable curvilinear lines in the pinyon-juniper woodlands. The creation of a harmonious variety in the landscape would result in a more visually pleasing scene.

4.2.3.3 ALTERNATIVE B: PROPOSED ACTION

Under the Proposed Action, the tract would encompass 3,576 acres, of which 2,280 acres are federal surface and mineral estate and 1,296 acres are split estate: private surface estate and federal mineral estate. Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden

removal has occurred. Reclamation would be concurrent with mining over the course of the estimated 25-year mine life and would be followed by a minimum 10-year reclamation and revegetation monitoring period.

Surface-mining operations would result in 1,750–2,152 acres of pit disturbance occurring at different times over the life of the mine. Where overburden is 300 feet or more in thickness, underground mining methods would be used to mine in-place coal reserves. At any time during the life of the mine, active surface operations would only involve approximately 120 acres (one open pit). Pits would be up to 300 feet deep and the associated highwall would be up to an additional 600 feet wide. Surface-mining operations would result in a noticeable contrast in landform, line, and color as the natural topography is altered, vegetation is removed, and soils that are lighter in color are exposed. The low rising hills dissected by shallow drainages throughout the tract would be altered during the excavation of pits and construction of highwalls. At any one time, up to 120 acres of rolling terrain common through the tract would be leveled, resulting in a contrasting long, straight horizontal line. Vegetation with varying shapes, colors, and heights would be cleared down to bare soil, removing those varying colors, and leaving a geometric, angular break (lines) in the vegetation. Additionally, at any one time during the 25-year mine life, closed pits would be in various stages of reclamation. Reclamation activities would reduce linear contrasts in topography by recontouring pits to a more natural sweeping line. Additionally, contrasts in texture and color of soil and vegetation would be reduced through revegetation with approved seed mixes.

Construction of the centralized facilities for the tract would be located on approximately 36 acres of public land. These facilities would consist of an office, maintenance shop, equipment wash bay, oil and fuel storage tanks, oil and fuel storage containment, truck unloading and coal sizing area, coal stockpile area, and truck loadout area. The buildings and other facilities would result in a noticeable contrast in landform, line, color, and texture on the landscape of that portion of the tract. In the long term, vegetation clearing would introduce a break in the medium/coarse texture and color of the tract. Additionally, construction of centralized facilities would introduce boxy, geometric shapes, hard edged lines, smooth textures, and contrasting colors into the natural, rolling terrain of the tract.

Dispersed facilities necessary to conduct mining operations consist of temporary light-use roads and haul roads, electrical poles and lines, various temporary ponds/water control structures, temporary topsoil and overburden stockpiles, and temporary berms and screens. These facilities would result in approximately 160 acres of disturbance. Construction of dispersed facilities, including roads, transmission lines, ponds and other water-control structures, stockpiles, and berms, would result in short-term changes to the landscape. Road construction would result in leveling of the landform, including some degree of cutting and filling. This would create horizontal lines and bench-like forms in the landscape. Ponds, water control structures, and berms would introduce horizontal and angular lines and low, mesa-shaped forms to the landscape. Topsoil and overburden stockpiles would introduce angular lines and conical forms to the landscape. Vegetation clearing for road construction would introduce curvy lines through relatively dense pinyon-juniper woodlands and dense stands of sagebrush, and expose varying (often lighter) soil colors. Construction of power lines would introduce vertical lines to the landscape. Following mine operations, however, these facilities would be removed from the site and disturbances would be reclaimed to their approximate original condition. In the short term, during construction, clearing would change the form and texture of vegetation cover. Currently, most of the tract has a continuous cover of varying vegetation types including perennial grasses and low gray-green shrubs interspersed with patches of dark green pinyon pine and juniper trees. Clearing would introduce breaks in the medium-textured element of the environment. As the dispersed facilities are relocated, if vegetation with larger shrubs and trees is reestablished, the texture would return to its original condition and the change in vegetation form would revert to its original condition. If the clearings in woodlands are managed for shrubs and grasses following relocation of the dispersed facilities, changes in the form of the pinyon-juniper woodland would remain and smaller shrubs and grasses would introduce softer textures and new colors to the landscape. These variations in the continuous vegetation cover would add variety to the landscape and new interest and appeal to the scene.

Actions proposed to prevent, minimize, and rehabilitate landscape disturbance consist of recontouring pits to a more natural topography and restoring vegetation with BLM-approved species. At any given time throughout the 25-year life of the mine, 120 or more acres would be in some stage of reclamation. The rehabilitation of disturbances by recontouring pits and planting vegetation would result in a less developed landscape that more closely resembles the surrounding undisturbed areas.

KOP 1–3. Actions proposed in the tract under Alternative B that would be visible from KOPs 1, 2, and 3 consist of surface-mining activities, underground mining activities, dispersed facilities, and rehabilitation of disturbances. These actions would have the same effects on the characteristic landscape as those described above.

KOP 4. Actions proposed in the tract under Alternative B that would be visible from KOP 4 consist of surface-mining activities and dispersed facilities. These actions would have the same effect on the characteristic landscape as described above.

KOP 5. Actions proposed in the tract under Alternative B that would be visible from KOP 5 consist of surface-mining activities, centralized facilities, and dispersed facilities. These actions would have the same effect on the characteristic landscape as described above.

KOP 6–7. Actions proposed in the tract under Alternative B that would be visible from KOPs 6 and 7 consist of surface-mining activities and dispersed facilities. These actions would have the same effect on the characteristic landscape as described above.

Under Alternative B, mining and construction of related facilities would noticeably change the landscape. However, as the 120-acre tracks of coal are removed and rehabilitated, the existing character of the landscape would be gradually restored. Depending on the BLM's objectives for management of vegetation, portions of the tract would eventually return to their original vegetation communities, and other parts would be reestablished to meet other objectives. The KFO RMP prescribes vegetation treatment areas with priority given to wildlife habitat. Incorporating this plan decision into the mine reclamation plan could result in returning pinyon-juniper woodlands to a mix of woodlands with openings of sagebrush and grasses. It may also include converting old growth sagebrush stands to a mix of age classes. These mining rehabilitation objectives would result in changes to the vegetation component of the landscape, and introduce some variety and appeal to the landscape scene. Under the No Action Alternative, no mining would occur, but the vegetation treatment objectives of the KFO RMP would continue to be implemented, resulting in the same long-term effect on the visual resources (landscape) of the tract. Thus, in the short- and mid-term, Alternative B would result in noticeable changes to visual resources. In the long term, the effect of the actions anticipated under Alternative B and the actions anticipated under No Action would have similar effect on the landscape scene; the creation of more variety and visual appeal.

4.2.3.3.1 BLM Visual Resource Management Objectives

VRM objectives for public lands in the tract are Class IV (BLM 2008b). Under the BLM VRM program, the objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view, and be the major focus of viewer attention (BLM 1986).

Under the Proposed Action, the level of change to the landscape was determined to be moderate to strong, based on the visual resource contrast analysis, and proposed activities were determined to be consistent with objectives. Although surface-mining activities would be apparent on the landscape, they would occur in the short term and would be reclaimed upon completion. Development of centralized and dispersed facilities would occasionally be visible on the landscape from KOPs during the active mining period. Dispersed facilities would be relocated throughout the tract during the active mining period and their disturbances

reclaimed. Dispersed and centralized facilities would be entirely removed from the tract at the end of the active mining period and the disturbances reclaimed. Because the level of landscape change resulting from actions proposed under this alternative would be consistent with VRM Class IV objectives, it would not reach a level of significance. See Appendix J for visual contrast ratings.

4.2.3.4 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

Under Alternative C the tract would be modified to exclude Block NW located near the town of Alton. The modified tract encompasses 3,173 acres, of which 2,280 acres are federal surface and mineral estate and 893 acres are split estate: private surface estate and federal mineral estate.

Under this alternative, 1,662–2,064 acres of surface disturbance would occur in the tract. Of this, 1,454– 1,856 acres would be the result of surface-mining operations. Centralized facilities associated with mining activities in the tract would be located in the same area, would occupy the same acreage (36 acres), and would include the same items as the Proposed Action. Impacts from dispersed facilities necessary to conduct mining operations would also be the same as the Proposed Action, except that fewer acres (135 acres) would be required.

Contrasts in landform, line, color, and texture would be the same as described under the Proposed Action but would occur on 321 fewer acres (the acreage of Block NW) than the Proposed Action and over a shorter amount of time (21 years). Additionally, the tract would be modified to exclude 321 acres from mining those areas closest to Alton. This would result in less apparent contrast from KOPs in Alton due to the greater distance between Alton and the nearest disturbance. Due to sage-grouse timing restrictions, no surface-disturbing actions would be allowed between March 15 and July 15 in Block S. To allow work to continue year-round, two simultaneously open pits would be required. At any one time during the life of the mine, active and suspended mining operations would involve up to 240 acres (two pits) or double the level of visual contrast associated with the Proposed Action. Additionally, this would necessitate a 40- to 60-acre permanent EODA. In the long term, disturbances including the EODA would be recontoured and reclaimed to a more natural condition.

KOP 1–3. Actions proposed in the tract under Alternative C that would be visible from KOPs 1, 2, and 3 consist of surface-mining activities, dispersed facilities, and rehabilitation of disturbances. These actions would occur in the middle ground, and because of the distance involved, the contrast would not be as apparent as under the Proposed Action.

KOP 4, 6, and 7. Actions proposed in the tract under Alternative C that would be visible from KOPs 4, 6, and 7 consist of surface-mining activities, dispersed facilities, and rehabilitation of disturbances. These actions would have the same effect on the characteristic landscape as described above.

KOP 5. Actions proposed in the tract under Alternative C that would be visible from KOP 5 consist of surface-mining activities, centralized facilities, and dispersed facilities. These actions would have the same effect on the characteristic landscape as described above.

4.2.3.4.1 Bureau of Land Management Visual Resource Management Objectives

The level of change to the landscape in the long term under Alternative C is less than that described under the Proposed Action. Surface-mining activities would remain apparent on the landscape, but would occur over less acreage than the Proposed Action and at a greater distance from KOPs in the town of Alton. Just as in the Proposed Action, open pit mines would occur in the short term, but would cover twice the acreage at any one time in the process as the Proposed Action. Unlike the Proposed Action, an additional 40 to 60–acre EODA would be required where more than one pit is excavated. In the short term, the EODA would introduce

horizontal and angular lines, a blocky, rectangular form, and a coarser texture to the landform of the landscape. Measures to restore more natural characteristics and to further reduce contrasts with the current landscape are included under this alternative and are the same as under the Proposed Action. These measures would be applied to the EODA as well as other surface disturbances. As under the Proposed Action, development of centralized and dispersed facilities would occasionally be visible on the landscape from KOPs. Likewise, resulting under this alternative, the level of landscape change would be consistent with VRM Class IV objectives, and would not reach a level of significance.

4.2.4 Nighttime Lighting and the Extent of Skyglow

The analysis of impacts to the natural lightscape is an assessment of changes in brightness of the night sky caused by the Proposed Action and alternatives. A natural lightscape is characterized by the natural rhythm of sun and moon cycles, clean air, and of dark nights unperturbed by artificial lights. Changes to natural lightscapes result from changes in air quality and changes in sources of artificial lighting.

A computer model developed by Dark Sky Partners and based on the Garstang model for calculating sky brightness arising from artificial lighting was used to assess the impacts caused by the Proposed Action and alternatives on the night skies viewed from Brian Head Peak and Yovimpa Point. Under the BLM, there are no objectives for management of natural lightscapes or dark skies. NPS policy is to preserve the natural lightscapes of parks to the greatest extent possible. The NPS worked directly with Dark Sky Partners to verify all model input parameters, especially atmospheric clarity. It is the policy of the NPS to evaluate impacts based on the best 20% of night sky conditions as recorded during night sky monitoring. For each alternative, this impact analysis assesses whether the changes in artificial lighting and air quality would meet NPS objectives to preserve dark night skies and the natural lightscape surrounding the parks. Actions that result in a long-term reduction in night sky conditions as observed from Brian Head Peak and Yovimpa Point would result in significant impacts to the natural lightscape. The NPS considered points in Zion National Park also, however, due to its proximity to St. George, Utah and Las Vegas, Nevada night skies are brighter at Zion National Park than Bryce Canyon National Park and Cedar Breaks National Monument. However, most of Zion National Park occurs at a lower elevation and in steep walled canyons, minimizing the amount of potential light pollution visible from the tract. Any perceived change in night sky conditions as viewed from the canyons of Zion National Park would be proportionately less when compared with the existing conditions viewed from table lands and other lands adjacent to the park (Personal Communication, Moore 2008). The brightness of light from the tract under this alternative would be greatest on the horizon of the nighttime sky in the direction of the mine. As a person's view moves in an arc from the horizon to vertical overhead, the presence of the light from the tract decreases, as does its effect on the darkness of nighttime skies. Given the depth and steepness of the canyons of Zion National Park, the view of the nighttime sky is near vertical to vertical.

4.2.4.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, ACD's application to lease the coal included in the tract would not be approved, and the coal included in the tract would not be mined. No impacts to night sky conditions over the tract or over Bryce Canyon National Park would result from coal mining under the No Action Alternative.

Under this alternative, however, existing land uses would continue, including livestock grazing, backcountry driving, hunting, and vegetation treatments. Although it has not been quantified, PM released into the sky in smoke from prescribed fire used to treat vegetation communities would temporarily increase the diffusion of artificial light in the nighttime sky, and result in infrequent and intermittent increases in skyglow.

4.2.4.2 ALTERNATIVE B: PROPOSED ACTION

Under the Proposed Action, surface-mining operations would result in 1,993–2,395 acres of surface disturbance occurring at different times over the estimated 25-year mine life. Surface-mining operations and motorized travel through the tract would result in increased airborne PM. Additionally, three types of artificial lighting are proposed during nighttime operations and would include one to four portable light towers located at each active pit and two to six fixed position light poles permanently located at the 36-acre centralized mine facilities. Portable light towers would be diesel powered with four to six lights (1,000 watts each) per tower. Each portable light tower would be approximately 30 feet tall and would be moved in accordance with the mining sequence. Fixed-position light poles would have similar dimensions as lights to the portable light towers. Additionally, equipment lighting would come from headlights, brake lights, and other safety lighting on mechanical equipment used during mining operations.

Portable and fixed-light towers would result in the greatest addition to artificial light under the Proposed Action. Fixed lights at the centralized mine facilities would use 250-watt metal halide lamps producing up to 25,000 lumens each. The fixed lights would be fully shielded and no light would be emitted upward. The portable lights would use 1,000-watt metal halide lamps producing 110,000 lumens each. Portable lights are adjustable, allowing them to be aimed in different directions and at different angles relative to the horizon. For the purpose of analysis, Dark Sky Partners assumed that portable lights would typically be aimed at 30 degrees below the horizon, directing 30% of light upward (Dark Sky Partners 2009). Equipment and vehicle lighting would represent a small contribution to artificial lighting. PM from surface-mining actions on up to 120 acres at any given time and from motorized travel on dirt surface roads would further diffuse artificial lighting through the night sky resulting in a less bright but more extensive skyglow (Carr 1989). As described in the Air Resources section of Chapter 4, the maximum impacts inside of Bryce Canyon National Park from increases in PM and NO_x associated with potential mine plumes under the proposed action would be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast (see Table 4.11). Due to the unpredictable variations in atmospheric dust content over time, and terrain relief produced by the proposed mining operations, the results of the night sky modeling analysis should only be used as a general indication of potential changes in absolute sky brightness (Dark Sky Partners 2009).

For the duration of active mining, the typical mine lighting scenario would result in a 1% increase in night sky brightness at an altitude of 10° above the horizon and a 10% increase 1° above the horizon visible from Yovimpa Point.

There would only be a fractional increase in sky brightness over the baseline condition visible from Brian Head Peak. In fact, the typical mine lighting scenario is fainter than all other artificial light sources visible from Brian Head Peak and considered in the study. A viewshed analysis shows a direct line of site to areas in the tract from Brian Head Peak and the northeast corner of Cedar Breaks National Monument (Dark Sky Partners 2009). While active mining is occurring in that area, there is the potential for direct visibility of portable lighting fixtures. Under the brightest scenario, and assuming that 24 of the portable mine lighting fixtures were aimed directly at Cedar Break National Monument, they would appear to be approximately as bright as the planet Venus. When portable lights are in place and pointed at Cedar Breaks National Monument, the impact to visitors is likely to be minor to moderate; however, because of the intermittent nature of these lights and their visibility, and the fact that glare would be visible in limited locations, the overall impact to Cedar Breaks National Monument would be negligible (NPS 2009). It is also expected that, at times, direct glare would be visible from Brian Head Peak in addition to other locations in the Dixie National Forest. In addition, the effects of direct glare would be reduced through the use of directional lighting and by installing shields on lights.

Additionally, as portable lights are located at pits adjacent to the community of Alton, some residents throughout the town may be impacted by glare from direct lighting. Glare would be reduced through the use of directional lighting and by installing shields on lights. Glare would also be reduced by placing portable lights in the pit disturbance using the change in terrain resulting from mining activity to block any potential direct lighting on the community of Alton.

The study conducted by Dark Sky Partners concluded that the predicted skyglow visible from Yovimpa Point in Bryce Canyon National Park would be less than that produced by several small towns in the general area. The study also concluded that the predicted skyglow visible from Brian Head Peak outside of Cedar Breaks National Monument would be much less than skyglow arising from St. George and Cedar City, Utah. Although the impacts of the Proposed Action do not reach a level of significance, there is a high value placed on night sky resources at Bryce Canyon. The mitigations listed in the Nighttime Lighting and the Extent of Skyglow section of this chapter are recommended to further reduce impacts to night sky conditions (Dark Sky Partners 2009).

4.2.4.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

Under Alternative C, centralized facilities associated with mining activities on the tract would be located in the same area, occupy the same acreage (36 acres), and include the same artificial lighting sources as the Proposed Action. Additionally, the artificial lighting associated with dispersed facilities necessary to conduct mining operations would also be the same as the Proposed Action. Impacts to natural lightscapes would be the same as those described under the Proposed Action except that they would occur for 21 years (the life of the mine under Alternative C).

4.2.5 Potential Mitigation Measures

A number of BMPs and design features are required and included as part of the action alternatives described above. The following measures are discretionary, and if prescribed, would further reduce impacts to aesthetic resources.

- Shields could be placed on all lights to focus light downward and reduce light scatter.
- Portable light fixtures could be kept in the mine pit below the ground surface and aimed as far as possible below the horizon and away from Bryce Canyon National Park, Cedar Breaks National Monument, and Brian Head Peak.
- Measures to control dust could be implemented. See the Air Resources section of Chapter 4 for specific measures.
- Interpretive signs could be placed at overlooks along USFS (Dixie National Forest) trails to describe the mining and rehabilitation activities.

4.2.6 Unavoidable Adverse Impacts

The Proposed Action and alternatives would result in unavoidable adverse impacts to aesthetic resources even following implementation of protective measures and the mitigation measures described above.

Although BMPs and required mitigation measures would result in a reduced increase in ambient noise levels relative to noise-sensitive receptors, increased ambient noise levels from truck traffic, blasting, and other heavy machinery would still occur for the duration of mining activities. The changes to landform, vegetation, and structures on the landscape from pit disturbances and construction of facilities would be evident in the natural landscape of the tract and surrounding lands, even with mitigation. Following reclamation, the landform would be restored to a near-natural condition, centralized and dispersed facilities would be removed, and a more varied vegetation pattern would be rehabilitated. Reclamation would restore the existing landscape following mining. Even with mitigation, the addition of artificial lighting in the tract and the added airborne PM (dust) would result in greater light pollution and skyglow over the tract and surrounding lands.

4.2.7 Short-term Uses versus Long-term Productivity

As discussed throughout this section, there would be a short-term loss of the aesthetic resources in the tract over the 25-year mine life under the Proposed Action and over the 21-year mine life under Alternative C. Effective implementation of required BMPs and protective measures described in Chapter 2, as well as prescribed mitigation measures identified in Chapter 4, would prevent these short-term uses from substantially impacting the long-term quality of aesthetic resources. Even with mitigation, increased levels of noise and decreased darkness of nighttime skies would result.

4.2.8 Irreversible and Irretrievable Commitments of Resources

The BMPs and protective measures detailed in Chapter 2 require the reclamation of disturbed areas following completion of mining operations under either action alternative. Because surface disturbances (including the EODA under Alternative C) would be recontoured and vegetation resources would be reclaimed, there would be no anticipated, irreversible impacts on visual resources associated with the actions proposed for the tract. Additionally, because noise and light pollution would only occur for the duration of the mining operations, there would be no irreversible impacts on soundscapes and lightscapes. There would, however, be irretrievable impacts associated with surface-disturbing activities proposed throughout the tract. The changes in landscape, soundscapes, and lightscapes that would result are an irretrievable loss of these aesthetic resources until mining operations are completed and successful reclamation takes place.

4.3 Air Resources

The analysis area for air resources consists of an approximately 150-km area surrounding the Alton Coal Tract (see Map 3.4). It is also referred to as the dispersion model domain. A series of technical analyses were performed to assess potential impacts on ambient air quality in the air analysis area from mining on the tract and transportation of coal along the reasonably foreseeable transportation route. The following are addressed quantitatively or qualitatively in these analyses:

- Mine construction-related emissions
- Mine operation-related emissions
- Impacts to attainment of the NAAQS for the tract
- PSD review
- Air quality-related values: Visibility impacts to the Class I areas, acid deposition, flora, and fauna
- General conformity

The analysis was based on a conceptual mine design and a set of planned and known mitigation strategies. The analysis is intended to be conservative to accommodate foreseeable emissions under various mining scenarios. A detailed mine plan has not yet been developed. An approved, detailed mine plan would be subject to state permitting requirements and would be subject to appropriate dispersion modeling at that time, as well as detailed operation and mitigation strategies. Technical aspects of the air resources analysis are addressed in more detail in the *Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application* (MESI 2010; Appendix K).

4.3.1 Emission Inventory

Air emissions are quantified to determine the relationship between emissions released into the atmosphere from various sources and the ambient concentrations that result. An emissions inventory is a listing, by source, of the amount of air pollutants discharged into the atmosphere per unit of time. Ambient concentration refers to the mass of a pollutant per unit volume in the atmosphere. It is commonly expressed in units of micrograms per cubic meter ($\mu g/m^3$). Tract-related air quality impacts can be predicted using the emissions calculated in an emissions inventory as inputs to a dispersion model. Dispersion model outputs are predicted concentrations of air pollutants in the atmosphere at receptors (locations where the dispersion model estimates pollution concentrations).

Adverse impacts to air quality generated by construction and mining activities in general would largely be due to the dispersion of small-diameter dust particles from the action of prevailing winds, the turbulence caused by moving machinery and trucks, or both. These dust emissions are typically called “fugitive dust.” Other impacts include exhaust emissions from diesel engines (such as loaders and haul trucks) and from diesel-powered generators.

Initial construction activities for the tract would include development of an access road, site preparation for fixed (i.e., centralized) facilities (e.g., crushers, conveyors, generators, and office and maintenance buildings), development of the main haul road, delivery of materials and equipment to the mine, and other construction-vehicle activity. It is assumed that 36 acres would be disturbed for construction activities on the tract; approximately 6 acres would be disturbed each month for six months.

Pollutant emissions sources during coal production on the tract would include PM emissions and fuel-combustion emissions. Both surface and underground mining were considered in this analysis. Surface mining up to approximately 200-feet or 300-feet of overburden removal was considered for both the Proposed Action and Alternative C (these are generally referred to as the 200-foot and 300-foot overburden thickness scenarios throughout the air resources analysis). Emissions were calculated for 24 hours per day, seven days per week, and 52 weeks per year. The total number of operating days per year was assumed to be 365.

Emission estimates that would be associated with construction and mining activities and diesel-powered generators are provided in this section. Pollutants considered are PM less than a nominal 10 and 2.5 micrometers in aerodynamic size (PM_{10} and $PM_{2.5}$), NO_x, VOCs, CO, SO_2, CO_2, and HAPs. On-site emission sources on the tract would include

- construction activities;
- topsoil removal and replacement;
- overburden removal and replacement;
- topsoil, overburden, haul truck, service vehicle, and employee travel on unpaved roads;
- wind erosion of disturbed areas and coal and overburden piles;
- coal loading, handling, and processing;

- bulldozer and grading activities;
- blasting, mobile source gaseous exhaust; and
- diesel-powered generators.

Off-site emission sources would include

- haul truck and employee travel on paved roads;
- motor vehicle exhaust;
- coal handling and train loading; and
- wind erosion of coal piles.

Emission controls would be implemented to reduce PM (fugitive dust) emissions during construction and ongoing production activities. Fugitive dust (PM_{10} and $PM_{2.5}$) emissions from vehicles traveling on unpaved roads during the life of the mine would be controlled using water or a combination of a chemical suppressant and water. Most coal transfer points and processing activities during coal production would be enclosed and would limit fugitive emissions from these sources. To reduce windblown dust, portions of the site and overburden storage piles and coal storage piles would be watered prior to predicted high-wind events. The analysis also assumes that 1) ultra low-sulfur diesel fuel would be used for vehicles and generators and 2) generators and nonroad diesel engines would meet Tier 4 emission standards.

4.3.1.1 ALTERNATIVE A: NO ACTION

Alternative A would result in no increases in air emissions associated with the tract. Emissions associated with growth or other developments would likely increase over time.

4.3.1.2 ALTERNATIVE B: PROPOSED ACTION

Construction and operation of the tract under the Proposed Action would result in both temporary and ongoing increases in emissions to the atmosphere. Two topsoil removal options exist for this alternative: 1) topsoil removal and replacement with scrapers, and 2) topsoil removal and replacement with a bulldozer, front-end loader, and trucks. Two overburden thickness removal scenarios were evaluated: 1) 200 feet of overburden removal, and 2) 300 feet of overburden removal. Following completion of surface mining, underground mining would occur for two or more years. Emissions are divided into five distinct groups: 1) emissions from construction, 2) on-site emissions with scrapers for topsoil removal and replacement, 3) on-site emissions with topsoil removal using a bulldozer, front-end loader, and trucks, 4) off-site emissions, and 5) emissions from underground mining. The construction phase would occur first, and the underground mining would occur last. Off-site emissions would occur for the four on-site options and during the underground mining phase. Estimated pollutant emissions from the five groups for the 200-foot and 300-foot overburden removal scenarios are shown in Tables 4.1 and 4.2, respectively.

Table 4.1. Estimated Pollutant Emissions (tons per year), 200-foot Overburden Removal Scenario, Proposed Action

Pollutant	Construction	On-site Scrapers	On-site Front-end Loader/Trucks	Off-site	Underground Mining	Total
PM_{10}	13	154	146	1,079	99	1,491
$PM_{2.5}$	1.3	25	25	43	16	110.3
NO_x	–	223	229	171	73	696
VOC	–	35	35	18	26	114
CO	–	354	352	186	249	1,141
SO_2	–	0.58	0.58	0.19	0.38	1.73
CO_2	–	35,307	36,822	18,423	40,561	131,113
Benzene	–	0.07	0.07	–	0.26	0.40
Toluene	–	0.03	0.03	–	0.09	0.15
Xylenes	–	0.02	0.02	–	0.06	0.10
Formaldehyde	–	0.01	0.01	–	0.03	0.05
Acetaldehyde	–	0.00	0.00	–	0.01	0.01
Acrolein	–	0.00	0.00	–	0.00	0

Table 4.2. Estimated Pollutant Emissions (tons per year), 300-foot Overburden Removal Scenario, Proposed Action

Pollutant	Construction	On-site Scrapers	On-site Front-end Loader/Trucks	Off-site	Underground Mining	Total
PM_{10}	13	203	193	1,079	112	1,600
$PM_{2.5}$	1.3	32	31	43	18	125.3
NO_x	–	563	570	171	74	1,378
VOC	–	74	74	18	26	192
CO	–	700	698	186	249	1,833
SO_2	–	0.69	0.69	0.19	0.38	1.95
CO_2	–	57,214	58,730	18,423	40,712	175,079
Benzene	–	0.07	0.07	–	0.26	0.40
Toluene	–	0.03	0.03	–	0.09	0.15
Xylenes	–	0.02	0.02	–	0.06	0.10
Formaldehyde	–	0.01	0.01	–	0.03	0.05
Acetaldehyde	–	0.00	0.00	–	0.01	0.01
Acrolein	–	0.00	0.00	–	0.00	0

4.3.1.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

As under the Proposed Action, construction operations and mining of the tract under Alternative C would result in both temporary and ongoing emission increases to the atmosphere. Pollutant emissions as a result of topsoil removal options, overburden thickness removal scenarios, and other components of mining the tract were evaluated for Alternative C in the same way as for the Proposed Action. Because there would be two open pits under Alternative C, fugitive dust emissions were doubled in the emissions inventory compared to the Proposed Action. This provided a better estimate of increased emissions resulting from the operational requirements of Alternative C (seasonal restrictions to address sage-grouse concerns). Estimated pollutant emissions under Alternative C are shown in Table 4.3 (200-foot overburden removal scenario) and Table 4.4 (300-foot overburden removal scenario).

Table 4.3. Estimated Pollutant Emissions (tons per year), 200-foot Overburden Removal Scenario, Alternative C

Pollutant	Construction	On-site Scrapers	On-site Front-end Loader/Trucks	Off-site	Underground Mining	Total
PM_{10}	13	163	156	1,079	108	1,519
$PM_{2.5}$	1.3	27	26	43	18	115
NO_x	–	223	229	171	73	696
VOC	–	35	35	18	26	114
CO	–	354	352	186	249	1,141
SO_2	–	0.58	0.58	0.19	0.38	2
CO_2	–	35,307	36,822	18,423	40,561	131,113
Benzene	–	0.07	0.07	–	0.26	0.40
Toluene	–	0.03	0.03	–	0.09	0.15
Xylenes	–	0.02	0.02	–	0.06	0.10
Formaldehyde	–	0.01	0.01	–	0.03	0.05
Acetaldehyde	–	0.00	0.00	–	0.01	0.01
Acrolein	–	0.00	0.00	–	0.00	0

Table 4.4. Estimated Pollutant Emissions (tons per year), 300-foot Overburden Removal Scenario, Alternative C

Pollutant	Construction	On-Site-Scrapers	On-site Front-end Loader/Trucks	Off-site	Underground Mining	Total
PM_{10}	13	215	193	1,079	124	1,624
$PM_{2.5}$	1.3	34	31	43	20	129.30
NO_x	–	563	570	171	74	1,378
VOC	–	74	74	18	26	192
CO	–	700	698	186	249	1,833
SO_2	–	0.69	0.69	0.19	0.38	1.95

Table 4.4. Estimated Pollutant Emissions (tons per year), 300-foot Overburden Removal Scenario, Alternative C

Pollutant	Construction	On-Site-Scrapers	On-site Front-end Loader/Trucks	Off-site	Underground Mining	Total
CO_2	–	57,214	58,730	18,423	40,712	175,079
Benzene	–	0.07	0.07	–	0.26	0.40
Toluene	–	0.03	0.03	–	0.09	0.15
Xylenes	–	0.02	0.02	–	0.06	0.10
Formaldehyde	–	0.01	0.01	–	0.03	0.05
Acetaldehyde	–	0.00	0.00	–	0.01	0.01
Acrolein	–	0.00	0.00	–	0.00	0

4.3.2 Near-field Air Resources Impacts

The near-field analysis for the tract comprises a 50 × 50–km area with the tract in the center (the near-field dispersion model domain, see Map 3.4). The near-field analysis was conducted to assess impacts to public health and welfare and to estimate potential impacts to lakes and viewsheds in nearby (near-field) national parks.

In particular, the near-field, ambient, air resources impact assessment was performed to quantify maximum-modeled pollutant impacts near the tract. To demonstrate that air quality standards and air quality-related values (AQRVs) would be protected, the following are required: the development of short-term (hourly and daily) and long-term (annual) emission rates of regulated pollutants, application of regulatory-approved models to quantify predicted concentrations of regulated pollutants, and a comparison of predicted concentrations and applicable background concentrations with applicable standards.

The EPA's guideline model, AERMOD, was the refined air dispersion model used to assess near-field impacts and to verify compliance with the applicable NAAQS in the ambient airshed that encloses the tract. The modeling analysis focused on the reasonable, maximum development year (i.e., the maximum emission year) for the mine. Using this anticipated, maximum, potential emission year, the AERMOD dispersion model was used to analyze potential near-field impacts of PM_{10}, $PM_{2.5}$, NO_2, CO, and SO_2.

Compliance with the respective annual NAAQS was based on the highest modeled value for each year of the four-year meteorological dataset added to the respective background concentrations. Compliance with the respective short-term NAAQS (24-hour, 8-hour, 3-hour, and 1-hour) for CO, NO_2, and SO_2 was based on the highest second-high modeled concentration for each year of the four-year meteorological period added to the respective background concentrations. Regulatory changes to the NAAQS NO_2 and SO_2 standards occurred during the tract analysis. Due to the timing of these regulatory changes in relation to the tract analysis, assessment of the new 1-hour NO_2 and SO_2 standards was not incorporated in the Draft EIS.

Compliance demonstrations with the 24-hour $PM_{2.5}$ standard use the average of the first-highest 24-hour concentration in each year over the length of the weather data period. Compliance with the 24-hour PM_{10} standard was verified against the highest fifth-high modeled concentration over the four-year period. All modeled concentrations were rounded to match the form of the appropriate NAAQS.

4.3.2.1 PM_{10} AERMOD RESULTS

Modeled PM_{10} concentrations associated with the maximum development year are summarized here. Both the 200-foot overburden removal and 300-foot overburden removal scenarios were modeled for compliance with the NAAQS under each action alternative. Model results—the highest fifth-high concentration over the four-year modeled dataset–are presented in Table 4.5.

Table 4.5. Highest Fifth-high PM_{10} 24-hour Modeling Results

Overburden Thickness (feet)	Alternative	Modeled concentration (µg/m^3)	Background concentration (µg/m^3)	Total concentration (µg/m^3)	NAAQS concentration (µg/m^3)
200	B	82.7	72	150	150
200	C	83.6	72	160	150
300	B	86.3	72	160	150
300	C	92.9	72	160	150

The 200-foot overburden removal scenario for Proposed Action complies with the NAAQS at all modeled receptors. However, the 200-foot overburden removal scenario for Alternative C and the 300-foot overburden removal scenario for both action alternatives do not show modeled compliance with the NAAQS. Modeled exceedances are off of the northwest side of the tract boundary near the boundary line. The public would only be exposed to lower concentrations of PM_{10}, because concentrations drop off quickly further away from the tract boundary.

4.3.2.2 $PM_{2.5}$ AERMOD RESULTS

Modeled $PM_{2.5}$ concentrations associated with the maximum development year are summarized here and in Table 4.6. Both the 200-foot overburden removal and 300-foot overburden removal scenarios were modeled for compliance with the NAAQS under each action alternative. Model results—both the highest, predicted annual concentration over all that was modeled and the 24-hour average first-high concentrations over the four-year meteorological dataset–are presented in Table 4.6.

Table 4.6. $PM_{2.5}$ Modeling Results

Overburden Depth (feet)	Alternative	Averaging Period	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
200	B	Annual	4.7	3.6	8	15
		24-hour	19.3	8.6	28	35
	C	Annual	5.1	3.6	9	15
		24-hour	21.1	8.6	30	35
300	B	Annual	6.0	3.6	10	15
		24-hour	22.7	8.6	31	35
	C	Annual	6.5	3.6	10	15
		24-hour	24.5	8.6	33	35

The 200-foot and 300-foot overburden removal scenarios for both action alternatives comply with the NAAQS for modeled concentrations of $PM_{2.5}$ at all modeled receptors.

4.3.2.3 NITROGEN DIOXIDE AERMOD RESULTS

The maximum-modeled NO_x concentrations associated with the maximum development year are summarized here and in Table 4.7. Based on the recent promulgation date for the 1-hour NO_2 standard (January 22, 2010), no 1-hour modeling was performed. Both the 200-foot overburden removal and 300-foot overburden removal scenarios were modeled for compliance with the annual NAAQS. The estimated NO_x emissions for the Proposed Action and Alternative C are the same though emissions vary between the 200-foot and 300-foot overburden removal scenarios. A 75% ozone correction was applied to all modeled annual NO_x modeling results. This was done in accordance with EPA's Ambient Ratio Method (ARM) of estimating ambient annual NO_2 concentrations from modeled NO_x emissions. The intent is to account for the interaction of ambient ozone with emissions of NO_x, which can chemically interact to form NO_2.

Table 4.7. Annual Maximum Nitrogen Dioxide Modeling Results for the Proposed Action and Alternative C

Overburden Thickness (feet)	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
200	31.6	17	49	100
300	99.9	17	117	100

The 200-foot overburden removal scenario under both action alternatives complies with the annual NAAQS for modeled concentrations of NO_2 at all modeled receptors. However, the 300-foot overburden removal scenario under both action alternatives does not show modeled compliance of the annual NAAQS.

4.3.2.4 CARBON MONOXIDE AERMOD RESULTS

The maximum-modeled CO concentrations associated with the maximum development year are summarized here and in Table 4.8. Both the 200-foot overburden removal and 300-foot overburden removal scenarios were modeled for compliance with the NAAQS. The estimated CO emissions for the Proposed Action and Alternative C are the same though emissions vary between the 200-foot and 300-foot overburden removal scenarios. Separate model runs were not necessary in each of the overburden removal depth scenarios.

Table 4.8. Carbon Monoxide Modeling Results

Overburden Thickness (feet)	Averaging Period	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
200	8-hour	582	1,150	1,732	10,000
	1-hour	2,639	1,150	3,789	40,000
300	8-hour	1,383	1,150	2,533	10,000
	1-hour	5,643	1,150	6,793	40,000

The 200-foot and 300-foot overburden removal scenarios under both action alternatives comply with the 1-hour and 8-hour NAAQS at all modeled receptors.

4.3.2.5 SULFUR DIOXIDE AERMOD RESULTS

Modeled SO_2 concentrations associated with the maximum development year are summarized here and in Table 4.9. Though potential SO_2 emissions associated with mining activities would be nominal, modeling was completed to quantify potential concentrations. Based on the recent promulgation date for the 1-hour SO_2 standard (June 2, 2010), no 1-hour modeling was performed. Both the 200-foot overburden removal and 300-foot overburden removal scenarios were modeled for compliance with the 3-hour, 24-hour, and annual NAAQS. Because the estimated SO_2 emissions associated with the maximum development year for the Proposed Action and Alternative C are the same, separate model runs were not necessary in each overburden removal scenario.

Table 4.9. Sulfur Dioxide Modeling Results for the Proposed Action and Alternative C

Overburden Thickness (feet)	Averaging Period	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
200	3-hour	1.64	20	22	1,300
	24-hour	0.47	10	10	365
	Annual	0.10	5	5	80
300	3-hour	1.90	20	22	1,300
	24-hour	0.47	10	10	365
	Annual	0.14	5	5	80

The 200-foot and 300-foot overburden removal scenarios under both action alternatives comply with the 3-hour, 24-hour, and annual NAAQS at all modeled receptors.

4.3.2.6 HAZARDOUS AIR POLLUTANTS IMPACT ASSESSMENT

HAPs can cause various adverse health effects, including respiratory problems and some forms of cancer. They are not part of the NAAQS, but high levels at the tract boundary could indicate the need for further analysis, mitigation strategies, or both. Therefore, HAPs have been included in the emission inventory and were modeled in the AERMOD near-field analysis. The modeled concentrations were compared with known health exposure levels as a means of assessing potential impacts.

The only quantifiable source of HAPs in the emissions inventory would be the generators needed to conduct mining operations. The HAP emissions from the generators would be the same for the 200-foot and 300-foot overburden removal scenarios under both action alternatives. No adverse impacts associated specifically with the tract HAP sources are anticipated based on modeled concentrations compared to threshold health exposure levels (Tables 4.10 and 4.11).

Table 4.10. Hazardous Air Pollutants AERMOD Modeling Results (noncarcinogenic)

Pollutant	Model Years	Avg. Period	Receptor Location		Modeled ($\mu g/m^3$)	Threshold ($\mu g/m^3$)[1]
			UTME	UTMN		
Benzene	2005–2008	1-hour	371800	4140300	0.440	1,300 (REL)
		24-hour	368400	4142500	0.046	53 (TSL)
		Annual	370060	4140000	0.003	30 (RfC)
Toluene	2005–2008	1-hour	371800	4140300	0.160	37,000 (REL)
		24-hour	368400	4142500	0.017	2,512 (TSL)
		Annual	370060	4140000	0.001	5,000 (RfC)
Xylenes	2005–2008	1-hour	371800	4140300	0.110	22,000 (REL)
		24-hour	368400	4142500	0.011	14,473 (TSL)
		Annual	370060	4140000	0.001	100 (RfC)
Formaldehyde	2005–2008	1-hour	371800	4140300	0.045	37 (TSL)
		Annual	370060	4140000	0.0003	9.8 (RfC)

[1] REL = recommended exposure limit; TSL = Toxic Screening Level; RfC = Reference Concentration.

Table 4.11. Hazardous Air Pollutants AERMOD Modeling Results (carcinogenic)

Analysis[1]	HAP Constituent	Carcinogenic Annual RfC (Risk Factor)[2] $1/(\mu g/m^3)$	Exposure Adjustment Factor	Modeled ($\mu g/m^3$)	Calculated Risk	Significance Criterion
MLE	Benzene	7.80E-06	0.0949	0.003	2.2E-09	1.00E-06
MLE	Formaldehyde	5.50E-09	0.0949	0.0003	1.6E-13	1.00E-06
MEI	Benzene	7.80E-06	0.33	0.003	7.7E-09	1.00E-06
MEI	Formaldehyde	5.50E-09	0.33	0.0003	5.4E-13	1.00E-06

[1] MLE = most likely exposure; MEI = maximally exposed individual.
[2] EPA Air Toxics Database, Table 1 (EPA 2007).

4.3.2.7 NEAR FIELD CLASS I AND CLASS II INCREMENTS

Under federal and state PSD regulations, increases in ambient air concentrations in Class I areas are limited by PSD Class I increments. Specifically, emissions associated with a particular development may increase ambient concentrations above baseline levels only within those specific increments developed for SO_2, PM_{10}, and NO_2. Modeling results for the maximum development year are presented in Table 4.12. For this air resources assessment, modeled concentrations are compared to the PSD increments. These comparisons are made for informational purposes only, and the analyses described herein are not intended to be, nor should they be interpreted as a regulatory increment consumption analysis.

Table 4.12. Near Field Class I (Bryce Canyon National Park) and Class II (Grand Staircase-Escalante) Results for the Maximum Emission Rate Case (300-foot overburden removal, Alternative C)

Pollutant	Averaging Period	Class I Analysis Results		Class II Analysis Results	
		Cumulative Concentration ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)	Cumulative Concentration ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)
PM_{10}	Annual	0.01	4	0.42	17
	24-hour	0.36	8	3.11	30
SO_2	Annual	0.00	2	0.00	20
	24-hour	0.00	5	0.02	91
	3-hour	0.01	25	0.15	512
NO_x	Annual	0.04	2.5	1.73	25
$PM_{2.5}$	Annual	0.00	n/a	0.10	n/a
	24-hour	0.07	n/a	1.15	n/a
CO	8-hour	5.3	n/a	67	n/a
	1-hour	32	n/a	497	n/a

Because modeling results displayed in Table 4.12 show values far below the relevant increments, results are only presented for the maximum emission rate case (300-foot overburden removal, Alternative C). Impacts from the other scenarios would be equal to or less than those presented here. Modeled concentrations are well below both the Class I and Class II increments. Even though there are no increments for $PM_{2.5}$ or CO, results are presented in Table 4.12 to convey a general impression of impact levels.

4.3.2.8 NEAR-FIELD VISCREEN ANALYSIS

VISCREEN was used to assess potential visibility impacts in the near-field modeling domain at Bryce Canyon National Park. The primary pollutants of concern that may impact visibility in the near-field are PM (PM_{10} and $PM_{2.5}$) and NO_x. The conservative Level-2 VISCREEN visual impacts category was used to assess visibility impacts inside of Bryce Canyon National Park. The results are summarized in Tables 4.13 and 4.14. This analysis was only performed for Alternative C because Alternative C represents the maximum emission rate case.

Table 4.13. Visual Impacts Inside of Bryce Canyon National Park, 200-foot Overburden Removal Results for Alternative C

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
Sky	10	157	35	11	6.21	0.267	0.13	0.005
Sky	140	157	35	11	3.41	0.074	0.13	-0.002
Terrain	10	84	18	84	6.80	0.691	0.28	0.003
Terrain	140	84	18	84	4.05	0.029	0.28	0.00

Table 4.14. Visual Impacts inside of Bryce Canyon National Park, 300-foot Overburden Removal Results for Alternative C

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
Sky	10	157	35	11	6.21	0.372	0.13	0.006
Sky	140	157	35	11	3.41	0.149	0.13	-0.003
Terrain	10	84	18	84	6.80	0.904	0.28	0.004
Terrain	140	84	18	84	4.05	0.041	0.28	0.000

These results demonstrate that the maximum impacts inside of Bryce Canyon National Park from a potential mine plume under the 200-foot and 300-foot overburden removal scenarios would be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.

4.3.3 Far-field Analysis

The purpose of the far-field analysis is to quantify potential air resources impacts to both ambient air concentrations and AQRVs from air pollutant emissions of NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$ that are expected to result from mining operations on the tract.

The analyses were performed using the EPA-approved CALMET/CALPUFF/CALPOST modeling system to predict direct and indirect impacts to air resources at far-field PSD Class I areas and selected Class II areas. The term “CALPUFF” is generally used to represent the entire modeling system, including the pre- and post-processors.

4.3.3.1 CLASS I AND CLASS II INCREMENTS

Under federal and state PSD regulations, increases in ambient air concentrations in Class I areas are limited by PSD Class I increments. Specifically, emissions associated with a particular development may increase ambient concentrations above baseline levels only within those specific increments developed for SO_2, PM_{10}, and NO_2. The modeling results for the maximum development year are presented in Table 4.15. For this air resources assessment, modeled concentrations are compared to the PSD increments. These comparisons are made for informational purposes only, and the analyses described herein are not intended to be, nor should they be interpreted as a regulatory increment consumption analysis.

Table 4.15. Far Field Class I and Class II Results for the Maximum Emission Rate Case (300-foot overburden removal, Alternative C)

Pollutant	Averaging Period	Class I Analysis Results		Class II Analysis Results	
		Cumulative Concentration (µg/m^3)	Class I Increment (µg/m^3)	Cumulative Concentration (µg/m^3)	Class II Increment (µg/m^3)
PM_{10}	Annual	0.14	4	0.03	17
	24-hour	1.06	8	0.24	30
SO_2	Annual	0.00	2	0.00	20
	24-hour	0.00	5	0.00	91
	3-hour	0.00	25	0.00	512
NO_x	Annual	0.02	2.5	0.01	25
$PM_{2.5}$	Annual	0.01	n/a	0.00	n/a
	24-hour	0.04	n/a	0.02	n/a
CO	8-hour	2.27	n/a	0.93	n/a
	1-hour	5.60	n/a	1.78	n/a

Because modeling results displayed in Table 4.15 show values far below the relevant increments, results are only presented for the maximum emission rate case (300-foot overburden removal, Alternative C). Impacts from the other scenarios would be less than those presented here. Modeled concentrations are well below both the Class I and Class II increments. Even though there are no increments for $PM_{2.5}$ or CO, results are presented in Table 4.15 to convey a general impression of impact levels.

4.3.3.2 VISIBILITY

Atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are set forth in *The Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I report* (FLAG 2000). This FLAG document provides guidance for evaluating visibility. According to this document a threshold change of 10% or more of the reference background visibility (1.0 deciview) due to the effects of both mining operations on the tract and existing source impacts may require additional scrutiny. Visibility results are presented in Table 4.16 (200-foot overburden removal, Proposed Action and 300-foot overburden removal, Alternative C). These results represent both the lowest and highest emission cases and summarize method 6 processing. There are no extinction changes exceeding 10% in any of the areas of interest (maximum change of 5.5% at Grand Canyon National Park).

Table 4.16. Results for the Proposed Action 200-foot Overburden Removal Scenario and Alternative C 300-foot Overburden Removal Scenario

METHOD 6	200-foot Overburden, Proposed Action		300-foot Overburden, Alternative C	
Class I/Class II Area	**# Days > 10%**	**Max Change (%)**	**# Days > 10%**	**Max Change (%)**
Capitol Reef National Park	0	1.2	0	1.7
Grand Canyon National Park	0	1.3	0	5.5
Zion National Park	0	5.4	0	4.9
Grand Staircase-Escalante National Monument	0	2.1	0	2.7

4.3.3.3 DEPOSITION

Maximum predicted sulfur and nitrogen deposition impacts were estimated for the 200-foot overburden removal scenario in the Proposed Action and the 300-foot overburden removal scenario in Alternative C. As above, this approach provides for complete representation of impacts from both the lowest and highest emission scenarios for the tract.

Predicted, direct mine-related impacts were compared to the minimum “green line” deposition analysis values for total nitrogen and sulfur deposition in the western United States, which are defined as 3.0 kilogram per hectare per year (kg/ha-year) for both nitrogen and sulfur (Fox et al. 1989). The green line represents a value below which no significant change in the forest ecosystem would occur. These results are presented in Table 4.17. Impacts for sulfur and nitrogen deposition are below the minimum green line value in all cases.

Table 4.17. Deposition Results

Location	Overburden Thickness (feet)	Alternative	Alton Coal Tract			
			Maximum Dry and Wet Annual Sulfur Deposition(kg/ha-yr)	>Green Line?	Maximum Dry and Wet Annual Nitrogen Deposition (kg/ha-yr)	>Green Line?
Bryce Canyon	200	B	0.0001	No	0.0124	No
	300	C	0.0001	No	0.0262	No
Capitol Reef	200	B	0.0000	No	0.0004	No
	300	C	0.0000	No	0.0009	No
Escalante	200	B	0.0000	No	0.0013	No
	300	C	0.0000	No	0.0024	No
Grand Canyon	200	B	0.0000	No	0.0003	No
	300	C	0.0000	No	0.0006	No
Zion	200	B	0.0000	No	0.0038	No
	300	C	0.0000	No	0.0087	No
Navajo Lake	300	C	0.0000	No	0.0044	No

4.3.3.4 ACID NEUTRALIZING CAPACITY

CALPUFF was used to predict annual deposition fluxes of sulfur and nitrogen at Navajo Lake for the maximum emission rate case (300-foot overburden removal scenario, Alternative C). Impacts from the other scenarios would be less than those presented here. These results are shown in Table 4.17. Because no data on lake chemistry at Navajo Lake were available, no estimates of acid neutralizing capacity change in Navajo Lake were performed. However, maximum modeled annual sulfur and nitrogen deposition values for Navajo Lake are zero and 0.0044 kg/ha, respectively. Both of these values are well below the green line value of 3.0 kg/ha per year. Though acid neutralizing capacity change is ultimately specific to the water body in question, Leydecker et al.'s (1999) study of high altitude Sierra Nevada lakes found that although acid neutralizing capacity was depressed as a result of modeled snowmelt nitrate and sulfate deposition rates up to 150% above baseline conditions, no lakes experienced chronic acidification.

4.3.3.5 GREENHOUSE GASES

Naturally occurring GHGs include water vapor, CO_2, CH_4, nitrous oxide (N_2O), and ozone (O_3). Water vapor accounts for the largest percentage of the greenhouse effect. Next to water vapor, CO_2 is the most abundant GHG. Because CO_2 is relatively stable in the atmosphere and uniformly mixed throughout the troposphere and stratosphere, the climatic impact of CO_2 emissions does not depend on the CO_2 source location on earth. The action alternatives would produce GHG emissions from the combustion of fuel by vehicles and equipment.

Research on how emissions of GHGs influence global climate change and associated effects has focused on the overall impact of emissions from aggregate regional or global sources. This approach is required primarily because GHG emissions from single sources are small relative to aggregate emissions. The climate change research community has not yet developed tools specifically intended for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. The current tools for simulating climate change generally focus on global and regional-scale modeling. Global and regional-scale models lack the capability to represent many important small-scale processes. As a result, confidence in regional- and sub-regional-scale projections is lower than at the global scale. Therefore, limited scientific capability exists in assessing, detecting, or measuring the relationship between emissions of GHGs from a specific single source and any localized impacts.

Globally, approximately 30,377 million metric tons of CO_2 was added to the atmosphere through the combustion of fossil fuels in 2008 (EPA 2010). The highest on-site and off-site CO_2 emission evaluated would occur in the 300-foot overburden removal scenario for both action alternatives. The 77,153 tons of CO_2 (0.07 million metric tons) calculated for these alternatives represents approximately 0.0002% of the 2008 global emissions.

Annual coal production from the tract would be approximately 2 million tons under both the Proposed Action and Alternative C. The annual worldwide primary coal production based on 2008 data is approximately 7.3 billion tons (EIA 2008). The coal produced from the tract would therefore be expected to account for approximately 0.028% of total worldwide annual production. Because heat content varies by coal produced, there is not a direct relationship to emissions produced. The percentage of emissions from burning the coal removed from the tract would be expected to be of about the same magnitude as the production relationship.

Because site-specific data are not available, EPA's default emission factor of 4,810 pounds per ton of subbituminous coal (EPA 1998) was used to approximate annual CO_2 emissions from combusting the 2 million tons of coal that would be produced from the tract. Based on this emission factor, the end user(s)

of the coal produced from the tract would emit 4.8 million tons of CO_2 per year (4.4 million metric tons). This represents 0.014% of the total CO_2 emissions from 2008 global fossil fuel combustion. Annual estimated CO_2 emissions as a result of mining operations on the tract (0.07 million metric tons) are small relative to the amount of estimated CO_2 emissions from end user annual combustion of the coal (4.4 million metric tons). The total of these two sources of annual CO_2 emissions (4.47 million metric tons) is approximately 0.015% of 2008 global emissions from fossil fuel combustion (Table 4.18).

Table 4.18. Carbon Dioxide Emission Comparisons

Comparison	Global	Alton Coal Tract (mining operations)	End User Annual Combustion of Coal Produced from the Tract	Total Emissions related to Alton Coal Tract
CO_2 Emissions from Fossil Fuel Combustion, MM metric tons/yr	30,377	0.07 (0.0002% of global emissions)	4.4 (0.014% of global emissions)	4.47 (0.015% of global emissions)
Annual Coal Production, million tons	7,271	2 (0.028% of global production)	–	–

4.3.4 Potential Mitigation Measures

Mitigation measures described in Section 4.3.1 (also see Appendix K) were incorporated into the analyses conducted as required measures under any action alternative. Potential mitigation measures may also be considered and incorporated at a later time to further reduce air resources impacts. If the BLM's decision is to offer the tract for competitive leasing under either action alternative the successful lessee would be required to obtain an air permit from the UDAQ. This air permit (and other permits that would be required prior to conducting mining operations on the tract) would be based on detailed mine plans (as described in Chapter 2, the analyses in this EIS are based on conceptual mine plans using conservative estimates and assumptions). The permit would include an approved dust control plan that may include potential mitigation measures such as vehicle speed limits, additional dust suppressants, additional prohibitions on surface-disturbing activities during high wind events, erecting artificial wind barriers, wetting materials prior to disturbing or processing, cleaning haul trucks, and/or other similar measures. Measures that would be included in a dust control plan may also be considered by the BLM in the leasing process.

4.3.5 Unavoidable Adverse Impacts

Unavoidable adverse impacts to air resources as a result of mining and transporting coal under either action alternative would consist of increases in concentrations of criteria pollutants and HAPs. As a consequence of increased concentrations of criteria pollutants some decrease in AQRVs would occur but would be within threshold values based on current regulations and guidance. Though concentrations would increase under the alternatives modeled values show compliance with all the NAAQS with the exception of

- PM_{10} 24-hour standard under the Proposed Action 300-foot overburden removal scenario and Alternative C both overburden removal scenarios, and
- NO_2 annual maximum under the Proposed Action 300-foot overburden removal scenario and Alternative C 300-foot overburden removal scenario.

Multiple mitigation measures have been incorporated into the analysis. Potential mitigation measures identified in Section 4.3.4 would further reduce emissions and associated impacts. These potential mitigation measures would likely reduce PM_{10} emissions and improve visibility impacts at the national parks, but would have no impact on CO_2 emissions.

4.3.6 Short-term Uses versus Long-term Productivity

The short-term use of the tract for mining operations would result in impacts to air resources in the analysis area for the duration of the mining operations. However, upon mine closure and reclamation, these impacts would be eliminated and would therefore not impact the long-term productivity of the air resource.

4.3.7 Irreversible and Irretrievable Commitments of Resource

The irreversible commitment of a resource means that, once committed, the resource is permanently lost to other uses. This type of commitment generally applies to nonrenewable resources (e.g., minerals, geologic features, or cultural resources) or to resources that are only renewable over a very long period of time (e.g., soil productivity or perhaps old-growth forest.). Irretrievable commitments of resources, on the other hand, are regained following cessation of the activity and reclamation. There would be no irreversible commitments of air resources as a result of mining the tract. All air resource impacts described would be irretrievable because air quality would cease to be impacted by mining operations following cessation of mining activities.

4.4 Cultural Resources

Inventories to identify and evaluate cultural resources in the Alton Coal Tract were conducted by Montgomery Archaeological Consultants, Inc. on behalf of ACD (Stavish 2007, 2008b) and by the BLM (Zweifel 2007). These inventories resulted in the identification of 132 prehistoric, historic, and multicomponent sites (a multicomponent site is one that contains both prehistoric and historic archaeological materials). Of these 132 sites, 107 are eligible for the NRHP (Table 4.19).

Table 4.19. Summary of Archaeological Site Types in the Tract

Cultural Association	Eligible	Not Eligible	Total
Historic	0	6	6
Multicomponent	7	0	7
Prehistoric	100	19	119
Total	**107**	**25**	**132**

In addition to these archaeological sites, other cultural resources that may be affected by the Proposed Action and alternatives include the Panguitch Historic District, which is listed on the NRHP, and Utah Heritage Highway 89 with its associated Mormon Pioneer Heritage Area. Finally, the Proposed Action and alternatives may affect TCPs identified by Native American groups during consultation with the BLM.

Impacts to these cultural resources under the Proposed Action and alternatives are analyzed here. Impacts for the Proposed Action and Alternative C are considered by type of disturbance: surface mining, underground mining, construction of centralized facilities, KFO Route 116 relocation, short haul route,

construction of dispersed facilities, increased human presence, other indirect effects, and coal truck traffic. It should be noted that not all 132 sites would be disturbed by each of the individual mining activities. Therefore, the following impact sections disclose the number of sites impacted by each activity. Methods and assumptions for the analysis are described next.

4.4.1 Regulatory Framework

According to the KFO RMP, the identification, preservation, and protection of significant cultural resources are necessary to ensure their appropriate uses for future generations (BLM 2008b). The Federal Land Policy and Management Act Sections 1039I, 201(a), and (c); the NHPA Section 110(a); and Archaeological Resources Protection Act Section 14(a) provide the regulatory framework that ensures cultural resource protection.

Prior to any mining disturbance, consultation with the State Historic Preservation Office (SHPO) would occur to evaluate the NRHP eligibility of cultural properties and to evaluate the effects of mining on historic properties. Cultural properties determined eligible for the NRHP would be avoided; if avoidance is not be possible, a data recovery plan would be implemented prior to disturbance.

Lease stipulations with regard to cultural resources include the following:

- Conducting Class I and III surveys to identify cultural properties on all state and federal lands and on private lands affected by federal undertakings
- Consulting with the SHPO to evaluate eligibility of cultural properties for the NRHP
- Consulting with the SHPO to evaluate effects of mining on historic properties
- Avoiding or recovering data from significant cultural properties identified by surveys, according to the approved cultural resources mitigation plan
- Notifying appropriate federal personnel if historic or prehistoric materials are uncovered during mining operations
- Instructing employees on the importance of cultural resources and the regulatory obligations to protect those resources
- Consulting with Native American tribes that have known interests in this area of leasing action and requesting assistance with identification of potentially significant religious or cultural sites
- Avoiding or recovering data from significant cultural properties identified by surveys, according to the approved cultural resources management plan (CRMP)
- Complying with the Native American Graves Protection and Repatriation Act

4.4.2 Impact Indicators and Thresholds

Impacts to cultural resources are analyzed by evaluating the extent to which NRHP-eligible properties would be affected directly or indirectly by any of the actions included in each alternative. The criteria used to assess adverse effects to NRHP-eligible properties are set forth in 36 CFR 800.5. An adverse effect consists of any impact that may alter one or more of the characteristics of a historic property that make the property eligible for the NRHP. Characteristics that must be considered with regard to NHRP criteria include the integrity of the property's setting, feeling, location, design, materials, workmanship, and association. In addition, consideration must also be given to effects that may alter the property's eligibility under any of the four NRHP Criteria (A to D). Criterion A refers to a property's association with events that have made a significant contribution to the broad patterns of our history. Criterion B refers to a property's association with the lives of persons significant in our past. Criterion C refers to properties that embody the distinctive characteristic of type, period, or method of construction, or that

represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction. Criterion D refers to properties that have yielded or may be likely to yield information important in prehistory or history. Most of the 132 sites that would likely be adversely affected under either action alternative are eligible under Criterion D.

Direct effects consist of any physical destruction or damage to all or part of the property, such as the creation of roads or trails through the resource, the selling or leasing of the land where the resource is located, development that would alter the physical landscape of the resource, and any other types of human activity that could affect the physical integrity of the landscape where the resource is located. Direct effects may also result from activities in areas adjacent to the resource, such as when the creation of a road, trail, or recreational facility denudes vegetation in the area or changes water drainage patterns and causes erosion of the resource.

Some of the more substantial indirect effects on cultural resources typically result from increased human activity in the area, which can increase the risk of vandalism, looting, or unintentional destruction of a property. Prehistoric sites are especially vulnerable to these effects. Other types of indirect effects can impact a property's integrity of setting, feeling, or association, rather than its physical integrity. These characteristics can be affected by visual intrusions such as buildings and transmission lines, by alteration of the surrounding landscape, or by atmospheric intrusions such as dust clouds or smog. They can also be affected by substantial changes to the audible environment; such changes can result from increased vehicle or air traffic, the operation of heavy machinery, blasting, or elimination of the natural sounds that would have created the historical audible environment.

Finally, cumulative impacts are those that occur when the effects of an action are added to or interact with the effects of other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts may result from individually minor, but collectively significant actions occurring over a period of time. For example, if cultural resources are being affected by development in areas adjacent to or nearby an area that is the subject of an action, then that action may contribute to a larger pattern of impacts in the region. Sites of specific types or from specific time periods may not have great individual significance, but if several such sites are being impacted by a variety of developments, they may become a rare and a much more valuable resource.

In this general framework, the effects of the Proposed Action and the alternatives on cultural resources are analyzed by considering these specific impact indicators:

- For archaeological sites and/or TCPs located in the tract, the number of sites completely or partially physically destroyed (e.g., by surface-mining activities or construction of facilities)
- For archaeological sites and/or TCPs located in the tract that are not physically destroyed, the loss of integrity, as defined above due to other direct and indirect effects
- For the Panguitch Historic District, Utah Heritage Highway 89 and the associated Mormon Pioneer Heritage Area, and Native American sacred sites or other TCPs not located in the tract, the loss of integrity of setting, feeling, and association

The first of these indicators can be analyzed quantitatively using data on cultural resource sites identified in the tract. The remaining two, which involve loss of integrity, must be analyzed qualitatively.

4.4.3 Analysis Assumptions

This analysis assumes that impacts to sites in areas of surface disturbance would be mitigated following procedures outlined in a CRMP created especially for the tract. It also assumes that impacts to sites that have not yet been identified but that may be encountered during the course of mining or construction activities (e.g., deeply buried sites without surface manifestations that allowed them to be identified during inventory) would be mitigated through monitoring procedures similar to those described in the data recovery plan. This plan has been prepared for archaeological sites in the fee coal areas adjacent to the tract. It can be found in Appendix A of the *Cultural Resource Management Plan for Alton Coal Development's Proposed Development of the Alton Amphitheater and Sink Valley* (Stavish 2008b) (Stavish 2008a:34).

4.4.4 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the tract under the Proposed Action or Alternative C would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined. As such, no coal mining activities or infrastructure development would occur under the No Action Alternative, and therefore no archaeological sites or other cultural resources would be directly affected by these activities. Likewise, no cultural resources located either inside or outside of the tract would be indirectly affected by increased vandalism, looting, or unintentional damage resulting from increased access associated with mining activities from the action alternatives, nor would the integrity of setting, feeling, or association of such resources be affected. Under the No Action Alternative, current land uses such as recreation, livestock grazing, and vegetation treatments may impact archaeological sites or cultural resources in the tract.

Management of cultural resources on BLM-administered lands in the tract would continue at the discretion of the BLM under the KFO RMP. The objectives of the RMP with regard to cultural resources are 1) to identify, preserve, and protect significant cultural resources and ensure that they are available for appropriate uses by present and future generations, 2) to seek to reduce imminent threats and resolve potential conflicts by ensuring that all authorizations for land use and resource use comply with NHPA Section 106, 3) to provide opportunities for scientific and educational uses of cultural resources, 4) to provide opportunities for traditional (Native American) uses of cultural resources, and 5) to ensure compliance with the Native American Graves Protection and Repatriation Act (BLM 2008b).

4.4.5 Alternative B: Proposed Action

Under the Proposed Action the tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The boundaries of the tract would be reasonably consistent with the tract reconfiguration completed by the BLM after ACD's original license by application (LBA) submittal (see Map 1.2). Approximately 1,993–2,395 acres of surface disturbance (surface mining and infrastructure development) would occur in the tract under the Proposed Action. In addition, underground mining would occur on 412–717 acres of land in the tract.

Surface mining methods with up to 200 feet of overburden removal would result in fewer disturbed acres, which would decrease the number of sites affected by the surface-mining process. Employing surface mining methods with up to 300 feet of overburden removal would result in more disturbed acres, which would increase the number of sites affected. The lower range of numbers detailed in the following sections relates to a 200-foot overburden removal scenario, whereas the higher range of numbers relates to a 300-foot overburden removal scenario.

4.4.5.1 EFFECTS OF SURFACE-MINING ACTIVITIES ON CULTURAL RESOURCES

Of the 1,993–2,395 acres of surface disturbance that would occur in the tract under the Proposed Action, 1,750–2,152 acres would be the direct result of surface mining (see Map 1.2). There are 81–85 known archaeological sites located either partially or wholly in the areas that would be surface mined; of these, 69 or 70 are eligible for the NRHP. These sites, or portions of them, would be destroyed by the surface-mining process. As described in the CRMP, a sample of these sites would undergo archaeological data recovery (i.e., excavation as well as other methods of collecting data) before being disturbed by surface mining. Thus, the loss of archaeological sites to surface mining would be offset to some degree by the acquisition of new information about the area's history and prehistory.

It is also possible that an unknown number of previously unidentified sites would be encountered during surface mining and may thus be affected. Implementation of a monitoring plan would mitigate impacts to NRHP-eligible sites and allow for the possibility of conducting data recovery at them.

4.4.5.2 EFFECTS OF UNDERGROUND MINING ACTIVITIES ON CULTURAL RESOURCES

Under the Proposed Action, underground mining would result in subsidence on 513 to 211 surface acres of the tract (see Map 1.2). An additional 166 surface acres (200-foot overburden removal scenario) to 109 surface acres (300-foot overburden removal scenario) outside the tract boundary but within the angle of influence would be disturbed by subsidence due to underground mining (see the Geology and Minerals section for more information on subsidence and angle of influence). At present, there are no known archaeological sites on the 412 surface acres of underground mining activity under the 300-foot overburden removal scenario. However, some possibility exists that there are buried sites or previously unrecognized surface sites in this region, and determination of underground mining effects on surface and near-surface deposits is evaluated here. Under the 200-foot overburden removal scenario, four sites occur within the 717 surface acres proposed for underground mining activity. One site is eligible for the NRHP.

The specific method of underground mining that would be used is not yet known, but regardless of the method, any surface disturbance associated with underground mining would occur in the pit disturbance areas discussed in the previous section (e.g., accessing subsurface coal from a high-wall exposed in a pit). Thus, compared to archaeological sites located in surface-mining areas, the impacts to sites located on the surface in the underground mining area would be relatively low. The main effect that underground mining may have on archaeological sites would occur through subsidence. Until a detailed mining plan is developed, the extent of subsidence that would occur cannot be estimated. However, the integrity of sites could possibly be diminished as a result. In particular, subsidence could alter spatial and stratigraphic relationships among artifacts and other materials, reducing their potential to provide archaeologically important information. Subsidence might also cause architectural damage to prehistoric or historic structures, although it is unlikely that such structures exist in the underground mining area because no archaeological sites were identified in this area, and sites with structures are generally the most visible type of archaeological site.

4.4.5.3 EFFECTS OF CENTRALIZED FACILITY CONSTRUCTION ON CULTURAL RESOURCES

Under the Proposed Action, centralized facilities associated with mining activities in the tract would be located on approximately 36 acres of BLM-administered land in the tract's no-coal zone (see Map 1.2). There are four archaeological sites located either partially or wholly in the centralized facility area; all four of these sites are eligible for the NRHP.

These sites would likely be destroyed by facilities construction. These sites would be considered for inclusion in the sample of sites that would undergo archaeological data recovery before construction begins. Thus, as with archaeological sites lost to surface mining, the loss of these sites would be offset to some degree by the acquisition of new information about the area's history and prehistory.

In the surface-mining areas, it is possible that some unknown number of previously unidentified sites would be encountered during construction of centralized facilities. Implementation of a monitoring plan would mitigate impacts to NRHP-eligible sites discovered in this way and would allow for the possibility of conducting data recovery.

4.4.5.4 EFFECTS OF KANAB FIELD OFFICE ROUTE 116 RELOCATION ON CULTURAL RESOURCES

Based on a series of assumptions discussed in Section 4.1 (Analysis Assumptions), relocation of KFO Route 116 under the Proposed Action would affect as many as four archaeological sites, two of which are eligible for the NRHP. These sites are located within potential ROWs for the relocated road and would be partially or completely destroyed by road construction. However, it might be possible to mitigate impacts to these sites during final road design by locating the road and associated construction areas to avoid them. If avoidance is not possible, these sites would be considered for inclusion in the sample of sites that would undergo archaeological data recovery before road construction begins, and their loss would be offset to some degree by the acquisition of new information about the area's history and prehistory.

4.4.5.5 EFFECTS OF DISPERSED FACILITY CONSTRUCTION ON CULTURAL RESOURCES

Dispersed facilities would be constructed under the Proposed Action on an estimated 160 acres; these 160 acres would be located within the 1,183 acres of the tract's no-coal zone outside of the 36-acre centralized facility area. There are 45 archaeological sites located either partially or wholly in the area available for dispersed facility construction, 35 of which are eligible for the NRHP. It is unlikely that it would be possible to avoid all archaeological sites in the construction of dispersed facilities, but because the locations of dispersed facilities are not yet known, it is not possible to determine the exact number of sites that would be impacted by them. However, it can be assumed that impacts to archaeological sites from dispersed facilities would be proportionate to the percentage of the area available for dispersed facilities that would actually be occupied by them (13.5%). Applying this percentage to the number of known archaeological sites in the area available for dispersed facilities, it is likely that approximately six archaeological sites would be impacted by dispersed facilities, and that approximately five of these would be eligible for the NRHP.

As with sites located in the surface-mining and centralized facilities areas, those impacted by construction of dispersed facilities would likely be partially or completely destroyed. However, these sites would be considered for inclusion in the sample of sites that would undergo archaeological data recovery before construction begins, and the loss of these sites would be offset to some degree by the acquisition of new information about the area's history and prehistory.

In addition, it is possible that some unknown number of previously unidentified sites would be encountered during construction of dispersed facilities, and may thus be affected. Implementation of a monitoring plan would minimize or mitigate impacts to NRHP-eligible sites discovered during construction by allowing facilities to be moved to avoid them, or by allowing for the possibility of conducting data recovery at them.

4.4.5.6 INDIRECT EFFECTS OF INCREASED HUMAN ACTIVITY IN THE TRACT ON CULTURAL RESOURCES

Under the Proposed Action, an estimated 160 employees would work at the mine, with operations occurring 24 hours a day, six days a week, over a projected mine life of 25 years. This increased human presence would have an unquantifiable but potentially great impact on the integrity of NRHP-eligible archaeological sites in the tract that occur on the surface but are not directly affected by pit disturbance or facilities construction. In particular, it could increase vandalism, looting, or unintentional destruction of archaeological sites during the course of mine operations.

As noted in the previous section, there are 45 archaeological sites, 35 of which are eligible for the NRHP, located either partially or wholly in the tract's no-coal zone outside of the centralized facility area. All these sites could be affected by vandalism, looting, or unintentional destruction to a much greater degree than would be the case under the No Action Alternative, although the magnitude of such impacts cannot be estimated precisely.

4.4.5.7 OTHER INDIRECT EFFECTS ON CULTURAL RESOURCES IN THE TRACT

As noted in the Native American Consultation section, natural landscape features (e.g., springs and creeks), resource harvesting and processing areas, and archaeological sites are significant to the Native American tribes in the region for cultural and spiritual reasons (Personal Communication, Zweifel 2008). As such, visual, auditory, and other atmospheric impacts from surface-mining activity under the Proposed Action may substantially degrade the integrity of setting, feeling, and association of TCPs that are not directly affected by pit disturbance or facilities construction. These are not impacts that can be quantified, but they would be a major concern for consulting tribes.

4.4.5.8 EFFECTS OF COAL TRUCK TRAFFIC ON CULTURAL RESOURCES

As discussed in the Cultural Resources along the Coal Haul Transportation Route section, the coal haul transportation route under the Proposed Action (see Map 2.4) would pass through the NRHP-listed Panguitch Historic District and would follow Utah Heritage Highway 89, which is part of the Mormon Pioneer Heritage Area. The Panguitch Historic District is significant under NRHP Criterion A for its association with the early settlement of Panguitch and with the subsequent economic development of the area, and it is significant under Criterion C for its intact concentration of historic buildings. The Mormon Pioneer Heritage Area was established in recognition of the role that Mormon settlement played in the Euro-American colonization of the West, and its purpose includes fostering conservation and interpretation of cultural and natural resources, as well as economic development related to the region's heritage.

Under the Proposed Action, it is projected that 153 coal truck round-trips per day would occur six days per week over a projected mine life of 25 years. A traffic analysis conducted for this EIS indicates that the portion of US-89 that corresponds to the coal haul transportation route presently experiences average traffic volumes ranging in various locations from approximately 3,600 to 4,100 vehicles per day, of which between 720 and 900 vehicles per day are heavy trucks (Fehr and Peers 2008). Projected total traffic volumes for the year 2020 on US-89 (without the addition of coal trucks) range from 4,400 to 5,850 vehicles per day (Fehr and Peers 2008). The coal truck traffic that would result from the Proposed Action would be an incremental addition to the existing and projected future traffic volumes. Compared to present levels, it would represent an increase in truck traffic volume of approximately 17%–21%, six days per week. Possible impacts to cultural resources from this incremental increase in truck traffic could include physical damage to historic buildings from traffic-generated vibrations, as well an alteration of the integrity of setting, feeling, and association of the Panguitch Historic District and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area.

The California Department of Transportation has presented a technical advisory on transportation-related vibrations (Caltrans 2002). The results in this advisory suggest that neither existing truck traffic nor the addition of further coal truck traffic should physically affect historic buildings. This technical advisory suggests that a peak particle velocity (i.e., velocity of soil particles) of 5.0 millimeters/second (mm/s) is the threshold at which there is a risk of architectural damage (i.e., damage to finish materials) to "normal dwellings," such as houses with plastered walls and ceilings. The advisory further suggests that minor structural damage would not occur until peak particle velocities of 10–15 mm/s are reached. Finally, the advisory recommends that "ruins and ancient monuments" not be subjected to peak particle velocities of greater than 2.0 mm/s. In contrast to these threshold levels, the advisory reports that the highest measured traffic-generated vibrations from heavy trucks, measured on freeway shoulders at a distance of 5 m (16 feet, five inches) from the center line of the nearest lane, have never exceeded 2.0 mm/s. Vibration velocity declines exponentially with distance from the source, and because buildings along the coal transportation route are located much farther than 5.0mm/s m from the center line of the closest traffic lane, it is unlikely that buildings along the route would ever experience vibrations that even approach the recommended maximum for "ruins and ancient monuments," much less the threshold at which architectural damage to "normal dwellings" might occur. Vibration velocity does depend on the road surface, and vibrations could be further minimized by filling potholes and cracks (Caltrans 2002).

Although it is unlikely that the additional truck traffic would result in physical damage to historic buildings along the coal haul transportation route, there is perhaps a greater chance that it could adversely affect the integrity of setting, feeling, and association of the Panguitch Historic District, the Utah Heritage Highway 89/Mormon Pioneer Heritage Area, or both. In particular, the increased traffic could result in increases in noise, air pollutants, and traffic congestion in downtown Panguitch and along US-89, thereby adversely affecting the historic feeling of the area for residents and visitors; such impacts are considered in greater detail in the aesthetic resources, air resources, and traffic sections of this document. Portions of US-89 along the coal haul transportation route currently experience heavy truck traffic of between 720 and 900 vehicles per day. As such, heavy truck traffic is part of the experience of the Panguitch Historic District and the Utah Heritage Highway 89, and the additional volume of 153 trucks per day would represent only an incremental increase against this baseline. In addition, mining is one of the historic uses of the region that was considered in establishing the region as a heritage area, and from this perspective coal truck traffic is not inconsistent with the heritage of the area.

4.4.5.9 SUMMARY OF EFFECTS ON CULTURAL RESOURCES UNDER THE PROPOSED ACTION

Under the Proposed Action, 69 or 70 NRHP-eligible archaeological sites would be completely or partially destroyed by surface mining on 1,750–2,152 acres, and four NRHP-eligible archaeological sites would be completely or partially destroyed by construction of centralized facilities on 36 acres. The range of NRHP-eligible sites destroyed is based on the 200-foot or 300-foot overburden removal scenario. As many as two NRHP-eligible archaeological sites would be impacted by the relocation of KFO Route 116, and an estimated five NRHP-eligible sites would be impacted by the construction of dispersed facilities on 160 acres out of 1,183 acres available for dispersed facility construction. The complete or partial destruction of archaeological sites under the Proposed Action are impacts that would not occur under the No Action Alternative because the No Action Alternative would not result in mining the tract. However, it is uncertain how many sites would be completely or partially destroyed when considering impacts from the current land uses discussed in the No Action Alternative.

Mitigation for the loss of eligible archaeological sites would be the information about regional prehistory and history that would be gained from data recovery to be conducted at a sample of sites. An unknown number of archaeological sites not identified during the cultural resources inventory for the tract (e.g., buried sites without surface manifestations) might be impacted by pit disturbance, construction of

centralized or dispersed facilities, or KFO Route 116 relocation, but such impacts would be mitigated by avoidance if possible (in the case of KFO Route 116) or through monitoring and possibly data recovery (if selected to be added to the sample of sites for data recovery). At present, no known archaeological sites have been identified within the 717 surface acres where underground mining would occur under the 300-foot overburden removal scenario, and the specific method of underground mining to be adopted is unknown. Thus, the effects of subsidence on archaeological sites cannot be evaluated quantitatively, although there is some chance that they could occur. Under a 200-foot overburden removal scenario, four sites occur in the area prone to subsidence. One site is eligible for the NRHP.

Sites that are not directly impacted by surface mining or facilities construction would be subject to a greater degree of threat for vandalism, looting, or unintentional destruction due to an increased human presence in the area. Native American TCPs, which include natural features as well as archaeological sites, would be subject to adverse effects to their integrity of setting, feeling, and association due to visual, auditory, and other atmospheric impacts from mining activity. Although not quantifiable, these impacts would be a major concern for the tribes that would be consulted.

The incremental increase in truck traffic through the Panguitch Historic District and along the Utah Heritage Highway 89 that would occur under the Proposed Action would likely not cause physical damage to historic buildings along the route. However, it likely would have some adverse effect on the integrity of setting, feeling, and association of these resources.

4.4.6 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, total projected surface disturbance would occur from 1,662 to 2,064 acres. The number of archaeological sites impacted by surface mining would be 76, of which 63 are eligible for the NRHP (compared to 69 or 70 NRHP-eligible sites affected by surface mining under the Proposed Action). Based on assumptions described for Alternative C in Section 4.1, the number of sites affected by the relocation of KFO Route 116 would be reduced from a maximum of four to a maximum of three, of which two are eligible for the NRHP (the same maximum number of NRHP-eligible sites affected by road relocation under the Proposed Action). The number of sites that would be located either partially or wholly in the area available for construction of dispersed facilities under Alternative C would be reduced from 45 to 43, of which 34 (rather than 35) are eligible for the NRHP. Applying the same percentage used to estimate impacts from dispersed facilities under the Proposed Action (13.5%), it can be estimated that the number of sites affected by dispersed facilities would not differ appreciably from the Proposed Action—that is, six sites would be affected, including five that are NRHP eligible. Impacts from underground mining and centralized facility construction would be the same as those described for the Proposed Action. Effects of increased human activity in the tract (e.g., increased threat of looting through increased access), other indirect effects (e.g., effects on the setting and feeling of TCPs), and effects from coal truck traffic would be reduced in proportion to a reduction in mine life from 25 to 21 years. Impacts from surface mining, facilities construction, and road relocation activities to sites not previously identified during cultural resource inventories would be reduced roughly in proportion to the reduction in total surface disturbance from the range of 1,993–2,395 acres to 1,662–2,064 acres. Alternative C would increase the complete or partial destruction of archaeological sites on the tract compared to the No Action Alternative because no mining would occur on the tract under No Action. However, it is not known how many sites would be completely or partially destroyed when considering impacts from the current land uses discussed for the No Action Alternative.

4.4.7 Potential Mitigation Measures

Mitigation measures would consist of a combination of avoidance, monitoring, and conducting data recovery at a sample of the sites that would be affected by the Proposed Action and outlined in a CRMP. The data recovery component of a CRMP would likely be proposed to be initiated in three major stages corresponding to stages of the Proposed Action. Phase I would cover actions on private land (i.e., Coal Hollow) and consist of the mitigation of adverse impacts through data recovery in compliance with Utah Code 9-8-404 in consultation with DOGM, SHPO, and Public Lands Policy and Coordination Office (Personal Communication, Stavish 2008c). Importantly, Phase I would need to adopt an adaptive field strategy, and any unanticipated field discoveries made during this phase would require immediate attention. At the completion of Phase I data recovery, archaeological monitoring would occur to further collect any unanticipated data or discoveries. Following the completion of Phase I mitigation, an internal review and consultation with participating agencies would be undertaken. Phase II and Phase III would be structured to address the Proposed Action analyzed in this document in compliance with Section 106 of the NRHP and NEPA, and in consultation with the BLM, DOGM, and SHPO. Phase II would be structured based on results of the Phase I data recovery program. Phase III would consist of the refinement of research methods and questions based on Phase I and Phase II data recovery and testing. Importantly, Phase III would also consist of a selection of a sample of eligible sites for mitigation of those that are being adversely affected. A public outreach component would also be incorporated into the Phase I, II, and III plans.

Employee education regarding the treatment of cultural resources and the restriction on access to inactive mining areas could also be included as an potential mitigation measure when managing cultural resources.

4.4.8 Unavoidable Adverse Impacts

Unavoidable impacts, or impacts that exist even after mitigation measures have been taken, would principally manifest through the destruction of all cultural resources in areas targeted for open pit disturbance. For previously identified sites that are included in the sample of sites to be excavated, even though impacts would be mitigated through the collection of information about the prehistory and history of the area, materials from those sites would forever be removed from their original context. Unavoidable damage to cultural resources could also occur if resources not identified during surveys were affected during ground disturbance, despite the implementation of a monitoring plan for mitigation purposes. Unavoidable loss of cultural resources due to nonrecognition, lack of information and documentation, increased erosion, and inadvertent damage or use could also occur.

4.4.9 Short-Term Uses versus Long-Term Productivity

Cultural resources that are wholly eliminated due to short-term uses such as scientific data recovery efforts and data recovery supporting surface-disturbing activities would no longer be available for further study. Therefore, the long-term productivity of the resources (e.g., their ability to provide additional data) is also reduced. Short-term uses comprising the actual mining of coal would have the combined effect of destroying sites as well as increasing threats (such as looting) to sites outside of the actual disturbance areas through increased traffic and public access. Those sites not affected by looting during the active life of the mine may still have some reduced long-term productivity through continued looting or inadvertent destruction as a result of increased access to the region. Natural forces such as erosion would also continue to affect cultural resources, and it is likely that these resources would suffer deterioration and loss of data as a result.

4.4.10 Irreversible and Irretrievable Commitments of Resources

The implementation of laws that protect cultural resources would provide mitigation of impacts from permitted activities. However, the development of a surface coal mine would impact a large number of sites. Such a large number of NRHP-eligible sites would make mitigation through full data recovery an impractical solution for every resource, and a sampling strategy for data recovery would consequently be implemented, as described in the CRMP. Loss of the sites that are not included in the sample to be excavated would result in an irreversible loss of the data from these sites. In addition, for sites that are excavated, even though data would be recovered through scientific research, excavation and subsequent destruction through mining activities would result in an irreversible commitment of resources.

Several irretrievable commitments of resources would also occur. During the active lifetime of the mine, cultural resources not otherwise impacted by direct mining effects would be under increasing threat of looting for a period of time. In addition, cultural resources in the tract would not be available to Native Americans for traditional uses or to scholars for research purposes for a period of time. The loss of integrity of setting and feeling that the Panguitch Historic District and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area would experience during transportation of coal to markets would also constitute an irretrievable commitment of resources. Because these impacts would be temporary, lasting only for the life of the mine, they would be irretrievable rather than irreversible.

4.5 Fire Management

This section discusses the impacts of the Proposed Action and alternatives as described in Chapter 2 on FRCC acreages in the Alton Coal Tract. Impacts would vary by alternative and would depend on specific actions that could directly or indirectly reduce or contribute to fuels loading or increase or decrease the risks of wildland fire.

4.5.1 Regulatory Framework

Although no specific regulations or lease stipulations are in place for fire activities, the successful bidder would follow internal protocol and BLM BMPs to reduce and mitigate fire risk.

4.5.2 Impact Indicators and Thresholds

Acres of surface disturbance in vegetation communities in each FRCC would be used as the primary indicator of impacts from implementation of the alternatives. Surface disturbance would mainly be incurred by minerals development and by the construction of facilities and roads as planned under the action alternatives.

FRCCs are categories that describe the degree of departure of vegetation communities from the central tendency of reference ecosystems (see Section 3.5.3.1 in Chapter 3). Central tendency is a composite estimate of fuel composition, fire severity and frequency, and other characteristics of an ecosystem. There are three FRCC categories: FRCC 1 consists of areas having no to low departure from reference communities, FRCC 2 consists of areas with moderate departure, and FRCC 3 consists of areas with high departure (Hann and Bunnell 2001). These departures are largely caused by changes to vegetation structure and composition through improper grazing, fire suppression, and exotic annual weed invasion. In the tract, 99.9% of all the vegetation types (excluding open water and acres of roads) are in FRCC 3 (see Map 3.8).

A secondary indicator of impacts to fire regimes in the tract would be the construction and presence of new roads. Because of the potential for vehicle traffic to start wildfires, increased travel in the tract could lead to a greater risk of human-caused wildfires. Also, increased machinery operation during construction of facilities could lead to a greater wildfire risk. Acres of land designated for facilities construction would also be a secondary indicator of impacts to fire regimes in the tract.

4.5.3 Analysis Assumptions

Lightning accounts for 78% of all fires in the KFO area. Human activity such as careless smoking, vehicle exhaust, sparks from machinery or vehicles, escaped agricultural burning, and unattended campfires accounts for the remaining 22% (2004b). However, alterations to vegetation community structure and composition that create conditions for frequent wildfires are, to some extent, all a result of human activity. Regardless of the initial cause of the fire, wildfires in unreclaimed disturbed areas (i.e., FRCC 2 and 3) tend to occur more frequently and cause more damage than wildfires in natural or reference conditions (BLM 2004b). For the purposes of this analysis, vegetation disturbance and FRCC rating would be considered the most important factors in determining wildfire risk, although risk due to new road and facilities construction is also discussed.

For this analysis, it is assumed that post-operational revegetation would be successful and that revegetated vegetation communities would be less susceptible to wildfires than they are currently. Under both of the action alternatives, approximately 43%–62% of pinyon-juniper communities in the tract would be cleared for mine or facilities construction (see Section 4.15). Because all pinyon-juniper communities in the tract are considered to be a result of invasive plant encroachment, these areas would not be restored to current vegetation community structures post-operation but would be revegetated with sagebrush and perennial grassland species. Permanent removal of 43%–62% of the vegetation in these communities would greatly reduce the overall fuel load in the tract. It is possible that the FRCC rating would be improved following revegetation, and the risk of catastrophic wildfires in the tract would be reduced in the long term.

It is also assumed that revegetated areas would only be subject to minimal, long-term invasive, annual weed species encroachment. This assumption is based on agency objectives for reclamation and on the relatively small amounts of invasive annual weed species observed in past revegetation projects in the area (Personal Communication, Reese 2008).

Preventive SOPs would be followed during all mine operations to minimize risk of equipment-started fires.

4.5.4 Actions that Would Cause Change to Existing Fire Conditions

Clearing of vegetation for mines, roads, and facilities would create a short-term reduction in fuel loading and fire frequency. There would be less risk of wildfires prior to reclamation, when these areas are not occupied with vegetation. These cleared areas would also act as firebreaks between vegetated areas. Increased vehicle traffic to and from mining operations would result in an increased risk of vehicle-caused ignitions that could start wildfires. However, new roads would also provide better access for firefighters in the case of a wildfire.

Because 99.9% of land in the tract is classified as FRCC 3, restoration of native vegetation communities would be expected to improve vegetation community quality and fire regime classifications. If the revegetation of vegetation communities at the completion of mining activities is successful, it could shift the lands' FRCC rating from high to low levels of departure from central tendencies of reference ecosystems.

Impacts of actions under each alternative are discussed in the following sections.

4.5.4.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, ACD's application to lease the coal included in the tract under the Proposed Action or Alternative C would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined.

No coal-mining activities or infrastructure development would occur under the No Action Alternative on the tract. Likewise, no acres of vegetation communities would be disturbed by these activities, and no change in the FRCC rating would result. Furthermore, no acres in the tract would be revegetated or have the potential to decrease in FRCC rating as a function of mining.

Management of vegetation on BLM-administered lands in the tract would continue at the discretion of the BLM under the KFO RMP. These treatments are generally used to restore sagebrush grasslands that have been invaded by pinyon-juniper woodland for ecosystem restoration and watershed health. In the short term, vegetation treatments could increase the risk of invasion by noxious weeds and invasive species by vegetation removal and ground disturbance. Under the No Action Alternative, the removal of pinyon-juniper woodlands would reduce fuel loads in the tract. However, the approximate percentage of tract to be treated under the No Action Alternative in the short and long term is not known at this time.

Implementing general treatment stipulations such as 1) using prescribed burning in lieu of mechanical treatment when deemed suitable, 2) evaluating treatment sites for soil suitability and stability prior to manipulation, and 3) excluding livestock from all treatment areas until seedlings are established would help facilitate reestablishment of vegetation communities. Using desired species of grasses, forbs, and browse in the rehabilitation and reseeding of treated areas would facilitate vegetation reestablishment and avoid creating single-species communities.

Vegetation treatments, if successful, would have long-term benefits to the ecology of the area by removing undesired species, increasing species diversity and age class of certain communities, improving vegetation composition and structure, increasing overall vegetation cover, and improving FRCC rating. This could result in healthier woodlands, upland communities, and riparian areas that are more capable of retaining moisture and nutrients and resisting disease, invasive species, drought, fire, and other natural disturbances and/or stressors.

4.5.4.2 ALTERNATIVE B: PROPOSED ACTION

Under the Proposed Action, the tract would be offered for lease at a sealed-bid, competitive lease sale subject to standard and special lease stipulations developed for the tract. The boundaries of the tract would be reasonably consistent with the tract reconfiguration completed by the BLM after ACD's original LBA submittal (see Map 1.2).

4.5.4.2.1 Vegetation Removal

Approximately 1,732.9–2,134.8 acres of surface disturbance in vegetation communities would result from surface-mining operations (pit disturbance) under the Proposed Action. Centralized facilities associated with mining activities on the tract would remove approximately 36 acres of vegetation on BLM-administered land in the tract's no-coal zone (see Map 1.2). Other dispersed facilities would result in approximately 160 acres of vegetation removal. Relocation of KFO Route 116 in the tract would also remove approximately 47 acres of vegetation. This leads to approximately 1,815–2,217 acres of vegetation removed due to mining and facilities construction. This is 51%–62% of the vegetation in the tract.

Under the management objectives described in Chapter 2, this entire acreage (1,815–2,217 acres) would be revegetated with suitable native and non-native species. Invasive annual grasses such as cheatgrass would be suppressed. This could lead to an improved FRCC rating on these revegetated areas due to the suppression of cheatgrass and the return of the vegetation community to one with a fire regime of less frequent and lower intensity fires.

4.5.4.2.2 Wildfire Risk Due to Increased Access to Tract and Construction of Facilities

Under the Proposed Action, approximately 6.5 miles of new roads would be constructed due to the relocation of KFO Route 116. This increase in new road, when compared to the No Action Alternative, would result in an increased risk of human-caused wildfires from construction activities.

The construction of centralized and dispersed facilities on 196 acres under the Proposed Action could lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation on and adjacent to the tract as compared with the No Action Alternative, where no facilities would be constructed.

The Western Utah RWPP does not consider the town of Alton as a state-identified community at risk of wildfire. However, the RWPP does identify WUI areas immediately west of the town, along the length of US-89, as well as the Spencer Bench, Spencer Cliff Estates, and Stout Canyon area. The RWPP risk assessment identifies a high wildfire risk in these areas (FCAOG 2007b), which include portions of the coal haul transportation route.

4.5.4.2.3 Wildfire Risk Due to Increased Vehicle Trips

Increased movement to and from the tract by construction equipment and coal haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. An estimated 153 coal haul vehicle round-trips per day are expected under the Proposed Action.

The number of projected employee vehicle trips is expected to increase under this alternative as compared to the No Action Alternative. These trips would also lead to increased wildfire risk due to fuel leakages and sparking.

The risk of spontaneous combustion of coal in haul trucks, coal storage piles, refuse piles, and exposed coal faces would also increase as a result of mining activities. Under the DOGM's coal-mine permitting application requirements (Rule R645-301), the successful bidder would be required to follow all regulations regarding fire prevention and response.

4.5.4.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

Under Alternative C, the tract would be modified to exclude Block NW of the tract near the town of Alton (see Map 2.1). Furthermore, certain mining activities in Block S would be subject to seasonal restrictions to reduce impacts to the local sage-grouse population. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.1.

4.5.4.3.1 Vegetation Removal

Approximately 1,443–1,845 acres of surface disturbance in vegetation communities would result from surface-mining operations (pit disturbance) under Alternative C. Centralized facilities associated with mining activities on the tract would remove approximately 36 acres of vegetation on BLM-administered land (see Map 2.1). Other dispersed facilities would result in approximately 135 acres of vegetation removal. Relocation of KFO Route 116 in the tract would also remove approximately 37 acres of vegetation. This leads to 1,515–1,917 acres of vegetation that would be removed due to mining and facilities construction. This is 48%–61% of the vegetation in the tract.

Under the management objectives described in Chapter 2, this entire acreage (1,515–1,917 acres) would be revegetated with suitable native and non-native species. Invasive annual grasses such as cheatgrass would be suppressed. This could lead to an improved FRCC rating on these revegetated areas due to the suppression of cheatgrass and the return of the vegetation community to one with a fire regime of less frequent and lower intensity fires.

4.5.4.3.2 Wildfire Risk Due to Increased Access to Tract and Construction of Facilities

Under Alternative C, approximately 4.6 miles of new roads would be constructed due to the relocation of KFO Route 116. This increase in new roads, when compared to the No Action Alternative, would result in an increased risk of human-caused wildfires from construction activities.

The construction of centralized and dispersed facilities on 171 acres under Alternative C would lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation on and adjacent to the tract when compared to the No Action Alternative, where no facilities would be constructed.

4.5.4.3.3 Wildfire Risk Due to Increased Vehicle Trips

Increased movement to and from the tract by construction equipment and coal haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. An estimated 153 coal haul vehicle round-trips per day are expected under Alternative C.

The number of projected employee vehicle trips would be greater than under the No Action Alternative and the same as the Proposed Action; however, the number of trips would last for 21 years as opposed to 25 under the Proposed Action. These trips would also lead to increased wildfire risk due to fuel leakages and sparking.

4.5.5 Potential Mitigation Measures

No potential mitigation measures are proposed for fire management.

4.5.6 Unavoidable Adverse Impacts

The risk of wildfire ignition would be an unavoidable impact under the Proposed Action and Alternative C. Restoration of native vegetation communities would be expected to improve vegetation community quality and fire regime classifications.

4.5.7 Short-term Uses versus Long-term Productivity

In the short term, areas cleared of vegetation for construction of mined areas, facilities, or roads would be removed from FRCC rating. These areas would serve as firebreaks in the event of wildfires in adjacent areas. At the completion of mining activities, these areas would be revegetated under the mitigation measures set out in Chapter 2. Revegetation has the potential to improve the tract's FRCC ratings. In the long term, the revegetation of 1,975–2,377 acres of land (55.6%–66.9%) under Proposed Action and 1,649.8–2,051.6 acres of land (52.2%–64.9%) under Alternative C would remove a large area of land from this high FRCC rating and therefore help this area move toward a more natural fire regime.

4.5.8 Irreversible and Irretrievable Commitments of Resources

The protective measures detailed in Chapter 2 require the reclamation of disturbed areas following the completion of mining. Because vegetation resources would be restored or rehabilitated after the proposed disturbance and/or development, there would be no anticipated irreversible impacts on native vegetation resources or fire regimes associated with the management decisions proposed for the tract. However, there would be irretrievable impacts associated with the surface-disturbing activities proposed throughout the planning area. Any native, fire-resistant vegetation that would be removed or disturbed would be an irretrievable loss until successful restoration took place.

4.6 Geology and Minerals

Each action alternatives analyzed below includes a range of numbers relating to the 200-foot and the 300-foot overburden removal scenarios. Either scenario could result in a difference in impact numbers. Numbers are given as a range, with the first number referencing the 200-foot scenario and the second number referencing the 300-foot scenario.

The analysis area for geology and minerals is primarily the Alton Coal Tract under both the Proposed Action and Alternative C. However, the area north and northeast of the tract's underground mining portion, extending 405 feet beyond the tract boundaries (an area of approximately 166 to 109 acres outside the tract boundary) along its northern and northeastern edge, is also included (Map 4.1). This area is within what is known as the "angle of draw" or "angle of influence" (hereafter referred to as the angle of influence) for the underground mine portion of the tract. The angle of influence defines the extent of the surface area affected by ground movement that occurs as a result of removing coal from an underground mine where overlying rock layers are no longer supported by underlying coal removed during mining. Above the mine workings of an underground mine, rock movements occur vertically and at angles projected away from the mined-out area (PDEP 2008). The angle of influence varies from approximately 8°–45° depending on the coal field (Bell and Donnelly 2006). This analysis assumes that the angle of influence in this portion of the Alton Coal Field is a maximum of approximately 30°. This is the angle of influence presumed by the DOGM to be the maximum angle in the permitting process unless the permit applicant can demonstrate, and the DOGM can determine, that a site-specific angle of influence would be more appropriate (DOGM 2008a). Assuming 1) a 30° angle of influence (as stated), 2) that the overburden depth at the tract boundary is approximately 700 feet, and 3) that the land surface extending beyond the tract boundary is flat, approximately 405 feet of land surface (or approximately 166 to 109 total acres) beyond the north and northeastern edge of the tract (as mentioned above) would be affected by underground mining operations in the tract (see Figure 4.1 for an illustration of the angle of influence and an explanation of calculations).

4.6.1 Regulatory Framework

4.6.1.1 FEDERAL REGULATIONS

- The MLA authorizes and governs the leasing of public lands for developing coal, petroleum, natural gas, and other hydrocarbons, phosphates, and sodium in the United States.
- The Mineral Materials Act of 1947 authorizes the United States government to sell and lease mineral rights to common varieties of minerals.
- The Federal Land Policy and Management Act of 1976 requires that public lands be managed in a manner that will protect scientific, environmental, air and atmospheric, and water resource values. It also requires land-use plans to be in compliance with applicable pollution control laws, including state and federal air, water, and other pollution standards.

4.6.1.2 STATE REGULATIONS

- The Coal Mining Reclamation Act of 1979: Utah Rule R645 provides provisions pertaining to the effects of coal mining and reclamation operations and pertaining to coal exploration.
- Coal Mining and Reclamation; Utah Administrative Code 40-10 assures that surface coal mine operations are conducted to protect the environment, that reclamation of mine lands occurs promptly, and that mining operations are not conducted where reclamation is not economically or technologically feasible.
- The DOGM requires the identification of unsuitable overburden materials and selectively placing, mixing chemically, or mixing physically this material to minimize adverse effects to vegetation or groundwater.
- The DOGM requires analysis before mining to detect unsuitable overburden.
- The DOGM requires that topography be restored to AOC.

4.6.2 Alternative A: No Action

Under the No Action Alternative, the BLM would not issue a lease for coal in the Alton Coal Tract. Therefore, the geomorphological surface features, subsurface stratigraphy, and chemical and physical characteristics of the area would not change as a function of coal mining. The current land uses in the tract, which consist of recreation, livestock grazing, and vegetation treatments, would continue in a similar manner to current conditions. Their impacts to the area's geomorphology would remain similar to current conditions. The BLM's current management of burnt shale, gravel, fluid materials, and locatable minerals in and adjacent to the Alton Coal Tract would also remain unchanged as a function of coal mining.

4.6.3 Alternative B: Proposed Action

Under the Proposed Action, the BLM would hold a competitive lease sale for 49 million tons of coal in the Alton Coal Tract. Under this alternative, the tract includes approximately 3,576 surface acres, roughly 1,296 acres of which are private surface and 2,280 acres of which are federal surface. All coal resources contained in the tract are federally owned. Approximately 1,132 acres of the tract under the Proposed Action do not contain coal (the tract's no-coal zone). Under the Proposed Action, approximately 1,993– 2,395 surface acres would be disturbed. Of this total acreage, approximately 1,750–2,152 acres would be disturbed from pit disturbance (active mining operations), 36 acres would be disturbed for centralized facilities, 160 acres would be disturbed for dispersed facilities, 17 acres would be disturbed to temporarily relocate KFO Route 116. Additionally, subsidence disturbance could occur over approximately 211 to 513 acres of the underground mining area and approximately 166 to 109 acres outside the tract boundary but within the angle of influence.

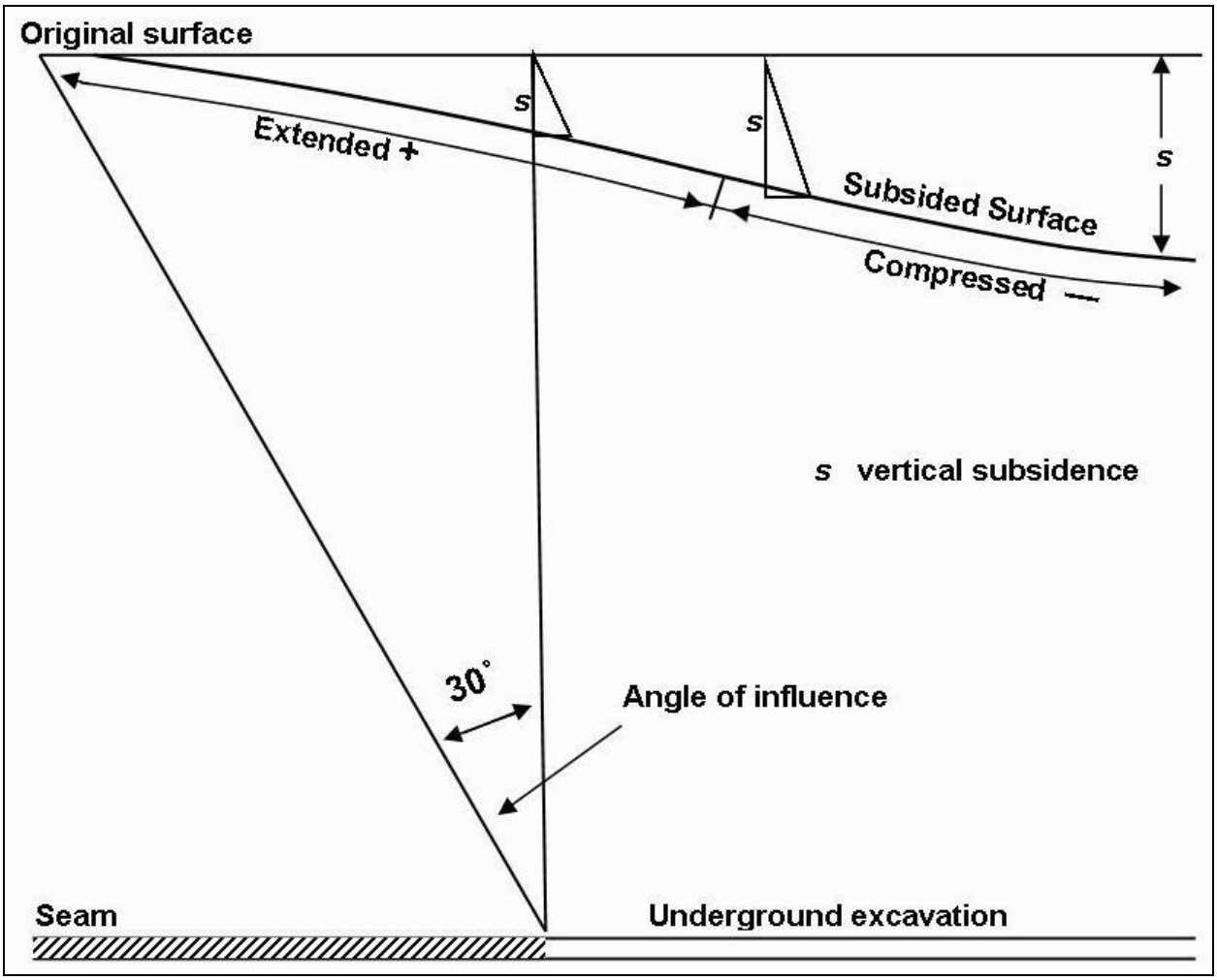

Figure 4.1. Angle of influence for underground mining (Modified from Bell and Donnelly 2006:91).
Note: The length of the land surface affected by underground mining operations, assuming that the surface is flat, was determined using the tangent function (tan A = o / a). Because the assumed angle of influence (A = 30˚) and the assumed length of the adjacent side or the overburden depth (a = 700′) are available, the length of the opposite side (o) or the land surface affected by underground mining operations was calculated by put ing the known numbers into the function to solve for the length of the opposite side equaling 404.13′.

4.6.3.1 IMPACTS TO GEOLOGY, INCLUDING TOPOGRAPHY, PHYSIOGRAPHY, AND STRATIGRAPHY

4.6.3.1.1 Impacts Due to Surface Mining

The surface-mining operation would remove coal and return noncoal material back into the pit on an estimated 1,750–2,152 acres (pit disturbance) under the Proposed Action. The geology of the mine pit area would be permanently altered. The replaced overburden material would be similar to pre-mining lithologies; however, the physical characteristics of the material, including permeability and stratigraphy, would be altered through the placement of a mixture of sizes and rock types back into the mined-out pit. The removal and relocation of the overburden would create a blend of the original geologic units. The stratigraphy of the area would also be permanently altered by the removal of the coal layer itself, which is currently a component of the stratigraphic arrangement of rock layers in the tract.

Like the geology of the mine pit area, the topographical expression of the land surface would be permanently altered. The PMT would be determined during the DOGM permitting process, but in general terms the land would be returned to AOC (unless a variance or exemption is granted by the DOGM). Alterations in final topography may be approved to improve wildlife habitat for species such as greater sage-grouse, mule deer, and elk. Other alterations in final topography may be approved based on the desires of private surface owners. According to DOGM regulations and procedures, variances or exemptions granted by the DOGM to approve alterations in final topography must follow a process that includes the opportunity for public comment. The removal of the coal seam (approximately 15 feet thick) would not significantly alter the original elevation of the area following reclamation because overburden and topsoil (after excavation and replacement in the mined-out pit) swell by a factor of approximately 30% (Personal Communication, Powell 2008). This swelling would compensate for the coal seam's removal. Although the replaced overburden and topsoil would settle slightly over time, the final ground surface elevation would not be significantly different from the tract's original elevation (Table 4.20).

Table 4.20. Calculation of Pre- and Post-mining Coal and Overburden Depths

	Current Conditions (feet)	Post Mining, Proposed Action (feet)	Post Mining, Alternative C (feet)
Overburden depth (approximate average)	100	120 (100 feet × 1.2 swell factor)	120 (100 feet × 1.2 swell factor)
Coal seam thickness (approximate average)	15	0	0
Total	**115**	**120**	**120**

Reclamation would therefore result in the replacement of overburden and topsoil and the regrading to AOC (or a contour suitable for post-mining land use subject to the DOGM's variance or exemption regulations and procedures), and may also include the forming of pits and valleys (gouging) on the surface. The outcome would be a gradual overall topography with moonlike surface microbasins of varying depth and width. The DOGM and BLM would approve the final gouge specifications as a function of growth medium properties.

Under the Proposed Action, surface-mining impacts to geology as described above would be long term and adverse because the tract's topography, physiography, and stratigraphy would be permanently altered after mining operations have ceased and after reclamation is complete.

4.6.3.1.2 Impacts Due to Underground Mining

Assuming that surface mining on the tract would be economically and technically feasible up to roughly 300 feet of overburden removal, underground mining would occur beneath approximately 211 surface acres of the tract under the Proposed Action. Assuming that surface mining would be feasible up to 200 feet of overburden removal, underground mining would occur beneath approximately 513 acres. Surface impacts from underground mining would generally be limited to the short-term placement of associated surface facilities and subsidence of the land above mined-out portions of the underground mine area and within the 30° angle of influence described above. At a minimum, underground mining operations on the tract would include building a portal, associated pad, and access route. The construction and placement of these facilities would typically require removing and stockpiling topsoil and overburden. However, because surface facilities for underground mining would be placed in areas previously surface mined, these impacts do not represent additional disturbances outside of those previously discussed. Upon completion of mining activities, just as with surface-mining operations, the facilities site would be reclaimed; facilities would be removed and the pit backfilled.

As underground mining operations proceed, removal of the coal would cause subsidence on portions of the Alton Coal Tract overlying the area of coal removal. Subsidence would be in the form of troughs and/or sink holes formed on the surface, depending in part on the underground mining method used. Overburden geological characteristics (the overall structure and strength of the materials contained in the overburden) also affect subsidence. Sink holes occur more commonly when room and pillar methods are used, whereas troughs are more typical of long-wall mining operations (PDEP 2008). The maximum extent of subsidence is a function of the coal seam thickness removed and a (unit-less) subsidence factor that ranges from 0.1 to 0.9 (Bell and Donnelly 2006). Subsidence factors in the western United States range from 0.33 to 0.65 (Bell and Donnelly 2006). To be conservative concerning potential impacts, this analysis assumes the higher of these values (0.65). Assuming that approximately 100% of the coal seam was removed (a conservative assumption for purposes of analysis), surface subsidence in the form of sinkholes and/or troughs directly above the area of coal removal would be up to approximately 9.75 feet. This is calculated by multiplying the thickness of the coal seam removed (15 feet) by the subsidence factor (0.65). In Utah, the effects of subsidence usually consist of surface cracks, general ground lowering, and cliff fracture or failure (Personal Communication, Smith 2008). Based on the 30° angle of influence previously described, the effects of subsidence would extend approximately 405 feet beyond the north and northeastern edge of the tract (for a range of 166 acres under a 300-foot overburden removal scenario to 109 acres under a 200-foot overburden removal scenario). A total of 679 to 320 acres including the 211 to 513 acres contained in the tract and the 166 to 109 outside of the tract boundary would be disturbed. Subsidence in this area would generally be less pronounced than in areas directly overlying those of coal removal (as illustrated in Figure 4.1), and would gradually taper toward the outside extent of this area. Surface impacts of underground mining as described would be permanent (long term) and adverse to the topography of the area because it would not be possible to resupport subsided areas. Impacts to stratigraphy from underground mining would also be permanent (long term) and adverse because the removal of the coal seam (a layer making up the stratigraphy of the area) and the lowering of subsided rock layers compared to surrounding rock layers that remain supported cannot be reversed. No mitigation measures for impacts to topography and/or stratigraphy are required by the DOGM. However, impacts to associated resources (e.g., water—surface and groundwater—which is the resource most commonly impacted by subsidence) would be repaired in accordance with DOGM rules and regulations and federal lease terms and stipulations. Mechanisms and methods used to repair damage to resources vary depending on the nature of the damage and the resource (Personal Communication, Burton 2008).

4.6.3.2 IMPACTS RELATED TO GEOLOGIC HAZARDS

4.6.3.2.1 Faults

The area around the tract has been shown to experience seismic activity of low frequency, ranging from magnitudes of 1.0–3.6 on the Richter Scale. The probability of seismic events associated with any or all of the faults in the area (see Section 3.6) impacting mining and reclamation operations at the Alton Coal Tract is fairly low (Personal Communication, DuRoss 2008). However, depending on the frequency and magnitude of seismic events and the stability of mine highwall construction, earthquakes could cause highwall failure (DuRoss 2008). Also, blasting activities would have the potential to initiate seismic activities on the tract. All highwalls and other mine-related structures would be required to comply with DOGM and MSHA safety regulations. Compliance with these regulations would limit or eliminate safety concerns with respect to seismic activity in the area.

The tract is shown on the USGS National Seismic Hazard Maps (USGS 2008) as having a 2% probability of exceeding a peak horizontal acceleration of between 20% and 30% of the acceleration due to gravity. This is above the 10% of gravity that is often assumed to be the threshold for damage to weak construction, such as unreinforced masonry buildings (Personal Communication, Pechmann 2008). Although these are not particularly high hazards, large earthquakes are possible throughout Utah. The hazard to workers and equipment in a mine from seismic events is highly dependent on local conditions. Where coal is exposed and

under considerable pressure, small events may cause considerable spalling (breaking up into chips or fragments) and other damage. If mines are stable, they may not experience any damage from large events (Personal Communication, Pechmann 2008).

In many parts of Utah where mining is common, the seismic hazard from mining-induced seismic events can be greater than that from natural events (Personal Communication, Pechmann 2008). The coal-mining process often induces seismic events due to subsidence, room collapse, and forces from the removal of coal and overburden. Seismicity associated with underground longwall mining of coal is strongly influenced by depth of cover, lithology of strata above and below the coal seam, and coal strength. Events ranging from 3.3 to 4.2 in magnitude have been observed at mines in the Wasatch Plateau–Book Cliffs region. Mining-induced events of up to magnitude 3.9 have been estimated as possible elsewhere in Utah (Arabasz et al. 2002), and would be possible under the Proposed Action.

4.6.3.2.2 Landslides

Landslide deposits are present at the Straight Cliffs/Tropic Shale contact (see Section 3.6). The deposits are located in a small portion of the tract's northwestern-most corner (see Map 3.9). At this contact, sandstone blocks of the Straight Cliffs Formation have moved onto the Tropic Shale. This condition has been facilitated by the presence of perched groundwater that has created a broad area of hummocky topography at the base of and adjacent to the Straight Cliffs (at the east of the Alton Amphitheater). Because these hummocky areas tend to hold moisture and because seeps are common, the potential for landslides exists where the Straight Cliffs/Tropic Shale is at or near the surface (Tilton 2001). Furthermore, blasting activities on the tract can initiate landslides in this area of the tract. Therefore, landslide hazards exist under the Proposed Action for structures that are built on or next to landslide deposits.

4.6.3.3 IMPACTS TO MINERAL RESOURCES

4.6.3.3.1 Leasable Minerals

4.6.3.3.1.1 Coal

The direct impact of the Proposed Action would be the production of up to approximately 44.9–49.1 million tons of recoverable coal from federal mineral reserves in the Alton Coal Tract over the 25-year life of the mine (2 million tons per year of coal removal). This would represent the removal of approximately 4%– 5% of the total estimated recoverable coal reserves (1 billion tons) in the Alton Coal Field. Impacts to coal reserves would be permanent and adverse because coal resources extracted from the tract cannot be replaced, and extraction would result in a permanent depletion from the total coal reserve in the Alton Coal Field.

4.6.3.3.1.2 Oil and Gas

Under the Proposed Action, the primary impact on oil and gas resources would be their temporary unavailability for extraction due to coal mining (unless directionally drilled from beyond active coal-mining areas). If oil and gas resources are currently present in geologic formations beneath the tract (well below the Smirl Coal Zone that would be mined), they would remain in these formations for the life of the mine or longer under the Proposed Action. The development of oil and gas resources would be more likely under the No Action Alternative than under the Proposed Action because no conflict between coal development and oil and gas exploration and development would occur under No Action.

Although coal-mining operations on the tract under the Proposed Action would not result in releases of oil and gas reserves, operations would cause the direct release of CH4 located in air pockets of the coal reserves (referred to as coalbed CH4). This CH4 is not currently considered recoverable; therefore, there

would be no impact to commercial coalbed CH4 based on its current market conditions. However, a long-term adverse impact to this resource would result because, once released, coalbed CH4 contained in the Smirl Coal Zone cannot be restored, and any potential for recovery would be lost.

4.6.3.3.2 Salable Minerals

4.6.3.3.2.1 Burnt Shale

Because most of the burnt shale deposits in the tract have been or would be mined by the time a decision is made by the BLM on this EIS, direct impacts to burnt shale resources are unlikely. However, if mining operations expose burnt shale in the tract, they would likely be lost as economically recoverable resources due to mixing with other overburden during reclamation. If segregated from other overburden sufficiently, they may remain usable.

Although most of the salable burnt shale deposits have been previously mined, there are other known, unmined deposits west of the tract. The BLM may need to resolve any conflicts that could arise if there is interest in this deposit in the future (such as the proposed access route to the site) that could interfere with burnt shale mining operations. Thus, the only impacts to burnt shale deposits beyond the tract would be more difficult access; the actual resource would not be adversely impacted or removed. Impacts to access and local economies are discussed in Section 3.8, Land Use and Access, and Section 3.12, Socioeconomics.

4.6.3.3.2.2 Gravel

Salable pediment gravels in the tract would be directly impacted under the Proposed Action due to mixing with other overburden following surface mining. It is not known how many areas of salable gravel are present in the tract; therefore, impacts to gravel are assumed to correspond to the total acreage that would be surface mined and uniformly spread over the entire area.

4.6.3.3.3 Locatable Minerals

4.6.3.3.3.1 Septarian Nodules

It is not known how common septarian nodules are in the tract, or if they are present in sufficient density to be economically viable for development. However, any nodules present at or near the surface in areas that would be surface mined would be at risk of burial during reclamation, and therefore may be less accessible for development. The nodules would not be removed and would therefore still be available as a resource, but their development would likely be less economically viable and their concentration in any area would likely be reduced.

4.6.3.4 UNDERGROUND COAL FIRES

The likelihood of spontaneous combustion and underground fires on the tract was assessed by the BLM Utah State Office in November 2010 using two points 1) the U.S. Bureau of Mines software program (now under the National Institute for Occupational Health and Safety [NIOSH]) and 2) historical data and coal history of the tract. This technical report can be found in the *Alton LBA EIS – Coal Spontaneous Combustion Technical Report*, which is part of the administrative record for this EIS.

Multiple runs of the NIOSH software resulted in a spontaneous combustion rating of “high” for the Smirl Coal Zone (the seam proposed for mining under both the Proposed Action and Alternative C). This indicates that the coal is highly susceptible to spontaneous combustion and rapid oxidation leading to smoke or open flames. However, historical reviews of the coal history prepared by Doelling and Graham (1972b) and site visits have not shown any indication of past coal mine fires near the tract. In addition, past mining of the Smirl Coal Zone

in and near the tract has occurred at very shallow depths with more exposure of the coal to atmospheric oxygen. These shallow mines have a higher potential for spontaneous combustion than the deeper underground mining that would occur under both action alternatives. The lack of evidence of fires at this site suggests that the risk is lower for the Alton Coal Tract than shown in the NIOSH results (McKenzie 2010).

The BLM required R2P2 would address:

- The monitoring and prompt control of any coal fires in surface coal pits, spoil piles, and surface coal stockpiles.
- Standard and, as necessary, enhanced monitoring of underground mine conditions to provide warning of possible mine fires (for both mine safety and environmental considerations).
- The design of underground workings to provide necessary, minimum overburden cover prior to commencing full extraction mining techniques and to ensure first mining efforts do not lead to introduction of atmospheric oxygen along fractures and/or bedding planes unless the actual conditions show the coals are stable.

This risk would be the same under Alternative C.

4.6.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts to geology (topography, physiography, and stratigraphy), impacts related to geologic hazards, and impacts to mineral resources would be the same in nature under Alternative C and the Proposed Action. Impacts would vary between Alternative C and the Proposed Action in terms of the total amount of coal mined, the total amount of disturbed acres, and the life of the mine. The key differences between Alternative C, the Proposed Action, and the No Action Alternative are shown in Table 4.21.

Table 4.21. Comparison of Impacts under the No Action Alternative, the Proposed Action, and Alternative C

Resource Type	Impact Type	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
Topography, physiography, and stratigraphy	Acres surface mining	0	1,750–2,152	1,454–1,856
	Acres underground mining	0	513–211	513–211
	Acres within the angle of influence	0	166–109	166–109
Geologic hazards	Fault hazard from underground mining	No	Yes	Yes
	Landslide risk	Low	Low	Low
Leasable mineral resources	Production of coal	None	44,900,000–49,100,000 tons	38,100,000–42,300,000 tons
	Impacts to fluid minerals	None	Decreased likelihood of removal due to mining activities	Decreased likelihood of removal due to mining activities
Salable mineral resources	Burial of burnt shale	None	Possible burial	Poss ble burial
	Burial of gravel	None	Possible burial	Poss ble burial
Locatable mineral resources	Damage or burial of septarian nodules	None	Poss ble damage or burial	Possible damage or burial

Under Alternative C, the BLM would hold a competitive lease sale for 38–42 million tons of federal, recoverable coal reserves (approximately 4% of the estimated one billion tons of recoverable coal reserves present in the Alton Coal Field, and 14%–15% less than under the Proposed Action) in a modified tract; the tract would exclude Block NW under the Proposed Action. Mining operations under Alternative C would result in approximately 1,454–1,856 acres of disturbance from surface mining (14%–17% less than under the Proposed Action), approximately 36 acres of disturbance for centralized facilities (the same as under the Proposed Action), approximately 135 acres of disturbance for dispersed facilities (16% less than under the Proposed Action), approximately 13 acres of disturbance for relocation of KFO Route 116 (24% less than under the Proposed Action), and approximately 679 to 320 acres (including the 211 acres in the tract) of surface disturbance from underground mining operations (the same as under the Proposed Action). The life of the mine under Alternative C would be approximately 21 years, or 16% less than under the Proposed Action. The no-coal zone under Alternative C would be approximately 1,034 acres. The suite of impacts associated with Alternative C would be smaller than that of the Proposed Action because the total acreage of the tract would be smaller.

4.6.5 Potential Mitigation Measures

The following mitigation measures could be used to reduce geologic hazards or impacts to geology and minerals associated with the implementation of the Proposed Action or Alternative C.

- Consider the mine and reclamation plan sediment pond location in relation to geologic hazards to reduce the risk of failure in the event of a seismic event.
- Develop a regularly scheduled subsidence survey and post a bond commitment to repair damage.
- Segregate the deposits if mining operations expose burnt shale.
- Segregate the deposits if mining operations expose gravel.

4.6.6 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts under the No Action Alternative. Under the action alternatives, the following adverse impacts would be unavoidable (i.e., they could not be mitigated):

- Mining operations would unavoidably remove between 42.3 and 44.9 million tons of coal from the tract. This coal would not be replaceable and mining operations would result in a permanent depletion of the coal reserves in the tract.
- The topography, physiography, and stratigraphy of the tract would be permanently altered after mining operations ceased and reclamation was complete.
- Subsidence due to underground mining would adversely impact the topography of the area; it would not be possible to resupport subsided areas. Impacts to stratigraphy as a function of underground mining would also be unavoidable due to removal of the coal seam and the lowering of subsided rock layers compared to surrounding rock layers.
- Coalbed CH_4 contained in the Smirl Coal Zone would be released.

4.6.7 Short-term Uses versus Long-term Productivity

In the short term, the removal of between 42.3 and 44.9 million tons of recoverable coal would eliminate the future production of the Alton Coal Tract in this specific area. A defining characteristic of nonrenewable resources such as coal is that their use in the near-term eliminates their future use. However, the short-term use of the coal in the tract would not impact the long-term productivity of the remaining coal present in the Alton Coal Field.

4.6.8 Irreversible and Irretrievable Commitments of Resources

There would be no irretrievable impacts to geology and mineral resources under the Proposed Action or Alternative C. However, the following commitments of geological and mineral resources would be irreversible and could not be recovered under the action alternatives:

- The topography, physiography, and stratigraphy of the tract would be permanently altered after mining operations ceased and reclamation was complete.
- Subsidence due to underground mining would adversely impact the topography of the area; it would not be possible to resupport subsided areas.
- Impacts to stratigraphy from underground mining would also be irreversible due to production of the coal seam (a layer making up the stratigraphy of the area) and the lowering of subsided rock layers compared to surrounding rock layers.
- If mining operations expose burnt shale in the tract, these resources would likely be lost as economically recoverable resources due to mixing with other overburden during reclamation. If segregated from other overburden sufficiently, they may remain usable but may be reduced in value.
- Once released, coalbed CH_4 reserves contained in the Smirl Coal Zone cannot be regained.
- The production of up to approximately 42 or 49 million tons of recoverable coal from federal mineral reserves in the Alton Coal Tract over the 21- or 25-year life of the mine would be permanent and adverse because coal resources extracted from the tract cannot be replaced once mined, and extraction would result in a permanent depletion from the total coal reserve in the Alton Coal Field.
- Without potential mitigation, pediment gravels, derived mostly from the erosion of the Tropic Shale, would be irreversibly mixed with other overburden following surface mining.

4.7 Hazardous Materials and Hazardous and Solid Waste

Under the action alternatives, sources of hazardous materials on the Alton Coal Tract would include liquid wastes, fuels such as diesel fuel and gasoline (potentially containing benzene, toluene, xylene, methyl tert-butyl, ether, and tetraethyl lead), coolants, antifreezes, lubricants such as motor oil and grease (potentially containing complex hydrocarbons and lithium compounds), paints, solvents, and solid wastes. Nonhazardous solid wastes would include floor sweepings, shop rags, lubricant containers, welding rod ends, metal shavings, worn tires, packing material, used filters, and office and food wastes. Solid wastes would include human waste from portable toilets and waste pumped from permanent toilets with sealed containment tanks.

Hazardous and solid materials and their related impacts are assessed using the number of vehicles in use at the site, the number of vehicles refueling, and the number of vehicles transporting hazardous materials to and from the site. Impacts under the action alternatives would be minimal because solid and hazardous wastes would be controlled through SOP. In addition, management of hazardous materials, substances, and waste, in addition to nonhazardous solid waste practices (including storage, transportation, and spills) would be conducted on the tract according to the procedures listed in Section 2.3.2.7 and in compliance with 29 CFR 1910, 49 CFR 100–185, 40 CFR 100–400, Comprehensive Environmental Response, Compensation, and Liability Act, Resource Conservation and Recovery Act, Superfund Amendments and Reauthorization Act, Toxic Substances Control Act, CWA, and other federal and state regulations and policies regarding hazardous materials management and solid waste management. Public land sites contaminated with hazardous and/or solid wastes would be reported, secured, and remediated according to applicable federal and state regulations and contingency plans (BLM 2008b).

4.7.1 Regulatory Framework

Minimizing the risks associated with hazardous materials is required by federal law (see Section 2.3.2.7 and Table 2.3). The measures listed below would be common to both action alternatives and are also discussed in Chapter 2. The minimization of risks would require the application of safety precautions during their transport, use, storage, and disposal. As required by law, the following precautions would be implemented as mitigation and prevention of hazardous materials and liquids spills or leakages.

- Used oil would be contained and recycled according to Utah Department of Environmental Quality Solid and Hazardous Waste Division guidelines.
- Solid waste and sewage within permit boundaries would be disposed of according to approved plans.
- All production, use, storage, transport, and disposal of hazardous waste would be in accordance with applicable existing or hereafter promulgated federal, state, and government requirements.
- Emergency reporting requirements for releases of hazardous materials, as established in Comprehensive Environmental Response, Compensation, and Liability Act, as amended, would be complied with.
- Files containing Material Safety Data Sheets for all chemicals, compounds, and/or substances used during the course of mining would be maintained.

The lessee would be expected to prepare and implement several plans and/or policies to ensure environmental protection from hazardous and extremely hazardous materials. These plans and/or policies would include the following:

- Spill prevention control and countermeasure plans
- Spill response plans
- Inventories of hazardous chemical categories pursuant to Section 312 of the Superfund Amendments and Reauthorization Act, as amended
- Emergency response plans

4.7.2 Alternative A: No Action

Under the No Action Alternative, ACD’s application to lease the coal included in the tract would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined.

No coal mining activities or infrastructure development would occur on the tract under the No Action Alternative, and therefore there would be no transportation, use, production, or risk of hazardous materials or hazardous and solid waste spills or leaks as a function of mining. Under the No Action Alternative, lands in the tract would continue to be managed in accordance with the KFO RMP. Land management in the tract currently includes livestock grazing, recreation (primarily OHV use and hunting), and vegetation treatments. These current uses could result in the introduction of fuel and lubricants to the tract. However, quantities would be minimal, largely resulting from minimal, dispersed use of the area by motorized recreationists and livestock grazing permittees accessing allotments by vehicle (generally truck or OHV).

4.7.3 Alternative B: Proposed Action

Mining activities under the Proposed Action would take place over approximately 25 years. Centralized facilities would occupy approximately 36 acres of land under this alternative. Another 160 acres would be used for construction of dispersed facilities, leading to 196 acres of constructed facilities. Under the Proposed Action, these acres would be subject to hazardous materials exposure for 25 years. However, adherence to SOPs and legal requirements would minimize or eliminate risks of hazardous material spills and contamination.

Under the Proposed Action, an estimated 153 coal haul vehicle round-trips per day would occur on the coal haul transportation route. In addition, service vehicle visits to the tract would supply the mine with diesel fuel, machine equipment, office supplies, and other necessary materials. Service vehicle visits would also remove solid waste from dumpsters, remove other nonsolid wastes (such as used motor oil), and would service portable toilets and permanent toilet sealed containment tanks. This increased movement to and from the tract by service vehicles and coal haul trucks has the potential to increase the risk of fuel leakage or solid waste spills in the tract and adjacent transportation corridors. Risks of fuel leakage and spills are associated with coal truck accidents, transportation during service, refueling of vehicles, and the maintenance of vehicles used on-site. Transportation during service operations on the tract would include delivery of diesel fuel and machine and equipment parts (daily or weekly), servicing of portable toilets (weekly or biweekly), servicing of permanent toilet facilities (monthly or bimonthly), and removal of waste oil (weekly or biweekly), as necessary. Maintenance and major oil changes for most moveable equipment would take place inside the maintenance shop, and used oil would be contained and disposed of or recycled in accordance with Utah Department of Environmental Quality Solid and Hazardous Waste Division guidelines. Accidental or inadvertent leakages from storage tanks would also be possible.

If they are not contained and quickly cleaned up, leaks or spills of hazardous materials from the aforementioned activities would impact vegetation and wildlife by killing individuals and/or poisoning habitat resources or prey. Spills would also contaminate soil and water resources. Spilled fuel or other hazardous waste or materials could be transported through soils or water to aquifers or to surface waters in or outside of the tract, increasing the potential for both short-term and long-term adverse effects on vegetation, terrestrial and aquatic wildlife, and habitat quality in the tract.

4.7.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts would be the same as those described under the Proposed Action with the following exceptions. Under Alternative C, the tract would be modified to exclude Block NW (see Map 2.1). The acreage of dispersed facilities constructed would be fewer than under the Proposed Action, and therefore the associated risks, such as fuel leakage and storage tank leakage, would be smaller under this alternative.

Mining activities under this alternative would take place over approximately 21 years, which is three years shorter than under the Proposed Action. Centralized facilities would occupy approximately 36 acres of land under this alternative. Another 135 acres would be used for construction of dispersed facilities, leading to 170 acres of constructed facilities. Under Alternative C, adherence to SOPs and legal requirements would minimize or eliminate risks of hazardous material spills and contamination.

4.7.5 Potential Mitigation Measures

No potential mitigation measures, beyond legal and regulatory requirements, have been identified for hazardous materials and hazardous and solid waste.

4.7.6 Unavoidable Adverse Impacts

No unavoidable adverse impacts would occur because SOPs and mitigation measures would be followed.

4.7.7 Short-term Uses versus Long-term Productivity

No further risk of hazardous materials or liquid spills or leakages would exist at the close of mining operations, and therefore no long-term adverse effects on productivity of the site are anticipated.

4.7.8 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitments of resources with respect to hazardous materials and hazardous and solid waste associated with mining.

4.8 Land Use and Access

4.8.1 Land Use and Ownership

Primary land uses in and adjacent to the Alton Coal Tract include tourism, farming, livestock grazing, and dispersed recreation including hunting. In addition, Alton Coal operates the Coal Hollow Mine east of Block S.

Impacts to land use and access were analyzed by determining which existing land uses would conflict with proposed mining activities. Land uses would be affected because public access would be eliminated during the life of the mine to ensure public safety. Land use would also be restricted during the post-mining reclamation period (10 years) to assist in the establishment of suitable vegetation. Disturbance from mine-related activities would include pit disturbance, grading for the construction and maintenance of centralized and dispersed facilities, and the relocation of KFO Route 116. Impacts from these activities are grouped together because the impacts to land use would result from a combination of all mine-related activities, and not specific aspects of each activity. Grazing and recreational activities in the tract would be prohibited from active mine areas for the life of the mine and the 10-year reclamation period. Tourism (sightseeing) would not be prohibited or restricted by mining activities because access to other federal lands in the area would still be available.

4.8.2 Regulatory Framework

The Federal Land Policy and Management Act of 1976 ensures that public lands are managed for multiple uses to best meet the present and future needs of the public. The KFO RMP identifies management direction for land uses in the area in the form of goals and objectives; “Make public lands available for ROWs, permits, and leases. The suitability for these land actions would be judged on a case-by-case basis.” (BLM 2008b; 2-44)

Although private lands in the tract are zoned for agriculture under the Kane County, Utah General Plan (FCAOG 1998a), uses are regulated by land-use ordinances and the general plan is used as an advisory guide for land-use decisions.

Under both action alternatives, BLM-administered lands in the tract would be reclaimed and suitably restored for historic uses such as livestock grazing, wildlife habitat, and recreation. Private lands would be reclaimed and suitably restored to allow existing land uses to be resumed following mining. Post-mining land uses may differ from those presented here; however, their approval would require a process and approval by DOGM.

4.8.3 Alternative A: No Action

Under the No Action Alternative, land use, ownership, and prior rights to the tract would remain unchanged. The tract would not be mined and activities in the area would continue under their current condition. Dominant activities such as grazing, recreation, and vegetation treatments in the area would not be impacted as a function of mining on the tract.

4.8.4 Alternative B: Proposed Action

Under the Proposed Action, 3,576 acres of surface disturbance would occur on federal and private lands (Table 4.22). Because the area is of mixed uses, some of the acres of impacts overlap.

Surface-mining activities would results in short-term impacts under the Proposed Action; livestock grazing would be restricted, wildlife habitat would be reduced, and public access and associate recreational use would be restricted. During the life of the mine, adjacent federal lands would support livestock grazing and recreation (e.g., hunting and OHV use).

There would be no long-term impacts under the Proposed Action; surface and vegetation in the tract would be reclaimed, and the land would be returned to a condition similar to its original status. The land would reopen to grazing, hunting, and other recreational opportunities that existed before the mine.

Table 4.22 illustrates the dominant land uses in the tract and the impacts that would occur from mining activities under the Proposed Action.

Table 4.22. Land Uses Impacted in the Alton Coal Tract under the Proposed Action

Affected Land Use	Type of Use	Impact
Grazing	Livestock, mainly cattle, for grazing and forage.	Loss of or unavailable access to approximately 92 AUMs annually (3,220 AUMs over the life of the mine and the 10-year reclamation period), due to mining activities (see Section 4.9 for additional information).
Agriculture	Farming	Loss of acres available for agriculture during the active mining period.
Recreation	Hunting and OHV use, common in and adjacent to the tract.	Unavailable access to lands for recreational use (throughout the life of the mine). Impacts to recreation experience by increased traffic, noise, and dust (see Section 4.11 for additional information).
Tourism	Visits to nearby park areas such as Bryce Canyon National Park, Grand Staircase-Escalante National Monument, and two scenic highways.	Neglig ble impacts to tourism from mining activities (see Section 4.12 for additional information).

4.8.4.1 FEDERAL LANDS

Under the Proposed Action, the primary use of federal lands would be coal extraction. Coal mining would preclude other possible uses of the land, making them unavailable during the life of the mine. Approximately 2,280 surface acres (64%) of the tract that would be unavailable for other uses under the Proposed Action are federally owned. Surface-disturbing activities to these lands would include the removal of vegetation, which would result in

- impacts to agriculture by removing acres available for crops,

- impacts to grazing by decreasing AUMs available for forage, and
- impacts to recreation from increased traffic, noise, and dust, diminishing the experience and opportunities available.

Although mining activities may be noticeable to those visiting the nearby Dixie National Forest, Bryce Canyon National Park, and Grand Staircase-Escalante National Monument, it is not anticipated that the increased traffic, noise, and dust resulting from the mine would decrease the overall experience of visitors enough to affect visitation to these areas. Two-track roads also exist throughout the tract for OHV use and hunting access.

4.8.4.2 PRIVATE LANDS

All coal reserves in the tract are federally owned, though surface ownership is mixed and mine activity would result in surface disturbance to private lands. Approximately 1,296 surface acres (36%) of the tract under the Proposed Action are privately owned, consisting of eight different private surface owners. Private land uses in the tract and surrounding land include agriculture, domestic grazing, and dispersed recreation. Two-track roads also exist throughout the tract for private landowner access to private surface lands.

Impacts resulting from surface disturbance on private lands would be the same as those described under federal lands. Impacts to counties from mining activity would be the temporary loss of lands that are zoned for activities such as agriculture, grazing, and recreation. Lands available for these uses would be removed for 25 years while mining activities took place; however, they would be available for use during the 10-year post-mining reclamation period. These activities are in compliance with the *Kane County, Utah General Plan*, which allows lands to be open for mineral exploration and development (FCAOG 1998a). Additionally, the Alton town cemetery is located 780 feet from the tract boundary. At this distance, it is not anticipated that any impacts would occur to the cemetery from mining activities.

4.8.5 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts to land use under Alternative C would be similar to those described under the Proposed Action, but to a slightly lesser degree. The nature of activities would be the same under both alternatives; however, Alternative C would propose to mine 403 fewer acres (removal of Block NW) of private lands than Proposed Action. Additionally, the life of the mine would be 21 years plus the 10-year reclamation period (31 years).

The shorter timeframe would result in a loss of 2,852 AUMs, which is 368 fewer than under the Proposed Action over the life of the mine and reclamation period. Additionally, the Alton town cemetery would be located 6,380 feet from tract boundary, which would create less of an impact than under the Proposed Action.

4.8.6 Potential Mitigation Measures

No potential mitigation measures are proposed to address land-use conflicts resulting from mining activities.

4.8.7 Unavoidable Adverse Impacts

Unavoidable adverse impacts would include the loss of use and access to the tract for described land uses during the life of the mine. After mitigation, the described land uses would be lost until reclamation is complete.

4.8.8 Short-term Uses versus Long-term Productivity

It is not anticipated that the short-term use of the area for mining would adversely affect the long-term productivity of land uses. Mining activities would temporarily make the area unavailable for the existing land uses and access for agriculture, grazing, and recreation; however, in the long term, the area would be reclaimed to its approximate original condition, and uses would resume as they had previously existed.

4.8.9 Irreversible and Irretrievable Commitments of Resources

The removal of coal from the tract would be an irreversible commitment of resources because this coal cannot be regenerated. Measures would be implemented to return the area to its approximate pre-mining condition following coal mining, making the loss of opportunities for other land uses irretrievable, but not irreversible. The land status and prior rights to the land would remain unchanged during the life of the mine.

4.9 Livestock Grazing

Impacts to livestock grazing were analyzed by determining how proposed mining activities would conflict with existing grazing activities. Grazing and access would be eliminated during the active mining period to ensure public safety. It would also be restricted during post-mining reclamation to assist in establishing suitable vegetation. Because access to the tract would be restricted, the livestock grazing analysis area consists of all acres of allotments on the tract; impacts were not analyzed by specific acres of vegetation removed (these impacts are discussed in Section 4.15, Vegetation). Disturbance from mine-related activities would include pit disturbance, grading for the construction and maintenance of centralized and dispersed facilities, and the relocation of KFO Route 116. Impacts from these activities are grouped together because the impacts to land use would result from a combination of all mine-related activities, and not specific aspects of each activity.

4.9.1 Regulatory Framework

The Federal Land Policy and Management Act of 1976 ensures that public lands are managed for multiple uses, including livestock grazing, to best meet the present and future needs of the public. The KFO RMP includes standards and guidelines for grazing management. These standards and guidelines provide management direction and the necessary regulatory framework for livestock grazing. Alternatively, they can be found on the Utah BLM website (BLM 2008b). If changes to public land use restrict livestock grazing, 43 CFR 4110.4-2 requires that permittees be notified two years in advance and receive compensation for authorized permanent range improvements.

4.9.2 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal in the Alton Coal Tract would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined. Therefore, under the No Action Alternative, there would be no impacts to livestock grazing as a function of coal mining; vegetation would be unaffected by mining, and grazing practices would remain unchanged. Grazing activities would continue to be managed as described in the KFO RMP (BLM 2008b). Impacts to livestock grazing from other land uses such as recreation and vegetation treatments would continue similar to current conditions.

4.9.3 Alternative B: Proposed Action

Mine-related surface activities on the tract would consist of land clearing, the construction of dispersed facilities, and the relocation of KFO Route 116. These would result in a short-term loss of vegetation access because livestock would be restricted to areas without mining activity throughout the life of the mine (25 years) and during the 10-year reclamation period. For purposes of analysis, it is assumed that grazing in the tract would be unavailable for 35 years; therefore, the allotments in the tract would be considered nonuse. Therefore, even in areas in the tract that would not be disturbed for mine-related activities, it is assumed that the use of available AUMs, existing water sources, and livestock facilities would be lost for the life of the mine and reclamation period. This approach provides the most conservative estimate of livestock grazing impacts for phased mining operations given that specific locations and timing of mining and reclamation activities are not available at this time.

Table 4.23 illustrates the total acres of disturbance and the percentage of allotments that would be affected by the Proposed Action.

Table 4.23. Acres of Vegetation Impacted by Mining Activities, by Alternative

	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
Acres of vegetation disturbance	0	1,815–2,217	1,515–1,917
Percentage of total allotments*	0%	22%–27%	18%–23%

*The total federal acreages of allotments is 8,222.

Assuming that that the annual disturbance would remain the same throughout the life of the mine, the Proposed Action would result in the loss of or restricted access to 1,815–2,217 acres of vegetation. This represents 22%–27% of the total acres in all seven allotments (see Table 4.23).

Total acres of allotments are used to calculate the number of AUMs using the number of AUMs allocated and the percentage of AUMs that lie in the tract. To determine overall impacts to forage available for grazing (AUMs) from the Proposed Action, the number of AUMs impacted is compared to the total number of AUMs available in each of the allotments. Table 4.24 shows the number of AUMs that would be lost per grazing allotment from restricted access, as well as the overall percentage that those AUMs represent for the entire allotment.

Table 4.24. Allotment Acreages and Animal Unit Months in Alton Coal Tract

Allotment	Season of Use	Number of Permittees	Total AUMs Allocated to Livestock Annually	Percentage of Allotment in the Tract	Calculated AUMs in the Tract	AUMS Allocated to Livestock over the Life of the Mine and the Reclamation Period		AUMS lost over the Life of the Mine and the Reclamation Period	
						B (35 years)	C (31 years)	B (35 years)	C (31 years)
Alton	6/1/2010–10/31/2010	1	5	99%	5	175	155	175	155
Cove (Alton)	6/1/2010–10/31/2010	1	10	99%	10	350	310	350	310
Isolated Tracts	5/16/2010–10/31/2010	1	67	24%	16	2,345	2,077	560	496
Levanger Lakes	6/1/2010–11/15/2010	1	33	23%	8	1,155	1,023	280	248
Robinson Creek	6/1/2010–11/30/2010	1	24	40%	10	840	744	350	310
Syler Knoll	5/1/2010–10/31/2010	1	6	82%	5	210	186	175	155
Upper Sink Valley	6/1/2010–10/15/2010	1	311	12%	38	10,885	9,641	1,330	1,178
Total		**7**	**456**	**26%**	**92**	**15,960**	**14,136**	**3,220**	**2,852**

The Proposed Action would restrict or prohibit access to approximately 92 AUMs annually for seven permittees (see Table 4.24). Assuming that permits and seasons of use would remain the same over the life of the mine, approximately 3,220 AUMs would be lost over 35 years. The Proposed Action would have greater impacts to grazing than both Alternative C and the No Action Alternative. During mine-related activities, the direct loss of livestock from vehicle collisions along transportation routes would be uncommon.

Indirect effects resulting from the spread of noxious weeds would adversely affect livestock because they cannot depend on these species for forage (BLM 1996). Additionally, effects to vegetation resulting from tract construction may result in increased dust on vegetation, which can also reduce forage palatability.

4.9.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts under Alternative C would be similar to those under the Proposed Action because the activities and acres of allotments and restrictions are the same for livestock grazing resources. However, access under Alternative C would be restricted for 31 years (21-year mine life plus 10-year reclamation period) instead of the 35 years under the Proposed Action. Alternative C would therefore impact 368 fewer AUMs and 290 fewer vegetation acres over the life of the mine and reclamation period. The impacts from Alternative C would have greater impacts to grazing than the No Action Alternative, which would impact 0 AUMs.

4.9.5 Potential Mitigation Measures

Although no specific mitigation measures have been proposed for livestock, measures committed for vegetation reclamation would benefit livestock through either preservation or reclamation of forage. Reclamation measures proposed for vegetation that would benefit livestock consist of

- permanently revegetating reclaimed areas according to a comprehensive revegetation plan using approved reclamation seed mixtures consisting of suitable native and non-native species;
- using native shrubs for reclamation;
- prior to seeding with final seed mixture, controlling erosion on reclaimed lands using mulching, cover crops, or other approved measures;
- chemically and/or mechanically controlling weed infestation;
- selectively planting shrubs in riparian areas; and
- planting sagebrush seedlings in addition to seeding with sagebrush.

4.9.6 Unavoidable Adverse Impacts

The loss of access and land available for livestock grazing during the life of the mine would result in unavoidable adverse impacts to livestock grazing during the life of the mine and during reclamation.

4.9.7 Short-term Uses versus Long-term Productivity

Short-term uses associated with proposed mine-related activities (e.g., roads, grading, and vegetation removal) would reduce the forage productivity and available AUMs until the disturbances were successfully reclaimed. Overall, impacts to long-term productivity resulting from these activities would be minimal due to the limited overall percentages that would be impacted by both action alternatives.

4.9.8 Irreversible and Irretrievable Commitments of Resources

Assuming that the entire tract would be unavailable for access and any activities other than mining during the life of the mine, irretrievable impacts would include the loss of livestock forage and access to allotments for several years until reclamation is successful. Irreversible impacts would include livestock mortality from collisions, should any occur.

4.10 Paleontology

Direct impacts to fossil resources from the Proposed Action and Alternative C would consist of the following:

- The physical loss of the resources through physical damage, destruction, and/or through extraction, weathering, or unauthorized collection after extraction.
- The loss of important contextual data for the resources if they are excavated without documentation of their stratigraphic horizon (age) and environment of deposition (taphonomy). Their value to science and to the public would be permanently degraded.

Either outcome would significantly impact the value and state of paleontological resources in the area. For paleontological resources, all impacts would be long term because they would persist for the life of the mine and following reclamation.

Surface mining methods under the 200-foot overburden removal scenario would result in fewer disturbed acres from surface mining. Surface mining methods under the 300-foot overburden removal scenario would result in greater disturbed acres.

4.10.1 Regulatory Framework

Certain types of mitigation would be mandatory because of the significance of the fossil resource in the Alton area. Three mitigation measures would be employed to ensure reasonable benefit to the fossil resource.

As per the Federal Land Policy and Management Act, 43 CFR, 8365.1–5, and the BLM Manual H-8270-1 (General Procedural Guidance for Paleontological Resource Management), the first measure would be to salvage significant in-situ specimens if they are discovered by mining personnel or qualified monitors during mining operations. Significant in-situ specimens are the most important specimens from both a scientific and public perspective because they have the most potential to be complete and in their original context. If potentially significant fossil remains are discovered, the mine operator (successful bidder) or qualified paleontological monitor would immediately notify the BLM-KFO paleontologist or their designated authority and protect the discovery from damage or looting, suspending all activities in the immediate vicinity of such discovery until the site can be evaluated by the BLM-KFO paleontologist or their designated authority. Next, a determination would be made as to whether the specimen is worth salvaging. Under normal circumstances, determinations would be completed within 24 hours of notification by the mine operator. If the specimen is determined to be of scientific significance and worth collecting, the BLM-KFO paleontologist, their designated authority, or a qualified paleontological consultant chosen by the mine operator would initiate scientific collection of the specimen. This would be completed within 72 hours of determination. Specimens would be housed at the Utah Museum of Natural History (UMNH) for the public benefit. Collection and curation costs of large specimens, which averaged $2,000–$5,000 in 2008 for a large specimen, would be borne by the mine operator. Costs for surface collection and curation of small specimens (1 m or less) would be borne by the BLM and the UMNH, the official BLM repository for Utah. Final determination on significance of smaller in-situ specimens would be made by the UMNH.

The second measure of mitigation would involve monitoring both the overburden piles and pits by the BLM-KFO paleontologist or their designated authority. Any significant material found in the overburden piles would be collected with as much data as possible and reposited at the UMNH. Final determination on the significance of ex-situ specimens would also be made by the UMNH.

The third mitigation measure would help offset the unavoidable loss of significant resource in the course of operations (see discussion below of the monetary value of the ammonite fossils) by enhancing research and public enjoyment of similar resources off-site. A $100,000 donation would be made by the mine operator to support scientific research on Late Cretaceous paleontology on the Paunsaugunt Plateau within the BLM-KFO. This would also make the region's Late Cretaceous fossil resources more accessible to the public through exhibits and other forms of education and outreach. The BLM would administer this fund in cooperation with the mine operator, through a third party such as a Natural History Association or other nonprofit group. Each year for the first five years of the mine's operation, calls for proposals for research and/or public outreach projects would be made, with all awards each year totaling approximately $20,000. Winning proposals from qualified scientific or public institutions would be awarded funds to complete a research or outreach project, with a report due at the end of the calendar year for research projects and an educational or exhibit product due for the outreach projects. The mine operator would be named as a partner in these projects.

4.10.2 Alternative A: No Action

Under the No Action Alternative, subsurface paleontological resources in the Alton Amphitheatre, including the Alton Coal Tract, would be unaffected by mining activities; therefore, there would be no significant impact to their condition or context. Permitted and unauthorized collections of ammonites would continue, which would result in a minor loss of fossil resources in the tract. Resources currently exposed at the surface would continue to weather and degrade over time, also causing a minor loss.

4.10.3 Alternative B: Proposed Action

Under the Proposed Action, approximately 1,750–2,152 acres of Tropic Shale overburden would be removed to access coal resources in the Smirl Coal Zone through pit disturbance. This amount is equal to the amount of surface disturbance that would occur from the pits because the Tropic Shale occurs under the surface where coal is present. An additional 717 to 412 acres of coal is potentially minable through subsurface techniques, but this would directly affect only the Smirl Coal Zone and not the overlying Tropic Shale. Because mining activity would go deep into the subsurface into fresh geologic bedrock units, accurate modeling of the impact to subsurface resources is difficult.

A total of 196 acres would be disturbed for operational facilities. This would consist of centralized and dispersed facilities. Centralized facilities would be present on approximately 36 acres for the 25-year life of the mine under the Proposed Action. Dispersed facilities, which would likely shift as coal extraction activities progress, would be located on approximately 160 acres. In addition, 17 acres would be disturbed for the relocation of KFO Route 116 into the no-coal zone. Exposures of the middle member of the Dakota Formation would be affected almost entirely by road and facility construction rather than by the operations in the mine pit. The centralized facilities would be located on the higher elevations of the tract divided by Sections 24 and 19, north of Lower Robinson Creek. They would cover both the lower Tropic beds and the middle and upper portions of the Dakota Formation. Ground-disturbing activities associated with the construction of centralized facilities and the rerouting of KFO Route 116 would potentially impact vertebrates and significant invertebrates in the middle member of the Dakota Formation and the Tropic Shale. The nature of impacts to fossils in this area would be the same as described at the beginning of this section. The amount of Tropic Shale disturbance under the Proposed Action would be 1,750–2,152 acres.

The most profound impacts to paleontological resources would be to fossils contained in the Smirl Coal Zone and fossils overlying the Tropic Shale overburden inside the pit disturbance areas. Quantifying the resource impacts in the Smirl Coal Zone is difficult because paleontology knowledge about the Smirl Coal Zone is limited. As stated earlier in Chapter 3's Paleontology section, the Smirl Coal Zone has the potential to preserve articulated vertebrates with soft tissue remains and delicate invertebrates such as insects (Konservat-Lagerstatte). However, such occurrences are rare in the Dakota Formation, and the presence of such resources in the pit disturbance areas associated with the Proposed Action would likely be revealed through the mining process. If such resources exist in the Dakota Formation, their importance to science and to the public cannot be overstated. They would be the only known example of a Cenomanian-age terrestrial Lagerstatte in the world, and its loss due to mining operations would be significant.

Increasing knowledge of the Tropic Shale's paleontology allows for some rough quantitative assessment and a better evaluation of impacts to fossil resources. Within 15 miles of the tract, there is 30,870 acres of Tropic Shale. A total of 1,790–2,192 acres of Tropic Shale would be disturbed in the tract under the Proposed Action. Therefore, 6% of the Tropic Shale's paleontology within a 15-mile band would be adversely impacted over the long term.

The density of well-preserved ammonites or other invertebrate fossil material in the lower ironstone interval of the Tropic Shale is low; however, occasional pockets of significant three-dimensional specimens in concretions do occur. Up to 12 such pockets would be expected to occur in pit disturbance areas. Well-preserved ammonites from the Vascoceras diartianum zone are rare in the region; therefore, they are scientific significance and their loss through physical degradation and destruction would be an adverse impact. Fortunately, the concretionary horizons that contain most of the ammonites are fairly well defined. Each zone is typically distinctive enough that loss of contextual data would not be a great issue for specimens salvaged off of spoils piles.

The overlying Euomphaloceras septemseriatum zone contains a high density of well-preserved ammonite and other fossil material. Examining nondisturbed exposures of concretions from this zone in the Alton area, large Metoicoceras geslinianum and Placenticeras cumminsi ammonites can be encountered approximately every 10–30 feet. Using one ammonite per 1,000 square feet as an extremely conservative estimate of specimen density, 76,230–93,741 significant ammonite specimens would potentially be destroyed or damaged in the pit disturbance area during mining operations under the Proposed Action. Although these specimens have only moderate scientific value, they have great significance to amateur fossil enthusiasts who eagerly seek them out. Even though these specimens cannot be mined commercially and sold from public lands, one way to estimate the magnitude of loss to the public is to assign a conservative $50 commercial value for each individual ammonite specimen (these specimens actually sell for $100 or more when collected from private lands) as a way to calculate loss to the public. This results in the ammonites having a surprising $3,811,500.00 to $4,687,050.00 cash value ($50 multiplied by the estimated number of specimens of 76,230–93,741). The density of vertebrates in this interval is not as high as it is in the overlying zones; therefore, only one or two larger vertebrate sites might be damaged during the course of mining operations. However such specimens have very high scientific significance. Several dozen articulated fish might also be damaged or removed from context. Little is known about Cenomanian fish from Utah; therefore, any of these specimens would be scientifically significant. Unfortunately it would be difficult to recover contextual data (i.e., placement into stratigraphic order) for any of the vertebrates if they were collected from overburden piles, because they typically create their own concretionary halos that do not contain diagnostic invertebrates.

The remainder of the Cenomanian concretionary interval would mostly suffer loss of rare and scientifically significant ammonite specimens from the Euomphaloceras costatum through Neocardioceras juddi zones. However, in similar fashion to the E. septemseriatum zone, several dozen articulated fish specimens and one or two larger vertebrate skeletons might also occur in the pit disturbance areas and therefore be damaged or removed from context. The overlying lower Turonian interval (Watinoceras coloradoense-Fagesia catinus

through Mammites nodosoides Ammonoid zones) is the opposite. Here, well-preserved invertebrates are not expected to be significantly impacted, but the density of larger marine vertebrate fossils is probably two or three times higher than it is in the underlying Cenomanian. As a result, four to six large vertebrate skeletons might be damaged in this interval over the life of the mine. Dozens of smaller fish skeletons could also be destroyed or salvaged out of context. Because the headwall of the mine would not exceed 300 feet in height above the Smirl Coal Zone, its impacts would probably be limited to lower Turonian strata, and the Collignoniceras woolgari and Prionocyclus hyatti zones would not be affected.

When compared to the No Action Alternative, disturbance to the Smirl Coal Zone and overlying Tropic Shale overburden and estimated monetary impacts would be much greater under the Proposed Action, because the No Action Alternative proposes no disturbance to existing paleontological resources.

4.10.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts would be similar to those discussed under the Proposed Action, except there would be approximately 1,454–1,856 acres of pit disturbance, 171 acres of disturbance from centralized and dispersed facility activities, and 13 acres of disturbance due to the relocation of KFO Route 116. The shorter time duration of mining activities under Alternative C (21 instead of 25 years) would not change impacts on paleontological resources because the impacts would occur from acreages disturbed regardless of the timeframe of when they occur.

The 16%–20% smaller footprint of the mine would lower the overall impact to paleontological resources affected by pit operations. For example, the monetary value of the estimated number of ammonites damaged or destroyed would be decreased from the range of $3,811,500.00 to $4,687,050.00, to the range of $3,619,850.00 to $4,495,400.00. For vertebrate resources, the estimated number of sites potentially affected by facilities construction, pit operations, and the rerouting of KFO Route 116 for Alternative C would be within the margin of error for the estimates made for the Proposed Action and would therefore be the same.

The total amount of disturbance to the 30,870-acre, 15-mile band of Tropic Shale in the area would be 1,662–2,064. Thus, a 5%–7% disturbance of the Tropic Shale's paleontology would occur under Alternative C.

When compared to the No Action Alternative, the 1,454–1,856 acres of pit disturbance, 171 acres of facilities, and 13 acres of road relocation would have a greater impact on the Smirl Coal Zone and overlying Tropic Shale overburden because 0 acres would be impacted under the No Action Alternative. The $3,619,850.00–4,495,400.00 estimated loss to the public would not occur under the No Action Alternative.

4.10.5 Potential Mitigation Measures

No potential mitigation measures are proposed or recommended.

4.10.6 Unavoidable Adverse Impacts

The loss of a percentage of significant fossil resource or their contextual data is an unavoidable impact under both action alternatives. In many other regions of Utah, such as the Book Cliffs or Price areas, the commercially viable coal seams are not directly associated with such highly fossiliferous marine or terrestrial units, and therefore impacts to fossil resources are minimal. In the Alton area, it is anticipated that a large number of significant fossils would be destroyed or removed from context particularly in the Tropic Shale.

4.10.7 Short-term Uses versus Long-term Productivity

The short-term use of the tract for purposes of coal extraction would result in adverse impacts to the long-term productivity of paleontological resources. The coal extraction process would result in the permanent removal of fossils from the Dakota Formation and the Tropic Shale in the tract resulting in a long-term decrease in the productivity of paleontological resources in the area.

4.10.8 Irreversible and Irretrievable Commitments of Resources

All impacts to paleontological resources in the tract would be irreversible. Once disturbed and removed, fossils currently present in formations where disturbance would occur to facilitate the extraction of coal cannot be replaced or restored. They would be permanently removed.

4.11 Recreation

The recreation resources analysis area for the tract is 92,573 acres. It consists of the tract, linear features such as roads and OHV trails affected by mining activity, and all adjacent lands within a 5-mile radius of the tract (see Map 3.11). A 5-mile radius was chosen on the assumption that recreational users affected by mining activity would move to lands immediately adjacent to the tract that would provide similar recreation opportunities. Outside the 5-mile radius, additional recreation activities, areas, and opportunities were identified to describe the indirect and cumulative impacts of the alternatives. These areas were identified from BLM and USFS land-use plans; NPS general management plans; UDWR management areas; discussions with BLM, USFS, and UDWR resource specialists; and county and municipality plans.

For all alternatives, short-term impacts to recreation resources are those impacts that would occur throughout the duration of mining operations. Long-term impacts are those impacts that would occur after mining operations and once reclamation activities are complete. With proper reclamation procedures, there would be no long-term impacts to recreation resources for all alternatives, and existing recreation opportunities would resume in areas affected either directly or indirectly by mining operations.

Impacts to recreation resources as a result of coal truck traffic on the coal haul transportation route (see Section 2.5.4) are not discussed under the alternatives sections because based on the transportation analysis (see Section 4.14), impacts would be negligible. LOS is a measure of the quality of service on transportation infrastructure. It generally indicates the level of traffic congestion. LOS measurements vary from LOS A (the best) to LOS F (the worst); see Table 4.33 for a description of LOS A–F. Transportation analyses illustrate that the existing LOS on the transportation route is LOS A for most segments and intersections and LOS B and C for others. These LOS would be maintained even with the addition of coal truck traffic. Transportation analyses also project LOS on the transportation route in the year 2020. Conditions in the year 2020, with the addition of coal trucks, would result in a LOS D on SR-20 between US-89 and I-15. All other segments and intersections would be LOS A, B, or C. LOS D conditions are those that are approaching unstable flows of traffic, tolerable delays of 25–35 seconds per vehicle at unsignalized intersections, and delays of 35–55 seconds per vehicle at signalized intersections. LOS changes would be minimal with additional truck traffic added to existing traffic conditions and with additional truck traffic added to 2020 conditions; therefore, changes to time spent traveling to recreational resources, and changes to the settings, experiences, and activities of recreationists using the transportation route for sightseeing and/or to travel to and from recreation destinations, would also be minimal.

4.11.1 Regulatory Framework

Public lands in and surrounding the proposed tract are managed for dispersed recreation. The goals and objectives for recreation management, including OHV use, are discussed in the KFO RMP (BLM 2008b). Hunting regulations on the PPMA are maintained and enforced by UDWR.

4.11.2 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the tract under the Proposed Action or Alternative C would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined.

Rejection of the application would not affect permitted mining activities on private land adjacent to the tract (the Coal Hollow Mine). The Coal Hollow Mine consists of approximately 635 acres of land and approximately 5 million short tons of recoverable coal leased from private surface and mineral owners. Discussion of impacts to recreation resources from the Coal Hollow Mine is included in Section 4.18 Cumulative Impacts.

Under the No Action Alternative, recreation use—predominantly big game hunting in and near tract—would continue at present or slightly increasing levels (Personal Communication, Aoude 2008). Hunting in the Alton CWMA would continue, and the same amount of big game permits would be issued as in years past. No acres of big game hunting would be affected by mining under the No Action Alternative.

Other than hunting, little recreation would occur on lands directly affected by the tract (Personal Communication, Christenson 2008; Personal Communication, Rechsteiner 2008). According to adjacent land managers, some OHV use occurs on approximately 13 miles of OHV-accessible routes in the proposed tract. In addition, visitors traveling along KFO Route 116 engage in sightseeing when traveling between known destinations such as Bryce Canyon National Park and Grand Staircase-Escalante National Monument. These uses would not be affected by mine-related activities under the No Action Alternative because the tract would not be offered for competitive lease sale and no mining would occur.

Existing conditions for other types of dispersed recreation (e.g., camping, picnicking, and hiking) would continue on lands in the recreation analysis area. Because the No Action Alternative would not decrease the amount of land available for dispersed recreation, it would not decrease the recreational experience of those recreational users who engage in recreational activities in the analysis area. Because there are no estimates of recreation use for public or private lands affected by mining activity, there is no way to quantify the amount of recreation users either directly or indirectly affected.

Under the No Action Alternative, other land uses would continue, including livestock grazing, backcountry driving, and vegetation treatments to maintain and enhance livestock forage, wildlife habitat, and watershed condition. These presently occurring land uses would continue to interact with recreation trends in the analysis area similar to current conditions under this alternative.

4.11.3 Alternative B: Proposed Action

Under the Proposed Action, the tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The Proposed Action would directly affect 3,576 acres of land, including 2,280 acres of public land (federal surface and subsurface) on the tract and 1,296 acres of split estate: private surface and federal subsurface land. Under the Proposed Action, the life of the mine would be approximately 25 years.

Under the Proposed Action, some recreation use, predominantly big game hunting, would be displaced from the tract. Approximately 3,576 acres of potential big game hunting areas would be directly affected by the Proposed Action. Hunter access to big game habitat (predominantly mule deer) on the tract would be restricted, displacing them from the tract. It is assumed that all 3,576 acres would be unavailable for recreational use over the life of the mine (25 years). This represents approximately 0.4% of all big game hunting areas in the PPMA (approximately 957,122 acres) and 3.9% of the recreation resources analysis area (92,573 acres). Users would move onto adjacent public lands (public lands and the Dixie National Forest) for hunting opportunities. This could affect the recreational experiences of hunters displaced from the tract and hunters in the analysis area because of a slight increase in crowding in those areas. However, a 0.4% displacement of hunters would not likely lead to overcrowding on other lands in the PPMA.

Hunting in the Alton CWMA would continue, and the same amount of big game permits would be issued as in years past. Because no big game kills have occurred in the proposed tract in the last 20 years, adverse impacts to hunters who use the CWMA are not anticipated. See Section 4.17 for a description of direct and indirect impacts to big game species as a result of the Proposed Action.

Outside of hunting, little recreation use occurs on lands that would be directly affected by the tract (Personal Communication, Christenson 2008; Personal Communication, Rechsteiner 2008). Because access would be restricted on the tract, these recreationists, like hunters, would be displaced from the tract for the 25-year mine life. The short-term loss of 3,576 acres for OHV use represents 3.9% of the recreation analysis area (92,573 acres). Further, there is an estimated 13 miles of OHV routes on the proposed tract. Some of this would be removed for mining activity (and replaced post mining), and all would be inaccessible for the life of the mine. The temporary loss of these routes represents a 0.7% reduction in routes available for OHV use across the BLM-KFO (1,402.7 miles of routes are currently available for OHV use in the BLM-KFO). KFO Route 116, an OHV-accessible route, would remain accessible to OHVs during mining operations. However, it is assumed that the road would be relocated to the no-coal zone to allow mining operations to occur. Also, the experiences and settings of OHV users traveling on KFO Route 116 adjacent to the tract would be modified from one characterized as semiprimitive and natural to one characterized by coal mining activities.

Other visitors traveling along KFO Route 116 engage in sightseeing when traveling between known destinations such as Bryce Canyon National Park and Grand Staircase-Escalante National Monument. Mining activity under this alternative would have an adverse effect on users seeking natural visual resources through the loss of natural visual resources over the life of the mine (25 years). However, new sightseeing recreational opportunities would be created under this alternative through the viewing of active mining operations and through the interpretation of coal mining on public lands along rerouted KFO Route 116.

Under this alternative, the direct loss of lands available for other types of dispersed recreation (e.g., camping, picnicking, hiking) would lead to increased use and diminished recreational experiences on lands in the analysis area adjacent to the tract. Up to 92,573 acres (the recreation analysis area) could be indirectly affected by mining operations. Desired recreational experiences for lands in the analysis area include opportunities for undeveloped and self-reliant recreation, a natural environment, and a high probability of solitude. Over the life of the mine, increased use in the analysis area would diminish those recreational experiences. Quantifying the amount of recreation users that would be directly or indirectly affected by this alternative is impossible because of the following: 1) the analysis area is not a known destination point for recreation, 2) there are no known attractions in the analysis area, and 3) there are no estimates of use for public or private lands affected by mining activity.

Because all acres in the tract would be unavailable for hunting, OHV use, and dispersed recreation over the 25-year mine life, the loss of 3,576 acres to recreation opportunities under the Proposed Action would result in a complete decrease in lands available for recreation on the tract when compared to the No Action Alternative.

4.11.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, the tract would be modified to exclude Block NW (see Map 2.1). Furthermore, certain mining activities in Block S would be subject to seasonal restrictions to reduce impacts to the local sage-grouse population. Under Alternative C, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.1.

The modified tract under Alternative C would encompass approximately 3,173 acres, of which approximately 2,280 acres are federal surface and mineral estate and 893 acres are split estate: private surface estate and federal mineral estate (Map 2.1 depicts private and BLM surface in the modified tract). Alternative C also anticipates approximately 153 truck round-trips per day to a coal loadout location west of Cedar City. The life of the mine under Alternative C would be approximately 21 years.

Alternative C and the Proposed Action would result in the same types of impacts to recreational resources. However, Alternative C would result in fewer acres of impact based on the smaller acreage of the tract and fewer years of impact based on the shortened mine life. Hunting in the Alton CWMA would continue, and the same amount of big game permits would be issued as in years past. Because no big game kills have occurred in the tract in the last 20 years, adverse impacts to hunters who use the CWMA are not anticipated. Under Alternative C, hunters would be displaced from the tract because an estimated 3,173 acres of potential big game hunting areas would be unavailable for recreational use over the 21-year mine life. This represents approximately 0.3% of all big game hunting areas in the PPMA (approximately 957,122 acres) and 3.4% of the analysis area (92,573 acres). Assuming that access on the tract would be restricted for the 21-year mine life, OHV users would lose 3,173 acres for OHV use, representing 3.4% of the analysis area (92,573 acres). Likewise, the 13 miles of OHV-accessible routes present on the tract would be inaccessible for the life of the mine and would represent a 0.7% reduction in routes available for OHV use across the BLM-KFO (1,402.7 miles of routes are currently available for OHV use in the BLM-KFO). As under the Proposed Action, KFO Route 116 would remain accessible to OHVs during mining operations, though it is assumed that it would be relocated to the no-coal zone. The experiences and settings of OHV users traveling on KFO Route 116 through the tract would be modified from one now characterized as semiprimitive and natural to one characterized by coal mining activities.

Other visitors traveling along KFO Route 116 engage in sightseeing when traveling between known destinations such as Bryce Canyon National Park and Grand Staircase-Escalante National Monument. Mining activity under this alternative would have an adverse effect on those users and their sightseeing experience through the loss of natural visual resources over the life of the mine (21 years). However, new sightseeing recreational opportunities would be created under this alternative through the viewing of active mining operations and through the interpretation of coal mining on public lands along rerouted KFO Route 116.

Finally, as under the Proposed Action, up to 92,573 acres (the recreation analysis area) could be indirectly affected by mining operations. Recreation users would be displaced from areas directly affected by mining activities and would likely recreate on nearby areas. This would increase the amount of use in those areas and would result in a reduction of the desired recreational experiences in those areas.

Because all acres in the tract would be unavailable for hunting, OHV use, and dispersed recreation over the 21-year mine life, the loss of 3,173 acres to recreation opportunities under Alternative C would result in a complete decrease in lands available for recreation when compared to the No Action Alternative.

4.11.5 Potential Mitigation Measures

During mining operations, mitigation measures to offset the loss of sightseeing opportunities could include installing viewing pull-off areas and interpretation panels along rerouted KFO Route 116. This would create new opportunities for sightseeing in the short term.

4.11.6 Unavoidable Adverse Impacts

Adverse impacts from both action alternatives would include a direct short-term loss of land available for recreation opportunities, predominantly hunting. In addition, there would be an indirect adverse impact to other recreational users from the displacement of recreational users, directly affected by mining activity, onto adjacent public and private lands. Following reclamation, existing recreation activities would return to areas previously affected by mining operations. This reclamation could enhance wildlife habitat and increase opportunities for hunting and wildlife viewing.

4.11.7 Short-term Uses versus Long-term Productivity

Mitigation and reclamation measures would be applied to areas affected by the mine; therefore, the long-term productivity of the tract to provide recreation opportunities would not be diminished once mining operations and reclamation are complete.

4.11.8 Irreversible and Irretrievable Commitments of Resources

As a result of mining operations, recreation resources and uses would be irretrievable over the life of the mine. Following completion of mining operations and reclamation, those uses and resources would be reestablished. No irreversible commitments of recreation resources are expected as a result of mining activity.

4.12 Socioeconomics

The socioeconomics analysis area for the tract consists of Kane, Garfield, and Iron counties. It is hereafter referred to as the SESA. The socioeconomic analysis depends in part on the findings of other resource sections, primarily the analysis of impacts to recreation (see Section 4.11) and transportation (see Section 4.14). This analysis does not include an in-depth discussion comparing impacts between Alternative A (No Action) and the action alternatives. Both action alternatives would result in impacts to socioeconomics than would not occur under the No Action Alternative because selection of the No Action Alternative would not result in mining the tract.

4.12.1 Regulatory Framework

Federal, state, and local regulations require that surface mines obtain reclamation bonds, pay royalties, and taxes based on the amount of coal extracted from the mine. Further, the Coal Mine Safety Act: Utah Administrative Code 40-2 of 2008 established the Office of Coal Mine Safety, which recommends to the governor measures that ensure the safety of those involved in Utah’s coal mine industry.

4.12.2 Alternative A: No Action

Under the No Action Alternative, coal in the tract would not be mined; therefore, no impacts would occur to the social and economic conditions of nearby communities in Kane, Garfield, and Iron counties as a function of mining the tract. The local population, employment, fiscal conditions, tourism rates, and social climate would remain similar to current conditions. Revenues from livestock grazing and recreation opportunities in the tract would continue. When compared to the Proposed Action, the No Action Alternative would result in the potential for forgone income for the successful bidder and revenue and royalties to federal, state, and local governments because the coal would not be mined and this revenue would not be generated.

4.12.3 Alternative B: Proposed Action

Under the Proposed Action, approximately 44.9–49.1 million tons of coal would be mined over a 25-year period (this equates to approximately 1.8–1.9 million tons annually though the target production rate, which is reflected in the socioeconomic analysis in this section, is 2 million tons per year). To conduct mining and transportation operations over the life of the mine approximately 160 employees would be required. An estimated 153 truck round-trips per day to and from the mine and along the coal haul transportation route would occur. Mine operations would occur 24 hours a day, five to seven days a week, for the life of the mine. The Proposed Action would directly affect (by surface disturbance, precluded access, or both) 3,576 acres of land consisting of 2,280 acres of BLM-administered land (federal surface and subsurface) and 1,296 acres of private land (private surface and federal subsurface).

The projected (target), annual coal production under both action alternatives would be approximately 2 million short tons. This analysis considers this target amount under both action alternatives. It also provides recovery values and revenues for the range of recoverable coal reserves throughout the life of the mine under each action alternative (44.9–49.1 million short tons over approximately 25 years under the Proposed Action and 38.1–42.3 million short tons over approximately 21 years under Alternative C).

To understand the amount of electrical energy that would be generated from the projected annual amount of coal (2 million short tons) produced under the action alternatives, the following statistics are provided. These numbers are for perspective use only because it is not assumed that the coal mined from the tract would be used solely to supply electric energy to residential customers. Under the Action Alternatives, the number of United States households provided with one year of residential energy would be approximately 185,010. According to the United States Census Bureau 2000 Census, there are 2.59 persons per household on average in the United States. As such, 2 million tons of coal would provide 479,176 individuals with one year of residential electrical energy (Personal Communication, McKenzie 2008).

When compared to the No Action Alternative, the Proposed Action would result in an increase in employment, personal income, and government revenues. A slight increase in population is anticipated (as illustrated in the analysis below), but this would not lead to an increased need for public services. Under the No Action Alternative, no mining would occur, and therefore an increase in local employment, income, and government revenues as a result of mining would not occur. Under the Proposed Action, there would be a slight decrease in grazing revenues as a result of a decrease in AUMs (as illustrated in the analysis below). Also, any recreation-related economic contributions from individuals who choose to recreate on the tract would be foregone under the Proposed Action.

4.12.3.1 EMPLOYMENT AND INCOME

4.12.3.1.1 Employment

Under the Proposed Action, approximately 160 people would be employed to conduct mining operations. It is estimated that 100 workers would be needed at the mine for mining operations, and 60 workers would be required for trucking the coal to the loadout location. Approximately 10% (16 employees) of the mine employees would be specialists in coal mining operations and would relocate to the area specifically to work at the mine (Personal Communication, McCourt 2008).

Employment related directly to coal mining operations would generate indirect jobs in the local economy. Indirect employment associated with the mine would include jobs in wholesale and retail trade, local government, and service sectors. Assuming a 3.0 multiplier (indirect employment to direct employment), it is estimated that approximately 320 additional jobs (full-time equivalents) would be generated as a result of mining operations on the tract.

Because a large portion of services directly and indirectly related to mining (e.g., fuel, equipment purchases and repairs, food, and retail services.) would be located in or around Cedar City in Iron County, it is likely that the indirect employees would be concentrated in this area as well.

4.12.3.1.2 Income

The range in salary for miners on the tract would be $18 to $21 per hour, not including benefits (Personal Communication, McCourt 2008). Using $20 as an average, the approximate annual wage for coal miners on the tract would be $41,600. Thus, the 160 employees of ACD would generate $6.65 million in total annual wages in the SESA and $166 million over the life of the mine. Employment and income impacts are shown in Table 4.25.

Table 4.25. Employment and Income Impacts under the No Action Alternative, the Proposed Action, and Alternative C (in 2008 dollars)

	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
Direct employment	0	160 employees	160 employees
Indirect employment	0	320 employees	320 employees
Total annual wages (for direct employment)	**$0**	**$6.65 million**	**$6.65 million**
Total life-of-mine wages (for direct employment)	**$0**	**$166 million**	**$140 million**

4.12.3.2 GOVERNMENT AND PUBLIC FINANCE

Over the 25-year mine life, approximately 44.9–48.2 million tons of recoverable coal would be mined. Under the Proposed Action, 1.8–1.9 million tons of coal would be mined each year. The 10-year average spot price for 11,700 BTU per pound of coal is $33.00 per ton from 2000 to 2010 (2008). The spot price for coal recovered in the tract would be slightly lower given that this coal is closer to approximately 10,000 BTU per pound. However, this analysis uses $33.00 per ton as the spot price of coal because the heat content of coal in the tract is closer to that referenced above than to the coal found in the Powder River Basin, which contains an estimated 8,800 BTU per pound. Spot prices for coal with a heat content more closely approximating the coal in the tract were not available to use in the analysis.

The annual recovery value for 1.8–1.9 million tons of coal would be approximately $59.4 to $62.7 million (1.8 million tons of coal × $33.00 and 1.9 million tons of coal × $33.00). Over the 25-year mine life, recovery values would be approximately $1.49 to $1.57 billion (1.8 million tons × $40.00 × 25 and 1.9 million tons × $33.00 × 25 years).

4.12.3.2.1 Federal Royalties

Coal producers in the State of Utah must pay royalties to the United States government for coal mined on federal lands. The current royalty rate for coal is 12.5% of sales value and is paid to the DOI Office of Natural Resources Revenue (ONRR). Fifty percent of the royalties are returned to the state where the mineral production occurs.

Assuming the annual recovery value for the coal produced under the Proposed Action would be $59.4 to $62.7 million per year, $7.46 to $7.89 million in royalties would be paid to ONRR ($59,400,000 × 0.125), and the State of Utah would receive approximately $3.73 to $3.95 million ([$62,700,000 × 0.125]/2) per year. Under the Proposed Action, $186.62 to $197.30 million in royalties would be paid to ONRR and $93.31 to $98.64 million would be disbursed to the State of Utah over a 25-year period.

Upon disbursement of royalty revenues to the State of Utah, more than 75% of the mineral revenue receipts are routinely appropriated to several state agencies. The distribution is as follows: 32.5% to the Permanent CIB, 40.0% to the UDOT for distribution to counties and county special service districts, and 5.0% to the Utah Department of Community and Culture for distribution to counties and special service districts. Projected appropriations as a result of mining the tract under the Proposed Action are listed in Table 4.26.

Table 4.26. Estimated Recovery Value and Royalty Revenue under the No Action Alternative, the Proposed Action, and Alternative C (2010 dollars)

	Alternative A (No Action) Annual and Life of Mine Values	Alternative B (Proposed Action) and Alternative C Annual Values (2 million short tons)	Alternative B (Proposed Action) Life of Mine Value (25-years of development)	Alternative C Life of Mine Value (21-years of development)
Recovery value	$0	$66.10 million	$1.49–$1.57 billion	$1.25–$1.32 billion
Total federal royalty revenue	$0	$8.26 million	$186.62–$197.30 million	$103.44–$111.43 million
Royalties disbursed to state (50% of federal royalties)	$0	$4.13 million	$93.31–$98.64 million	$78.38–$82.11 million
Appropriation to CIB (32.5% of state revenue	$0	$1.34 million	$30.20–$32.04 million	$25.49–$26.71 million
Appropriation to UDOT (40% of state revenue	$0	$1.70 million	$37.32–$39.46 million	$31.40–$32.84 million
Appropriation to Utah Department of Community and Culture (5% of state revenue)	$0	$206,615	$4.69–$4.96million	$3.95–$4.10million

Under the Proposed Action, 92 AUMs allocated to livestock grazing would be lost annually. This loss of AUMs would total 3,220 over the life of the mine. The 2010 value of an AUM, according to the BLM, is $1.35. Thus, over the life of the mine (35 years for livestock grazing, 25 years for the mining activities,

and 10 years for reclamation) a $4,347.00 (or $124.20 annually) decrease in contributions to the BLM would result. Should livestock permittees need to decrease livestock numbers as a result of the decrease in AUMs, this could result in lost revenue for permittees and a potential decrease in the workforce required to manage the livestock. However, with annual rotations in the tract over the life of the mine, adverse impacts to permittees would be minimized.

4.12.3.2.2 Additional Taxes and Fees

Black Lung Tax: The Black Lung Excise Tax on coal has been in effect since 1978. The tax finances the Black Lung Disability Trust Fund, which compensates miners (and their survivors and dependants) that have contracted "black lung disease" or pneumoconiosis. The current Black Lung Excise Tax rate for surface mines is $0.55 per ton. Under the Proposed Action, approximately $990,000 to $1.0 million annually and $24.7 to $26.1 million over the life of the mine would be paid to the Black Lung Disability Trust Fund (Table 4.27).

Table 4.27. Additional Taxes and Payments Associated with the No Action Alternative, The Proposed Action, and Alternative C (in 2008 dollars)

	Alternative A (No Action) Annual and Life of Mine Values	Alternative B (Proposed Action) and Alternative C Annual Values (2 million short tons)	Alternative B (Proposed Action) Life of Mine Value (25-years of development)	Alternative C Life of Mine Value (21-years of development)
Black Lung Tax	$0	$1.1 million	$24.7–$26.1 million	$20.8–$21.0 million
Abandoned Mine Land Tax	$0	$300,000	$6.8–$7.1 million	$5.7–$5.9 million
Bonus bid payment	$0	n/a	$28.3–$30.4 million	$24.0–$26.1 million
Bonus bid payment disbursed to state (50% of federal payment)	$0	n/a	$14.2–$15.2 million	$12.0–$13.1 million

Abandoned Mine Lands: A reclamation fee of $0.15 per ton is assessed by the federal government on domestically produced, underground-mined coal to pay for the cleanup of abandoned mine lands. The fund was designed to be split evenly between the federal government and the state from which the money was generated. Assuming 1.8–1.9 million tons of coal are mined annually, $270,000 to $285,000 would be paid to the abandoned mine lands program and $6.8 to $7.1 million would be paid over the 25-year mine life.

Bonus Bid Payments: Before mining can begin in the tract, a company (or companies) must submit a sealed bid for the coal. The successful bidding company must pay one fifth of the total bonus at the time of the sale and would continue to pay one fifth every year for the next four years. The bid money would be paid to the federal government regardless of the production taxes and royalties that are paid by the mining company as the coal is mined. The federal government would keep half of this bonus bid payment and the State of Utah would receive the other half.

Although the exact amount of bid money anticipated through the lease of the tract is unknown, recently awarded bonus bids can be used to estimate potential federal and state revenue. In January 2008, the successful bidder on a new coal tract paid $0.631 per ton of recoverable coal (BLM 2008f). Using the same amount per ton and the assumption that 44.9–48.2 million tons of coal would be recovered over the life of the mine (under the Proposed Action), the successful bidder on the tract would pay approximately $28.3 to $30.4 million to the federal government. Of the total bonus bid, $14.2 to $15.2 million would be disbursed to the State of Utah.

Property and Sales Tax: The Utah Property Tax Division centrally assesses the ad valorem tax based on coal production, assessed property values, and current tax rates. Ad valorem taxes assessed on property and production generate revenue for local counties. The greater the production of coal, the greater the generation of property taxes for Kane County.

Sales and use taxes are levied by state and local governments on purchases of goods and services related to coal mining. The sales tax rate for Iron County is 5.90% and the sales tax for Kane and Garfield counties is 6.90%. The tax payments would indirectly benefit the local and national businesses supporting the coal mine operations. These economic impacts would be present throughout the life of the mine and to a lesser extent during the reclamation activities. It should be noted that because such a large percentage of mine-related services would be found in Cedar City, increases in sales tax revenues would be disproportionately higher in Iron County when compared to Kane and Garfield counties.

Permanent CIB: As previously mentioned, Kane, Garfield, and Iron counties receive a portion of federal mineral lease monies returned to the State of Utah by the federal government through the CIB. The funds received by counties in the SESA for infrastructure projects would likely continue in amounts similar to current contributions regardless of the alternative selected, because CIB funding is not directly correlated with mineral production by county but rather by applicant eligibility. An estimated appropriation to the State of Utah as a result of the Proposed Action is given in Table 4.26.

Payments in Lieu of Taxes Program: Given that none of the alternatives would result in changes in federal land ownership in the SESA, Payments in Lieu of Taxes payments to Kane, Garfield, and Iron counties would remain similar to current conditions under all alternatives, including the No Action Alternative.

4.12.3.3 POPULATION AND HOUSING

As mentioned earlier, it is assumed that 90% (144 employees) of employees would commute from in the SESA and 10% (16 employees) of the 160 employees would relocate to the SESA. The average size of a family in the United States is 3.14 according to the United States Census 2000 (U.S. Census Bureau 2000b). Assuming in-migrants family size is similar to the United States average, approximately 50.24 additional people would move into the SESA during the life of the mine. Adding an additional 16 workers and their families concentrated in Kane County or dispersed throughout the SESA would have negligible impacts on population. Using the population data given in Section 3.12, the total population in the SESA is 58,714. An additional 50.24 people in the SESA would result in a 0.09% increase in the population of the SESA.

Although 16 employees would likely come from outside the SESA, the remaining employees would likely come from local communities. Given that 90% of the potential workforce is currently living in Kane, Garfield, and Iron counties, it is not anticipated that the demand for housing in the area would increase under the Proposed Action. The current housing market would accommodate the small percentage (0.09%) of in-migrants for short- or long-term housing because accommodations for 16 families in the SESA would likely be present at any given time.

As noted in Section 3.12 second-home ownership is largely influenced by scenic beauty and recreation opportunities. For many individuals, mining operations on the tract would detract from the desirable qualities associated with scenic views and recreation. As such, individuals may choose not to obtain second homes near the tract. However, because most of the second homes in Kane County are located on Cedar Mountain (approximately 30 miles away from the tract), it is unlikely that most of the potential second-home purchases would be adversely impacted. Potential second-home purchases in Iron and Garfield counties are not likely to be adversely impacted by the Proposed Action given the distance from the tract.

Should mining operations on the tract be perceived as an undesirable land use, adverse impacts to the value of nearby property could be experienced. Several studies indicate that undesirable land uses, such as a power plant, superfund site, hazardous waste site, or landfill, do have a tendency to decrease the reported dollar value of a residence. The decrease in value was dependant on the distance (miles) from the site and varied considerably depending on the land use. One study cited that properties within 2.5 miles of a power plant have a 6.3% lower value. Others indicate that that an increase in distance of 1.0 mile from the site increased values by $451 to $10,034 (inflated to 2010 dollars) (Boyle and Kiel 2001).

4.12.3.4 RECREATION AND TOURISM

Section 4.11 identifies potential impacts to recreation due to the implementation of the Proposed Action. As stated in Section 4.11.2, there are currently no estimates for the amount and type of recreation use on or near the tract. Therefore, it would be speculative to make quantitative estimates of the potential economic impact to the region from a potential decrease in use of recreation resources in the area.

The Proposed Action would displace 3,576 acres of potential big game hunting. This represents approximately 0.4% of all big game hunting areas in the PPMA. Users would likely move onto adjacent public lands (BLM-administered lands and the Dixie National Forest) for hunting opportunities. Because hunters would be able to hunt on adjacent public lands and because the overall percentage of lands unavailable to big game hunting in the PPMA is less than 1%, it is unlikely that hunters would be adversely impacted by the Proposed Action. Direct and indirect sales and revenue generated by this recreational user group would continue similar to current conditions.

As stated in Section 4.11.2, there is little recreation use that occurs on lands that would be directly affected by the tract. In addition to big game hunting, OHV use is the only other identified recreation use on the proposed tract. For the 25-year mine life, OHV users would be displaced from 3,576 acres (assuming that access to the tract would be precluded for the life of the mine); although, KFO Route 116 (an OHV accessible route) would remain accessible to OHVs during mining operations. The experiences and settings of OHV users traveling on KFO Route 116 through the tract would be modified from one now characterized as semiprimitive and natural to one characterized by coal mining activities. It would be speculative to assume that a change in landscape characterization along KFO Route 116 would preclude future OHV use.

From a qualitative perspective, the shift in landscape characterization from semiprimitive and natural to one characterized by coal mining would also be absorbed by local residents in the area who enjoy and/or depend on the naturalness of the area for their livelihood. An increase in truck traffic in and near Alton would likely alter the essence of the rural community. Individuals who moved to the area specifically because of the rural feel and semiprimitive landscape, or those who operate tourist-related businesses, would likely notice a change in the social climate of the area. Although the transportation analysis anticipates negligible impacts to traffic flow or the ADT from a quantitative perspective (see Section 4.14), the frequency and noise of the daily truck traffic would adversely impact the quaint, small-town feel of Alton. Altering the essence of the community through daily truck traffic, noise, artificial lighting, and other mine-related operations could deter tourists from visiting Alton and the surrounding communities. If tourists choose not to visit the area because of the mining operations, tourist-related revenue would not be generated and tourist-dependent businesses would be adversely impacted. Under the Proposed Action, there would be a possibility that the mine would draw tourists to the area. Tourist-related revenue from those who view the mine as an attraction would be realized by the town of Alton and the surrounding communities.

Local recreation and tourism can be adversely and indirectly impacted by the mining industry if local lodging is disproportionately used by the mining employees, displacing visitors seeking hotel accommodations. Under both action alternatives, this is not likely to happen because nearly all of the 160 employees would be residents of Garfield, Iron, or Kane counties; thus, the existing stock of motel rooms in the SESA would continue to meet the demands of tourists to the area.

4.12.3.5 PUBLIC HEALTH AND SAFETY

4.12.3.5.1 Transportation

The transportation analysis in Section 4.14.2 identifies a potential 4% increase in ADT on US-89 through Hatch and Panguitch and a 2% increase on SR-56 through Cedar City. A traffic study conducted by Fehr and Peers shows that LOS C or better would be maintained on all road segments and intersections of the coal haul transportation route (2008) (See Section 3.14 for definitions of LOS levels). Given the slight increase in ADT and the limited congestion as reflected in the expected LOS levels, adverse impacts to public health and safety are not likely. Although it is plausible to consider that an increase in traffic on any given roadway would increase the potential risk for an accident, the findings of the transportation analysis do not suggest a measurable increase in transportation-related accidents.

4.12.3.5.2 Law Enforcement

A growth in population, which could occur to some extent in the SESA, could cause proportionate increases in crime. As mentioned earlier, 16 of the anticipated 160 employees and their families would relocate to the area specifically for employment at the mine. Such a slight increase in population across the SESA would not likely cause an increase in crimes. County and municipal law enforcement agencies would likely be able to accommodate the slight population growth projected under the Proposed Action.

With a slight increase in ADT along the transportation routes, there may be a potential need for increased traffic enforcement; however, it is not likely that an increase in current staffing conditions would be necessary because an increase in traffic does not assume an increase in traffic violations. Furthermore, the LOS of C or better estimated to be maintained on all transportation routes would not require increases in law enforcement.

4.12.3.5.3 Wildland Fire Protection

The fire department in the Town of Alton, the nine fire departments in Kane County, and the efforts of the BLM would provide adequate fire fighting capabilities on the tract as a result of coal mining operations. Given the relatively small amount of acres impacted in the SESA (1,993 – 2,395 acres) and increase in ADT, it is assumed that aforementioned agencies could accommodate any increase in fires resulting from mining operations.

4.12.3.5.4 Health Care and Ambulance

The hospitals in the SESA would be able to handle the slight population growth and potential for acute traumas. As stated in Section 3.12.3.4, each county has a hospital that provides 24-hour emergency care. Air transport through Air-Med or Life Flight would provide emergency service to out-of-area hospitals.

4.12.3.5.5 Explosives

Under the Proposed Action, there could be a potential need for the use of explosives in the tract. Blasting activities could have adverse impacts on existing structures in the town of Alton. The potential damage to buildings would depend on the location of the explosive use and the condition of the structures in the town. However, a blasting plan would not be completed until the successful bidder has been awarded the contract; until then, detailed impacts from the use of explosives are unknown.

4.12.3.5.6 Underground Coal Fires

Under the Proposed Action, there is a potential risk for underground coal fires. In the event of an underground coal fire, potential impacts could include an increase in health and safety issues from toxic fumes, surface fires, subsidence, and damage to infrastructure such as roads, power lines, and buildings. Section 4.6.3.4, Geology, describes the risk of underground fires for the Alton Coal Tract.

4.12.3.6 ENVIRONMENTAL JUSTICE

The American Indian and Alaskan Native (American Indian) population in Iron County is 1.75 times greater than the reference population (State of Utah). Because the American Indian and Alaskan Native population exceeds the reference population threshold by 0.25%, the proceeding analysis examines the potential disproportionate adverse impacts to the American Indian.

Potential adverse impacts to the health, safety, and welfare of a potential environmental justice population are first examined by looking for adverse impacts to resources that affect health and welfare. Under the Proposed Action, resources whose impacts could directly or indirectly affect the health and welfare of American Indian populations in Iron County are air quality, noise, water quality, and transportation.

As stated in Section 4.3, adverse air quality impacts would likely occur in Kane County in the town of Alton. There are no potential environmental justice populations in Kane County. No adverse air quality impacts would be anticipated in Iron County; therefore, American Indian populations in Iron County would not be disproportionately impacted.

According to the noise analysis in Section 4.2, there would be a 2% increase in heavy truck traffic on SR-56 in Iron County through Cedar City. The increases in ambient noise levels from the 2% increase in truck traffic could result in increased annoyance but would not increase the risk for measurable hearing loss. Although American Indians living along SR-56 in Iron County may be annoyed by increases in noise from truck traffic, they would not experience a disproportionate increase in ambient noise levels when compared to nonminority populations living along the route.

The water quality analysis in Section 4.16 indicates that there would be no adverse impacts to the drinking water supply in the SESA; therefore, there would be no potential for disproportionate impacts to the American Indian population in Iron County. The potable water supplied to Iron County residents is not gathered from groundwater or surface-water sources near the proposed tract; therefore, any potential contamination of drinking water as a result of the Proposed Action would be negligible.

The impacts to general public health and safety (transportation, law enforcement, health care, etc.) for all individuals in the SESA would be negligible under the Proposed Action. Therefore, adverse impacts to American Indians in Iron County would also be negligible.

In summary, the percentage of American Indians in Iron County exceeds the reference population (i.e., State of Utah). Consequently, an examination of the potential impacts to resources that could impair the health, safety, and welfare of the American Indian population was completed. The analysis found that none of the impacts to resources (air, noise, transportation, water and public health and safety) as a result of the Proposed Action would disproportionately impact the American Indian population in Iron County.

4.12.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, approximately 38.1–41.4 million tons of coal would be mined over a 21-year period. As under the Proposed Action, 1.8–1.9 million tons of coal would be mined annually, and 160 employees would be required to complete mining operations. Alternative C would also require an identical amount of truck round-trips to move coal from the tract to the reasonably foreseeable coal loadout location west of Cedar City. The tract, as modified under Alternative C, would encompass approximately 3,178 acres consisting of 2,280 acres of BLM-administered land (federal surface and subsurface and 893 acres of private land (private surface and federal subsurface. The life of the mine under Alternative C would be 21 years, four years less than under the Proposed Action. When compared to the No Action Alternative, Alternative C would result in an increase in employment, personal income, and government revenues. A slight increase in population is anticipated, but would not lead to an increased need for public services. Under the No Action Alternative, no mining would occur and therefore an increase in local employment, income, and government revenues as a result of mining would not occur. Under Alternative C, a slight decrease in grazing revenues would be lost as a result of a decrease in AUMs and any recreation-related economic contributions from individuals who choose to recreate on the tract would be foregone under Alternative C.

4.12.4.1 EMPLOYMENT AND INCOME

Employment requirements (for direct and indirect jobs) under Alternative C would be identical to the Proposed Action, though employment at the mine would be required for 21 years under Alternative C. The annual total wages generated (from direct and indirect jobs) would be the same under Alternative C as under the Proposed Action.

4.12.4.2 GOVERNMENT AND PUBLIC FINANCE

Under Alternative C, an estimated 1.8–1.9 million tons of coal would be mined each year. Over the 21-year mine life, approximately 38.1–41.4 million tons of recoverable coal would be mined. Using the same spot price as under the Proposed Action (11,700 BTU per pound of coal and $33.00 per short ton), the annual recovery value would be identical to the Proposed Action at approximately $59.4 to $62.7 million (1.8 million tons of coal × 33.00 and 1.9 million tons of coal × 33.00). Over the 21-year mine life, recovery values would be approximately $1.25 to $1.32 billion (1.8 million tons × 33.00 × 25 and 1.9 million tons × 33.00 × 21 years). This is a 16% decrease in potential recovery value compared to the Proposed Action.

4.12.4.2.1 Federal Royalties

Under Alternative C, annual royalties paid to the federal government would be similar to those paid under the Proposed Action because the amount of coal mined each year would be similar. However, royalty revenues would be generated for 21 years, four years less than the Proposed Action. When compared to the Proposed Action, Alternative C would produce 16% less royalty revenue. Assuming the annual recovery value for the coal produced under the Proposed Action would be $59.4 to $62.7 million per year, $7.46 to $7.89 million in royalties would be paid to ONRR ($59,400,000 × 0.125) and the State of Utah

would receive approximately $3.73 to $3.94 million ([$62,700,000 × 0.125]/2) per year. Under the Proposed Action, $103.44 to $111.43 million in royalties would be paid to ONRR and $78.38 to $82.11 million would be disbursed to the State of Utah over a 21-year period (see Table 4.26)

Under Alternative C, 118 AUMs allocated to livestock grazing would be lost. This loss of AUMs would total 2,852 over the life of the mine. The 2009 value of an AUM, according to the BLM is $1.35. Thus, over the 21-year mine life, this would result in a $4,938.30 (or $159.30 annually) decrease in contributions to the BLM. Should livestock permittees need to decrease livestock numbers as a result of the decrease in AUMs, this could result in lost revenue for permittees and a potential decrease in the workforce required to manage the livestock. However, with annual rotations in the tract over the life of the mine, adverse impacts to permittees would be minimized.

4.12.4.2.2 Additional Taxes and Fees

Under Alternative C, approximately 16% fewer coal mine-related taxes and fees would be generated. Contributions to the Black Lung Excise Tax would be between $20.8 and $21.0 million over the 21-year mine life, and Abandoned mine land fees would be between $5.7 and $5.9 million. Ad valorem taxes generated over the life of the mine would be 16% less than the Proposed Action. The sales and use tax generation on goods and services associated with the mine would taper off four years earlier under Alternative C.

Bonus bid payments: Approximately $24.0 to $26.1 million would be paid in bonus bid payments under Alternative C, given that 38.1–41.4 million tons of coal are expected to be mined over a 21-year period. Of the total bonus bid payment, 50% ($12.0 to $13.1 million) would be disbursed to the State of Utah.

4.12.4.3 POPULATION AND HOUSING

Impacts to population and housing under Alternative C would be nearly identical to impacts under the Proposed Action. However, because the duration of the mining activities would be 21 years under Alternative C, the 10% of the 160 employees (16 individuals) that would relocate to the tract for mine employment may choose to move away from the area once the mining operations are complete. Thus, the results would be a negligible decrease in population and an increase in housing availability.

Potential impacts to property values would be similar to the Proposed Action. However, given that the life of the mine would be four years shorter under Alternative C, reclamation would begin earlier, and adverse impacts to property values would be mitigated sooner than under the Proposed Action.

4.12.4.4 RECREATION AND TOURISM

Both action alternatives would result in the same types of impacts to recreational resources. However, Alternative C would result in fewer acres of recreation-related impact based on the smaller acreage of the tract and fewer years of impact based on the shortened life of the mine. Big game hunting areas in the PPMA would be reduced by 0.3%. OHV users would not be able to access 13 miles of designated routes on the tract. It is unlikely that these slight reductions in availability would deter these types of recreationists to the area. Economic contributions from these user groups would likely remain similar to current conditions given the amount of nearby lands available for big game hunting and OHV use.

Impacts to tourists and tourism-related businesses under Alternative C would be similar to the Proposed Action. Under Alternative C, the alteration of the existing rural, quiet nature of the town of Alton and surrounding areas due to truck traffic, noise, and artificial lighting would occur at the same level as the Proposed Action, but would end four years earlier.

4.12.4.5 PUBLIC HEALTH AND SAFETY

Under Alternative C, impacts to public health and safety would be identical to the Proposed Action. However, the duration of impacts and need for services would be four years less.

4.12.4.6 ENVIRONMENTAL JUSTICE

Similar to the Proposed Action, there would be no disproportionate impacts to the American Indian population in Iron County because mine-related activities would be the same as under Alternative C.

4.12.5 Potential Mitigation Measures

No potential mitigation measures have been identified for socioeconomic resources.

4.12.6 Unavoidable Adverse Impacts

Given that natural resource development is finite and based on demand, the SESA is susceptible to a boom-and-bust cycle. Although the proposed development would temporarily have positive impacts on the local economy with regard to revenue generation, the depletion of the resource would result in a long-term adverse impact to the economy. Those who had been dependent on the jobs and revenue provided by the mining operation would be adversely impacted as a result of job and revenue loss following resource depletion.

4.12.7 Short-term Uses versus Long-term Productivity

Increases in the workforce would contribute to temporary increases in income, housing, and service requirements. The increase in employment and revenues resulting from the mining operation would have short-term benefits for the local communities. However, once mining is complete, local revenues would be reduced and jobs would be eliminated or redirected. Once the tract has been rehabilitated, AUMs could return to current levels and recreation opportunities could be restored. The revenues and employment from those land uses would be realized indefinitely, or as long as the land uses were permitted to exist.

4.12.8 Irreversible and Irretrievable Commitments of Resources

The extraction of coal would result in a permanent (irreversible) loss of a portion of our natural resources. The irreversible loss of the resource would preclude future potential revenues for local, state, and federal governments and the local communities.

Implementation of the Proposed Action or Alternative C could reduce recreational tourism and livestock grazing and associated revenues. Social well-being and feelings of community satisfaction could also be disrupted during the life of the mine. However, studies in natural resource communities have observed that disruptive social effects do not last once the mining operations have ceased and the stability of the community has been reestablished (BLM 2008g).

4.13 Soils

4.13.1 Regulatory Framework

Numerous federal and state regulations shape the management of soils as a natural resource. Regulations that pertain to soils and potential impacts from mining and other land uses include, but are not limited to the following:

- The Taylor Grazing Act of 1934, as amended, provides for continued study of erosion and flood control, and provides for any work that may be necessary to protect and rehabilitate public lands to prevent soil deterioration.
- The Federal Land Policy and Management Act of 1976 requires that public lands be managed in a manner that will protect scientific, environmental, air and atmospheric, and water resource values. It also requires land-use plans to comply with applicable pollution control laws, including state and federal air, water, and other pollution standards.
- The Utah Coal Mine Permitting Requirements for soils (Utah Administrative Code [UAC] R645-301-200) include, but are not limited to, the following:
- Development of an operation plan for removing, storing, and reclaiming soils
- Development of a reclamation plan for redistributing and reclaiming of soils
- Protection and stabilization of all exposed surface areas to control erosion and air pollution (fugitive dust)
- Salvage of soils suitable to support plant growth for use in reclamation
- Protection of soil stockpiles from contaminants, disturbance, compaction, and erosion

In addition to the aforementioned regulations, the BLM uses trends or changes in vascular plants (NRCS ecological sites) and soils conditions (rangeland health) to guide the management of biological soil crusts.

In addition to promoting ecosystem health, BLM's Rangeland Health: Fundamentals and Standards (43 CFR 4180.1) specifically require that "soil and plant conditions support infiltration, soil moisture storage, and the release of water that are in balance with climate and landform" and "upland soils exhibit permeability and infiltration rates that sustain or improve site productivity".

Management actions adopted in the KFO RMP would also be incorporated into the lease as required actions in the event of a lease sale for the tract. The KFO RMP lists the following management actions applicable to soils:

- Implement BMPs designed to minimize impacts on soils from ground-disturbing activities, as appropriate.
- Reduce soil loss on watersheds by performing appropriate land treatments.
- Initiate reclamation of surface disturbances, where appropriate, during or upon completion of the authorized project.
- Identify areas of "fragile soils" during preparation of project-level plans, as well as necessary mitigation measures to minimize risks and degradation.
- Develop and implement site-specific restrictions and/or mitigations for activities proposed in fragile soil areas on a case-by-case basis. Surface-disturbing activities must be approved by the BLM before construction and maintenance is authorized.

- Incorporate BMPs and soil protection measures into developments on sensitive soils. Measures to stabilize soils and minimize surface-water runoff would be required for slopes greater than 15%, both during tract activities and following tract completion.
- When feasible, identify and salvage biological crusts prior to disturbance; use salvaged soil crusts to inoculate reclaimed soils.

4.13.2 Alternative A: No Action

Under the No Action Alternative, no impacts to soils would occur as a result of mining activities. Some soil impacts associated with current surface uses, including livestock grazing, vegetation treatments, and OHV use, would continue. These impacts would generally be relatively minor in both extent and severity in comparison to the disturbances associated with surface mining under the action alternatives. These impacts would include erosion (related soil exposure) and compaction due to existing land uses. Under current uses, soil disturbance is generally limited to surface uses by livestock and light-duty vehicles, and heavy machinery is not a typical use. In addition, uses are generally limited to designated routes or grazing areas, rather than large swatches of major disturbance, as would occur under the action alternatives. Thus, in comparison to the action alternatives, impacts would be of lesser aerial extent and far lesser magnitude and severity. Impacts to sensitive soils would occur proportionally to the prevalence of the soils on the tract, as described in Chapter 3. However, these impacts would generally be minor and limited to surface disturbance and compaction by livestock and light-duty vehicles, and thus would not result in the need for major reclamation projects. Therefore, sensitive soils would unlikely limit reclamation success.

4.13.3 Alternative B: Proposed Action

4.13.3.1 TYPES AND NATURE OF IMPACTS TO SOILS

Under the Proposed Action, 1,993–2,395 acres of soils would be directly disturbed by surface mining and by the construction of related facilities and roads. Of this total, 1,750–2,152 acres of soil resources would be disturbed by surface mining, and 243 acres would be disturbed by other related activities, including the construction of centralized and dispersed facilities, the relocation and construction of roads, and the grading of road ROWs. Impacts under the Proposed Action would be considerably greater than under the No Action Alternative due to the large-scale removal and replacement of soils that would occur during proposed surface-mining operations (which would not occur under the No Action Alternative). Impacts to soils from current land uses on the tract from vegetation treatments, livestock grazing, and recreation would be discontinued under the Proposed Action. They would resume 35 years after mining commences (25 years for the life of the mine and 10 years for reclamation and rehabilitation).

Surface-mining activities under the Proposed Action would drastically disturb soil texture, structure, and porosity through the large-scale removal, stockpiling, and replacement of soils during surface mining. A total of 1,750–2,152 acres of soils would be removed to their full depth where surface mining takes place, and topsoil and suitable subsoil would be stockpiled for reclamation. Following the completion of mining, mined areas would be backfilled and regraded, then topped with the stockpiled soils. This would result in reclaimed soils with different long-term physical, structural, biological, and chemical properties than those present prior to surface mining. Post-mining soils would be more uniform in thickness, structure, type, texture, nutrient availability, and chemistry. The existing soil structure would largely be eliminated by the removal and replacement of soils in areas that are surface mined. In addition, changes in bulk density would occur due to mixing, aeration, and compaction. The bulk density of the entire soil profile would likely be reduced, as demonstrated by evidence that replaced soils in surface mines typically expand by approximately 15%–35% (Pfleider 1968). However, grading and compaction of topsoil would

likely increase the bulk density of near-surface soils. Surface-mining impacts are referred to as "pit" impacts in this section's tables.

Surface-mining activities would directly remove and stockpile up to 120 acres of soil per year. Topsoil would be stockpiled only until the overburden is moved to the next pit. Each of these up to 120-acre blocks would be replaced within a year, and the loss of soil productivity and increased potential for erosion related to soil removal and replacement would be short term. However, the drastic disturbance (impact) caused by removing and replacing soils, as described above, would be long term. Revegetation and natural weathering would eventually reform new soil structures with the reclaimed soils, although this would be a long-term process (hundreds of years) in the arid environment present in the tract. Per State of Utah and OSM regulation, reclaimed surface soils would be free of acid-forming soils, sodic zones, or toxic materials. They would also have a rooting zone sufficient to establish an effective and permanent vegetative cover. Thus, the long-term fertility of the soils would not be affected.

Impacts to soil resources within the 243 acres of other related activities would generally be less drastic than in areas that are surface mined. The construction of roads and facilities in these areas would result in soils being covered by infrastructure, graded or mixed, moved, compacted, or otherwise disturbed. These soils would generally not be disturbed to as great a depth, would retain more of their original qualities, and would be less uniform following reclamation. However, most of these impacts (caused by facilities, some roads, etc.) would be long-term impacts, persisting for the life of the tract.

Where the near-surface soil is compacted during disturbance and/or reclamation, its infiltration capacity would be temporarily decreased, resulting in a greater potential for runoff and erosion. However, soils and vegetation would also be more uniform, and overall erosion rates following successful reclamation could therefore be lower than pre-disturbance rates (OSM 2006). Numerous erosion-control measures and reclamation measures would be employed per state and federal regulation, as detailed in Chapter 2. Specifically, reclaimed areas would be required (UAC R645-301-200) to use best available technology to prevent sedimentation. They would also be required to stabilize all exposed surfaces to effectively control erosion, and stabilize rilled (or eroded) areas where post-mining land use, vegetation, or water quality would be threatened. Because temporary erosion controls specified on unreclaimed areas often prevent erosion from traveling long distances rather than completely preventing erosion (e.g., silt fencing, retention basins, etc.), there would likely be some mass transfer of eroded materials downslope early in the reclamation process. This erosion would be reduced as vegetation is established, and eroded materials would generally be prevented from impairing other resources by the required controls.

The reclamation and restoration of soil structure and functioning is determined by physical, chemical, and biological factors. As described in the above paragraphs, both disturbance and reclamation alter soil structure through compaction and the resulting loss of porosity and biological activity. These structural changes can potentially diminish the movement of water into and through the soil (Stolt et al. 2001), reduce seed and spore viability, and prevent the establishment and growth of vegetation and biological soil crusts and associated soil microbes (Scoles-Sciulla and DeFalco 2009).

Successful reclamation of soil structure and ecological function is assumed, provided that the management practices prescribed per UAC R645-301-200 are successfully implemented. However, ecological factors outside of human control, such as drought and other short-term climatic variations, can limit the effectiveness of soil reclamation efforts. There is limited information on reclamation success for arid west soils, but published studies clearly indicate that below-average precipitation during the restoration period can impede or delay the successful restoration of soils and associated vegetation (Romney et al. 1987; Bainbridge 1990; Bainbridge et al. 1995; Bainbridge and Lovich 1999).

4.13.3.2 IMPACTS TO SENSITIVE SOILS

4.13.3.2.1 Water-erosive Soils

Under the Proposed Action, 332–463 acres of highly erosive soils, and an additional 1,362–1,730 acres of moderately erosive soils, would be disturbed. Together, 77%–92% of all soil disturbances under this alternative would take place in highly or moderately erosive soils (Table 4.28). Most of this disturbance would occur in areas that are surface mined. The disturbances under this alternative would likely result in substantial erosion, particularly during the period following mining but prior to reclamation. Required erosion-control measures would effectively mitigate the impacts of erosion on water bodies and other resources, but would likely not prevent short-term erosion over short distances. This could result in some rilling (formation of shallow linear erosional features on the soil surface by water) and varied soil depths in areas where erosion would occur, contributing to limited reclamation success by limiting the soil depth available to vegetation in some areas, and impacting other vegetation through sedimentation. In addition, accelerated erosion could contribute to excess sedimentation in streams (e.g., Kanab Creek or Robinson Creek), and stock ponds, and could affect the stability of slopes that are planted for reclamation purposes.

4.13.3.2.2 Drought-intolerant Soils

A total of 300–335 acres of highly drought-intolerant soils would be disturbed under the Proposed Action (Table 4.29). An additional 10–83 acres of moderately intolerant soils would be disturbed. Of the 309–418 acres of total disturbance in these soils, 295–357 acres would be disturbed in the surface mine pit. Overall, 17%–18% of all soil disturbance under the Proposed Action would occur in highly or moderately drought-intolerant soils, and 15%–16% of all disturbance would be associated with surface-mining removal and replacement of these soils. Any disturbance of drought-intolerant soils would require the reclamation of those areas, which would be at an increased risk of poor reclamation success due to low available water capacity. In addition, the need to reclaim areas with droughty soils that are disturbed would likely prolong the reclamation period.

Table 4.28. Acres of Highly and Moderately Water-erosive Soils Impacted under each Alternative (and percentage of the total disturbance under each alternative)

Disturbance Type	Alternative A[1] (No Action)	Alternative B (Proposed Action)*	Alternative C**
Highly Erosive			
Pit disturbance	0	322.3–417.2 (18.1%–17.4%)	315.8–410.7 (20.7%–19.9%)
Other[2] disturbance	0	46.1 (1.9%–2.3%)	41.4 (2.0%–2.5%)
Total disturbance	**0**	**331.5–463.3 (18.1%–19.3%)**	**325.0–452.2 (21.3%–21.9%)**
Moderately Erosive			
Pit disturbance	0	1,288.6–1,535.5 (70.3%–64.1%)	1,124.1–1,371 (73.6%–66.4%)
Other disturbance	0	194.1 (8.1%–9.7%)	166 (8.0%–10.0%)
Total disturbance	**0**	**1,362.3–1,729.6 (74.3%–72.2%)**	**1,187.4–1,537 (77.8%–74.5%)**
Sum of Highly and Moderately Erosive			
Pit disturbance	0	1,610.9–1,953 (87.9%–81.5%)	1,439.9–1,782 (94.3%–86.4)
Other disturbance	0	240 (10.0%–12.0%)	207 (10.0%–12.5%)
Total disturbance	**0**	**1,693.8–2,193 (92.4%–91.6%)**	**1,512.4–1,989 (99.1%–96.4%)**

* 1,933–2,395 acres total soil disturbance.

**1,662–2,064 acres total soil disturbance.

[1] Although there would be no impact to soils related to mining under the No Action Alternative, impacts to soils due to other current land uses (grazing and vegetation treatments) would continue.

[2] "Other" disturbances include centralized and dispersed facilities and roads wi h their adjoining ROWs. Sensitive soil impacts would be identical for "other" disturbances because the no-coal zone would remain the same. However, the proportional impact of that disturbance would vary with the difference in acres of surface disturbance between the 200- and 300-foot overburden removal scenarios.

Table 4.29. Acres of Highly and Moderately Drought-intolerant Soils Impacted under each Alternative (and percentage of the total disturbance under each alternative)

Disturbance Type	Alternative A[1] (No Action)	Alternative B (Proposed Action)*	Alternative C**
Highly Droughty			
Pit disturbance	0	291.0–296.1 (15.9%–12.4%)	111.7–296.1 (7.3%–14.3%)
Other[2] disturbance	0	39.1 (1.6%–2.0%)	36.8 (1.8%–2.2%)
Total disturbance	**0**	**299.6–335.2 (16.3%–14.0%)**	**120.3–332.8 (7.9%–16.1%)**
Moderately Droughty			
Pit disturbance	0	3.8–61.1 (0.2%–2.6%)	57.3–61.1 (3.8%–3.0%)
Other disturbance	0	22.1 (0.9%–1.1%)	18.3 (0.9%–1.1%)
Total Disturbance	**0**	**9.7–83.2 (0.5%–3.5%)**	**60.5–79.4 (4.0%–3.8%)**
Sum of Highly and Moderately Droughty			
Pit disturbance	0	294.8–357.0 (16.1%–14.9%)	169.0–357.0 (11.1%–17.3%)
Other disturbance	0	61.0 (2.5%–3.1%)	55.0 (2.7%–3.3%)
Total disturbance	**0**	**309.3–418.0 (16.9%–17.5%)**	**180.8–412.0 (11.8%–20.0%)**

* 1,933–2,395 acres total soil disturbance.

**1,662–2,064 acres total soil disturbance.

[1] Although there would be no impact to soils related to mining under the No Action Alternative, impacts to soils due to other current land uses would continue.

[2] "Other" disturbances include centralized and dispersed facilities and roads with their adjoining ROWs. Sensitive soil impacts would be identical for "other" disturbances because the no-coal zone would remain he same. However, the propor ional impact of hat disturbance would vary with the difference in acres of surface disturbance between the 200- and 300-foot overburden removal scenarios.

4.13.3.2.3 Saline Soils

No highly or moderately saline soils would be disturbed under any of the alternatives. Therefore, there would be a relatively low risk of poor reclamation success due to excess salinity in the soils, or due to increases in salinity in downstream waters as a result of soil disturbance.

4.13.3.2.4 Sodic Soils

A total of 1.4–4.1 acres of highly sodic soils would be disturbed under the Proposed Action (Table 4.30). This disturbance would take place exclusively in the surface-mining pit, and would represent approximately less than 0.001%–0.2% of the total soil disturbance under this alternative. Because OSM rules restrict the use of sodic soils for reclamation, the disturbed areas would be reclaimed with less sodic soils, which would likely improve growing conditions for most vegetation. High sodium levels in soils affect reclamation potential by inhibiting the establishment of vegetation in disturbed areas. Thus, where sodic soils are used, reclamation success would have an increased risk of failure or delayed success of vegetation establishment. Areas with sodic soils that are reclaimed could also require different seed mixes and species in order to be successfully

reclaimed. Therefore, the disturbance of sodic soils would result in either an increased risk of impeded reclamation or would require their burial, which would in turn reduce the depth of topsoil for use elsewhere for reclamation (as discussed under Shallow Soils, below).

Table 4.30. Acres of Highly and Moderately Sodic Soils Impacted Under Each Alternative (and percentage of the total disturbance under each alternative)

Disturbance Type	Alternative A[1] (No Action)	Alternative B (Proposed Action)*	Alternative C**
Highly Sodic			
Pit Disturbance	0	1.4–4.1 (<0.001%–0.2%)	1.4–4.1 (<0.001%–0.2%)
Other[2] Disturbance	0	0 (0%)	0 (0%)
Total Disturbance	**0**	**1.4–4.1 (<0.001%–0.2%)**	**1.4–4.1 (<0.001%–0.2%)**
Moderately Sodic			
Pit Disturbance	0	0 (0%)	0 (0%)
Other Disturbance	0	0 (0%)	0 (0%)
Total Disturbance	**0**	**0 (0%)**	**0 (0%)**
Sum of Highly and Moderately Sodic			
Pit Disturbance	0	1.4–4.1 (<0.001%–0.2%)	1.4–4.1 (<0.001%–0.2%)
Other Disturbance	0	0 (0%)	0 (0%)
Total Disturbance	**0**	**1.4–4.1 (<0.001%–0.2%)**	**1.4–4.1 (<0.001%–0.2%)**

* 1,933–2,395 acres total soil disturbance.

**1,662–2,064 acres total soil disturbance.

[1] Although there would be no impact to soils related to mining under the No Action Alternative, impacts to soils due to o her current land uses would continue.

[2] "Other" disturbances include centralized and dispersed facilities and roads with their adjoining ROWs. Sensitive soil impacts would be identical for "other" disturbances because the no-coal zone would remain the same. However, the proportional impact of that disturbance would vary with the difference in acres of surface disturbance between the 200- and 300-foot overburden removal scenarios.

4.13.3.2.5 Shallow Soils

All of the soil disturbance under the Proposed Action would occur in areas where the soil's A horizon is less than 20 inches deep, or where the soil is at a high or moderate risk of limited reclamation due to its shallow depth (Table 4.31). Approximately 74%–76% of all disturbance would occur in areas with less than a 10-inch-deep A horizon. The considerable disturbance of shallow soils under this alternative would limit the depth of topsoil that could be used for reclamation, and would increase the reliance on subsoils in the rooting zone during reclamation. The use of shallow topsoil and subsoil during reclamation would increase the risk of inhibited restoration potential due to limited water holding capacity and nutrient availability during plant establishment.

Table 4.31. Acres of Highly and Moderately Shallow Soils Impacted Under Each Alternative (and percentage of the total disturbance under each alternative)

Disturbance Type	Alternative A[1] (No Action)	Alternative B (Proposed Action)*	Alternative C**
Highly Shallow			
Pit Disturbance	0	1,285.9–1,617.3 (70.2%–67.5%)	1,177.8–1,509.3 (77.2%–73.1%)
Other[2] Disturbance	0	213.4 (8.9%–10.7%)	184.4 (8.9%–11.1%)
Total Disturbance	**0**	**1,362.5–1,830.8 (74.3%–76.4%)**	**1,246.2–1,693.7 (81.6–82.1%)**
Moderately Shallow			
Pit Disturbance	0	452.0– 522.4 (24.7%–21.8%)	276.3–346.6 (18.1%–16.8%)
Other Disturbance	0	29.5 (1.2%–1.5%)	23 (1.1%–1.3%)
Total Disturbance	**0**	**458.3– 551.9 (25.0%–23.0%)**	**280.4–369.6 (18.4%–17.9%)**
Sum of Highly and Moderately Shallow			
Pit Disturbance	0	1,737.9–2,140 (94.8%–89.3%)	1,454.1–1,856 (95.3%–89.9%)
Other Disturbance	0	243 (10.1%–12.2%)	207 (10.0%–12.5%)
Total Disturbance	**0**	**1,820.8–2,383 (99.3%–99.5%)**	**1,526.6–2,063 (100%–100%)**

* 1,933–2,395 acres total soil disturbance.

**1,662–2,064 acres total soil disturbance.

[1] Although there would be no impact to soils related to mining under the No Action Alternative, impacts to soils due to other current land uses would continue.

[2] "Other" disturbances include centralized and dispersed facilities and roads with their adjoining ROWs. Sensitive soil impacts would be identical for "other" disturbances because the no-coal zone would remain the same. However, the proportional impact of that disturbance would vary with the difference in acres of surface disturbance between the 200- and 300-foot overburden removal scenarios.

4.13.3.2.6 Alkaline Soils

No highly alkaline soils would be disturbed under any alternative. Under the Proposed Action, 302–327 acres of moderately alkaline soils would be disturbed, primarily in the surface-mining pit (Table 4.32). Alkaline soils limit plant establishment during reclamation, and their disturbance under this alternative would result in either an increased risk of impeded reclamation or would require their burial, which would in turn reduce the depth of topsoil for use elsewhere for reclamation (as discussed under Shallow Soils, above).

Table 4.32. Acres of Highly and Moderately Alkaline Soils Impacted Under Each Alternative (and percentage of the total disturbance under each alternative)

Disturbance Type	Alternative A[1] (No Action)	Alternative B (Proposed Action)*	Alternative C**
Moderately Alkaline			
Pit Disturbance	0	295.4–305.8 (16.1–12.8%)	228.7–239.1 (15.0–11.6%)
Other[2] Disturbance	0	20.9 (0.9%–1.0%)	17.6 (0.9%–1.1)
Total Disturbance	**0**	**301.6– 326.7 (16.5–13.6%)**	**232.8–256.7 (15.3–12.4%)**

* 1,933–2,395 acres total soil disturbance.

**1,662–2,064 acres total soil disturbance.

[1] Although there would be no impact to soils related to mining under the No Action Alternative, impacts to soils due to other current land uses would continue.

[2] "Other" disturbances include centralized and dispersed facilities and roads wi h their adjoining ROWs. Sensitive soil impacts would be identical for "other" disturbances because the no-coal zone would remain the same. However, the proportional impact of that disturbance would vary with the difference in acres of surface disturbance between the 200- and 300-foot overburden removal scenarios.

4.13.3.2.7 Biological Soil Crusts

Biological soils crusts are found on various soil surfaces throughout the analysis area; although, no data on the prevalence of biological soil crust are available for the tract. Because the amount of biological soil crusts cannot be quantified, impacts are discussed qualitatively.

Total crust cover is usually inversely related to vascular plant cover, because less plant cover results in more surfaces available for colonization and growth of crustal organisms (Belnap et al. 2001). Biological soil crusts in the analysis area are mostly cyanobacteria (Microcoleus) and nitrogen-fixing lichens (Collema). These cyanobacteria and nitrogen-fixing lichens are limited and sparse in the analysis area due to relatively high average elevations (5,000–7,000 feet) and relatively dense vascular plant cover.

Within the 1,933–2,395 acres of predicted surface disturbance where biological soils are not identified beforehand, existing soils crusts would be adversely impacted by surface-disturbing activities. The crusts could be removed entirely and buried or disrupted to the point of nonfunctionality. Burial generally results in a greatly simplified crustal community, and disturbance flattens pinnacled and rolling crusts, thus decreasing water infiltration and increasing runoff (Belnap et al. 2001).

Soil crusts are thought to improve the moisture capacity of soils, stabilize them against erosion, enhance soil nutrients, and discourage the growth of some types of annual weeds. Thus, their disturbance would reduce the moisture capacity, nutrient availability, and erosion resistance of the disturbed areas' soils. This would therefore reduce the soils' productivity, fertility for vascular plants, and reduce reclamation success. At this time, the success of reclamation measures is poorly understood for the tract; therefore, the impacts would result from the disturbance of soil crust and would persist as long-term impacts. However, when feasible, crusts would be identified and preserved, and efforts would be made to inoculate newly replaced topsoil with biological soil crust spores.

4.13.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

4.13.4.1 TYPES AND NATURE OF IMPACTS TO SOILS

Under Alternative C, 1,662–2,064 acres of soils would be disturbed by surface mining and the construction of related facilities and roads. Of this total, 1,454–1,856 acres of soil resources would be disturbed by surface mining, and 208 acres would be disturbed by other related activities, including the construction of centralized and dispersed facilities, the relocation and construction of roads, and the grading of road ROWs. Impacts under Alternative C would be of the same type in nature as under Proposed Action, and they would (similarly) be considerably greater than under the No Action Alternative. Impacts to soils from current land uses on the tract from vegetation treatments, livestock grazing, and recreation would be discontinued under the Proposed Action and resume 31 years after mine-related activities begin (21 years for the life of the mine and 10 years for reclamation and rehabilitation).

4.13.4.2 IMPACTS TO SENSITIVE SOILS

4.13.4.2.1 Water-erosive Soils

Under Alternative C, 325–452 acres of highly erosive soils and an additional 1,187–1,537 acres of moderately erosive soils would be disturbed. Together, 99%–96% of all soil disturbances under this alternative would take place in highly or moderately erosive soils (see Table 4.28). This is slightly less disturbance of erosive soils than would take place under the Proposed Action. Impacts would be of the same nature as described for the Proposed Action in all other respects.

4.13.4.2.2 Drought-intolerant Soils

A total of 120–333 acres of highly drought-intolerant soils would be disturbed under Alternative C (see Table 4.29). An additional 61–79 acres of moderately drought-intolerant soils would be disturbed. Of the 412 acres of total disturbance in these soils, 357 acres would be disturbed in the surface-mining pit. Overall, 12%–20% of all soil disturbance under Alternative C would occur in highly or moderately drought-intolerant soils; 11%–17% of all disturbance would be associated with surface-mining removal and replacement of these soils (slightly less than under the Proposed Action). Impacts would be of the same nature as described for the Proposed Action in all other respects.

4.13.4.2.3 Saline Soils

No highly or moderately saline soils would be disturbed under any of the alternatives. Therefore, there would be a relatively low risk of poor reclamation success due to excess salinity in the soils, or to increases in salinity in downstream waters as a result of soil disturbance.

4.13.4.2.4 Sodic Soils

Impacts under Alternative C would be the same as described for the Proposed Action.

4.13.4.2.5 Shallow Soils

All of the soil disturbance under Alternative C would occur in areas where the soil's A horizon is less than 20 inches deep, or where the soil is at a high or moderate risk of limited reclamation due to its shallow depth (see Table 4.31). Under Alternative C, approximately 82% of all disturbance would occur in areas with less than a 10-inch-deep A horizon (slightly less than under the Proposed Action). Impacts would be of the same nature as described for Proposed Action in all other respects.

4.13.4.2.6 Alkaline Soils

No highly alkaline soils would be disturbed under any alternative. Under Alternative C, 233–257 acres of moderately alkaline soils would be disturbed, primarily in the surface-mining pit (slightly less than under the Proposed Action; see Table 4.32). Impacts would be of the same nature as described for Proposed Action in all other respects.

4.13.4.2.7 Biological Soil Crusts

Impacts would be of the same nature as described for Proposed Action, except that 306–332 fewer acres of predicted surface disturbance would occur under Alternative C.

4.13.5 Potential Mitigation Measures

Potential mitigation measures to reduce impacts to soil resources could include the following:

- Whenever feasible, direct haul topsoil to areas currently being reclaimed to retain viable biological components of the soil (seeds, root fragments and rhizomes, soil microbes).
- Identify and map rocky outcrops prior to disturbance; replace rocky outcrops with rock or rocky subsoil rather than topsoil to increase habitat diversity and increase the depth of topsoil available for reclamation elsewhere.

4.13.6 Unavoidable Adverse Impacts

Under the Proposed Action and Alternative C, the physical, structural, biological, and chemical properties of soils disturbed by surface mining would be unavoidably impacted. Post-mining soils would be far more uniform in thickness, structure, type, texture, nutrient availability, and chemistry. The existing soil structure would largely be eliminated by the removal and replacement of soils in areas that are surface mined. In addition, changes in bulk density would occur due to mixing, aeration, and compaction. In areas where sensitive soils are disturbed, their use in reclamation would limit the success of reclamation due to increased erosion, limited water hold capacity, high Ph, or high sodium content. These soil attributes would limit the establishment of vegetation relative to areas without sensitive soils.

Successful reclamation of soil structure and ecological function is assumed provided that reclamation practices are successfully implemented. Nevertheless, drought and other ecological factors outside of human control can limit the effectiveness of soil reclamation efforts by limiting soil productivity or increasing the time required for soil recovery.

4.13.7 Short-term Uses versus Long-term Productivity

The short-term removal and replacement of soils in areas that are surface mined would result in long-term changes in the productivity of soils under the Proposed Action and Alternative C. Soil productivity following mining and reclamation would be far less diverse and far more uniform. Soils capable of limiting productivity (i.e., sodic, acid-producing, droughty) that are currently present on the tract would be buried or mixed into other soils. Therefore, post-mining productivity may be slightly higher, but would also reduce the productivity of highly productive areas and reduce the prevalence of less productive areas. Some productivity would be lost due to the removal of soil structure and changes in soil properties. Despite the slight loss in productivity, the soil would still be able to support rangeland plants (native and suitable non-native species). The productivity of soils impacted by other mine-related activities (dispersed and centralized facilities, roads, and ROWs) would be eliminated or reduced during the life of the mine (25 years and 21 years under the Proposed Action and Alternative C, respectively). Soil productivity in areas that are only disturbed at their surface, or that are covered by facilities (that are eventually removed), would largely be restored once those facilities were removed because the severity of impact would be minor relative to areas that are surface mined.

4.13.8 Irreversible and Irretrievable Commitments of Resources

Under the Proposed Action and Alternative C, the physical, structural, biological, and chemical properties of soils that are removed for surface mining would be irreversibly altered (because it may take hundreds of years to reform). The productivity of soils impacted by other mine-related activities (dispersed and centralized facilities, roads, and ROWs) would be irretrievably removed or reduced until reclamation is completed at the tract's termination.

4.14 Transportation

The analysis of impacts to transportation near the tract is an assessment of the changes in LOS caused by the Proposed Action and alternatives. LOS is a measure of the quality of service on transportation infrastructure and generally indicates the level of traffic congestion. LOS on two-lane highways is a reflection of traffic flow conditions, average speed, and time spent following other vehicles. Three different alternatives are analyzed in this section. Each alternative considers different tract sizes and duration of operations. LOS is rated on a scale of A (the best) to F (the worst). Table 4.33 provides a description of LOS A–F (Fehr and Peers 2008).

Table 4.33. Intersection Level of Service Descriptions

Level of Service	Description of Traffic Conditions
A	Free Flow/Insignificant Delay Extremely favorable progression. Individual users are virtually unaffected by others in the traffic stream.
B	Stable Operations/Minimum Delays Good progression. The presence of other users in the traffic stream becomes noticeable.
C	Stable Operations/Acceptable Delays Fair progression. The operation of individual users is affected by interactions with others in the traffic stream.
D	Approaching Unstable Flows/Tolerable Delays Marginal progression. Operating conditions are noticeably more constrained.
E	Unstable Operations/Significant Delays Can Occur Poor progression. Operating conditions are at or near capacity.
F	Forced Flows/Unpredictable Flows/Excessive Delays Unacceptable progression with forced or breakdown of operating conditions.

Source: Fehr and Peers 2008.

4.14.1 Regulatory Framework

Coal haul trucks operating in the tract would be within the weight and size limitations established by the UDOT's Motor Carrier Division. There are also no regulations concerning the volume of coal haul trucks allowed on tract-associated roadways. Therefore, the weight and size of trucks as well as truck volume are not components of the analysis.

4.14.2 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the Alton Coal Tract would not be approved, and the coal included in the tract would not be mined. Roads along the coal haul transportation route would continue to operate under their current LOS. Peak-hour LOS projected for 2020 under the No Action Alternative would continue to have low delays per vehicle and little to no congestion (Fehr and Peers 2008). Changes to LOS would not reach a level of significance. Under the No Action Alternative, coal haul trucks would use the coal haul transportation route to deliver coal from the Coal Hollow Mine (private mining area) to the rail loadout at Iron Springs. This activity would occur for the life of the Coal Hollow Mine (approximately 2–3 years).

Continued increases in population in Iron County, largely in and near the Cedar City area (as indicated in Section 3.12) could increase LOS on certain roads over time, regardless of mining activity.

4.14.3 Alternative B: Proposed Action

Under the Proposed Action, workers would commute from their homes to the tract according to the normal operating hours. Service operations would include delivery of diesel fuel and machine and equipment parts (daily or weekly), servicing of portable toilets (weekly or biweekly), servicing of permanent toilet facilities (monthly or bimonthly), removal of waste oil (weekly or biweekly), and incidental trips such as delivery of office supplies (bi-weekly or monthly), as necessary. Up to 100 workers would be employed at the tract. Although the traffic study completed by Fehr and Peers (2008) does not include projections of mine employee traffic, it is assumed that these employees would commute individually to the mine from communities within a one-hour to two-hour radius of the tract, resulting in an estimated 100 round-trips per day to and from the tract. Because of the proximity of the communities of Panguitch and Hatch to the tract, it is assumed that most of the commuter traffic would occur on US-89. The additional commuter traffic along US-89 would represent a 2% increase in ADT. Based on service and operations needs, it is estimated that no more than 20 service trips per week or an average of four round-trips per day to the tract would occur. This would be a 0.1% increase in ADT along US-89. Commuter traffic and service trips would represent a minimal contribution to traffic levels and would not result in any changes to LOS.

The following actions under the Proposed Action would result in impacts to LOS.

- An estimated 153 truck round-trips per day would occur to and from the tract and along the reasonably foreseeable loadout location.
- Mine operations would occur 24 hours a day, six days a week for the 25-year life of the mine.

The coal haul transportation route ADT on US-89 through Hatch and Panguitch is currently 3,600–4,100. The additional coal truck traffic would represent a 4% increase in ADT through Hatch and Panguitch when compared to the No Action Alternative. The ADT on SR-56 through Cedar City is 8,600 (Fehr and Peers 2008). The additional coal truck traffic would represent a 2% increase in ADT through Cedar City when compared to the No Action Alternative. Under the Proposed Action, traffic conditions at intersections and along road segments of the coal haul transportation route would continue to operate at their current, acceptable LOS-C or better. A traffic study conducted demonstrates that LOS-C or better would be maintained on all road segments and intersections of the coal haul transportation route (Fehr and Peers 2008). Capacity for additional traffic would remain, and increased traffic volume would not result in reductions in LOS or reach a level of significance.

4.14.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts to transportation would be the same as those described under the Proposed Action but would occur over a 21-year period.

4.14.5 Potential Mitigation Measures

No transportation mitigation measures have been identified.

4.14.6 Unavoidable Adverse Impacts

Increase in vehicle traffic of no more than 4% in the tract and on the coal haul transportation route would occur over time under both action alternatives; however, no unavoidable adverse impacts to LOS would result from those increases.

4.14.7 Short-term Uses versus Long-term Productivity

Because there would be an increase in vehicle traffic of no more than 4%, surface mining and infrastructure development and use during the life of the mine would not impact the short-term use or the long-term productivity of local transportation.

4.14.8 Irreversible and Irretrievable Commitments of Resources

Under both action alternatives, there would be no irreversible impacts to transportation, because transportation resources would not be permanently altered as a result of mining operations on the tract. The increase in vehicle traffic that would occur during the life of the mine would be an irretrievable impact that would dissipate once mining operations ceased.

4.15 Vegetation

This section discusses the impacts of the Proposed Action and alternatives, as described in Chapter 2, on upland, wetland, and riparian vegetation. Upland vegetation communities in the tract are pinyon-juniper woodland, mountain brush, annual and perennial grasses, rabbitbrush, sagebrush/grassland, and sagebrush/grassland (treated) communities (Section 3.15). The meadow communities in the tract are considered potential wetlands for the purpose of this analysis due to the presence of predominately hydrophytic vegetation (Section 3.15.2.4). Impacts to riparian vegetation are analyzed separately.

4.15.1 Impact Indicators, Thresholds, and Analysis Assumptions

Acres of surface disturbance in the vegetation communities are used as the primary indicator of impacts to the vegetation resource by implementation of the alternatives. This disturbance would mainly be incurred by minerals development and construction activities as planned under both action alternatives.

Acres of increased susceptibility to noxious or weedy plant species invasion are also used as an indicator of impacts to this resource. Gelbard and Belnap (2003) found that weed densities were highest in vegetation up to 14 m (average) away from paved roads, although weeds were also found in areas farther away from the roads (up to 50 m, the extent of the survey area). This is mainly due to 1) weed seed transport during road construction, and subsequent vehicle traffic on roads; 2) ground disturbance during construction that creates bare soil, deeper soil, or soil with greater nutrient availability; and 3) soil compaction by construction and travel that creates conditions that favor invasive species (Gelbard and Belnap 2003). These factors are also similar to those that occur in other types of facilities construction and as a result of mining activities; therefore, a buffer would also be used around these areas for the purpose of this analysis. Increased susceptibility would be calculated by creating a GIS buffer of 30 m around roads, pipelines, construction areas, and surface-mined areas that would demark acres of land with an increased susceptibility to weed invasion. The 30-m buffer was chosen as a safe estimate for the likely spread of weed species; this is meant to represent 14 m with high weed occurrence (Gelbard and Belnap 2003) with an additional 16 m of lower weed occurrence. This model is not meant to predict the actual spread of weeds in the tract following mining operations, but illustrates that the potential for weed invasion is likely to increase in undisturbed lands adjacent to disturbance areas. Use of a buffered area around construction and mining areas would also allow for a more quantitative comparison between action alternatives. To simplify these calculations, environmental variables such as soil depth, vegetation community structure, slope, ecosystem health, and moisture availability in the surrounding areas would not be taken into consideration even though these factors do contribute to the ability of vegetation communities to withstand invasion. Data on these parameters in the tract are not currently available and an accurate model for invasion is not feasible at this time.

A site-specific, detailed mining and reclamation plan would be created by the lessee in consultation with DOGM. The operation portion of the plan requires the operator to promptly establish and maintain an interim vegetative cover on disturbed areas that would not be immediately redisturbed. The reclamation portion of this plan would include specifications for grading the surface to an acceptable PMT, replacement of salvaged topsoil to an acceptable depth over suitable overburden, and reestablishment of vegetation for the determined post-mining land use. Reestablishment of vegetation would serve to mitigate some of the negative effects of surface disturbance on vegetation communities. This is discussed in the Regulatory Framework and Lease Stipulations section of this chapter, as well as in the alternatives analyses. Revegetation would also increase the quality of vegetation communities over current conditions due to agency objectives for reclamation.

Consequences of increased dust due to area travel and construction is also analyzed for both action alternatives.

4.15.2 Regulatory Framework

There are numerous federal and state regulations that shape the management of vegetation resources. Regulations that pertain to vegetation and potential impacts from mining and other land uses include but are not limited to the following:

- The Taylor Grazing Act of 1934, as amended, provides for continued study of erosion and flood control, and provides for any work that may be necessary to protect and rehabilitate public lands to prevent soil deterioration.

- The ESA of 1973 protects endangered species and their habitat. This act is also used as a basis for eradicating non-native invasive species that threaten endangered species.
- The Federal CWA, with amendments in 1972 and 1977, has the objective of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. The CWA of 1987 provides additional authorizations.
- Section 404 of the Federal CWA requires the identification of all wetlands and waters under the jurisdiction of USACE, replacement of all jurisdictional and functional wetlands, and monitoring of reclaimed wetlands that may be impacted by proposed activities.
- The Federal Noxious Weed Act of 1974 authorizes measures to eradicate or control the spread of noxious weeds.
- The Federal Land Policy and Management Act of 1976 directs managers to determine areas suitable for livestock grazing under the multiple-use, sustained-yield mandate.
- The Public Rangelands Improvement Act of 1978 provides policy to manage, maintain, and improve public rangelands to increase productivity while remaining consistent with management objectives.
- The Plant Protection Act of 2000 consolidates and modernizes all major statutes pertaining to plant protection and quarantine (e.g., the Federal Noxious Weed Act, the Plant Quarantine Act).
- The Utah Seed Act (Utah Code, Title 4, Chapter 16) provides guidelines for the labeling and distribution of seeds, in conjunction with the Seed Law (Rule R68-8), which prohibits the sale and distribution of noxious weed seeds.
- The Utah Noxious Weed Act, as amended (Utah Code, Title 3 Chapter 17), authorizes measures to eradicate or control the spread of noxious weeds.
- The Utah Noxious Weed Act (Rule R68-9) designates State of Utah noxious weeds and sources capable of weed dissemination.

Utah coal mine permitting requirements for vegetation (Utah Administrative Code R645-301.300) include but are not limited to the following:

- Description of the vegetative resources of the tract and potential impacts to vegetation resources adequate to predict the potential for reestablishing vegetation.
- Description of the productivity of the land before mining in the tract.
- Reclamation designed to restore and enhance vegetation resources to a condition suitable for designated post-mining land uses. Control of erosion on reclaimed lands prior to seeding with final seed mixture using mulching, cover crops, or other approved measures.
- Monitoring of revegetation growth and diversity until release of final reclamation bond (after a minimum of 10 years).

Monitoring of erosion to identify any need for corrective action during the establishment of vegetation.

The KFO RMP and other BLM documents such as the Standards for Rangeland Health and Guidelines for Livestock Management have provided the framework for other required mitigation measures. The following standards would be applicable to vegetation resources and special status plant species:

- Using grazing exclosures and monitoring vegetation during revegetation to determine suitability for post-mining land uses.
- Controlling weed infestation chemically and mechanically.
- Directly hauling topsoil.

- Selectively planting shrubs in riparian areas.
- Planting sagebrush seedlings in addition to seeding the area with sagebrush.
- Creating depressions and rock piles.
- Using special planting procedures around rock piles.
- Promptly establishing interim vegetative cover in disturbed areas that would not be immediately redisturbed.

4.15.3 Actions that Would Cause Change to the Existing Vegetation Resource

4.15.3.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, ACD's application to lease the coal included in the Alton Coal Tract would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined.

No coal mining activities or infrastructure development would occur under the No Action Alternative, and therefore no acres of vegetation communities would be disturbed. Likewise, no acres in the tract would be at an increased susceptibility to weed invasion due to actions associated with mining activities or infrastructure development.

Management of vegetation on BLM-administered lands in the tract would continue at the discretion of the BLM under the KFO RMP (2008a). Specifically, this would mean managing vegetation in the tract to improve wildlife habitat, increasing forage production for livestock grazing, providing watershed protection, and reducing soil loss. In addition to vegetation treatments and livestock grazing, other land uses such as OHV use would continue similar to current levels.

The use of vegetation management is emphasized under the KFO RMP. The management process restores sagebrush grasslands that have been invaded by pinyon-juniper woodlands for ecosystem restoration and watershed health. In the short term, vegetation treatments would increase the risk of invasion by noxious weeds and invasive species by vegetation removal and ground disturbance. Areas where vegetation treatments were not successful could be invaded by weed species and/or become infested with other undesired vegetation, which could also reduce the health of the upland communities over the long term. Implementing general treatment stipulations such as prescribed burning in lieu of mechanical treatment when suitable, evaluating treatment sites for soil suitability and stability prior to manipulation, and excluding livestock from all treatment areas until seedlings are established, would help facilitate reestablishment of the desired vegetation communities. Using desired species of grasses, forbs, and browse in the rehabilitation and reseeding of treated areas would facilitate vegetation reestablishment and avoid creating single-species communities.

Vegetation treatments, if successful, would have long-term benefits to the area by removing undesired species, increasing species diversity and age class of certain communities, improving vegetation composition and structure, and increasing overall vegetation cover. This would result in healthier woodlands, upland communities, and riparian areas that are more capable of retaining moisture and nutrients and resisting disease, invasive species, drought, and other natural disturbances and/or stressors.

Vegetation treatments could also improve watershed health, reduce soil loss, and enhance forage vegetation conditions. Implementing erosion-control measures in fragile watershed areas would help reduce short-term impacts such as soil erosion, surface runoff, and sedimentation of water sources. These vegetation treatments would help to reestablish upland communities, maintain or improve the health of riparian/wetland communities, reestablish seedlings and understory vegetation, and retain soil moisture and nutrients in forests and woodlands (2008b).

4.15.3.2 ALTERNATIVE B: PROPOSED ACTION

Under the Proposed Action, the Alton Coal Tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The boundaries of the tract would be reasonably consistent with the tract reconfiguration completed by the BLM after ACD's original LBA submittal (see Map 1.2). A total of 1,993–2,395 acres of surface disturbance (surface mining and infrastructure development) would occur in the Alton Coal Tract under the Proposed Action. Underground mining would occur on 717 to 412 acres of land in the tract (depending on the extent of surface mining). Though subsidence related to underground mining is not expected to impact the overlying vegetation, any adverse effects would be repaired in accordance with DOGM rules and regulations (Utah Administrative Code 40-10). In Utah, the effects of subsidence usually consist of surface cracks, general ground lowering, and cliff fracture or failure (Personal Communication, Smith 2008).

4.15.3.2.1 Effects of Surface-mining Activities on Vegetation

Of the total 1,993–2,395 acres of surface disturbance that would occur in the Alton Coal Tract under the Proposed Action, 1,750–2,152 acres would be the direct result of surface-mining operations (pit disturbance). Of this total, approximately 17 acres would occur on existing roads and the remaining 1,733–2,135 acres would occur in the vegetation communities.

4.15.3.2.1.1 Upland Areas

Of the 3,437 acres of vegetated land in the tract to be impacted by surface mining, approximately 1,677–2,075 (49%–60%) would occur in upland areas. Of this total, 609–883 acres would be in pinyon-juniper communities, 315–383 acres would be in the sagebrush/grassland community, 472 acres would be in the sagebrush/grassland (treated) community, 259–280 acres would be in the annual and perennial grassland community, and 22–57 acres would be in the mountain brush community. This information is shown in Table 4.34.

Table 4.34. Acres of Upland Vegetation Communities Directly Disturbed by Surface Mining under the Proposed Action

Upland Vegetation Community	Acres Disturbed	Total Upland Acres in Tract	Percentage Disturbed by Surface Mining
Pinyon-juniper woodlands*	609.0–883.1	1,430.0	42.6%–61.8%
Sagebrush/grassland	314.9–383.1	860.2	36.6%–44.5%
Sagebrush/grassland (treated)	471.5	749.1	62.9%
Annual and perennial grasses	259.3–280.4	324.1	80.0%–86.5%
Mountain brush	22.0–57.1	62.8	35.0%–90.8%
Rabbitbrush	0.0	10.7	0.0%
Surface mining total	**1,676.7–2,075.2**	**3,436.9**	**48.8%–60.4%**

*This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Surface mining would result in the removal of 49%–60% of 3,437 acres of upland vegetation in the tract. These vegetation communities require long periods of time and the relative absence of invasive annual plant species (such as cheatgrass) in order to reestablish naturally. Active restoration would be needed after mining operations are complete and the land has been regraded. The reestablishment of vegetation is based on the ability of reclaimed soils to support new native and suitable non-native vegetation. See the Soils section of Chapter 4 for soils analysis.

Some vegetation communities, such as the mountain brush community (35%–91% reduction) would be very impacted by this disturbance. Likewise, 37%–45% of sagebrush/grassland acres, 63% of sagebrush/grassland (treated) communities, and 43%–62% of pinyon-juniper woodlands in the tract would also be eliminated due to surface-mining activities. Revegetation efforts would focus on restoring these areas to sagebrush and grassland ecosystems to benefit watershed health, wildlife, and livestock. Because of this, a total elimination of pinyon-juniper and mountain brush community acreages in the mining footprint would be likely in the short and long term.

Because annual and perennial grasses are not considered a native vegetation community, a reduction of 87% is not necessarily considered a loss to the resource. This is especially true of annual and perennial grasses displaced by surface mining that are to be revegetated with native and non-native rangeland-suitable vegetation at the completion of mining activities.

4.15.3.2.1.2 Wetland Areas

Disturbance due to surface mining is expected to impact 52.5 acres of meadow vegetation. This is approximately 84% of the total 62.8 acres of meadow vegetation in the tract. A reconnaissance-level wetland survey of these areas was conducted in July 2008 (Appendix F). This survey concluded that approximately 37.4 acres of these areas may be jurisdictional wetlands. Official wetland delineations would need to be completed in these areas and approved by the USACE before the actual extent of wetlands in this vegetation type can be determined. Acres of potential disturbance in wetland areas would require avoidance, minimization, or compensatory mitigation measures as approved by the USACE in a Section 404 permit that would be granted upon review of the official wetland delineation.

Canada thistle, the only listed noxious weed currently identified in the tract, is found in the meadow community. Further disturbance in this community would lead to an increase in the spread of this species in the tract.

4.15.3.2.1.3 Riparian Areas

Disturbance due to surface mining is expected to impact 3.8–7.1 acres of riparian vegetation. This is approximately 7%–13% of the total 55.3 acres of riparian vegetation in the tract. Revegetation of this area at the completion of mining activities would be required, with the objective of restoring riparian communities to achieve rangeland health standards and proper functioning condition (PFC).

4.15.3.2.2 Effects of Facilities Construction Activities on Vegetation

Centralized facilities associated with mining activities on the Alton Coal Tract would be located on approximately 36 acres of BLM-administered land in the tract’s no-coal zone (see Map 2.1). Other dispersed facilities such as temporary light-use roads and haul roads, electrical poles and lines, various temporary ponds and water-control structures, temporary topsoil and overburden stockpiles, and temporary berms and screens would result in approximately 160 acres of vegetation removal, and would be sited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not possible to avoid disturbances to these areas, the mitigation measures described in the Regulatory Framework section above would be prescribed.

Approximately 36 acres of vegetation would be removed as a result of construction of centralized facilities. Of this total, 34.3 acres (96%) would be in the sagebrush/grassland (treated) community, and 1.4 acres (4%) would be in pinyon-juniper communities. This information is shown in Table 4.35.

Table 4.35. Acres of Upland Vegetation Communities Directly Disturbed by Construction of Centralized Facilities under the Proposed Action

Upland Vegetation Community	Acres Disturbed	Percentage Total Area Disturbed by Centralized Facility Construction
Pinyon-juniper woodlands*	1.4	4%
Sagebrush/grassland (treated)	34.3	96%
Centralized facilities construction total	**35.7**	**100**%

* This associa ion includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Land disturbed by construction of centralized facilities would remove approximately 1% of the total 3,437 acres of upland vegetation in the tract. The 34.3 acres of disturbance in the sagebrush/grassland (treated) vegetation community is approximately 5% of its total 749 acres. The 1.4 acres of disturbance in pinyon-juniper woodlands is less than 0.001% of all the land occupied by these communities (1,430 acres). No acres of riparian or wetland vegetation would be removed by construction of centralized facilities.

A total of 160 acres would be disturbed by construction of other dispersed facilities; however, the locations of these facilities have yet to be determined. To estimate vegetation disturbance from dispersed facility construction, total potential acreage was identified by acres of no-coal zone for each vegetation community (Table 4.36). This acreage was capped, when applicable, to the total maximum extent of disturbance (160 acres) and provides the most conservative estimate of potential dispersed facility impacts to tract vegetation. It is assumed that only a portion of the maximum potential acreage would be disturbed for each vegetation community. Total acres of dispersed facility disturbance were apportioned across vegetation communities based on their percentage of land in the tract (See Section 3.15.2). Based on this approach, 64.3 acres (40%) would be in pinyon-juniper communities, 38.6 acres (24%) would be in sagebrush/grasslands, and 33.4 acres (21%) would be treated sagebrush/grasslands. Remaining acres of disturbance would be distributed across other vegetation communities in the tract.

Care would be taken to avoid wetland and riparian areas when selecting sites for these facilities. Assuming that all these facilities would be placed in upland areas, this would represent a loss of approximately 5% of the 3,437 acres of upland vegetation communities in the tract. No acres of riparian or wetland vegetation would be removed by construction of dispersed facilities.

Table 4.36. Acres of Vegetation Communities Potentially Disturbed by Construction of Dispersed Facilities under the Proposed Action

Vegetation Community	Maximum Potential Acres Disturbed	Estimated Acres Disturbed
Pinyon-juniper woodlands*	160	64.3
Sagebrush/grassland	160	38.6
Sagebrush/grassland (treated)	160	33.4
Mountain brush	5.8	2.9
Annual and perennial grasses	39.1	14.6
Rabbitbrush	10.1	0.5
Riparian	47.6	2.4
Meadow	10.3	2.9

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

4.15.3.2.3 Effects of Road Relocation on Vegetation

Approximately 47 acres of vegetation in the tract would be removed due to surface disturbance (clearing) for the relocation of KFO Route 116 under the Proposed Action. Table 4.37 shows the acres of surface disturbance to each vegetation community that would occur due to the relocation of the actual road surface and due to the KFO Route 116 ROW.

Table 4.37. Acres of Vegetation Communities Directly Disturbed by Kanab Field Office Route 116 Relocation on BLM-administered Lands in the Tract under the Proposed Action

Vegetation Community	Acres Disturbed Road Surface	Acres Disturbed ROW	Total Acres in Tract	Percentage Disturbed by Road Relocation
Meadow	0.0	0.0	62.8	0%
Mountain brush	0.0	0.0	62.8	0%
Annual and perennial grasses	1.7	2.9	324.1	1.4%
Pinyon-juniper woodlands*	7.1	12.7	1,430.0	1.4%
Rabbitbrush	0.2	0.3	10.7	4.8%
Riparian	0.2	0.3	55.3	0.9%
Sagebrush/grassland	4.8	8.1	860.2	1.5%
Sagebrush/grassland (treated)	3.0	5.2	749.1	1.1%
Road relocation total	17.0	29.5	3,555.0	0.5%

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Road relocation by itself would not disturb large acreages of land in the tract. The greatest disturbance by percentage (4.8%) would occur in the sagebrush/grassland vegetation community. No disturbance due to road relocation would affect the meadow or mountain brush communities.

4.15.3.2.4 Increased Risk for Weed Invasion

Because of BMPs to be implemented during mining activities, it is assumed that no new weed species would be introduced to the tract. However, it is possible that weed species currently present in the tract could expand their ranges. This is especially likely for species such as cheatgrass that thrive in disturbance areas. Canada thistle, the only state-listed noxious weed in the tract, also tends to spread into disturbed areas (Morishita 1999). Soil and vegetation disturbance associated with mining are planned to occur in areas currently occupied by both these species under this alternative.

A 30-m buffer around all proposed roads, construction facilities, and surface mines was used to calculate the potential spread of weeds as a result of proposed activities under the Proposed Action. The results of these calculations are shown in Table 4.38.

Table 4.38. Acres of Land at Increased Risk for Weed Invasion under the Proposed Action

	Area (acres) or Length (miles)	Additional Area (acres) included in 30-m Buffer*	Total Acres at Increased Risk for Weed Invasion
Centralized facilities	35.8	9.5	45.3
Dispersed facilities	160.0	unknown	160.0 (plus unknown buffer)
KFO Route 116 relocation	12.9–16.9 (6.5 miles)	103.5–134.7	116.4–151.6
Surface mine	1,107.4–2,151.8	133.6–131.1	1,241.0–2,282.9
Total			**1,562.6–2,639.8**

* Some buffered areas extend outside the tract.

Mined areas, even though they are to be revegetated at the completion of activities, would still be susceptible to weed invasion. Disturbed soils are generally more susceptible to invasion (DiTomaso 2000); the soils in these areas would be repositioned and regraded and would otherwise be dissimilar to the native soils that existed pre-disturbance.

The construction and mining activities proposed under the Proposed Action would increase the acres of land susceptible to weed invasion by 1,563–2,640 acres over the No Action Alternative. This acreage includes the 30-m buffers as well as the mined and construction footprint areas.

4.15.3.2.5 Revegetation

Under the Proposed Action, recoverable portions of in-place coal reserves would be mined over approximately 25 years using surface and underground mining methods. Reclamation would be concurrent with mining over the course of the estimated 25-year mine life, and would be followed by a potential 10-year reclamation and revegetation monitoring period.

The entire 1,677–2,075 acres affected by surface mining under the Proposed Action would be revegetated. The 196 acres of vegetated land affected by centralized and dispersed facilities construction would also be revegetated as deconstruction occurs. Specific revegetation plans, including target communities for restoration, would be made by the lessee in accordance with guidance from the BLM and DOGM. Wetland revegetation plans would have to be made in accordance with USACE guidelines and mitigation requirements. General methods for revegetation are outlined in Chapter 2.

Revegetation in the mining and development footprint would change the distribution of vegetation communities. Reclamation measures proposed include an overall reduction in pinyon-juniper woodlands and an increase in sagebrush and grassland communities.

4.15.3.2.6 Other Actions

Increased traffic on highways and new roads, construction, and mining would lead to an increase in fugitive dust, which would create short-term direct negative impacts to vegetation in all the communities in the tract and the surrounding area. Dust on the surface of leaves inhibits stomatal function and photosynthesis (Hirano et al. 1995), and therefore impacts overall plant health. Dust would impact vegetation in the tract and surrounding area for the life of mining operations on the tract.

The effects of vegetation management would be the same as under Alternative A, outlined in the Impact Indicators, Thresholds, and Analysis Assumptions section above.

4.15.3.2.7 Summary of Effects of Management Actions on Vegetation under the Proposed Action

The acres of vegetation affected by each type of surface disturbance under the Proposed Action are shown in Table 4.39. Acres affected by underground mining are not shown because these would not result in direct removal of vegetation at the surface.

Table 4.39. Acres of Each Vegetation Community to be Removed Due to Surface-disturbing Activities in the Alton Coal Tract under the Proposed Action

Vegetation Community	Total Acres in Tract	Acres Disturbed by:				Total Acres Removed[1]	Percentage Total to be Disturbed
		Surface Mining	Centralized Facilities Construction	Dispersed Facilities Construction[2]	KFO Route 116 Relocation		
Pinyon-juniper woodlands[3]	1,430.0	609.0–883.1	1.4	64.3	19.8	694.4–968.5	48.6%–67.7%
Sagebrush/grassland	860.2	314.9–383.1	–	38.6	12.9	366.5–434.7	42.6%–50.5%
Sagebrush/grassland (treated)	749.1	471.5	34.3	33.4	8.2	547.5	73.1%
Annual and perennial grasses	324.1	259.3–280.4	–	14.6	4.6	278.4–299.6	85.9%–92.4%
Meadow	62.8	52.5	–	2.9	–	55.5	88.3%
Mountain brush	62.8	22.0–57.1	–	2.9	–	24.9–60.0	39.6%–95.5%
Riparian	55.3	3.8–7.1	–	2.4	0.5	6.7–10.0	12.1%–18.1%
Rabbitbrush	10.7	–	–	0.5	0.5	1.0–1.0	9.2%–9.2%
Total	**3,555.0**	**1,732.9–2,134.8**	**35.7**	**160**	**46.5**	**1,974.8–2,376.7**	**55.6%–66.9**

[1] In addition to dispersed facilities to be constructed.

[2] Specific placement of facilities is unknown at this time; however, acres of vegetation removal were estimated by apportioning total dispersed facility acres across vegetation communities based on their percentage of land in the tract. Additional information on this approach, as well as a more conservative estimate of total potential acreage, is discussed in Section 4.15.3.2.2.

[3] This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Within the total 3,555 acres of land in the tract currently occupied by vegetation, 1,815–2,217 acres, or 51%–62% of these, would be removed due to surface-mining and construction activities. Approximately 35%–91% of the vegetation in the mountain brush community would be removed, approximately 84% of the vegetation in the meadow community and 81%–88% in the annual and perennial grasses community would be removed, 44%–63% of the vegetation in the pinyon-juniper woodlands would be removed, 69% of the vegetation in the sagebrush/grassland (treated) community would be removed, and 38%–46% of the vegetation in the sagebrush/grassland community would be removed. Approximately 8%–14% of vegetation in the riparian community would also be removed.

Vegetation in the tract and surrounding areas would be negatively impacted by dust from increased travel and construction activities during the life of mining operations.

All areas affected by surface mining and facilities and road construction would be revegetated at the completion of the mine activities. However, it would be assumed that revegetated areas would still be susceptible to weed invasion due to the increased nutrient availability of disturbed soils that favors invasive species colonization (Lowe et al. 2003). A 30-m buffer around these areas (see rationale in this chapter's Introduction section) leads to 1,563–2,640 acres that would become more susceptible to invasion by noxious and invasive weeds because of mining and infrastructure development activities.

4.15.3.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

Under Alternative C the tract would be modified to exclude Block NW (see Map 2.1). Further, certain mining activities in Block S would be subject to seasonal restrictions to reduce impacts to the local sage-grouse population. Under Alternative C, the modified tract would be offered for lease at a sealed-bid, competitive lease sale subject to standard and special lease stipulations developed for the tract. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.1.

Consistent with the purpose and need for the action, the intent of Alternative C is to resolve in part or in full issues related to the local sage-grouse population, noise, and visual impacts to the town of Alton as well as issues related to conflicting land uses (agriculture versus surface mining). Alternative C may also reduce impacts to other resources such as AVF, springs and surface waters, wildlife, soils, public health and safety, paleontological resources, cultural resources, and vegetation. Potential impacts to vegetation would be the same as described under the Proposed Action (see Section 4.15.3.2)

4.15.3.3.1 Effects of Surface-mining Activities on Vegetation

Of the total 1,662–2,064 acres of surface disturbance that would occur in the Alton Coal Tract under Alternative C, 1,454–1,856 acres would be the direct result of surface-mining operations (pit disturbance). Of this total, 11 acres of disturbance would occur on existing roads, and the remaining 1,443–1,845 acres would occur in vegetation communities.

4.15.3.3.2 Upland Areas

Under Alternative C, approximately 1,439–1,838 (46%–59%) of the 3,107 acres of vegetated uplands in the tract would be disturbed by surface mining (Table 4.40). Of this total, 22–57 acres would be in mountain brush, 182–203 acres would be in annual and perennial grasses, 602–876 acres would be in pinyon-juniper communities, 162–230 acres would be in the sagebrush/grassland community, and 472 acres would be in the sagebrush/grassland (treated) community. Active restoration would be needed after mining operations are complete and the land has been regraded.

Table 4.40. Acres of Upland Vegetation Communities Directly Disturbed by Surface Mining under Alternative C

Upland Vegetation Community	Acres Disturbed	Total Acres in Tract	Percentage Disturbed by Surface Mining
Pinyon-juniper woodlands*	601.7–875.7	1,409.7	42.7%–62.1%
Sagebrush/grassland (treated)	471.5	749.1	62.9%
Sagebrush/grassland	161.7–229.9	627.8	25.8%–36.6%
Annual and perennial grasses	182.2–203.4	247.0	73.8%–82.3%
Mountain brush	22.0–57.1	62.8	35.0%–90.9%
Rabbitbrush	0.0	10.7	0.0%
Surface Mining Total	**1,439.1–1,837.6**	**3,107.1**	**46.3%–59.1%**

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Some vegetation communities such as the mountain brush community (35%–91% reduction) would be very impacted by this disturbance. Likewise, approximately 26%–37% of sagebrush/grassland acres, 63% of sagebrush/grassland (treated) communities, and 43%–62% of pinyon-juniper woodlands in the tract would also be eliminated due to surface-mining activities. Revegetation efforts would focus on restoring these areas to sagebrush and grassland ecosystems in order to benefit the watershed, wildlife, and livestock; and as such, a total elimination of pinyon-juniper and mountain brush community acreages in the mining footprint would be likely in the short and long term.

Because annual and perennial grasses are not considered a native vegetation community, a reduction of 74%–82% is not considered a loss to the native vegetation resource. Impacts to annual and perennial grasses removed during surface mining and associated activities would be mitigated by reclamation and revegetation with native and non-native rangeland-suitable plants upon completion of mining activities.

4.15.3.3.2.1 Wetland Areas

Disturbance due to surface mining would not impact the meadow vegetation community because the area containing the meadow vegetation community would not be included in the tract under this alternative.

4.15.3.3.2.2 Riparian Areas

Disturbance due to surface mining is expected to remove 3.7–7.0 acres of riparian vegetation. This is approximately 8%–14% of the total 54 acres of riparian vegetation in the tract. Revegetation of this area at the completion of mining activities would be required, and would lead to an increase in vegetation quality due to the requirements of rangeland health standards and agency objectives for reclamation.

4.15.3.3.3 Effects of Facilities Construction Activities on Vegetation

Centralized facilities associated with mining activities on the Alton Coal Tract would be located on approximately 36 acres of BLM-administered land in the tract's no-coal zone (see Map 2.1). This is the same as under the Proposed Action.

Dispersed facilities would occupy 135 acres of land in the tract. The placement of these facilities would be the same as under the Proposed Action. although the maximum potential and estimated vegetation disturbance by vegetation community would be less due to the smaller size of the tract under this alternative (Table 4.41).

Table 4.41. Acres of Vegetation Communities Potentially Disturbed by Construction of Dispersed Facilities under Alternative C

Vegetation Community	Maximum Potential Acres Disturbed	Estimated Acres Disturbed
Pinyon-juniper woodlands*	135	60.2
Sagebrush/grassland	135	26.8
Sagebrush/grassland (treated)	135	32.0
Mountain brush	5.8	2.7
Annual and perennial grasses	39.9	10.5
Rabbitbrush	10.2	0.5
Riparian	46.5	2.3

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Avoidance criteria would also be the same as under the Proposed Action. Assuming construction of dispersed facilities takes place in upland areas, this would be a loss of an additional 135 acres of upland vegetation, or 4% of the total 3,107 upland acres in the tract.

4.15.3.3.4 Effects of Road Relocation on Vegetation

Approximately 36 acres of vegetation on BLM-administered land in the tract would be removed due to the relocation of KFO Route 116 under Alternative C (Table 4.42).

Table 4.42. Acres of Vegetation Communities Directly Disturbed by Kanab Field Office Route 116 Relocation on BLM-administered Lands in the Tract under Alternative C

Upland Vegetation Community	Acres Disturbed Road Surface	Acres Disturbed ROW	Total Acres in Tract	Percentage Disturbed by Road Relocation
Pinyon-juniper woodlands*	5.9	10.4	1,409.7	1.2%
Sagebrush/grassland (treated)	3.0	5.2	749.1	1.1%
Sagebrush/grassland	2.6	4.6	627.8	1.1%
Annual and perennial grasses	1.4	2.4	247.0	1.5%
Mountain brush	0.0	0.0	62.8	0.0%
Riparian	0.1	0.2	54.0	0.6%
Rabbitbrush	0.2	0.3	10.7	4.7%
Meadow	0.0	0.0	0.0	0.0%
Road relocation total	**13.2**	**23.1**	**3,161.1**	**11.5%**

*This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Road relocation alone would not disturb large acreages of land in the tract. The greatest disturbance by percentage (4.7%) would occur in the rabbitbrush vegetation community. No disturbance due to road relocation would affect meadow or mountain brush communities. These acreages are similar to those under the Proposed Action.

4.15.3.3.5 Increased Risk for Weed Invasion

Because BMPs would be implemented during mining activities, it is assumed that no new weed species would be introduced to the tract. However, it is possible that weed species currently present in the tract could expand their ranges. Canada thistle, the only state-listed noxious weed in the tract, also tends to spread into disturbed areas (Morishita 1999). Soil and vegetation disturbance associated with mining are planned to occur in areas currently occupied by both these species under this alternative.

A 30-m buffer around all proposed roads, construction facilities, and surface mines was used to calculate the potential for spread of weeds as a result of proposed activities under Alternative C. The results of these calculations are shown in Table 4.43.

Table 4.43. Acres of Land at Increased Risk for Weed Invasion under Alternative C

	Area (acres) or Length (miles)	Additional Area included in 30-m Buffer*	Total Acres at Increased Risk for Weed Invasion
Centralized Facilities	35.7	9.5	45.2
Dispersed Facilities	135.0	unknown	135.0 (plus unknown buffer)
KFO Route 116 Relocation	13.2–16.9 (4.6 miles)	105.5–134.7	118.7–151.6
Surface Mine	1,454.0–2,151.8	122.1–131.1	1,576.1–2,282.9
Total			**1,875.0–2,614.7**

*Some buffered areas extend into the surrounding nontract area.

The construction and mining activities proposed under Alternative C would increase the acres of surface disturbance and land susceptible to weed invasion by 1,875–2,615 acres over the No Action Alternative. This includes the mining and construction footprint areas, as well as the 30-m buffers around these disturbances. Mined areas, even though they are to be revegetated at the completion of activities, would still be susceptible to weed invasion. Disturbed soils are generally more susceptible to invasion (DiTomaso 2000); the soils in these areas would be repositioned and alcinat and would otherwise be dissimilar to the native soils that existed pre-disturbance.

4.15.3.3.6 Revegetation

Under Alternative C, recoverable portions of in-place coal reserves would be mined over approximately 21 years using surface and underground mining methods. Reclamation would be concurrent with mining over the course of the estimated 21-year mine life and would be followed by a minimum 10-year reclamation and revegetation monitoring period.

The entire 1,443–1,845 acres affected by surface mining under Alternative C would be revegetated. The 171 acres affected by centralized and dispersed facilities construction would also be revegetated as deconstruction occurs. Specific revegetation plans, including target communities for restoration, would be

implemented by the lessee in accordance with guidance from the BLM and the DOGM. Wetland revegetation plans would have to be made in accordance with USACE guidelines and mitigation requirements. General methods for revegetation are outlined in Chapter 2.

Revegetation in the mining and development footprint would most likely change the distribution of vegetation communities; mainly as a reduction in pinyon-juniper woodlands and an increase in sagebrush and grassland communities.

4.15.3.3.7 Other Actions

Increased traffic on highways and new roads, construction, and mining would lead to an increase in fugitive dust, which would create short-term direct negative impacts to vegetation in all the communities in the tract and the surrounding area. Dust on leaf surfaces inhibits stomatal function and photosynthesis (Hirano et al. 1995) and reduces overall plant health. This effect is likely to be felt by vegetation in the tract and surrounding area for the life of the tract.

The effects of vegetation management would be the same as described under Alternative A.

4.15.3.3.8 Summary of Effects of Management Actions on Vegetation under Alternative C

The acres of vegetation affected by each type of surface disturbance are shown in Table 4.44. Acres affected by underground mining are not shown because they would not result in direct removal of vegetation at the surface.

Table 4.44. Acres of Each Vegetation Community to be Removed Due to Surface-disturbing Activities in the Alton Coal Tract under Alternative C

Vegetation Community	Total Acres in Tract	Acres Disturbed by:				Total Acres Removed[1]	Percentage Total to be Disturbed
		Surface Mining	Centralized Facilities Construction	Dispersed Facilities Construction[2]	KFO Route 116 Relocation		
Meadow	0.0	–	–	0	–	0.0	0%
Mountain brush	62.8	22.0–57.1	–	2.7	–	24.7–59.8	39.3%–95.2%
Annual and perennial grasses	247.0	182.2–203.4	–	10.5	3.8	196.5–217.6	79.6%–88.1%
Pinyon-juniper woodlands[3]	1,409.7	601.7–875.7	1.4	60.2	16.3	679.5–953.5	48.2%–67.6%
Rabbitbrush	10.7	–	–	0.5	0.5	0.9	8.0%
Riparian	54.0	3.7–7.0	–	2.3	0.3	6.3–9.6	11.7%–18.0%
Sagebrush/grassland	627.8	161.7–229.9	–	26.8	7.2	195.7–263.9	31.2%–42.0%
Sagebrush/grassland (treated)	749.1	471.5	34.3	32	8.2	546.1	72.9%
Total	**3,161.1**	**1,442.8–1,844.6**	**35.7**	**135**	**36.3**	**1,649.7–2,051.4**	**52.2–64.9**

[1] In addition to dispersed facilities to be constructed.

[2] Specific placement of facilities is unknown at this time; however, acres of vegetation removal were estimated by apportioning total dispersed facility acres across vegetation communities based on their percentage of land in the tract. Additional information on this approach, as well as a more conservative estimate of total potential acreage, is discussed in Section 4.15.3.3.3.

[3] This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Within the total 3,161 acres of land in the tract currently occupied by vegetation, 1,650–2,052 acres (52%–65%) would be removed due to surface-mining and construction activities (including 135 acres for dispersed facilities). Thirty-five percent to 90% of the vegetation in the mountain brush community would be removed, approximately 75%–83% of the vegetation in the annual and perennial grasses community would be removed, 44%–63% of the vegetation in the pinyon-juniper woodlands would be removed, 69% of the vegetation in the sagebrush/grassland (treated) community would be removed, and 27%–38% of the vegetation in the sagebrush/grassland community would be removed. Approximately 8%–14% of vegetation in the riparian community would also be removed and no acres of the meadow community would be removed.

All areas affected by surface mining and facilities and road construction would be revegetated at the completion of mine activities. However, it is assumed that revegetated areas would still be susceptible to weed invasion due to the increased nutrient availability of disturbed soils that favors invasive species colonization (Lowe et al. 2003). A 30-m buffer out from these areas (see rationale in this chapter's Introduction section) leads to 1,875.0–2,614.7 acres that would become more susceptible to invasion by noxious and invasive weeds because of soil and vegetation disturbance resulting from mining and infrastructure development activities.

Vegetation in the tract and surrounding areas would be negatively impacted by dust from increased travel and construction activities during the life of mining operations.

4.15.4 Potential Mitigation Measures

The protective measures for vegetation described above and in the Management and Considerations Common to Each Action Alternative section of Chapter 2 would mitigate and/or minimize impacts to vegetation resources in the tract. These mitigation measures would help to reduce the amount and severity of weed infestations and would help to restore native vegetation communities. No potential mitigation measures are recommended.

4.15.5 Unavoidable Adverse Impacts

Unavoidable adverse impacts would occur where vegetation resources are removed during mining pit disturbance, soil stockpiling, road and infrastructure development, and other mine operations. These impacts would be mitigated by site reclamation and revegetation concurrent with mining that would minimize soil loss or weed invasion in disturbed sites. Unavoidable loss would occur where special status plant species are not detected or identified during surveys and are subsequently lost. Implementation of mitigation and monitoring plans would reduce the risk of loss or destruction of special status plant species. Unavoidable loss of special status plant species due to nondetection or loss of function in native vegetation communities from inadvertent adverse impacts would also occur.

4.15.6 Short-term Uses versus Long-term Productivity

Surface mining and infrastructure development and use during the life of the mine would negatively impact the short-term productivity of vegetation communities. The vegetation communities present in the tract are typically slow to recover from disturbance. Productivity would be limited during reclamation and restoration activities for the time period required for plants to grow to mature size and for the development of functioning vegetation communities. Long-term productivity would be reduced because vegetation communities are unlikely to be fully developed immediately following mining and restoration activities. Until vegetation communities are fully developed, these habitats would be less diverse (Belnap et al. 2001) and less productive (Garcia-Pichel and Belnap 1996) where ecologically important habitat components such as biological soil crusts have been lost. Effective implementation of the regulatory compliance and mitigation measures outlined in Chapter 2 and enumerated above would minimize impacts to the long-term productivity of vegetation communities.

4.15.7 Irreversible and Irretrievable Commitments of Resources

The protective measures detailed in Chapter 2 and enumerated above require the reclamation of disturbed areas following completion of the management action. Because vegetation resources would be restored or rehabilitated after proposed disturbance and/or development, there would be no anticipated irreversible impacts on vegetation resources associated with the management decisions proposed for the tract. However, there would be irretrievable impacts associated with surface-disturbing activities proposed throughout the tract. The vegetation that would be removed or disturbed to facilitate mining would be irretrievably lost until successful restoration took place.

4.16 Water Resources

This section addresses potential impacts on surface water, groundwater, wetlands and riparian areas, floodplains, and AVFs due to the removal of coal from the Alton Coal Tract using primarily surface-mining methods. Direct and indirect effects would consist of 1) surface-water depletions, 2) potential degradation of surface-water quality from increased sediment delivery and subsequent changes in turbidity, dissolved solids, or temperature, 3) groundwater depletions, 4) potential degradation of groundwater quality from increased TDS, 5) disturbance to wetland and riparian areas and floodplains, and 6) indirect impacts to AVFs that may exist adjacent to areas where surface mining would occur (in a reconnaissance-level survey there were no probable AVFs identified in areas that would be surface mined). Impacts to the quality of deep groundwater are not discussed in the alternatives analysis because no impacts are expected to deep groundwater resources (as described in Section 3.16.2.) under any alternative. Under any action alternative the successful bidder would be required to comply with state and federal mining regulations intended to reduce or eliminate impacts to surface and groundwater resources (see Table 2.3 and Section 4.16.1). Hazardous materials contained and used in the tract represent a risk of contamination to near-surface groundwater and surface-water resources from spills. Spills would be contained and mitigated in accordance with applicable state and federal regulations dealing with hazardous materials (see Table 2.3 and Section 4.7.1). Transportation of coal by truck from the tract to a rail loadout near Cedar City, Utah, represents a risk to surface-water resources near the coal haul transportation route due to coal dust and potential accidents. Potential subsidence in the portion of the tract that would be underground mined could result in changes to surface draining and deterioration of surface water quality and changes to groundwater levels, flow, and quality.

4.16.1 Regulatory Framework

Numerous federal and state regulations shape the management of water resources. Regulations that pertain to water resources and potential impacts from mining and other land uses include but are not limited to the following:

- The Fish and Wildlife Coordination Act (1934), as amended, provides the basic authority for USFWS's involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. The Water Resources Act of 1954, as amended, permits the Secretary of the Interior to give grants to and cooperate with federal, state, and local agencies to undertake research into any water problems related to the DOI’s mission.
- The Water Resources Planning Act of 1965, as amended, established the Water Resources Council, which is directed to maintain studies of water supplies and water programs. The chairman of any river basin commission can request from an agency, and that agency is authorized to furnish, such information as is necessary to carry out its function.

- The Federal CWA (1977) – The Federal Pollution Control Act, with amendments 1972 and 1977, has the objective of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. The CWA of 1987 provides additional authorizations.
- The Federal Land Policy and Management Act of 1976 requires that public lands be managed in a manner that will protect scientific, environmental, air and atmospheric, and water resource values. It also requires land-use plans to be in compliance with applicable pollution control laws, including state and federal air, water, and other pollution standards.
- SMRCA requires federal agencies to gather hydrologic data to ascertain the suitability for mining.
- The Safe Drinking Water Act of 1977 protects all public water systems from pollutants or contaminants that would endanger public health and welfare. Activities on public lands in these watersheds must not cause contaminant levels to exceed promulgated standards.

The KFO RMP, other BLM, and state regulations have provided the framework for other required mitigation measures. The following standards would be applicable to water resources and compel mitigation for impacts to water resources related to mining the tract:

- UPDES permitting process administered by the Utah Division of Water Quality requires that a water quality discharge permit be obtained for construction and coal mining operations. UPDES storm water permits require BMPs to mitigate storm water discharge. After August 1, the successful bidder would be required to monitor turbidity in storm water to assure compliance with Effluent Limit Guidelines 280 Nephelometer Turbidity Units (40 CFR Part 450).
- The Division of Water Rights may require issuance of a permit for the diversion and/or evaporation of water associated with retention ponds.
- Spill Prevention, Control, and Countermeasure (SPCC) regulations apply to any operation with greater than 1,320 gallons of oil storage capacity on-site. Regulated facilities also include those that could reasonably be expected to discharge oil in harmful quantities into the navigable waters of the U.S. or adjoining shorelines.
- The DOGM permitting process has multiple provisions for the mitigation of potential impacts to water resources.
- Build and maintain sediment control ponds or other devices during mining.
- Monitor storage capacity in sediment ponds.
- Monitor quality of discharges through the UPDES permit.
- Restore approximate original drainage patterns during reclamation.
- Monitor streamflow and water quality and selected springs in and adjacent to the tract.
- Restore stock ponds and playas during reclamation.
- Identify all wetlands that would be affected by mining.
- Identify jurisdictional wetlands as required by USACE and replace any that would be disturbed by mining.
- Replace functional wetlands as required by surface managing agency, surface landowner, and/or DOGM.
- Monitor reclaimed wetlands using the same procedures used to identify pre-mining jurisdictional wetlands.
- Repair subsidence-related disturbances in accordance with Utah Administrative Code 40-10.

4.16.2 Impact Indicators, Thresholds, Area of Analysis, and Assumptions

4.16.2.1 SURFACE WATER

The analysis area for direct and indirect impacts to the Proper Functioning Condition of streams is the Alton Coal Tract. Impacts to stream channel condition are assessed according to the length of stream altered or realigned and the number of stream crossings required for mining operations. It is assumed that a portion of Robinson Creek would be realigned to allow surface mining to occur. In addition, one or two stream crossings of Kanab Creek would be required.

The tract is located in parts of three sub-drainages (HUC 12) of Kanab Creek. These sub-drainages are Reservoir Canyon, Lower Robinson Creek, and Sink Valley Wash. The analysis area for direct and indirect impacts on surface water is the area (40,040 acres) of these three sub-drainages (Map 3.16).

Impacts to surface-water hydrology in this section are assessed by estimating the total annual runoff from the tract that would be collected in ponds. Water collected in ponds would be subject to increased evaporation and infiltration, which would constitute a loss of runoff to surface waters.

Impacts to surface-water quality are primarily assessed by qualitatively describing the risk of impairment of surface waters, as indicated by state water quality standards, which serve as threshold indicators for surface-water quality impacts. The criteria used for all surface waters are those listed by the State of Utah for Kanab Creek; the creek's most stringent criteria are for the beneficial use as a warm water fishery (3B). Risk of impact measurements under each alternative included the area of each surface use or disturbance, such as roads, graded ROWs, facilities, soil stockpiles, and mine pits. Impacts to surface-water quality along the coal haul transportation route are assessed in terms of tons of coal dust and fugitive dust deposited on surface waters. The miles of stream within 100 feet of the coal haul transportation route and the number of times the coal haul route crosses streams are used to assess impacts from dust deposition as well as risk of spills associated with the transportation of hazardous materials.

In addition, impacts to surface-water quality are assessed through the linear feet of creek realigned (to indicate the relative magnitude of thermal impacts and increases in dissolved solids and other constituents).

In the analysis it is assumed that surface runoff from all pit disturbances and centralized facilities would be captured in sediment retention ponds. The area draining to the ponds is assumed to be the total projected surface disturbance from pits and centralized facilities (1,786–2,188 acres under the Proposed Action, and 1,490–1,892 acres under Alternative C). Water would not be released from these ponds; therefore it is assumed that the ponds would be 100% effective at controlling sediment. Water would be lost only to evaporation or infiltration. Water loss from the ponds is estimated using local evaporation rates on a per-unit area basis. It is assumed that there would be minor recharge to shallow groundwater systems from pond infiltration due to the low permeability of these aquifers. In either case, the retention ponds represent a 100% loss of surface water from the tract for immediate use by irrigators downstream. Sediment runoff would not be captured in retention ponds from dispersed facilities and the relocation of KFO Route 116. It is assumed that sediment from these areas would be controlled using BMPs such as silt fencing, straw wattles, matting, etc, as required by UPDES storm water permitting.

Because underground mining activities produce unique risks to surface-water systems, a separate qualitative summary of potential subsidence and hydrologic changes from underground mining is also provided. Additional discussion of subsidence impacts is provided in Section 4.6, Geology and Minerals. The acreage subject to subsidence-related impacts is the same under both action alternatives.

4.16.2.2 GROUNDWATER

The analysis area for direct and indirect impacts on groundwater quality is the area that would be disturbed as a result of surface mining (1,750–2,152 acres under the Proposed Action and 1,454–1,856 acres under Alternative C). Impacts to groundwater hydrology are assessed according to groundwater losses due to reduced recharge, consumptive use for coal mining activities, loss of coal moisture, and evaporation of groundwater exposed in pits.

Impacts to groundwater quality are assessed by qualitatively describing the risk of impairment of shallow groundwater, as indicated by state surface-water quality standards, for typical underground water uses in the area as identified in the Utah Division of Water Rights database (i.e., irrigation and stock watering). The principal parameter of concern for these groundwater uses is TDS. The Utah TDS standard for irrigation is less than 1,200 mg/L, and for stock watering the TDS standard is less than 2,000 mg/L.

The moisture content of coal in the Smirl Coal Zone is 13% and includes moisture that is bound in the organic matter and/or hydrated clays found in the coal zone. It represents an additional groundwater resource separate from mined groundwater that could be lost due to removal of 2 million tons of coal per year under both the Proposed Action and Alternative C.

As with surface-water resources, underground mining impacts to groundwater from subsidence and hydrology changes are discussed qualitatively as a separate analysis. Additional discussion of subsidence impacts is provided in Section 4.6, Geology and Minerals. The acreage subject to subsidence-related impacts is the same under both action alternatives.

4.16.2.3 WETLANDS, RIPARIAN AREAS, FLOODPLAINS, AND ALLUVIAL VALLEY FLOORS

The area of analysis for wetlands, riparian areas, floodplains, and AVFs is the tract and its immediate surroundings. The impact indicator for these areas is acres of disturbance in each zone based on GIS analysis of the tract and surrounding areas.

For purposes of analysis, and based on existing GIS data, approximately 62.8 acres of private surface in Block NW is assumed to be jurisdictional wetlands. A preliminary field assessment of this area was also conducted. According to this assessment, approximately 37.5 acres of this area exhibit wetland characteristics including dominant presence of hydrophytic vegetation and hydric soils. Data on wetland hydrology were not collected as part of the preliminary field assessment. Because the preliminary field assessment was conducted on a reconnaissance level the larger acreage figure is used in the analysis. A complete wetland delineation would be required under Section 404 of the CWA during the DOGM-permitting process.

With respect to floodplains it is assumed that any in the tract would be subject to protections and regulations detailed in EO 11988. Areas identified as probable AVFs during a reconnaissance-level survey (see Appendix E) are assumed to be AVFs in the analysis. During the permitting process, a more extensive study to determine the presence of AVFs would be required. For the purposes of this analysis, it is further assumed that floodplains are included in the AVF determination (Petersen Hydrologic 2008).

4.16.3 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the Alton Coal Tract under the Proposed Action or Alternative C would not be approved, the tract would not be offered for competitive lease sale, and the coal in the tract would not be mined.

No coal-mining activities or infrastructure development would occur under the No Action Alternative, and therefore no surface disturbance would occur in the tract as a function of mining operations (Table 4.45). However, existing land uses would continue, including livestock grazing, recreation, and vegetation treatments for wildlife habitat and watershed health.

Table 4.45. Surface Disturbance (acres) and Creek Realignment (miles) under all Alternatives

Disturbance Type	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
Pit disturbance	0	1,750–2,152	1,454–1,856
Centralized facilities	0	36	36
Dispersed facilities	0	160	135
Road relocation	0	47 (17 actual road and 30 ROW)	37 (13 actual road and 24 ROW)
Total Surface-disturbing Activities	**0**	**1,993–2,395**	**1,662–2,064**
Underground mining	0	717–412	717–412
Robinson Creek realigned (miles)	0	0.49–0.81	0.49–0.81

4.16.3.1 SURFACE WATER

No impacts to surface-water quantity or quality would result under the No Action Alternative beyond those that may result from ongoing land uses such as livestock grazing, vegetation treatments, and recreation. These ongoing impacts may include active erosion along stream channels in the tract (Petersen Hydrologic 2007) and continued background erosion of sediments from the tract surface. Because no mining, construction, or additional surface disturbance would occur under the No Action Alternative, there would be no additional impacts to surface-water quality or quantity.

Reportedly a result of land management practices in the late 1800s or early 1900s, the creeks in the tract have limited riparian vegetation, in many locations are not stable in their current configurations, are actively eroding their channels during precipitation events, and are deeply incised (Petersen Hydrologic 2007). Based on a November 2010 field assessment of creeks in and around the tract, as defined by the BLM's Proper Functioning Condition Assessment protocol (BLM 1998). Robinson Creek is rated as "Functional – At Risk" and the functional rating for Upper Kanab Creek is "Proper Functioning Condition." Under the No Action Alternative the creeks' channels would remain incised and would continue to contribute sediment to the creek during relatively infrequent high flow periods.

4.16.3.2 GROUNDWATER

No impacts to groundwater quantity or quality would result under the No Action Alternative beyond those minor impacts from ongoing land uses. Because no mining, construction, or additional surface disturbance would occur under the No Action Alternative, there would be no additional impacts to groundwater quality or quantity.

4.16.3.3 WETLANDS, RIPARIAN AREAS, FLOODPLAINS, AND ALLUVIAL VALLEY FLOORS

Under the No Action Alternative, the wetlands (62.8 acres) assumed to be present in Block NW would not be disturbed as a function of mining the tract and, therefore, no impacts are anticipated under this alternative. Under the No Action Alternative, no disturbance to riparian areas (54 acres), floodplains (57 acres), or AVFs (57 acres) would occur either.

4.16.4 Alternative B: Proposed Action

Under the Proposed Action, the Alton Coal Tract would be offered for lease at a sealed-bid competitive lease sale, subject to standard and special lease stipulations developed for the tract. The tract boundaries would be reasonably consistent with the tract reconfiguration completed by the BLM after ACD's original lease application submittal (see Map 1.2). Depending on the extent of surface mining (200 feet to 300 feet of overburden removal) approximately 1,993–2,395 acres of surface disturbance would occur in the Alton Coal Tract under the Proposed Action, (see Table 4.45). Similarly, underground mining would occur on 717 to 412 acres of land in the tract. Surface-mining methods involving up to 200 feet of overburden removal would result in a lesser quantity of disturbed acres, meaning a lesser impact on water resources, than surface-mining methods involving up to 300 feet of overburden removal. The first number provided in the acreage ranges detailed in the following sections (and previously in Table 4.45) relates to surface mining up to approximately 200-foot of overburden removal whereas the second number provided relates to surface mining up to approximately 300-foot of overburden removal.

4.16.4.1 SURFACE WATER

4.16.4.1.1 Stream Proper Functioning Condition

Under the Proposed Action, approximately 0.49–0.81 mile of Robinson Creek would be relocated from the tract and diverted into a new manmade channel hardened with riprap (see Table 4.45). Ordinarily, the rerouting of a creek would have direct and indirect impacts to stream function and water quality. However, because Robinson Creek is currently ranked as "Functional – At Risk," if the stream is rerouted through a properly sized and designed channel, relocation could result in a more stable channel in many areas and therefore less sediment transport during high flows. Nonetheless, where streamside vegetation is removed or where the new channel has less shading, increases in water temperature would occur. This impact is limited to the lower section of Robinson Creek, because the upper sections of Robinson Creek (above the seepage area) is dry most of the time (Petersen Hydrologic 2007). This impact would be minimal during high flow periods due to the relatively low residence time of the swiftly moving water. The thermal impact could be mitigated through planting riparian vegetation and the use of materials that mimic a natural stream channel on the rerouted channel. If there is removal of vegetation this would also reduce stream stability locally because there would no longer be root material to hold streambanks in place.

The relocation of the channel would require a State of Utah Stream Alteration Permit and a CWA Section 404 Permit administered by the Department of the Army. Compensatory mitigation for loss of waters of the U.S., sediment controls, and other mitigation would likely be required under these permits. Any loss of channel function remaining after this mitigation would be long term. However, due to the assumed nonfunctional status of the stream channel, function could be improved during temporary relocation or reclamation, particularly with respect to erosion and downstream sedimentation.

4.16.4.1.2 Surface-water Hydrology

Under the Proposed Action, adverse short-term impacts to surface-water quantity would occur from the implementation of sediment- and erosion-management BMPs. Under this alternative, 1,993–2,395 acres of the tract would be disturbed by open pit mining, the construction of centralized and dispersed facilities, and road relocation, which is 1,993–2,395 acres more than would be disturbed under the No Action Alternative. Runoff from 1,750–2,152 acres would be diverted and captured in storm-water retention ponds to reduce the amount of eroded sediments that are discharged to downstream water bodies such as Kanab Creek and Robinson Creek. Areas where runoff is not captured, such as dispersed facilities and the road relocation right of way, would be treated through the use of silt fencing, check dams (e.g. straw bales), or other BMPs that slow runoff and allow sediments to settle. Because water that is permanently retained in ponds or temporarily slowed or detained is subject to additional infiltration and evaporation, loss of surface water would result.

Under the Proposed Action, approximately 29–35 acre-feet of water would be captured annually from pits and centralized facilities (Table 4.46). These values are estimated as a portion of the flow (equal to the proportion of the tract relative to the watershed area) associated with runoff from precipitation events at the USGS gauge on Kanab Creek downstream of the tract. Storm and snowmelt peaks were identified on the gauge using a simple hydrograph line method (Chow et al. 1988) and checked against climate data for the area (precipitation, snowfall, and temperature) (NCDC Station 420086; NCDC 2010). Ten years of precipitation data from the Alton NCDC climate station were used in this calculation. Pit disturbance and centralized facilities make up 1.4%–1.7% of the total drainage area upstream of the USGS gauge. It was assumed that the same percentage of flow at the gauge was generated on those areas of the tract. Because this water would be captured in retention ponds that would not discharge to downstream water bodies, the full volume of runoff captured from the tract would be lost to increased evaporation or infiltration into the ground. Maximum annual evaporation from standing water in the tract is approximately 35 inches per year. Evaporated water would be lost as a surface-water resource; however, infiltrated water could be lost, or could be lost temporarily if it eventually rejoined the surface-water system (if discharged at a spring, for instance). However, because groundwater and surface water in the tract are in general disconnected, no impacts to surface-water resources would be expected due to reduced or increased groundwater recharge. In addition, because any new seeps would frequently discharge to a dry channel, seep discharge may subsequently be lost to evaporation.

Table 4.46. Water Resource Impacts under all Alternatives

Disturbance Type	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
Surface Water			
Acre-feet of surface-water runoff from pit disturbance and dispersed facilities (annual)	0	29–35	24–30
Acre-feet of water loss from streams (annual)	0	29–35	23–35
Total miles of streams within 100 feet of transportation route	0	48–49	48–49
Total miles of perennial streams within 100 feet of transportation route	0	8.4	8.4
Number of stream crossings	0	135	135

Table 4.46. Water Resource Impacts under all Alternatives

Disturbance Type	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
Groundwater			
Acre-feet of groundwater lost for dust suppression (life of the mine)	0	625	525
Acre-feet of groundwater lost to evaporation (life of the mine)	0	2,900	4,893
Acre-feet of coal moisture lost (life of the mine)	0	4,701–7,326	3,989–6,312
Wetlands, Riparian Areas, Floodplains, and Alluvial Valley Floors			
Acres of wetland removal	0	52.5	0
Acres of riparian disturbance	0	6.7–10.0	6.3–9.6
Acres of floodplain/AVF disturbance	0	8	7.2
Acres Subject to Potential Subsidence	0	513–211 (+166–109 outside the tract)	513–211 (+166–109 outside the tract)

Because most of the surface flows from the tract in Kanab and Robinson Creeks are impounded in irrigation ponds or lost to stream channel infiltration downstream (Petersen Hydrologic 2007), indirect impacts resulting from any loss of surface waters would primarily affect downstream irrigators rather than in-stream flows. However, these ponds may be bypassed during infrequent high discharges, and any depletion would somewhat decrease peak flows downstream in Kanab Creek.

4.16.4.1.3 Surface-water Quality

Under the Proposed Action, no direct adverse impacts to surface-water quality are likely. Runoff from disturbed areas on the tract would be captured in retention ponds, which do not release water into downstream receiving waters. Erosion of sediment from dispersed facilities and the relocation of KFO Route 116 would be controlled with silt fences and other sediment-control BMPs. These BMPs are more than 90% effective in capturing sediment when installed and maintained properly (Robichaud et al.). Therefore, most of the sediment and associated contaminants found in surface runoff from the tract would be contained, and would not pose any direct threat to surface waters.

Indirect effects on water quality from the Proposed Action would result from the loss of 29–35 acre-feet of water to streams associated with diversion of surface-water runoff on the tract into retention ponds (see Table 4.46). This loss of water to the surface-water system would reduce flows in Robinson Creek and Kanab Creek, and thereby reduce the dilution of any pollutant (total phosphorus, suspended solids, nitrogen, or dissolved solids) downstream of the tract. This could increase the pollutant's concentration in the surface-water system. However, reduced flow would also reduce in-stream erosion, and therefore could reduce sediment concentrations in the stream. The primary pollutant that could pose a concern to Kanab Creek is TDS, because current concentrations of TDS in surface water in and around the tract already exceed the standard of 1,200 mg/L identified by the State of Utah as protective of irrigation water. Water quality data in and around the tract indicate that TDS concentrations are highest under low flow conditions. Mean TDS concentrations in groundwater in Sink Valley Wash are 378 mg/L (maximum 623 mg/L); therefore the use of groundwater for dust suppression would not lead to an increase in TDS concentrations in future surface runoff from the tract. Use of groundwater from wells in Lower Robinson Creek in which mean TDS is 1,172 mg/L (maximum 3,197 mg/L) for dust suppression could lead to an increase in TDS concentrations in future surface runoff from the tract. In this case, salt-tolerant plants could be used for revegetation.

Adverse impacts to surface water as a result of accidental spills of hazardous materials along the coal haul transportation route or at the tract are also unlikely because of spill prevention, control, and countermeasure (SPCC) plan regulations associated with the transportation and storage of bulk oil products (see the Hazardous Materials section of this chapter). However, there would be a small increased risk of surface-water contamination. Deposition of coal dust and fugitive dust along the coal haul transportation route would lead to a small increase in fine particles (suspended solids) in streams because fugitive dust and coal dust are themselves fine particles. Under the Proposed Action, there are 48–49 miles of stream within 100 feet of the coal haul transportation route, of which 8.4 miles are perennial. The route crosses many different streams 135 times (see Table 4.46).

4.16.4.2 GROUNDWATER

4.16.4.2.1 Groundwater Hydrology

Under the Proposed Action, adverse short-term impacts to groundwater hydrology would occur as a result of groundwater pumping for dust suppression. Groundwater pooled in mining pits could also be used for dust suppression. Water supplies needed for dust suppression are assumed to originate as groundwater. Assuming all the water used for dust suppression is lost to evaporation, the loss of groundwater would be 25 acre-feet per year. Over the approximate 25 year projected life of the mine under this alternative, 625 acre-feet of groundwater would be lost (625 acre-feet more than would be lost under the No Action Alternative) (see Table 4.46). Assuming no groundwater recharge this equates to approximately 6% of the estimated groundwater resources available (10,000 acre-feet) in the zone from which groundwater resources would be extracted (Personal Communication, Petersen 2010).

The tract is located at the base of a valley, along the north-south axis of Kanab Creek, where shallow aquifers could support stream flows during periods of peak runoff. During these periods, areas along Kanab Creek could be considered groundwater discharge zones. The principal recharge areas to the shallow aquifers are located outside the tract on the Paunsaugunt Plateau. Groundwater in the bedrock stratigraphic sequence of the Paunsaugunt Plateau east of the tract is located large distances laterally and topographically up-gradient of the tract. Therefore, there is no reasonably plausible mechanism whereby groundwater systems in these formations could be impacted by mining activities (Petersen Hydrologic 2007). Local recharge to shallow aquifers occurs as diffuse infiltration through the unsaturated zone during precipitation events. Because the principal recharge areas are located outside and up-gradient of the tract and could not be impacted by mining activities (Petersen Hydrologic 2007), no adverse impacts to groundwater quantity would occur as a result of reduced recharge associated with the Proposed Action.

Adverse long-term impacts to groundwater could also result from the permanent removal of moisture in the mined coal. The coal is assumed to have a moisture content of 13% (2004) and a bulk density of 40–57 pounds per cubic foot (The Engineering Toolbox 2005). With an average projected annual coal production of 2 million tons, the loss of moisture from coal would be 209–298 acre-feet per year. Under this alternative, 4,701–7,326 acre-feet of moisture would be lost (4,701–7,326 acre-feet more than would be lost under the No Action Alternative) over the life of the mine (see Table 4.46). However, this moisture is largely unavailable in the groundwater and surface-water systems in the area, and its loss would not result in impacts to other groundwater resources.

A portion of groundwater pooled in mining pits that is not removed for dust suppression would be lost to evaporation and represents a groundwater loss. Under the Proposed Action, up to 40 acres of groundwater would be exposed to evaporation at any one time. The average annual evaporation from standing water in the tract is approximately 35 inches (based on evaporation data available for Bryce Canyon National Park from 1971 – 1978). Therefore, the loss of groundwater from mining pits due to evaporation would be up to 116 acre-feet per year. Under this alternative, over the life of the mine the total loss of groundwater due

to evaporation from mining pits would be up to 2,900 acre-feet (2,900 acre-feet more than under the No Action Alternative) (see Table 4.46). This estimate assumes that there would be one open pit (approximately 40 total acres) for the life of the mine. However, there would be one open pit only for the surface mining portion of the total mine life. For the underground mining portion of the mine life there would not be any open pits and therefore no exposed groundwater as a result of mining. However, some groundwater would still be lost as a result of groundwater evaporation through underground mine openings.

4.16.4.2.2 Groundwater Quality

Due to the poor groundwater-transmitting properties of the Dakota Formation it is assumed that no degradation to deeper aquifers would occur, and therefore there would be no impact to municipal water supplies.

Based on laboratory analysis of samples collected in the Alton Area but not directly in the tract, it is apparent that acid-forming and toxic-forming materials that could result in the contamination of groundwater supplies in the tract are generally not present (Petersen Hydrologic 2007). As part of the permitting process, the DOGM requires permittees to pre-sample overburden for acid-forming and toxic-forming substances. In the event that either of these is discovered, the permittee would be required to develop a plan to treat these substances to minimize or eliminate impacts to groundwater quality.

4.16.4.3 WETLANDS, RIPARIAN AREAS, FLOODPLAINS, AND ALLUVIAL VALLEY FLOORS

Under the Proposed Action, approximately 52.5 acres of wetlands in Block NW would be removed as a result of surface-mining operations, compared to none under the No Action Alternative (see Table 4.46). This is approximately 84% of the total 62.8 acres of wetlands in the tract. In the short term, the functions performed by these wetlands would be lost with the removal of the wetland areas. Reclamation would partially or fully restore the wetland functions lost; however, the precise pre-mining structure, extent, and character of the wetlands would be permanently altered. Assuming these wetlands are jurisdictional, the successful bidder would be required to mitigate wetland impacts in accordance with guidance and directives provided by USACE during the CWA Section 404 permitting process.

Under the Proposed Action, total disturbance to riparian areas would be 6.7–10.0 acres (see Table 4.46). Of this total, 3.8–7.1 acres would be disturbance as a result of surface mining. Direct impacts from the relocation of KFO Route 116 would be from the removal of 0.5 acres of riparian area. Assuming that impacts from dispersed facilities (160 acres) are proportional to the acreage of riparian areas present in the no coal zone (where all dispersed facilities are assumed to be located), then approximately 2.4 acres of riparian area would be lost as a result of construction of these facilities. This is 2.4 acres more disturbance of riparian areas than under the No Action Alternative. The impacts due to disturbance or removal of riparian areas would depend on the quality of the existing habitat and the reclamation that followed the disturbance. Impacts could include loss of native vegetation, loss of wildlife habitat, and destabilization of the associated streambanks.

Under the Proposed Action, all floodplains (57 acres), and probable AVFs (57 acres) that are present on the tract occur in the no-coal zone. Therefore, this acreage would not be directly impacted from pit disturbance. Direct impacts would be the result of construction of dispersed facilities and relocation of KFO Route 116. The floodplains/AVFs make up approximately 5.0% of the total no-coal zone area available for dispersed facilities (1,131 acres) under the Proposed Action. Assuming that impacts from dispersed facilities (160 acres) are proportional to the acreage of floodplains/AVFs present in the no coal zone, then approximately 8.0 acres of floodplains/AVFs would be impacted under the Proposed Action (8.0 acres more disturbance of floodplains/AVFs areas than under the No Action Alternative) (see Table 4.46). The requirements to protect AVFs refer to protecting the essential hydrologic function of AVFs as they relate to the ability to conduct

farming at the AVF. In the six areas delineated as probable AVFs (including the 8 acres that would be impacted under the Proposed Action), the essential hydrologic function is related to the ability of the land to be irrigated using surface water in either Kanab Creek or Sink Valley Wash. Groundwater is not thought to be a significant factor in the essential hydrologic functions of any these probable AVFs. Accordingly, the only reasonably plausible way that the essential hydrologic functions of these AVFs could be impacted would be if impacts to water quantity or water quality in Kanab Creek or lower Sink Valley Wash were to occur (these are discussed above). Because the probable AVFs are located in no-coal areas, and thus would not be mined, the physical capability of the land to be irrigated would not be impacted outside of the construction of dispersed facilities and relocation of KFO Route 116 in these areas (approximately 207 acres, and no more than 57 acres, which is the total area of probable AVFs in the tract). Development of floodplains would result in the loss of their functions and values in these areas (approximately 8 acres) (see Table 4.46). Floodplain functions that could be lost include flood storage and attenuation, riparian habitat (described above), groundwater recharge, water filtration, and erosion prevention.

4.16.4.4 SUBSIDENCE

Coal removal by underground mining methods and the withdrawal of water to facilitate mining would result in subsidence as overlying strata settle into mining-produced voids. Subsidence is a natural consequence of underground mining; although, the magnitude and extent vary based on a range of mining and geologic factors, such as surface topography, depth of mining, near surface geology, and mining method (Society for Mining, Metallurgy, & Exploration 1992). In the tract, 513 to 211 acres would be affected by subsidence through underground mining. An additional 166 to 109 acres outside of the tract would be disturbed through ground movement associated with coal removal.

Subsidence-related surface-water impacts would include potential changes to surface drainage and deterioration of surface-water quality. Additionally, subsidence could cause fissures and pits or open cracks, which, if connected to aboveground streams, could lead to partial or complete loss of surface water. As discussed in the previous sections, aquifer pumping for underground mining could also interrupt groundwater flow to surface waters, leading to reduced stream flows.

Groundwater could be affected by mine-generated subsidence through changes to groundwater levels, flow, and quality. Because mining produces voids in the strata, these voids induce groundwater movement from the surrounding saturated rock, leading to nearby rock dewatering while water accumulation occurs in the voids. This water movement is often accompanied by rock fracturing or movement, which can change how water moves through the rock, leading to changes in groundwater level, storage capacity, flow direction, and chemistry (Society for Mining, Metallurgy & Exploration 1992). Other potential hydrological impacts from underground mining include changes to the permeability of rock units, creation of fresh rock surfaces, and water flow between previously unconnected units or between surface and groundwater, leading to decreased evapotranspiration in those areas (Marcus 1997).

4.16.5 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, the tract would be modified to exclude Block NW (see Map 2.1). Further, certain mining activities in the tract's southern portion (Block S) would be subject to seasonal restrictions to reduce impacts to the local sage-grouse population. Under Alternative C, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.1.

Approximately 1,662–2,064 acres of surface disturbance would occur in the Alton Coal Tract under Alternative C, depending on the extent of surface mining (see Table 4.45). As under the Proposed Action, underground mining would occur on 717 to 412 acres of land in the tract under Alternative C.

4.16.5.1 SURFACE WATER

4.16.5.1.1 Stream Proper Functioning Condition

Under Alternative C, approximately 0.49–0.81 mile of Robinson Creek would be relocated from the area that would be surface mined into a new manmade channel hardened with rip-rap (see Table 4.45). This is the same length as would be relocated under the Proposed Action. Thus, Alternative C would have the same direct and indirect impacts to stream proper functioning condition and water quality as described under the Proposed Action. No stream relocation would be conducted under the No Action Alternative.

4.16.5.1.2 Surface-water Hydrology

Impacts to surface-water quantity under Alternative C would be of the same nature as those under the Proposed Action, but would be of lesser magnitude. Under this alternative, 1,490–1,892 acres of the tract would be disturbed by surface mining and the construction of centralized facilities (1,490–1,892 acres more than would be disturbed under the No Action Alternative). Runoff from 1,490 to 1,892 acres (1.3% –1.7% of the area draining to the USGS gauge) would be diverted and captured in storm water retention ponds to reduce the amount of eroded sediments that are discharged to downstream water bodies such as Kanab Creek and Robinson Creek. Under Alternative C, approximately 24–30 acre-feet of water would be captured from disturbed areas (24–30 more acre-feet than under the No Action Alternative) (see Table 4.46). Areas where runoff would not be captured (the road relocation ROW and dispersed facilities), would be treated through the use of silt fencing, check dams (e.g., straw bales), or other BMPs that slow runoff and allow sediments to settle. As discussed for the Proposed Action, this water would be removed from the surface-water system due to infiltration and evaporation.

4.16.5.1.3 Surface-water Quality

Impacts to surface-water quality under Alternative C would be of the same nature as those under the Proposed Action, but would be of a lesser magnitude. Under Alternative C, approximately 23–35 acre-feet of water would be captured from disturbed areas (see Table 4.46). This quantity of water would no longer reach receiving waters downstream resulting in reduced dilution and therefore a potential increase in the concentration of pollutants in associated surface waters compared to the No Action Alternative.

Adverse impacts along the coal haul transportation route would be the same as those described under the Proposed Action, but would occur for approximately 21 years rather than approximately 25 years.

4.16.5.2 GROUNDWATER

4.16.5.2.1 Groundwater Hydrology

Impacts to groundwater hydrology under Alternative C would be of the same nature as those under the Proposed Action, but would be of a lesser magnitude. Over the approximate 21 year life of the mine under Alternative C groundwater losses for dust suppression would be approximately 525 acre-feet (525 more acre-feet than under the No Action Alternative) (see Table 4.46). Assuming no groundwater recharge this equates to approximately 5% of the estimated groundwater resources available (10,000 acre-feet) in the zone from which groundwater resources would be extracted (Personal Communication, Petersen 2010).

Groundwater losses due to the removal of coal moisture would also occur under Alternative C, with 3,989–6,312 acre-feet of moisture lost (3,989–6,312 acre-feet more than would occur under the No Action Alternative) over the life of the mine (see Table 4.46).

Groundwater pooled in mining pits that is not removed for dust suppression would be lost to evaporation and represents a groundwater loss. Under Alternative C, up to 80 acres of groundwater would be exposed to evaporation at any one time. The maximum annual evaporation from standing water in the tract is approximately 35 inches per year. Therefore, the loss of groundwater from mining pits due to evaporation would be up to 233 acre-feet per year. Under this alternative, over the life of the mine the total loss of groundwater due to evaporation from mining pits would be up to 4,893 acre-feet (4,893acre-feet more than under the No Action Alternative) (see Table 4.46). This estimate assumes that there would be two open pits (approximately 80 total acres) for the life of the mine. However, there would be two open pits only for a portion of the total mine life to comply with the timing restrictions of this alternative. Following this time frame, up to 40 acres of groundwater would be exposed as a result of pooling in mining pits (one open pit). Further, for the underground mining portion of the mine life there would not be any open pits and therefore no exposed groundwater as a result of mining. However, some groundwater would still be lost as a result of groundwater evaporation through underground mine openings.

4.16.5.2.2 Groundwater Quality

Potential degradation to deeper aquifers (and therefore impacts to municipal water supplies) and potential impacts to groundwater resources as a result of acid-forming and toxic-forming materials would be the same under Alternative C as under the Proposed Action.

4.16.5.3 WETLANDS, RIPARIAN AREAS, FLOODPLAINS, AND ALLUVIAL VALLEY FLOORS

Under Alternative C, the wetlands (62.8 acres) assumed to be present in Block NW would not be disturbed as a function of mining because this portion of the tract would not be included in a lease sale under this alternative (see Table 4.46). As under the No Action Alternative, no impacts are anticipated to wetlands under Alternative C.

Under the Alternative C, total disturbance to riparian areas would be 6.3–9.6 acres (see Table 4.46). Of this total, 3.7–7.0 acres would be disturbance as a result of surface mining. Direct impacts from the relocation of KFO Route 116 would be from the removal of 0.3 acres of riparian area. Assuming that impacts from dispersed facilities (160 acres) are proportional to the acreage of riparian areas present in the no coal zone (where all dispersed facilities are assumed to be located), then approximately 2.3 acres of riparian area would be disturbed as a result of construction of these facilities. Under Alternative C, the total disturbance to riparian areas of 6.3–9.6 acres would be 6.3–9.6 acres more disturbance than under the No Action Alternative. As under the Proposed Action, the impacts due to disturbance or removal of riparian areas would depend on the quality of the existing habitat and the reclamation that followed the disturbance. Impacts would include loss of native vegetation, loss of wildlife habitat, and destabilization of the associated streambanks.

Under Alternative C, all floodplains (56.6 acres) and probable AVFs (56.6) that are present on the tract occur in the no-coal zone. Therefore, this acreage would not be directly impacted from pit disturbance. Direct impacts would be the result of construction of dispersed facilities and relocation of KFO Route 116. The nature of these impacts is the same under Alternative C as under the Proposed Action. The floodplains/AVFs make up 5.3% of the total no-coal zone area available for dispersed facilities (1,063 acres). Assuming that impacts from dispersed facilities (135 acres) would be proportional to the acreage of floodplains/AVFs present in the no coal zone, approximately 7.2 acres of floodplain/AVF area would receive surface disturbance under Alternative C (7.2 acres more disturbance of floodplain/AVF area than under the No Action Alternative) (see Table 4.46).

4.16.5.4 SUBSIDENCE

Subsidence-related water resources impacts from underground mining under Alternative C would be of the same nature and magnitude as those under the Proposed Action, because the area that would be underground mined under Alternative C would also be underground mined under the Proposed Action.

4.16.6 Potential Mitigation Measures

The following measures could be applied to both action alternatives, in addition to required measures, to further reduce or eliminate impacts to water resources identified in the analysis above:

- Water detention ponds (rather than retention) could be used to decrease the amount of water lost to evaporation following its interception and collection.
- Temporarily (life of mine) relocated segments of Robinson Creek could be planted with native vegetation to shade the creek (reducing thermal pollution) and stabilize its banks (reducing sediment pollution).
- Any flow in Robinson Creek could be diverted around the construction area to reduce sediment discharges during construction; construction could take place during a period of zero or low flow.
- Temporarily (life of mine) relocated segments of Robinson Creek could be properly designed to function as a stable, functional channel with 1) a floodplain connected to the stream, 2) the proper width, velocity, and gradient to replace all lost habitat, and 3) the proper form to convey sediment without eroding or aggrading.
- Temporarily (for life of mine) relocated segments of Robinson Creek may avoid capturing groundwater, which could increase the concentration of TDS in the creek. In addition, the bed and banks could be constructed to avoid use of or contact with the Tropic Shale.
- Construction of dispersed facilities in riparian areas and floodplains/AVFs could be avoided to the maximum extent possible.

4.16.7 Unavoidable Adverse Impacts

The Proposed Action and Alternative C would result in unavoidable adverse impacts to water resources even following implementation of protective measures and following the above potential mitigation measures. Approximately 0.49–0.81 mile of Robinson Creek would be unavoidably relocated under the action alternatives, including the removal of its streamside and riparian vegetation. Surface water on the tract would be lost due to evaporation from ponds and infiltration. Loss of surface-water volume would reduce downstream dilution, and could therefore alter water quality. Some sediment runoff from dispersed facilities and road relocation ROWs would be unavoidable because BMPs are less than 100% effective. The risk of spills or water contamination would be small, but would be unavoidably increased under the action alternatives. Groundwater would also be consumed (depleted) under the action alternatives. Approximately 25 acre-feet per year of groundwater would be lost due to evaporation from pits and dust suppression. A total of 200 to 300 acre-feet of coal moisture would be removed per year as well. The loss of wetland acreage and function on the tract could not be avoided.

4.16.8 Short-term Uses versus Long-term Productivity

No impacts to the long-term productivity of water quantity are expected as a result of the short-term use of the land for coal extraction. Once mining ceased and reclamation was complete, mine-related water use and increased evaporation would cease. The short-term use of the land for coal extraction would result in long-term alteration of wetland and riparian area functions and productivity. Similarly, the short-term use of areas occupied by Robinson Creek would result in the long-term alteration of Robinson Creek.

4.16.9 Irreversible and Irretrievable Commitments of Resources

The removal of approximately 4,701–7,326 acre-feet (Proposed Action) or 3,989–6,312 acre-feet (Alternative C) of water from the tract as coal moisture would be an irreversible impact under the action alternatives. The following commitments of water resources would be irretrievable until successful reclamation was completed under the action alternatives.

- Loss of Robinson Creek's channel function and riparian vegetation;
- Changes to Robinson Creek's discharge volume and water quality resulting from its realignment;
- Loss of wetland area and function due to its removal and reconstruction;
- Loss of riparian area and function due to its removal along Robinson Creek; and
- Surface disturbance to floodplains and probable AVFs as a result of the construction of dispersed facilities and relocation of KFO Route 116.

4.17 Wildlife and Special Status Species

This section assesses the environmental consequences of Alternative A (No Action), Alternative B (Proposed Action), and Alternative C on one federally threatened species, 25 State of Utah/BLM Sensitive species, and wildlife, raptors, and migratory birds with potential to occur on the proposed Alton Coal Tract and coal haul transportation route. Special status species have limited distributions or numbers, and they generally have specific habitat requirements. If these species are lost, displaced, or if their habitat is altered, there is limited potential for relocation or reestablishment elsewhere. As a result, impacts to special status species must be assessed according to factors that are most important for their maintenance or recovery, or to prevent their listing as threatened or endangered. Impacts to wildlife special status species would be avoided to some degree through conservation and/or mitigation measures. However, both direct and indirect impacts to wildlife and special status species are expected to result from minerals development and construction activities in the tract, as proposed under the action alternatives, and from traffic changes on the coal haul transportation route, both of which could affect individuals, populations, or habitat conditions.

4.17.1 Regulatory Framework and Lease Stipulations

4.17.1.1 REGULATORY FRAMEWORK

Numerous federal and state regulations shape the management of wildlife and special status species. Regulations that pertain to wildlife and special status species and potential impacts from mining and other land uses include, but are not limited to, the following:

- The Migratory Bird Treaty Act of 1929, as amended, establishes federal responsibility to protect international migratory birds and authorizes the Secretary of the Interior, through the USFWS, to regulate hunting of migratory birds. The North American Waterfowl Management Plan, signed in 1986 between Canada and the United States, further sets population goals and how to achieve them.
- The Taylor Grazing Act of 1934, as amended, requires cooperation with states and other groups interested in conservation and propagation of wildlife in established grazing districts. It provides for fishing and hunting in those districts in accordance with applicable laws.
- The Bald Eagle Protection Act of 1940, as amended, establishes penalties for taking, possessing, selling, purchasing, or bartering bald and golden eagles. It also provides for cancellation of the lease, license, or other federal land use authorization for anyone convicted of violating the act or any of its implementing regulations or permits.
- The Fish and Wildlife Coordination Act of 1958 mandates equal consideration of wildlife conservation with other features of water resource development programs. It requires that damage to fish and wildlife resources be prevented and that these resources be developed and improved.
- The Clean Air Act of 1970 establishes the mechanism for control of air pollution for public health and welfare, recognizing wildlife as one aspect of public welfare.
- The ESA of 1973, as amended, requires the BLM to ensure that proposed actions do not jeopardize the continued existence of a threatened or endangered species and do not cause its critical habitat to be modified or destroyed.
- Federal Land Policy and Management Act of 1976 recognizes wildlife as a principal land use, requires consideration of wildlife objectives in commodity-oriented programs, and authorizes use of range-betterment funds for enhancement of habitat for fish and wildlife.
- The objective of the Federal Water Pollution Control Act (CWA) of 1977 is the restoration and maintenance of the chemical, biological, and physical integrity of the nation's waters at a quality sufficient to protect fish and wildlife and sufficient for recreational use.
- The Fish and Wildlife Improvement Act of 1978 authorizes the Secretary of the Interior to permit the taking of golden eagle nests that interfere with resource development or recovery operations.
- The Public Rangelands Improvement Act of 1978 directs that the condition of the public rangelands be improved so that they become as productive as feasible for wildlife habitat and other rangeland values. The act provides for on-the-ground funding of wildlife habitat protection, improvements, and maintenance projects.
- The North American Wetlands Conservation Act of 1989 is the first act to make federal funds available annually for wetland restoration in the United States, Canada, and Mexico. The act is intended to generate as much as $30 million a year toward the North American Waterfowl Management Plan.

Other federal laws that could occasionally affect wildlife habitat management actions in the tract are the MLA, the Water Resources Planning Act, the Water Pollution Act, the Water Resources Development Act, the Federal Grants and Cooperative Agreements Act, the Safe Drinking Water Act, the Fish and Wildlife Act, and the Soils and Water Resources Conservation Act.

4.17.1.2 LEASE STIPULATIONS

The KFO RMP and other BLM and state documents provided the framework for the tract's lease stipulations. The following standards would be applicable to wildlife and would compel mitigation for impacts to wildlife related to mining the tract.

- Survey for threatened, endangered, proposed, and candidate species and their habitats.
- Avoid disturbance to individuals, populations, and habitats of threatened, endangered, proposed, and candidate species.
- Restore habitat for threatened, endangered, proposed, and candidate species in areas disturbed by mining.
- Conduct baseline and annual wildlife monitoring surveys.
- Follow approved raptor mitigation plans such as USFWS Utah Field Office Guidelines for Raptor Protection from Human and Land-use Disturbances (Romin and Muck 1999).
- Monitor for migratory bird species of management concern in Utah.
- Restore pre-mining topography to the maximum extent possible.
- Plant a diverse mixture of grasses, forbs, and shrubs in configurations beneficial to wildlife.
- Design fences to permit wildlife passage.
- Follow power transmission pole guidance from Avian Power Line Interaction Committee (Avian Power Line Interaction Committee/USFWS 2005).
- Increase habitat diversity by creating rock clusters and shallow depressions on reclaimed land.
- Use appropriate plantings along reclaimed drainages.
- Replace drainages, wetlands, and AVFs disturbed by mining.
- Enforce appropriate vehicle speed limits to minimize potential for wildlife mortality.
- Instruct employees not to harass or disturb wildlife.
- Conduct annual post-reclamation surveys for undesirable invasive plant species.
- Monitor restored vegetation during the growing season following fall seeding and planting to assess reclamation success.
- Monitor reclamation sites to assess habitat reclamation success.

In addition to the above, the following regulatory measures would apply to Greater Sage-grouse:

- Create or enhance nesting and brooding habitat on public lands in the tract in the no-coal zone (habitat creation/enhancement area identified as Block Sa in Map 1.1) and on Block S.

On Block S (and other locations in the tract as appropriate), the following short- and long-term habitat reclamation measures would apply to enhance habitat for Greater Sage-grouse:

- Reclaim to AOC and seed with similar plant species and composition to approximate pre-mining, original community.
- Following mining, graze livestock in the same areas as pre-mining to maintain approximate pre-mining or desirable vegetation conditions.
- Where practicable, avoid storing mining-generated spoil and topsoil stockpiles on intact sagebrush stands.
- Locate operations to create the least possible disturbance to sage-grouse and sage-grouse habitat.
- Clear young juniper from intact sagebrush stands.
- Cut back juniper woodlands surrounding intact sagebrush stands.

On Block S (and other locations in the tract as appropriate), the following long-term habitat reclamation measures would apply to enhance habitat for Greater Sage-grouse:

- Reclaim to create range sites based on approved ecological site descriptions (conditions for the growth of grasses, forbs, and sagebrush).
- Plant bare root or potted sagebrush and bitterbrush in identified sites to accelerate shrub reestablishment.
- Seed and plant in the fall.
- Remove juniper and pinyon seedlings found in reclaimed areas until full release of the reclamation bond.

These stipulations would help reduce the severity of impacts to wildlife and special status species by enhancing and restoring native and suitable non-native vegetation communities in the short term and long term.

4.17.2 Impact Indicators and Thresholds

In this analysis, acres of surface disturbance in or adjacent to wildlife and special status species habitats are used as the primary indicator of impacts in the tract. Potential impacts to wildlife and special status species, such as changes in habitat quality or quantity, reduced population size, or increased mortality, are also used as impact indicators. Surface disturbance from minerals development and construction activities would occur in the tract as planned under the action alternatives. On the coal haul transportation route, impacts to the Utah prairie dog and its habitats adjacent to the route are analyzed as acres within a 350-foot buffer on both sides of the route. Impacts to wildlife and special status species associated with riparian habitats adjacent to the coal haul transportation route are analyzed as acres within a 100-foot buffer on both sides of the route. Impacts to all other wildlife and special status species and their habitats on the coal haul transportation route are analyzed using miles of habitat adjacent to the route. Impacts to wildlife and special status species on the coal haul transportation route are analyzed separately from impacts associated with the tract (see Section 4.17.4).

As indicated in Section 3.17, wildlife and special status species habitat acreages are based on detailed vegetation community surveys in the tract (SWCA 2007b), and on southwest regional land-cover data (SWReGAP 2004) along the coal haul transportation route (see Section 3.15 for a detailed description of the vegetation communities present in the tract). The habitat types discussed for the tract and coal haul transportation route differ because of differences between the field surveys and SWReGAP datasets, and because different land-cover types occur in these areas. Because impacts to the tract and coal haul transportation route are analyzed separately, land-cover types are not directly compared, and differences in cover types are not a limiting factor in the analysis.

Three general categories of impacts are anticipated to be the most influential on wildlife and special status species and their habitats: 1) habitat fragmentation and alteration, 2) habitat loss and displacement, and 3) habitat enhancement. Habitat fragmentation occurs when a contiguous habitat is broken up or fragmented by surface-disturbing activities causing a reduction in usable ranges and a disruption of movement among habitat areas. In addition, habitat fragmentation causes the isolation of less mobile species, a decline in habitat specialists, and facilitates invasion by generalist species (Marvier et al. 2004). Habitat alteration occurs when surface-disturbing activities directly or indirectly change the composition, structure, or functioning of the habitat. Habitat loss is caused by surface-disturbing activities or other activities that degrade or remove habitat. Habitat displacement occurs when land-use activities force wildlife or special status species to move into other habitats, thereby increasing stress on individual animals and increasing competition for habitat resources. Any surface-disturbing actions could lead to habitat alteration, fragmentation, displacement, or loss; limit the amount of usable habitat for special status species and wildlife; and restrict movement among habitat areas. Habitat enhancement results from maintenance,

reclamation, revegetation, or other management actions that increase the quantity and/or quality of habitat conditions, or is otherwise beneficial to one or more wildlife or special status species.

4.17.3 Analysis Assumptions

The locations and habitats of some species in the tract and coal haul transportation route are known; however, the data are neither complete nor comprehensive for all wildlife and special status species occurrences or for all potential habitats that might exist. Both known and potential special status species and habitat locations are considered in the analysis. The species and potential habitats that could be affected by various actions are assumed to be directly correlated with the degree, nature, and quantity of surface disturbance and other activities. Impacts are quantified wherever possible. In the absence of quantitative data, best professional judgment is used to analyze impacts. This analysis was prepared using the following assumptions:

- Local populations are naturally affected by nonhuman causal factors such as climate, natural predation, disease, natural fire regimes, and competition with other native species for available habitat.
- Impacts to wildlife and special status species depend on the location, extent, timing, and intensity of the disturbance.
- Impacts to special status species and certain wildlife species are likely greater than impacts to nonspecial status species due to the limited distribution of individuals and habitats and/or a low tolerance for disturbance.
- Ground-disturbing activities could lead to the fragmentation, alteration (positive or negative), loss, or displacement (short-term or long-term) of wildlife and special status species habitats and/or loss or gain of individuals or populations.
- Disturbance occurring adjacent to wildlife and special status species habitat would contribute to habitat fragmentation, alteration, and displacement due to reduced habitat quality or accessibility.
- Changes in air, water, and habitat quality may cause direct and indirect impacts to wildlife and special status species and habitats, and may also have cumulative impacts on species survival.
- Mitigation, habitat maintenance, or habitat enhancement actions could maintain or improve the condition of vegetation, soils, and other habitat conditions through vegetation treatments, restrictions on surface-disturbing activities, and site reclamation and restoration.

In addition to the assumptions listed above, to analyze and disclose the effects of coal mining on wildlife and special status species associated with the Proposed Action and Alternative C, it is assumed that 1) mining would occur and that there would be an exemption, waiver, or modification of surface stipulations for Greater Sage-grouse (BLM 2008a: Appendix 3), and that 2) surface disturbance would be allowed within a 0.5-mile radius of a Greater Sage-grouse lek and within a 2.0-mile radius of a Greater Sage-grouse lek in brood-rearing habitat from March 15 to July 15. Without an exemption, waiver, or modification to surface stipulations, mining would not be permitted on most of the tract.

Impacts to stream and riparian habitats associated with the coal haul transportation route are based on the assumption that the likelihood of a coal spill along the route would be proportional to the occurrence of one accident per year anywhere along the entire reasonably foreseeable route. It is not possible to predict future conditions that could contribute to an accident; nevertheless, the chance of an accident occurring near stream or riparian habitats, which make up a very small portion of the route, would be extremely low.

In addition to conservation and lease notices, the following would apply: species-specific recovery plans and conservation documents that include management plans and strategies to protect wildlife and special status species. Applicable documents to the tract and coal haul transportation route include, but are not limited to, the Bald and Golden Eagle Protection Act of 1940, *the American Peregrine Falcon Recovery Plan* (1984), *the Utah Prairie Dog Recovery Plan* (1991), *the Utah Prairie Dog Interim Conservation Strategy* (1997), *the Northern Goshawk Conservation Agreement* (1998), *Strategic Management for Sage-Grouse* (UDWR 2002), *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* (Romin and Muck 2002), and *Best Management Practices for Raptors and Their Associated Habitats* (BLM 2008a). In addition, most native bird species are protected under the Migratory Bird Treaty Act of 1918, which prohibits direct take and destruction of occupied nests, whereby clearing of vegetation during the breeding season could result in loss of eggs or young and would be a violation of the Act.

4.17.4 Regional Greater Sage-grouse Status Summary

Greater Sage-grouse numbers have declined throughout its range due to habitat loss, habitat fragmentation, and reduced habitat quality from urban expansion, conversion of habitats to agriculture, and pinyon-juniper encroachment (UDWR 2002; Bosworth 2003; UDWR 2005). In Utah, Greater Sage-grouse occupies approximately 40% of its historic range (Beck et al. 2003). The Alton–Sink Valley sage-grouse lek is the southern-most active Greater Sage-grouse lek in North America (Curtis and Frey 2007)(; (BLM 2008b). The Alton sage-grouse population is currently estimated at 30–40 birds, and has remained static for the approximately ten years (Personal Communication, Frey 2009). There are three inactive Greater Sage-grouse leks approximately 15 miles south of Alton, which indicates that Alton–Sink Valley is not the southern limit of the species' range. However, the closest active lek, with approximately 120 sage-grouse, is at Heut's Ranch approximately 6 miles north of Alton (Personal Communication, Frey 2009). Sage-grouse move from the Heut's Ranch lek to the Alton–Sink Valley lek, but there is no other known source of genetic exchange with the Alton sage-grouse population. Because of its small size, the Alton–Sink Valley population is highly susceptible to extirpation due to environmental or demographic stochastic events, such as severe drought or disease outbreak, respectively (Personal Communication, Frey 2009). Specific threats to the Alton sage-grouse population include habitat loss, West Nile virus, increased predation, severe drought, or a combination of these events. Fences and other structures are also potential threats to sage-grouse because they function as vertical barriers, collision risks, and raptor perches (Curtis and Frey 2007). The Alton sage-grouse population has experienced high mortality from predation, with a relatively large number of sage-grouse known to have been killed by predators since 2005 (Curtis and Frey 2007). Increasing predation by non-native predators (domestic pets, red foxes, raccoons) and native ravens is of concern (Frey et al. 2006).

4.17.5 Greater Sage-grouse Conservation Issues

Greater sage-grouse is a sagebrush obligate species that requires contiguous sagebrush-dominated habitats (Connelly et al. 2004). In Utah, nesting sage-grouse prefer mature, well-developed sagebrush communities (Connelly et al. 2004). Range-wide, sage-grouse use other sagebrush-dominated habitats and forage in riparian, wet meadow, and agricultural habitat types during the summer nesting and brood-rearing seasons, and they are dependent on mature sagebrush stands for both forage and shelter in the winter (Connelly et al. 2004).

The Alton sage-grouse population uses sagebrush-steppe, agricultural, pinyon-juniper woodland, and riparian habitats in the Alton–Sink Valley area. Alton sage-grouse appear to nest exclusively in sagebrush habitats adjacent to the Alton–Sink Valley lek (Personal Communication, Frey 2009).Nesting sage-grouse habitats on the tract include sagebrush/grassland and sagebrush/grassland (treated) habitats in Block S. Summer brooding habitats on the tract include sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses in Block S, and grassland and meadow habitats in the northern portion of the tract (Map 4.2). During

summer brooding season, approximately one-third of nesting females move their chicks from nesting habitats in Block S to horse pastures and wetlands north of the tract (Curtis and Frey 2007).Wintering habitats include all habitat types in the tract.

In the Alton area, fragmentation and loss of sagebrush stands has occurred due to pinyon-juniper woodland encroachment (BLM 2008a: Appendix 3) and may have contributed to the isolation of the sage-grouse population due to loss of habitat connectivity (Petersen 2006). Changes in habitat quality and availability both locally and throughout the region have limited sage-grouse migration and isolated populations, thereby potentially restricting gene flow and reducing the fitness of local populations. However, beginning in fall 2005, Alton sage-grouse have responded favorably to the removal of pinyon-juniper trees and seeding with forbs and grasses on 1,700 acres in Alton–Sink Valley (Frey et al. 2006). Nine hundred acres in the tract have been treated for pinyon-juniper removal. The treatments resulted in increased forb and grass cover and increased use of treated areas by sage-grouse in summer and fall (Curtis and Frey 2007; Frey 2008).

Because sage-grouse migrate between habitats several times during the year, and because of the small size and isolation of the Alton sage-grouse population, habitat connectivity is important for facilitating genetic exchange with other populations, and in determining the availability and quality of sage-grouse habitats. Off-site mitigation and conservation activities are neither enforceable nor required by BLM, but could include habitat enhancement and the development of migration corridors between habitat areas. Conservation measures to increase connectivity between the Heut's Ranch lek (north of Alton) and Alton–Sink Valley sage-grouse habitats have been planned. These would be implemented prior to any mining activity in the tract. Voluntary mitigation measures which would be provided by the proponent have also been proposed to increase connectivity between Alton–Sink Valley sage-grouse habitats and the historic leks at Johnson Canyon (Skutumpah leks) and Ford Pasture (south of the Alton–Sink Valley lek). These measures could provide Alton sage-grouse with wintering habitat refugia during mining activities by increasing the quality and connectivity of sagebrush habitats between the Alton-Sink Valley sage-grouse population and other sage-grouse populations and habitats. However, the success of these conservation measures is contingent on the Alton–Sink Valley sage-grouse population actually using available habitats.

The habitat reclamation and restoration activities that would follow mining disturbance would be designed to create habitat for the Greater Sage-grouse. In the short term (life of the mine), habitat enhancement in Block S would improve conditions for sage-grouse by removing pinyon and juniper, and by establishing sagebrush and native and desirable non-native grasses and forbs. This would improve the structural and compositional diversity of sage-grouse habitat compared to current conditions (BLM 2008b: Appendix 3). Reclamation and restoration actions that would take place concurrently with mining would also be designed to improve habitat conditions for sage-grouse. However, retention of the Alton sage-grouse population would require that year-round, suitable habitats are continuously available to provide refugia for the sage-grouse population while removal and restoration of other habitat areas is taking place. This would require the avoidance of 1) intact sagebrush stands and other seasonal sage-grouse habitats, such as the agricultural and wet meadow habitats in Block NW that are used as summer brood-rearing habitats, and 2) sagebrush nesting, brood-rearing, and wintering habitats in Block S.

The Alton sage-grouse population is unusually tolerant of human disturbance (Curtis and Frey 2007; Personal Communication, Frey 2009), which suggests that the population may tolerate indirect disturbance associated with mining and reclamation. Nevertheless, successful restoration would require that restored sagebrush communities achieve maturity and the structural diversity required to support the Greater Sage-grouse. Development of a mature sagebrush community requires approximately 15–30 years following fire (Miller and Rose 1999). In the tract, sagebrush communities would presumably require a similar time period to recover on reclaimed soils. Recovery time would depend on numerous ecological variables such as local topography, soil reclamation success, soil type, variations in local and regional climate, colonization of the site by soil-building fungi and bacteria, and other site features that cannot be predicted or easily quantified. The restoration plan to

plant sagebrush seedlings would be designed to accelerate sagebrush reestablishment and to accelerate the successional development of mature sagebrush communities. The recovery time for sagebrush reestablishment would likely be reduced but cannot be quantified because of the variables involved in plant establishment and growth.

The northern and southern blocks of the tract would not be mined at the same time, with mining likely beginning in Block S. This could allow the Block NW to serve as one of the sage-grouse refugia during Block S mining operations. Avoidance of intact and restored sagebrush habitats would be required to provide adequate refugia throughout the life of the mine. Over the long term, reclamation of disturbed areas and successful restoration of diverse sagebrush habitat in the tract would contribute to the creation of contiguous sagebrush vegetation necessary for the long-term persistence of the Alton sage-grouse population. The analysis presented here assumes that habitat avoidance, enhancement, reclamation, and restoration actions would be successful, and that these actions would lead to the establishment of self-sustaining and self-propagating mature sagebrush communities.

4.17.6 Impacts Occurring in the Tract Analysis Area

4.17.6.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, the tract would not be mined, and no coal mining or related activities, infrastructure development, or relocation of KFO Route 116 would occur. Therefore, no acres of wildlife habitat would be disturbed by these activities. However, management under the No Action Alternative would not restrict permitted mining activities on private lands adjacent to the tract. Mine-related activities would occur to a lesser degree than under the Proposed Action or Alternative C because the total acreage of mining activities and the total duration of mining activities would be considerably less than under either of these alternatives.

Management of wildlife and special status species habitats on BLM-administered lands in the tract would be conducted as directed under the KFO-RMP (BLM 2008a). Under the No Action Alternative, prescribed management on BLM-administered lands would include watershed protections and improvements to wildlife and special status species habitats. Vegetation management to restore sagebrush grasslands that have been invaded by pinyon-juniper woodlands would improve ecosystem functioning and watershed health. Vegetation management would have long-term, beneficial effects for upland animal species by removing undesirable vegetation, increasing species and structural diversity, and improving overall habitat quality. Pinyon-juniper tree removal would reduce the amount of foraging, roosting, and nesting habitats available to raptors, bats, and migratory birds. Vegetation treatments that would help reduce soil loss and improve water quality would likely improve aquatic and riparian habitats and benefit the wildlife and special status species that rely directly or indirectly on these habitats. Erosion-control measures would reduce sedimentation of water sources and associated impacts to special status amphibian and fish species. Vegetation and soil treatments would help to reestablish upland communities, maintain or improve the health of riparian/wetland communities, reestablish seedlings and understory vegetation, and retain soil moisture and nutrients (BLM 2008a).

The invasion of pinyon pine and Utah juniper into sagebrush habitats, and the lack of contiguous sagebrush habitats for nesting, brood-rearing, and wintering sage-grouse have been limiting factors in the size and distribution of the Alton sage-grouse population. Tree removal and seeding to restore sagebrush habitats on 1,700 acres in Alton–Sink Valley by BLM in 2005 has resulting in increased forb and grass cover and increased use of the treated areas by sage-grouse (Curtis and Frey 2007). Ongoing management to improve the distribution, abundance, and connectivity of suitable habitats would have beneficial impacts on the species.

Table 4.47 lists the habitat types present in the tract, the wildlife and special status species associated with each habitat type, and the acres of disturbance that would occur to each habitat type under the No Action Alternative, Proposed Action, and Alternative C.

Table 4.47. Acreages and Direct Disturbance in the Alton Coal Tract by Habitat Type and Associated Wildlife and Special Status Species Under the No Action and Action Alternatives

Habitat Type	Associated Wildlife and Special Status Species[12]	Alternative A (No Action)	Alternative B: (Proposed Action)			Alternative C		
		Acres Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed
Pinyon-Juniper Woodland	Allen's big-eared bat, Arizona toad, e k, Ferruginous Hawk, Lewis' Woodpecker, Townsend's big-eared bat	0.0	1,430.0	694.4–968.5	48.6%–67.7%	1,409.7	679.5–953.5	48.2%–67.6%
Sagebrush/ Grassland	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-grouse, kit fox, Long-billed Curlew, mule deer, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	0.0	860.2	366.5–434.7	42.6%–50.5%	627.8	195.7–263.9	31.2%–42.0%
Sagebrush/ Grassland (treated)	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-grouse, kit fox, Long-billed Curlew, mule deer, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	0.0	749.1	547.5	73.1%	749.1	546.1	72.9%
Annual and perennial grasses	Elk, Ferruginous Hawk, Long-billed Curlew, mule deer, Short-eared Owl	0.0	324.1	278.4–299.6	85.9%–92.4%	247.0	196.5–217.6	79.6%–88.1%
Mountain Brush	Elk, Ferruginous Hawk, Lewis's Woodpecker	0.0	62.8	24.9–60.0	39.6%–95.5%	62.8	24.7–59.8	39.3%–95.2%
Wetland (meadow)	Elk, mule deer, western toad	0.0	62.8	55.5	88.3%–88.3%	0.0	0.0	0%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Northern Goshawk, western toad	0.0	55.3	6.7–10.0	12.1%–18.1%	54.0	6.3–9.6	11.7%–18.0%
Rabbitbrush	Burrowing Owl, elk, Ferruginous Hawk, Golden Eagle, Greater Sage-grouse, kit fox, pygmy rabbit, Short-eared Owl, spotted bat	0.0	10.7	1.0	9.2%	10.7	0.9	8.0%
Bedrock, Cliff, and Canyon	Allen's big-eared bat, Black Swift, big free-tailed bat, fringed myotis, Golden Eagle, spotted bat, Townsend's big-eared bat	0.0	0.0	0.0	0%	0.0	0.0	0%
Open water	Black Swift, Bonneville cutthroat trout, desert sucker, leatherside chub, virgin spinedace	0.0	4.1	0.0	0%	0.0	0.0	0%
Habitat Total		**0.0**	**3,559.1**	**1,974.8–2,376.7**	**55.5%–66.9%**	**3,161.1**	**1,649.7–2,051.4**	**52.2%–64.9%**

[12] Scientific names for all wildlife and special status species can be found in Chapter 3.

4.17.6.2 IMPACTS COMMON TO THE ACTION ALTERNATIVES

Under the Proposed Action and Alternative C, there would be a short-term loss of all habitat types from the clearing of vegetation during the life of the mine and from the construction of centralized and dispersed facilities. Vegetation and soil would be removed from active mining areas and stockpiled, with reclamation and revegetation taking place concurrently with mining. Long-term fragmentation, alteration, loss, or displacement of wildlife and special status species habitats would occur during mining and restoration activities, because some or all reclaimed habitats would not have developed to a mature, structurally and compositionally diverse condition. Sagebrush takes approximately five years to reestablish following a fire; however, the successional development of a mature sagebrush community takes from 15 to 30 years (Miller and Rose 1999). Because restoration plans include planting sagebrush seedlings, the recovery period for sagebrush would be reduced to some degree. Successional development of a mature sagebrush community would require up to 30 years, depending on site conditions. During this recovery period, restored sites may have lower habitat quality than fully developed vegetation communities, and would therefore be of less value to wildlife and special status species, particularly those that require mature sagebrush habitats such as Greater Sage-grouse.

On federal lands, reclamation would involve the reestablishment of native and suitable non-native vegetation communities. On private lands, revegetation would involve the reestablishment of pre-mining agricultural vegetation. Impacts would be partially mitigated by revegetation and habitat enhancement plans. There would be displacement of wildlife and interference with movement patterns during periods of active mining and construction. Injury or potential for mortality of smaller and less mobile animals (e.g., rodents, reptiles, and amphibians) could result from individuals being crushed on the ground or in burrows, buried in spoil areas, or trapped in excavated areas and buried. Small animals in mined and developed areas would likely be displaced, injured, or have potential for mortality.

Disruption of breeding or loss of nests or young could take place if mining and construction occurs during the nesting season for raptors and other migratory and nonmigratory birds. These impacts would be avoided by restricting clearing of vegetation to nonbreeding seasons, or by conducting nest surveys and protecting individual nests during breeding periods. Of the habitats in the tract, pinyon-juniper woodlands would likely have the highest diversity of breeding migratory birds, and would be similarly affected under both action alternatives. Disturbance to native habitats could also cause degradation of wildlife and special status species habitats due to an increased risk of noxious weeds invasion and associated alteration of habitat composition and structure.

Under the action alternatives, approximately 8.12 million gallons (25 acre-feet) of water per year would be used for dust suppression and equipment washing. Modifications to Robinson Creek and Kanab Creek in the tract would have negligible impacts on potential habitats for fish and amphibian species due to limited surface water. Nevertheless, relocation of Robinson Creek would reduce or eliminate any existing flows and connectivity, remove structural habitat features, reduce or eliminate prey species, and increase erosion and sedimentation of connected surface waters. Relocation of existing streams would require surface impacts during dredging of a new stream channel and filling of the existing channel, as well as surface disturbance from construction equipment. Aquatic and riparian habitats would be displaced from both the original creek bed and replacement creek bed until restoration is completed. Impacts from stream crossing developments on Kanab Creek would be minimal due to limited surface-water flows and associated fish and amphibian habitats.

Under the action alternatives, portions of KFO Route 116 in the tract would be relocated to allow for mine-related disturbance within 100 feet of the road. KFO Route 116 would be sited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not

possible to avoid disturbances to these areas, mitigation measures would be prescribed. Relocation of KFO Route 116 would be temporary, and the road would be reestablished in the approximate, original roadbed following mining. Two-track roads on private and BLM-administered lands in the tract would be closed during mining operations and replaced following completion of mining and reclamation activities. Temporary two-track roads may be constructed and reclaimed following mining. Surface disturbance from road relocation would impact wildlife and special status species by removing and fragmenting existing habitats, and by reducing habitat quality in adjacent habitats due to noise and disturbance associated with road construction and use. There would be an increased likelihood of mortality of individuals from collisions with mine-related vehicles on KFO Route 116.

Under both action alternatives, mining activities would be ongoing 24 hours a day, six days a week. Noise and ground vibration would occur from blasting, the use of electrical power generators, and coal processing, loading, and transport from centralized facilities. Approximately 153 truck round-trips per day, and worker and service traffic to and from the tract would occur for the duration of the mining operation. Impacts to wildlife and special status species from coal truck and other vehicle traffic in the tract would vary according to the size, mobility, and movements of each species. The use of narrow, unpaved roads in the tract would increase the likelihood of mortality of smaller, less mobile animals (e.g., small mammals, ground birds, reptiles, and amphibians) from collisions with mine-related vehicles. Vehicle-related mortality of raptors and other special status bird species could also occur from birds scavenging roadkill, and would be proportional to the amount of roadkill that occurs.

Disturbance to or displacement of wildlife and special status species would likely occur due to lighting during nighttime operations. Artificial night lighting affects animal foraging behavior, reproduction, movement, and species interactions (such as predator-prey and pollinator-plant relationships) (Longcore and Rich 2004, 2005). Bats and other nocturnal mammals respond to increased nighttime light by reducing or shifting their periods of activity, traveling shorter distances, and consuming less food (Longcore and Rich 2005). Diurnal (day-active) and nocturnal wildlife and special status species could be displaced from, or attracted to, habitats affected by night lighting. Bat species are likely to be attracted to insect activity around lights and could benefit from concentrated prey. However, night lighting increases the risk of predation for small, nocturnal mammals and decreases food consumption when animals reduce foraging activities to remain concealed in an artificially lit environment (Beier 2005). Night lighting may also increase the risk of animal mortality from vehicle collisions (Longcore and Rich 2005).

Subsidence from underground mining operations and from the removal of coal would be expected to cause surface cracks, lower the ground surface, and cause the fracture or failure of cliffs (Personal Communication, Smith 2008). Several small areas of bedrock, cliff, and canyon habitat occur adjacent to the eastern boundary of the proposed tract, but none of this habitat type occurs on or adjacent to the NE corner of the tract (Block C) where underground mining is expected to occur. Subsidence would be expected to occur within one year of mining operations and would permanently impact the topography, physiography, and stratigraphy of the area. If subsidence were to occur, direct or indirect impacts to wildlife and special status species and their habitats would occur from collapse of surface topography, such as rock walls or cliffs, and any resulting loss of nesting or roosting habitat.

The KFO-RMP (BLM 2008a) includes habitat maintenance, enhancement, and species-specific management (particularly for Greater Sage-grouse). A detailed, site-specific mining and reclamation plan would be applied for reclamation and reestablishment of vegetation with planned mitigation required before coal mining and coal mine-related activities could occur. Under the *Alton Sage-grouse Habitat Assessment and Mitigation Plan* (ACD 2008: Appendix 3), nearby grasslands and shrublands would be protected to provide alternate breeding and nesting sites, intact sagebrush stands in the tract would be avoided, and pinyon-juniper woodlands would be removed with subsequent restoration of the sagebrush community. In addition to habitat reclamation and restoration of disturbed areas, the successful bidder

would be required to enhance sage-grouse habitat in Block Sa concurrent with mining (see Map 1.2 and Map 2.1). Irrigated alfalfa fields would also be created in Swapp Valley to provide sage-grouse brood-rearing habitat away from mining disturbance and residential areas (ACD 2008: Appendix 3). Nevertheless, wildlife and special status species habitats would be fragmented, altered, or lost in the short term due to surface disturbance from coal mining and construction, and associated impacts such as increased susceptibility of disturbed sites to weed invasion, reduced species diversity, and altered habitat structure.

Over the long-term, mining reclamation and sagebrush restoration activities are expected to improve crucial big game and special status species habitats, restore ecological functioning, and increase forage production. Habitat reclamation and revegetation actions would enhance habitat for some wildlife and special status species. Reestablishment of vegetation would serve to mitigate the short-term, negative impacts of surface disturbance on vegetation communities by restoring native and desirable non-native species. Immediate site reclamation and restoration of the native vegetation community would reduce the duration of habitat loss and the impacts to wildlife and special status species from habitat fragmentation and loss. Habitat restoration actions would be expected to enhance habitat quality over the long-term by creating structurally and compositionally diverse vegetation communities.

The regulatory framework and required mitigation measures are described under the action alternatives and in Section 4.17.1.

Direct adverse effects under the action alternatives would include

- direct mortality of individuals due to trampling, crushing, or burial during mining operations;
- alteration or loss of suitable and/or potential habitats due to surface disturbance, noise, ground vibration, or night lighting;
- disruption of breeding, nesting, or roosting activities due to surface disturbance, human presence, increased levels or duration of noise, and night lighting during 24-hour operations;
- disruption of bird migration and habitat use due to mining and associated disturbance and human presence;
- alteration of hydrologic or geologic conditions in or adjacent to the tract due to surface disturbance or subsidence during underground mining; and
- mortality, stress, or effective loss of habitat due to increased vehicle and coal truck traffic.

Indirect adverse impacts would include

- habitat fragmentation and subsequent displacement of individuals or populations due to surface disturbance and development;
- dust impacts to habitat quality from increased travel and construction activities during the life of mining operations;
- increased susceptibility of disturbed areas to weed invasion and associated alteration of vegetation communities and habitat structure from surface disturbance; and
- increased mosquito-borne disease transmission to special status species populations due to the presence of standing water in holding ponds or excavated areas.

4.17.6.3 ALTERNATIVE B: PROPOSED ACTION

Under the Proposed Action, the tract would encompass approximately 3,576 acres. Approximately 1,993–2,395 acres of surface disturbance from surface mining and infrastructure development would occur in the tract over approximately 25 years. There would be a single open pit (approximately 120 acres), and at any

one time, there would be approximately 120 acres of open surface mining pit disturbance and an additional 120 or more acres in some stage of reclamation. Reclamation would be concurrent with mining over the course of the estimated 25-year mine life and would be followed by a minimum of 10 years of reclamation and revegetation monitoring. Impacts are reported in terms of total acres of disturbance over the life of the mine; however, this disturbance would not all occur at one time.

Under the Proposed Action, approximately 1,975–2,377 acres of disturbance would occur in vegetated areas (see Table 4.47).Of this total, dispersed facilities would be sited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible, with mitigation measures prescribed where it is not possible to avoid disturbances. Underground mining would not directly impact overlying vegetation; however, impacts associated with underground mining could include hydrological changes and subsidence. Surface disturbance, consisting of the road and ROW, would occur for the reroute of KFO Route 116 in and outside the tract. Although the entire ROW would not be directly disturbed, for purposes of analysis, we assume that these areas would be nonfunctional as habitat for wildlife and special status species for the life of the mine. Following mining of the original roadbed, KFO Route 116 would be returned to its original route and the temporary ROW would be reclaimed and restored. Under the Proposed Action, approximately 56%–67% of the wildlife and special status species habitats in the tract would be removed by surface mining and associated disturbance.

Water use for dust suppression and the washing of equipment would occur over the 25-year mine life. Water sources would consist of groundwater accumulated in open pits and water pumped from existing wells or from wells established near the mine for coal mining purposes. Direct and indirect impacts to wildlife and special status species could result from surface-water depletions or from degradation of surface-water quality due to increased sediment loads from mining operations or spills of petroleum products and other hazardous materials. Direct impacts to wildlife and special status species that occupy wetlands or riparian habitats (see Table 4.47) would consist of habitat removal during mining and related disturbances. Indirect impacts would consist of loss of habitat and/or reduced habitat functioning (i.e., reduced water quality, reduced prey availability) as a result of water depletions or sedimentation of surface waters. See Section 4.16, Water Resources, for more detailed discussion of water use under the Proposed Action.

4.17.6.3.1 Impacts on Wildlife Occurring in the Tract Analysis Area

The tract is located entirely in crucial summer habitat for mule deer and in crucial summer and year-long substantial value habitats for elk. These big game species are likely to be displaced from crucial and substantial-value habitats on the tract during mining operations and development. Direct impacts would consist of habitat loss, alteration, and fragmentation due to surface disturbance. Other impacts would consist of disruption of movement and habitat use due to noise, night lighting, and increased human presence. Disturbed habitat would have reduced forage and cover value until reclamation and restoration actions are complete (approximately 10 years post-mining activity). Reclaimed sites may have limited habitat value in early stages of succession, and may never fully return to their original habitat function in late successional stages. Under the Proposed Action, surface-disturbing activities would remove 67%–73% of crucial summer mule deer habitat, 66%–72% of crucial summer elk habitat, and 40% of year-long substantial value elk habitat in the tract (Table 4.48). No designated pronghorn habitats occur in the proposed tract.

Table 4.48. Direct Impacts to Mule Deer and Elk Habitats in the Alton Coal Tract under the No Action and Action Alternatives

	Alternative A (No Action)	Alternative B (Proposed Action)			Alternative C		
	Acres Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed
Mule Deer Crucial Summer	0	3,576.6	2,394.0–2,605.1	66.9%–72.8%	3,172.7	2062.8–2273.9	65.0%–71.7%
Elk Crucial Summer	0	3,576.6	2,369.3–2,580.3	66.2%–72.1%	3,101.6	2035.0–2246.1	65.6%–72.4%
Elk Year-long Substantial Value	0	71.1	28	39.4%	71.1	27.8	39.1%

Source: Utah Division of Wildlife Resources GIS data updated May 2006.

Under the Proposed Action, an additional 0.8 acre of mule deer crucial summer, 0.2 acre of elk crucial summer, and 0.6 acre of elk year-long substantial value habitats on BLM-administered land adjacent to the tract would be disturbed to reroute KFO Route 116. Impacts to big game species along the coal haul transportation route are discussed in Section 4.17.7.2.1. Direct impacts to mule deer and elk habitats in the tract would be considerably greater under the Proposed Action compared to the No Action Alternative. Implementation of the Proposed Action would result in the disturbance of 2,394–2,605 more acres of crucial summer mule deer habitat, 2,369–2,580 more acres of crucial summer elk habitat, and 28 more acres of year-long substantial elk habitat than would occur under the No Action Alternative.

4.17.6.3.2 Impacts on Special Status Species Occurring in the Tract Analysis Area

4.17.6.3.2.1 Greater Sage-grouse

The Alton sage-grouse population is isolated by its distribution at the southern portion of the species' range and the limited distribution of nesting, brood-rearing, and wintering habitats in the area. Under the Proposed Action, the Alton sage-grouse population would be adversely affected in the short term where surface disturbance associated with coal mining and construction activities occur in the species' habitats. As described in Section 4.17.1.2, short-term, medium-term, and long-term habitat reclamation measures would be required to enhance Greater Sage-grouse nesting and brooding habitats. Accelerated reclamation actions in Block Sa (planting of grass, forb, and sagebrush seedlings) would also be required to minimize loss of existing sagebrush habitat and to create restored sagebrush habitats within approximately 10 years. However, the restoration and successional development of a mature sagebrush community would be expected to require 15–30 years or longer depending on site conditions (see Section 4.17.3). In the long term, reclamation and restoration actions throughout the tract would create sagebrush stands of varying ages and structure, and would increase the overall quality and quantity of habitats available to the Alton population.

Although the location of the tract's coal resources do not coincide with the lek used by the local population, the development of the coal mine would eliminate brood-rearing and wintering habitat and habitat resources adjacent to the lek during the life of the mine and during subsequent restoration and

recovery period. Fragmentation, alteration, degradation, and loss of Greater Sage-grouse habitats would likely occur as a result of mining activity and associated noise and human presence. Development of the coal mine, removal of overburden, and surface mining operations would result in the short-term loss of habitat resources and displacement or loss of individual birds. The reclamation and restoration plan would be designed to enhance the long-term survivability of the Alton sage-grouse population. However, although mitigation and reclamation actions are expected to reduce impacts to sagebrush habitats in the short term and increase the quality and quantity of sagebrush habitats over the long-term, development of the coal mine could result in the short-term or long-term displacement or loss of the local population.

Infrastructure associated with mining activities could also facilitate increased predation by raptors and *Corvus* species (crows and ravens) because it would increase availability of perching sites. Mining activities and associated surface disturbance and road development could also facilitate invasion by weed species (Bergquist et al. 2007). In addition, the creation of holding ponds could increase mosquito abundance and transmission of West Nile Virus to the local sage-grouse population (Naugle et al. 2004). This disease is a considerable threat to the species (Naugle et al. 2004), and this population would be adversely impacted by the loss of individual birds due to its relative isolation and limited numbers. Mosquito abatement in holding ponds and standing water would reduce the potential for transmission of West Nile Virus to the sage-grouse population.

Construction activities near active leks during the breeding season would have direct adverse impacts to sage-grouse by disrupting courtship behaviors and increasing the risk of mortality of adult sage-grouse, fledglings, and nestlings from collisions with, or crushing by vehicles and construction equipment. Recent studies indicate that sage-grouse lekking and brooding habitat is devalued within 1,300 feet of roads and other surface disturbances, which causes avoidance and displacement to other habitat areas (Connelly et al. 2000; UDWR 2002; Crawford et al. 2004). Noise associated with human presence, mining, and associated facilities (i.e., power generators) in the tract, and coal truck traffic to and from the tract, would reduce breeding success by reducing lek use and nest initiation in and adjacent to brooding habitats. Because 70%–80% of sage-grouse hens nest and rear their young within 1.75–2.50 miles of the lek where they breed (Rowland 2004), ongoing surface disturbance and associated noise could cause the displacement of sage-grouse from crucial brooding habitats in the tract. Under the Proposed Action, 1,290–1,403 acres (62%–68%) of crucial brooding habitat (see Map 4.2) would be impacted through direct surface disturbance (Table 4.49).

Table 4.49. Direct Impacts to Greater Sage-grouse Habitats in the Tract Under the No Action and Action Alternatives

	Alternative A (No Action)	Alternative B (Proposed Action)			Alternative C		
	Acres Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed
Crucial Brooding Habitat	0	2,067.5	1,290.4–1,402.8	62.4%–67.9%	1,833.4	1,056.4–1,168.8	57.6%–63.8%

Source: Utah Division of Wildlife Resources GIS data updated May 2006.

The Proposed Action would result in more direct adverse impacts to the Alton sage-grouse population and its habitat than would occur under the No Action Alternative. Implementation of the Proposed Action would result in the disturbance of 1,290–1,403 more acres of crucial sage-grouse brooding habitat than would occur under the No Action Alternative. Restoration actions would include seeding sagebrush and planting seedlings to accelerate the successional development of suitable sage-grouse habitat. Over the long-term, these restoration measures would improve the overall quantity and quality of habitats,

provided that sufficient refugia are available in habitats adjacent to the tract to retain the Alton sage-grouse population and to provide lekking and brood-rearing sites throughout the period of disturbance. Because this population is small and isolated, and individuals have been found to complete their life cycles in the Alton and Sink Valley areas, and sage-grouse in general exhibit high fidelity to nesting and lek sites, the extent of available, suitable habitats may not be adequate to prevent the loss or displacement of the existing population.

4.17.6.3.2.2 Pygmy Rabbit

Threats to the pygmy rabbit are primarily from habitat loss across its limited range in the Intermountain West (Bosworth 2003). In Utah, the pygmy rabbit occurs in the western half of the state, primarily in the Bonneville Basin (Bosworth 2003). Like the Greater Sage-grouse, this species is largely dependent on sagebrush for both food and cover. Approximately 914–982 acres (57%–61%) of the pygmy rabbit's sagebrush/grassland and sagebrush/grassland (treated) habitats would be removed under the Proposed Action (see Table 4.47). In addition to direct impacts to individuals that may occur during surface disturbance and mining, pygmy rabbit would be displaced from these habitat resources until reclamation and successful restoration have been completed. The Proposed Action would result in greater short-term direct adverse impacts to pygmy rabbit and its habitats than would occur under the No Action Alternative.

4.17.6.3.2.3 Kit Fox

The kit fox is widely distributed in Utah, but may be declining (UDWR 2005). Its distribution in the tract analysis area is not known. Habitat loss, displacement by competitors, and indiscriminant predator poisoning are the primary threats to the species (Bosworth 2003). Indirect impacts can result from reduced abundance of small mammal prey due to habitat alteration. Approximately 914–982 acres (57%–61%) of kit fox sagebrush/grassland and sagebrush/grassland (treated) habitats would be removed under the Proposed Action (see Table 4.47). In addition to direct impacts to individuals that may occur during surface disturbance and mining, kit fox would be displaced due to the removal of its habitat until reclamation and successful restoration have been completed. Because a large portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term direct adverse impacts to kit fox and its habitats than would occur under the No Action Alternative.

4.17.6.3.2.4 Bat Species

Most of the habitat types in the tract are used as foraging habitat by one or more special status bat species (see Table 4.47). Potential bat roosting habitats occur adjacent to the tract. Adverse impacts to Allen's big-eared bat, big free-tailed bat, fringed myotis, spotted bat, and Townsend's big-eared bat would include the direct loss of foraging habitat in the tract; potential displacement from roosting and foraging habitats adjacent to the tract due to increased noise, human presence, and surface-disturbing activities; and habitat fragmentation and alteration. Decreased productivity of individuals or populations could result from the loss of, or displacement from, foraging habitats in or adjacent to the tract. Night lighting could disrupt roost emergence timing, predator avoidance, and foraging behaviors (Briggs 2004; Navarra and Nelson 2007). No bedrock, cliff, or canyon habitat occurs in the tract, but several small habitat areas are adjacent to the tract's eastern boundary. However, indirect impacts to these habitat areas from subsidence would be unlikely because underground mining operations would only occur in the northeast corner of the tract. Because a large portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to bat species and their habitats than would occur under the No Action Alternative.

4.17.6.3.2.5 Raptor Species

The Proposed Action would result in direct adverse impacts to Bald Eagle, Burrowing Owl, Ferruginous Hawk, Golden Eagle, Northern Goshawk, and Short-eared Owl foraging and wintering habitats, and active and inactive nest sites. Raptor species are sensitive to human disturbance (Romin and Muck 1999). Disturbance from mining activities or human presence near an active nest during breeding season could result in nest abandonment and/or mortality of young from increased vulnerability to predators, temperature extremes, or reduced food intake due to avoidance of the nest site by adult raptors. Raptor species would be directly impacted by habitat loss from pit disturbance and construction activities, and by the long-term loss of wooded foraging habitats (e.g., riparian, pinyon-juniper woodland, and mountain brush habitats). Construction of roadways and mine-related traffic could result in increased mortality from vehicle strikes. There is an increased risk of direct mortality of ground-nesting raptor species, particularly the Burrowing Owl, from pit development and construction equipment, which could crush or bury adults, nestlings, or eggs in burrows. Impacts to active nesting sites would be mitigated by raptor nest surveys and avoidance measures. The loss of foraging habitats due to direct disturbance or removal would result in the displacement of raptors from these areas until habitats have been successfully restored. Raptor nesting sites would likely be reduced by the removal of 694–969 acres of pinyon-juniper woodland. No bedrock, cliff, or canyon roosting and nesting habitat occurs in the tract, but several small habitat areas are adjacent to the tract's eastern boundary. However, indirect impacts to these habitat areas from subsidence would be unlikely because underground mining operations would occur in the northeast corner of the tract. Because a large portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to raptor species and their habitats than would occur under the No Action Alternative. In the long term, the Proposed Action would result in greater beneficial impacts to raptor species associated with sagebrush habitat compared to the No Action Alternative by increasing the quality and quantity of foraging habitats through sagebrush habitat restoration. Special lease stipulations and BMPs would minimize adverse impacts to raptor species, especially during the breeding season, by providing spatial and seasonal buffers of both occupied and unoccupied nests.

4.17.6.3.2.6 Other Bird Species

The Proposed Action would result in direct adverse impacts to the Black Swift, Lewis' Woodpecker, Long-billed Curlew, and Three-toed Woodpecker breeding, nesting, and wintering habitats. Loss of habitat due to removal of vegetation and surface disturbance and associated activities would reduce foraging and nesting habitats, cover, and roosting and nesting sites. Most surface disturbance under the Proposed Action would occur in sagebrush/grassland and sagebrush/grassland (treated) (914–982 acres) and pinyon-juniper woodland habitats (694–969 acres). Therefore, the Long-billed Curlew and Lewis's Woodpecker, respectively associated with these habitat types, would be most greatly affected. Habitat fragmentation, alteration, displacement, and loss for ground-nesting species would result from pit disturbance and construction activities. These species would be at increased risk of direct mortality from excavation and construction due to potential for crushing or burial of adults, nestlings, and eggs on the ground. Increased mine-related traffic could also result in increased mortality from vehicle strikes. Impacts to active nesting sites would be mitigated by nest surveys and avoidance measures.

The loss of foraging habitats due to direct disturbance or removal would result in the displacement of special status bird species from these areas until habitats have been successfully restored. Woodpecker nesting habitat in the tract would be reduced by the removal of 49%–68% of pinyon-juniper woodland habitats in the tract. Because of the large portion of the tract that would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to special status bird species and their habitats than would occur under the No Action Alternative. In the long term, the Proposed Action would result in greater beneficial impacts to Long-billed Curlew

compared to the No Action Alternative by increasing the quality and quantity of sagebrush-grassland foraging and nesting habitats. Special lease stipulations and BMPs would minimize adverse impacts, especially during the breeding season, by requiring surveys for and avoidance of nest sites.

4.17.6.3.2.7 Migratory Bird Species

Under the Proposed Action, direct adverse impacts to migratory birds would occur from the direct removal, alteration, or fragmentation of habitat during surface mining and associated activities. Loss of habitat would reduce forage, cover, perches, and nesting areas for migratory birds. Most surface disturbance under the Proposed Action would occur in sagebrush/grassland and sagebrush/grassland (treated) (914–982 acres) and pinyon-juniper woodland habitats (694–969 acres) (Table 4.50). Therefore migratory bird species associated with these habitat types would be most greatly affected. In addition, 278–300 acres (86%–92%) of annual and perennial grasses habitat would be directly disturbed and effectively lost for migratory bird species associated with this habitat type. Under the Proposed Action, approximately 1,975–2,377 acres (56%–67%) of migratory bird habitat would be disturbed by surface mining over the life of the mine. Because a large portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to migratory bird species and their habitats than would occur under the No Action Alternative. In the long term, the Proposed Action would result in greater beneficial impacts to migratory birds associated with sagebrush habitat compared to the No Action Alternative by increasing the quality and quantity of foraging and nesting habitats through sagebrush habitat restoration.

Table 4.50. Acreages and Direct Disturbance in the Alton Coal Tract by Habitat Type and Associated Migratory Bird Species Under the Action Alternatives

Habitat Type	Associated Wildlife and Special Status Species	Alternative B (Proposed Action)			Alternative C		
		Acres in Tract	Acres Disturbed	Percentage Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed
Pinyon-Juniper Woodlands	Black-throated Gray Warbler, Gray Vireo, Loggerhead Shr ke, Virginia's Warbler	1,430.0	694.4–968.5	48.6%–67.7%	1,409.7	679.5–953.5	48.2%–67.6%
Sagebrush/ Grassland	Brewer's Sparrow, Sage Sparrow	860.2	366.5–434.7	42.6%–50.5%	627.8	195.7–263.9	31.2%–42.0%
Sagebrush/ Grassland (treated)	Brewer's Sparrow, Sage Sparrow	749.1	547.5	73.1%	749.1	546.1	72.9%
Annual and perennial grasses	Peregrine Falcon, Prairie Falcon, Swainson's Hawk	324.1	278.4–299.6	85.9%–92.4%	247.0	196.5–217.6	76.6%–88.1%
Mountain Brush	Black-throated Gray Warbler, Gray Vireo, Virginia's Warbler	62.8	24.9–60.0	39.6%–95.5%	62.8	24.7-59.8	39.3%–95.2%
Wetland (meadow)	Northern Harrier	62.8	55.5	88.3%	0.0	0.0	0%
Riparian	Broad-tailed Hummingbird, Gambel's Quail, Lucy's Warbler, Peregrine Falcon	55.3	6.7–10.0	12.1%–18.1%	54.0	6.3–9.6	11.7%–18.0%
Rabbitbrush	Brewer's Sparrow, Sage Sparrow	10.7	1.0	9.2%	10.7	0.9	8.0%
Habitat Total		**3,555.0**	**1,974.8–2,376.7**	**55.5%–66.9%**	**3,161.1**	**1,649.7–2,051.4**	**52.2%–64.9%**

4.17.6.3.2.8 Amphibian Species

Impacts to amphibian species from mining activities include habitat fragmentation and loss, displacement to lower quality habitats, increased exposure to predators from cover removal, crushing and burial of adults and young, and attraction to ecological 'traps' such as water holding ponds. Potential habitats for the Arizona toad in pinyon-juniper woodlands near water comprise up to 1,430 acres of the tract. Under the Proposed Action, 44%–63% (694–969 acres) of pinyon-juniper woodland would be directly disturbed by mining and associated activities (see Table 4.47). Potential habitats for the western toad in wetland (meadow) and riparian habitats comprise approximately 118 acres (3%) of the tract. Under the Proposed Action, approximately 53%–55% (62–66 acres) of wetland and riparian habitats would be removed by mining and associated activities (see Table 4.47). Because a large portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to amphibian habitats than would occur under the No Action Alternative.

4.17.6.3.2.9 Fish Species

No special status fish species are known to occur on the tract or in adjacent waterways. Surface water on the track is limited, and impacts to fish species in the tract are unlikely to occur. Any impacts that would occur would be indirect adverse affects to local waterways from reduction in surface or groundwater or from degradation of surface-water quality from mining and mine-related activities. See Section 4.16 for more detail on impacts to surface water and groundwater.

4.17.6.4 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

Under Alternative C, the nature of impacts would be the same as under the Proposed Action, but would differ in the acres of disturbance and timing of mine-related activities. Timing restrictions would be in place for Block S to reduce impacts to the Alton sage-grouse population (see Section 2.4.2.3 Sage-grouse Timing Restrictions). The tract would encompass approximately 3,173 acres due to the exclusion of Block NW. Under the Alternative C, approximately 1,650–2,052 acres of disturbance would occur in vegetated areas over approximately 21 years (see Table 4.47). Dispersed facilities would be sited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible, with mitigation measures prescribed where it is not possible. Relocation of KFO Route 116 would not be required in Block NW under this alternative because this portion of the tract would not be included (see Map 2.1). Relocation of KFO Route 116 elsewhere in the tract would require approximately 36 acres of surface disturbance, with an additional 0.6 acre of disturbance outside of the tract. As described for the Proposed Action, for purposes of analysis, the entire 36.6 acres is assumed to be nonfunctional as habitat for wildlife and special status species for the life of the mine. The reroute would be cited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Under Alternative C, approximately 52%–65% of wildlife and special status species habitats in the tract would be directly impacted by surface disturbance.

Timing restrictions designed to reduce impacts to Greater Sage-grouse in Block S would be implemented to reduce impacts to the local lek and sage-grouse population that occupies portions of the tract during the nesting and brooding periods. Under this alternative, no surface-disturbing activities would be allowed within 0.5 mile of the lek during the lekking period (February 15–March 15) or in Block S (see Map 2.1) during the nesting and brooding period (March 15–July 15). These timing restrictions would alter the timing and distribution of mining activities, and would reduce impacts to Greater Sage-grouse as well as to surface waters, soils, vegetation, and other wildlife and special status species.

Alternative C would require that two pits (approximately 240 acres) are open simultaneously, and would require the use of additional heavy equipment. In addition, a stockpiling area for approximately 40–60 acres of overburden would be required for two simultaneously open pits. At any one time, there would be approximately 240 acres of open surface mining pits and an additional 240 or more acres in some stage of reclamation. Reclamation would be concurrent with mining over the course of the estimated 21-year mine life and would be followed by an up to 10-year reclamation and revegetation monitoring period, with reclamation activities potentially extended for some pits due to timing restrictions for sage-grouse. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

Water use for dust suppression and the washing of equipment would occur over the 21-year mine life. Water sources would consist of groundwater accumulated in open pits and water pumped from existing wells or wells established near the mine for coal mining purposes. Impacts to wildlife and special status species would be the same as would occur under the Proposed Action. See Section 4.16 for more detailed discussion of water use.

4.17.6.4.1 Impacts on Wildlife Occurring in the Tract Analysis Area

Under Alternative C, the nature of impacts to wildlife occurring in the tract analysis area would be the same as described for the Proposed Action and in the Impacts Common to the Action Alternatives section. Surface-disturbing activities would impact 2,063–2,274 acres (65%–72%) of crucial summer mule deer habitat, 2,035–2,246 acres (66%–72%) of crucial summer elk habitat, and 27.8 acres (39%) of year-long substantial value elk habitat (see Table 4.48). An additional 0.6 acre of mule deer crucial summer and 0.6 acre of elk year-long substantial value habitats on BLM-administered land adjacent to the tract would be disturbed for the reroute of KFO Route 116. Direct impacts to mule deer and elk habitats in the tract would be greater under Alternative C compared to the No Action Alternative. No designated pronghorn habitats occur on or adjacent to the tract under Alternative C.

4.17.6.4.2 Impacts on Special Status Species Occurring in the Tract Analysis Area

Under Alternative C, the nature of impacts to special status species occurring in the tract analysis area would be the same as described for the Proposed Action and under the Impacts Common to the Action Alternatives section.

4.17.6.4.2.1 Greater Sage-grouse

Under Alternative C, mining would not occur in the Block NW. Timing restrictions would be placed on mining activities in Block S, and habitat enhancement would be implemented in Block Sa to minimize impacts to the Greater Sage-grouse population in the tract. The sage-grouse population and its habitats would be adversely affected in both the short term and long term due to surface coal mining activities on and adjacent to the tract, but to a lesser degree than would occur under the Proposed Action. Data show that a lek site occurs on adjacent private property and that birds from the Alton sage-grouse population use Block S during the nesting and brooding period. As would occur under the Proposed Action, mining activities in the tract would not directly disturb the sage-grouse lek, but there is potential for indirect impacts to the lek from human presence, noise, and night-lighting associated with mining activities. As previously mentioned, under Alternative C, no surface-disturbing activities would be allowed within 0.5 mile of the lek during the lekking period or in Block S during the nesting and brooding period; however, outside of these time periods, surface disturbance would occur and would adversely impact habitat known to be used by the local sage-grouse population. There would be potential for direct and indirect impacts associated with human presence, noise, and night lighting within the 0.5-mile lek buffer and in adjacent habitats.

Fragmentation, alteration, degradation, and loss of Greater Sage-grouse habitats are likely to occur as a result of mining activity and associated noise and human presence. Due to timing stipulations, there would be a greater area of open pits during active mining under this alternative than would occur under the Proposed Action. Development of the coal mine, removal of overburden, and surface mining operations would result in the short-term loss of habitat resources and displacement or loss of individual birds. The reclamation and restoration plan would be designed to enhance the long-term survivability of the Alton sage-grouse population. However, although mitigation and reclamation actions are expected to reduce impacts to sagebrush habitats in the short term and increase the quality and quantity of sagebrush habitats over the long-term, habitat loss and disturbance associated with the coal mine could result in the short-term displacement or loss of the local population.

Under Alternative C, 1,056–1,169 acres (58%–64%) of crucial brooding habitat in the tract would be impacted through direct surface disturbance (see Table 4.49). Alternative C would result in more direct adverse impacts to the Alton sage-grouse population and its habitat than would occur under the No Action Alternative. Over the long-term, habitat restoration measures would result in improvements to the overall quantity and quality of habitats, provided that sufficient refugia are available in habitats on or adjacent to the tract to retain the Alton sage-grouse population and provide lekking and brood-rearing sites throughout the period of disturbance. Because this population is small and isolated, and individuals have been found to complete their life cycles in the Alton and Sink Valley areas, the extent of available, suitable habitats may not be adequate to prevent the loss or displacement of the existing population. Long-term, beneficial impacts to the local sage-grouse population from habitat improvements are contingent upon the population having persistent and sufficient habitat quantity and quality on or adjacent to the tract while removal, reclamation, and restoration of habitats are occurring. Improvements to habitat would not be beneficial to the Alton sage-grouse population if it is displaced or lost from the area as a result of mining activity.

4.17.6.4.2.2 Pygmy Rabbit

Approximately 742–810 acres (54%–59%) of the pygmy rabbit's sagebrush/grassland and sagebrush/grassland (treated) habitats in the tract would be removed under Alternative C (see Table 4.47). In addition to direct impacts that may occur during surface disturbance and mining, the pygmy rabbit would be displaced from these habitat resources until reclamation and successful restoration have been completed. Alternative C would result in greater short-term adverse impacts to the pygmy rabbit and its habitat than would occur under the No Action Alternative. In the long term, Alternative C would beneficially impact the pygmy rabbit by increasing the quality and quantity of sagebrush habitats in the tract.

4.17.6.4.2.3 Kit Fox

Approximately 742–810 acres (54%–59%) of the kit fox's sagebrush/grassland and sagebrush/grassland (treated) pinyon-juniper habitats would be removed under Alternative C (see Table 4.47). In addition to direct impacts that may occur during surface disturbance and mining, the kit fox would be displaced from these habitat resources until reclamation and successful restoration have been completed. Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to the kit fox and its habitats than would occur under the No Action Alternative. In the long term, Alternative C would result in greater beneficial impacts to the kit fox compared to the No Action Alternative by increasing the quality and quantity of the species' habitats and habitat conditions for its prey through sagebrush restoration.

4.17.6.4.2.4 Bat Species

Under Alternative C, impacts to Allen's big-eared bat, big free-tailed bat, fringed myotis, spotted bat, and Townsend's big-eared bat would include the loss of roosting and foraging habitat; displacement from habitat due to increased noise, human presence, and surface-disturbing activities; and habitat

fragmentation and alteration (see Table 4.47). Impacts due to night lighting and 24-hour mine operations would be reduced by timing restrictions on mining in Block S. No bedrock, cliff, or canyon roosting habitat occurs in the tract, but several small habitat areas are adjacent to the tract's eastern boundary. However, indirect impacts to these habitat areas from subsidence would be unlikely because underground mining operations would only occur in the northeast corner of the tract. Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to bat species and their habitats than would occur under the No Action Alternative. In the long term, Alternative C would result in greater beneficial impacts to bat species compared to the No Action Alternative by increasing the quality and quantity of foraging habitats through sagebrush habitat restoration.

4.17.6.4.2.5 Raptor Species

Under Alternative C, Bald Eagle, Burrowing Owl, Ferruginous Hawk, Golden Eagle, Northern Goshawk, and Short-eared Owl would be directly impacted by habitat loss from pit disturbance and construction activities, and by the long-term loss of wooded foraging habitats (e.g., riparian, pinyon-juniper woodland, and mountain brush habitats). The nature of impacts to raptor species would be the same as described for the Proposed Action. The increased risk of direct mortality of ground-nesting raptor species from pit development and construction equipment would be reduced by the elimination of the Block NW and by timing stipulations in Block S. Raptor nesting sites would likely be reduced by the removal of 680–954 acres of pinyon-juniper woodland. Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to raptor species and their habitats than would occur under No Action. In the long term, Alternative C would result in greater beneficial impacts to raptor species associated with sagebrush habitat compared to the No Action Alternative by increasing the quality and quantity of foraging habitats through sagebrush habitat restoration. As under the Proposed Action, special lease stipulations and BMPs would minimize adverse impacts to raptor species, especially during the breeding season, by providing spatial and seasonal buffers of both occupied and unoccupied nests.

4.17.6.4.2.6 Other Bird Species

Under Alternative C, Black Swift, Lewis' Woodpecker, Long-billed Curlew, and Three-toed Woodpecker foraging and nesting habitats, cover, and roosting and nesting sites would be directly impacted by surface disturbance and associated activities. The nature of impacts to these bird species would be the same as described for the Proposed Action. Most surface disturbance under Alternative C would occur in sagebrush/grassland and sagebrush/grassland (treated) (742–810 acres) and pinyon-juniper woodland habitats (680–954 acres). Long-billed Curlew and Lewis's Woodpecker, respectively associated with these habitat types, would be most greatly affected. Ground-nesting and foraging species would be directly impacted by pit disturbance and construction activities, and would be at increased risk of direct mortality from excavation and construction due to potential for crushing or burial of adults, nestlings, and eggs on the ground. Increased mine-related traffic could result in increased mortality from vehicle strikes. Impacts to active nesting sites would be mitigated by nest surveys and avoidance measures. The loss of foraging habitats due to direct disturbance or removal would result in the displacement of special status bird species from these areas until habitats have been successfully restored. Woodpecker nesting habitat would be reduced by the removal of 680–954 acres of pinyon-juniper woodland. Because of the large portion of the tract that would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to special status bird species and their habitats than would occur under the No Action Alternative. In the long term, Alternative C would result in greater beneficial impacts to Long-billed Curlew compared to the No Action Alternative by increasing the quality and quantity of foraging and nesting habitats through sagebrush habitat restoration. Special lease stipulations and BMPs would minimize adverse impacts, especially during the breeding season, by requiring surveys for and avoidance of nesting sites.

4.17.6.4.2.7 Migratory Bird Species

Under Alternative C, direct adverse impacts to migratory birds would occur from the direct removal, alteration, or fragmentation of habitat during surface mining and associated activities. The nature of impacts to migratory bird species would be the same as described for the Proposed Action. Most surface disturbance under Alternative C would occur in sagebrush/grassland and sagebrush/grassland (treated) (742–810 acres) and pinyon-juniper woodland habitats (680–954 acres) (see Table 4.50). Therefore, migratory bird species associated with these habitat types would be most greatly affected. In addition, 197–218 acres (77%–88%) of annual and perennial grasses would be directly disturbed and effectively lost for migratory bird species associated with this habitat type. Under Alternative C, approximately 1,650–2,052 acres (52%–65%) of migratory bird habitat in the tract would be disturbed by surface mining over the 21-year life of the mine (see Table 4.50). Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to migratory bird species and their habitats than would occur under the No Action Alternative. In the long term, Alternative C would result in greater beneficial impacts to migratory birds associated with sagebrush habitat compared to the No Action Alternative by increasing the quality and quantity of foraging and nesting habitats through sagebrush habitat restoration.

4.17.6.4.2.8 Amphibian Species

Impacts to amphibian species from mining activities include habitat fragmentation and loss, displacement to lower quality habitats, increased exposure to predators from cover removal, crushing and burial of adults and young, and attraction to ecological ‘traps’ such as water holding ponds. The nature of impacts to amphibian species would be the same as described for the Proposed Action. The Arizona toad’s pinyon-juniper woodland habitats make up 1,410 acres in the tract under Alternative C. Under this alternative, 48%–68% (680–954 acres) of pinyon-juniper woodland would be directly disturbed by mining and associated activities (see Table 4.47). None of the western toad’s wetland (meadow) habitats would be directly disturbed under Alternative C. However, approximately 6.3–9.6 acres of the western toad’s riparian habitats would be disturbed under this alternative. Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to amphibian species’ habitats than would occur under the No Action Alternative.

4.17.6.4.2.9 Fish Species

The nature and degree of impacts to fish species would be the same as described for the Proposed Action.

4.17.7 Impacts Occurring in the Coal Haul Transportation Route Analysis Area

Wildlife mortality along highways and roads is facilitated by the presence of open foraging areas along the roadside, and by the need for road crossings during daily or seasonal movements (U.S. Department of Transportation 1975; BLM 1995). Wildlife mortalities along highways and roads is most likely to occur from dusk to dawn, when wildlife may be more active and motorist visibility is reduced, and during seasonal migrations when wildlife are more likely to cross roads. Impacts from coal truck traffic on wildlife and special status species would vary according to the individual’s size, mobility, and movements; large, nocturnal species and migratory species such as mule deer, elk, and pronghorn would be at the greatest risk. An increase in vehicle collision mortality of raptors and other special status bird species could also occur due to birds scavenging roadkill, and would be proportional to the volume of other animal mortalities. The attraction of raptors to any increase in roadkill could also result in an increase in raptor predation of sage-grouse and small animal species in habitats adjacent to the coal haul transportation route.

4.17.7.1 ALTERNATIVE A: NO ACTION

Wildlife mortalities along US-89, SR-20, I-15, and SR-56 are likely to increase due to additions of mine-related traffic from existing fee coal mine areas adjacent to the tract that would use existing routes (see Section 4.18). A large portion of the coal haul transportation route would be adjacent to wildlife and special status species habitats (Table 4.51). From 2003 to 2005, wildlife-related single-vehicle crashes made up 51.1% of crashes on US-89, 17.7% of crashes on US-20, 11.4% of crashes on I-15, and 40.5% of crashes on SR-56 (Fehr and Peers 2008). Wildlife mortality and associated disruptions in habitat use and migration routes would be expected to occur under both the No Action Alternative and the action alternatives. However, mine-related traffic and associated wildlife impacts would be minimized under the No Action Alternative due to the expected lower volume of truck traffic.

Table 4.51. Land-cover Miles* Adjacent to the Coal Haul Transportation Route and Associated Wildlife and Special Status Animal Species Under the No Action and Action Alternatives**

Cover Type	Associated Wildlife and Special Status Animal Species	Miles	Percentage of Route
Sagebrush	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-grouse, kit fox, mule deer, pronghorn, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat, Utah prairie-dog	43.0	39.0%
Developed	None	42.6	38.7%
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, e k, Ferruginous Hawk, Lewis's Woodpecker, spotted bat, Townsend's big-eared bat	9.9	9.0%
Agriculture	E k, Ferruginous Hawk, Long-billed Curlew, mule deer, pronghorn, Short-eared Owl	7.3	6.6%
Shrub steppe	Burrowing Owl, elk, Ferruginous Hawk, Golden Eagle, Greater Sage-grouse, kit fox, Long-billed Curlew, pronghorn, Pygmy Rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat, Utah prairie dog	3.5	3.2%
Woodland-shrubland	Black Swift, elk, Ferruginous Hawk, Lewis's Woodpecker, Three-toed Woodpecker	2.2	2.0%
Bedrock, Cliff and Canyon	Allen's big-eared bat, Black Swift, big free-tailed bat, fringed myotis, spotted bat, Townsend's big-eared bat	1.0	0.9%
Grassland (native and invasive grasses/forbs)	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Long-billed Curlew, mule deer, pronghorn, Short-eared Owl, Utah prairie-dog	0.1	0.1%
Open water	Black Swift, Bonneville cutthroat trout, desert sucker, leatherside chub, virgin spinedace	0.1	<0.001%
Salt desert scrub	Big free-tailed bat, Burrowing Owl, Ferruginous Hawk, Golden Eagle, kit fox, Long-billed Curlew, pronghorn, Short-eared Owl, spotted bat	0.1	<0.001%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Lucy's Warbler, Northern Goshawk, Northern Harrier, Peregrine Falcon, Short-eared Owl, western toad	0.1 38.3 acres†	<0.001%
Total		**109.8 miles**	**100.0%**

Note: Scientific nomenclature for all wildlife species in this EIS is introduced in Chapter 3.

* Acres of riparian habitat within 100-feet of the coal haul transportation route are also included to assess potential impacts in the unlikely event of a coal truck accident in close proximity to this cover type.

** Land-cover miles are he same for all three alternatives because the coal haul transportation route is the same for all alternatives.

† The analysis area for riparian also includes acres of habitat within a 100-foot buffer of the coal haul transporta ion route.

4.17.7.2 ALTERNATIVE B (PROPOSED ACTION) AND ALTERNATIVE C (REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS)

Under both the Proposed Action and Alternative C, the addition of coal trucks and other mine-related traffic is expected to generate an additional 160 employee round-trips per day on existing roadways, and 153 truck round-trips over each 24-hour period, or six trucks each way per hour, along the reasonably foreseeable transportation route (approximately 110 miles from Alton via US-89 to US-20 to I-15 to SR-56 to Iron Springs). Coal trucks are expected to leave the mine at nine- to 10-minute intervals, with a truck passing any given point along the route approximately every five minutes. The increase in ADT from employee and service round-trips and coal trucks is estimated at 4% on US-89 and 2% on SR-56 compared to the No Action Alternative (see Section 4.14.3). Coal truck traffic would increase average, daily, heavy truck volume of 28%–43% along US-89 and US-20 (Fehr and Peers 2008). There would be an increased risk of wildlife and special status species mortality from vehicle collisions along the coal haul transportation route, particularly due to the relative increase in nighttime truck traffic. Wildlife and special status species would also be impacted by disruption of diurnal or nocturnal activities from traffic-related noise. Because wildlife and special status species habitats occur adjacent to a large portion of the coal haul transportation route (see Table 4.51), there would be an increased risk of mortality from vehicle collisions and greater impacts from traffic-related noise due to an increase in coal truck traffic. There would also be an increased risk of sedimentation or contamination of the Sevier River drainage system from accidental spillage of coal associated with increased coal truck traffic.

Any increase in roadkill could increase raptor activity along the coal haul transportation route, which could result in increased predation on sage-grouse, pygmy rabbit, or other special status animals occupying habitats adjacent to the route. The increase in truck traffic at night would be considerably higher than daily traffic volume increases (BLM 1995) (see Section 4.14). Coal truck traffic would not be reduced by timing restrictions on Block S under Alternative C, because of the operation of a second pit that would allow mining at all times. Direct and indirect impacts to wildlife and special status species would be greater under both the Proposed Action and Alternative C compared to the No Action Alternative.

4.17.7.2.1 Impacts to Wildlife Occurring in the Coal Haul Transportation Route Analysis Area

Mule deer are the primary big game animal affected by highway traffic in the United States, with an estimated 1 million deer-vehicle collisions annually (Conover et al. 1995). As discussed for Alternative A, wildlife accounted for a considerable portion of the vehicle accidents that occurred on the proposed coal haul transportation route from 2003 to 2005 (Fehr and Peers 2008). The factors contributing to deer-vehicle collisions are traffic volume, deer density, and higher vehicle speeds (Sullivan and Messmer 2003). As a result, vehicle-related mortality of mule deer along the coal haul transportation route would be proportional to mule deer density and the speed and volume of traffic relative to deer movements and concentrations. Traffic timing is also a factor; the greatest potential for mule deer fatalities from truck traffic most likely to occur during spring and fall migrations and at night, when deer are most active. Traffic impacts to elk and pronghorn would also be proportional to the density of animals, and the timing, speed, and volume of traffic relative to their movements. Under the No Action Alternative, coal transport from the tract along US-89, SR-20, I-15, and SR-56 would not occur as a function of mining because the tract would not be offered for lease sale. Under the Proposed Action and Alternative C, a large portion of the coal haul transportation route would be adjacent to crucial winter mule deer habitat (81%), crucial winter elk habitat (49%), and crucial year-long pronghorn habitat (49%) (Table 4.52), with impacts to wildlife in these habitats expected to be proportional to the volume and timing of coal truck traffic along the route. Although the estimated increase in ADT is estimated to be from 2% to 4% along the route, there would be a proportionally greater increase in nighttime traffic due to the 24-hour coal truck activity.

Table 4.52. Miles of Mule Deer, Elk, and Pronghorn Habitats Adjacent to the Coal Haul Transportation Route Under the No Action and Action Alternatives

	Miles	Percentage of Route
Mule Deer Habitats		
Crucial Winter	89.7	81.4%
Crucial Summer	28.5	25.9%
Substantial Value Year-long	14.5	13.2%
Substantial Value Winter	2.8	2.5%
Elk Habitats		
Crucial Winter	53.5	48.6%
Crucial Summer	11.5	10.5%
Pronghorn Habitats		
Crucial Winter	5.9	5.3%
Crucial Year-long	54.0	49.1%

Source: Utah Division of Wildlife Resources GIS data updated May 2006.

4.17.7.2.2 Impacts on Special Status Species Occurring in the Coal Haul Transportation Route Analysis Area

4.17.7.2.2.1 Greater sage-grouse

Occupied Greater Sage-grouse habitats occur adjacent to 44.5 miles of the route, consisting of brooding habitat adjacent to 43.8 miles of US-89 and SR-20, and wintering habitat adjacent to 0.7 mile of SR-20 (UDWR GIS data updated May 2006). Greater sage-grouse that occur along the coal haul transportation route are most likely distinct from the population that occurs in the tract due to the isolated distribution of that population.

Adverse impacts to the Greater Sage-grouse that occur along the coal haul transportation route are expected to be minimal; however, they could occur from an increase in collisions with truck and commuter traffic, increased noise, and increased predator activity along roadways. Greater traffic volume would increase the risk of mortality of adult sage-grouse, fledglings, and nestlings from vehicles. Noise and vibration near active leks during the breeding season could disrupt courtship behavior or prevent hens from locating lekking areas. Sage-grouse have been found to avoid lekking and brooding habitats within 1,300 feet of roads and other surface disturbances, which could cause displacement and increased competition for habitat resources (Connelly et al. 2000; Crawford et al. 2004). Under the Proposed Action and Alternative C, traffic and noise-related adverse impacts to the Greater Sage-grouse and its habitats along the coal haul transportation route would likely be greater than would occur under the No Action Alternative.

4.17.7.2.2.2 Pygmy Rabbit

Impacts to the pygmy rabbit along the coal haul transportation route would consist of increased loss of individuals from vehicle collisions and from increased predator abundance along roadways, which is a likely result of increased traffic-related roadkills. The Pygmy rabbit's sagebrush and shrub steppe habitats occur adjacent to approximately 47 miles (42%) of the coal haul transportation route (see Table 4.51). Under the Proposed Action and Alternative C, transportation-related adverse impacts to the pygmy rabbit and its habitats would likely be greater than would occur under the No Action Alternative.

4.17.7.2.2.3 Utah Prairie-dog

There is limited information on road-related impacts to the prairie-dog and other small mammals. Impacts associated with increased vehicle traffic likely include greater loss of individuals from vehicle collisions and from increased predator abundance along roadways, a likely result of increased traffic-related roadkills. It is not known if traffic noise interferes with predator warning calls or with other communication in prairie-dog colonies. Utah prairie-dog habitats occur adjacent to 28.3 miles (26%) of the coal haul transportation route (UDWR GIS data updated May 2006). The USFWS has established a 350-foot buffer as the range within which normal behavior of individual Utah prairie dogs may be disrupted by noise or human presence. Known Utah prairie dog colonies occur within 350 feet of the coal haul transportation route on 640 acres. These colonies are estimated to contain 309 prairie dogs, or 6.1% of the total estimated Utah prairie dog population in the West Desert and Paunsaugunt Recovery Units, which are the two units impacted by the tract (UDWR 2010). Under the Proposed Action and Alternative C, traffic and noise-related adverse impacts to the Utah prairie-dog and its habitats would likely be greater than would occur under the No Action Alternative.

4.17.7.2.2.4 Kit Fox

Impacts to the kit fox from increased vehicle traffic would likely include loss of individuals from vehicle collisions. Kit fox sagebrush, shrub steppe, and salt desert scrub habitats occur adjacent to approximately 47 miles (42%) of the coal haul transportation route (see Table 4.51). Impacts associated with an increase in vehicle traffic would likely include an increased loss of individuals from vehicle collisions, particularly due to increased nighttime traffic when the species is active. Under the Proposed Action and Alternative C, transportation-related adverse impacts to the kit fox and its habitats would likely be greater than would occur under the No Action Alternative.

4.17.7.2.2.5 Bat Species

Potential foraging and roosting bat habitats occur adjacent to the coal haul transportation route (see Table 4.51). Traffic-related impacts to Allen's big-eared bat, big free-tailed bat, fringed myotis, spotted bat, and Townsend's big-eared bat would likely consist of displacement from habitat due to 1) increased noise and 2) disruption of roosting or foraging behaviors in habitats adjacent to the route resulting from an increase in nighttime vehicle traffic. Special status bat habitats in sagebrush, pinyon-juniper woodland, shrub steppe, grassland, salt desert scrub, cliff and canyon, and riparian cover types occur adjacent to approximately 58 miles (52%) of the coal haul transportation route (see Table 4.51). Riparian habitats occur on 38.3 acres within a 100-foot buffer of the coal haul transportation route. Under the Proposed Action and Alternative C, transportation-related adverse impacts to bat species and their habitats would likely be greater than would occur under the No Action Alternative.

4.17.7.2.2.6 Raptor Species

Increased coal truck traffic would likely result in direct adverse impacts to bald eagle, burrowing owl, ferruginous hawk, golden eagle, northern goshawk, and short-eared owl from vehicle strikes. The increase in traffic volume would likely result in increased roadkills, which would attract raptor species to the coal haul transportation route and increase the likelihood of raptor mortality from vehicle collisions. Raptor foraging and nesting habitats in sagebrush, pinyon-juniper woodland, agriculture, shrub steppe, woodland-shrubland, grassland, salt desert scrub, and riparian cover types occur adjacent to approximately 66 miles (60%) of the coal haul transportation route (see Table 4.51). Potential habitats for the northern goshawk occur in 38.3 acres of riparian habitat within 100 feet of the coal haul transportation route. These riparian habitats contain two known occupied goshawk habitat areas (UDWR 2010). Under the Proposed Action and Alternative C, transportation-related adverse impacts to raptor species would likely be greater than would occur under the No Action Alternative.

4.17.7.2.2.7 Other Bird Species

Increased coal truck traffic would likely result in limited adverse impacts to the Black Swift, Lewis' Woodpecker, Long-billed Curlew, and Three-toed Woodpecker and their habitats. Nevertheless, increased traffic volume could result in increased mortality from vehicle strikes. Foraging and nesting habitats for special status bird species in agriculture, shrub steppe, woodland-shrubland, cliff and canyon, grassland and salt desert scrub cover types occur adjacent to approximately 14 miles (13%) of the coal haul transportation route (see Table 4.51). Under the Proposed Action and Alternative C, transportation-related adverse impacts to these bird species would likely be greater than would occur under the No Action Alternative.

4.17.7.2.2.8 Migratory Bird Species

Increased coal truck traffic would likely result in limited adverse impacts to migratory bird species adjacent to the coal haul transportation route. Nevertheless, increased traffic volume could result in increased mortality from vehicle strikes. Foraging and nesting habitats for migratory bird species in sagebrush, pinyon-juniper woodland, agriculture, shrub steppe, woodland-shrubland, grassland, and salt desert scrub cover types occur adjacent to approximately 66 miles (60%) of the coal haul transportation route (see Tables 4.50 and 4.51). Under the Proposed Action and Alternative C, transportation-related adverse impacts to migratory bird species would likely be greater than would occur under the No Action Alternative.

4.17.7.2.2.9 Amphibian Species

Increased coal truck traffic would likely result in limited adverse impacts to the Arizona toad and western toad along the coal haul transportation route. Nevertheless, increased traffic volume could result in increased mortality from vehicle strikes. Amphibian habitat in pinyon-juniper woodlands occur adjacent to approximately 10 miles (9%) of the coal haul transportation route (see Table 4.51). Under the Proposed Action and Alternative C, transportation-related adverse impacts to amphibians would likely be slightly greater than would occur under the No Action Alternative.

4.17.7.2.2.10 Fish Species

No special status fish species are known to occur in habitats adjacent to the coal haul transportation route. However, due to the expected increase in the volume of coal truck traffic associated with mining operations, there is increased potential for accidental coal spills to stream habitats along the coal haul transportation route. Approximately 0.1 miles (<0.001%) of the coal haul transportation route transects stream habitats where there is the potential for a coal truck spill into the waterway. Stream and riparian habitats occur on 38.3 acres of riparian habitat within 100 feet of the coal haul transportation route. Although the risk of a spill to this small portion of the route is negligible, the introduction of coal, petroleum products, or other hazardous materials

from a coal truck spill could directly or indirectly adversely impact fish species and their habitats by causing mortality of individual fish or prey species from poisoning, or from loss of habitat due to reduced water quality or other habitat features.

4.17.8 Potential Mitigation Measures

Protective measures for wildlife and special status animal species described above and in Management and Considerations Common to Each Action Alternative in Chapter 2 would mitigate and/or minimize impacts to wildlife resources and special status species in the tract. Potential mitigation measures for wildlife and special status animal species include the following:

- Install fencing and/or netting or other protective features around evaporation and production pits to reduce mortality of wildlife and special status species (e.g., Greater Sage-grouse, migratory birds, raptors, bats) due to drowning or entrapment.
- Monitor and treat water storage impoundments to prevent mosquito breeding and the associated spread of West Nile Virus to the Greater Sage-grouse population.
- Monitor the Alton sage-grouse population throughout the year to assess bird survival, nest site and nest success, brood-rearing sites, and key winter habitat areas.
- Install deer ‘whistles’ on coal haul trucks to reduce potential wildlife mortality.

4.17.9 Unavoidable Adverse Impacts

Unavoidable adverse impacts would occur where the loss of wildlife or special status species occurs during mining pit disturbance, soil stockpiling, road and infrastructure development, or regular mine operations. Unavoidable loss could occur where wildlife or special status species are not detected or identified during surveys. Unavoidable loss of wildlife and special status species due to nondetection or inadvertent adverse impacts would also occur. There would also be unavoidable, short-term loss of wildlife habitats as a result of mining operations.

4.17.10 Short-term Uses versus Long-term Productivity

The short-term use of the tract for coal extraction would result in reduced structural and compositional diversity and reduced long-term productivity of wildlife and special status species habitats. The habitats present in the proposed tract are typically slow to recover from disturbance and productivity would be limited during reclamation and restoration activities. Long-term productivity would be reduced because vegetation communities would not develop immediately following mining and restoration activities. Until they are fully developed, these habitats would be less diverse and less productive, particularly if critical habitat components such as biological soil crusts and other soil properties have been lost. Effective implementation of the mitigation measures outlined above would minimize impacts to the long-term productivity of these vegetation communities and the wildlife and special status species that rely on them.

4.17.11 Irreversible and Irretrievable Commitments of Resources

Under the Proposed Action and Alternative C, wildlife and special status species forage and cover removed for surface mining would be irretrievably altered during the life of the mine. Once impacted by surface mining, dispersed and centralized facilities, roads, and ROWs, the productivity of vegetation communities would be irretrievably removed or reduced until reclamation and restoration have been completed. The loss of wildlife and special status animal species from mining and associated activities and from coal truck strikes along the coal haul transportation route would constitute an irreversible commitment of the resource because these individuals would be permanently lost.

4.18 Cumulative Impacts

4.18.1 Introduction

Cumulative impacts are the environmental effects that result from the incremental impacts of an action, when added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions (40 CFR 1508.7). Past actions are those that have created the affected environment, as described in Chapter 3 of this EIS. Present actions are those that are occurring at the time of this evaluation. Future actions are those that are in planning stages and may reasonable occur in the next 20 years. Cumulative impacts can result from individually minor, but collectively substantial actions occurring over time. This section analyzes the cumulative impacts to specific resource values and uses that would occur from implementation of the Proposed Action and Alternative C, when added to other past, present, and reasonably foreseeable future actions that are not associated with this action.

In general the geographic scope of this analysis—the CIAA—is the BLM-KFO, approximately 2.85 million acres of lands in Kane and Garfield counties. This area was selected because BLM recently completed the KFO RMP and EIS, a large-scale, land-use planning effort, which included a cumulative impact assessment of this planning area. This analysis area provides good baseline information for comparison with the effects of potential mining operations on the tract. Overall, this CIAA provides a reasonable area for analysis of the cumulative impacts of mining the tract and other actions on the multiple resource values and uses of the CIAA because 1) there is a reasonable degree of data available to conduct the analysis, 2) it is large enough to account for resource impacts where impacts may be far-reaching (e.g., watersheds, wildlife), and 3) it is small enough that analyses do not become unreasonably cumbersome to complete with an acceptable degree of accuracy and precision. However, for certain resource values and uses, the CIAA may be slightly different than that described here. In these cases, the modified CIAA is described and explained. The timeframe for analysis of cumulative impacts is approximately 20 years.

The following list consists of land-use planning and environmental documents that were consulted to determine the existing and reasonable foreseeable future actions that are analyzed in this cumulative analysis.

- Coal Hollow Mine Permit C/025/005 (private fee coal area)
- BLM-KFO Proposed RMP and Final EIS, 2008.
- BLM, Coal Hollow Environmental Assessment (BLM 2009).
- BLM, West-Wide Energy Corridor Draft Programmatic EIS, October 2007

Although much of the cumulative impact analysis focuses on adverse cumulative effects, it should be noted that cumulative impacts may also be beneficial. For example, there would be beneficial economic effects as a result of coal mining, including additional employment, additional tax revenues to local governments, and additional royalties to the federal government.

Section 4.18.2 below identifies and summarizes the actions included in this cumulative impact analysis.

4.18.2 Reasonably Foreseeable Actions and Development

This section of the EIS incorporates into the analysis key projects for ongoing, proposed, and potential action in Kane and Garfield counties in the CIAA. For the purposes of analysis, the reasonably foreseeable actions come from the proposed actions and Records of Decision of the land-use planning and environmental documents identified in the list above. However, some of the documents identified above

are not yet complete. Use of draft land-use plans and environmental analyses does not imply that the actions are final decisions. Still, they represent "reasonably" foreseeable actions and development that can be used in this analysis. These projections are not to be considered part of the Proposed Action or Alternative C. Table 4.53 summarizes the reasonably foreseeable future actions and anticipated acres of disturbance. Table 4.54 summarizes disturbances as a result of mining the tract. The discussion that follows provides further explanation of the information in the tables.

Table 4.53. Reasonably Foreseeable Actions and Development in the Cumulative Impact Assessment Area, Next 20 years

Action	Anticipated Disturbance (acres)	Total Anticipated Disturbance (%)
Wildfire	3,476	4.52%
Wildfire use	390	0.51%
Prescr bed fire	800	1.04%
Vegetation treatments	60,000	78.07%
Alton Coal Mine, Coal Hollow Mine (Permit #C/025/005)	424	0.55%
Alton Coal Mine, northern private coal area (permit application not submitted)	378	0.49%
Alton Coal Mine Short Haul Route	19	0.02%
Oil and gas exploration, development, and production	2,070	2.69%
Seismic exploration	906	1.18%
Mining Alabaster and Septarian Nodules	20	0.03%
Sand and gravel production	625	0.81%
Building stone production	400	0.52%
Clay production	5	0.01%
Tropic to Hatch Transmission Line	379	0.49%
Cross-country OHV travel	1,000	1.30%
Lake Powell pipeline	5,745	7.48%
Jackson Flat Reservoir	200	0.26%
KFO Route 116	17	0.02%
West-wide Energy Corridor	0	0.00%
Wind energy development	0	0.00%
Total	**76,854**	**100.00%[1]**

[1]The total surface disturbance is less than 100% because surface disturbance resulting from the West-wide Energy Corridor and wind energy development is not known at this time.

Table 4.54. Additional Surface Disturbance as a Result of Mining the Alton Coal Tract

	Additional Surface Disturbance (acres) as a Result of Mining Operations on the Alton Coal Tract	Increase in Surface Disturbance in the CIAA over the next 20 years as a Result of Mining the Tract (%)
Proposed Action	1,993–2,395	2.59%–3.12%
Alternative C	1,662–2,064	2.16%–2.69%

Reasonably foreseeable development in the CIAA would impact 78,854 surface acres. Under the Proposed Action, the tract would directly impact 1,993–2,395 acres, which is a 2.59% to 3.12% increase in the total surface disturbance in the CIAA over the next 20 years. Alternative C would directly impact 1,662–2,064 acres, which is a 2.16%–2.69% increase in the total disturbance in the CIAA over the next 20 years.

4.18.2.1 MINERALS AND ENERGY EXPLORATION, DEVELOPMENT, AND PRODUCTION

4.18.2.1.1 Exploration, Development, and Production of Coal

In November 2010 the State of Utah approved a permit for the Coal Hollow Mine (Permit #C/025/005) on approximately 424 acres of private lands. The tract would be developed by surface mining methods. ACD is also pursuing development of an additional coal mine on 378 acres. Leases have not been finalized, and a PAP has not been submitted to mine this additional coal mine. These two private areas are associated with the tract and are adjacent to federally administered coal that BLM is considering for competitive leasing in this EIS.

4.18.2.1.2 Exploration, Development, and Production of Oil and Gas and Other Leasable Minerals, Salable Minerals, and Mining under the Mining Laws

A total of 90 oil and gas wells (70 exploration wells and 20 production wells) could be drilled on public lands managed by the BLM-KFO over the next 15–20 years. This exploration, development, and production could disturb 2,070 acres, and seismic operations could disturb an additional 906 acres. Of this total disturbance, 2,370 acres could be reclaimed.

Septarian and gypsum (alabaster) mining could disturb 1 acre per year, or 20 acres over the next 15–20 years.

Surface disturbance from salable mineral production (sand, gravel, building stone, and clay) could be 1,030 acres over the next 15–20 years. Of that total, sand and gravel operations could disturb 625 acres, building stone operations could disturb 400 acres, and clay production could disturb 5 acres.

4.18.2.2 WIND ENERGY DEVELOPMENT

Although the KFO-RMP does not allocate specific areas to wind energy development, it does provide for consideration of such proposals, except in designated wilderness, WSAs, areas of critical environmental concern, and suitable wild and scenic river corridors. The KFO-RMP also prescribes BMPs for wind energy development projects on the public lands.

4.18.2.3 UTILITY CORRIDORS AND TRANSMISSION LINES

4.18.2.3.1 West-wide Energy Corridor

The *West-Wide Energy Corridor Draft Programmatic EIS* (PEIS) analyzes the environmental impacts of designating more than 6,000 miles of energy corridors on federal land in 11 western states. One corridor would be designated by the KFO RMP in the CIAA.

4.18.2.3.2 Tropic to Hatch Transmission Line

Garkane Energy Cooperative proposes to construct and operate an electric transmission line in Garfield County, Utah. The tract would include the construction of a 138-Kv transmission line within a 100-foot ROW, associated substations, access roads, and the removal and reclamation of a portion of the existing 69-Kv transmission line west of Bryce Canyon National Park. The proposed line would cross approximately 15 miles of USFS land; 3.7 miles of the Grand Staircase-Escalante National Monument; 3.5 miles of public lands managed by BLM-KFO, 7.3 miles of State of Utah, and 1.8 miles of private lands. The existing line and alternatives under consideration cross Bryce Canyon National Park.

4.18.2.4 WATER PROJECTS

4.18.2.4.1 Lake Powell Pipeline

The State of Utah Board of Water Resources and Washington, Kane, and Iron counties are pursuing the construction of a pipeline that would run from Lake Powell to Sand Hollow Reservoir, approximately 10 miles east of St. George. The pipeline would consist of approximately 120 miles of 66-inch pipe and 38 miles of 30-inch pipe north from Sand Hollow to Cedar City. The corridor is anticipated to be 300 feet wide. As part of the initial feasibility studies, various alternative alignments are being investigated. The pipeline would bring 70,000 acre-feet of water to Washington County, 10,000 acre-feet to Kane County, and 20,000 acre-feet to Iron County. Construction of the pipeline is estimated to take three years.

4.18.2.4.2 Jackson Flat Reservoir

The Jackson Flat Reservoir is proposed by the Kane County Water Conservancy District for construction on approximately 200 acres of land within the Kanab city limits. The reservoir would store 3,900 acre-feet of water.

4.18.2.5 ROAD PROJECTS

4.18.2.5.1 U.S. Highway 89

US-89 is expected to be widened over the next 20 years. The widening of the highway would allow for an increase in traffic volume. In addition, portions of the highway would be developed into a four-lane divided highway.

4.18.2.5.2 Kanab Field Office Route 1116

There is a proposal to relocate KFO Route 116, west of its current location, to provide uninterrupted access around the proposed Alton Coal Mine. The proposed road relocation would be approximately 3.1 miles long, have a 24-foot running surface, and lie within a 66-foot-wide ROW. Total area of disturbance would be 16.9 acres.

4.18.2.6 VEGETATION TREATMENTS

Historically, the BLM has treated on average 3,000 acres of upland vegetation annually. Using this average, it is estimated that the BLM would treat 60,000 acres over the next 20 years (Personal Communication, Church 2010). These treatments are to enhance wildlife habitat, restore watershed condition, increase livestock forage, and reduce fuel loading. A full range of upland vegetation treatment methods would be used, including wild and prescribed fire; mechanical, chemical, and biological treatments; and woodland product removal. There are currently two approved burn plans in the KFO totaling 800 acres (BLM 2001b, 2002). According to the KFO RMP, wildfire use disturbance over the next 20 years would total 390 acres (BLM 2008a).

4.18.2.7 WILDFIRE

A five year average for wildfires in the KFO totals approximately 869 acres (Personal Communication, Church 2010). Using these past numbers, it is estimated that wildfires would disturb 3,476 acres over the next 20 years.

4.18.2.8 LAND-USE PLANNING AND DEVELOPMENT

As communities in the CIAA continue to grow, agricultural lands are expected to be converted to residential and commercial uses. There is no specific projection as to the number of acres per year that would be converted, but for analysis purposes, growth (and thus, conversion of agricultural land) is expected to continue at a steady pace. Under the KFO-RMP, BLM has identified 6,000 acres potentially available for sale over the next 20 years. If disposed of, these lands would provide for the needs of the communities in the field office area. Assuming these lands would be developed for public purposes, 320 acres per year would convert to community purposes.

4.18.3 Cumulative Impacts Related to the Proposed Action and Alternatives

4.18.3.1 AESTHETIC RESOURCES

4.18.3.1.1 Cumulative Impact Analysis Area

The geographic extent of the CIAA for aesthetic resources consists of the BLM-KFO and the coal haul transportation route to the loadout west of Cedar City, Utah. It includes sensitive viewpoints and soundscapes in Bryce Canyon National Park to the east, Dixie National Forest to the east and west, and the communities along the coal haul transportation route. The area was selected to incorporate lands where aesthetic resources would be affected regardless of administrative jurisdiction. The area is primarily used for agriculture, travel, tourism, and recreational activities.

4.18.3.1.2 Soundscape

Past and present actions that have resulted in increased ambient noise levels in the characteristic soundscapes of the CIAA (as described in Section 4.18.3.1.1 above) include vehicle traffic on the coal haul transportation route, motorized recreation, mineral material mining, mechanical vegetation treatments, and wild and prescribed fire operations. Future actions include expansion of US-89; the realignment of KFO Route 116; construction of the Tropic to Hatch transmission line; coal mining near the Town of Alton (private coal); oil and gas exploration, development, and production; continued sand and gravel, building stone, and clay mining; additional vegetation treatments; continued wild and prescribed fire operations, construction of the Lake Powell pipeline; continued growth in OHV use and

back country driving; and construction of a utility corridor as part of the West-Wide Energy Corridor grid. All of the projected actions could disturb approximately 78,854 acres of lands. Mining operations on the Alton Coal Tract under the Proposed Action would disturb approximately 1,993–2,395 acres, a 2.59%–3.12% increase in the entire disturbance associated with the reasonably foreseeable future activity. Under Alternative C mining operations on the Alton Coal Tract would disturb approximately 1,662–2,064 acres, or a 2.16%–2.69% increase in the entire disturbance associated with the reasonably foreseeable future activity. Using the amount of surface disturbance as an indication of noise levels associated with this activity, coal mining on the tract would contribute less than 1% of future anticipated surface disturbance, and thus ambient noise to soundscapes.

Mitigation measures would be implemented with the Proposed Action or Alternative C to reduce the impacts of increased noise levels on noise-sensitive receptors. Additionally, noise from the Proposed Action or Alternative C would occur only for the duration of active mining. The analysis assumes that mitigation measures would be implemented with future projects to reduce increases in ambient noise levels at noise-sensitive receptors. Cumulatively, noise levels at noise-sensitive receptors would remain below EPA noise levels necessary to prevent measurable hearing loss over a lifetime (EPA 1974) in the CIAA.

4.18.3.1.3 Visual Resources

The area of analysis consists of the BLM's KFO, including the view shed surrounding the tract as well as portions of the Dixie National Forest and private lands. Past and present actions have contributed to modifications to the characteristic landscape in the area of analysis including mechanical vegetation treatments, transmission lines and other linear ROWs. Future actions that would contribute to cumulative impacts to the landscape (visual resources) consists of cross country OHV travel, additional vegetation treatments, coal mining private coal near the Town of Alton, oil and gas exploration and production, mining, sand and gravel and building stone production and development of pipelines and power lines (see Table 4.53).

Over the next 20 years, reasonably foreseeable future development would change the character of the existing landscape. Reasonable foreseeable actions would potentially remove vegetation by fire and land treatment methods, change landform by surface disturbance during mining and road building, and introduce linear structures to the landscape including power lines and pipelines. These developments would introduce moderate to noticeable changes to the characteristics landscape (visual resources) on as much as 78,854 acres.

The incremental impacts of mining coal on the Alton Coal Tract under the Proposed Action or Alternative C would add moderate to strong contrasts to the characteristic landscape on up to 1,993–2,395 or 1,662–2,064 acres, respectively, spread out over the active mining period and would result in cumulative impacts to the view shed. Over the next 20 years, coal mining on the Alton Coal Tract would increase disturbance by approximately 2.59%–3.12% under the Proposed Action and 2.16%–2.69% under Alternative C in the CIAA. Mitigation measures would be implemented to return the tract to a more natural landscape as pit activities are completed. The analysis assumes that mitigation measures for visual resources would be implemented with reasonably foreseeable future projects to reduce contrasts. Cumulatively, contrasts would remain consistent with BLM VRM Class IV objectives in the area of analysis.

4.18.3.1.4 Night Sky

The area of analysis consists of the lands surrounding the tract including portions of Bryce Canyon National Park, Dixie National Forest and private lands. Because of the nature of artificial light, the area of analysis must be larger than the tract's view shed. Past and present actions in the area of analysis that

have contributed to the existing night sky conditions include management of Bryce Canyon National Park, residential development and tourism facilities. Future actions include expansion of US-89, and development of the Tropic to Hatch transmission line. These future actions would increase the amount of light seen during construction, but would be temporary impacts.

The incremental impacts of the Proposed Action or Alternative C would add to the artificial sources of light pollution and would have a cumulative impact on the night sky conditions of the tract Bryce Canyon National Park and Dixie National Forest. The analysis assumes that mitigation measures for night sky conditions including directional lighting would be implemented with future projects to reduce those impacts. Cumulatively, light conditions would not exceed Bryce Canyon National Park night sky objectives in the area of analysis.

4.18.3.2 AIR QUALITY

4.18.3.3 CUMULATIVE EMISSION INVENTORY

The cumulative emission inventory is composed of 1) an inventory of emissions from the proposed coal haul transportation route, and 2) an inventory of proposed emission sources within a 300 × 300–km area. The cumulative inventory includes the identification and evaluation of permitted source changes (increases or decreases), RFFA, and RFD.

It was assumed that all existing permitted emission sources are included in the background concentrations estimates. The cumulative emission inventory was developed based on any Title V major modifications and new minor- or major-source permits that occurred after September 1, 2008. The data were obtained from the state air resources regulators (e.g., Utah, Nevada, and Arizona) in the emission inventory domain. RFFA and RFD sources are proposed sources and include new sources expected from BLM- and USFS-related activities, such as oil and gas development and mining. Oil and gas commissions in the various states and other state agencies also provided information on planned, new emission-producing sources. Due to the uncertainty in projected traffic increases on the existing road network, only mine-related transportation increases are considered in the analysis. RFFA and RFD sources evaluated in the modeling domain are listed in Table 4.55 and the emissions from these RFFA and RFD sources are presented in Table 4.56.

Table 4.55. Sources of Potential Reasonable Foreseeable Future Actions and Reasonable Foreseeable Developments in the Modeling Domain

NEPA Documents, Land-use Plans, and Personnel	Disposition
Oil and Gas Leasing on Lands Administered by the Dixie National Forest Draft EIS	Dixie and Fishlake national forests oil field development are included as point sources in cumulative modeling.
BLM-KFO RMP	90 new production wells over 20 years (4.5 wells per year); no production or drilling of coalbed CH_4 wells; no oil wells
BLM-KFO Mineral Potential Report	Uses highest projected pollutant emissions for oil and gas and area sources. Included lands and realty, livestock grazing, OHVs, resource roads, saleable minerals, and vegetation Eliminates coal mining (projected mine is the Alton Coal Tract) Eliminates prescribed burning as a cumulative source because it is intermittent and regulated such that it occurs during favorable weather conditions

Table 4.55. Sources of Potential Reasonable Foreseeable Future Actions and Reasonable Foreseeable Developments in the Modeling Domain

NEPA Documents, Land-use Plans, and Personnel	Disposition
BLM Richfield Field Office RMP	Oil well and non-oil well activities: 30 wells per year Uses highest projected pollutant emissions for oil and gas and area sources Included lands and realty, livestock grazing, OHVs, resource roads, saleable minerals, and vegetation Eliminates coal mining (outside domain)
BLM Cedar City Field Office Personnel	No sources to add
BLM St. George Field Office Personnel	No sources to add
BLM Ely Field Office	No sources to add
BLM Las Vegas Field Office	No sources to add
BLM Arizona Strip Field Office	No sources to add
UDAQ: Permit Actions	Two new gas turbines at St. George City Power
Arizona Department of Environmental Quality: Permit Actions	EPA PSD permit: Modification to Navajo Generating Station
Nevada Department of Environmental Quality: Permit Actions	No sources to add
UDOT	No sources to add

Table 4.56. Emissions (tons per year) from Potential Reasonable Foreseeable Future Actions and Reasonable Foreseeable Developments in the Modeling Domain

	PM_{10}	$PM_{2.5}$*	NO_x	SO_2	CO	VOC	HAPs
Dixie National Forest	84.0	36.8	529.8	28.6	–	–	–
Fishlake National Forest	30.9	21.1	364.9	17.7	–	–	–
BLM-KFO RMP	15	10	10	0	692	258	26
BLM Richfield Field Office RMP	58.0	18.0	230.5	3.8	558.0	177.1	17.7
Utah DEQ: St George City Power	–	–	33.3	–	34.4	–	–
Arizona DEQ: Navajo Generating Station Modifications *	–	–	-22,386	–	36,570	–	–
Total RFFA and RFD	**188**	**85**	**-21,217**	**50**	**37,855**	**435**	**44**

* Planned modifications at the Navajo Generating Station result in a net decrease of NO_x emissions.

4.18.3.4 CUMULATIVE IMPACTS RESULTS

An ambient, air resources impact assessment was performed to quantify cumulative impacts near the tract and in the far-field modeling domain. To demonstrate that air quality standards and air quality-related values (AQRV) are protected, the RFFA and RFD sources were modeled in conjunction with the tract sources. The KFO RMP sources are in the near-field modeling domain; the remaining RFFA and RFD sources are in the far-field modeling domain.

4.18.3.5 CUMULATIVE NATIONAL AMBIENT AIR QUALITY STANDARDS AND HAZARDOUS AIR POLLUTANTS RESULTS

The modeling results indicate that there is minimal interaction between the RFFA/RFD sources and the receptors exhibiting the highest concentrations in the tract only analysis. Therefore, the results and conclusions drawn for the PM_{10}, $PM_{2.5}$, NO_2, CO, SO_2, and HAPs are as presented in Tables 4.5 through 4.11 in Section 4.3.2.

4.18.3.6 CLASS I AND CLASS II INCREMENTS RESULTS

Under federal and state PSD regulations, increases in ambient air concentrations in Class I areas are limited by PSD Class I increments. Specifically, emissions associated with a particular development may increase ambient concentrations above baseline levels only within those specific increments developed for SO_2, PM_{10}, and NO_2. The modeling results for the maximum cumulative scenarios are presented in Table 4.57 for the near field Class I and II areas, and Table 4.58 for the far field Class I and II areas. Negative values indicate a net improvement due to cumulative sources showing a net reduction in emissions. The analysis did not follow the methodology for a regulatory PSD increment analysis, and the increment comparison is included to disclose maximum cumulative scenario impacts.

Table 4.57. Near Field (Bryce Canyon National Park, Grand Staircase-Escalante) Class I and Class II Results

Pollutant	Averaging Period	Class I Analysis Results		Class II Analysis Results	
		Cumulative Concentration	Class I Increment	Cumulative Concentration	Class II Increment
PM_{10}	Annual	0.01	4	0.42	17
	24-hour	0.42	8	3.16	30
SO_2	Annual	0.01	2	0.00	20
	24-hour	0.01	5	0.03	91
	3-hour	0.06	25	0.20	512
NO_x	Annual	0.04	2.5	1.73	25
$PM_{2.5}$	Annual	0.00	n/a	0.10	n/a
	24-hour	0.09	n/a	1.17	n/a
CO	8-hour	31	n/a	92	n/a
	1-hour	91	n/a	541	n/a

Table 4.58. Far Field (Zion, Grand Canyon, Capital Reef National Park) Class I and Class II Results

Pollutant	Averaging Period	Class I Analysis Results		Class II Analysis Results	
		Cumulative Concentration	Class I Increment	Cumulative Concentration	Class II Increment
PM_{10}	Annual	0.15	4	0.04	17
	24-hour	1.06	8	0.25	30
SO_2	Annual	0.00	2	0.001	20
	24-hour	0.02	5	0.01	91
	3-hour	0.06	25	0.07	512
NO_x	Annual	0.01	2.5	-0.01	25
$PM_{2.5}$	Annual	0.01	n/a	0.004	n/a
	24-hour	0.09	n/a	0.03	n/a
CO	8-hour	25	n/a	52	n/a
	1-hour	108	n/a	118	n/a

Because results show values far below the relevant increments, results are only presented for the cumulative sources with the tract maximum emission rate case (300-foot overburden removal, Alternative C) and are presented above. Impacts from the other scenarios would be less than presented here. The impacts are significantly below both the Class I and Class II increments. Even though there are no increments for $PM_{2.5}$ or CO, results are presented in Tables 4.57 and 4.58 to convey a general impression of impact levels.

4.18.3.7 VISIBILITY

Cumulative visibility results are presented in Table 4.59, using method 6. Only Capitol Reef National Park and Bryce Canyon National Park have visibility extinction changes that surpass 10%, with maximums of 10.7% and 21.7%, respectively. The Capitol Reef impact occurs on a single day, and is due to one of the regional sources because the tract impacts at Capitol Reef National Park were small (maximum change of 1.80%). Bryce Canyon had four days with impacts greater than 10%, all under the 300-foot Alternative C scenario.

Table 4.59. Cumulative Visibility Results, Alton Coal Tract

METHOD 6	200-foot Overburden, Proposed Action		300-foot Overburden, Alternative C	
Class I/Class II Area	**# Days > 10%**	**Max Change (%)**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon National Park	0	9.6	4	21.7
Capitol Reef National Park	1	10.5	1	10.7
Grand Canyon National Park	0	2.9	0	5.5
Zion National Park	0	4.8	0	4.9
Grand Staircase-Escalante National Monument	0	5.0	0	5.0

4.18.3.8 DEPOSITION

Maximum predicted sulfur and nitrogen deposition impacts were estimated for the cumulative sources (Table 4.60).

Total deposition impacts from direct mine-related and regional sources were compared to green line values (Fox et al. 1989). All sulfur deposition impacts are below the green line values. All nitrogen deposition impacts are also considerably below the green line values. The improvements in the cumulative cases versus the Alton cases are due to the large NO_x emission decrease from the Navajo generating station. In fact, most of the nitrogen deposition values turned out to be 0, signifying that the Navajo emission decrease over the annual period exceeded the increased impacts from other sources.

Table 4.60. Cumulative Deposition Results

Location	Overburden Thickness (feet)	Alton Alternative	Cumulative Sources			
			Maximum Dry and Wet Annual Sulfur Deposition (kg/ha-yr)	>Green Line?	Maximum Dry and Wet Annual Nitrogen Deposition (kg/ha-yr)	>Green Line?
Bryce Canyon	200	B	0.0003	No	0.0000	No
	300	C	0.0003	No	0.0110	No
Capitol Reef	200	B	0.0007	No	0.0000	No
	300	C	0.0007	No	0.0000	No
Escalante	200	B	0.0010	No	0.0000	No
	300	C	0.0010	No	0.0000	No
Grand Canyon	200	B	0.0001	No	0.0000	No
	300	C	0.0001	No	0.0000	No
Zion	200	B	0.0001	No	0.0000	No
	300	C	0.0001	No	0.0000	No
Navajo Lake	300	C	–	–	–	–

4.18.3.9 CLIMATE CHANGE

The human and natural causes of climate change, and the impacts of climate change, are global. GHG emissions, which have been shown to contribute to climate change, do not remain localized, but become mixed with the general composition of the earth's atmosphere. Therefore, this analysis cannot separate the particular contribution of project GHG emissions to global climate change (and its regional implications) from the multitude of other past, present, and reasonably foreseeable projects that have produced or would produce or mitigate GHG emissions. Rather, this analysis focuses on the cumulative impacts of GHG emissions and climate change from a global perspective.

A worldwide environmental issue is the likelihood of changes in the global climate as a consequence of global warming from increasing atmospheric concentrations of GHGs (Intergovernmental Panel on Climate Change [IPCC] 2007a). The atmosphere allows a large percentage of incoming solar radiation to pass through to the earth's surface, where it is converted to heat energy (infrared radiation) that is more readily absorbed by GHGs such as CO_2 and water vapor than by incoming solar radiation. The heat energy absorbed near the earth's surface increases the temperature of air, soil, and water.

GHGs include water vapor, CO_2, CH_4, nitrous oxide, ozone, and several chlorofluorocarbons. GHGs constitute a small percentage of the earth's atmosphere, but are entirely responsible for its heat-trapping properties. Water vapor, a natural component of the atmosphere, is the most abundant GHG, but its atmospheric concentration is driven primarily by changes in the earth's temperature. As such, water vapor simply serves to amplify the effects of other GHGs such as CO_2. The second-most abundant GHG is CO_2, which remains in the atmosphere for long periods of time. Due to human activities, atmospheric CO_2 concentrations have increased by approximately 35% over preindustrial levels. Fossil fuel burning, specifically from power production and transportation, is the primary contributor to increasing concentrations of CO_2 (IPCC 2007a). In the United States, stationary CO_2 emission sources include energy facilities (such as coal and natural gas power plants) and industrial plants. Industrial processes that emit these gases include cement manufacture, limestone and dolomite calcinations, soda ash manufacture and consumption, CO_2 manufacture, and aluminum production (EIA 2009).

In the preindustrial era (before 1750 A.D.), the concentration of CO_2 in the atmosphere appears to have been 275–285 ppm (IPCC 2007a). In 1958, C.D. Keeling and others began measuring the concentration of atmospheric CO_2 at Mauna Loa in Hawaii (Keeling et al. 1976). The data collected by Keeling's team indicate that the amount of CO_2 in the atmosphere has been steadily increasing from approximately 316 ppm in 1959 to 386 ppm in 2008 (NOAA 2010). This increase in atmospheric CO_2 is attributed almost entirely to the anthropogenic (e.g., human) activities noted previously. In addition, industrial and agricultural activities release GHGs other than CO_2—notably CH_4, NO_x, ozone, and chlorofluorocarbons—to the atmosphere, where they can remain for long periods of time.

4.18.3.9.1 Impacts of Greenhouse Gases on Climate

Climate is usually defined as the average weather of a region, or more rigorously as the statistical description of a region's weather in terms of the means and variability of relevant parameters over time periods ranging from months to thousands of years. The relevant parameters include temperature, precipitation, wind, and dates of meteorological events such as first and last frosts, beginning and end of rainy seasons, and appearance and disappearance of pack ice. Because GHGs in the atmosphere absorb energy that would otherwise radiate into space, the possibility that human-caused emissions of these gases could result in warming that might eventually alter climate was recognized soon after the data from Mauna Loa and elsewhere confirmed that the atmosphere's content of CO_2 was steadily increasing (IPCC 2007a; NOAA 2010).

Changes in climate are difficult to detect because of the natural and complex variability in meteorological patterns over long periods of time and across broad geographical regions[13]. There is much uncertainty regarding the extent of global warming caused by human-caused GHGs, the climate changes this warming has or will produce, and the appropriate strategies for stabilizing the concentrations of GHGs in the atmosphere. The World Meteorological Organization and United Nations Environment Programme established the IPCC to provide an objective source of information about global warming and climate change, and IPCC's reports are generally considered to be an authoritative source of information on these issues.

According to the IPCC fourth assessment report, "[w]arming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC 2007b). The IPCC report finds that the global average surface temperature has increased by approximately 0.74°C in the last 100 years; global average sea level has risen approximately 150 millimeters over the same period; and cold days, cold nights, and frosts over most land areas have become less frequent during the past 50 years. The report concludes that most of the temperature increases since the middle of the twentieth century "is [are] very likely due to the observed increase in anthropogenic [GHG] concentrations."

The 2007 report estimates that, at present, CO_2 accounts for approximately 77% of the GWP attributable to human-caused releases of GHGs, with most (74%) of this CO_2 coming from the combustion of fossil fuels. Although the report considers a variety of future scenarios regarding GHG emissions, CO_2 would continue to contribute more than 70% of the total warming potential under all scenarios. IPCC therefore believes that further warming is inevitable, but that this warming and its effects on climate could be mitigated by stabilizing the atmosphere's concentration of CO_2 through the use of 1) "low-carbon technologies" for power production and industrial processes, 2) more efficient use of energy, and 3) management of terrestrial ecosystems to capture atmospheric CO_2 (IPCC 2007b).

4.18.3.9.2 Environmental Impacts of Climate Changes

IPCC and the U.S. Climate Change Science Program (CCSP) have examined the potential environmental impacts of climate change at global, national, and regional scales. The IPCC report states that, in addition to increases in global surface temperatures, the impacts of climate change on the global environment may include:

- more frequent heat waves, droughts, and fires;
- rising sea levels and coastal flooding;
- melting glaciers, ice caps, and polar ice sheets;
- more severe hurricane activity and increases in frequency and intensity of severe precipitation;
- spread of infectious diseases to new regions;
- loss of wildlife habitats; and
- heart and respiratory ailments from higher concentrations of ground-level ozone (IPCC 2007b).

On a national scale, average surface temperatures in the United States have increased, with the last decade being the warmest in more than a century of direct observations (U.S. Climate Change Science Program 2008). Impacts on the environment attributed to climate change that have been observed in North America include:

- extended periods of high fire risk and large increases in burned areas;

[13] Detection of these types of changes was also difficult because of the limited tools that were available for collecting data and for modeling climate systems. However, scientific advances over the last 20 years have vas ly improved the tools available for climatological research.

- increased intensity, duration, and frequency of heat waves;
- decreased snow pack, increased winter and early spring flooding potentials, and reduced summer stream flows in the western mountains; and
- increased stress on biological communities and habitat in coastal areas (IPCC 2007b).

On a regional scale, there is greater natural variability in climate parameters that makes it difficult to attribute particular environmental impacts to climate change (IPCC 2007b). However, based on observational evidence, there is likely to be an increasing degree of impacts such as coral reef bleaching, loss of specific wildlife habitats, reductions in the area of certain ecosystems, and smaller yields of major cereal crops in the tropics (IPCC 2007b). For the northern hemisphere, regional climate change could affect physical and biological systems, agriculture, forests, and amounts of allergenic pollens (IPCC 2007b)[14].

4.18.3.9.3 Production of Greenhouse Gases

Emissions of GHGs from the tract would increase the atmosphere's concentration of GHGs, and in combination with past and future emissions from all other sources, they would contribute incrementally to the global warming that produces the adverse effects of climate change described previously. At present, however, the climate change research community has not yet developed tools specifically intended for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. The current tools for simulating climate change generally focus on global and regional-scale modeling. Global and regional-scale models lack the capability to represent many important small-scale processes. As a result, confidence in regional- and sub-regional-scale projections is lower than at the global scale. Therefore, there is no methodology that would allow the BLM to estimate the specific impacts (if any) that this increment of warming or climate change would produce in the proposed project area or elsewhere.

4.18.3.10 CULTURAL RESOURCES

The primary geographic area for analysis of cumulative impacts on archaeological resources consists of the Coal Hollow Mine and the potential fee coal mine located to the north of the Alton Coal Tract. Mining activity in these areas is a reasonably foreseeable future action that, in conjunction with the Proposed Action and Alternative C analyzed in this EIS, would lead to a broader pattern of impacts to cultural resources in the Alton Amphitheatre and Sink Valley area. There are no other reasonably foreseeable future actions identified in the BLM KFO Proposed RMP and Final EIS that have the potential to affect archaeological sites in this area. For the Panguitch Historic District and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area, cumulative impacts analysis considers the anticipated expansion of US-89, the only reasonably foreseeable future action identified in the BLM KFO Proposed RMP and Final EIS that has the potential to affect these resources.

[14] The IPCC report provides more detailed information on the current and potential environmental impacts of climate change and on how climate may change in the future under various scenarios of GHG emissions.

Reasonably foreseeable future activities in the fee coal areas adjacent to the Alton Coal Tract include surface mining and the construction of facilities. Four archaeological sites that would not be affected by mining in the Alton Coal Tract have been identified in the portion of the Coal Hollow Mine area in which surface mining can be expected to occur (an additional six sites that have been identified in the potential surface mining area straddle the border between the Coal Hollow Mine and the Alton Coal Tract and are included in the analysis of impacts for the Proposed Action and Alternative C). Of these, two are NRHP-eligible prehistoric sites, one is an NRHP-eligible multicomponent site, and one is a prehistoric site that is not eligible for the NRHP. There is one archaeological site that has been identified in the potential fee coal area to the north of the tract that occurs in an area where surface mining may occur (this is in addition to two sites that straddle the border between the potential fee coal area and the tract that were considered in the analysis of impacts in the tract). This is a NRHP-eligible prehistoric site. Thus, surface mining in the fee coal areas may impact five sites, four of which are NRHP-eligible, in addition to those that would be affected by the Proposed Action. Impacts of surface mining in the fee coal areas can be expected to be similar to those of surface mining in the tract and would likely result in complete destruction of these sites.

Another three archaeological sites have been identified in the portion of the Coal Hollow Mine in which surface mining will not occur (in addition to two sites in the area where surface mining will not occur that straddle the border between the Coal Hollow Mine and the Alton Coal Tract and are included in the analysis of impacts in the tract). These are all NRHP-eligible prehistoric sites. These sites may be impacted by activities associated with mining, such as facilities construction.

Overall, reasonably foreseeable activities in the fee coal areas will incrementally add to the impacts to archaeological sites that would occur under either the Proposed Action or Alternative C for the Alton Coal Tract. It should be noted that that the cumulative nature of impacts on archaeological sites in the tract and the fee coal areas has been recognized and is the reason for the development of the CRMP that has been developed for the Alton Amphitheatre and Sink Valley area (Stavish 2008b).

Regarding the Panguitch Historic District and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area, according to the BLM KFO Proposed RMP and Final EIS (BLM 2008a: 4-157), it is anticipated that US-89 will be widened over the next 20 years to allow for an increase in traffic volume. The increased truck traffic that would occur under either the Proposed Action or Alternative C for the life of the mining operation would contribute to the increased traffic volume that is already expected to occur on US-89. Overall, it can be expected that truck traffic associated with mining in the Alton Amphitheatre and Sink Valley area would contribute to a broader pattern of increased traffic volume along US-89 that will likely occur over the next two to three decades. To the extent that increased traffic has impacts on the integrity of setting, feeling and association of the Panguitch Historic District and the Utah Heritage Highway 89, coal truck traffic would contribute to an even broader pattern of such impacts. For a further discussion of cumulative impacts related to US-89 see the transportation section below (Section 4.18.3.14)

Finally, in the broader CIAA (the BLM-KFO) any increase in surface-disturbing activities would increase the potential to adversely impact known and currently unknown archaeological sites. With the implementation of the Proposed Action or Alternative C there would be a 2.59%–3.12% and a 2.16%–2.69% increase, respectively in surface disturbance in the entire CIAA over the next 20 years.

4.18.3.11 FIRE MANAGEMENT

As mineral development, recreational activities, and general use of the area increase, so would the number of potential ignition sources and consequently the probability of wildland fire occurrence. Activities associated with fire suppression, recreation, development, and general land use would cumulatively contribute to the modification of the composition and structure of vegetation communities and increase the spread of noxious and invasive weeds. Such effects would, in turn, alter the fire regime of the area, potentially increasing the frequency, size, and intensity of wildland fires. Developed areas and associated roads and ROW corridors could also provide increased accessibility to remote areas for fire suppression equipment and provide fuel breaks in the case of wildland fire events. The reasonably foreseeable development in the CIAA, of which fire management activities would be required, would impact 78,854 acres. The Proposed Action would increase surface disturbance, as well as potential fire management actions, by 2.59%–3.12% and Alternative C would increase the total disturbance by 2.16%–2.69% in the CIAA.

4.18.3.12 GEOLOGY AND MINERALS

Reasonably foreseeable development in the CIAA could impact up to 78,854 surface acres. Under the Proposed Action, the Alton Coal Tract would directly impact 1,993–2,395 acres which is a 2.59%–3.12% increase in the total surface disturbance in the CIAA over the next 20 years. Alternative C would directly impact 1,662–2,064 acres which is a 2.16%–2.69% increase in the total surface disturbance in the CIAA. Various forms of surface disturbance impact geological resources by potentially altering surface and subsurface features, modifying stratigraphic layers, resulting in potential geologic hazards, etc.

In addition to the Alton Coal Field there are two other major coal fields (Kaiparowits and Kolob) in the CIAA. No coal mining activities are currently occurring or reasonably foreseeable in these coal fields. However, in the Alton Coal Field two other mining operations, both on private lands for fee coal, would result in the extraction of approximately 13 million tons of coal from the Alton Coal Field (estimated tons assume that acre-for-acre coal tonnage is approximately the same on the private tracts as on the federal tract). Under the Proposed Action or Alternative C, 44.9–49.1 million tons or 38.1–42.3 million tons, respectively of coal would be permanently removed from the Alton Coal Field. This would be a 29%–26% or 34%–31% increase, respectively in the amount of coal removed from the coal field when considered with reasonably foreseeable coal mining activities.

Other reasonably foreseeable mineral development in the CIAA includes oil and gas development, locatable mineral development, and salable mineral development. The Alton Coal Tract lies in a high potential area for oil and gas. Assuming that coal mining on the tract would preclude all oil and gas development over the life of the mine the incremental impact of activities associated with the Alton Coal Tract under the Proposed Action or Alternative C would be to decrease impacts to oil and gas resources because their extraction would be postponed to allow for coal mining. On the other hand, impacts to locatable minerals (namely Septarian nodules) and salable minerals (largely burnt shale and gravel) would be incrementally increased as a result of coal mining activities under the Proposed Action or Alternative C depending on how their unearthing were dealt with during the mining process (i.e. if the gravel is separated from the overburden). If these materials were returned to mined-out pits along with the remainder of overburden they would remain in place following mining and no extraction related impact would occur. On the other hand, if these materials were to be set aside and sold the mining operation would result in increased impacts to these resources in the CIAA via extraction and sale.

4.18.3.13 HAZARDOUS MATERIALS AND HAZARDOUS AND SOLID WASTE

The State of Utah is considering an application to surface mine privately owned coal resources adjacent to the tract in Kane County. Resource decisions from this project could combine with other past, present, and reasonably foreseeable future actions to produce cumulative impacts from hazardous materials and solid waste in the CIAA. Additional opportunities for incidences related to hazardous materials in the CIAA include: oil and gas development and transport, prescribed fire treatments, and to a lesser extent the installation of transmission lines and pipelines. With adherence to SOPs cumulative impacts in the CIAA would be minimal.

4.18.3.14 LAND USE AND ACCESS

Land tenure on the tract would not change based on any known past, present, or reasonably foreseeable projects. The land status and prior rights currently held by parties would remain unchanged. However, the overall land use in the tract would be restricted to mining operations. The mine operator would lease private and federal surface estates and federal mineral estates from the BLM for the life of the mine and until the coal mine area has been reclaimed and released from bond.

Using surface disturbance acres as an indicator of land use in the CIAA mining operations on the Alton Coal Tract would increase the total acreage of land in the CIAA used for mineral extraction by 1,993–2,395 acres under the Proposed Action and 1,662–2,064 acres under Alternative C. Reasonably foreseeable future actions would result in the use of 4,826 acres of land for mineral extraction related activities. Coal mining activities on the tract under the Proposed Action or Alternative C would result in a 41%–50% or 34%–43% increase, respectively in the acreage of land in the CIAA used for mineral extraction. However, under the Proposed Action or Alternative C the amount of land used for mineral extraction across the CIAA (again using surface disturbance acres as an indicator) would still be relatively low at 3% and 2%–3%, respectively.

4.18.3.15 LIVESTOCK GRAZING

Potential, cumulative impacts on livestock grazing operations could occur from a combination of activities and land uses occurring in the CIAA. Vegetation treatments and range improvements on lands adjacent to the decision area (public and private) would increase available forage and water for a wide range of uses, including livestock grazing and rangeland health. Surface-disturbing activities, including coal development activities and related construction of roads and infrastructure, could be a primary cause of site-specific loss of forage and the spread of noxious weeds. The implementation of BLM's mitigation guidelines, restrictions on surface use, Standards for Rangeland Health, vegetation treatments, and monitoring efforts would all provide measures of protection for forage resources on federal lands, which would help to reduce overall effects on livestock grazing operations.

4.18.3.16 PALEONTOLOGY

It is likely that intense hobby fossil collecting and other nearby mining activities for burnt shale clinker and Septarian concretions would continue through the life of the mine under the Proposed Action or Alternative C. It is also expected that research activities in the Alton Amphitheatre would increase as knowledge of the nearby Kaiparowits Basin matures creating additional demands for undisturbed fossils and outcrops. The mining of burnt shale, Septarian concretions, or nearby coal resources would contribute to the total loss of fossil resources on federal lands, perhaps as much as an additional 40%.

Across the CIAA reasonably foreseeable future actions would result in approximately 78,854 acres of surface disturbance. Surface-disturbing activities have the potential to result in the destruction of fossils depending on the location of the surface-disturbing activity. On the other hand, surface-disturbing activities can also result in the unearthing of fossils and their inclusion in the paleontological scientific body of knowledge. Mining operations on the tract under the Proposed Action or Alternative C would result in a 2.59%–3.12% or 2.16%–2.69% increase, respectively in surface disturbance in the CIAA.

4.18.3.17 RECREATION

Cumulative effects to recreation resources would potentially occur from a combination of land uses and permitted actions. These include the conversion of agricultural lands to residential and commercial uses and known projects such as the West-Wide Energy Corridor Programmatic EIS, the Coal Hollow Environmental Assessment (which occurs on lands adjacent to and including the Alton Coal Tract), the Tropic to Hatch transmission line project, the Lake Powell water pipeline project, the Jackson Flat Reservoir project, and the US-89 Highway widening project.

For many of these projects and permitted actions, some recreation users would be temporarily or permanently displaced from the immediate area around the tract. The Proposed Action would cause a 2.59%–3.12% increase in overall surface disturbance in the CIAA. Alternative C would increase surface disturbance by 2.16%–2.69%. This disturbance would result in displacement of recreationists to other areas in the CIAA. Users would move onto adjacent public lands (BLM-administered lands and the Dixie National Forest) for hunting and other dispersed recreation opportunities (camping, hiking, sightseeing, etc.). The conversion of agricultural land to residential and commercial uses is likely the largest area of impact to recreation resources in the CIAA. As removal of minimally developed land available for hunting and dispersed recreation increases, the amount of land available for recreation in those types of settings decreases permanently. This increases crowding and decreases the recreational experiences of displaced and existing users in those remaining areas.

4.18.3.18 SOCIOECONOMICS

The CIAA for socioeconomics includes Kane, Garfield, and Iron counties. Thus, in addition to considering the past, present, and reasonably future impacts from the KFO (Kane and Garfield counties), the cumulative socioeconomic analysis considers management decisions related to the Cedar City Field Office (Iron County) as well. Most of the cumulative impacts to the social and economic conditions of the three-county area would be a result of mineral development. According to the Utah Geologic Survey, two coal fields do exist in Iron County (Harmony and Kolob) (UDNR 2006). However, development of these fields is not anticipated in the foreseeable future. Given that there is no current or reasonably foreseeable coal production or oil and gas development in Iron and Beaver counties, the Proposed Action or Alternative C would add a new revenue stream, via indirect expenditures, into the local economy. The Proposed Action or Alternative C could contribute to revenues from existing and future oil and gas development and exploration in the KFO. The KFO estimates that 90 oil and gas wells will be drilled over a 20-year period. An increased contribution of mineral-related royalties, taxes, and payments from the successful bidder to the federal, state, and local government would be beneficial to current economic conditions at all levels of government. As stated in the KFO RMP/Final EIS the Alton coal mine “would provide by far the largest new economic stimulus to the [Kane and Garfield counties].

Increasing natural resource development in the KFO and potentially in the Cedar City Field Office over the next 20 years would likely alter the social character in many of the small central and southern Utah communities. In addition to the truck traffic required to move mined coal to market, other production-related trucks would further degrade the rural, small-town nature of communities near mines, wells, and along transportation routes. The alteration of landscapes from semiprimitive/natural to ones characterized

by coal mining and oil and gas development would be experienced by local residents in the area who enjoy and/or depend on the naturalness of the area for their livelihood. Cumulatively, these changes could result in adverse impacts to recreationists who value primitive recreation and businesses dependant on tourism-related revenue.

4.18.3.19 SOILS

In addition to the 1,993– 2,395 to 1,662–2,064 acres of soil disturbance that would occur under the Proposed Action and Alternative C respectively, several other activities would impact soils in the CIAA. The reasonably foreseeable development in the CIAA would disturb 78,854 surface acres. The Proposed Action would increase surface disturbance, by 2.59%–3.12% and Alternative C would increase the total disturbance by 2.16%–2.69% in the CIAA.

Proposed coal mine development on private surface areas adjacent to the Alton Coal Tract would result in an additional 802 acres of surface disturbance to soils, potentially contributing to soil erosion and loss of soil productivity. Other activities could also contribute to cumulative impacts to soil in the CIAA, including OHV and vehicle use, rangeland use, oil and gas development, and other surface uses and activities. Under the KFO-RMP, the public lands in the CIAA limit OHV use to designated trails and roads, and the area is open to oil and gas leasing. All oil and gas development, mining, public lands grazing, and other uses of public lands would require permits that would comply with authorizing permit stipulations and apply BMPs that would minimize the overall erosion and loss of soil productivity resulting from incremental impacts. Thus, the mining of the Alton Coal Tract and adjacent private lands would be one of the dominant cumulative impacts to soils in the CIAA.

4.18.3.20 TRANSPORTATION

Past and present actions including improved recreational opportunities in the region have contributed to the existing LOS in the area of analysis. Future actions that would contribute to cumulative impacts to transportation include expanding US-89, oil and gas development, locatable mineral development, salable mineral development, energy corridor development, wind energy development, and water project. The Proposed Action or Alternative C would cause incremental increases in traffic density; however it would not result in substantial decreases to LOS. The expansion of US-89 is expected to improve LOS on portions of the coal haul transportation route and would mitigate the incremental increases in traffic density resulting from the Proposed Action or Alternative C.

4.18.3.21 VEGETATION

Resource decisions from mining activities on the tract under the Proposed Action or Alternative C would combine with other past, present, and reasonably foreseeable future actions to produce cumulative impacts to vegetation resources in the CIAA. The total amount of surface disturbance from reasonably foreseeable future actions across the CIAA is estimated at 78,854 acres. The Proposed Action would disturb 1,993–2,395 surface acres, a 2.59%–3.12% increase in surface disturbance in the CIAA. Alternative C would disturb 1,662–2,064 acres, a 2.16%–2.69% increase in total CIAA surface disturbance. Surface disturbance associated with consumptive uses such as oil, gas, and other minerals development, and forage use by livestock and wildlife species would result in cumulative effects over a larger landscape scale than analyzed in this document.

Minerals development has occurred across this region in the past and is projected to continue at an increasing rate into the future. Additionally, both copper and uranium mining have occurred and would continue to occur in and around the tract. The combined amount of surface disturbance of these past, present, and future actions would be detrimental to vegetation resources. The spatial layout of oil and gas

facilities and access roads disturbs a large proportion of vegetation when considered across the landscape. Each disturbed area increases the opportunity for weed invasions and disrupts the spatial continuity of vegetation communities.

The overall cumulative impact of activities proposed for all resource decisions on vegetation resources in the CIAA includes short-term detrimental impacts and long-term improvements. Major contributors to detrimental impacts include continuing or increasing OHV activities throughout most of the area, and degradation to vegetation and habitats from mineral development-related activities. However, of the estimated 78,854 acres of surface disturbance as a result of reasonably foreseeable future activities in the CIAA, approximately 60,000 acres (or 78% of the total 78,854 acres) are anticipated to be for vegetation treatments intended to create desired vegetation communities such as stable sagebrush stands. An additional 4,666 acres of disturbance would be a result of wildfire, wildfire use, and prescribed fire. Although impacts related to fire are adverse to vegetation in the short term, in the long term fire results in beneficial impacts to vegetation be culling out decadent and decaying plant material and returning vegetation communities to historical fire return intervals that promote vegetation community vigor. Though coal mining activities on the Alton Coal Tract would result in short-term adverse impacts to vegetation as described, in the long term reclamation activities would restore native and suitable non-native plants to the landscape in arrangements beneficial to the vegetation communities themselves and to the wildlife that depends on these communities for habitat. Under the Proposed Action or Alternative C reclamation operations on the tract would increase restoration (i.e., vegetation treatment related) activities by 31%– 37% or 26%–32%, respectively (percentage increase is based on 64,666 acres of surface disturbance combined for vegetation treatments, wildfire, wildfire use, and prescribed fire) in the CIAA.

4.18.3.22 WATER RESOURCES

Reasonably foreseeable development in the CIAA, which has the potential to impact water resources, would impact approximately 78,854 acres. The Proposed Action would increase surface disturbance, as well potentially adverse impacts to water quality and/or quantity, by 2.59%–3.12% whereas Alternative C would increase the total disturbance by 2.16%–2.69% in the CIAA. In the CIAA, coal mining related operations on the tract combined with future construction and development of the Lake Powell pipeline, development of the West-wide energy corridor, construction of the Jackson Flat Reservoir, and oil and gas development would increase the incremental impacts associated with localized erosion and sediment loading, which could degrade downstream water quality. However, projects occurring on BLM-administered land must comply with BLM-permitted activities and would comply with permit stipulations that would minimize soil erosion and degradation of water quality and quantity. These permitted activities are not expected to contribute to the overall cumulative effect to water quality and quantity from past, present, and reasonably foreseeable actions. Several actions identified by the BLM as reasonably foreseeable actions such as fire use and vegetation treatments would incrementally improve watershed health in the long term though short-term impacts on water quality as a result of these activities would be adverse.

4.18.3.23 WILDLIFE AND SPECIAL STATUS SPECIES

The overall cumulative impact of activities proposed for the Alton Coal Tract and surrounding planning areas on wildlife and special status animal species includes short-term detrimental impacts and long-term improvements to habitats. Surface disturbance associated with oil, gas and other minerals development, and forage use by livestock would result in cumulative effects over a larger area than is analyzed in this document. The combined surface disturbance of past, present, and future development would be detrimental to wildlife and special status animal species due to fragmentation and destruction of habitat. Detrimental impacts include ongoing or increasing OHV use, loss and degradation of habitat due to mineral development, and disruption of daily and seasonal animal movement and habitat use due to

increased human presence, increased traffic volume and speeds, and noise and light pollution. Each disturbed area increases habitat fragmentation, reduces the connectivity and integrity of habitats, and displaces wildlife and special status species over the short- and long-term. The reasonably foreseeable development in the CIAA, which has the potential to impact wildlife, would impact 78,854 acres. The Proposed Action would increase surface disturbance, as well potentially adverse impacts to wildlife, by 2.59%–3.12% and Alternative C would increase the total disturbance by 2.16%–2.69% in the CIAA.

The development of the Alton Coal Tract combined with mining operations on adjacent private lands could result in the long-term loss of local sage-grouse habitat and displacement of the southern-most lek of the greater sage-grouse. Although mitigation and reclamation could reduce these impacts in the long term (perhaps resulting in improved habitat for the population), development of the Alton Coal Tract could result in the displacement of the location population in the short term or the loss of the local population in the long term (BLM 2008b).

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CHAPTER 5. CONSULTATION AND COORDINATION

CHAPTER 5 CONSULTATION AND COORDINATION

Council on Environmental Quality regulations implementing NEPA require that federal agencies provide meaningful opportunities to the public and stakeholders to provide input and identify their concerns during an EIS process. Federal laws such as the ESA, the CWA, and the NHPA mandate public involvement and consultation with agencies or federally recognized tribal governments.

This chapter documents the specific consultation and coordination efforts undertaken by the BLM throughout the entire process of developing the *Alton Coal Tract LBA Draft EIS*. It also includes a list of agencies and individuals on the document distribution list.

5.1 Public Notice and Involvement

5.1.1 Notice of Intent and Public Scoping

The public scoping process was initiated on November 28, 2006 when the BLM published a NOI to prepare an EIS to offer the Alton Coal Tract (tract) for competitive leasing. Pursuant to NEPA requirements, public scoping meetings were advertised in a variety of formats, at least two weeks prior to their scheduled dates (Table 5.1). In each format, the advertisements provided logistics, explained the purpose of the public meetings, gave the schedule for the public comment (scoping) period, outlined additional ways to comment, and provided methods of obtaining additional information.

Table 5.1. Meeting Advertisement Locations

Publicity Item	Venue		
NOI	*Federal Register*		
Fliers/Posters	Posted in the following communities in the given locations a week before the scheduled meetings:		
	Cedar City	**Mt. Carmel**	**Panguitch**
	Post office	Thunderbird Inn/ Restaurant	Ace Hardware
	Library	Kane County Mobile Library	Chevron station
	Walmart	**Orderville**	City Hall
	Kanab	Post office	County Courthouse
	Post office	Grocery store	County Clerk
	Library	**Glendale**	Conoco station
	County offices	Post office	Dixie National Forest Ranger Station
	BLM-KFO	**Hatch**	Garfield Memorial Healthcare Foundation Thrift Shop
	Grand Staircase-Escalante National Monument headquarters	Restaurant/resort	Ice cream parlor
	Grand Staircase-Escalante National Monument visitors' center in Kanab		Library
			Main Street Market
			NAPA auto parts store
			Post office
			Sinclair Station
			State liquor store
			Cowboy Corner
			C Stop Pizza
			Country Corner I
			Ice cream shop
Press Release	**Newspaper**	**Television**	**Radio**
	Deseret News	KSL-TV Channel 5	KXAZ 93.3 FM
	Garfield County Insider	KUTV Channel 2	KPGE 1340 AM
	Salt Lake Tribune	KTVX Channel 4	
	Southern Utah News	KSTU Channel 13	
	Spectrum		

Five public scoping meetings were held at various locations and dates (Table 5.2). Each meeting was conducted in an open-house format with BLM and ACD personnel present to answer questions and provide information. Other resources available at the public scoping meetings included informational display boards, one video explaining the conceptual mining and reclamation sequence, one video explaining a potential transportation route including truck details, and comment forms on which to submit comments at the meetings. Informational display boards and comment forms are available in the *Alton Coal Tract LBA EIS Public Scoping Report* (SWCA 2007b) prepared following completion of the scoping process. Copies of the videos are available at the BLM-KFO. The 90-day scoping period closed on February 26, 2007.

Table 5.2. Public Scoping Meeting Dates, Times, and Locations

Date	Time	City	Address
January 30, 2007	5:00–8:00 pm	Alton	Alton Town Hall 11 South 100 West, Alton, Utah 84710
January 31, 2007	5:00–8:00 pm	Kanab	Kanab City Library 374 North Main Street, Kanab, Utah 84741
February 1, 2007	5:00–8:00 pm	Panguitch	Triple C Arena 50 East 900 North, Panguitch, Utah 84759
February 6, 2007	5:00–8:00 pm	Cedar City	Cedar City Library 303 North 100 East, Cedar City, Utah 84720
February 7, 2007	5:00–8:00 pm	Salt Lake City	Salt Lake City Public Library 210 East 400 South, Salt Lake City, Utah 84111

Opportunities for public comment during the public scoping period consisted of the following:

- Public scoping meeting attendees could write comments on pre-addressed comment forms and submit them at the meeting (or mail at a later date).
- Emails could be sent to a dedicated email address: UT_Kanab_Altoncoal@blm.gov.
- Public letters could be mailed to BLM-KFO, Attention: Keith Rigtrup, 318 North 100 East, Kanab, Utah 84741.
- Public letters could be faxed to Keith Rigtrup at 435-644-4620.

At the end of the public scoping period, 7,788 responses were received. The bulk of these (7,352) were form letters received by email. The remainder were unique emails (167), email form letters with additional text (178), and letters received by mail, fax, or at scoping meetings (91). For a complete listing of responses received and descriptions of the scoping comment analysis process and scoping comments received, a copy of the *Alton Coal Tract LBA EIS Public Scoping Report* (SWCA 2007b) SWCA 2007b is available at the BLM-KFO and the BLM Utah State Office as well as online at the BLM's website.

5.1.1.1 COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

Concurrent with publication and release of the Draft EIS, the EPA and BLM each publish a Notice of Availability (NOA) for the Draft EIS in the *Federal Register*. The BLM NOA also includes a Notice of Public Hearing on the Maximum Economic Recovery and Fair Market Value associated with the proposed lease sale pursuant to 43 CFR 3425.4. This public hearing will occur in Cedar City, Utah. Public meetings on the Draft EIS are scheduled to occur in Alton, Kanab, Panguitch, Cedar City, and Salt Lake City, Utah. The comment period on the Draft EIS is 60 days.

Following the comment period on the Draft EIS, the Final EIS will be prepared. Comments received on the Draft EIS will be included in the Final EIS. Parties on the distribution list will be sent copies of the Final EIS when it is completed, and the EPA and BLM will each publish an NOA for the Final EIS. After a 30-day availability period, the BLM will make a decision to hold or not to hold a competitive lease sale for the federal coal in the tract, and a ROD for the tract will be issued. If the decision is to hold a competitive lease sale, the BLM will also decide what special lease stipulations to attach to the lease. Copies of the ROD will be mailed to parties on the mailing list and others who commented during the NEPA process. There will be a 30-day appeal period after the ROD is signed but before the ROD is implemented.

5.2 Section 106 and Government-to-government Consultations

The BLM is engaged in Section 106 and formal government-to-government consultation with several parties with interest in the tract.

Consultation for tribal cultural resources is required under Section 106 of the NHPA. Historic properties under the NHPA are properties that are included in the NRHP or that meet the criteria for inclusion on the NRHP. Section 106 of the NHPA requires a federal agency, upon determining that activities under its control could affect historic properties, consult with the appropriate state historic preservation officer (SHPO) and tribal historic preservation officer. Under NEPA, any impacts to tribal, cultural, or other treaty resources must be analyzed and mitigated. Section 106 of the NHPA requires that federal agencies consider the effects of their actions on cultural resources, following regulation in 36 CFR 800.

5.2.1 Section 106 Consultation

The BLM initiated Section 106 consultation with the SHPO in 2007 via email correspondence and telephone communication. An inventory report (Report U-05-1568-b, p) for private and BLM lands was provided to SHPO on July 11, 2007. SHPO's reply on August 29, 2007, (via email) began the consultation process regarding the eligibility of sites for inclusion on the NRHP. Report U-07-BL-0969-b, a BLM cultural resources inventory report covering additional BLM lands was provided to SHPO on September 25, 2007. Following consultation with SHPO and a field meeting on October 23, 2007, concurrence on site eligibility was provided via email on November 16, 2007. The final version of report U-05-MQ-1568b.p. with all site eligibility determinations agreed upon by the BLM and SHPO was provided January 9, 2008. A separate cultural resources inventory and report (Report U-05-MQ-0346-p), related only to the Coal Hollow Mine, was completed and submitted to SHPO on March 10, 2006. The BLM reviewed this report but otherwise had no involvement in its production or submittal to SHPO, because no BLM-managed surface or sub-surface is present in this area. The BLM has no record of the SHPO's reply to this report. An additional private land report (Report U-08-MQ-0539) was provided to SHPO that also does not apply to the BLM action, and there is no BLM record of the SHPO's reply in this case either. The BLM understands that the Coal Hollow Mine and the Alton Coal Tract leasing process are related activities (though not connected actions under NEPA), and because they are related, each would best be served by the development of a combined CRMP. This CRMP would be implemented in a phased process, beginning with immediate impacts to cultural resources on private lands (Coal Hollow Mine), and including as subsequent phases any data recovery that would be conducted should a federal action proceed (see discussion below of the CRMP).

The Class III cultural resource surveys that were conducted resulted in the documentation of 113 cultural resources, consisting of five historic sites, six multi-component prehistoric/historic sites, and 102 prehistoric sites. Of these, 92 have been determined to be eligible for the NRHP.

The CRMP introduced above was developed in coordination with BLM, SHPO, OSM, and ACD to provide a systematic approach to the management of sites located in the federal tract and the private tract. The plan consists of three phases:

1. A data recovery plan for seven archaeological sites that will be impacted by the Coal Hollow Mine, located entirely on private land.
2. Archaeological testing of eligible sites located within the Alton Coal Tract, to be conducted if the tract is leased.

3. Mitigation of the archaeological sites determined most likely to provide the necessary information for addressing the overarching research design and questions.

The data recovery and research from Phase I will serve to inform subsequent phases of research through the collection of data regarding geomorphology, site depositional processes, depositional preservation, and erosional processes.

5.2.2 Government-to-government Consultation

In August 2005, the BLM sent tribal consultation letters to the tribes list in Table 5.3. Of these, the Hopi, Zuni, and Paiute Indian Tribe of Utah have responded in writing to date. They requested copies of the cultural resources survey reports and indicated that they will continue formal consultation if any prehistoric cultural resources would be adversely affected by mining on the tract. As part of the government-to-government consultation process, the BLM also conducted a field visit with the Kaibab Band of Paiute Indians.

The BLM is currently waiting for development of Phase II of the CRMP before resuming formal consultation with the tribes.

Table 5.3. Tribes Receiving Tribal Consultation Letters

Cedar Band of Paiutes	Navajo Nation – Cameron Chapter	Navajo Nation – Olijato Chapter
Hopi Tribe	Navajo Nation – Coalmine Canyon Chapter	Navajo Nation – Tuba City Chapter
Indian Peak Band of Paiutes	Navajo Nation – Coppermine Chapter	Navajo Nation – Window Rock, AZ
Kaibab-Paiute Tribe	Navajo Nation – Historic Preservation Department	Paiute Tribes of Utah
Kanosh Band of Paiutes	Navajo Nation – Ka beto Chapter	Pueblo of Zuni
Koosharem Band of Paiutes	Navajo Nation – Lechee Chapter	San Juan Southern Paiute
Navajo Nation – Bodaway/Gap Chapter	Navajo Nation – Navajo Mountain Chapter	Shivwits Band of Paiutes
		Ute Cultural Rights and Preservation

5.3 Agency Coordination/Consultation

5.3.1 U.S. Fish and Wildlife Service

Section 7 of the ESA requires federal agencies to ensure that their actions do not jeopardize the continued existence of threatened or endangered species or result in the destruction of their designated critical habitat. It also requires consultation with the USFWS in making that determination.

The BLM has initiated consultation with the USFWS via informal email correspondence and teleconference meetings. The BLM obtained from the Utah Ecological Services Field Office of the USFWS a list of endangered or threatened species (or species proposed for listing) that may occur on the tract or that may be affected by mining on the tract. The BLM is currently preparing a biological assessment (BA) to determine if the development and/or operation of the tract would have any effects on those species. Additional information with respect to the evaluation of potential impacts to endangered or threatened species is contained in Appendix F.

5.3.2 U.S. Army Corps of Engineers

The USACE contacted the BLM in September 2009 to express their interest in the Alton Coal Tract LBA. The USACE was invited to participate in bi-weekly teleconferences with the BLM and cooperating agencies. In the event that the tract is offered for competitive leasing, the successful bidder would likely require a permit(s) from the USACE.

5.3.3 Cooperating Agency Involvement

In fall 2006, the BLM invited the OSM to participate in the EIS process as a cooperating agency. Following the scoping process, cooperating agency status was also extended to the State of Utah (including its agencies). All cooperating agencies had the opportunity to review the analysis in this EIS prior to its publication.

5.3.4 Other Agency Coordination/Consultation Efforts

5.3.4.1 AIR RESOURCES STAKEHOLDER GROUP

In November 2008 the BLM created an Air Resources Stakeholder Group. This group comprises participants from the EPA, OSM, State of Utah (DOGM; State Attorney General's Office; and Public Lands Policy Coordination Office), NPS, ACD (including its contractors), and the BLM. Third-party contractor representatives also participated in the stakeholder group as the analysis team. The stakeholder group provided input to the development of the air resources analysis protocol that was used as the basis for the emissions inventory and the analysis of potential air resources impacts. Section 4.3 contains the results of the analysis. The technical support document, which provides additional details on methodologies and results, can be found in Appendix K. Table 5.3 provides a listing of cooperators, contributors, and reviewers from federal, state, and local agencies. This list includes participants in the Air Resources Stakeholder Group.

5.3.4.2 NIGHT SKY IMPACT ASSESSMENT

In September 2008 the BLM engaged the NPS Night Sky Program Manager, Chad Moore, to assist with the impact analysis for night sky. A night sky analysis contractor, Dark Sky Partners (an LLC-based in Arizona), was also engaged in this process as a subconsultant to the BLM's third-party contractor (SWCA). Together, the BLM, NPS, ACD, Dark Sky Partners, and SWCA agreed on the impact analysis approach, including observation points and model inputs. The impact analysis was evaluated by NPS, and the results are reported in Section 4.2. Additional detail on the night sky impact analysis is provided in Appendix I.

5.4 Department of Justice Consultation

If the BLM decision is to hold a competitive lease sale for the federal coal in the tract after the competitive coal lease sale but prior to issuance of a lease, the BLM will solicit the opinion of the DOJ on whether the planned lease issuance creates a situation inconsistent with federal anti-trust laws. The DOJ is allowed 30 days to make this determination. If the DOJ has not responded in writing within the 30-day period, the BLM can proceed with issuance of the lease.

5.5 List of Preparers

This EIS was prepared by SWCA, a third-party contractor, under the direction of the BLM. Representatives from cooperating and contributing agencies also prepared, reviewed, and contributed to the EIS. Table 5.4 provides a listing of cooperators, contributors, and reviewers from federal, state, and local agencies. Table 5.5 provides a listing of BLM personnel who prepared, reviewed, and contributed to this EIS. Table 5.6 provides a listing of the third-party contractor personnel, including subcontractors, who prepared, reviewed, and contributed to this EIS. Table 5.7 provides a listing of other contractors who conducted field studies, authored reports, and/or reviewed sections of the EIS.

Table 5.4. Cooperators, Contributors, and Reviewers from Federal, State, and Local Agencies

Name	Organization/Entity	Project Responsibility
Burton, Priscilla	DOGM	Document review, Air Resources Stakeholder Group
Distler, Ken	EPA	Air Resources Stakeholder Group
Furhmann, Kelly	Bryce Canyon National Park	Air Resources Stakeholder Group
Golden, Kevin	EPA	Air Resources Stakeholder Group
Haas, Sarah	Bryce Canyon National Park	Air Resources Stakeholder Group
Hanley, James	EPA	Air Resources Stakeholder Group
Harja, John	Utah Public Lands Policy Coordination Office	Air Resources Stakeholder Group
Holland, James	Grand Staircase-Escalante National Monument	Document review
Kirby, Foster	OSM	EIS project coordinator; document review
Legg, Kristin	Zion National Park	Air Resources Stakeholder Group
Moore, Chad	NPS Night Sky Team	Night sky analysis preparation and review
Nielsen, Kezia	Zion National Park	Air Resources Stakeholder Group
Notar, John	NPS-Air Quality Team	Air Resources Stakeholder Group
Payne, Val	Utah Public Lands Policy Coordination Office	EIS coordinator
Pranger, Hal	OSM	Document review
Rathbun, Richard	State of Utah, Attorney General's Office	Air Resources Stakeholder Group
Schrage, Laura	Bryce Canyon National Park	Air Resources Stakeholder Group
Sharrow, Dave	Zion National Park	Air Resources Stakeholder Group
Stacey, Andrea	NPS-Air Quality Team	Air Resources Stakeholder Group
White, Susan	DOGM	Document review

Table 5.5. BLM Personnel Who Prepared, Reviewed, and Contributed to this Environmental Impact Statement

Name	Title, Education	Project Responsibility
Alberts, Dan	GIS Analyst	GIS Analysis and Mapping
Barber, Harry	KFO Field Manager; B.S., Wildlife Range Science; M.S., Wildlife	Air Resources Stakeholder Group
Beckstrand, Randy	Utah State Office; B.S., Range Science	EIS review
Bryant, Lisa	Utah State Office; B.S., General Agriculture; M.S., Social Science	EIS review; Air Resources Stakeholder Group
Caplan, Susan	BLM National Operations Center, Air Quality; B.S., Meteorology and Mathematics; M.S., Air Resource Management	Air Resources Stakeholder Group
Christensen, Tom	Outdoor Recreation Planner; B.S., Forestry; M.S., Forest Recreation	Recreation; aesthetic resources (visual, noise, night sky)
Church, Lisa	Wildlife Biologist; B.S., Wildlife; B.S., Fisheries Ecology	Threatened, endangered or candidate wildlife species; wetlands/riparian zones; fish and wildlife
Glasson, Mike	Price Field Office Coal Group;	Recoverable coal estimates
Gubler, Carson	Range Specialist; B.S., Biology/Botany	Air quality; floodplains; invasive, non-native species; threatened, endangered or candidate plant species; water quality (drinking/ground); rangeland health standards and guidelines; fuels/fire management
Herr, Leonard	Utah State Office Air Quality Specialist; B.S., Natural Resources	Air Resources Stakeholder Group
McKenzie, Jeff	Utah State Office Solid Minerals Group; M.B.A., Finance; B.S., Mining Engineering	EIS Review; Air Resources Stakeholder Group
Nicholls, Craig	BLM National Operations Center, Air Quality;	Air Resources Stakeholder Group
Perkes, Stan	Utah State Office Solid Minerals Group; B.S., Mining Engineering	EIS review
Pope, Dennis	KFO Assistant Field Manager (Retired)	EIS review; Air Resources Stakeholder Group
Powell, J. Doug	Geologist; B.S., Geology; Graduate Certificate-Hazardous Waste Control	Wastes (hazardous or solid); geology/mineral resources
Reese, John	Range Specialist; B.S., Rangeland Resources	Livestock grazing woodland/forestry; vegetation; soils
Rigtrup, Keith	Color Country District Office Environmental Coordinator; B.A., Economics	EIS project manager; environmental justice; socioeconomics; Air Resources Stakeholder Group
Thayne, Greg	Utah State Office NEPA Coordinator (Retired);	EIS review
Titus, Alan	Paleontologist; B.S., Geology; M.S., Geology; Ph.D., Geology	Paleontology
Wolfe, Hugh	Realty Specialist;	Lands and access
Zweifel, Matt	Archaeologist; B.S., Anthropology; M.A., Archeology	Cultural Resources; Native American religious concerns; Section 106 consultation; government-to-government consultation

Table 5.6. Third-party Contractor Personnel, including Subcontractors, who Prepared, Reviewed, and Contributed to this Environmental Impact Statement

Name	Title, Education/Experience	Project Responsibility
SWCA		
Bollong, Chuck	Ph.D., Anthropology; M.A., Anthropology; M.A., Archaeology; B.A., Archaeology; 25 years of experience	Cultural resources
Cannon, M ke	Ph.D., Anthropology; M.A., Anthropology; B.A., Anthropology; B.A., English; 15 years of experience	Cultural resources
Childs, Amanda	B.S., Environmental Studies; 13 years of experience	Document review and preparation
Christensen, John	M.S., Geology; B.S., Geology; 28 years of experience	Water resources
Gaddis, Benjamin	M.E.M., Water Resources; B.S., Environmental Science; 9 years of experience	Project management; public involvement; report preparation and review; EIS preparation and review; Air Resources Stakeholder Group
Gaddis, Erica	Ph.D., Natural Resources; M.S., Environmental Science and Policy; B.S., Biology and Environmental Science; 9 years of experience	Water resources
Guinn, Janet	B.S., Psychology and Anthropology; 9 years of experience	Hazardous materials, fire management, public involvement
Hornbeck, Hope	B.A., Environmental Biology; M.S., Plant Biology; 10 years of experience	Vegetation and special status species; wildlife and special status species; soils
Hornung, Elisha	B.S., Environmental Studies; 9 years of experience	Livestock grazing; land use and access; hazardous materials; paleontology; fire management; public involvement
Knox, Steve	B.S., Watershed Management; 34 years of experience	Document review and report preparation; Air Resources Stakeholder Group
Larson, Greg	B.A., Geography; M.S., Watershed Science	Water resources; soils
Leslie, Steve	B.S., Natural Resource Management; 11 years of experience	Aesthetic resources; transportation
Lombardi, Kathy	B.S., Environmental Engineering; M.S., Civil and Environmental Engineering; 17 years of experience	Document review and public scoping
McCulley, Audrey	B.S., Biology; 6 years experience	Wildlife and vegetation field studies and reporting
Morrow, Dave	B.A., Environmental Studies; 22 years of experience	Air resources; Noise
Nelson, Megan	B.A., English; 2 years experience	Administrative record; document formatting and production; glossary; references
Pecorelli, John	B.S., Journalism; B.S., Physical Anthropology; 15 years of experience	Technical editing
Reber, Deb	B.S., Natural Resource Management; 15 years of experience	Soils
Reinhart, Dave	B.A., Anthropology; 9 years of experience	GIS analysis
Sharp, Thomas	B.S., Biology; M.S., Biology; 15 years of experience	Wildlife and vegetation field studies and reporting
Stutz, Allen	B.S., Biology/Ecology; B.S., Zoology; 2 years of experience	GIS analysis
Summerhays, Jan	B.A., Environmental Studies; 3 years of experience	Vegetation and special status species, fire management

Table 5.6. Third-party Contractor Personnel, including Subcontractors, who Prepared, Reviewed, and Contributed to this Environmental Impact Statement

Tucker Burfitt, Linda	B.A., Media Communications; A.F., Forestry, A.S.; Ecosystem Management; 8 years of experience	Formatting, technical editing, publishing
Vernon, Laura	B.A., Psychology; M.P.A., Public Administration; 8 years of experience	Socioeconomics
Weekley, George	B.S., Plant and Soil Science; M.S., Forestry; 10 years of experience	Recreation
Wilmot, Sue	Ph.D., Human Dimensions of Ecosystem Science and Management; M.E.M., Water Resources; B.S., Biology; 9 years of experience	Soils; livestock grazing; transportation
SUBCONTRACTORS FOR SWCA		
Marquez Environmental Services, Inc. (MESI)		
Addison, Ted	(Addison Air Consulting subcontracting to MESI) M.S., Environmental Engineering; B.S., Meteorology; 20 years of experience	Air resources analysis
Dismukes, Jerry	(Cornerstone Environmental subcontracting to MESI) M.S., Atmospheric Sciences; B.S., Atmospheric Sciences; 10 years of experience	Air resources analysis
Marquez, Lori	M.S., Environmental Sciences; B.S., Electrical Engineering; 15 years of experience	Air resources analysis
Zimmer, Robert	B.S., Mathematics; 30 years of experience	Air resources analysis
Dark Sky Partners, LLC (DSP)		
Davis, Don	Ph.D., Physics; B.S., Physics; 43 years of experience	Night sky
Luginbuhl, Chris	B.S., Physics; 30 years of experience	Night sky
Fehr and Peers Transportation Consultants (F&P)		
Nepstad, Jon	B.A., Liberal Arts; M.S., Urban Planning; 21 years of experience	Public involvement, report review
Stinger, Preston	B.S., Civil Engineering; 4 years of experience	Report preparation and review

Table 5.7. Other Contractors Who Conducted Field Studies, Authored Reports, and/or Reviewed Environmental Impact Statement Sections

Name	Education and Experience	Project Responsibility
Collins, Patrick (Mt. Nebo Scientific, Inc.)	Ph.D., Botany; B.A., M.S., Biology; 33 years of experience	Wildlife and vegetation field studies and report review, sandloving penstemon field studies and reporting, wetland field studies and reporting
Petersen, Erik (Petersen Hydrologic)	M.S., Hydrogeology; B.S., Geology; 19 years of experience	AVFs reconnaissance survey and reporting, water resources, and geology and minerals review
Johnson, Chris (JBR)	B.S., Meteorology; 30 years of experience	Air quality
Strom, Dave (JBR)	B.S., Meteorology; 10 years of experience	Air quality

5.6 Distribution

Pursuant to 40 CFR 1502.19, the BLM is circulating this Draft EIS to 1) agencies having jurisdiction by law or special expertise with respect to any environmental impact involved and any appropriate federal, state, or local agency authorized to develop and enforce environmental standards, 2) the applicant; and 3) any agencies, organizations, or individuals requesting a copy of the document.

The *Alton Coal Tract LBA Draft EIS* distribution list was developed from the stakeholder lists compiled prior to and during the scoping process and then supplemented throughout the planning process.

Table 5.8 lists the individuals that requested copies of the Draft EIS either in their public comments or on the sign-up sheet at the public meetings. Requests were made for a hardcopy, a CD, or both. Additionally, it is required that the Draft EIS be sent to certain agencies. Agencies (along with the appropriate individual, if known) who will receive copies of the Draft EIS are listed in Table 5.9. Finally, organizations and businesses (along with the appropriate individual) that will receive copies of the Draft EIS are listed in Table 5.10.

Table 5.8. List of Individuals Requesting Copies of the Draft Environmental Impact Statement

Gina Al bright	Peggy Egan	Pat Henrie	Jay Pace
Arthur Andersen	Laura Fertig	Betsy Herrmann	Mark Page
Caralyn Avenido	Ed Firmage	Tracy Hiscock	Cindy Palmer
Charley No Last Name	John Flatberg	Gary Hodge	Dilbert Palmer
DeLynn Barton	Tom Forsythe	Catherine Ives	Mark Palmer
Robert Blackett	Jeff Frey	Co by Johnson	Roger Pugh
Erik Boron	Jan Frummond	Jim Johnson	John Ruple
Dale Brinkerhuff	Sam Ghosh	Brent Judd	Jeff Salt
Neal Brown	Allen Gilberl	Byard Kershaw	Vince Salvato
Dixie Brunnel	David Goldsmith	Jun Kim	Jake Schoppe
Bobbi Bryant	Melissa Goldsmith	Linda Kollander	John Scribner
Vane Campbell	John Goodell	Liz Kolle	James Sortomme
Jim Case	Mike Gorrell	Marilyn Larson	Dale Spencer
Randy Cearn	Susan Hand	Truman Lynd	Margaret Stewart
Cloyd Chamberlain	Mark Harnes	No First Name MacDonald	Monte Stewart
Sky Channey	Bert Harris	Luci Malin	Phyllis Stewart
Jason Childs	Mark Havnes	Lori Maximenko	Anne Stoenworth
Scott Christensen	Darol Heaton	Norma McKee	Patricia Swapp
Richard Costigan	Heam Heaton	Ryan Miller	Dan Thebean
Dave Cox	Julie Heaton	Gaylen Moore	John Veranth
Duke Cox	Kari Heaton	Marilee Murray	Laner Warky
Dustin Cox	Kevin Heaton	Terry Nelson	Jim Wells
Mel Cox	Leonard Heaton	Brian Nichols	Heather Wood
Paul Cox	Richard Heaton	Frank Nichols	Jim Wood
Trudy Decantu	Vaughn Heaton	Martin Nielson	Monica Wren
Joyel Dhieux	Wade Heaton	Ed Nobibins	Doug No Last Name
Wally Doddi	No First Name Heaton	Del Orme	Mark No Last Name
D. Meloy Dodds	Mary Helsley	Andy Osterhout	Mike No Last Name
Jerry Drummond	Allen Henrie	David Owens	Rich No Last Name

Table 5.9. List of Agencies and Officials (including individual, if known) that will receive copies of the Draft Environmental Impact Statement

DOGM Priscilla Burton	Utah Public Lands Policy Coordination Office Val Payne	Mayor of Panguitch Art Cooper	Bryce Canyon National Park Eddie Lopez
NPS, Bryce Canyon National Park Kristin Legg	City of Alton Mayor Claren Heaton	Utah Division of Wildlife Resources Teresa Bonzo	EPA Larry Svoboda
Office of the Governor John Harja			

Table 5.10. List of Organizations and Businesses (including individual, if known) that will receive copies of the Draft Environmental Impact Statement

Southern Utah Wilderness Alliance Steve Bloch	Garkane Energy Bryant Shakespear	Utah Mining Association David Litvin	National Parks Conservation Association David Nimkin

CHAPTER 6. REFERENCES

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CHAPTER 7. ABBREVIATIONS AND GLOSSARY

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7.1 Abbreviations

ACD	Alton Coal Development, LLC
ADT	average daily traffic
AOC	approximate original contour
AQRC	air quality-related values
AUM	animal unit month
AVF	alluvial valley floor
BLM	Bureau of Land Management
BLM-KFO	Bureau of Land Management-Kanab Field Office
BMP	best management practices
BP	before present
BOCC	birds of conservation concern
Btu	British thermal units
C	central (geographic section of tract)
CCSP	U.S. Climate Change Science Program
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CIAA	cumulative impact assessment area
CIB	Community Impact Fund Board
CO	carbon monoxide
CO_2	carbon dioxide
CRMP	cultural resource management plan
CWA	Clean Water Act
CWN	central western north (geographic section of tract)
CWS	central western south (geographic section of tract)
dBa	A-weighted decibel
DOGM	Utah Division of Oil, Gas, and Mining
DOI	Department of the Interior
DOJ	Department of Justice

EIS	environmental impact statement
EO	Executive Order
EODA	external overburden disposal area
EPA	Environmental Protection Agency
ERMA	Extensive Recreation Management Area
ESA	Endangered Species Act
F	Fahrenheit
FCAOG	Five County Association of Governments
FMU	fire management units
FRCC	fire regime conditions class
GCVTC	Grand Canyon Visibility Transport Commission
GHG	greenhouse gas
GWP	global warming potential
HAP	hazardous air pollutants
IPCC	Intergovernmental Panel on Climate Change
KFO	Kanab Field Office
KOP	key observation points
LBA	Lease by Application
Ldn	day-night sound level
Leq	equivalent continuous noise level
LOS	level of service
mg/L	milligrams per liter
MLA	Mineral Leasing Act
MSHA	Mine Safety and Health Administration
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPS	National Park Service

NRHP	National Register of Historic Places
NW	northwestern (geographic section of tract)
OHV	off-highway vehicle
ONRR	Office of Natural Resources Revenue
OSM	Office of Surface Mining Reclamation and Enforcement
PAP	permit application package
Pb	lead
Ph	measure of the acidity or basicity of a solution
PM_{10}	particulate matter, having particles of 10 micrometers or less
$PM_{2.5}$	particulate matter, having particles less than 2.5 micrometers
PMT	post-mining topography
ppm	parts per million
PPMA	Paunsaugunt Plateau Management Area
PRISM	Parameter-elevation Regressions on Independent Slopes Model
PSD	Prevention of significant deterioration
R2P2	Resource Recovery and Protection Plan
RMP	resource management plan
ROD	record of decision
ROS	recreation opportunity spectrum
ROW	right-of-way
RWPP	regional wildfire protection plan
S	southern (geographic section of tract)
Sa	southern no-coal zone (geographic section of tract)
SESA	socioeconomic study area
SHPO	state historic preservation officer
SMCRA	Surface Mining Control and Reclamation Act
SO_2	sulfur dioxide
SO_x	sulfur oxides
SOP	standard operating procedure(s)
SR	State Road (e.g., SR-20)
SWCA	SWCA Environmental Consultants
SWReGAP	Southwest Regional Gap Analysis Project
TCP	traditional cultural properties

TDS	total dissolved solids
UDAQ	Utah Division of Air Quality
UDNR	Utah Department of Natural Resources
UDOT	Utah Department of Transportation
UDWR	Department of Wildlife Resources
UDWS	Utah Department of Workforce Services
UII	Utah International Inc.
UMNH	Utah Museum of Natural History
UPDES	Utah Pollution Discharge Elimination System
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic carbons
VRM	visual resource management
WSA	wilderness study area
WUI	wildland-urban interface

7.2 Glossary

adverse impacts	An apparent direct or indirect detrimental effect.
airshed	A part of the atmosphere that responds in a coherent way with respect to the dispersion of emissions.
alkalinity	The degree to which the pH of a substance is greater than 7.
alluvial deposits	Deposits of clay, silt, sand, gravel, and/or other materials carried by moving surface water such as streams, and deposited at points of weak water flow; alluvium.
alluvial valley floor	An area of unconsolidated stream-laid deposits holding streams with water availability sufficient for sub-irrigation or flood irrigation agricultural activities (see 30 CFR 701.5).
alluvium	Sorted or semi-sorted sediment consisting of clay, silt, sand, gravel, or other unconsolidated rock material deposited in comparatively recent geologic time by a stream or other body of running water in the bed of that stream or on its floodplain or delta.

alternative	In terms of the National Environmental Policy Act, one of several substitute or alternate proposals being considered by a federal agency in an environmental analysis.
ambient	Surrounding conditions (or environment) in a given place and time.
ammonite	Extinct externally shelled cephalopod related to modern squid and cuttlefish.
angle of influence	Defines the extent of the surface area affected by ground movement that occurs as a result of removing coal from an underground mine where overlying rock layers are no longer supported by underlying coal removed during mining.
annual precipitation	The quantity of water that falls yearly in the form of rain, hail, sleet, and snow.
Aquatic	Living or growing in or on the water.
Aquifer	A layer of permeable rock, sand, or gravel that stores and transmits water in sufficient quantities for a specific use. In hydrology, a rock layer or sequence that contains water and releases it in appreciable amounts. The rocks contain water-filled pores that, when connected, allow water to flow through their matrix. A confined aquifer is overlain by a rock layer that does not transmit water in any appreciable amount or that is impermeable. There probably are few truly confined aquifers. In an unconfined aquifer, the upper surface (water table) is open to the atmosphere through permeable overlying material. An aquifer also may be called a water-bearing stratum, lens, or zone.
Ash	The residual non-combustible matter in coal that comes from included silt, clay, silica, or other substances. The lower the ash content, the better the coal quality.
Backfill	The act of refilling an excavation. Also, the material placed in an excavation when it is refilled.
Baseline	Conditions, including trends, existing in the human environment before a proposed action has started; a benchmark state from which the environmental consequences of an action are forecast; the No Action Alternative.
Beneficial impact	An apparent direct or indirect advantageous effect.
Bentonite	An absorptive and colloidal clay used especially as a sealing agent or suspending agent formed by the decomposition of volcanic ash that has the ability to absorb large amounts of water and to expand to several times its normal volume; used in adhesives, cements and ceramic fillers.
Big game	Indigenous ungulate wildlife species that are hunted (e.g., elk, deer, bison, bighorn sheep, and pronghorn).

Biological soil crust (or cryptobiotic crust)	Biological communities that form a surface layer or crust on some soils. These communities consist of cyanobacteria (blue-green bacteria), micro fungi, mosses, lichens, and green algae, and perform many important functions, including fixing nitrogen and carbon, maintaining soil surface stability, and preventing erosion. Biological soil crusts also influence the nutrient levels of soils and the status and germination of plants in the desert. These crusts are slow to recover after severe disturbance.
Bonus bid	That value in excess of the rentals and royalties that is paid to the United States as part of the consideration for receiving a lease for publicly owned minerals [see 43 CFR 3400.0-5©].
Buffer zone	An area between two different land uses that is intended to resist, absorb, or otherwise preclude development or intrusion between the two use areas.
Category 1	Substantial biological information on file to support the appropriateness of proposing to list as endangered or threatened.
Category 2	Current information indicates that proposing to list as endangered or threatened is possibly appropriate, but substantial biological information is not on file to support an immediate ruling (USFWS).
Cenomanian	The first of six main divisions (in ascending order) in the Upper Cretaceous series, representing rocks deposited worldwide during the Cenomanian Age, which occurred 99.6 to 93.5 million years ago during the Cretaceous Period. Rocks of the Cenomanian overlie those of the Albian and underlie rocks of the Turonian ages.
Class I areas (air quality)	Airsheds of special national or regional natural, scenic, recreational, or historic value for which the PSD regulations provide special protection (e.g., little to no development). Class I areas include national parks larger than 6,000 acres, national wilderness areas larger than 5,000 acres, and international parks and national memorial parks larger than 5,000 acres.
Class II areas (air quality)	All other clean airsheds (in attainment of the NAAQS) where development is permitted under state authority.
Coal bed CH_4	Natural gas (CH_4) that is generated during the coal-forming process.
Colluvium	Rock fragments, sand, or soil material that accumulates at the base of slopes; slope wash.
Confluence	The point at which two or more streams meet.
Conglomerate	A rock that contains rounded rock fragments or pebbles cemented together by another mineral substance.
Conservation agreement	A formal written document agreed to by the USFWS and/or the National Marine Fisheries Service and another federal agency, state agency, local government, or private organization to achieve the conservation of candidate species or other special status species through voluntary cooperation. It documents the specific actions and responsibilities to which each party agrees to be accountable. The objective of a conservation agreement is to reduce threats to a special status species or its habitat. An effective conservation agreement may lower a species' listing priority or eliminate the need for listing.

Conservation strategy	A strategy outlining current activities or threats that are contributing to the decline of a species, along with the actions or strategies needed to reverse or eliminate such a decline or threats. Conservation strategies are generally developed for species of plants and animals that are designated as Bureau of Land Management–sensitive species or that USFWS or NOAA Fisheries have determined to be federal candidates under the ESA.
Contiguous	Lands or legal subdivisions having a common boundary (lands having only a common corner are not contiguous).
Cooperating agency	An agency that has jurisdiction by law in an action being analyzed in an environmental document and that is requested to participate in the NEPA process by the agency that is responsible for preparing the environmental document [see 40 CFR 1501.6 and 1508.5].
Cretaceous	Of or belonging to the geologic time, system of rocks, and sedimentary deposits of the third and last period of the Mesozoic Era, characterized by the development of flowering plants and ending with the sudden extinction of the dinosaurs and many other forms of life.
Crucial habitat	Any particular range or habitat component that directly limits a community, population, or subpopulation to reproduce and maintain itself at a certain level over the long term. Such habitat includes sensitive use areas that, because of limited abundance and/or unique qualities, constitute irreplaceable critical requirements for high-interest wildlife. It may also include highly sensitive habitats, including fragile soils that have little or no reclamation potential. Restoration or replacement of these habitats may not be possible. Examples include the most crucial (critical) summer and/or winter range or concentration areas; critical movement corridors; breeding and rearing complexes; spawning areas; developed wetlands; Class 1 and 2 streams, lakes, ponds, or reservoirs; and riparian habitats critical to high-interest wildlife.
Crucial wildlife habitat	Parts of the habitat necessary to sustain a wildlife population during periods of their life cycle. It may be a limiting factor on the population, such as nesting habitat or winter habitat.
Crucial winter range	The portion of the winter range to which a wildlife species is confined during periods of heaviest snow cover.
Cultural resources	The remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that reveal the nature of historic and prehistoric human events. These resources consist of 1) physical remains, 2) areas where significant human events occurred, and 3) the environment immediately surrounding the resource.
Cumulative impact	The impact on the environment that 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 actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

decibel	A unit of sound measurement. In general, a sound doubles in loudness for every increase of 10 decibels.
Desired wildland fire condition (DWFR)	The desired condition of a vegetative community as it relates to susceptibility from severe fire effects (e.g., the loss of key ecosystem components—soil, vegetation structure, species; or alteration of key ecosystem processes—nutrient cycles, hydrologic regimes).
Direct impact	An impact caused by an action that occurs at the same time and place as the action (40 CFR 1508.8).
discharge	Any of the ways that groundwater comes out of the surface, including through springs, creeks, or being pumped from a well.
dispersion model domain	The analysis area for air resources, which consists of an approximately 150-km area surrounding the tract.
Endangered species	Any species that is in danger of extinction throughout all or a significant portion of its range (from M6840, Special Status Species Manual).
Eocene	Of or belonging to the geologic time, rock series, or sedimentary deposits of the second epoch of the Tertiary Period, characterized by warm climates and the rise of most modern mammalian families.
Ephemeral stream	A stream that flows occasionally because of surface runoff, and is not influenced by permanent groundwater.
Erosion	The wearing away of the land surface by running water, wind, ice, or other geologic agents.
Evapotranspiration	The sum total of water lost from the land by evaporation and plant transpiration.
Excavation	The scientifically controlled recovery of subsurface materials and information from a cultural site. Recovery techniques are relevant to research problems and are designed to produce maximum knowledge about the site's use, its relation to other sites and the natural environment, and its significance in the maintenance of the cultural system.
Fair market value	The amount in cash (or in terms reasonably equivalent to cash) for which in all probability a coal deposit would be sold or leased by a knowledgeable owner willing, but not obligated, to sell or lease to a knowledgeable purchaser who desires, but is not obligated, to buy or lease.
Fire management plan	A plan that identifies and integrates all wildland fire management and related activities within the context of approved land/resource management plans. It defines a program to manage wildland fires (wildfire, prescribed fire, and wildland fire use). The plan is supplemented by operational plans, including, but limited to, preparedness plans, preplanned dispatch plans, and prevention plans. Fire management plans assure that wildland fire management goals and components are coordinated.

Fire regime	Description of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects, in a given area or ecosystem. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval.
FRCC	Depiction of the degree of departure from historical fire regimes, possibly resulting in alternations of key ecosystem components. These classes categorize and describe vegetation composition and structure conditions that currently exist inside the fire regime groups. Based on the coarse-scale national data, they serve as generalized wildfire rankings. The risk of loss of key ecosystem components from wildfires increases from Condition Class 1 (lowest risk) to Condition Class 3 (highest risk).
Fixed carbon	In coal, the solid combustible material remaining after removal of moisture, ash, and volatile matter. It is expressed as a percentage.
Floodplain	The relatively flat area or lowland adjoining a body of flowing water, such as a river or stream, that is covered with water when the river or stream overflows its banks.
Forage	Vegetation used for food by wildlife, particularly big game wildlife, and domestic livestock.
Formation	A rock body distinguishable from other rock bodies and useful for mapping or description. Formations may be combined into groups or subdivided into members.
Fossil	The remains or traces of an organism or assemblage of organisms that have been preserved by natural processes in the earth's crust. Many minerals that may be of biologic origin are not considered to be fossils (e.g., oil, gas, asphalt, limestone).
fugitive dust	Small-diameter dust particles from the action of prevailing winds, the turbulence caused by moving machinery and trucks, or both.
Glare	Compromised vision due to very bright light (such as direct or indirect sunlight or artificial light).
greenhouse gas	A gas in an atmosphere that absorbs and emits radiation within the thermal infrared range; naturally occurring GHGs include water vapor, CO_2, CH_4, nitrous oxide (N_2O), and ozone (O_3).
Groundwater	Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.
Habitat	A place where a plant or animal naturally or normally lives and grows.
Habitat	The place where an organism (plant or animal) lives. There are four major divisions of habitat, namely terrestrial, freshwater, estuarine, and marine.
Hazardous air pollutants (HAP)	Air pollutants that are not part of the NAAQS, but are often brought forward for analysis if their levels would be elevated by a proposed project.

Hazardous materials	Substance that, because of its potential for corrosivity, toxicity, ignitability, chemical reactivity, or explosiveness, may cause injury to persons or damage to property.
Hazardous waste	Those materials defined in Section 101 (14) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, and listed in 40 CFR 261. A used or discarded material that can damage the environment and be harmful to human health. Hazardous wastes include heavy metals and toxic chemicals used in industrial products and processes as well as infectious medical wastes and radioactive materials such as spent nuclear fuel rods.
High-value habitat	Any particular habitat that sustains a community, population, or subpopulation. It includes intensive use areas that because of relative wide distribution do not constitute crucial (Utah Division of Wildlife Resources critical) values but are highly important to high-interest wildlife. It may also include moderately sensitive habitats of high-interest species that have low reclamation potential, and Class 3 streams, lakes, ponds, or reservoirs. Reconstruction or enhancement of these areas may be possible, but should be avoided if not possible. Examples include less crucial (critical) but more widely distributed summer and/or winter ranges, important feeding areas, areas of high wildlife diversity and/or density of high-interest species, natural wetlands, and all other riparian areas.
Holocene	Of or belonging to the geologic time, rock series, or sedimentary deposits of the more recent of the two epochs of the Quaternary Period, beginning at the end of the last Ice Age approximately 11,000 years ago and characterized by the development of human civilizations.
Human environment	The natural and physical environment in which humans preside or have an impact and the relationship of people with the surrounding environment (30 CFR 1508.14).
hydraulic conductivity	The capacity of a medium to transmit water; permeability coefficient. Expressed as the volume of water at the prevailing temperature that will move in unit time under a unit hydraulic gradient through a unit area. Units include gallons per day per square foot, centimeters per second.
Hydric soil	A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (water-loving) vegetation. Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.
Hydrocarbon	Any organic compound, gaseous, liquid, or solid, consisting solely of carbon and hydrogen.
Hydrology	The science dealing with the behavior of water as it occurs in the atmosphere, on the surface of the ground, and underground.
Hydrology	The science dealing with the properties, distribution, and circulation of water.

Hydrophytic vegetation	The plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. When hydrophytic vegetation comprises a community where indicators of hydric soils and wetland hydrology also occur, the area has wetland vegetation.
Impacts (or effects)	Environmental consequences (the scientific and analytical basis for comparison of alternatives) as a result of a proposed action. Effects may be either direct, which are caused by the action and occur at the same time and place, or indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable or cumulative.
Impermeable	Not capable of transmitting fluids or gasses in appreciable quantities.
Incised	Having a margin that is deeply and sharply notched.
Indirect impact (or secondary)	A reasonably foreseeable impact resulting from an action but occurring later in time than or removed in distance from that action (40 CFR 1508.8).
initial attack	An aggressive suppression action consistent with fire-fighter and public safety and values to be protected.
In-place coal reserves	The estimated volume of all of the coal reserves in a lease without considering economic or technological factors that might restrict mining.
Interburden	A layer of sedimentary rock that separates two mineable coal beds.
Interdisciplinary	Characterized by participation or cooperation among two or more disciplines or fields of study.
Intermittent stream	A stream that does not flow year-round but has some association with groundwater for surface or subsurface flow.
Key observation point	Critical viewpoints of typical landscapes in a project area (in this case, the tract) that have been selected to represent the views of disturbances throughout the life of the mine and that are encountered by the greatest number of people.
Konservat-Lagerstatte	A locality or geologic horizon with exceptionally good fossil preservation, generally exhibiting soft tissue and other organic structures.
Land and resource management plan	A land-use plan that directs the use and allocation of USFS lands and resources.
Lead agency	The agency or agencies preparing or having taken primary responsibility for preparing an environmental document (40 CFR 1508.16).
lease	A legal document executed between a mineral owner or lessor and another party or lessee that grants the lessee the right to extract minerals from the tract of land for which the lease has been obtained [43 CFR 3400.0-5®].
Lek	A traditional breeding area for grouse species where territorial males display and establish dominance, or an assembly area where birds, especially Greater Sage-grouse, carry on display and courtship behavior.

Lenticular	Term describing a body of rock or earth that thins out in all directions from the center like a double convex optical lens.
Lightscape	Characterized by the natural rhythm of sun and moon cycles, clean air, and dark nights unperturbed by artificial lights.
Limestone	A sedimentary rock consisting chiefly of calcium carbonate.
Lumens	An unit of measurement that measures the power of light perceived by the human eye.
Maximum economic recovery	The requirement that based on standard industry operating practices, all profitable portions of a leased federal coal deposit must be mined. MER determinations will consider existing proven technology; commercially available and economically feasible equipment; coal quality, quantity, and marketability; safety, exploration, operating, processing, and transportation costs; and compliance with applicable laws and regulations [43 CFR 3480.0-5(a)(24)].
Mesozoic	Of, belonging to, or designating the era of geologic time that includes the Triassic, Jurassic, and Cretaceous periods and is characterized by the development of flying reptiles, birds, and flowering plants, and by the appearance and extinction of dinosaurs.
CH_4	A colorless, odorless, and flammable gaseous hydrocarbon; the simplest hydrocarbon; chemical formula=CH_4. It is the product of decomposition of organic matter and of the carbonization of coal, is used as a fuel and as a starting material in chemical synthesis, and is the simplest of the alkanes. It is a constituent of natural gas and is also found associated with crude oil and coal.
Mineable coal	Coal that can be economically mined using present day mining technology.
Mining permit	A permit to conduct surface coal mining and reclamation operations issued by the state regulatory authority pursuant to a state program or by the Secretary pursuant to a federal program (30 CFR 701.5).
mitigation	An action to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.
Mitigation	A method or process by which impacts from actions may be made less injurious to the environment through appropriate protective measures. 40 CFR 1508.20 further defines mitigation as 1) avoiding the impact altogether by not taking a certain action or parts of an action; 2) minimizing an impact by limiting the degree or magnitude of the action and its implementation; 3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; 4) reducing or eliminating the impact over time by preservation and maintenance; and 5) compensating for the impact by replacing or providing substitute resources or environments.
Mudstone	A hardened sedimentary rock consisting of clay. It is similar to shale but lacks distinct layers.

NAAQS	Standards set by the Clean Air Act for pollutants considered harmful to public health and the environment. They consist of CO, lead, nitrogen dioxide, PM (PM_{10} and $PM_{2.5}$), ozone, and SO_2.
NRHP	A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, and culture maintained by the Secretary of the Interior. Expanded as authorized by Section 2(b) of the Historic Sites Act of 1935 (16 USC 462) and Section 101(a)(1) (A) of the NHPA.
Native species	Wild animals and plants that have evolved in a particular region and environment. Native species are the most adapted to the area and are more disease and drought resistant than non-native species. Native plants provide the greatest benefits to wildlife because the native wildlife evolved with native plants. Often the food provided by native plants is the most nutritious to our native wildlife.
NEPA process	All measures necessary for compliance with the National Environmental Policy Act of 1969 (40 CFR 1508.21).
No Action Alternative	An alternative where no activity would occur. The development of a no action alternative is required by regulations implementing the National Environmental Policy Act (40 CFR 1502.14). The No Action Alternative provides a baseline for estimating the effects of other alternatives.
nonattainment	A designated air quality area or airshed that exceeds a NAAQS. Areas with levels of a criteria pollutant below the health-based standard are designated as “attainment.”
OHV	Any motorized vehicle capable of, or designed for, travel on or immediately over land, water, or other natural terrain, excluding 1) any non-amphibious registered motorboat; 2) any military, fire, emergency, or law enforcement vehicle while being used for emergency purposes; 3) any vehicle whose use is expressly authorized by the authorized officer or otherwise officially approved; 4) vehicles in official use; and 5) any combat or combat support vehicle when used for national defense (from H-1601-1, BLM Land-use Planning Handbook).
outcrop	A rock formation that appears at or near the surface; the intersection of a rock formation with the surface.
overburden	Overburden is the term used in mining to describe material above (excluding topsoil) the area of economic interest, e.g., the rock and soil above the coal seam. Also known as 'waste'. Overburden is distinct from tailings, the material that remains after economically valuable components have been extracted from the generally finely milled ore. Overburden is removed during surface mining, but is typically not contaminated with toxic components and may be used to restore a mining site to a semblance of its appearance before mining began. Overburden may also be used as a term to describe all soil and ancillary material above the bedrock horizon in a given area.
Paleogene	The older of two subdivisions of the Tertiary Period, including the Paleocene, Eocene, and Oligocene Epochs.

paleontological resource	A site containing evidence of plant or non-human animal life of past geological periods, usually in the form of fossil remains.
PM	Complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.
peak discharge	The highest discharge of water recorded over a specified period of time at a given stream location; also called maximum flow. Often thought of in terms of spring snowmelt, summer, fall, or winter rainy season flows.
perennial species	Vegetation that lives over from season to season.
perennial stream	A stream or part of a stream that flows continuously during the calendar year as a result of groundwater discharge or surface runoff.
permeability	The ability of rock or soil to transmit a fluid.
permit application package	A proposal to conduct surface coal mining and reclamation operations on federal lands, including an application for a permit, permit revision, or permit renewal and all the information required by SMCRA, the applicable state program, any applicable cooperative agreement, and all other applicable laws and regulations including, with respect to federal leased coal, the MLA and its implementing regulations.
permit area	The area of land, indicated on the approved map submitted by the operator with his or her application, required to be covered by the operator's performance bond under the regulations at 30 CFR 800 and that shall include the area of land upon which the operator proposes to conduct surface coal mining and reclamation operations under the permit, including all disturbed areas (30 CFR 701.5).
physiography	Physical geography
Pleistocene	Of or belonging to the geologic time, rock series, or sedimentary deposits of the earlier of the two epochs of the Quaternary Period, characterized by the alternate appearance and recession of northern glaciation, the appearance and worldwide spread of hominids, and the extinction of numerous land mammals, such as the mammoths, mastodons, and saber-toothed tigers.
predator	An animal that obtains food by killing and consuming other animals.
prescribed burning	Application of prescribed fire.
prescribed fire	The intentional application of fire to wildland fuels in either their natural or modified state under conditions that will allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, etc.). Any fire ignited by management actions under certain, predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Prevention of significant deterioration (PSD)	Regulations promulgated by the EPA to further protect and enhance air quality. They use an incremental approach and are intended to help maintain good air quality in area that attain that NAAQS and to provide special protections for national parks.
Proboscidean	Any member of the elephant family.
proper functioning condition (PFC)	1) An element of the Fundamentals of Rangeland Health for watersheds, and therefore a required element of state or regional standard and guidelines under 43 CFR §4180.2(b). 2) A condition in which vegetation and ground cover maintain soil conditions that can sustain natural biotic communities. For riparian areas, the process of determining function is described in BLM Technical Reference (TR) 1737-9. 3) Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality; filter sediment, capture bed load, and aid floodplain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action; develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity. The functioning condition of riparian-wetland areas is influenced by geomorphic features, soil, water, and vegetation. 4) Uplands function properly when the existing vegetation and ground cover maintain soil conditions capable of sustaining natural biotic communities. The functioning condition of uplands is influenced by geomorphic features, soil, water, and vegetation. See also, Nonfunctioning Condition and Functioning at Risk (from H-4180-1, BLM Rangeland Health Standards).
Proposed Action	In terms of NEPA, the project, activity, or action that a federal agency proposes to implement or undertake and that is the subject of an environmental analysis. In this EIS Alternative B is the Proposed Action.
raptor	Bird of prey, such as an eagle, falcon, hawk, owl, or vulture.
recharge	The processes by which groundwater is absorbed into a zone of saturation.
reclamation	Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, replacement of topsoil, revegetation (with native plant life), and other work necessary to restore the disturbed area for post-mining use. In general and where viable, an attempt to put the terrain back to the pre-mining contours is also of paramount importance.
Record of Decision	A document separate from, but associated with, an EIS that publicly and officially discloses the responsible official's decision on the proposed action (see 40 CFR 1505.2).
recoverable coal	The amount of coal that (is economically feasible to recover) can actually be recovered for sale from the demonstrated coal reserve base.
rental payment	Annual payment from a lessee to a lessor to maintain the lessee’s mineral lease rights.

resource management plan	A land-use plan prescribed by Federal Land Policy and Management Act that directs the use and allocation of public lands and resources managed by BLM. Prior to selection of the RMP, different alternative management plans are compared and evaluated in an EIS to determine which plan will best direct the management of the public lands and resources.
revegetation	The reestablishment and development of self-sustaining plant cover following land disturbance. This may occur through natural processes, or the natural processes may be enhanced by human assistance through seedbed preparation, reseeding, and mulching.
ROW	The right to pass over property owned by another. The strip of land over which facilities such as roadways, railroads, or power lines are built.
riparian	The area adjacent to rivers and streams that lies between the stream channel and upland terrain and that supports specific vegetation influenced by perennial and/or intermittent water.
riparian area	A form of wetland transition between permanently saturated wetlands and upland areas. A riparian area is defined as an area of land directly influenced by permanent (surface or subsurface) water. Riparian areas exhibit vegetation or physical characteristics that reflect the influence of permanent surface or subsurface water. Typical riparian areas include lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, hanging gardens, and areas surrounding seeps and springs. Excluded are ephemeral streams or washes that lack vegetation and depend on free water in the soil.
royalty	A share of production that is free of the expense of production. It is generally paid by a lessee to a lessor of a mineral lease as part of the terms of the lease.
runoff	That portion of rainfall that is not absorbed; it may be used by vegetation, lost by evaporation, or it may find its way into streams as surface flow.
salinity	Refers to the solids such as sodium chloride (table salt) and alkali metals that are dissolved in water. In non-saltwater areas, the term “TDS” is often used as an equivalent term.
sandstone	A common sedimentary rock primarily composed of sand grains, mainly quartz, that are cemented together by other mineral material.
scoping	A public informational process required by NEPA to determine private and public concerns, scope of issues, and/or questions regarding a proposed action to be evaluated in an EIS.
sedimentation pond	An impoundment used to remove solids from water to meet water quality standards or effluent limitations before the water leaves the permit area (30 CFR 701.5).
sensitive noise receptor	Receptors that only consider noise as it relates to the human environment, for example, residences, hospitals, libraries, recreation areas, churches, etc.

sensitive species	Those species designated by a state director, usually in cooperation state natural heritage programs and the state agency responsible for managing the species as sensitive. They are those species that 1) could become endangered in or extirpated from a state, or within a significant portion of its distribution; 2) are under status review by USFWS and/or National Marine Fisheries Service; 3) are undergoing significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution; 4) are undergoing significant current or predicted downward trends in population or density such that federal listed, proposed, or candidate or state listed status may become necessary; 5) typically have small and widely dispersed populations; 6) inhabit ecological refugia or other specialized or unique habitats; or 7) are state listed but which may be better conserved through application of BLM sensitive species status.
septarian	Carbonate concretionary mass formed in shale with hollow or crystal filled interiors. Sedimentary equivalent of geodes, which are mostly volcanic in origin.
Sevier Thrust Belt	Zone of low angle faulting- and folding-caused uplift that follows the Wasatch Front and that was active in the Cretaceous.
shale	A very fine-grained clastic rock or sediment consisting predominately of clay-sized particles.
significant impact	A qualitative term used to describe the anticipated importance of impacts to the human and or the environment as a result of a direct or indirect action (or actions).
siltstone	A fine-grained clastic rock consisting predominately of silt-sized particles.
skyglow	The wide-scale illumination of the night sky or parts of it. The most common cause of skyglow is artificial light that emits light pollution.
socioeconomics	The social and economic situation that might be affected by a proposed action.
soil survey	The systematic examination, description, classification, and mapping of soils in an area, usually a county. Soil surveys are classified according to the level of detail of field examination. Order I is the most detailed and Order V is the least detailed.
special status species	Includes proposed species, listed species, and candidate species under the ESA; state-listed species; and BLM state director-designated sensitive species (see BLM Manual 6840, Special Status Species Policy).
stipulations	Requirements that are part of the terms of a mineral lease. Some stipulations are standard on all federal leases. Other stipulations may be applied to specific leases at the discretion of the surface management agency to protect valuable surface resources or uses existing on those leases.
stratigraphic	Of, relating to, or determined by stratigraphy, which is the branch of geology dealing with the study of the nature, distribution, and relations of layered rocks in the earth’s crust.

strutting ground	An area used by Greater Sage-grouse in early spring for elaborate, ritualized courtship displays (see also Lek).
subbituminous	A lower rank of coal (35%–45% carbon) with a heating value between that of bituminous and lignite, usually 8,300 to 11,500 BTU per pound. Sub-bituminous coal contains a high percentage of volatile matter and moisture.
surface disturbance	Greater than casual-use actions created through mechanized or mechanical means that would cause soil mixing and result in alteration or removal of soil and vegetation, exposing the mineral soil to erosive processes to the extent that reclamation may be required. These actions may include the use of mechanized earth-moving equipment; truck-mounted drilling equipment; geophysical exploration; vehicle travel off routes in areas designated as limited or closed to OHV use; placement of surface facilities such as utilities, pipelines, structures, and oil and gas wells; new road construction; and use of pyrotechnics, explosives, and hazardous chemicals.
suspended solids	The very fine soil particles that remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.
threatened and endangered species	These species of plants or animals classified as threatened or endangered pursuant to Section 4 of the ESA. Any species that is in danger of extinction, or is likely to become so within the foreseeable future.
timing limitation	A fluid minerals leasing constraint that prohibits surface use during specified time periods to protect identified resource values. The constraint does not apply to the operation and maintenance of production facilities unless analysis demonstrates that such constraints are needed and that less stringent, project-specific constraints would be insufficient.
topography	Physical shape of the ground surface; the configuration of land surface including its relief, elevation, and the position of its natural and human-made features.
topsoil	The upper portion of a soil, usually dark colored and rich in organic material. It is more or less equivalent to the upper portion of an A horizon in an ABC soil.
TDS	The total quantity in milligrams per liter of dissolved materials in water.
uranium	A very hard, heavy, metallic element that is crucial to development of atomic energy.
vegetation type	A kind of existing plant community with distinguishable characteristics described in terms of the present vegetation that dominates an area.
vertebrate fossils	The fossilized remains of animals that possessed a backbone; examples are fish, amphibians, reptiles, dinosaurs, birds, and mammals.
VRM	The systematic means to identify visual values, establish objectives that provide the standards for managing those values, and evaluate the visual impacts of proposed projects to ensure that objectives are met.

visual resources	The physical features of a landscape that can be seen (e.g., land, water, vegetation, structures, and other features).
waterfowl	A bird that frequents water, especially a swimming bird such as a duck or swan.
wetlands	Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs (33 CFR 328.3[a][7][b]).
wild and scenic rivers	Rivers or sections of rivers designated by Congressional actions under the 1968 Wild and Scenic Rivers Act as wild, scenic, or recreational by an act of the Legislature of the state or states through which they flow. Wild and scenic rivers may be classified and administered under one or more of the following categories: **Wild river areas**: Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America. **Scenic river areas**: Rivers or sections of rivers that are free of impoundments, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. **Recreational river areas**: Rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.
wilderness	An area of undeveloped federal land designated wilderness by Congress, retaining its primeval character and influence, without permanent improvements or human habitation, protected and managed to preserve its natural conditions and that 1) generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable, 2) has outstanding opportunities for solitude or primitive and unconfined recreation, 3) has at least 5,000 acres or is of sufficient size to make practical its preservation and use in an unimpaired condition, and 4) also may contain features that are of ecological, geological, scientific, educational, scenic, or historical value. These characteristics were identified by Congress in the Wilderness Act of 1964.
wildfire	An unplanned, unwanted wildland fire including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.
wildfire suppression	An appropriate management response to wildfire, escaped wildland fire use, or prescribed fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire.

wildland fire	A non-structure fire, other than prescribed fire, that occurs in the wildland. Any fire originating from unplanned ignition.
wildland fire use	The application of the appropriate management response to naturally ignited wildland fires to accomplish specific resource management objectives in pre-defined designated areas outlined in fire management plans.
WUI	The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

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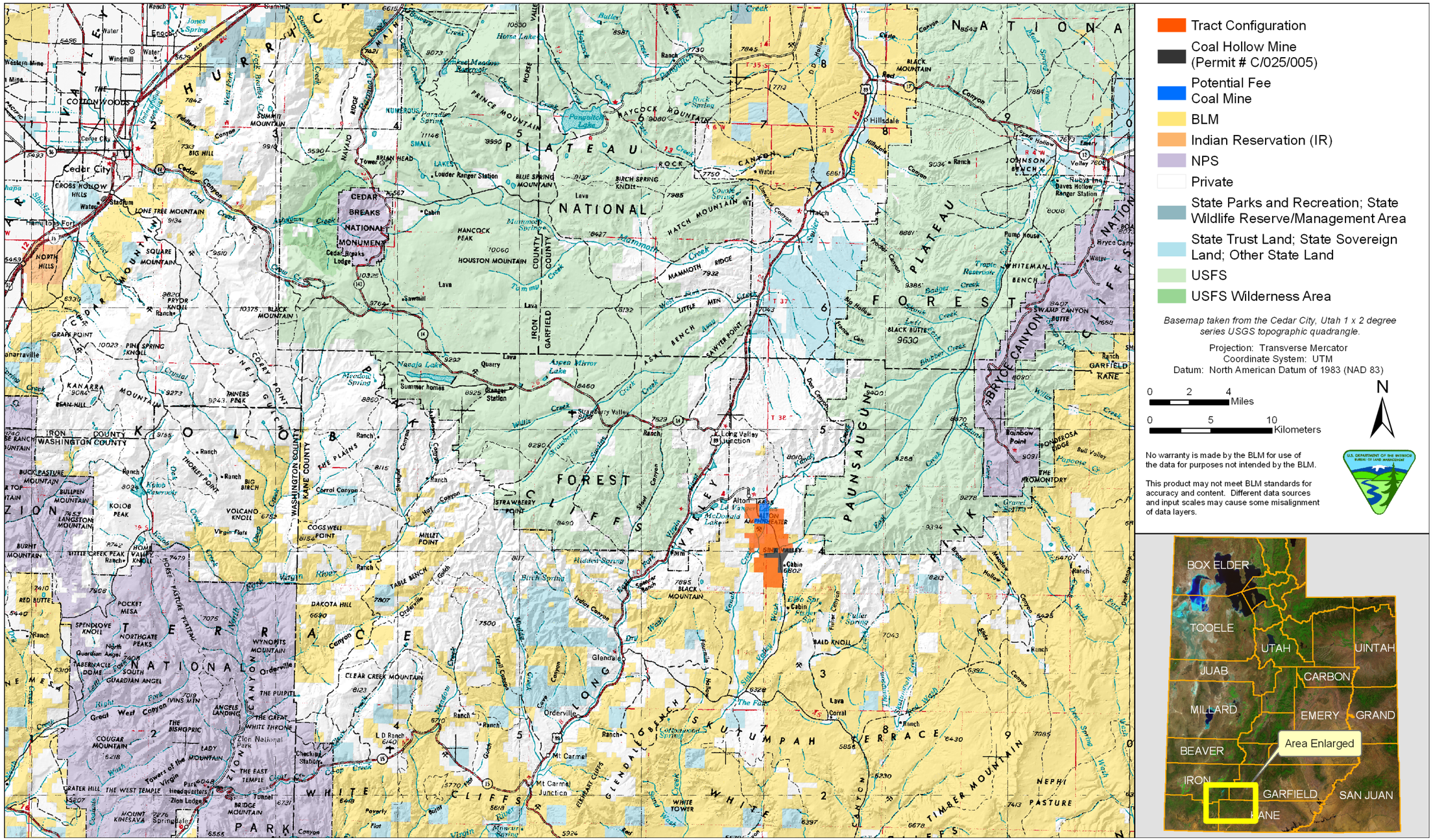
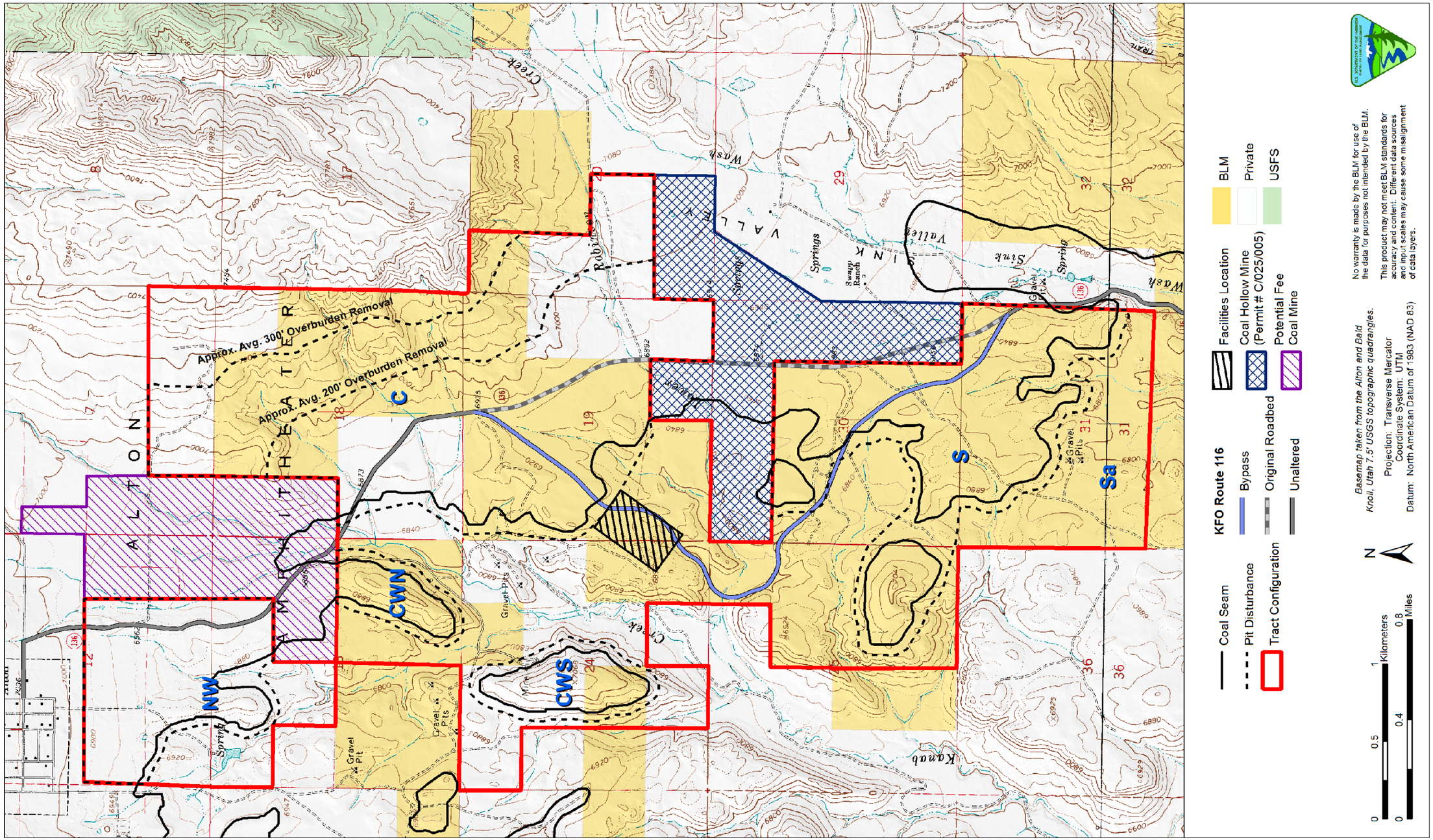
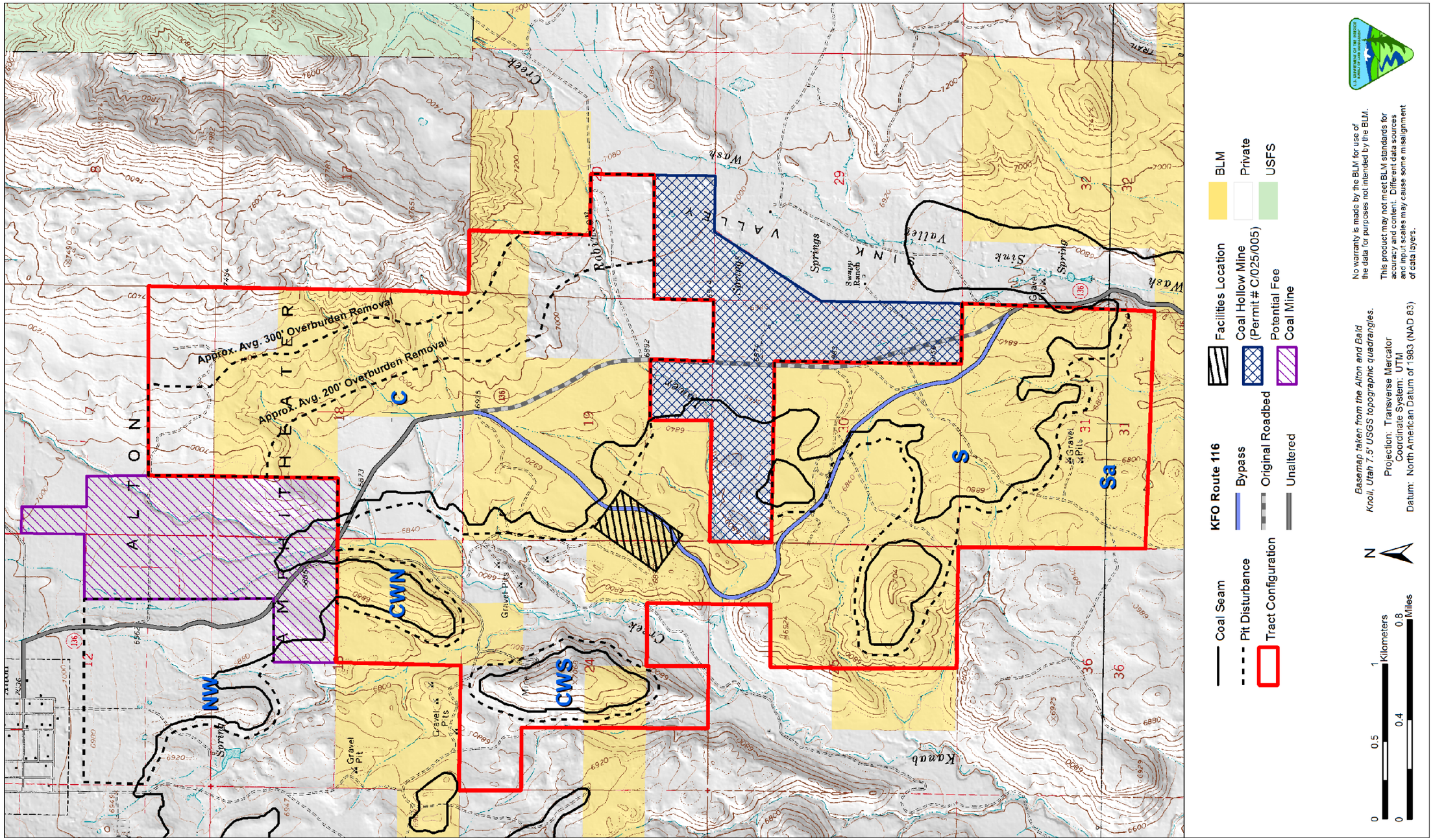
APPENDIX A.
MAPS



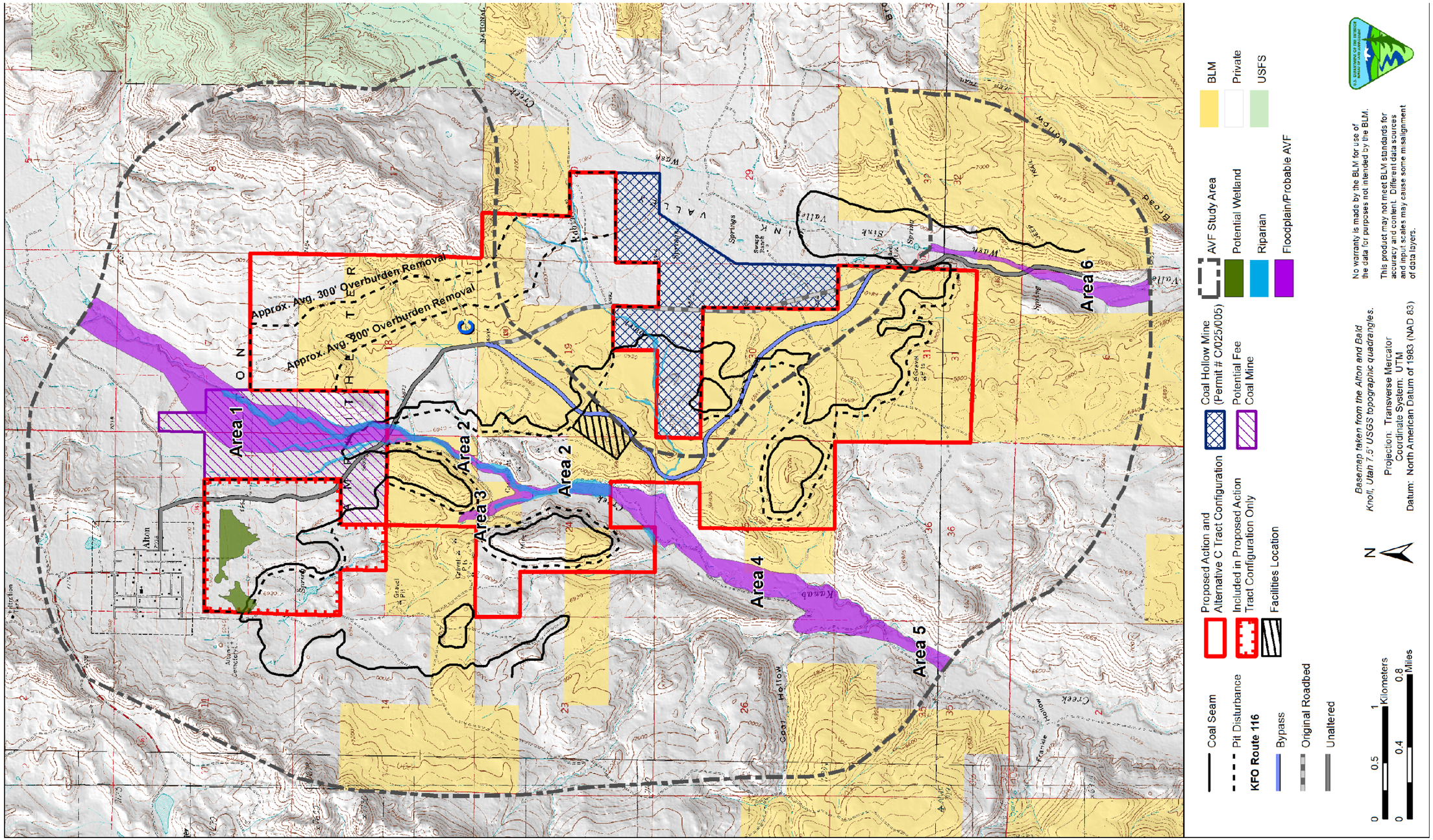
Map 1.1. Alton Coal Tract (Proposed Action) in relation to the Town of Alton and other area landmarks.



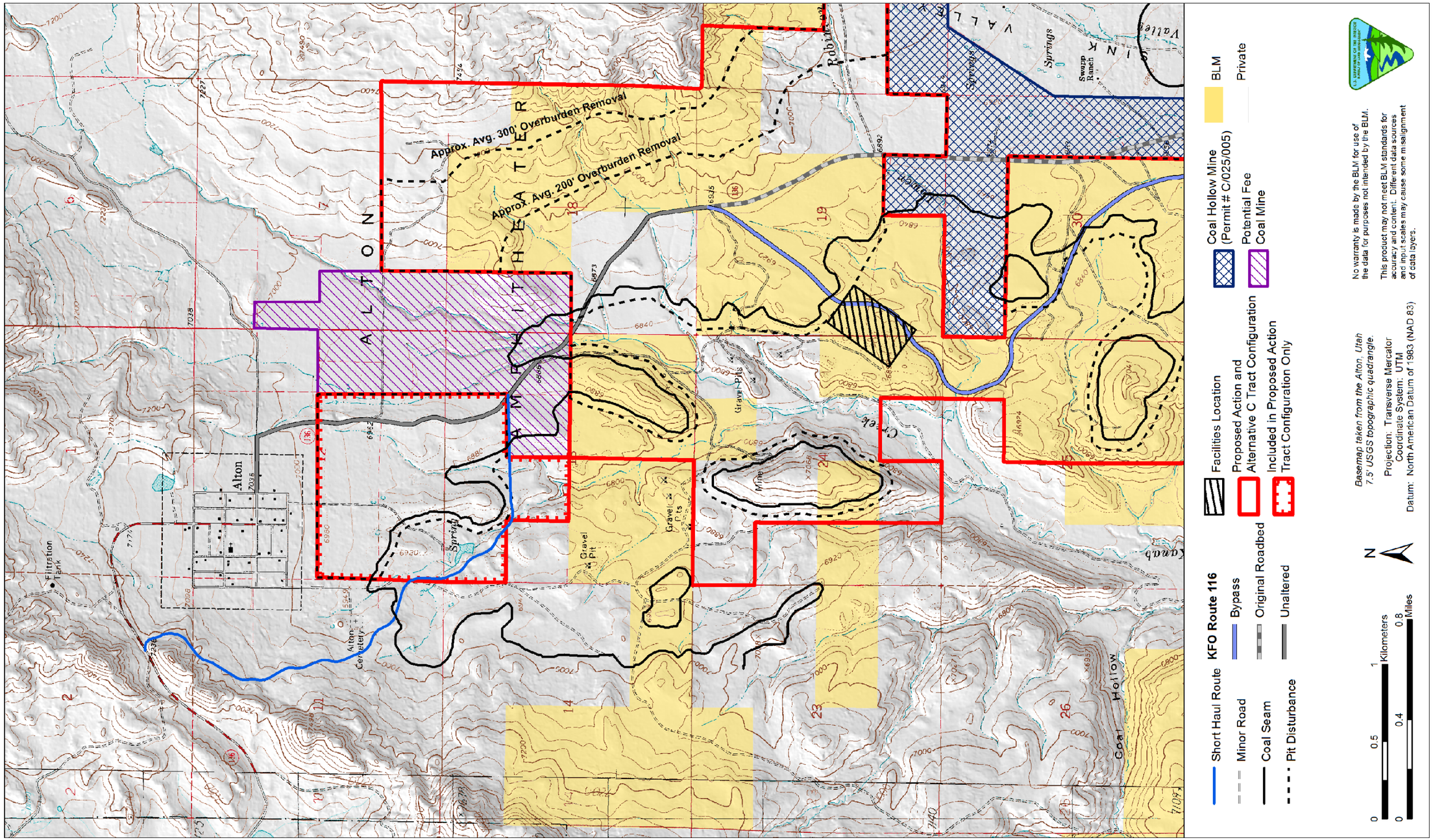
Map 1.2. Alton Coal Tract configuration and land ownership under Alternative B (Proposed Action).



Map 2.1. Alton Coal Tract configuration and land ownership under Alternative C.



Map 2.2. Potential wetlands, floodplains, and probable alluvial valley floors, in addition to the alluvial valley floor study area, in relation to the Alton Coal Tract**.**



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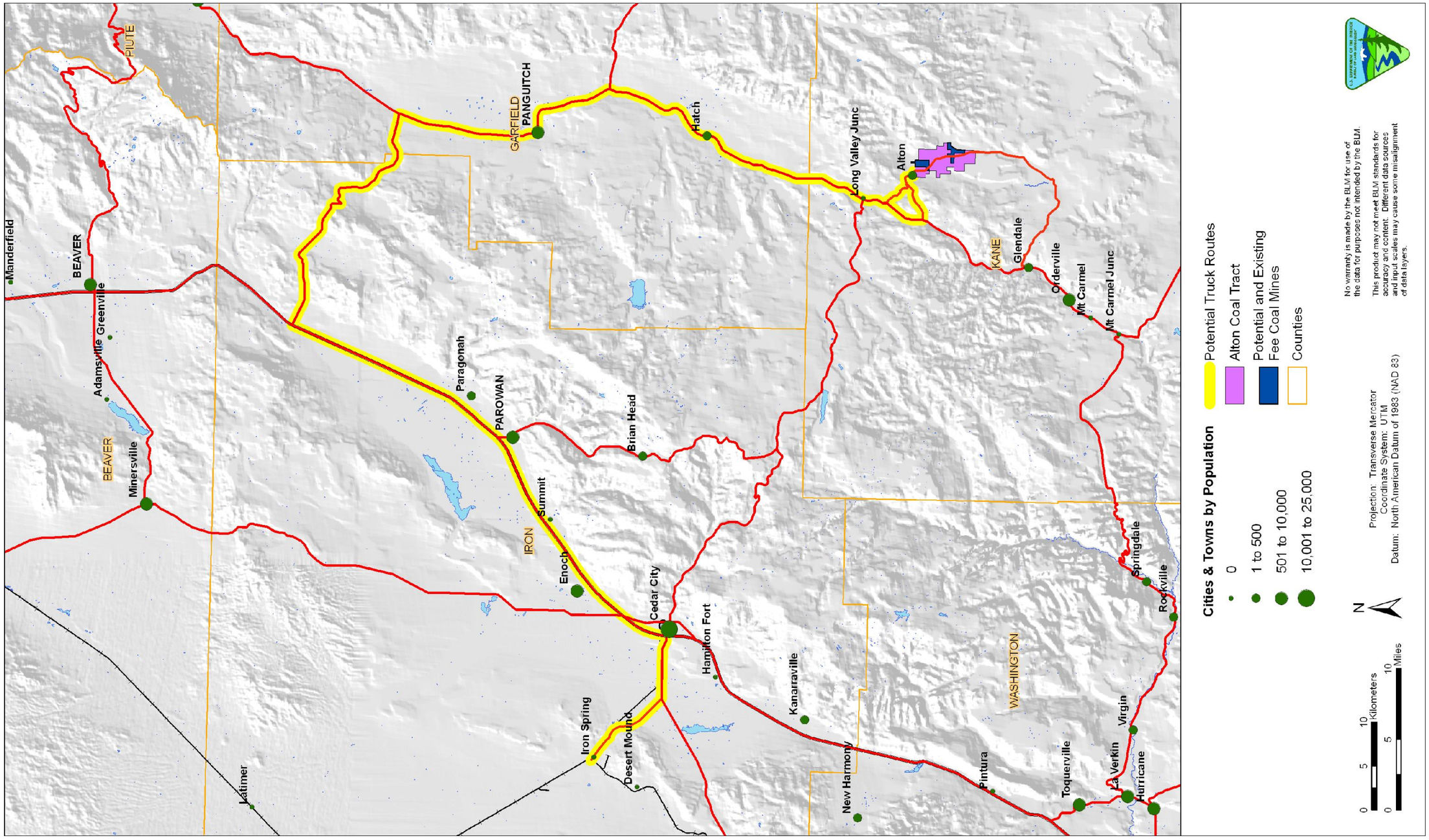
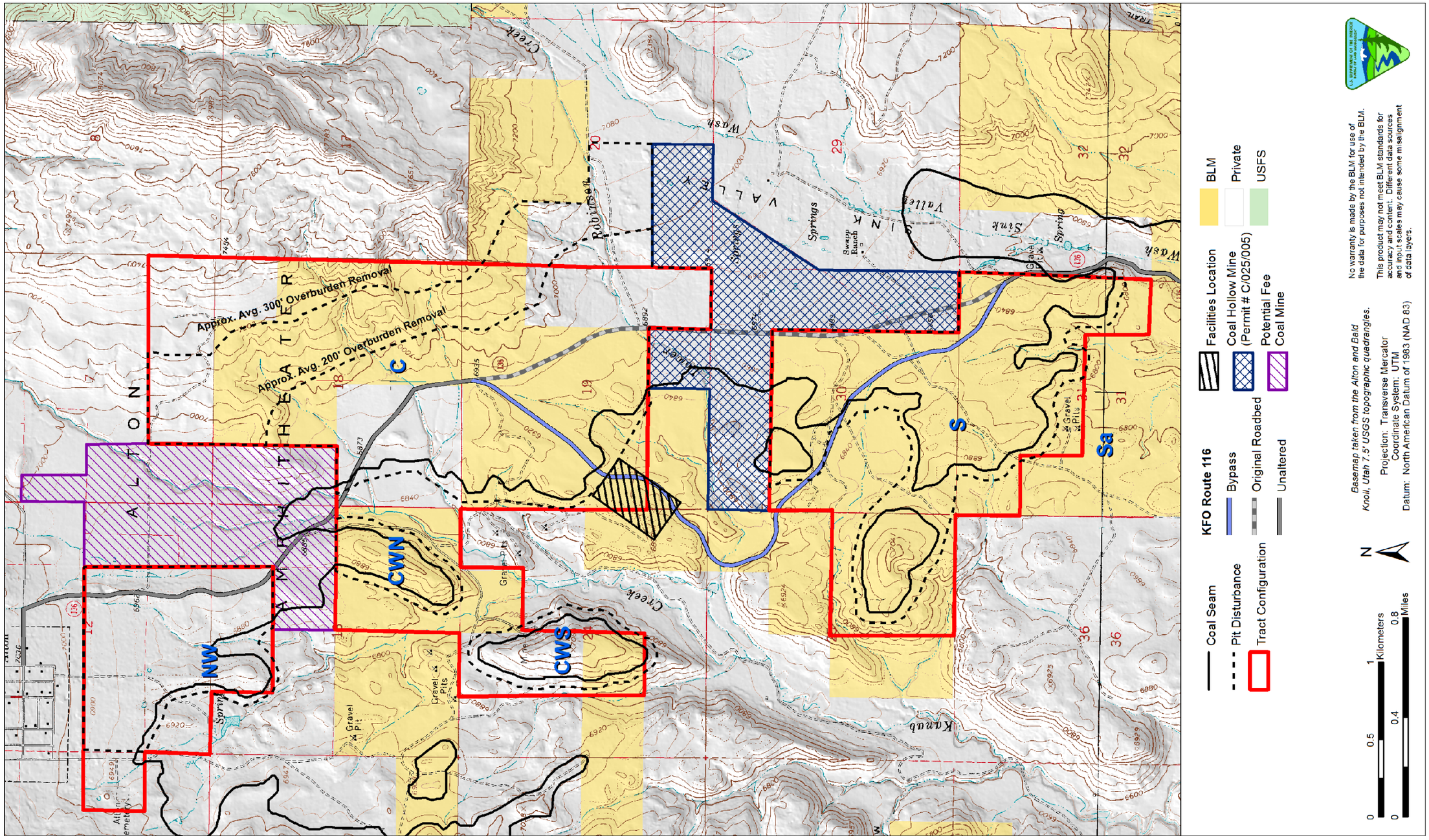
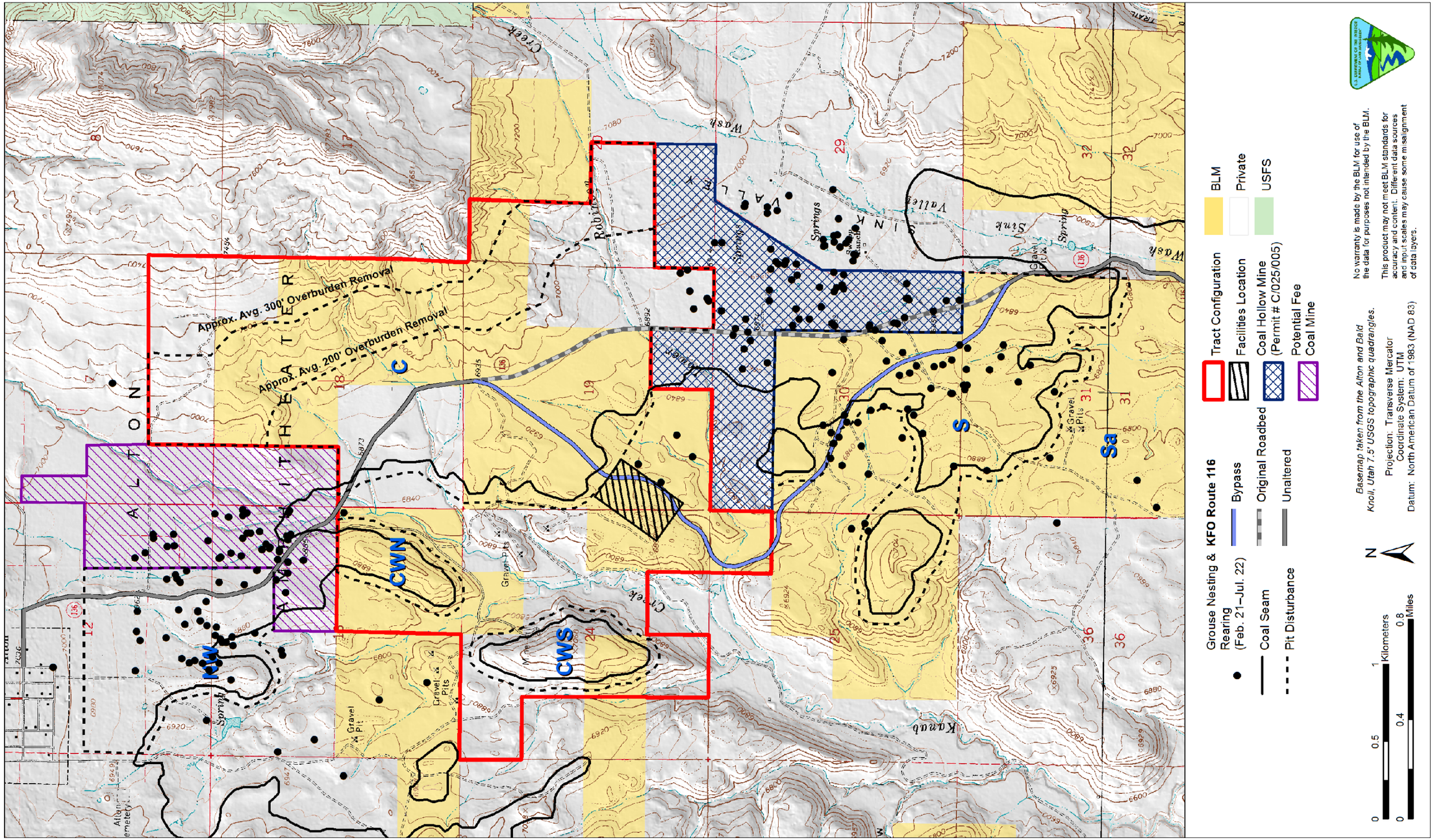


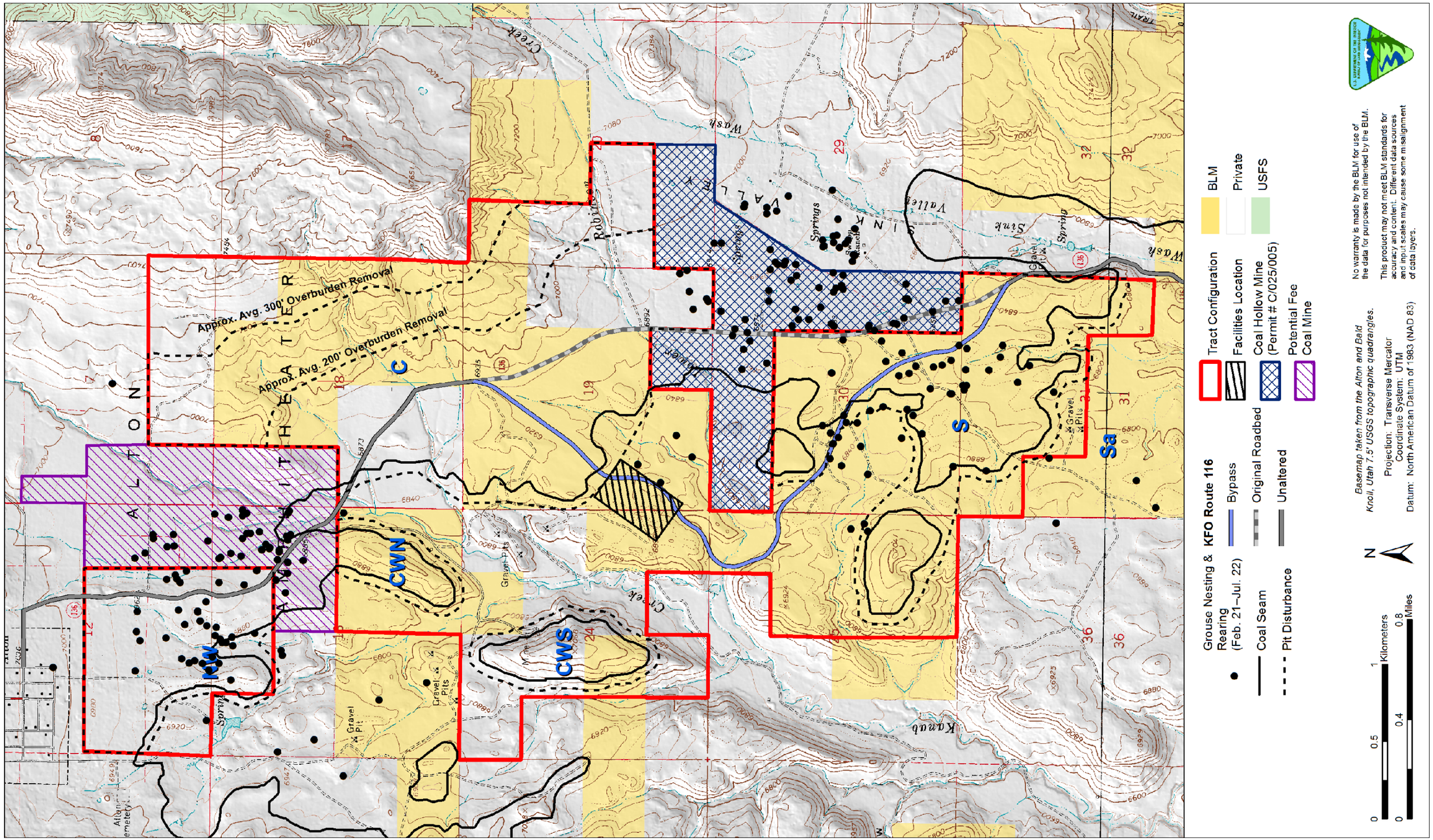
Map 2.4. Reasonably foreseeable coal loadout location and transportation route for delivery of coal from the tract to market.



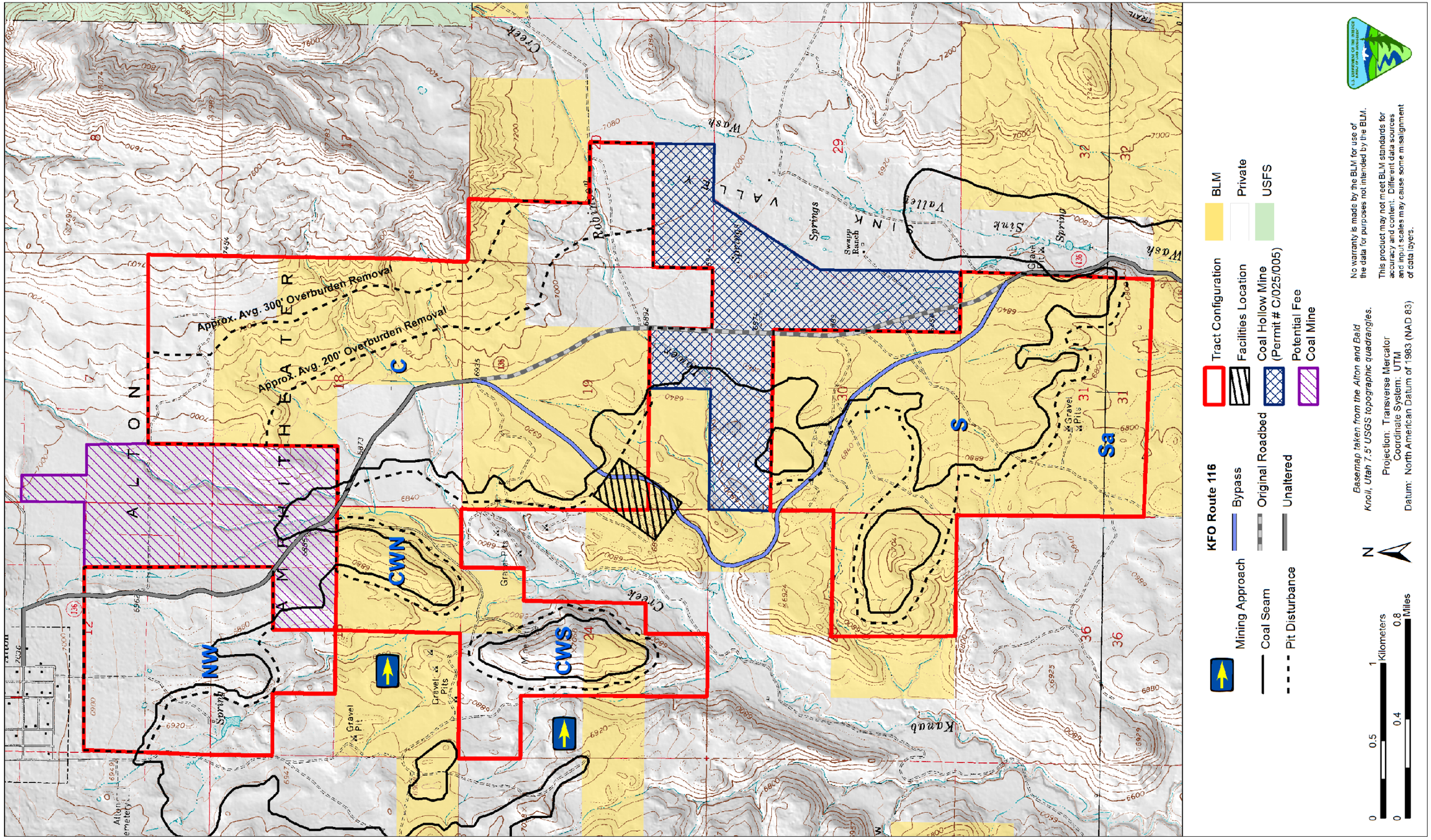
Map 2.5. The Alton Coal Tract configuration under Alton Coal Development's original lease by application submittal (Alternative D).



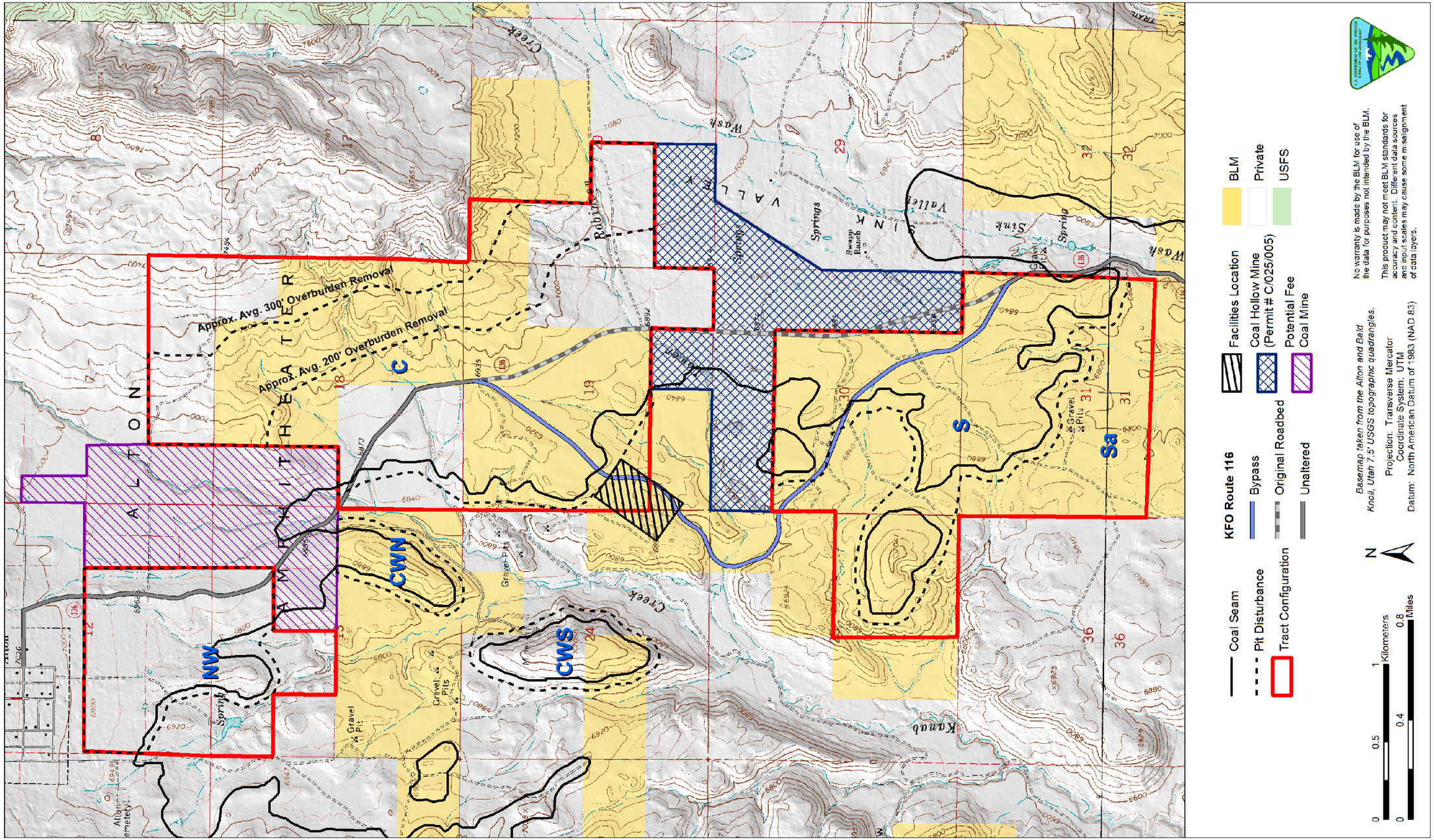
Map 2.6. Alternative K1 where Block NW and Block S of the tract were removed**.**



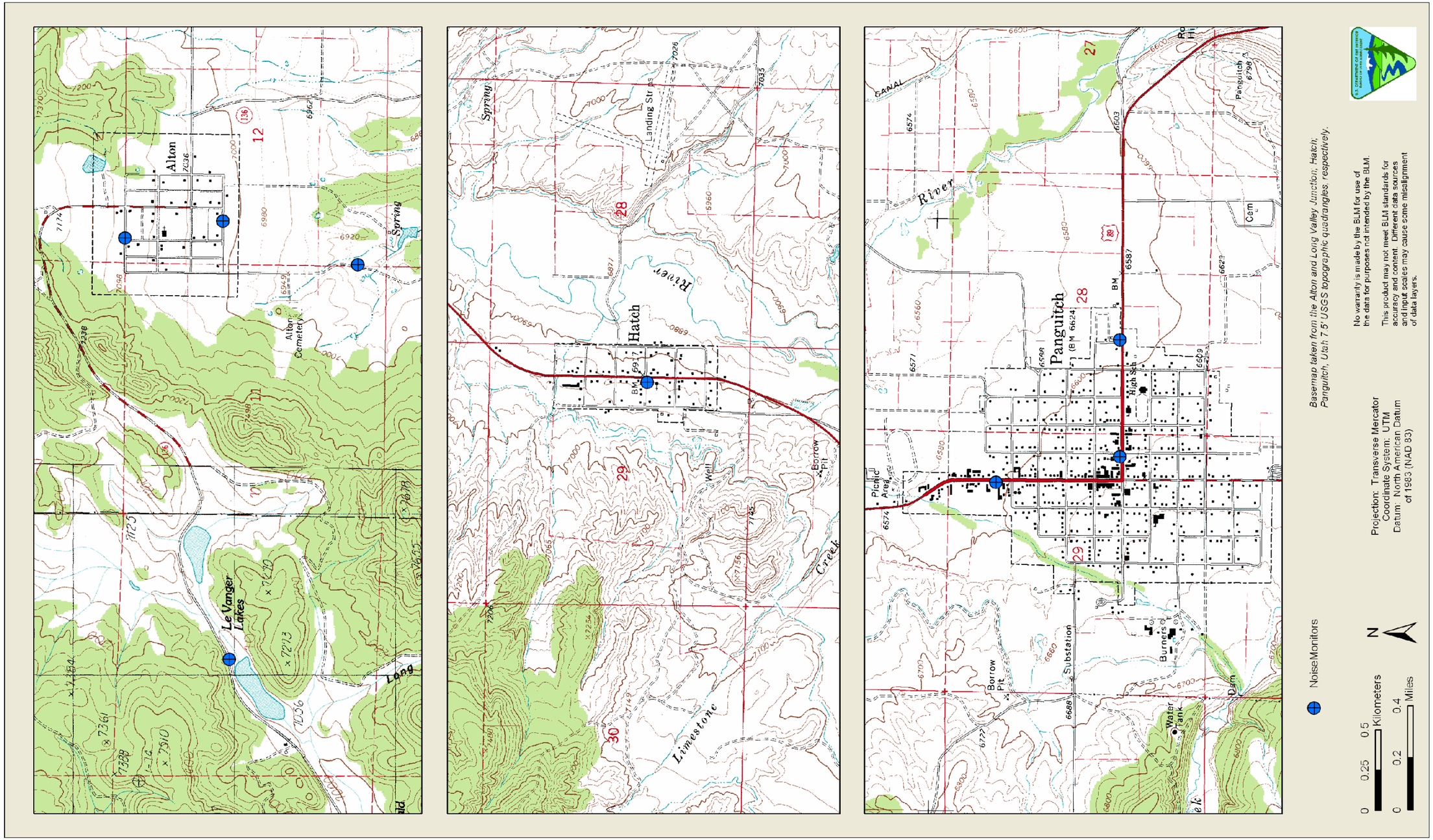
Map 2.7. Alternative K2 would remove small portions of the tract in Block NW and Block S.



Map 2.8. Alternative L1 would require the mining of Blocks CWN and CWS from west to east and would remove a portion of the tract in the no-coal zone east of these blocks.



Map 2.9. Alternative L2 would remove Blocks CWN and CWS, including the no-coal zone, from the tract**.**



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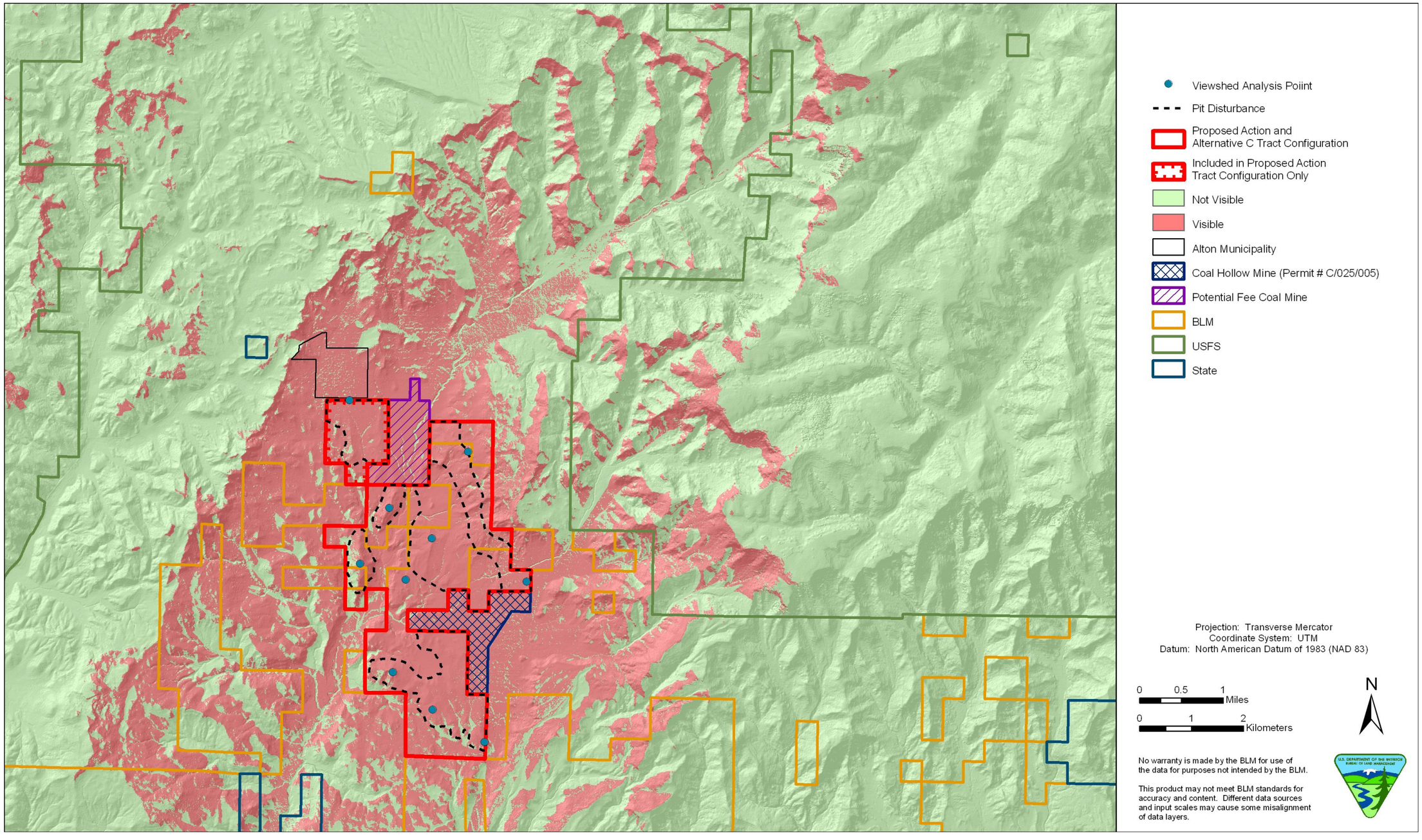
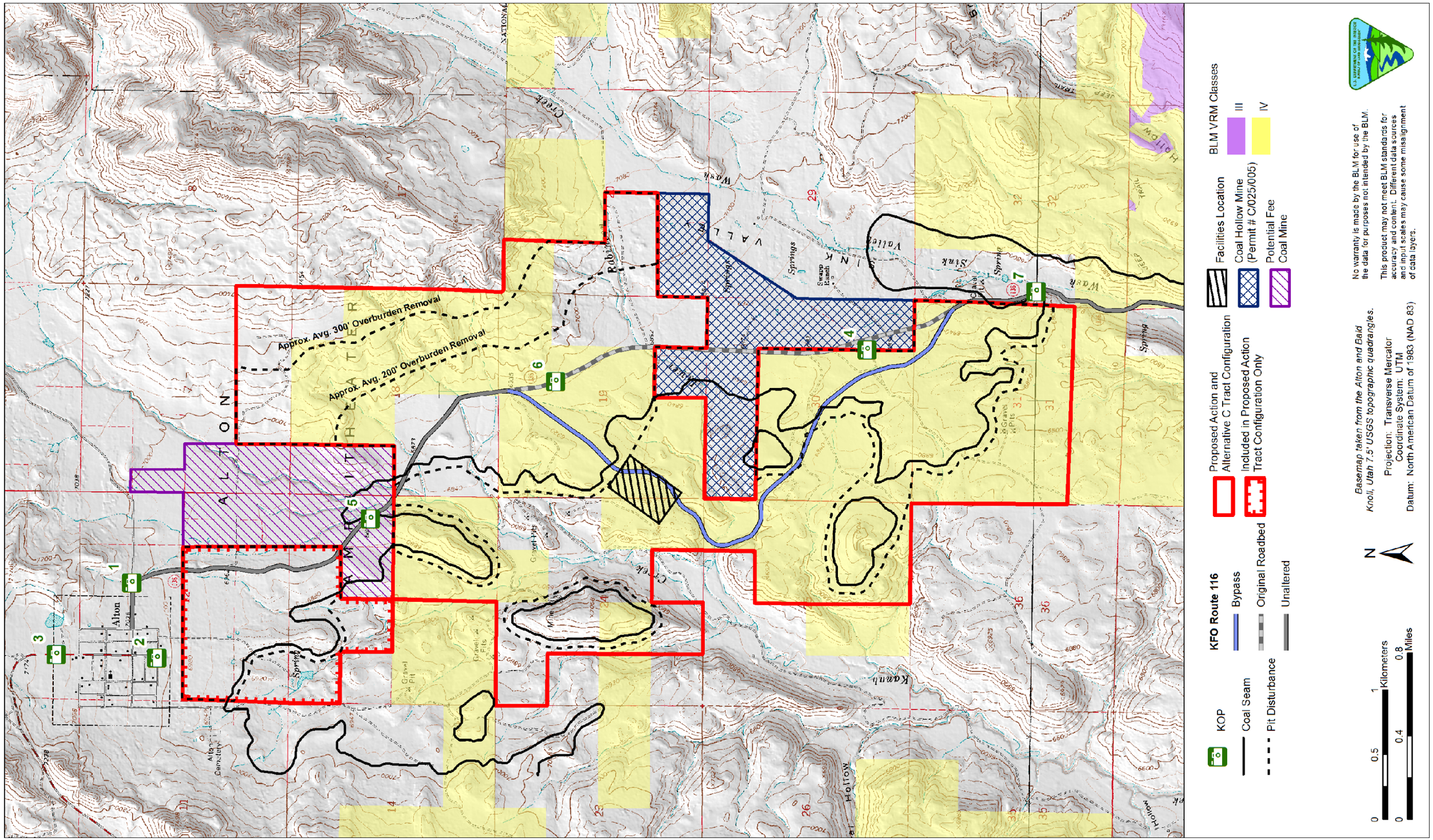
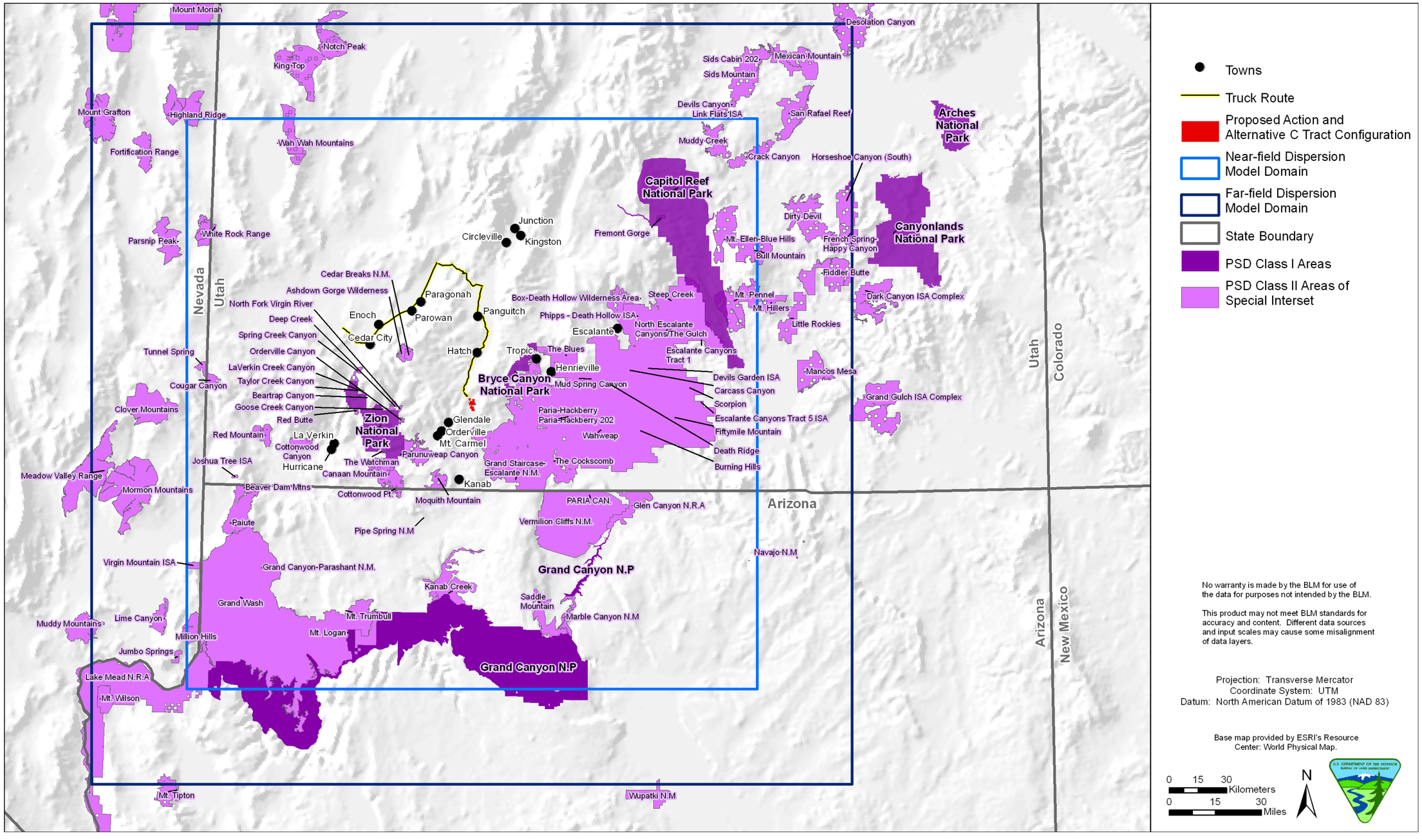


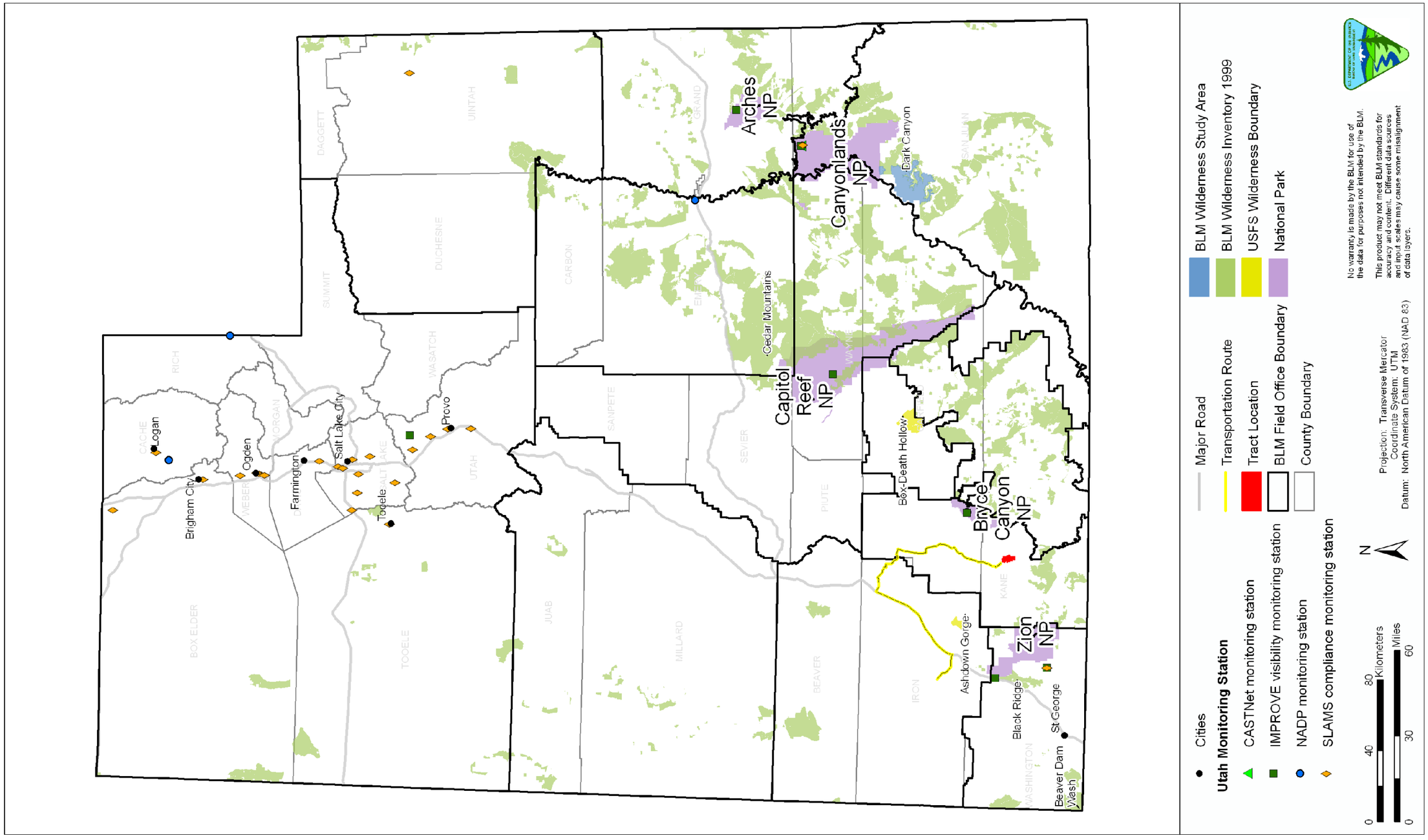
Map 3.2. Visual analysis area with viewshed analysis points (key observation points) in relation to the Alton Coal Tract**.**



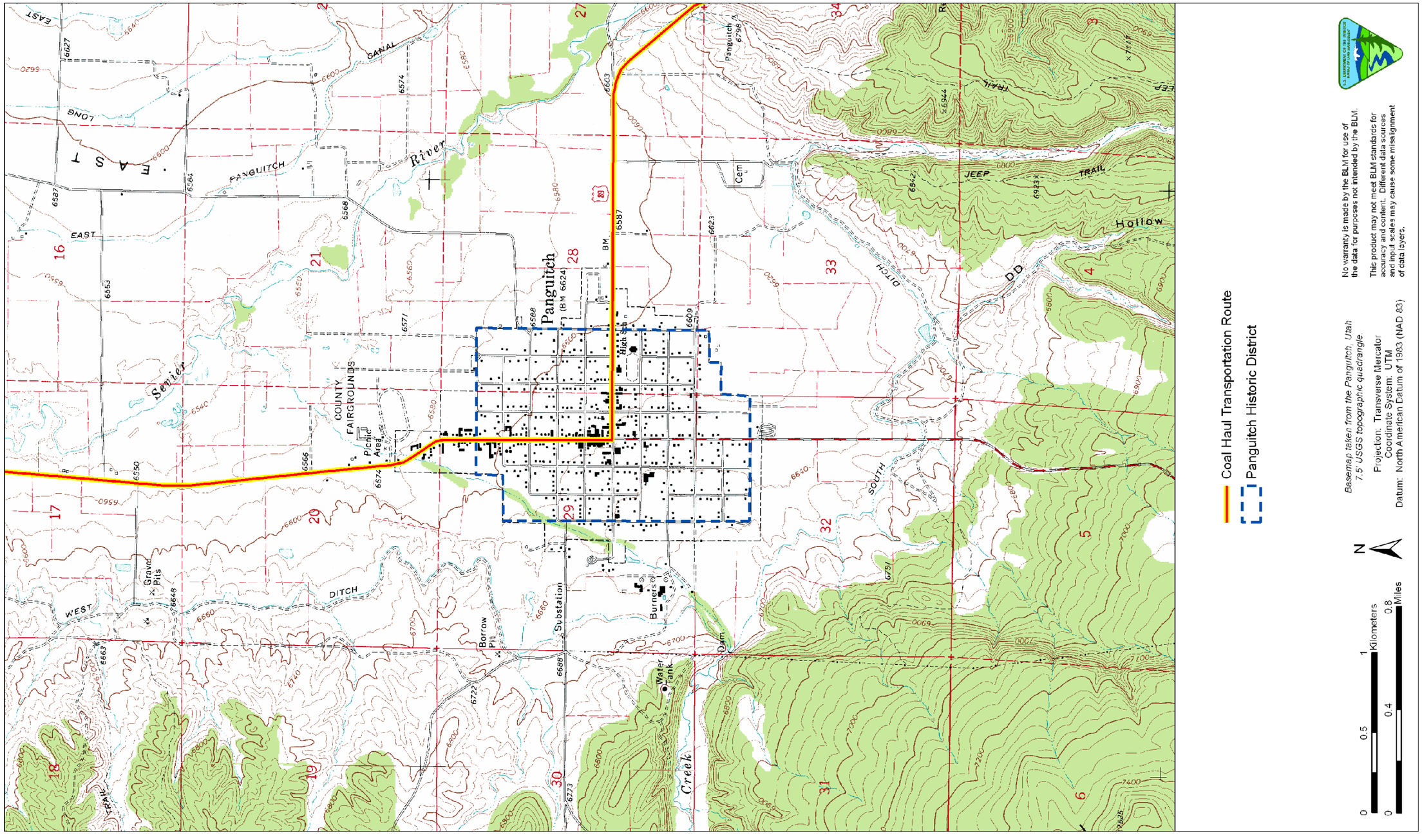
Map 3.3. Visual resource management classes and key observation points in and near to the Alton Coal Tract**.**



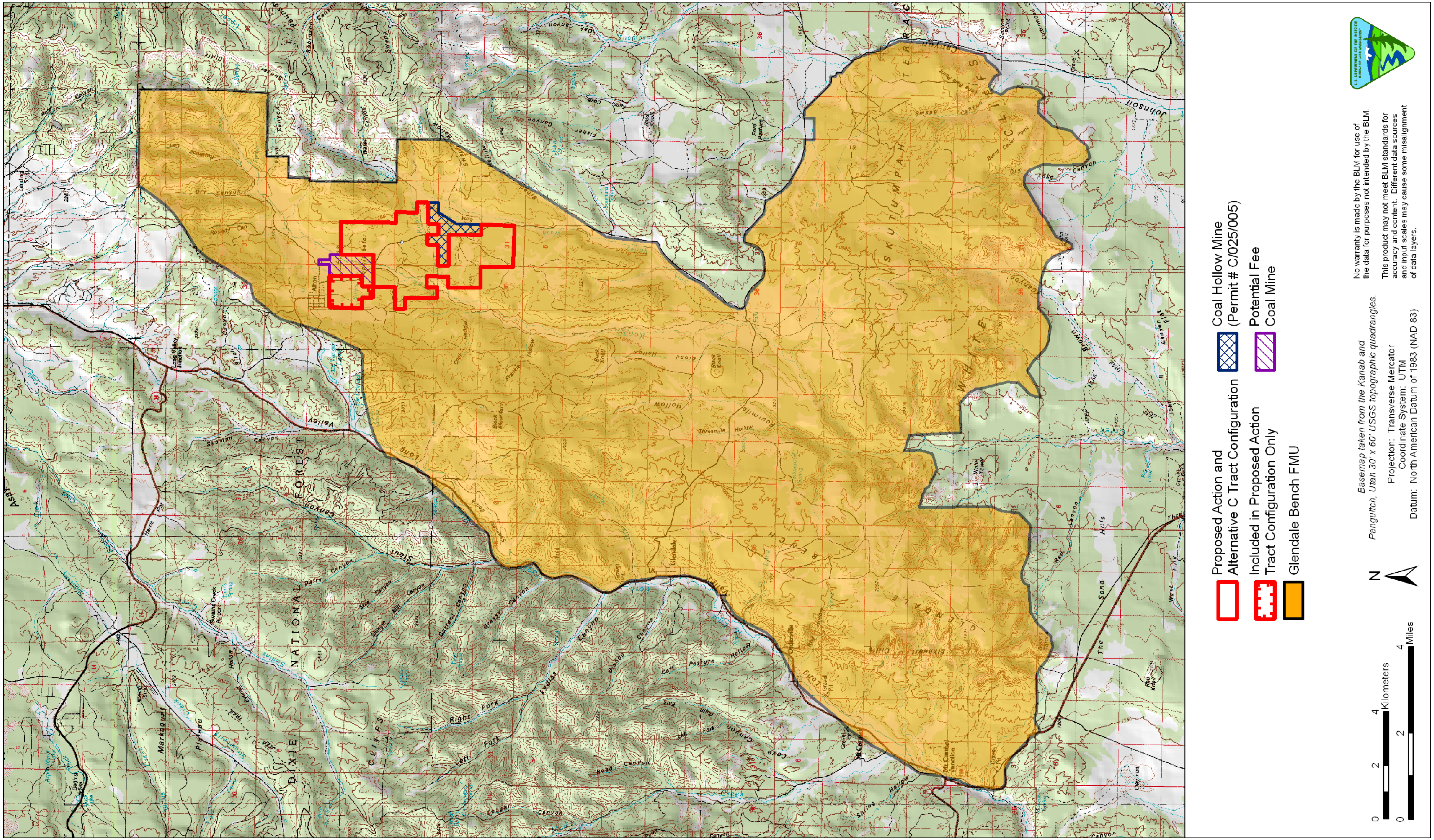
Map 3.4. Air resources analysis area (the near-field and far-field modeling domains).



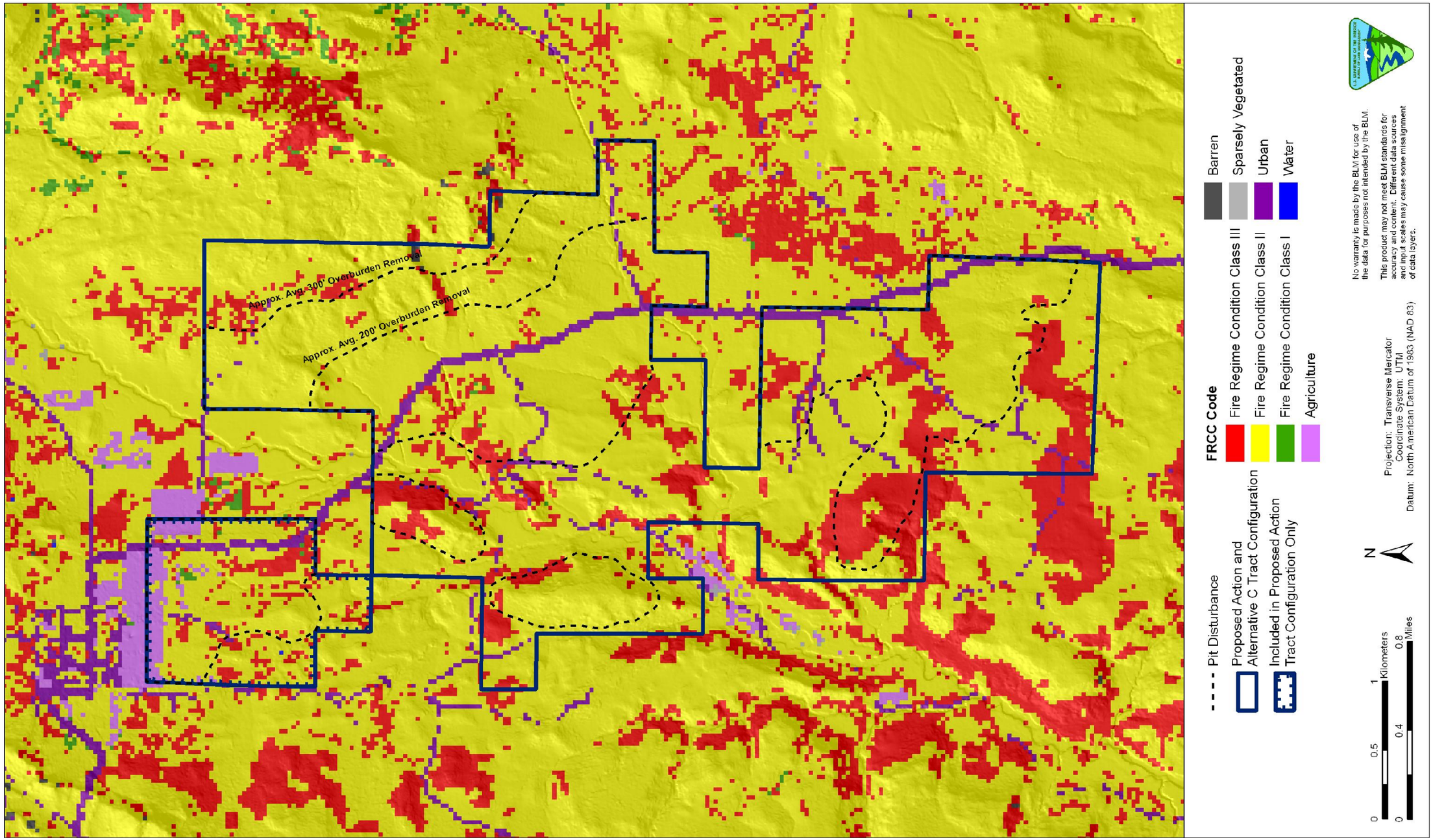
Map 3.5. Air quality monitoring stations in Utah.



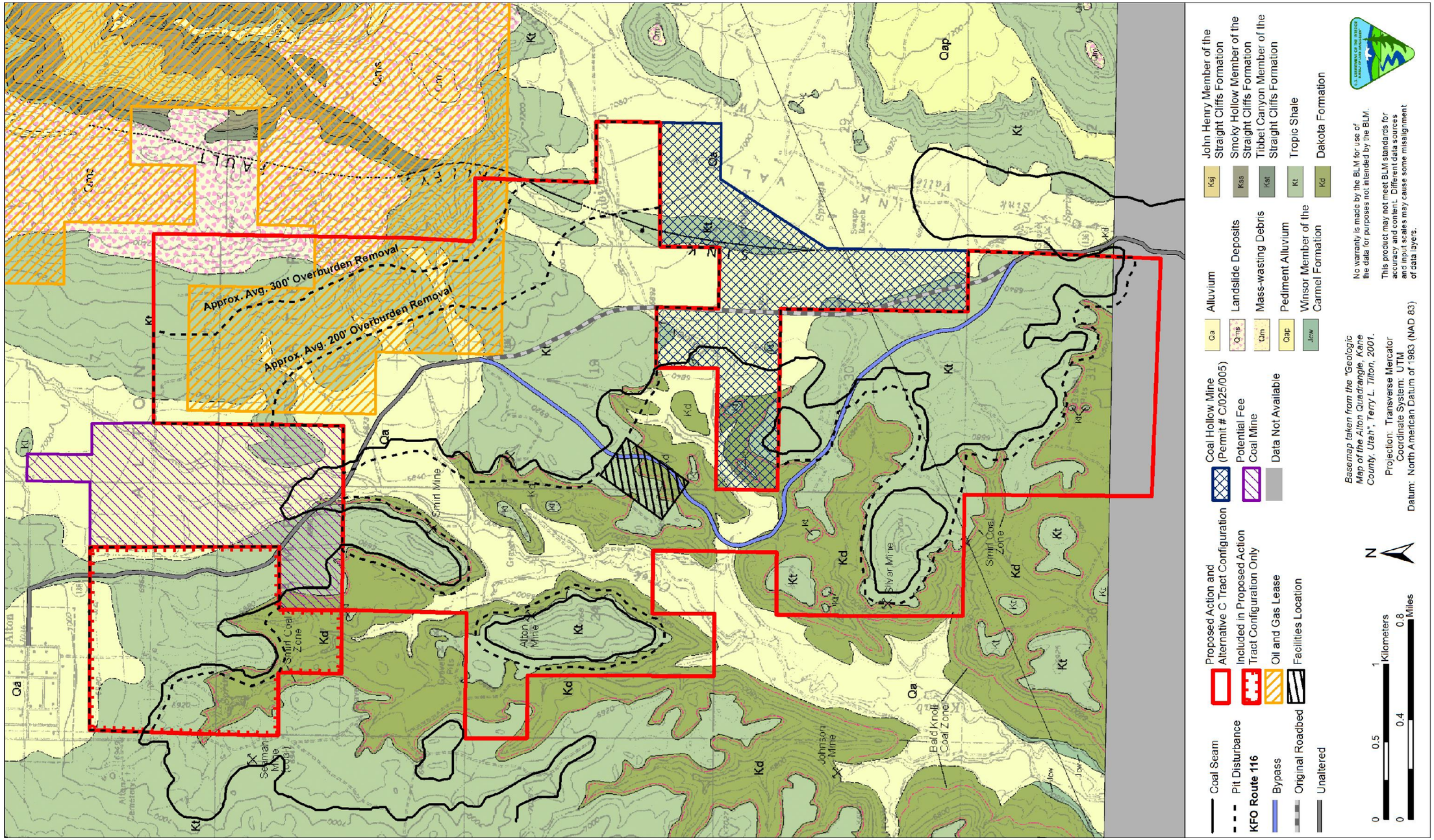
Map 3.6. Map of Panguitch showing historic district boundaries and coal haul transportation route**.**



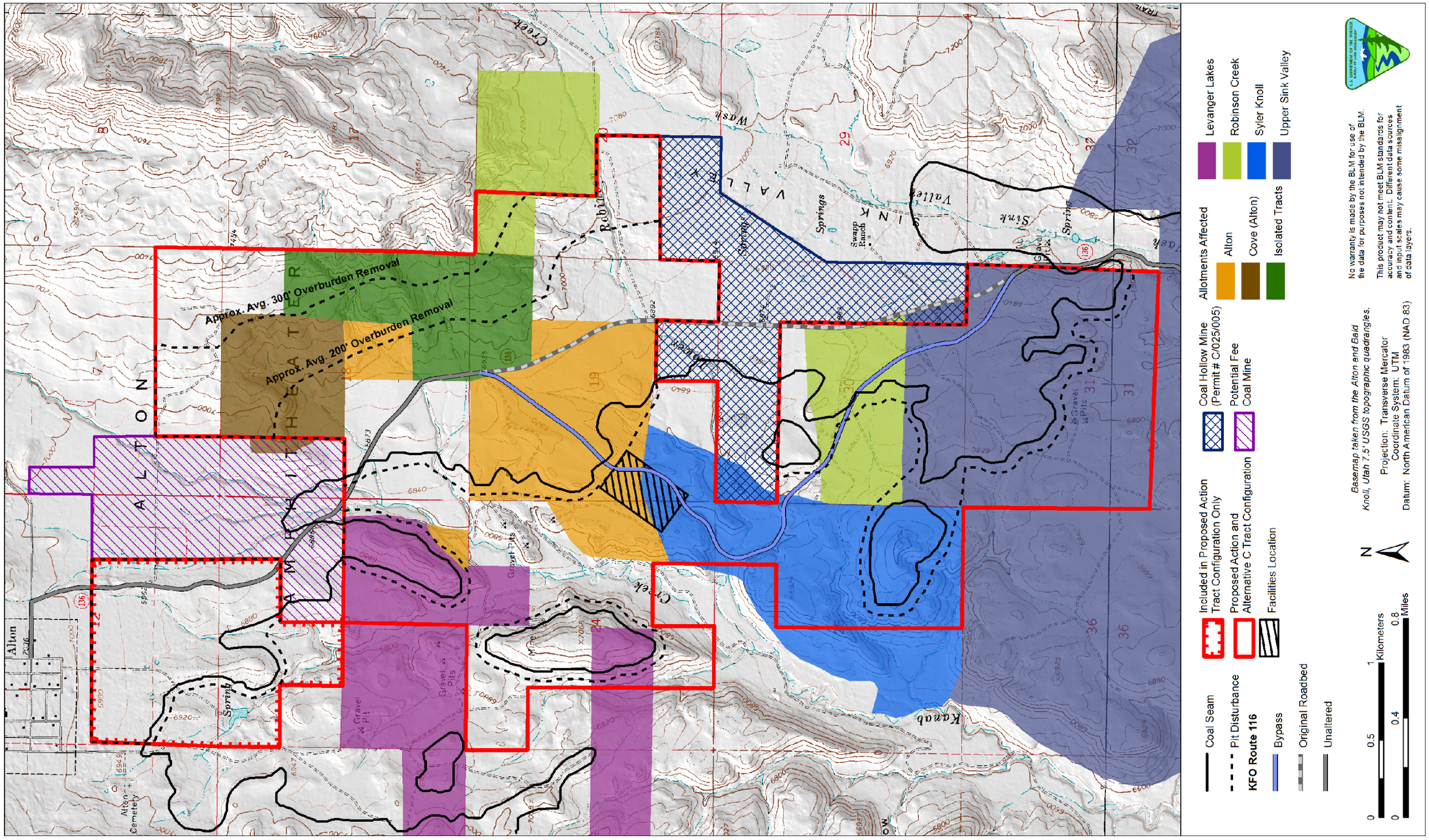
Map 3.7. Glendale Bench Fire Management Unit in relation to the Alton Coal Tract**.**



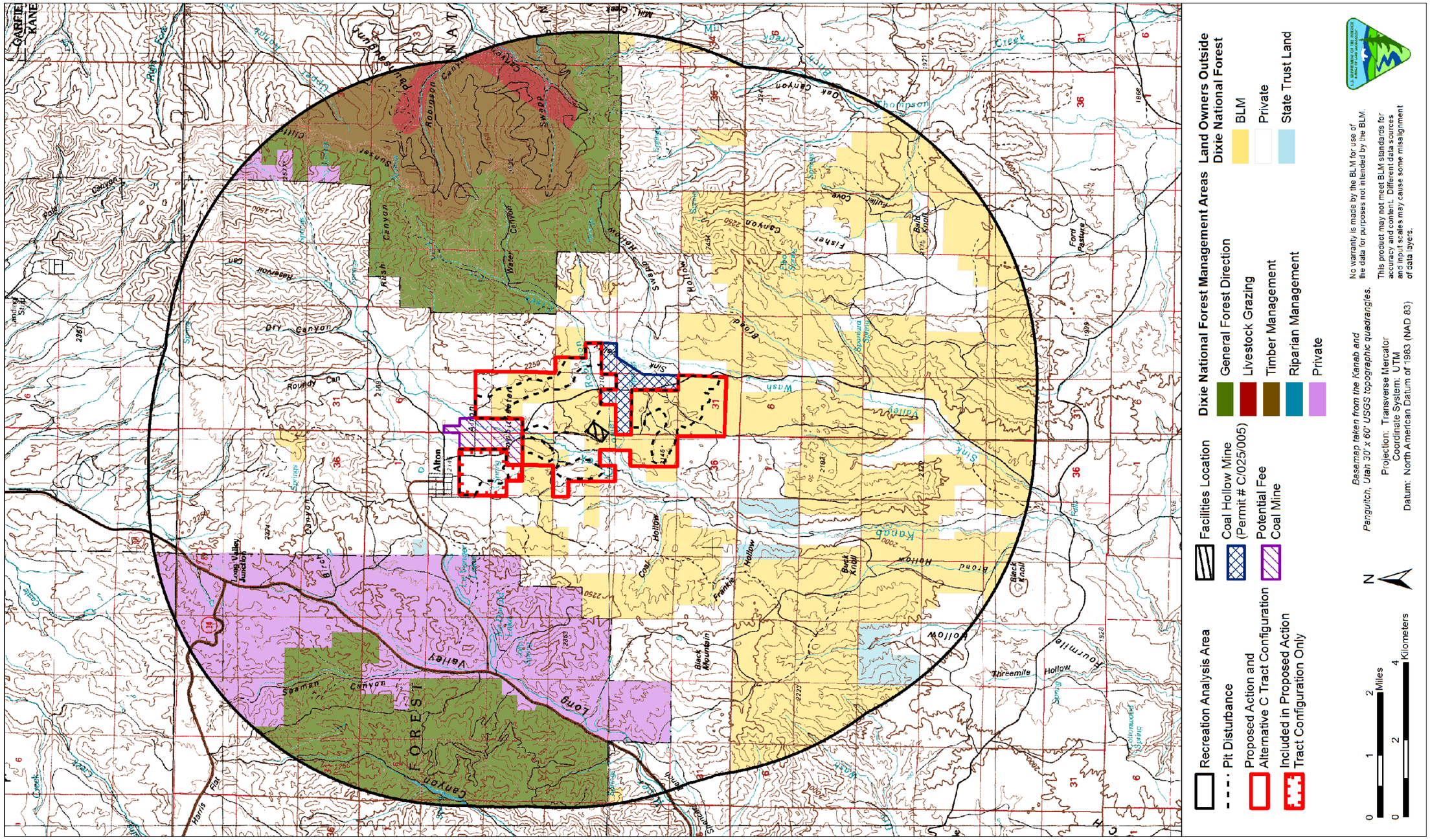
Map 3.8. Fire regime conditions class acreage in the Alton Coal Tract under Alternative B (Proposed Action) and Alternative C.



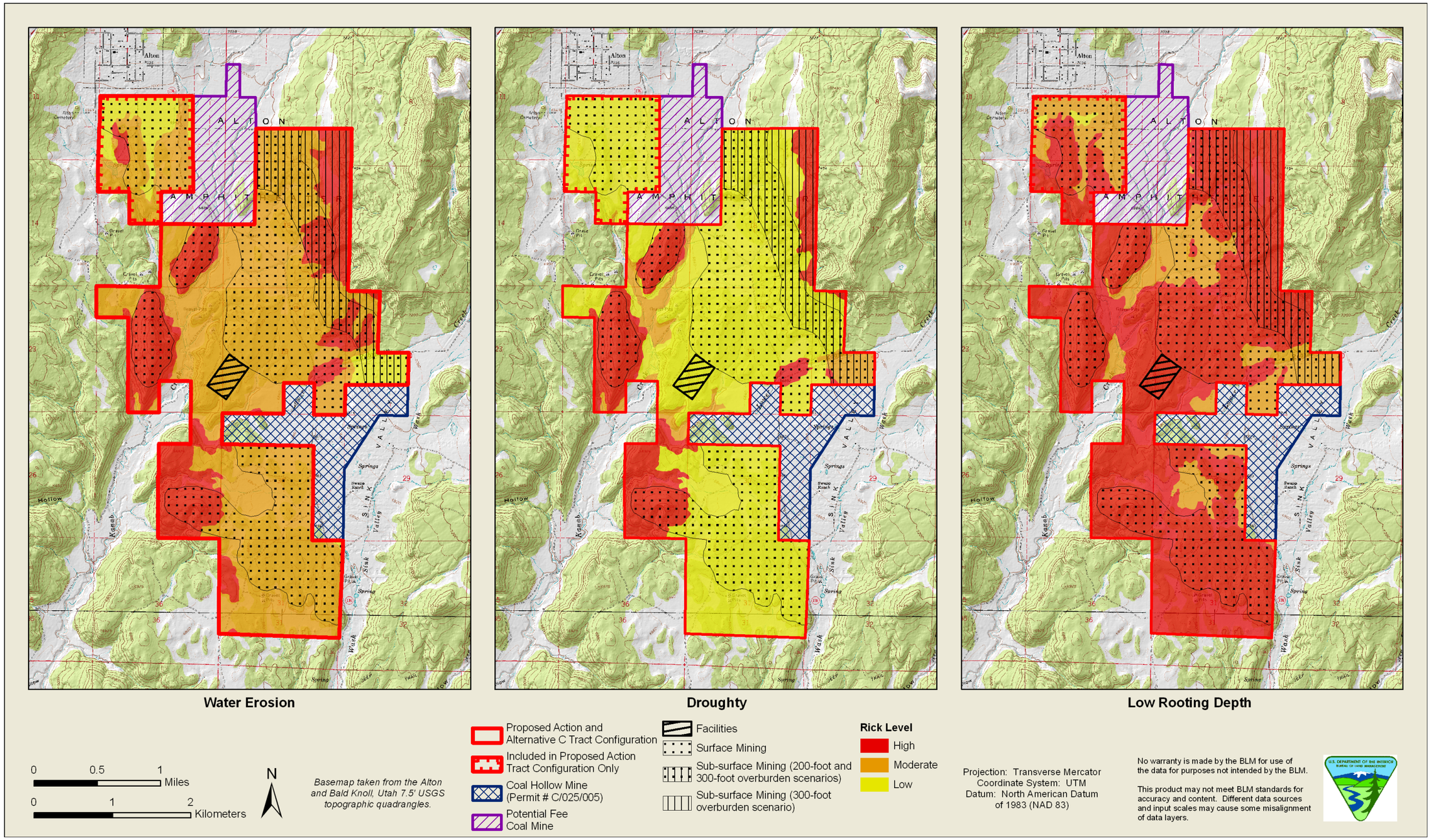
Map 3.9. Geological processes for the Alton Coal Tract.



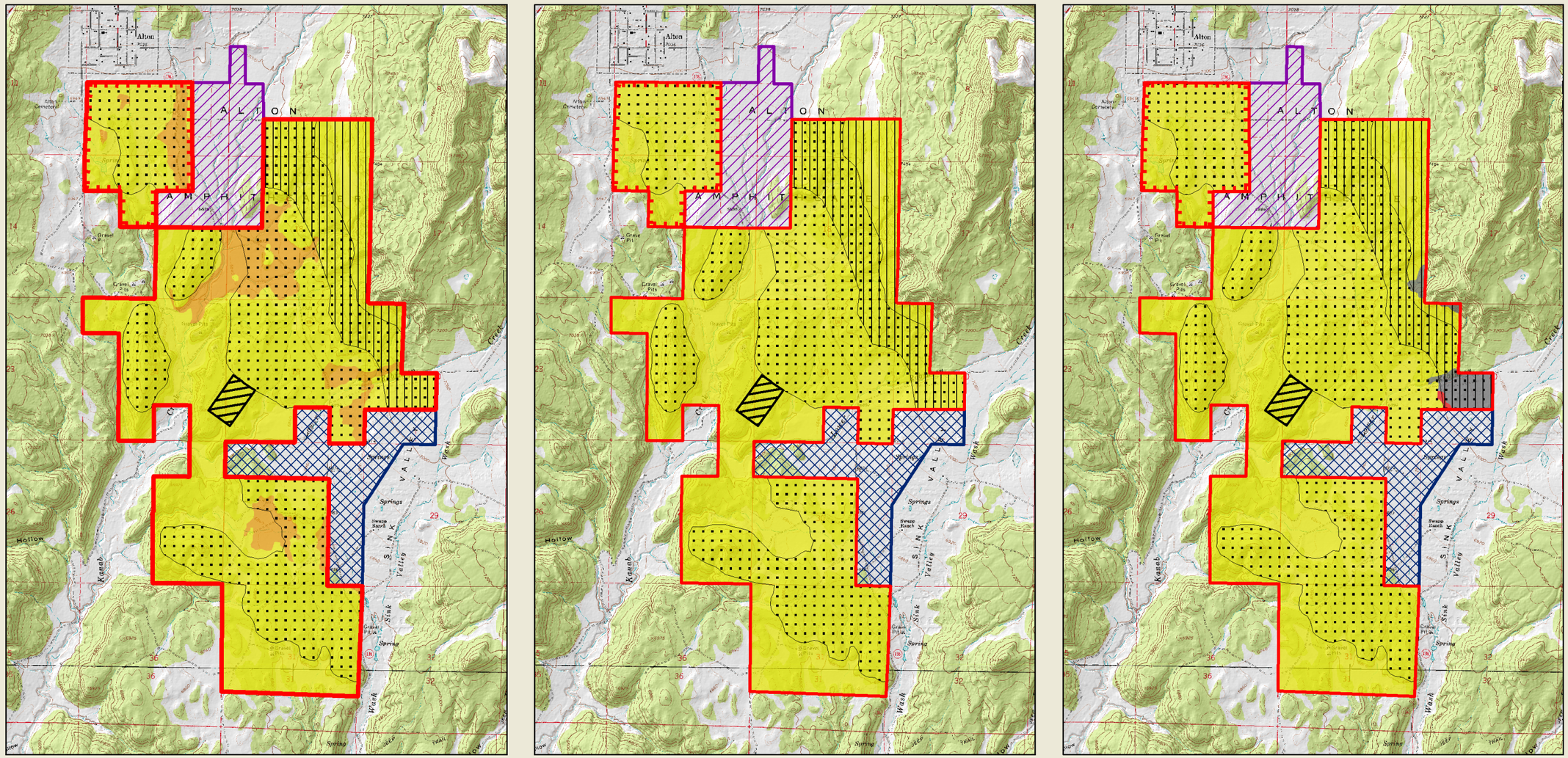
Map 3.10. Grazing allotments in the Alton Coal Tract**.**



Map 3.11. Recreation resources analysis area for the Alton Coal Tract**.**



Map 3.12. Highly erodible, drought intolerant, and shallow soils in the Alton Coal Tract**.**



0 0.5 1 Miles

0 1 2 Kilometers

N

Basemap taken from the Alton and Bald Knoll, Utah 7.5' USGS topographic quadrangles.

Proposed Action and Alternative C Tract Configuration

Included in Proposed Action Tract Configuration Only

Coal Hollow Mine (Permit # C/025/005)

Potential Fee Coal Mine

Facilities

Surface Mining

Sub-surface Mining (200-foot and 300-foot overburden scenarios)

Sub-surface Mining (300-foot overburden scenario)

Risk Level

Low

Moderate

High

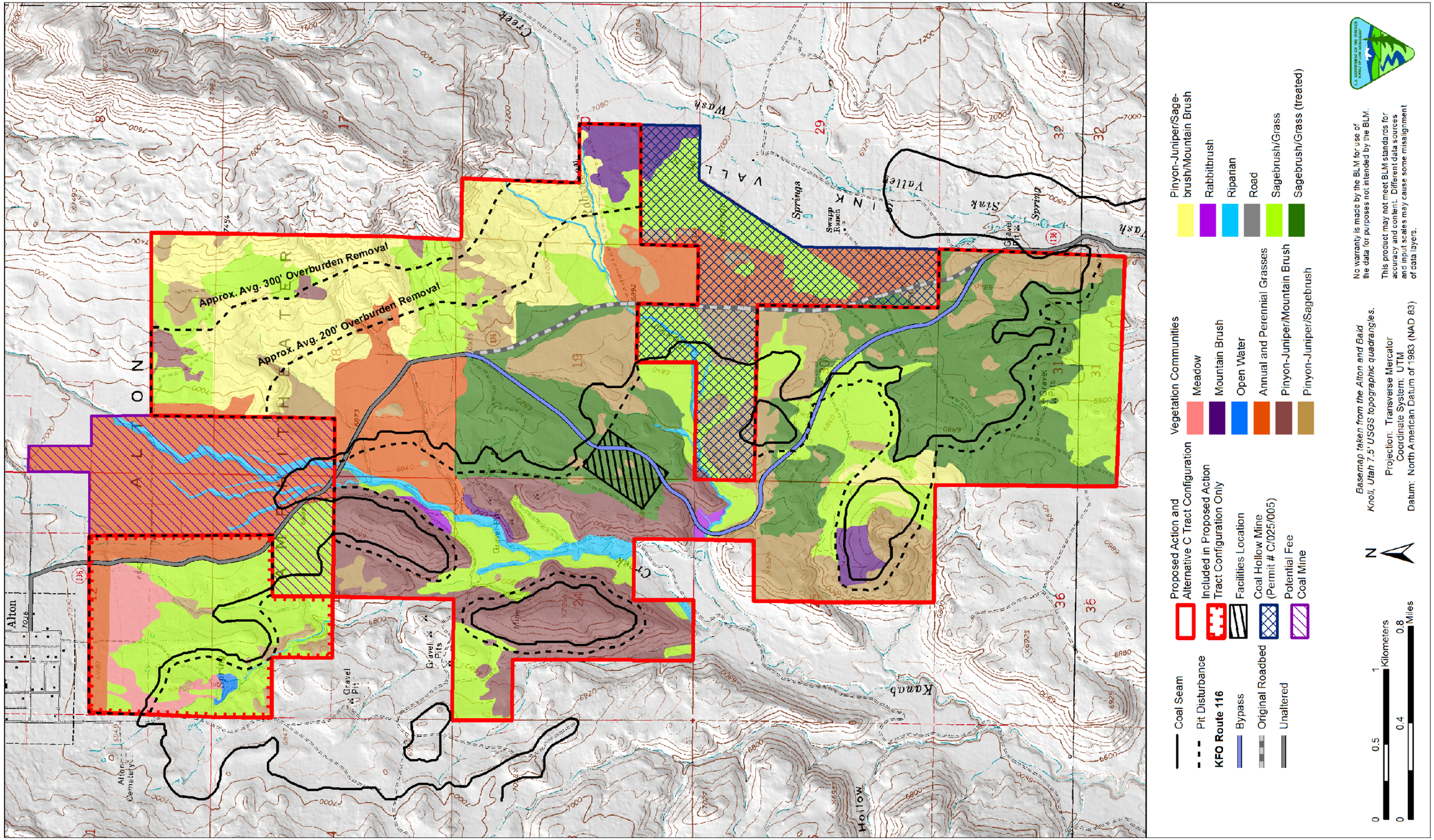
Unknown

Projection: Transverse Mercator
Coordinate System: UTM
Datum: North American Datum of 1983 (NAD 83)

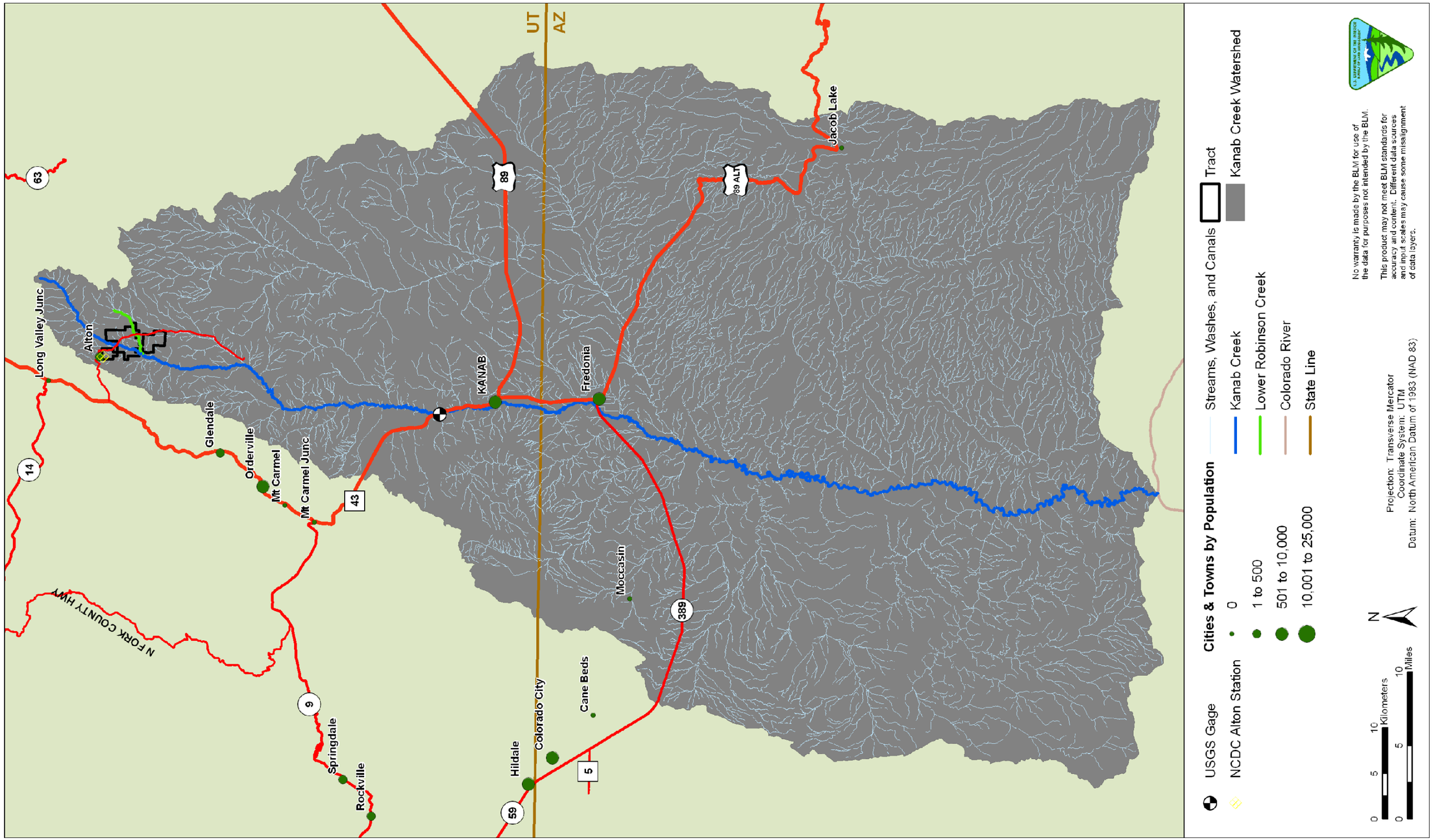
No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

This product may not meet BLM standards for accuracy and content. Different data sources and input scales may cause some misalignment of data layers.

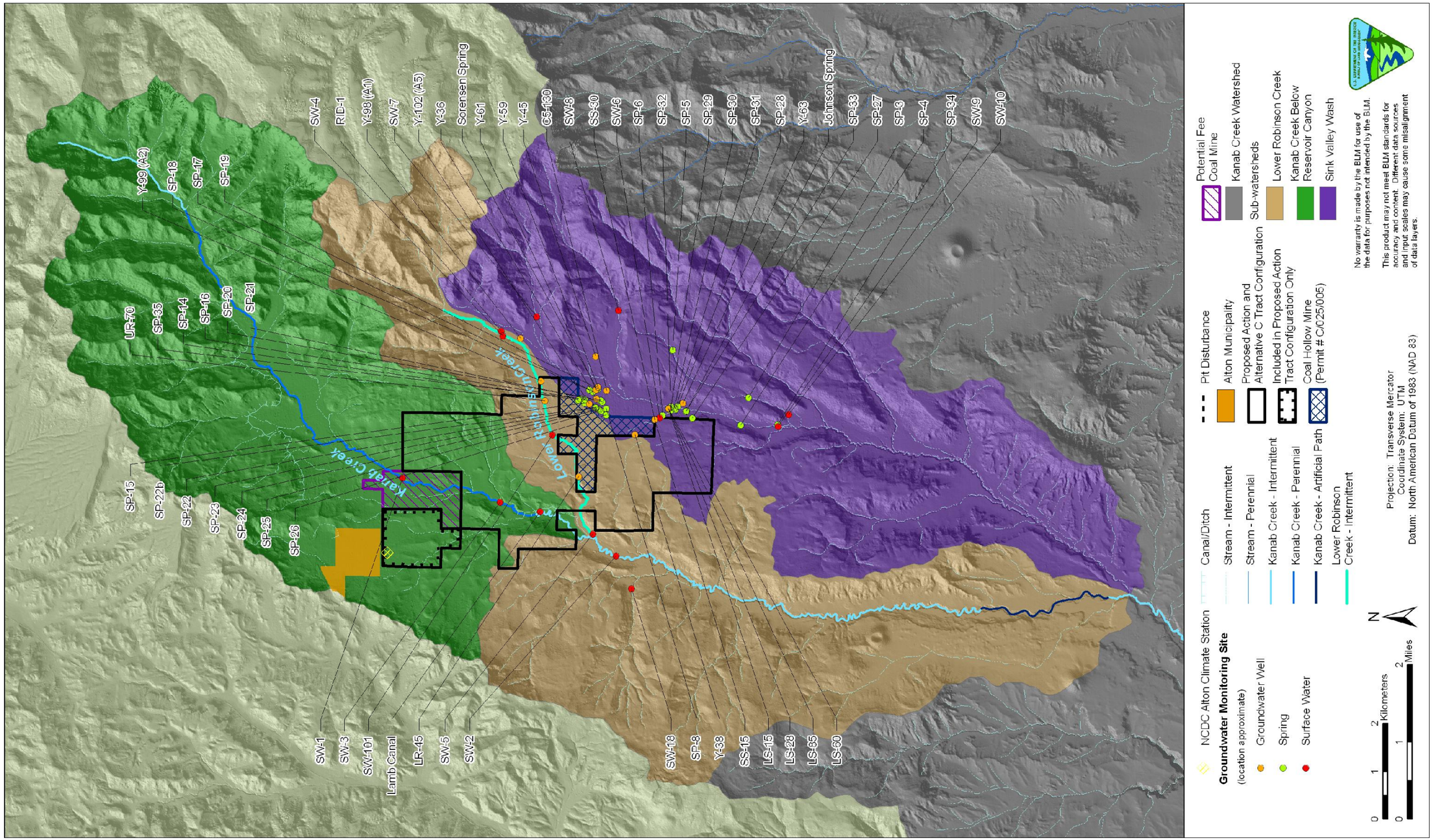
Map 3.13. Alkaline, saline, and sodic soils in the Alton Coal Tract.



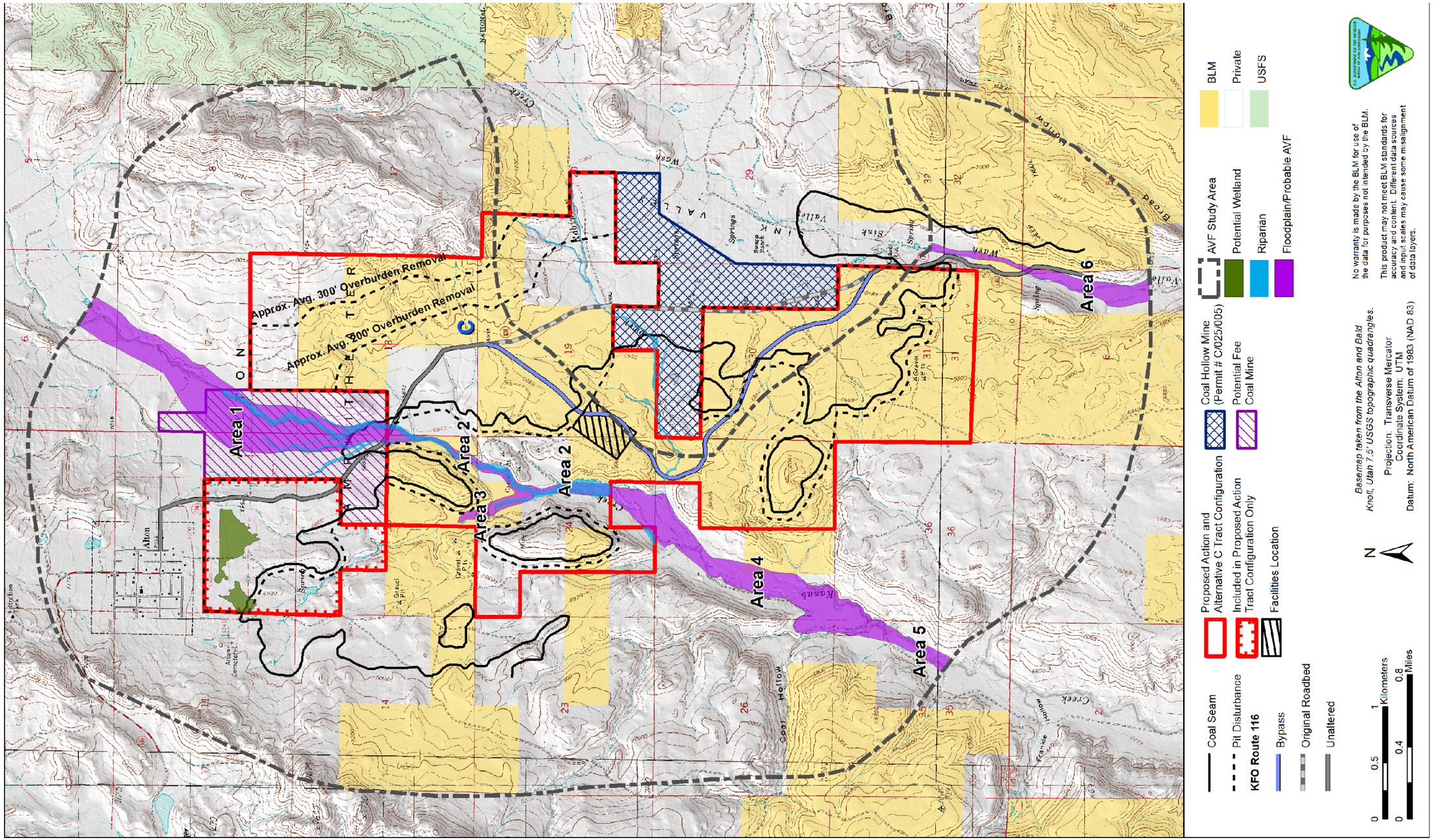
Map 3.14. Vegetation communities in the Alton Coal Tract.



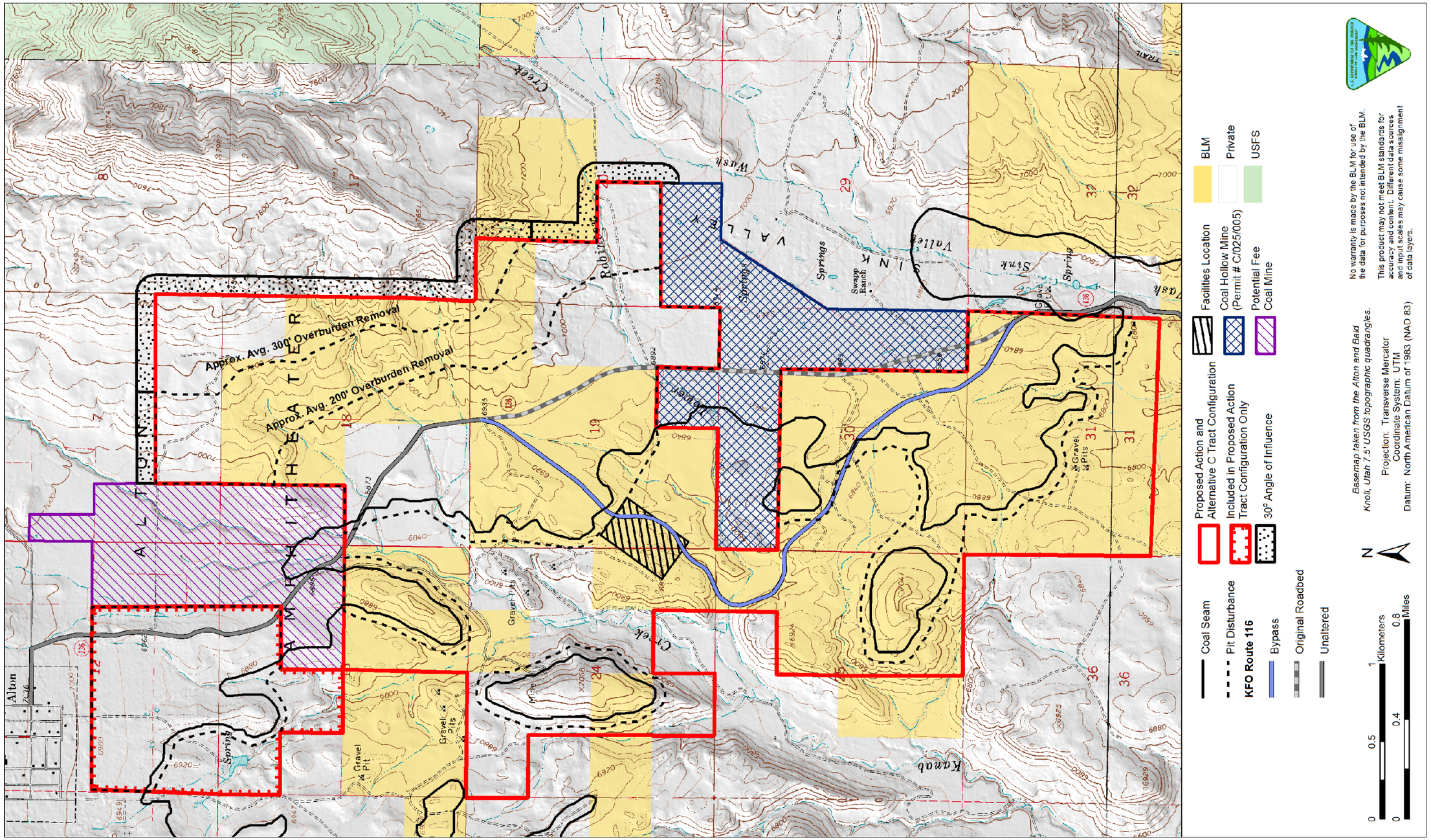
Map 3.15. Entire watershed, National Climatic Data Center station, and U.S.Geological Survey gage downstream on Kanab Creek.



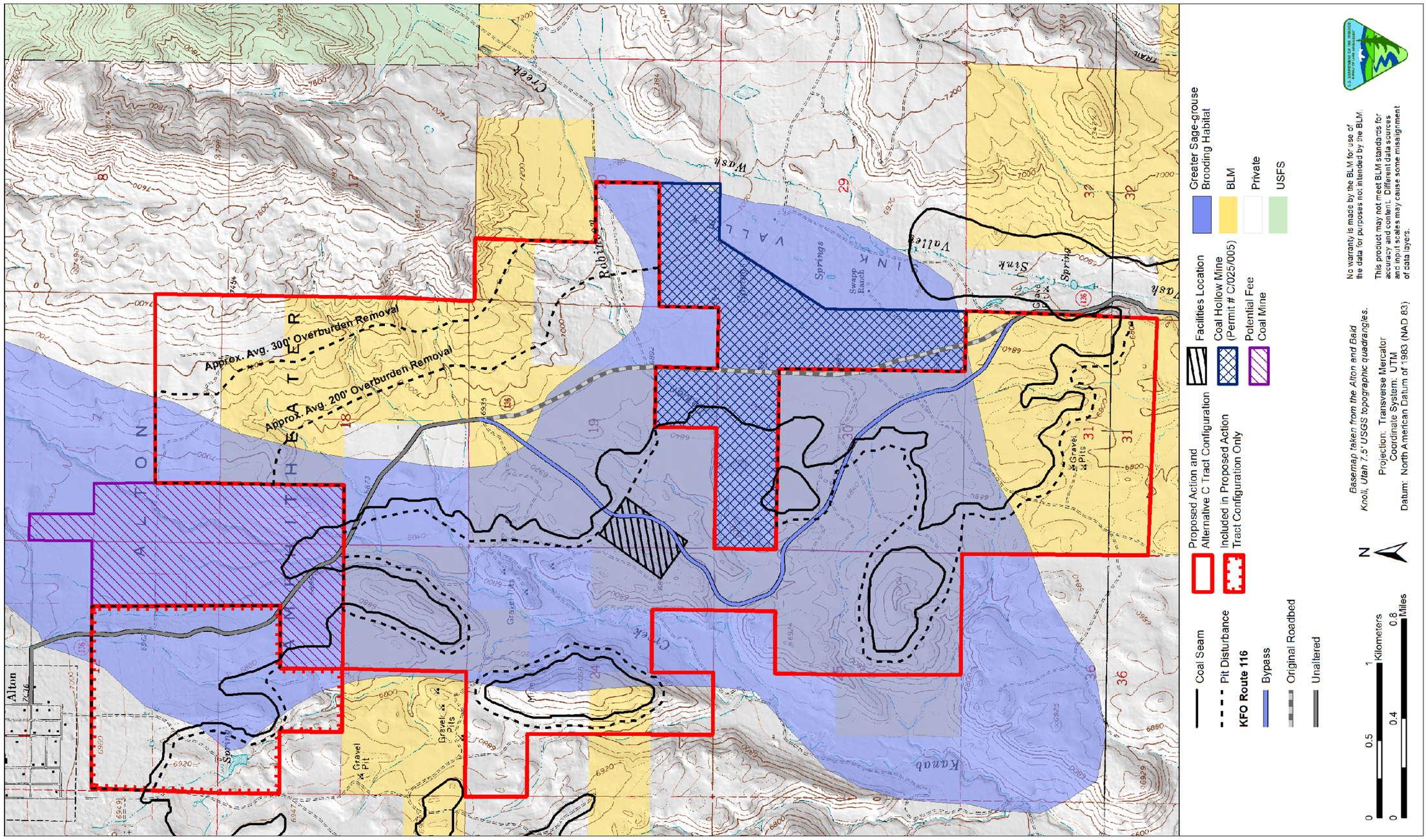
Map 3.16. National Climatic Data Center station, intermittent and perennial streams, three main sub-watersheds, and surface water monitoring stations in tract**.**



Map 3.17. Potential wetlands, floodplains, and probable AVFs, in addition to the AVF study area, in relation to the Alton Coal Tract**.**



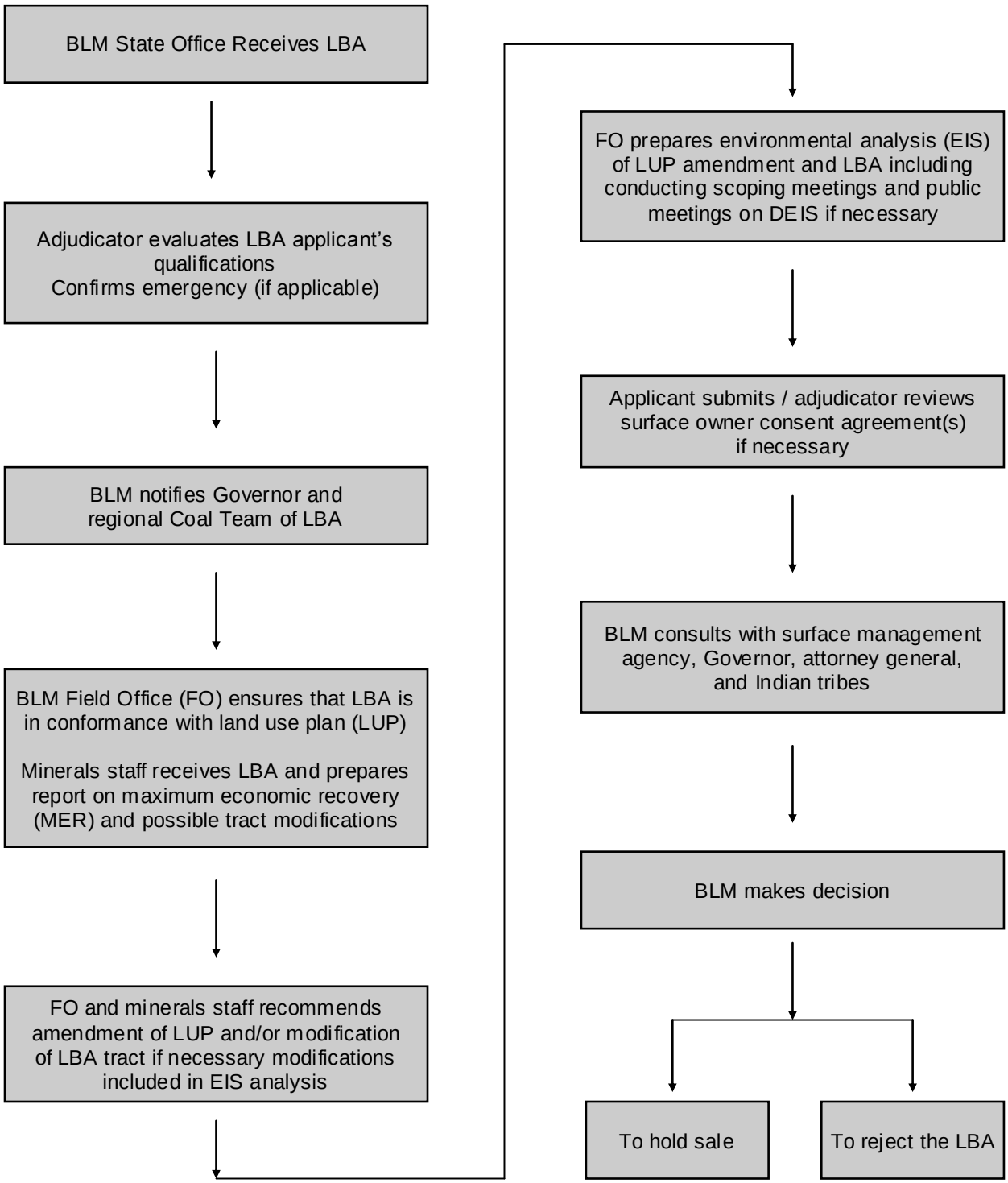
Map 4.1. Assessment area for gas and minerals, including the 30° angle of influence**.**



Map 4.2. Greater Sage-grouse brooding habitat in and near the Alton Coal Tract.

APPENDIX B.
THE COAL LBA PROCESS

The Coal LBA Process



APPENDIX C.
UNDERGROUND (SUBSURFACE) MINING METHODS

UNDERGROUND (SUBSURFACE) MINING METHODS

SURFACE-RELATED: AUGER MINING AND HIGHWALL MINING

For coal seams that are too deep for surface mining and also too small to warrant extensive underground mining, auger mining and highwall mining methods can be used. The coal seams must be exposed or easily accessible by the highwall of a surface mine or other excavation.

AUGER MINING

Generally, auger mining is used for recovering coal beyond that which is accessible by contour strip-mining (Figure A1). This method is limited to coal seams that are horizontal or slightly pitched. Auger mining can create pits up to 500 feet into the highwall (Crowell 2001) depending on the conditions of the site and the type of auger used. This mining method is generally inexpensive; however, coal recovery rates are low.

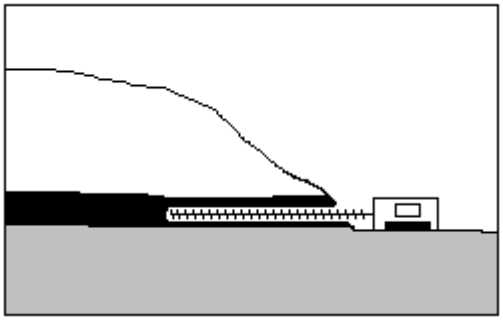


Figure A1. Auger mining into a coal seam.

HIGHWALL MINING

Highwall mining is another method used when an otherwise inaccessible coal seam is exposed by contour strip mining. In this method, a continuous mining machine operated remotely is driven into the exposed seam. The haulage system on the machine brings the coal out of the tunnel to be collected and stockpiled. In this method, drives into the seam are separated by long, parallel coal pillars that support the overburden (Figure A2). The width of these support pillars must be based on the geologic conditions of the site. The maximum recovery rate of this method is higher than that of auger mining although continuous mining machines require more capital investment.

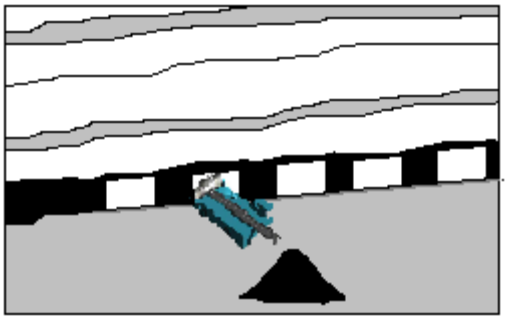


Figure A2. Highwall mining into a coal seam.

UNDERGROUND: ROOM-AND-PILLAR MINING AND LONGWALL MINING

Underground methods are used when the coal reserve is 300 feet or more below the surface of the earth. These methods, room-and-pillar mining and longwall mining, require heavy machinery and a greater degree of capital investment than the surface-related methods. Machinery used in underground mining includes continuous miners, shuttle cars, drills, cutting machines, and tractors. Underground mining also requires ventilation and airway systems, dust control, fire prevention, electrical power and communication systems (Given et al. 1973).

ROOM-AND-PILLAR MINING

In this form of underground mining, coal is removed from a seam in such a way that rectangular or square pillars remain in order to support the overburden (Figure A3). In most cases, coal seams must be relatively flat (maximum 5 to 6 degrees pitch), although steep pitch mining methods also exist. Seams must be large enough to allow heavy machinery such as shuttle cars and tractors through easily (Given et al. 1973).

With this method there is flexibility as to which areas of the seam are to be mined; areas with high quality materials can be extracted while areas of lower quality material can be left as overburden support. Discontinuing extraction in areas that are not economically convenient is relatively simple. It is also easy to adapt the shape of the mined area to fit the outline of the seam. Depending on the site conditions and the goals of the mining operation, the pillars can either be left in place or removed when mining is complete (Given et al. 1973).

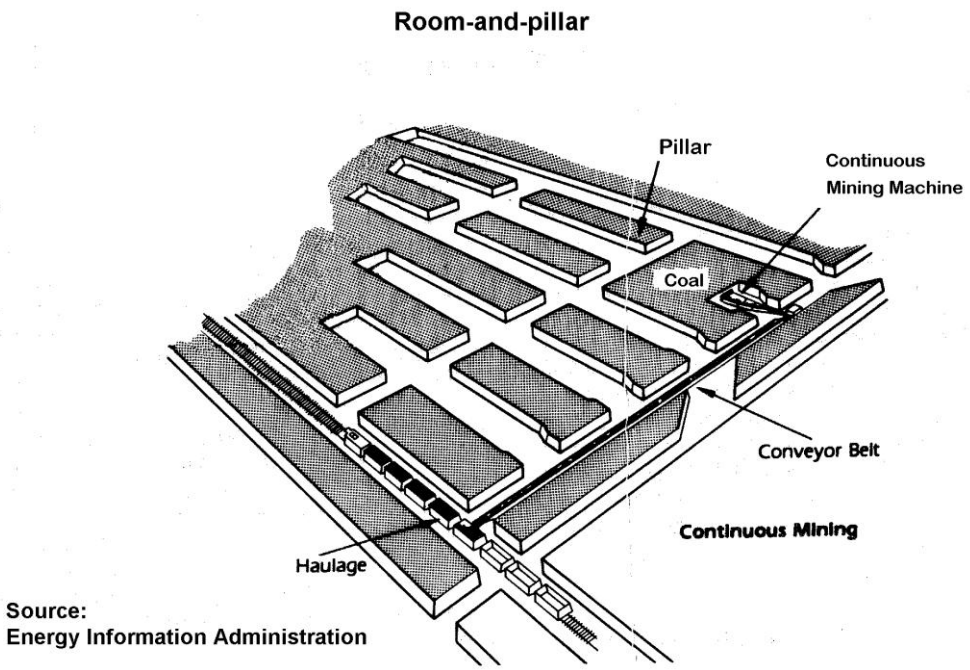


Figure A3. Room-and-Pillar mining method.

LONGWALL MINING

In areas where coal veins are relatively flat and expansive, longwall mining can be used in conjunction with room-and-pillar mining. In this method, large continuous blocks of coal are isolated within a seam (Figure A4), either by room-and-pillar areas or with the use of roadways. These blocks are usually 200 to 600 feet wide and up to several miles long. Conveyor systems are set up along the sides and faces of the blocks to carry coal to areas where it can be loaded and stockpiled (Given et al. 1973).

A machine called a shearer is drawn along the face of the block of coal that is opposite the mine entry (Figure A5). The roof behind the shearer is supported by hydraulic jacks that are around 5 ½ feet wide and up to about 20 feet tall placed in a long line. When the shearer has reached the end of the longwall face, these roof supports automatically move forward about 3 feet so the shearer can begin a new pass. Once the roof supports have advanced, the overburden behind them is allowed to collapse (called the “gob” or “goaf” area). The coal cut by the shearer falls onto a conveyor system that brings it to where it can be loaded into trucks and stockpiled (Given et al. 1973).

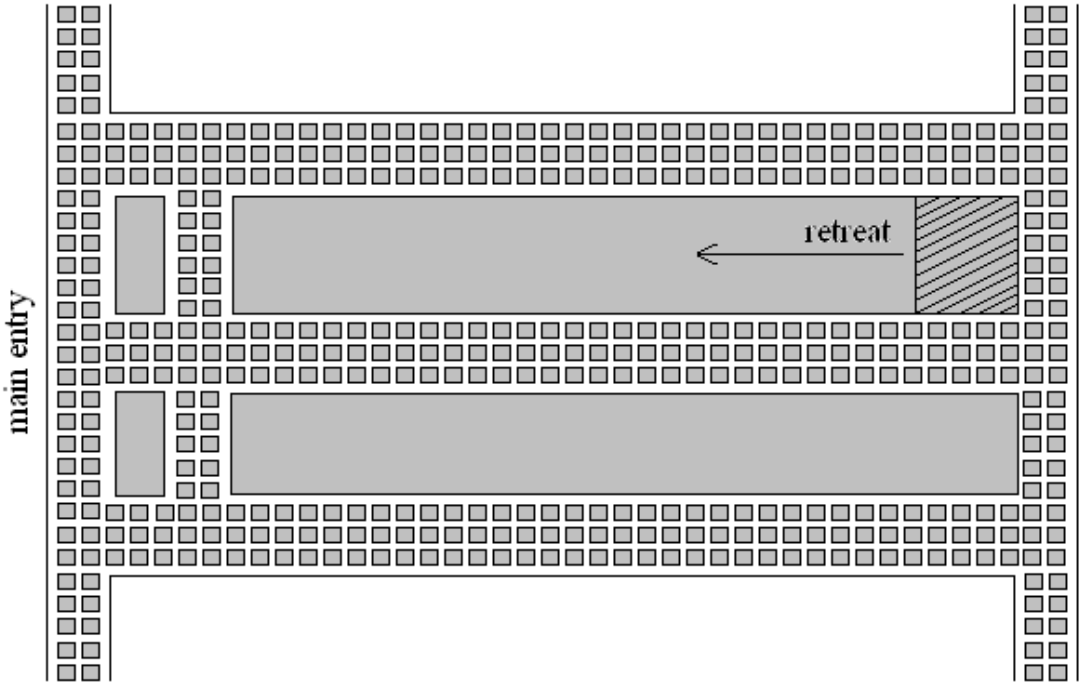


Figure A4. Longwall mining areas outlined with room-and-pillar areas. Longwall machinery is set up on the face of the block of coal opposite to the main entry to the mine. Coal is mined towards the mine entry. (Adapted from Given et. al 1973).

The benefits of longwall mining include a greater coal recovery rate than the room-and-pillar method and enhanced safety for mine workers due to the hydraulic roof supports. A detailed diagram of longwall mining is shown in Figure A5. A photo taken in a longwall mine is shown in Figure A6.

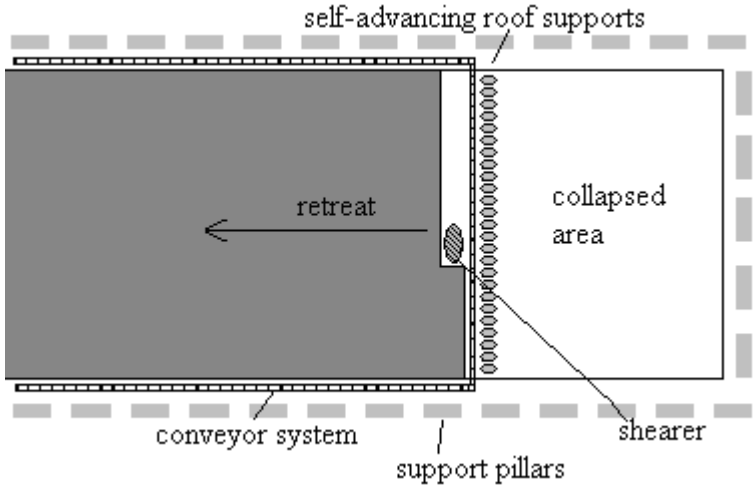


Figure A5. Detail of longwall mining.

Figure A6. Photo of longwall mining machinery including the shearer and the self-advancing roof supports (Hill-Douglas 2007).

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Hill-Douglas, O. 2007. Mining: Mine Automation. CSIRO SOLVE:8-9.

APPENDIX D.
KANAB FIELD OFFICE: COAL UNSUITABILITY REPORT

APPENDIX 6—KANAB FIELD OFFICE: COAL UNSUITABILITY REPORT

INTRODUCTION

Bureau of Land Management (BLM) regulations regarding coal management on public lands are found in Title 43 of the Code of Federal Regulations (CFR), Part 3400. During land use planning, BLM is required to review federal lands and assess whether there are areas unsuitable for all coal mining or for certain stipulated methods of coal mining. This report addresses the 20 criteria of coal unsuitability as defined in 43 CFR 3461.5 and applies these criteria to the known recoverable coal resource areas (KRCRA) for the Alton, Kaiparowits, and Kolob coal fields. Unsuitability decisions were based on these criteria and applied to federally owned coal estates within the Kanab Field Office (KFO) Decision Area (KDA). Currently there are no active coal leases within the KDA, but one lease application is presently being processed/analyzed in the Alton Amphitheater.

GEOLOGIC SETTING

KPA coals are located within Late Cretaceous sedimentary strata of the Dakota and Straight Cliffs formations. The Alton and Kolob coal fields are in the Dakota Formation and the Kaiparowits coal field is in the John Henry Member of the Straight Cliffs Formation. The depositional environment for both the Dakota and Straight Cliffs coals was a coastal plain setting along the Western Interior Seaway. The Dakota coals were deposited approximately 95 million years ago during the onset (transgression) of the Western Interior Seaway. Kaiparowits coals were deposited approximately 85 million years ago as the Western Interior Seaway regressed from the area. Rivers originating along the Sevier Mountain belt and Mogollon highlands provided a steady supply of sediment for burial of the rich coastal mires.

LANDS CONSIDERED

The recoverable coal resources within the Kanab Planning Area (KPA) cross a number of surface ownership boundaries, including BLM, U.S. Forest Service (USFS), National Park Service (NPS), State of Utah, and private lands, and are located within Kane and Garfield counties. This report considers approximately 149,168 acres of federally owned coal within the KRCRA (Map 1) of the KDA.

COAL RESOURCES

The Kanab Field Office Mineral Potential Report (BLM/Utah Geological Survey 2006) identifies an in-ground coal resource for the KPA of approximately 10 billion tons. Approximately 200 million tons have been identified as surface minable in the Alton coal field. Generally, Dakota Formation coals range from a subbituminous B rank in the Alton coal field to subbituminous A rank in the Kolob coal field. The sulfur content varies, but averages about 1.2 percent. The in-place ash content generally ranges between 10 percent and 15 percent. Heat content for Dakota Formation coals varies from about 7,500 to 9,500 BTU/lb. In the Kaiparowits field, the coal rank decreases from high-volatile C bituminous to subbituminous from south to

north in the KPA. The ash and sulfur levels of the Straight Cliffs coals average about 10 percent and 0.7 percent, respectively. The heat content of Kaiparowits coal ranges from about 7,420 to 10,300 BTU/lb (BLM/UGS 2006).

Table A0-1 through Table A0-3 identify the coal resources based on the depth of cover and the mapped quadrangle. Shallower depths of cover, which have the potential for surface mining, are presented in Table A0-1.

Table A0-1. Alton Coal Field

Quadrangle	Depth of Cover				
	0 200 ft	200 1000 ft	1000 2000 ft	2000 3000 ft	TOTAL
Alton	95.3	212.1	114.3	98.9	520.6
Bald Knoll	52.7	152.9	48.8	42.3	296.7
Orderville NE-SE	38.3	96.9	0.0	0.0	135.2
Skutumpah Creek	16.9	183.4	107.4	17.8	325.5
TOTAL	203.2	645.3	270.5	159.0	1,278.0
PERCENT	15.9%	50.5%	21.2%	12.4%	100.0%

Identified coal resource for the Alton coal field within the KPA by depth of cover and quadrangle (in millions of tons; from BLM/UGS 2006)

Table A0-2. Kolob Coal Field

Quadrangle	Depth of Cover			
	0 1000 ft	1000 2000 ft	2000 3000 ft	TOTAL
Orderville Canyon NE	62.4	305.6	193.2	561.2
Orderville Canyon SE	258.7	143.0	0.0	401.7
Orderville SW	132.2	257.0	8.4	397.6
TOTAL	453.3	705.6	201.6	1,360.5
PERCENT	33.3%	51.9%	14.8%	100.0%

Identified coal resource for the Kolob coal field within the KPA by depth of cover and quadrangle (in millions of tons; from BLM/UGS 2006)

Table A0-3. Kaiparowits Coal Field

Township/ Range	Depth of Cover					
	Minable			Deep		TOTAL
	0 1000 ft	1000 2000 ft	2000 3000 ft	3000 6000 ft	> 6000 ft	
33S, 2W	0.0	0.0	0.0	0.0	0.0	0.0
33S, 1W	0.0	0.0	0.0	0.0	0.0	0.0
33S, 1E	0.0	94.9	655.4	1,046.6	0.0	1,796.9
33S, 2E	10.5	48.8	93.3	7.3	0.0	159.9
34S, 2W	7.5	121.2	113.1	74.4	0.0	316.2

Township/ Range	Depth of Cover					TOTAL
	Minable			Deep		
	0 1000 ft	1000 2000 ft	2000 3000 ft	3000 6000 ft	> 6000 ft	
34S, 1W	0.0	0.0	45.3	49.9	0.0	95.2
34S, 1E	33.2	589.7	284.5	278.9	0.0	1,186.3
34S, 2E	1.4	45.0	0.0	0.0	0.0	46.4
35S, 2W	111.3	150.2	165.6	249.0	0.0	676.1
35S, 1W	0.0	0.0	0.0	405.7	54.4	460.1
35S, 1E	20.0	190.5	188.9	356.4	6.9	762.7
36S, 2W (N½)	65.5	42.6	7.9	0.1	0.0	116.1
36S, 1W (N½)	9.7	22.5	101.8	151.8	7.4	293.2
36S, 1E	104.2	217.8	189.5	948.8	0.0	1,460.3
TOTAL	363.3	1,523.2	1,845.3	3,568.9	68.7	7,369.4
PERCENT	4.9%	20.7%	25.0%	48.4%	0.9%	100.0%

Identified coal resource for the Kaiparowits Plateau coal field within the KPA by depth of cover and township (in millions of tons; from BLM/UGS 2006)

EVALUATION OF THE COAL UNSUITABILITY CRITERIA

This report assesses KDA coal resources for unsuitability based on the 20 criteria outlined in 43 CFR 3461.5. Underground mining of coal deposits is exempt from the criteria, where there would be no surface coal mining operations as stated at 3461.1.1(a). Surface mining operations include surface operations and surface impacts incident to an underground mine as stated in 43 CFR 3400.0-5(mm). In addition, where underground mining would include surface operations and surface impacts on federal lands to which a criterion applies, the lands shall be assessed as unsuitable unless an exception or exemption applies (43 CFR 3461.1(b)). Each criterion is subject to exceptions and/or exemptions as prescribed in the regulations.

Criterion Number 1

All Federal lands included in the following land systems or categories shall be considered unsuitable: National Park System; National Wildlife Refuge System; National System of Trails; National Wilderness Preservation System; National Wild and Scenic Rivers System; National Recreation Areas; lands acquired with money derived from the Land and Water Conservation Fund; National Forests; and Federal lands in incorporated cities, towns, and villages.

- Exceptions. (i) A lease may be issued within the boundaries of any National Forest if the Secretary finds no significant recreational, timber, economic or other values which may be incompatible with the lease; and (A) surface operations and impacts are incident to an underground coal mine, or (B) where the Secretary of Agriculture determines, with respect to lands which do not have significant forest cover within those National Forests west of the 100th Meridian, that surface mining may be in compliance with the Multiple-

Use Sustained-Yield Act of 1960, the Federal Coal Leasing Amendments Act of 1976 and the Surface Mining Control and Reclamation Act of 1977. (ii) A lease may be issued within the Custer National Forest with the consent of the Department of Agriculture as long as no surface coal mining operations are permitted.

- Exemptions. The application of this criterion to lands within the listed land systems and categories is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977.

A number of land systems specified in Criterion 1 are applicable under the unsuitability criteria.

National Forests

All National Forest lands are considered unsuitable for surface coal mining operations. An exception to this criterion would allow surface operations based on the specific criteria outlined above. The Dixie National Forest prepared a Coal Unsuitability Study in 1983, and found that only 10 acres met the conditions of the exception. The study was based on areas identified as high- and moderate-potential coal lands that did not have significant forest cover. However, National Forest lands are outside of the KDA and are not included in the BLM unsuitability decision.

National Recreation Areas

There are about 2,120 acres of federal coal in the Kaiparowits coal field that underlie the Glen Canyon National Recreation Area. Under Criterion 1, this federal coal is unsuitable for surface coal mining, however, it is not included in the BLM unsuitability decision because the lands are outside of the KDA.

National Wild and Scenic Rivers System

There are about 230 acres of lands that are considered suitable for inclusion in the National Wild and Scenic Rivers System.

Incorporated Cities, Towns, and Villages

Approximately 3,000 acres of federal coal in the Alton and Kolob coal fields within the KRCRA underlie the towns of Alton, Orderville, and Glendale. Because of possible damage to private property caused by subsidence and surface mining, these areas are determined to be unsuitable and will not be further considered for future leasing. The breakdown of the number of acres within each town is as follows:

Alton	101 acres
Glendale	1,742 acres
Orderville	1,162 acres

Exemptions for valid existing rights do not apply.

Summary: Criterion 1—Approximately 3,237 acres are determined to be unsuitable based on the conditions set forth in this criterion.

Criterion Number 2

Federal lands that are within rights-of-way or easements or within surface leases for residential, commercial, industrial, or other public purposes, on federally owned surface shall be considered unsuitable.

- Exceptions. A lease may be issued, and mining operations approved, in such areas if the surface management agency determines that: (i) All or certain types of coal development (e.g., underground mining) will not interfere with the purpose of the right-of-way or easement; or (ii) The right-of-way or easement was granted for mining purposes; or (iii) The right-of-way or easement was issued for a purpose for which it is not being used; (iv) The parties involved in the right-of-way or easement agree, in writing, to leasing; or (v) It is impractical to exclude such areas due to the location of coal and method of mining and such areas or uses can be protected through appropriate stipulations.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

There are only 17 recorded rights-of-way (ROW), totaling approximately 30 acres of land, within the KRCRA. The exception (parts (i), (iv), and (v)) of this criterion offers protection for the ROWs and their improvements from the potential adverse effects of mining or associated surface facilities and, therefore, will not be considered unsuitable.

There are a large number of roads that will be evaluated in the future for Revised Statute (RS) 2477 standing. This could greatly affect the number of ROWs within the KRCRA. It is likely that the criterion exception would also apply in these cases.

Summary: Criterion 2—No acres are determined to be unsuitable based on the conditions set forth in this criterion.

Criterion Number 3

The terms used in this criterion have the meaning set out in the Office of Surface Mining Reclamation and Enforcement regulations at Chapter VII of Title 30 of the Code of Federal Regulations. Federal lands affected by section 522(e) (4) and (5) of the Surface Mining Control and Reclamation Act of 1977 shall be considered unsuitable. This includes lands within 100 feet of the outside line of the right-of-way of a public road or within 100 feet of a cemetery, or within 300 feet of any public building, school, church, community or institutional building or public park or within 300 feet of an occupied dwelling.

- Exceptions. A lease may be issued for lands: (i) Used as mine access roads or haulage roads that join the right-of-way for a public road; (ii) For which the Office of Surface Mining Reclamation and Enforcement has issued a permit to have public roads relocated; (iii) If after public notice and opportunity for public hearing in the locality, a written finding is made by the authorized

officer that the interests of the public and the landowners affected by mining within 100 feet of a public road will be protected; (iv) For which owners of occupied dwellings have given written permission to mine within 300 feet of their buildings.

- Exemptions. The application of this criterion is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977.

Criterion 3 identifies approximately 3,200 acres of land within the KRCRA that have been found to be unsuitable. Data was not available to ascertain the location of all public buildings, community or institutional buildings, or occupied dwellings. Therefore, municipality boundaries were used to identify the areas of unsuitability. There are still a number of homes and summer cabins on private lands outside of these boundaries that are underlain by federal coal in the Alton and Kolob fields. A survey of the exact locations was not conducted. Because many of these structures are located in areas that would be mined primarily by underground methods, the underground exemption could possibly be applied. If the exemption could not be applied, mining would not be allowed within 300 feet of any such dwelling. A survey of existing dwellings would be made if leasing of federal coal is considered. The owners of the dwellings would be given the opportunity to give written permission for mining. If permission is not obtained, the area would then be designated unsuitable and the exact acreage calculated. Until that time, the area will be considered suitable.

The Alton Cemetery is underlain by surface minable coal. This area is unsuitable because surface mining is prohibited within 100 feet of a cemetery. This involves only about 1 acre.

As mentioned above in Criterion 2, the total acreage determined to be unsuitable could increase significantly in the future based on administrative determinations regarding RS 2477 road assertions.

The exemptions for valid existing rights do not apply because there are presently no authorized coal leases within the KRCRA.

Summary: Criterion 3—Approximately 3,200 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining based on the conditions set forth in this criterion.

Criterion Number 4

Federal lands designated as wilderness study areas shall be considered unsuitable while under review by the Administration and the Congress for possible wilderness designation. For any Federal land which is to be leased or mined prior to completion of the wilderness inventory by the surface management agency, the environmental assessment or impact statement on the lease sale or mine plan shall consider whether the land possesses the characteristics of a wilderness study area. If the finding is affirmative, the land shall be considered unsuitable, unless issuance of noncompetitive coal leases and mining on leases is authorized under the Wilderness Act and the Federal Land Policy and Management Act of 1976.

- Exemptions. The application of this criterion to lands for which the Bureau of Land Management is the surface management agency and lands in designated wilderness areas in National Forests is subject to valid existing rights.

There is one Wilderness Study Area (WSA) that partially overlies the KRCRA. Therefore, approximately 45 acres within the Parunuweap Canyon WSA are considered unsuitable.

The exemptions for valid existing rights do not apply because there are presently no authorized coal leases within the KRCRA.

Summary: Criterion 4—Approximately 45 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining based on the conditions set forth in this criterion.

Criterion Number 5

Scenic Federal lands designated by visual resource management analysis as Class I (areas of outstanding scenic quality or high visual sensitivity) but not currently on the National Register of Natural Landmarks shall be considered unsuitable.

- Exceptions. A lease may be issued if the surface management agency determines that surface coal mining operations will not significantly diminish or adversely affect the scenic quality of the designated area.
- Exemptions. This criterion does not apply to lands: to which the operator has made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977, or which include operations on which a permit has been issued.

There are presently no Visual Resource Management (VRM) Class I lands within the KRCRA. This will change in the future with the new KFO Resource Management Plan (RMP) based on BLM policy set forth in the Washington Office Instruction Memorandum 2000-096, which directs BLM to assign VRM Class I designations to all WSA lands. Therefore, after authorization of the new RMP, 45 acres in the Parunuweap Canyon WSA that fall within the KRCRA (Criterion 4) will become unsuitable for surface mining.

Summary: Criterion 5—No acres are determined to be unsuitable at this time.

Criterion Number 6

Federal lands under permit by the surface management agency, and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments shall be considered unsuitable for the duration of the study, demonstration or experiment, except where mining could be conducted in such a way as to enhance or not jeopardize the purposes of the study, as determined by the surface management agency, or where the principal scientific user or agency gives written concurrence to all or certain methods of mining.

- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Southern Utah University in conjunction with the Utah Division of Wildlife Resources (UDWR) and the KFO BLM are studying Greater sage-grouse in the Alton area. The study incorporates

approximately 5,800 acres within the Alton Amphitheater. The purpose of the study is to determine locations and suitability for sage-grouse brooding and winter habitats. This study is scheduled to be complete in 2008. The schedule would not conflict with future mining/leasing and, therefore, the project area is considered suitable under this criterion.

Summary: Criterion 6—No acres are determined to be unsuitable.

Criterion Number 7

All publicly or privately owned places which are included in the National Register of Historic Places shall be considered unsuitable. This shall include any areas that the surface management agency determines, after consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Officer, are necessary to protect the inherent values of the property that made it eligible for listing in the National Register.

- Exceptions. All or certain stipulated methods of coal mining may be allowed if, after consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Officer, they are approved by the surface management agency, and, where appropriate, the State or local agency with jurisdiction over the historic site.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

This criterion applies to districts, sites, objects, and other items of historical, architectural, archaeological, or cultural significance in or eligible for inclusion in the National Register of Historic Places. Although no sites within the KRCRA have been included in the National Register, there are a large number of known and documented archaeological sites that have been determined eligible. The exception for stipulated coal mining methods that will not result in adverse impacts is applicable; however, mitigation may be required for eligible sites where adverse impacts cannot be avoided. The State Historic Preservation Officer has identified possible subsidence problems associated with underground mining. Stipulations would be necessary in any future leases to mitigate the adverse effects of subsidence.

Summary: Criterion 7—No acres are determined to be unsuitable at this time.

Criterion Number 8

Federal lands designated as natural areas or as National Natural Landmarks shall be considered unsuitable.

- Exceptions. A lease may be issued and mining operation approved in an area or site if the surface management agency determines that: (i) The use of appropriate stipulated mining technology will result in no significant adverse impact to the area or site; or (ii) The mining of the coal resource under appropriate stipulations will enhance information recovery (e.g., paleontological sites).
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which includes operations on which a permit has been issued.

There are no designated natural areas or National Natural Landmarks designated under 43 CFR 2070 within the KRCRA.

Summary: Criterion 8—No acres are determined to be unsuitable.

Criterion Number 9

Federally designated critical habitat for listed threatened or endangered plant and animal species, and habitat proposed to be designated as critical for listed threatened or endangered plant and animal species or species proposed for listing, and habitat for Federal threatened or endangered species which is determined by the Fish and Wildlife Service and the surface management agency to be of essential value and where the presence of threatened or endangered species has been scientifically documented, shall be considered unsuitable.

- Exceptions. A lease may be issued and mining operations approved if, after consultation with the Fish and Wildlife Service, the Service determines that the proposed activity is not likely to jeopardize the continued existence of the listed species and/or its critical habitat.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

There are approximately 33,972 acres of federally designated critical habitat for the Mexican spotted owl (MSO) within the boundaries of the KRCRA. In informal consultation with the U.S. Fish and Wildlife Service (USFWS), BLM mapped areas that contain only the primary constituent elements for MSO habitat, as defined by the Mexican Spotted Owl Recovery Plan (USFWS 2001, FR 8530, vol. 66 no. 22). These areas were identified using professional judgment and by buffering the 2000 Willey MSO habitat model by ½ mile. The areas identified include approximately 4,380 acres of habitat that would be considered unsuitable for surface coal mining or surface facilities. In the event of future leasing, BLM would inventory coal areas for threatened and endangered (T&E) plant and animal species in conjunction with a site-specific environmental impact statement (EIS) analysis. Critical habitat designations for T&E plant or animal species will likely change in the future, at which time the determination of suitability would be revised.

Past surveys include a general reconnaissance for T&E plants in the entire southern Utah coal area by Dr. Stanley Welch in 1977. Moderately intensive surveys were conducted by Dr. Kent Ostler in 1979 on about 56,500 acres on the Utah Power and Light Company preference right lease application area, the El Paso Coal Company leases, and the Resources Company leases. A moderately intensive survey on about 26,800 acres in the Alton coal field was conducted by Dr. Robert Foster in 1979. UDWR inventoried the coal areas of southern Utah for T&E animals in 1977 and 1978. The process included a literature search and field inventories. In 1979 and 1980, BLM conducted an essential habitat inventory for the Utah prairie dog, peregrine falcon, and bald eagle in southern Utah. Several bald eagle sightings were made on the Alton and Kolob coal fields, and one concentration area was located (Criterion 12). No peregrine falcons or Utah prairie dogs were identified closer than 10 miles from the KRCRA (Escalante and Zion Unit Resource Analyses; Johnson 1979; UDWR 1977; USFWS 1978, 44 FR 7096, December 10, 1979).

The exception in this criterion could allow for surface mining and surface facilities within these areas only after the USFWS determined that the proposed activity is not likely to jeopardize the continued existence of the MSO or other listed species in the future and/or their critical habitats.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 9—Approximately 4,380 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining in the KDA. Exception(s) to this criterion may be applicable subject to site-specific analysis and consultation with USFWS.

Criterion Number 10

Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as endangered or threatened shall be considered unsuitable.

- Exceptions. A lease may be issued and mining operations approved if, after consultation with the state, the surface management agency determines that the species will not be adversely affected by all or certain stipulated methods of coal mining.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

The State of Utah does not maintain an official state T&E species list; therefore, no state-listed T&E plant or animal species or critical habitat exists for this criterion.

Summary: Criterion 10—No acres are determined to be unsuitable.

Criterion Number 11

A bald or golden eagle nest or site on Federal lands that is determined to be active and an appropriate buffer zone of land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

- Exceptions. A lease may be issued if: (i) It can be conditioned in such a way, either in manner or period of operation, that eagles will not be disturbed during breeding season; or (ii) The surface management agency, with the concurrence of the Fish and Wildlife Service, determines that the golden eagle nest(s) will be moved. (iii) Buffer zones may be decreased if the surface management agency determines that the active eagle nests will not be adversely affected.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

In 2003, UDWR identified an active bald eagle nest within the KPA adjacent to the KRCRA. When including a 1-mile buffer zone, a portion of the KRCRA is intersected. Nests are considered active for a period of 7 years after discovery of a nest in use. Exercising (iii) of the exception above, the buffer has been modified because the natural topography provides adequate protection for the nest site. Approximately 20 acres of land remain unsuitable after the readjustment. Leasing may be feasible within the area determined to be unsuitable if the condition of exceptions (i and ii) are met. The underground exemption could also be applied on possible future leasing. Future leases would stipulate that no surface facilities could be built within a 1-mile radius of an active nest site and that surface operations could be conducted only between September 1 and December 31 of each year (Utah Field Office Guidelines for Raptor Protection From Human and Land Use Disturbances [USFWS 1999]). Future inventories by UDWR and BLM may identify additional eagle nests within the coal areas that would render the nest and buffer areas unsuitable.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 11—Approximately 20 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining. The exception in this criterion may be applicable subject to site-specific analysis and consultation with USFWS.

Criterion Number 12

Bald and golden eagle roost and concentration areas on Federal lands used during migration and wintering shall be considered unsuitable.

- Exceptions. A lease may be issued if the surface management agency determines that all or certain stipulated methods of coal mining can be conducted in such a way, and during such periods of time, to ensure that eagles shall not be adversely disturbed.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

BLM and UDWR inventories have identified a bald eagle winter concentration area of approximately 1,160 acres on Table Bench along the North Fork of the Virgin River. The wintering area is used from about November 1 to March 15 each year. The rough surface topography and the deep coals have led to the determination that only underground methods would be used to mine this area. The exception and underground exemption could be applied to possible future leases and surface facilities to restrict activities that could adversely disturb the eagles during the winter concentration period. Future inventories by BLM and UDWR may identify other bald eagle concentration areas within the coal areas, which could affect suitability (BLM 1978 and 1979, Zion Unit Analysis; UDWR 1977; Johnson 1979).

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 12—Approximately 1,160 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining. The exception in this criterion may be applicable subject to site-specific analysis.

Criterion Number 13

Federal lands containing a falcon (excluding kestrel) cliff nesting site with an active nest and a buffer zone of Federal land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

- Exceptions. A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the falcon habitat during the periods when such habitat is used by the falcons.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

BLM and UDWR inventories conducted in the late 1970s and early 1980s identified several prairie falcon nesting sites within the KPA, two of which were located within the KRCRA (BLM 1978, 1979 Zion and Escalante Unit Resource Analyses; UDWR 1977, 1978; Hoffman 1978; Johnson 1979; BLM field inventories 1976, 1977, 1978, and 1980). No recent surveys have been conducted to verify this data. Because of the amount of time that has passed since the data was collected and the likelihood of a change of status, no lands are designated as unsuitable under this criterion. A more thorough analysis would be required at the time of coal leasing to adequately address this criterion. Future inventories by UDWR and BLM or site-specific lease analysis may identify new falcon nests within coal areas. At that time the lands would be designated unsuitable unless the exception could be applied.

Summary: Criterion 13—No acres are determined to be unsuitable.

Criterion Number 14

Federal lands which are high priority habitat for migratory bird species of high Federal interest on a regional or national basis, as determined jointly by the surface management agency and the Fish and Wildlife Service, shall be considered unsuitable.

- Exceptions. A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the migratory bird habitat during the periods when such habitat is used by the species.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Several Bird Habitat Conservation Areas have been identified by the Intermountain West Joint Venture (IWJV) along the East Fork of the Virgin River, East Fork of the Sevier River (Parker Mountain), and Escalante River in and adjacent to the KRCRA. In consultation with USFWS, BLM determined that high-priority habitats for migratory birds exist along these corridors, defined as a ½-mile buffer zone from the outer edge of the bank. Approximately 8,376 acres of the KRCRA would be affected and considered unsuitable. Future leasing within these areas could occur if site-specific consultation with USFWS determined that such operations would not adversely affect the migratory bird habitat during the periods of use.

The underground exemption does not apply in this criterion because of the potential to affect hydrologic systems and riparian habitat.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 14—Approximately 8,120 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining. The exception in this criterion may be applicable subject to site-specific analysis and consultation with USFWS.

Criterion Number 15

Federal lands which the surface management agency and the state jointly agree are habitat for resident species of fish, wildlife and plants of high interest to the state and which are essential for maintaining these priority wildlife and plant species shall be considered unsuitable. Examples of such lands which serve a critical function for the species involved include: (i) Active dancing and strutting grounds for Greater sage-grouse, sharp-tailed grouse, and prairie chicken; (ii) Winter ranges crucial for deer, antelope, and elk; (iii) Migration corridor for elk; and (iv) Extremes of range for plant species.

- Exceptions. A lease may be issued if, after consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

There are approximately 18,330 acres of crucial elk winter range; 12,780 acres of crucial mule deer winter range; 8,735 acres of Greater sage-grouse breeding, nesting, and brood-rearing habitat; and 12 acres classified as leks on federal coal lands within the KRCRA. The State of Utah and BLM agree that elk, mule deer, and sage-grouse habitats should remain suitable because site-specific analyses would occur before coal field leasing. Presently there is an EIS underway as part of a coal leasing application in the Alton Amphitheater. High-interest habitat issues will be addressed in this EIS.

Table A0-4. State Sensitive Species Habitat

State Sensitive Species Habitat (acres of habitat by ownership)	USFS	BLM	State Surface	Private Surface
Elk	17,015	1,235		80
Mule Deer	8,445	2,530	680	1,125
Sage-Grouse Breeding, Nesting, and Brood-Rearing	5,735	1,940		1,060
Sage-Grouse Lek		12		

Neither the BLM nor the State of Utah has high-interest plant species of concern within the KRCRA.

The first exception and underground exemption in this criterion would apply.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 15—No acres are determined to be unsuitable.

Criterion Number 16

Federal lands in riverine, coastal and special floodplains (100-year recurrence interval) on which the surface management agency determines that mining could not be undertaken without substantial threat of loss of life or property shall be considered unsuitable for all or certain stipulated methods of coal mining.

- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Data for this criterion is not presently available to adequately delineate riverine and special floodplains. Limited 100-year flood hazard maps are available from the U.S. Department of Housing and Urban Development, but the data is not adequate to determine the threat assessment. A more thorough analysis will be required at the time of coal leasing to adequately address this criterion.

Summary: Criterion 16—No acres are determined to be unsuitable.

Criterion Number 17

Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.

- Exceptions. A lease may be issued where the surface management agency in consultation with the municipality (incorporated entity) or the responsible governmental unit

determines, as a result of studies, that all or certain stipulated methods of coal mining will not adversely affect the watershed to any significant degree.

- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

No lands within the KRCRA have been committed for use as municipal watersheds.

Summary: Criterion 17—No acres are determined to be unsuitable.

Criterion Number 18

Federal lands with National Resource Waters, as identified by states in their water quality management plans, and a buffer zone of Federal lands ¼ mile from the outer edge of the far banks of the water, shall be unsuitable.

- Exceptions. The buffer zone may be eliminated or reduced in size where the surface management agency determines that it is not necessary to protect the National Resource Waters.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

In the State of Utah, the designation "High Quality Waters" is the equivalent of National Resource Waters, and therefore waters with this designation receive additional regulatory protection.

Within the KPA, the State of Utah has designated Category 1 High Quality Waters in the following drainages:

1. North Fork of the Virgin River and tributaries, from the confluence with the East Fork of the Virgin River to its headwaters
2. East Fork of the Virgin River and tributaries, from the confluence with the North Fork of the Virgin River to its headwaters
3. East Fork of the Sevier River and tributaries, from the Kingston diversion to its headwaters
4. Kanab Creek and tributaries, from the irrigation diversion at the confluence with Reservoir Canyon to its headwaters (Utah Administrative Code R317-2-12).

Consistent with Criterion 18 and state rules, BLM has determined that protection of High Quality Waters can be achieved through the use of the unsuitability designation, best management practices (BMP), and the state permitting process. Buffers were established for springs and perennial and intermittent streams, as follows:

- Perennial streams: ¼ mile (1,320 feet; 402 meters) slope distance from the outer edge of the bank

- Intermittent streams: 330 feet (100 meters) slope distance from the outer edge of the bank
- Springs: 330 feet (100 meters) slope distance from the edge of the saturated area.

The locations of springs and perennial and intermittent stream reaches were determined based on interviews with employees of the BLM KFO and NPS (Sharrow, personal communication) as well as with a local landowner who has extensive knowledge of the area (Esplin, personal communication). Their input was used to edit the U.S. Geological Survey (USGS) digital line graphs dataset that covers the KPA. Stream segments that would be perennial or intermittent if it were not for irrigation diversions were classified according to their potential condition rather than their altered condition.

Approximately 13,760 acres are determined to be unsuitable because of proximity to National Resource Waters. It is likely that additional perennial/intermittent streams and springs are present that were not mapped. If such waterways are determined to exist after the publication of this report, they would be buffered and protected as described above.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 18—Approximately 12,988 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining.

Criterion Number 19

Federal lands identified by the surface management agency, in consultation with the state in which they are located, as alluvial valley floors according to the definition in §3400.0—5(a) of this title, the standards in 30 CFR Part 822, the final alluvial valley floor guidelines of the Office of Surface Mining Reclamation and Enforcement when published, and approved state programs under the Surface Mining Control and Reclamation Act of 1977, where mining would interrupt, discontinue, or preclude farming, shall be considered unsuitable. Additionally, when mining Federal land outside an alluvial valley floor would materially damage the quantity or quality of water in surface or underground water systems that would supply alluvial valley floors, the land shall be considered unsuitable.

- Exemptions. This criterion does not apply to surface coal mining operations which produced coal in commercial quantities in the year preceding August 3, 1977, or which had obtained a permit to conduct surface coal mining operations.

There is insufficient data at this time to determine either suitability or unsuitability of any area for coal development under this criterion. Identification of alluvial valley floors (AVF) is accomplished by the surface management agency in consultation with the state according to the definition in the Surface Mining Control and Reclamation Act of 1977 (SMCRA) (PL 95-87), the standards in 30 CFR 822, the Office of Surface Mining (OSM) AVF guidelines, and approved state programs under SMCRA.

The AVF guidelines provide a sequential procedure for identifying AVFs. The first phase is a reconnaissance investigation that identifies probable AVFs using available regional or generalized data. The second phase is more detailed, and involves test drilling and mapping of

geologic, vegetation, and soils data, leading to a determination that an area meets the criteria outlined in the regulations (30 CFR 78 19(c)(2)). The third phase requires more detailed descriptions of the AVFs identified in phase two, and involves water monitoring for a sufficient period of time to be able to describe seasonal fluctuations.

In response to a petition to designate certain lands in the study area as unsuitable for surface coal mining, OSM completed the first phase of an AVF investigation in the Alton coal field area (OSM 1983). The following list represents areas identified as possible AVFs within the KRCRA, but additional analysis would be required before leasing:

1. Kanab Creek, upper and lower
2. Sink Valley Wash
3. Unnamed tributary north of Alton and west of Kanab Creek
4. Thompson Creek
5. Mill, Tenny, and Skutumpah Creeks
6. Lower Johnson Wash
7. Yellow Creek
8. Upper Paria drainage
9. East Fork of the Sevier River.

AVFs may exist within the decision area, but initial mapping of AVFs has occurred only within the Alton area and at a reconnaissance level. Approximately 3,850 acres were identified as possible AVFs using data obtained from an investigation conducted by Jack Schmidt (1980) and BLM geographic information system (GIS) data layers. No lands within the planning area are designated as unsuitable under this criterion. A more detailed investigation would be required at the time of lease analysis.

The exemption for ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 19—No acres are determined to be unsuitable.

Criterion Number 20

Federal lands in a state to which is applicable a criterion (i) proposed by the state or Indian tribe located in the planning area, and (ii) adopted by rulemaking by the Secretary, shall be considered unsuitable.

- Exceptions. A lease may be issued when: (i) Such criterion is adopted by the Secretary less than 6 months prior to the publication of the draft comprehensive land use plan or land use analysis, plan, or supplement to a comprehensive land use plan, for the area in which such land is included, or (ii) After consultation with the state or affected Indian tribe, the surface management agency determines that all or certain stipulated methods of coal mining will not adversely affect the value which the criterion would protect.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Neither the State of Utah nor Indian tribes have proposed any criteria that would affect the coal lands under review, although in 1980 Secretary of Interior Andrus signed a decision designating certain areas in the viewshed of Bryce Canyon National Park unsuitable for surface coal mining and surface impacts incident to underground mining. Approximately 31,620 acres fall within the KRCRA, and these are determined to be unsuitable.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 20—Approximately 10,614 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining.

SUMMARY OF THE UNSUITABILITY EVALUATION

The coal resources with development potential within the KPA have been evaluated based on the 20 criteria of unsuitability. Based on the criteria, the coal resources that are considered unsuitable for surface coal mining or surface operations and impacts incident to underground mining are shown on Map 2. These resources have been determined to be unsuitable based on Criteria 1, 3, 4, 9, 11, 12, 14, 15, 18, and 20. As a result of this analysis, there are approximately 35,538 acres within the KDA that are determined to be unsuitable for surface coal mining or operations and surface impacts incident to underground mining.

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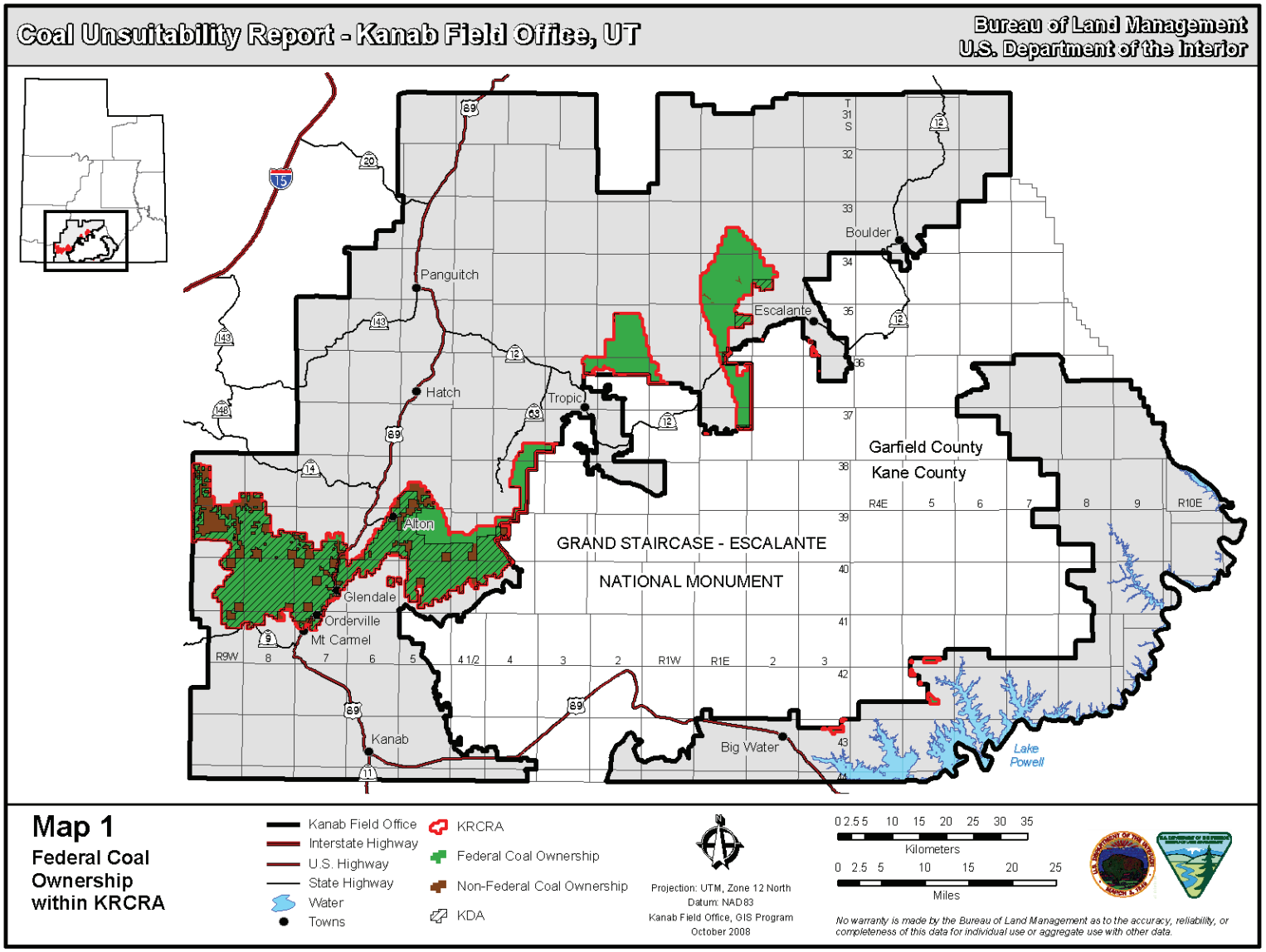
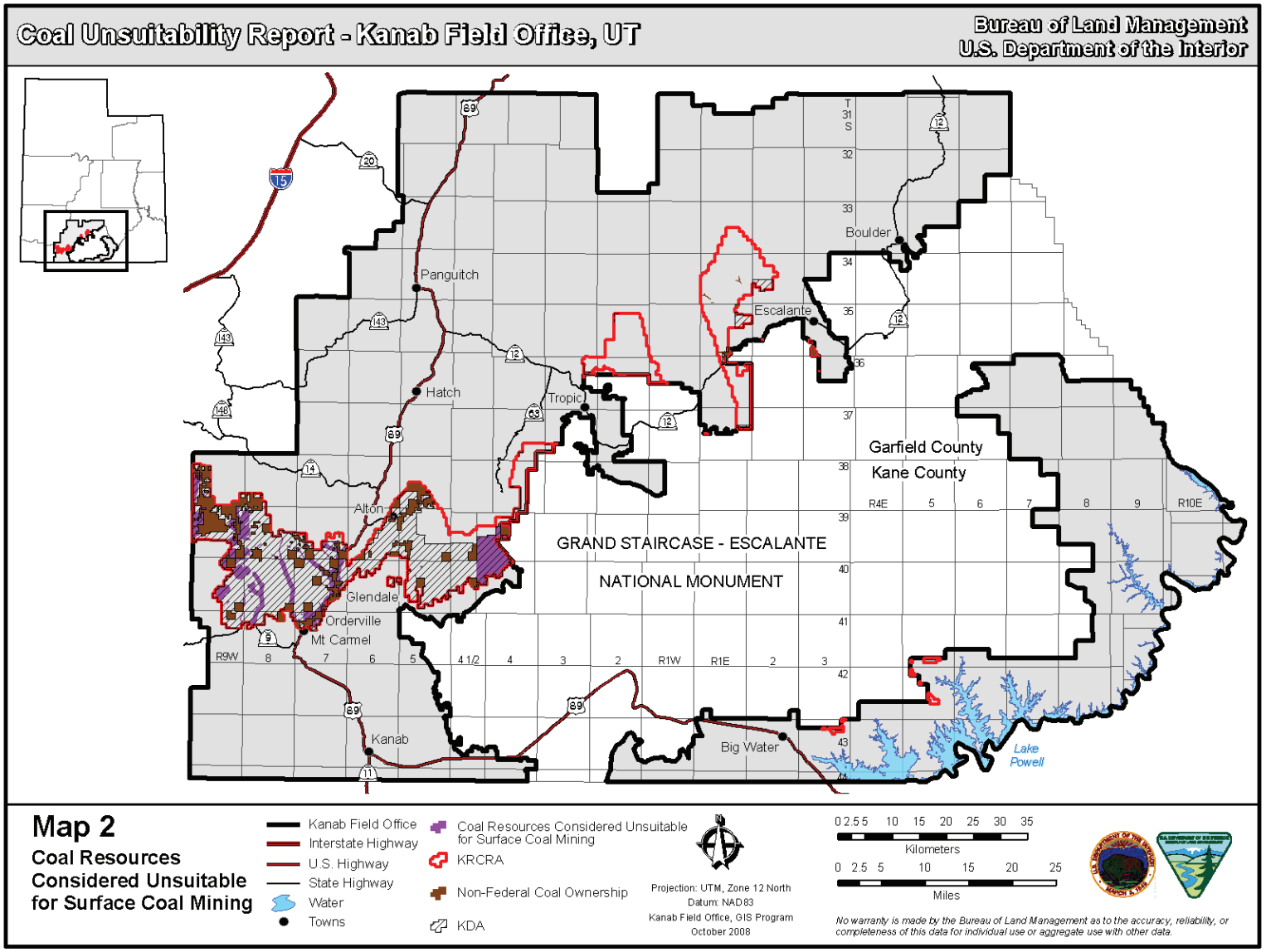
MAP 1. FEDERAL COAL OWNERSHIP WITHIN KRCRA



MAP 2. COAL RESOURCES CONSIDERED UNSUITABLE FOR SURFACE MINING



APPENDIX E.

RECONNAISSANCE ALLUVIAL VALLEY FLOOR INVESTIGATION IN THE ALTON COAL TRACT LBA AND ADJACENT AREAS, KANE COUNTY, UTAH

Reconnaissance Alluvial Valley Floor Investigation in the Alton Coal Tract LBA and Adjacent Areas, Kane County, Utah

7 June 2011

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Reconnaissance Alluvial Valley Floor Investigation in the Alton Coal Tract LBA and Adjacent Areas, Kane County, Utah

7 June 2011

Prepared by:

Erik C. Petersen, P.G.
Senior Hydrogeologist
Utah P.G. No. 5373615-2250

PETERSEN HYDROLOGIC
CONSULTANTS IN HYDROGEOLOGY

2695 N. 600 E.
LEHI, UTAH 84043
(801) 766-4006
PETERSEN@RELIA.NET

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Reconnaissance Alluvial Valley Floor Investigation in the Alton Coal Tract LBA and Adjacent area, Kane County, Utah

1.0 Introduction

The United States Department of the Interior, Bureau of Land Management (BLM) is currently preparing a draft environmental impact statement in conjunction with proposed federal coal leasing actions in the Alton Coal Field at the Alton Coal Tract LBA (LBA). The LBA includes federal coal reserves located near the town of Alton, Utah (Figure 1).

Under the provisions of the Surface Mining Control and Reclamation Act of 1977 (SMCRA), special consideration is given to coal mining in certain types of stream valleys in the western United States west of the 100th meridian. These valleys are called alluvial valley floors (AVF). While the regulatory definition of an alluvial valley floor is rather complex, in the general sense, alluvial valley floors are stream valleys which 1) are located in those topographic valleys having an associated stream channel, 2) are underlain by unconsolidated deposits whose surface usually has the landform appearance of flood plains or terraces, and 3) have agricultural importance derived from the availability of surface-water or groundwater (OSM, 1983). Under SMCRA, certain alluvial valley floors are prohibited from disturbance by coal mining activities, while other alluvial valley floors may be mined, but are subject to higher standards of reclamation than are other coal mined areas.

Because of the complexities of alluvial valley floor identification, a multi-step investigative identification process is often implemented in coal leasing and permitting actions. Initial

identification studies are typically performed at a reconnaissance level using currently available or easily obtainable information. The performance of detailed, site-specific AVF studies typically involves the collection and analysis of large amounts of data and requires considerable effort and expense. Consequently, where necessary, detailed site-specific AVF studies are typically performed at a later time (often during the mine permitting stage). The primary purpose of a reconnaissance-level initial identification study is to identify those areas in and adjacent to proposed coal mining areas that clearly are not alluvial valley floors as defined by SMCRA. Additionally, those areas that are determined to be probable alluvial valley floors, based on the reconnaissance-level information and identification criteria, are delineated in these studies. The results of these reconnaissance-level AVF identification studies are useful to regulatory agencies in making initial decisions regarding leasing actions and permitting of coal mining areas. Where considered necessary, additional more detailed investigations may subsequently be performed in those areas where the presence or absence of a regulatory alluvial valley floor is less clear.

It should be emphasized here that the delineation of an area as a probable alluvial valley floor at the reconnaissance-level identification stage should not result in any scientific or other bias with regards to any future post-identification-stage AVF determinations in that area. This is because 1) the AVF delineation criteria utilized at the reconnaissance-level investigatory stage are different and more generalized than those utilized at the detailed-study identification phase, and 2) the identification-stage determinations are typically based on regional-scale information that is commonly less refined and more general than the types of data obtained from detailed study investigations.

Specifically, the primary purpose of this investigation is to delineate those areas within the Alton Coal Tract LBA and the adjacent area that are clearly not alluvial valley floors. The secondary purpose of this investigation is to provide an initial identification of those areas that are probable alluvial valley floors based on a reconnaissance-level investigation.

Including this introduction, this report contains the following sections:

1. Introduction
2. Methods of Study
3. Alluvial Valley Floor Initial Identification Criteria
4. Regional Agricultural Practices
5. Mine Site Study Area
6. Water Availability
7. Presently Irrigated Lands
8. Subirrigated Areas
9. Lands Which Have the Capability of Being Flood Irrigated
10. Surficial Geology and Geomorphology
11. Reconnaissance-Level Alluvial Valley Floor Determinations
12. References Cited

2.0 Methods of Study

This reconnaissance-level alluvial valley floor identification study was performed using the following methods of study.

- Existing geologic and hydrogeologic maps and reports pertinent to this investigation were obtained and reviewed.

- A field reconnaissance survey was performed that included traversing each of the primary stream drainages in the study area as well as the upland portions of the area that could conceivably contain alluvial valley floors.

- The surficial geologic and geomorphologic characteristics of the surveyed areas were examined in the field and noted. Additional geologic information was obtained from the geologic map of the 7.5-minute Alton, Utah quadrangle (Tilton, 2001).

- Stream valleys and their associated stream channels were photographed for analysis.

- Aerial photographs were obtained and analyzed that included high-resolution color aerial photography, high-resolution color infrared imagery, and oblique color aerial photography.

- An analysis of high-resolution stereoscopic aerial photography was performed to delineate geomorphologic features.

- Information relating to the AVF identification criteria was plotted on a 1:24,000 United States Geological Survey topographic base for analysis.

3.0 Alluvial Valley Floor Identification Criteria

The identification criteria used to delineate probable alluvial valley floors in this reconnaissance investigation are based on the information provided in the document *Alluvial Valley Floor Identification and Study Guidelines,* which is published by the Office of Surface Mining Reclamation and Enforcement (OSM, 1983). It is important to note that, although the concept of an alluvial valley floor may have a technical meaning to a geologist, in the context of SMCRA, an alluvial valley floor is a *regulatory term* that has been defined in statute and clarified in legislative history, court decisions, regulations, and ongoing administrative decisions (OSM, 1983). Consequently, in this investigation, the AVF identification criteria established by SMCRA and as outlined by OSM have been strictly followed . These delineation criteria are summarized below.

The SMCRA definition of an alluvial valley floor is based on agricultural water use and surficial geologic characteristics of a stream valley. An alluvial valley floor is defined by SMCRA as:

> *the unconsolidated stream-laid deposits holding streams with water availability sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff or slope wash, together with talus, or other mass-movement accumulations and windblown deposits.*

Regulations, judicial review, and administrative decisions have expanded and clarified the statutory definition as follows (OSM, 1983):

The geologic criteria of an alluvial valley floor are understood to be:

(a) A topographic valley with a continuous perennial, intermittent, or ephemeral stream channel running through it; and
(b) Within that valley, those surface landforms that are either flood plains or terraces if these landforms are underlain by unconsolidated deposits; and
(c) Within that valley, those side-slope areas that can reasonably be shown to be underlain by alluvium and which are adjacent to flood plain or terrace landform areas.

The water availability criteria are met if:

(a) Water is available by surface-water irrigation or subirrigation and is being or has successfully been used to enhance production of agriculturally useful vegetation; or
(b) Surface water is available in sufficient quantities to support agricultural activities.

It is apparent that alluvial valley floors, in the regulatory sense, are not merely those valleys filled with alluvium. Additionally, stream valleys which do not have any agricultural importance or whose importance is not related to the greater water availability of the valleys are not alluvial valley floors (OSM, 1983).

The acquisition of the types and quantity of data required to make a definitive determination of a stream valley's alluvial valley floor status is typically a labor-intensive and expensive task. Commonly, the types of data utilized to make a final AVF determination at the detailed study level may include detailed subsurface characterization of alluvial sediments (typically performed by drilling and/or the excavation of soil pits), soil moisture characterizations, alluvial groundwater characterizations, baseline hydrologic information on groundwater and surface-water quantity and quality, detailed geomorphologic studies, detailed vegetative studies, and detailed evaluation of the agricultural potential of the land. At the preliminary land management and coal leasing stage, these types of data are typically not available to decision makers. Consequently, the determination of the AVF status of a stream valley is commonly performed in a multi-step process.

Commonly, prior to the performance of any detailed AVF investigation, a reconnaissance-level identification stage is performed in a coal lease study area. The reconnaissance-level identification study relies primarily on previously existing or easily obtained data from the project area. The primary goal of an identification stage study is to establish whether or not alluvial valley floors exist in the study area (OSM, 1983). Clearly, because the quantity and level of detail in the data utilized in a reconnaissance-level identification study are not of a detailed nature, the results of the reconnaissance-level identification study are utilized for general purposes only, and possibly to provide direction for future studies in the area.

Based on guidelines outlined by OSM, for the purpose of the reconnaissance-level identification study, the study procedure and criteria utilized to identify potential alluvial valley floors generally include the following:

Water Availability study procedure and Criteria (identification stage study)

- Presently irrigated lands are identified and mapped.

- All lands which appear to have the capability of being flood irrigated, based on a previous evaluation of commonly employed regional irrigation practices, are identified and mapped. If the type of undeveloped stream valley is not typically developed for irrigation elsewhere in the region, those valley floors are not AVF.

- Potential subirrigated lands which are of agricultural importance are identified and mapped.

Geologic study procedure and Criteria (identification stage study)

- Surficial geologic data are collected and flood plain or terrace areas are identified and mapped.

The water availability and geologic data in a reconnaissance-level study are typically plotted at a scale of 1:24,000 (1 inch = 2,000 feet).

Any areas meeting the geologic criteria and one of the water availability criteria can be considered alluvial valley floors for the purposes of initial identification (OSM, 1983).

4.0 Regional Agricultural Practices

This discussion of common agricultural practices in the study area is based on inspection of agricultural operations in the area and on discussions with local farmers and ranchers.

In the Alton, Utah and surrounding areas, the limiting factor for agricultural activity is typically the availability of a reliable supply of adequate water. In the Alton Coal Field area, near-surface groundwater resources are generally not sufficient to allow the pumping of groundwater for substantial crop irrigation. Groundwater in the near-surface formations in agricultural areas is generally limited to groundwater in shallow alluvial groundwater systems. Geologic conditions in the near-surface bedrock formations are not conducive to the production of appreciable quantities of groundwater (Petersen Hydrologic, 2007). It should be noted that appreciable groundwater resources are likely available in deep aquifers beneath the Alton Coal Field (i.e. the Navajo Sandstone regional aquifer). However, the difficulties and expense of producing groundwater from these deep formations are likely prohibitive. Consequently, appreciable production of groundwater from the deep aquifers for irrigation use is not known to have occurred in the area. Groundwater discharging from springs is commonly utilized for stock watering in the region.

Because of the unavailability of appreciable groundwater resources, the irrigation of croplands in the region is most commonly carried out using surface waters in streams originating in the upland areas of the adjacent Paunsaugunt Plateau located to the east of the study area (Figure 1). Because of the highly seasonal character of the discharge in these mountain streams (i.e. much of the annual yield from these streams occurs during the springtime snowmelt event prior to the growing season, while discharge usually declines dramatically thereafter in the summer months) surface waters are commonly diverted into earthen holding ponds and stored for use later in the growing season. Because of the appreciable stream gradients and topographic relief present in the area, surface water can be routed from up-stream diversions to irrigated fields at lower topographic elevations via earthen ditches or other conveyance mechanism under gravity flow. Crop yields in the region commonly show considerable variability from year to year depending on the surface-water availability as determined by the prevailing climatic conditions.

It is most commonly observed that irrigation of croplands is limited to parcels of land that are reasonably flat and of large enough acreage to warrant the effort required to design, construct, and maintain the irrigation system and to perform the irrigation. Commonly,

irrigated crop lands are irrigated using flood irrigation techniques. In other areas, sprinkler systems utilizing wheel lines and pivot systems (sourced with stored surface water) are increasingly being utilized.

5.0 Mine Site Study Area

The area of study for this reconnaissance-level identification study is shown on Plate 1. The study area boundaries encompass all of the Alton Coal LBA and the adjacent area. The boundaries of the study area have been delineated to facilitate the identification of alluvial valley floors within all areas possibly affected by coal mining activities in the Alton Coal Tract LBA.

It should be noted that a detailed alluvial valley floor study has previously been performed in the Coal Hollow Project and adjacent area in conjunction with the mine permitting activities with the Utah Division of Oil, Gas and Mining (Petersen Hydrologic, 2008). The study area for that investigation, which also includes portions of the Alton Coal LBA, is shown on Plate 1. The reader is referred to the report of that investigation (Petersen Hydrologic, 2008) for specific information regarding alluvial valley floors within that region. It should be noted that, prior to the issuance of the mining permit for the Coal Hollow Mine, the Utah Division of Oil, Gas and Mining made a finding that there are no alluvial valley floors present within the Coal Hollow Project area.

6.0 Water Availability

For general informational purposes, discharge hydrographs depicting seasonal flows rates measured historically in streams in the study area are provided in Figure 2. The discharge data used to create these hydrographs were obtained from data submitted to the Utah Division of Oil, Gas and Mining on-line hydrology database (UDOGM, 2008) by operators

in conjunction with mine permitting actions. It should be noted that these hydrographs depict instantaneous discharge measurements performed monthly or quarterly during times when the monitoring sites are accessible. These hydrographs do not depict a continuous, uninterrupted flow record, but rather are presented here to assist in evaluating the general magnitude of seasonal discharge rates in these streams.

It is apparent in Figure 2 that the most significant source of surface water in the study areas is from Kanab Creek. Kanab Creek provides irrigation water that is largely used in the Alton, Utah and nearby areas. Further downstream, flows diminish in the drainage, both as a result of upstream irrigation diversions and from losses to evapotranspiration. It is not uncommon for Kanab Creek to have little or no discharge south of the study area during much of the year.

Surface water flows in Sink Valley Wash below Sink Valley are usually present only in direct response to snowmelt and during torrential precipitation events. Consequently, Sink Valley Wash is not considered a significant source of irrigation water in the study area.

Water availability criteria in this alluvial valley floor identification study include 1) the identification and mapping of all presently irrigated lands, 2) the mapping of all lands which appear to have the capability of being flood irrigated, and 3) the mapping of potentially subirrigated areas. The results of these activities as performed for this investigation are summarized in the following three sections of this report.

7.0 Presently irrigated lands

A map showing presently irrigated lands in the study area is presented in Plate 2. The mapping of presently irrigated lands is based on 1) field observations of irrigated areas, and 2) analysis of high-resolution color IR aerial imagery.

Presently irrigated areas in the study area have been identified in two main regions. These include irrigated lands in the northern portion of the study area near the town of Alton, Utah, and irrigated lands located in the narrow valley bottoms adjacent to Kanab Creek in the central and southern portion of the study area about 2.5 miles south of Alton, Utah. The characteristics of these two irrigated areas are described below.

Alton area

Currently irrigated areas near the town of Alton, Utah are comprised mostly of irrigated hay fields. These fields are irrigated predominantly with sprinklers using wheel lines and pivots. The source of irrigation water is predominantly surface-water diverted from Kanab Creek into earthen storage ponds in upstream areas. Some apparently flood irrigated areas are also present, but these are generally smaller sized areas than are the sprinkler irrigated areas. It should be noted that all of the town has been mapped as presently irrigated lands. Irrigation within the town consists predominantly of irrigation of domestic and municipal landscaping and the irrigation of domestic gardens and pastures.

It is apparent that irrigation return water running off the irrigated fields immediately south of the town of Alton enhances the growth of vegetation and increases soil moisture in adjacent rangelands immediately south of the irrigated fields (see Plate 2). This conclusion is based in part on analysis of infrared imagery, which clearly shows the zones of increased wetness and vegetation occurring immediately below lowest elevation areas of the irrigated fields. Similar wet zones are not apparent in adjacent areas at similar elevations which are not adjacent to irrigated fields. Infiltration of springtime snowmelt runoff water from the fields and other up-gradient areas may also contribute to the increased wetness of these areas during the springtime. It is unlikely that there is an appreciable component of natural groundwater discharge in this area as the geologic conditions are not favorable for this to occur. The bedrock formation underlying the area consists of relatively impermeable Tropic Shale, which is overlain by an apparently thin veneer of alluvium and soil. The identification of a likely recharge location that could support appreciable natural groundwater discharge to these areas is also problematic.

Southern Kanab Creek valley area

Irrigated lands have been identified in the narrow valley bottoms adjacent to Kanab Creek about 2.5 miles south of Alton, Utah (Plate 2). Irrigation in these areas is by flood irrigation techniques. Water for irrigation of these areas is diverted from Kanab Creek into transmission ditches at upstream locations. This surface water is stored in earthen storage ponds for use in flood irrigation of the irrigable lands during the growing season.

It is apparent that at times in the past, hay production has likely occurred in these fields. However, during at least the past four years, it appears that these fields have been utilized primarily as pasture lands for seasonal cattle grazing.

8.0 Subirrigated Areas

Areas that appear to be potentially subirrigated and are of agricultural importance have not been identified within the study area. Narrow strips of riparian vegetation are present in some areas immediately adjacent to stream channels. While these narrow riparian areas are likely subirrigated, they are not considered significant to local agricultural activities and, consequently, are not mapped here. Subirrigation of the broader valley bottoms adjacent to the major stream drainages is generally not observed in the study area (other than in the narrow strip of riparian vegetation sometimes present near the stream channel). This condition is likely the result of several factors including 1) the lack of appreciable discharge in many of the stream reaches during much of the year, 2) the abundant presence of low permeability clayey sediments in the alluvial materials adjacent to the streams that limits the potential for appreciable lateral migration of water, and 3) the fact that many of the stream drainages in the study areas are deeply incised in their channels, often by several tens of feet, which results in an increased vertical distance between the active stream level and the vegetation present on the abandoned adjacent terrace.

9.0 Lands which appear to have the capability of being flood irrigated

Lands which appear to have the capability of being flood irrigated are mapped on Plate 3. The delineation of these areas is based on typical regional irrigation practices as described in Section 4 above. Regionally, those topographic valley areas which are reasonably flat and of a sufficient acreage to justify the effort and expense required to construct and maintain an irrigation system are often developed for irrigation. Narrow canyon bottoms and steep side slopes are generally not irrigated regionally. Because of the appreciable topographic relief present in the study area which provides the hydraulic head required to transport water through ditches or pipes under gravity flow, it has been assumed that surface waters could be conveyed via conveyance ditches to most valley bottom locations.

It should be noted that the mapping of potentially flood irrigable lands in Plate 3 is considered conservative. With sufficient effort, almost any lands in the project area (with the probable exception of some hill tops) could conceivably be flood irrigated. However, upland areas similar to those in the areas intervening between the major drainages in the study area are rarely irrigated in the region. For this investigation, essentially all of the valley bottoms and adjacent moderate side slope areas along the major drainages have been mapped as flood irrigable. It is acknowledged that many of these areas are probably too narrow to justify the efforts required to develop these lands for flood irrigation.

10.0 Surficial Geology and Geomorphology

A geologic map of the Alton, Utah 7.5 minute quadrangle was prepared by the Utah Geological Survey in cooperation with the United States Geological Survey in 2001 (Tilton, 2001).

As discussed above, detailed geologic information (particularly subsurface characteristics of alluvial sediments) is typically not available for reconnaissance-level AVF investigations. Consequently, for the purposes of the reconnaissance-level initial identification study, delineations of alluvial geomorphological features (flood plains and alluvial terraces) are usually relied upon as the basis for the geologic criteria for the identification-stage AVF delineation (OSM, 1983). The locations of flood plains and alluvial terraces identified in the study area are mapped in Plate 4. It should be noted that the shaded area on Plate 4 delineates regions where either flood plain or terrace geomorphic features have been identified. Regions including either of these geomorphic features (flood plains or terraces) were mapped together as the shaded region on Plate 4. However, these geomorphic features are not individually delineated on Plate 4. This methodology is considered appropriate as a determination of the presence of either flood plains or terrace landforms is inherent in a probable alluvial valley floor identification at the reconnaissance level.

The identification of geomorphologic features in this investigation were determined using high-resolution aerial photographs, high-resolution stereoscopic imagery, published geologic maps, and reconnaissance-level field investigations in the study area. It is apparent on Plate 4 that the mapable flood plains and terraces in the study area are located adjacent to Kanab Creek and lower Sink Valley Wash.

It is noteworthy that flood plains and alluvial terraces were not identified in the region near the town of Alton. Much of the region surrounding the town of Alton is underlain by bedrock of the Tropic Shale, which is a low-permeability marine shale (Tilton, 2001). Within the town itself, an apparently thin veneer of alluvium directly overlies the Tropic Shale. Alluvial sediments that would be consistent with those that would typically comprise an alluvial valley with associated flood plains and terrace complex are not present in this area.

11.0 Reconnaissance-Level Alluvial Valley Floor Determinations

As described in the OSM Alluvial Valley Floor Identification Guidelines (1983), those areas meeting the geologic criteria of the presence of alluvial flood plains and terraces, and also meeting one of the water availability criteria (lands presently irrigated, lands with the capability of being flood irrigated, or potentially subirrigated lands) are classified as probable alluvial floors for the purposes of the reconnaissance-level identification study.

Based on the reconnaissance-level identification study criteria outlined in Section 3 above, six Identification Areas have been identified in the study area. These areas encompass those lands within the study area that appear to have the greatest likelihood for being potential alluvial valley floors. Accordingly, these regions are considered areas for potential future detailed-level AVF delineation studies should additional characterization of the AVF status of these lands be warranted. The six Identification Areas are shown on Plate 5. Details summarizing the delineations of the AVF status of each of these areas are presented below.

Identification Area 1

Identification Area 1 is located in the Kanab Creek drainage in the northern portion of the study area east of the town of Alton, Utah (Plate 5). Photographs of the land surface in Area 1 are included in the Photographs Section of this report. Agricultural activities in Area 1 include the production of hay in irrigated fields in the flat lands adjacent to Kanab Creek. Pasture lands used for cattle grazing are also present in Area 1. The flat lands adjacent to Kanab Creek appear at the reconnaissance level to have the geomorphologic characteristics of flood plains. Consequently, at the reconnaissance-stage identification study level, the land in Area 1 is considered a probable alluvial valley floor.

It is noteworthy that bedrock outcrops are present along both the east and west margins of Area 1 with the land surface sloping toward the stream channel on both sides of the drainage. Additional information regarding the subsurface characteristics of the alluvial sediments and

the lateral alluvium/bedrock interface locations in Area 1 would facilitate the further refinement of the boundaries of the flood plain and to confirm the presence of an alluvial valley floor.

It should be noted that on satellite images, agricultural activities have been observed in upland areas (that are either alluvial fan or terrace geomorphic landforms) northeast of Identification Area 1 (beyond the study area extents of this investigation). The geomorphic character of these features, being outside the study area for this investigation, has not been definitively determined. However, within the study area for this investigation, upland alluvial terraces (beyond the flood plain and terrace complexes delineated in Plate 4) have not been identified. Accordingly, there is no identified potential for irrigation of any such upland alluvial terraces within the study area.

Identification Area 2

Identification Area 2 is located in the Kanab Creek drainage in the central portion of the study area (Plate 5). Photographs of the land surface in Area 2 are included in the photograph section of this report. The width of the valley bottom in Area 2 is much narrower than that of Area 1. A narrow flood plain is also present in Area 2. However, there has apparently not been any substantial agricultural development in Area 2, likely because of the narrowness of the valley. A narrow strip of riparian vegetation exists adjacent to the stream in the active channel area, but this does not seem to be large enough to be of appreciable agricultural importance for grazing. The surrounding land (outside the riparian area) consists mostly of undeveloped rangeland. While the land surface in Area 2 could conceivably be irrigated, the irrigation of valleys of similar geometry in the region has generally not been observed. Consequently, at the reconnaissance-stage identification study level, the land in Area 2 is considered a possible (though unlikely) alluvial valley floor. Refinement of the locations of the lateral margins of the stream-laid deposits overlying the flood plains could be accomplished with additional study of the subsurface characteristics of the sediments in the valley bottom.

It should be noted that grazing lands are present in regions located east of the northeast portion of Area 2 (which include privately owned lands in the southwestern quarter of Section 18, Township 39 South, Range 5 West). While some of these areas are mapped as alluvium in the Tilton (2001) geologic map of the area, the geomorphic landforms present in this region, which generally slope from the adjacent mountainous regions toward lower-lying regions adjacent to Kanab Creek, have been identified in this investigation as alluvial fan landforms. These areas do not show characteristics of flood plain or terrace geomorphic landforms. Accordingly, because of the absence of flood plain or terrace landforms, these areas are not considered as probable alluvial valley floors.

Within the study area for this investigation, upland alluvial terraces (beyond the flood plain and terrace complexes delineated in Plate 4) have not been identified. It should be noted that broad, sloping alluvial fan geomorphic features (which generally slope away from adjacent upland areas) have been identified in some areas, but these are not associated with either flood plain or terrace geomorphic features. Accordingly, there is no identified potential for irrigation of any such upland alluvial terraces within the study area (including the regions adjacent to Investigation Area 2).

Identification Area 3

Identification Area 3 is located in the Kanab Creek drainage in the central portion of the study area (Plate 5). The stream valley associated with Area 3 is a small tributary to Kanab Creek. A narrow, well-defined flood plain is present in the lower reaches of this tributary (See Photographs Section). A narrow corridor with increased vegetation is present in the bottom of this stream valley. As with Area 2 described previously, this stream drainage generally satisfies most of the reconnaissance-level identification criteria for AVF. However, its small size and narrow width probably preclude its development for irrigation and limit its agricultural importance. While the land surface in Area 3 could conceivably be irrigated, the irrigation of valleys of similar geometry in the region has generally not been observed. Consequently, at the reconnaissance-stage identification study level, the land in Area 2 is considered a possible (though unlikely) alluvial valley floor.

Identification Area 4

Identification Area 4 is located in the southwestern portion of the study area in the Kanab Creek drainage (Plate 5). Photographs showing the land surface in Area 4 are included in the Photographs Section of this report. It is apparent that the agricultural fields in Area 4 are currently utilized primarily for cattle grazing. The fields are currently flood irrigated using Kanab Creek surface water diverted from the creek at upstream diversions and conveyed through ditches to a series of earthen storage ponds (Plate 2). It appears likely that hay was produced in the past in some of the fields in Area 4 (dilapidated hay production equipment is still present at the site). In the southernmost portion of Identification Area 4, the Kanab Creek stream channel is incised below the adjacent abandoned terrace areas by more than 50 feet in some locations. The lands on the upland terrace adjacent to the active stream channel consist primarily of undeveloped rangelands. The flat lands adjacent to Kanab Creek that comprise Area 4 appear at the reconnaissance level to have the geomorphologic characteristics of flood plains. Consequently, at the reconnaissance-stage identification study level, the land in Area 4 is considered a probable alluvial valley floor.

Identification Area 5

Identification Area 5 is located in the southern portion of the study area in the Kanab Creek drainage immediately below Area 4 (Plate 5). Photographs showing the land surface in Area 5 are included in the Photographs Section of this report. The Kanab Creek stream drainage in Area 5 is deeply incised relative to the surrounding abandoned terrace areas. It is apparent that the lands in Area 5 outside the narrow, incised active stream channel area consist primarily of undeveloped rangelands with sagebrush and juniper vegetation. The riparian vegetation adjacent to the active stream channel in Area 5 is appreciably less extensive than in upstream locations. It is likely that the quantity of surface water available in this area for irrigation is meager during most of the year, given the numerous upstream irrigation diversions and potential losses to evapotranspiration in the considerable distance between Area 5 and the Paunsaugunt Plateau source areas for the stream. Consequently, the importance of this land for agricultural use seems low. However, the flat lands adjacent to Kanab Creek in Area 5 appear at the reconnaissance level to have the geomorphologic

characteristics of flood plains, and the relatively flat lands on the upper terrace appear to have the physical capability of being flood irrigated (although the availability of water for irrigation purposes is meager). Consequently, at the reconnaissance-stage identification study level, the land in Area 5 is considered a possible (although unlikely) alluvial valley floor.

Identification Area 6

Identification Area 6 is located in Sink Valley Wash in the southern portion of the study area (Plate 5). Photographs showing the land surface in Area 6 are included in the Photographs Section of this report. Surface water flows in Sink Valley Wash in this area are usually absent, with water usually being present in the drainage only in direct response to snowmelt or during torrential precipitation events. Consequently, the availability of water for irrigation of the land in Area 6 is very low and irrigation of these lands is probably a practical impossibility.

The land surface in lower Sink Valley Wash below the county road-136 crossing is relatively broad and consists predominantly of undeveloped rangeland. The relatively flat lands adjacent to Sink Valley Wash that comprise Area 6 appear at the reconnaissance level to have the geomorphologic characteristics of flood plains. In the adjacent region above the county road-136 crossing, a well-defined flood plain is not apparent. Based on these factors, at the reconnaissance-stage identification study level, the land in Area 6 is considered a possible (although unlikely) alluvial valley floor.

Alton Town Area

It should be noted that AVF status of the lands within and immediately south of the town of Alton and west of the Tropic Shale bedrock ridge that divides that area from the Kanab Creek stream valley were considered in this investigation. Although significant agricultural activity takes place on these lands, it is readily apparent that these lands do not meet the regulatory criteria described in Section 3 above to qualify as alluvial valley floors. The lands immediately south of the agricultural fields at the southern end of the town of Alton, and also the lands immediately to the west and east of the town consist of Tropic Shale bedrock

(Tilton, 2001). The apparently thin veneer of alluvial sediments overlying the Tropic Shale in the town of Alton does not show geologic characteristics consistent with stream-laid deposits associated with flood plains and terraces. Additionally, the presence of a continuous stream channel that runs though the area and which resulted in the deposition of stream-laid sediments with flood plains or terraces is not apparent. It seems most probable that the thin alluvial sediments near the town of Alton are associated with residuum or slope wash deposits derived from the adjacent soft Tropic Shale bedrock and mud slide deposits located topographically above the town (Tilton, 2001). For these reasons, this area is not considered to be an alluvial valley floor in this investigation.

Lower Robinson Creek Area

Most of the Lower Robinson Creek area is contained within the previously evaluated Coal hollow Project study area (Plate 1). Previously, the Utah Division of Oil, Gas and Mining found that there are no alluvial valley floors in the Lower Robinson Creek area within the Coal Hollow Project area study boundary. As part of this investigation, Identification Area 4, which includes lands adjacent to Kanab Creek and the lowest reaches of Lower Robinson Creek have been identified as a probable alluvial valley floor at the reconnaissance-stage identification study level. It should be noted here that the approximately 0.25 mile reach of the Lower Robinson Creek drainage between the previous Coal Hollow Project study area boundary and the eastern edge of Identification Area 4 has also been evaluated for AVF potential as part of this investigation. While alluvial sediments have been identified in this region and minor stream flows are commonly present in this reach of the creek, flood plain and terrace landforms have not been identified in this area. The narrow valley adjacent to Lower Robinson Creek in this portion of the drainage generally slopes from the adjacent upland areas towards Lower Robinson Creek. The land in this area consists of undeveloped rangeland. Accordingly, this area is not considered to be an alluvial valley floor in this investigation.

12.0 References Cited

OSM, 1983, United States Department of the Interior, Office of Surface Mining Reclamation and Enforcement, Alluvial valley floor identification and study guidelines.

Petersen Hydrologic, 2008, Supplemental information for Utah Division of Oil, Gas and Mining alluvial valley floor finding for the proposed Coal Hollow Mine, unpublished consulting report.

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Tilton, T.L., 2001, Geologic map of the Alton Quadrangle, Kane County, Utah, Utah Geological Survey, Miscellaneous Publication 01-4, 7.5 minute geologic map, cross-sections, and text.

UDOGM, 2008, Utah Division of Oil, Gas and Mining, Utah coal mine water quality database, on-line at http://ogm.utah.gov/coal/edi/wqdb.htm.

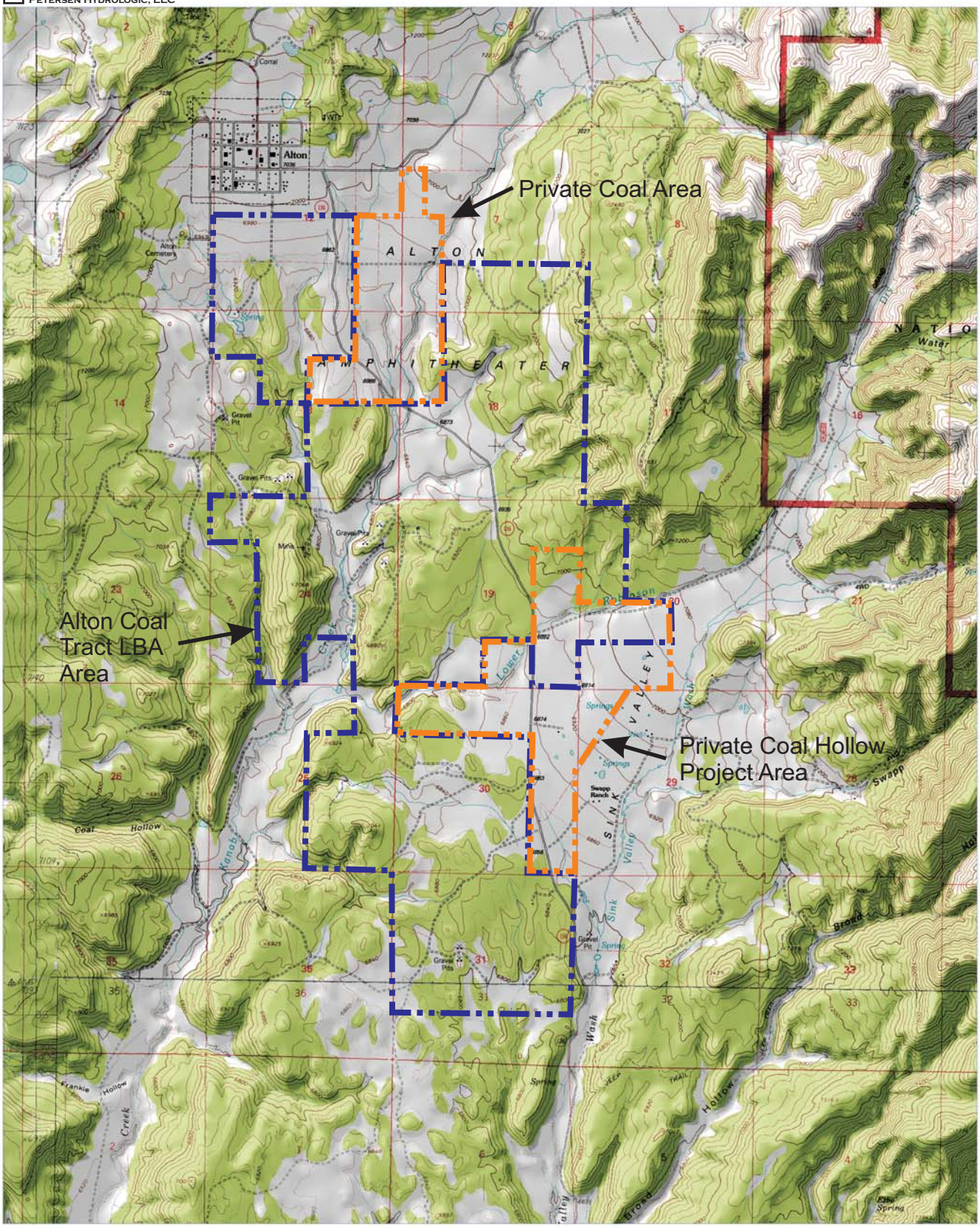


Figure 1 Location map showing the Alton Coat Tract LBA and adjacent areas and the town of Alton, Utah.

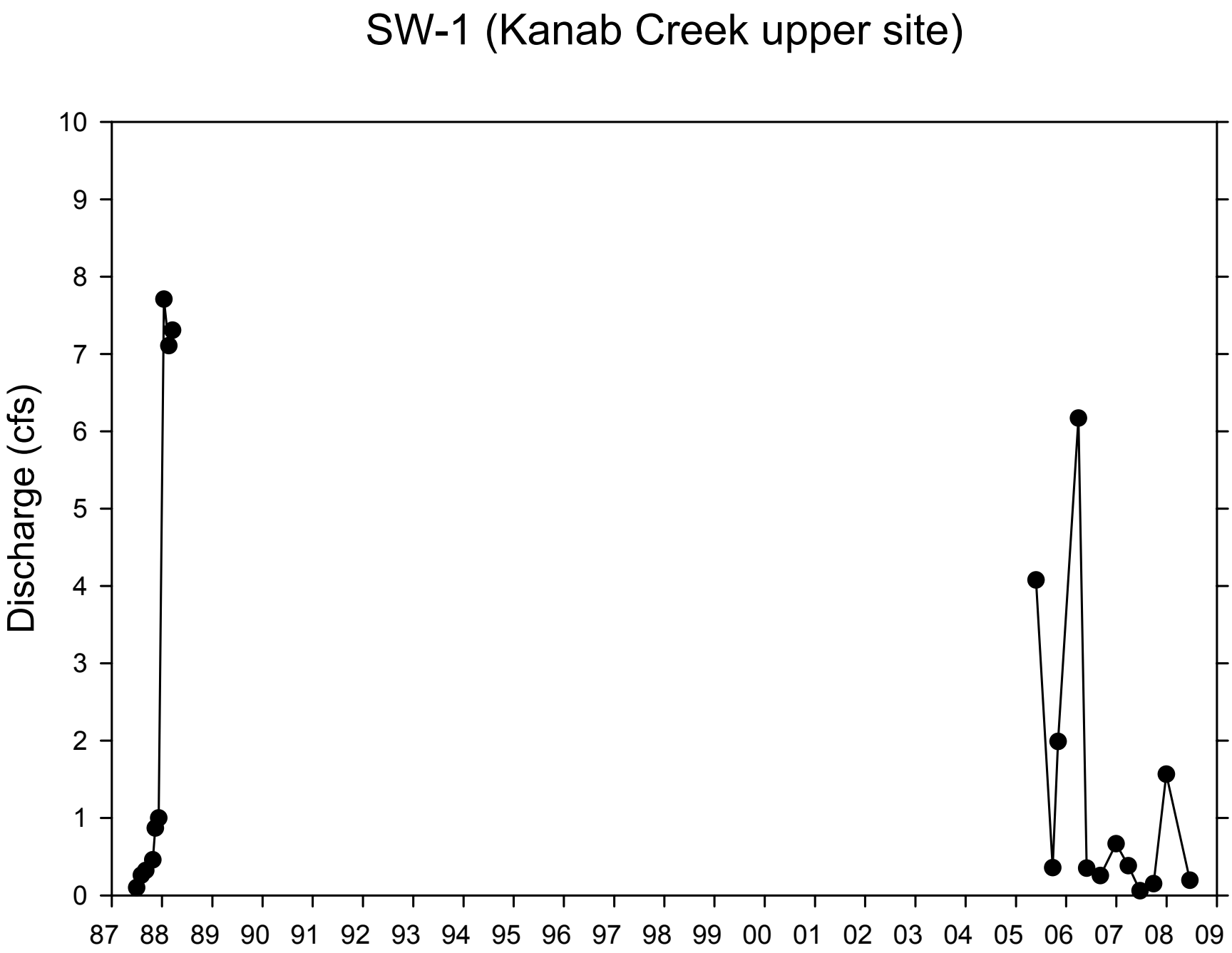


Figure 2a Discharge measured in Kanab Creek at site SW-1
(See Plate 2 for monitoring site location).

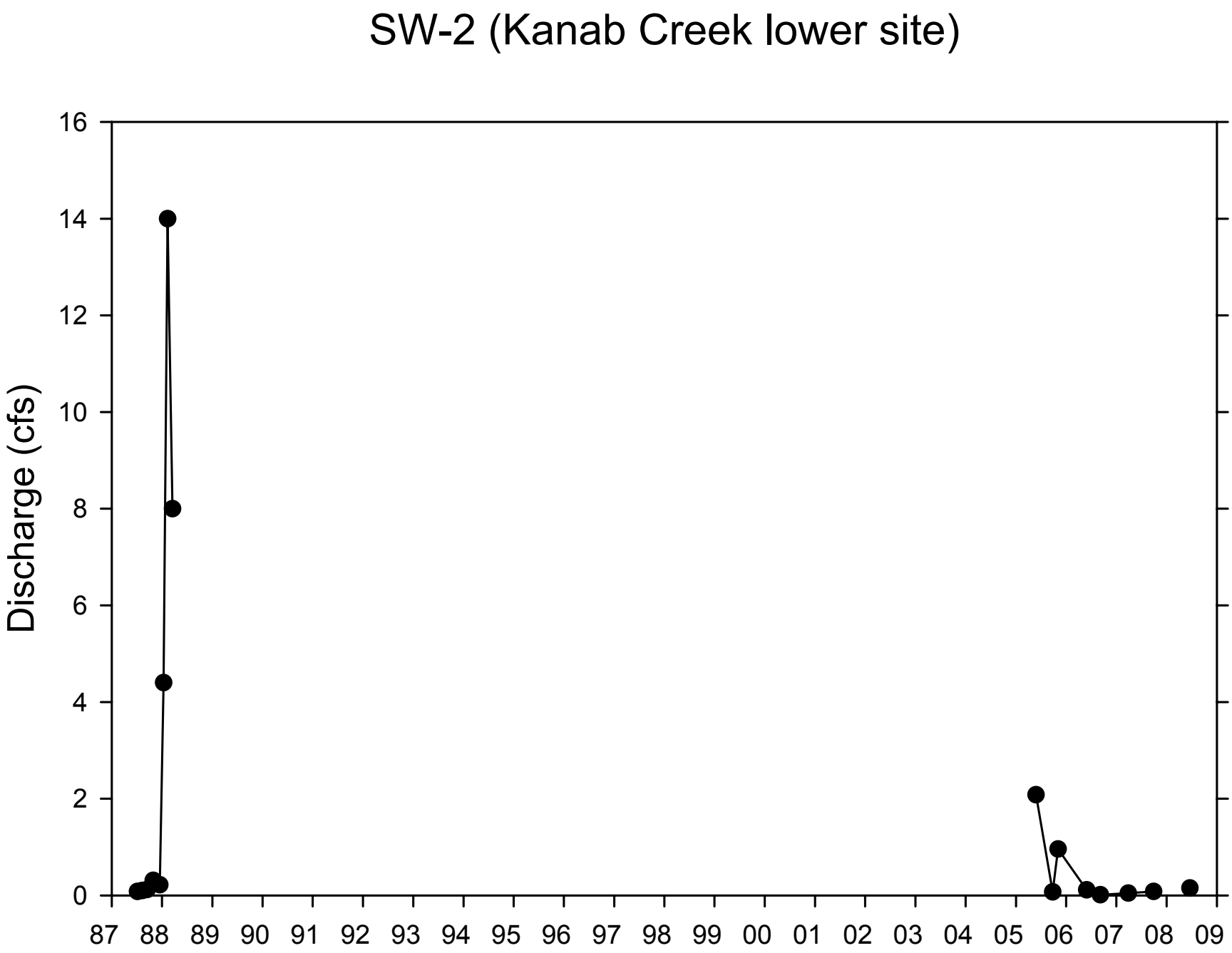


Figure 2b Discharge measured in Kanab Creek at site SW-2
(See plate 2 for monitoring site location).

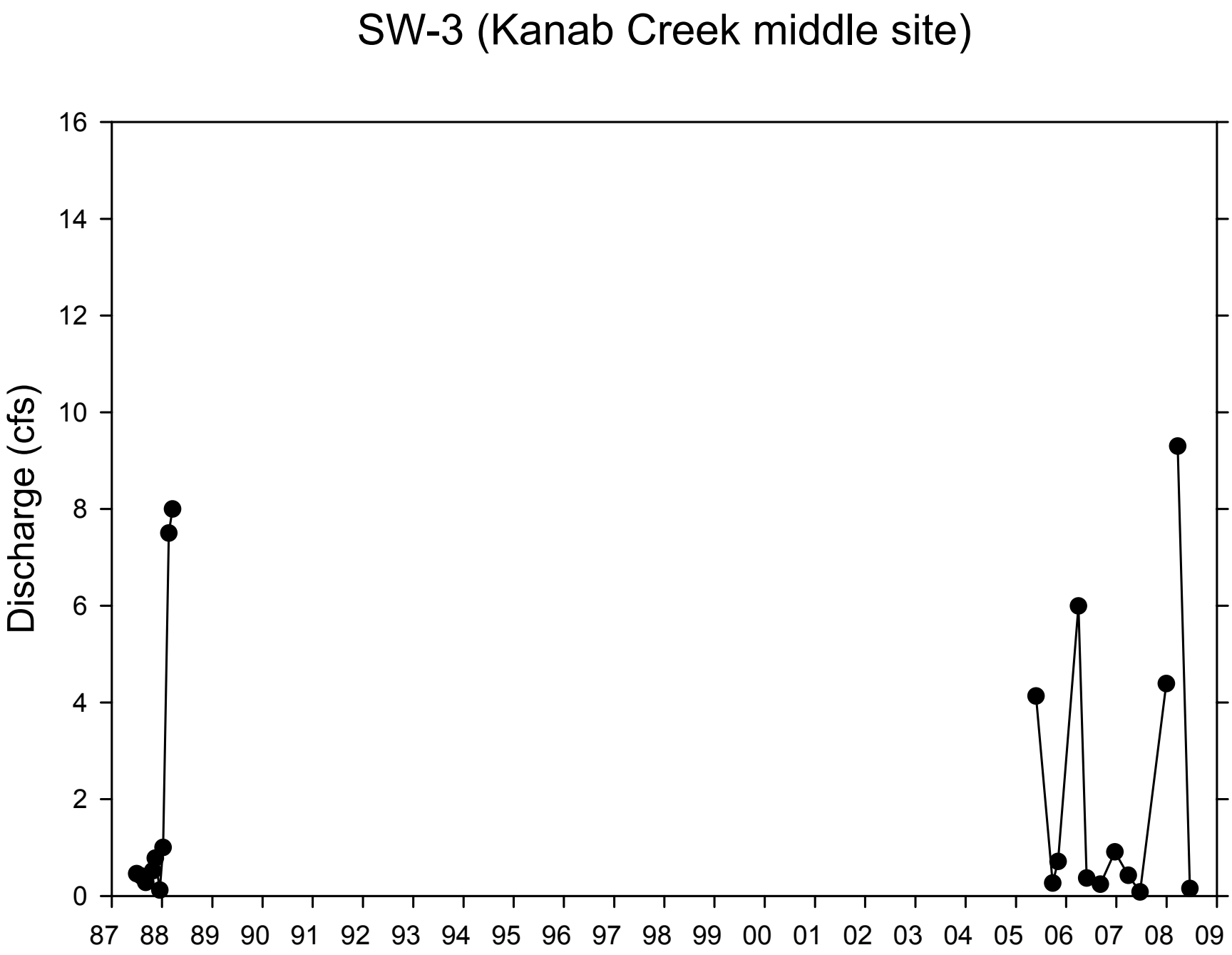


Figure 2c Discharge measured in Kanab Creek at site SW-3
(See Plate 2 for monitoring site location).

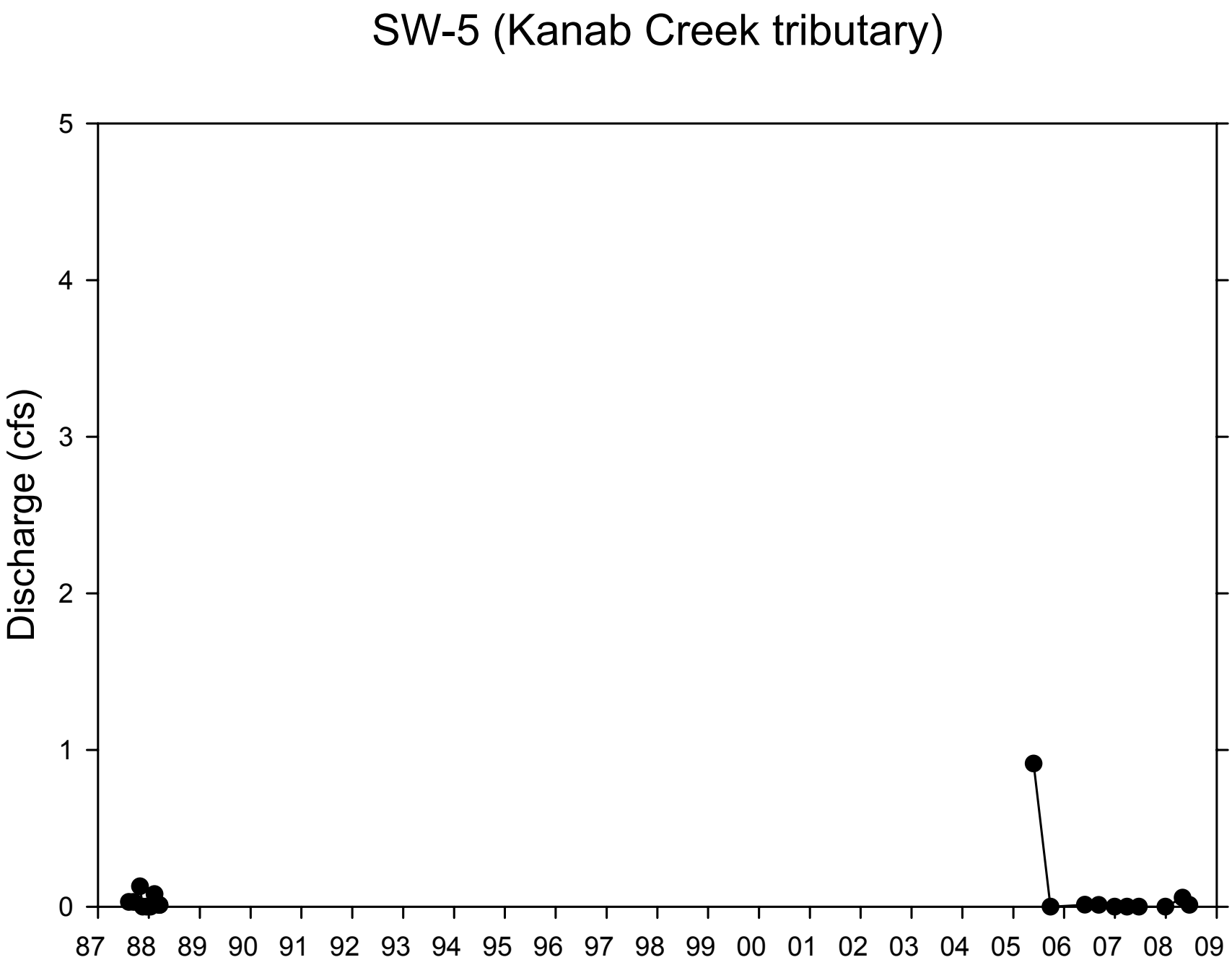


Figure 2d Discharge measured in Lower Robinson Creek, a tributary of Kanab Creek at site SW-5 (See Plate 2 for monitoring site location).

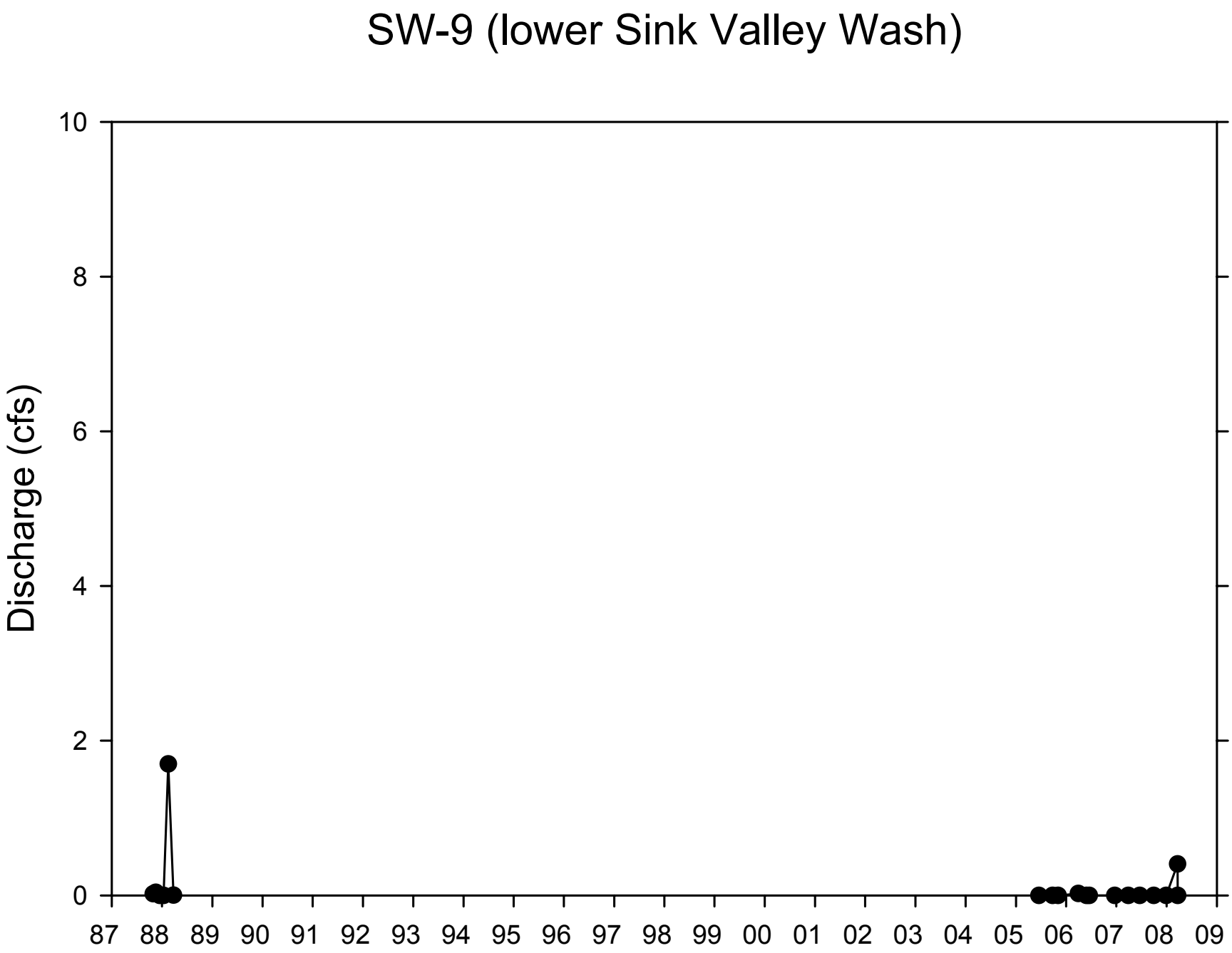


Figure 2e Discharge measured in Sink Valley Wash
(See Plate 2 for monitoring site location).

Table 1 Instananeous stream discharge measurements in streams in the study area.

Notes: Data from Utah Division of Oil, Gas and Mining on-line coal hydrology database.
See Plate 1 for monitoring site locations.

Site	Date	Discharge (cfs)
Kanab Creek upper monitoring site		
SW-1	7/1/1987	0.10
SW-1	8/3/1987	0.26
SW-1	9/4/1987	0.32
SW-1	10/26/1987	0.46
SW-1	11/13/1987	0.87
SW-1	12/8/1987	1.00
SW-1	1/15/1988	7.71
SW-1	2/20/1988	7.11
SW-1	3/17/1988	7.31
SW-1	5/27/2005	4.08
SW-1	9/25/2005	0.36
SW-1	11/3/2005	1.99
SW-1	3/31/2006	6.17
SW-1	5/30/2006	0.35
SW-1	9/7/2006	0.26
SW-1	12/30/2006	0.67
SW-1	3/29/2007	0.38
SW-1	6/22/2007	0.06
SW-1	9/29/2007	0.15
SW-1	12/30/2007	1.57
SW-1	6/18/2008	0.20
Kanab Creek upper lower monitoring site		
SW-2	7/7/1987	0.08
SW-2	8/10/1987	0.10
SW-2	9/14/1987	0.12
SW-2	10/29/1987	0.31
SW-2	12/16/1987	0.22
SW-2	1/13/1988	4.40
SW-2	2/11/1988	14.00
SW-2	3/17/1988	8.00
SW-2	5/27/2005	2.08
SW-2	9/25/2005	0.07
SW-2	11/3/2005	0.96
SW-2	5/30/2006	0.11
SW-2	9/7/2006	0.01
SW-2	3/29/2007	0.05
SW-2	9/29/2007	0.08
SW-2	6/18/2008	0.15

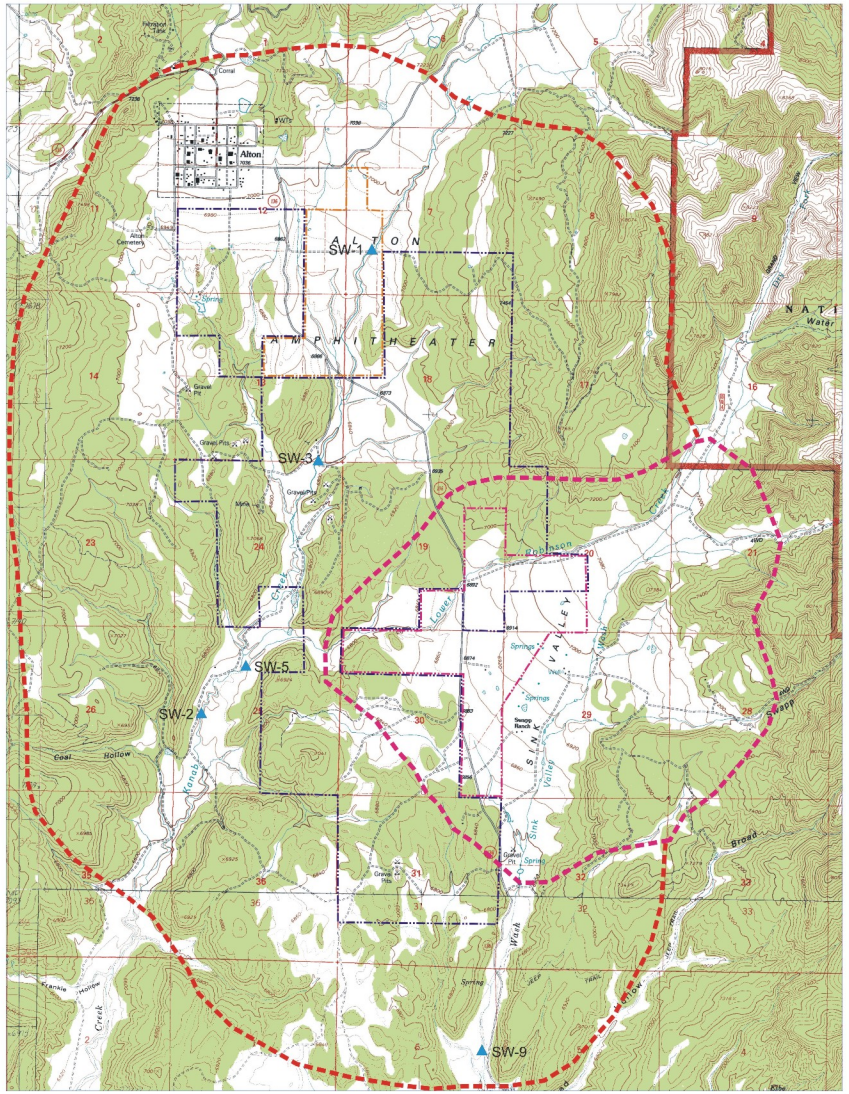
Site	Date	Discharge (cfs)
Kanab Creek upper middle monitoring site		
SW-3	7/1/1987	0.46
SW-3	8/3/1987	0.41
SW-3	9/4/1987	0.28
SW-3	10/26/1987	0.52
SW-3	11/13/1987	0.78
SW-3	12/16/1987	0.12
SW-3	1/9/1988	1.00
SW-3	2/20/1988	7.50
SW-3	3/17/1988	8.00
SW-3	5/27/2005	4.13
SW-3	9/25/2005	0.27
SW-3	11/3/2005	0.71
SW-3	3/31/2006	5.99
SW-3	5/30/2006	0.37
SW-3	9/7/2006	0.24
SW-3	12/21/2006	0.91
SW-3	3/29/2007	0.43
SW-3	6/22/2007	0.08
SW-3	12/30/2007	4.39
SW-3	3/22/2008	9.30
SW-3	6/18/2008	0.15
Lower Robinson Creek tributary at confluence with Kanab Creek		
SW-5	8/10/1987	0.03
SW-5	9/14/1987	0.03
SW-5	10/29/1987	0.13
SW-5	11/18/1987	0.00
SW-5	12/16/1987	0.00
SW-5	1/13/1988	0.00
SW-5	2/11/1988	0.08
SW-5	3/17/1988	0.01
SW-5	3/17/1988	0.01
SW-5	5/27/2005	0.91
SW-5	9/25/2005	0.00
SW-5	5/30/2006	0.01
SW-5	9/7/2006	0.01
SW-5	12/30/2006	0.00
SW-5	3/29/2007	0.00
SW-5	6/22/2007	0.00
SW-5	12/29/2007	0.00
SW-5	5/1/2008	0.06
SW-5	6/18/2008	0.01
Sink Valley Wash monitoring site		
SW-9	10/29/1987	0.02
SW-9	11/17/1987	0.04
SW-9	12/16/1987	0.00

Site	Date	Discharge (cfs)
SW-9	1/13/1988	0.00
SW-9	2/16/1988	1.70
SW-9	3/24/1988	0.00
SW-9	6/17/2005	0.00
SW-9	9/24/2005	0.00
SW-9	11/3/2005	0.00
SW-9	3/30/2006	0.02
SW-9	5/29/2006	0.00
SW-9	6/18/2006	0.00
SW-9	12/20/2006	0.00
SW-9	3/29/2007	0.00
SW-9	6/20/2007	0.00
SW-9	9/30/2007	0.00
SW-9	12/29/2007	0.00
SW-9	3/21/2008	0.41
SW-9	3/22/2008	0.00

Table 2 Summary of Alton Coal LBA reconnaissance-level Identification study designations

	Water Availability Criteria					Geologic Criteria	
Identifica ion Area	Presently irrigated?	Potentially Irrigable?	Sufficient water for irriga ion?	Subirrigated lands?	Agriculturally important?	Flood plains/terraces present?	Identification-stage AVF designation
Area 1	Yes	Yes	Yes	No	Yes	Yes	Probable AVF
Area 2	No	Yes	Probably	No	Probably not	Yes	Possible AVF (unlikely)
Area 3	No	Yes	Probably not	No	Probably not	Yes	Possible AVF (unlikely)
Area 4	Yes	Yes	Yes	No	Yes	Yes	Probable AVF
Area 5	No	Yes	Probably not	No	Probably not	Yes	Possible AVF (unlikely)
Area 6	No	Yes	Probably not	No	Probably not	Yes	Possible AVF (unlikely)
Alton Town and adjacent	Yes	Yes	Yes	No	Yes	No	Not an AVF
Lower Robinson Creek	No	Yes	Probably not	No	Probably not	No	Not an AVF

Note: Other areas within the study area were determined to have not met the identification-stage AVF identification criteria.



1927 North American Datum; UTM grid zone 12
Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Long Valley Junction; UT Alton; UT Glendale; UT Bald Knoll; UT

0 ¼ ½ 1 2 Miles
1000 0 2000 4000 6000 8000 10,000 Feet
1,000 Meters 500 0 ½ 1 2 Kilometers

NORTH

BigTopo Map

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CONSULTANTS IN HYDROGEOLOGY

LBA AVF Recon.cdr
21 October 2009

Study area boundary

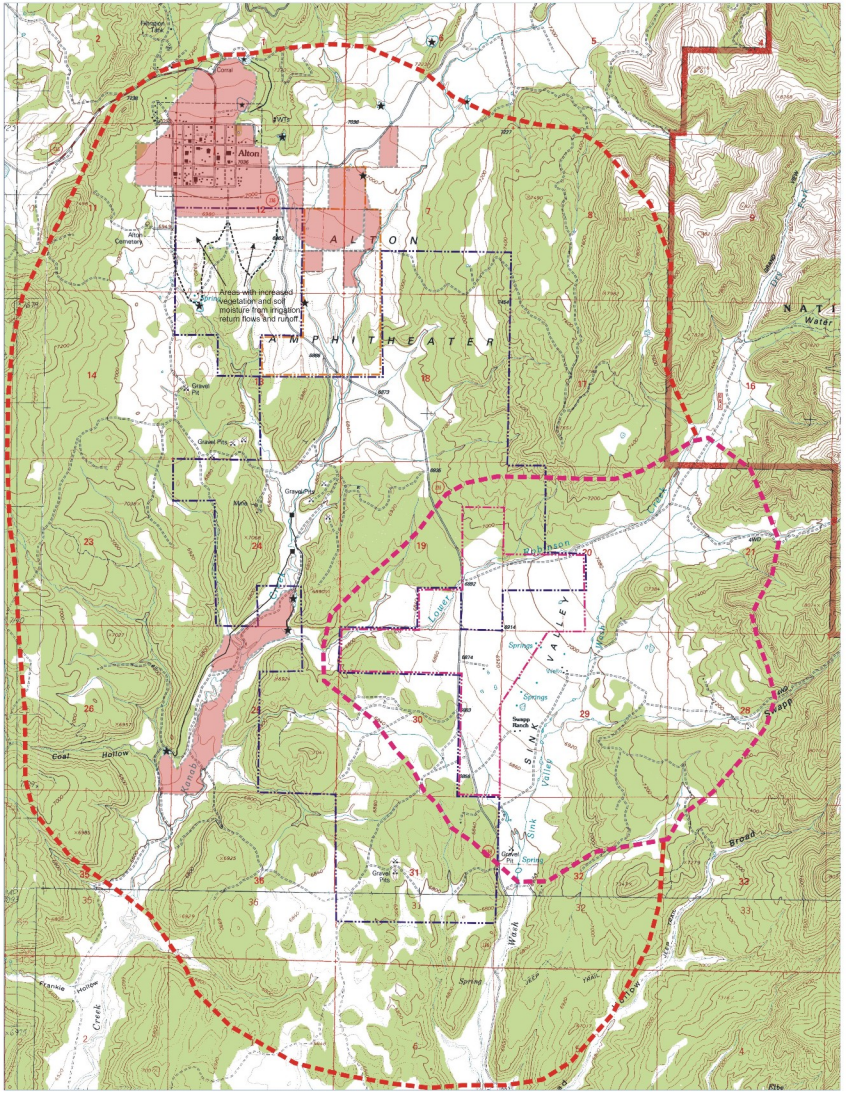
Coal Hollow Project study area boundary (separate investigation)

SW-2 Surface-water monitoring site.

Alton Coal LBA boundaries

Private coal boundaries

Plate 1 Study area location and surface-water data sites.



1927 North American Datum; UTM grid zone 12
Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Long Valley Junction; UT Alton; UT Glendale; UT Bald Knoll; UT

0 ¼ ½ 1 2 Miles
1000 0 2000 4000 6000 8000 10,000 Feet
1,000 Meters 500 0 ½ 1 2 Kilometers

NORTH

BigTopo Map

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21 October 2009

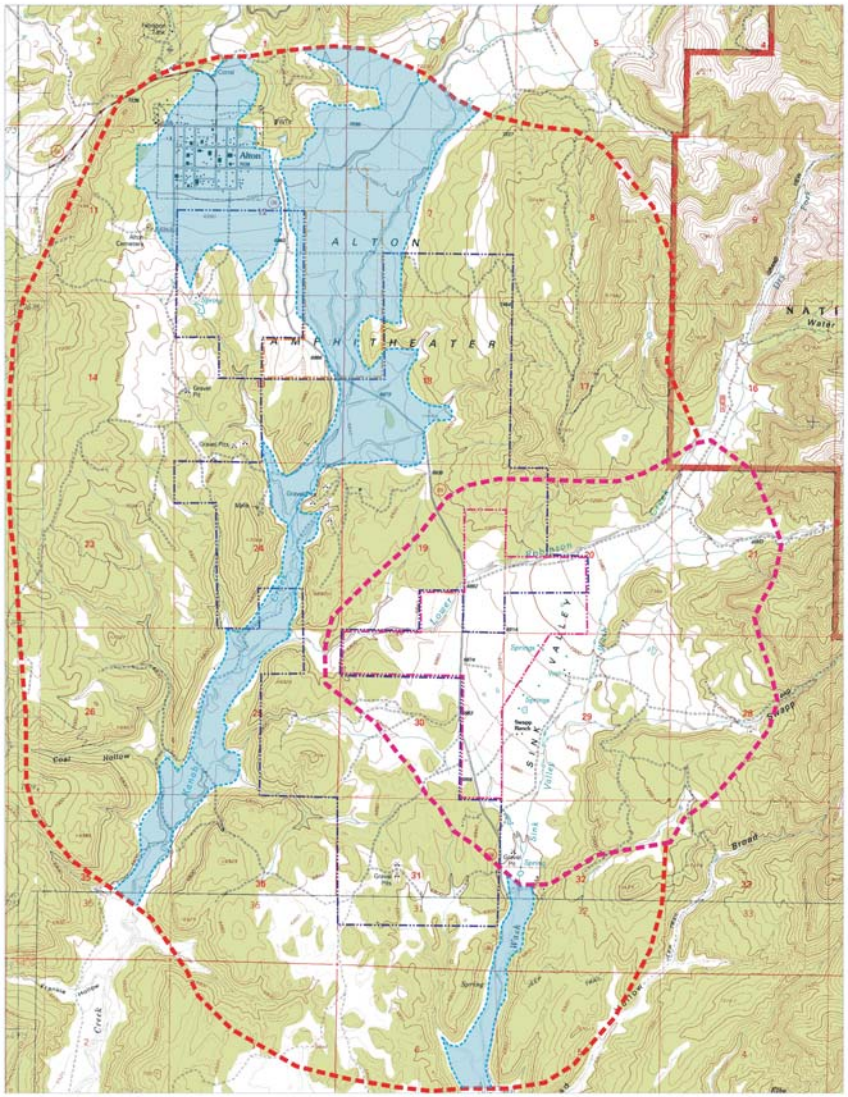
Presently irrigated lands

Irrigation diversion

Pond

Irrigation canal/ditch

Plate 2 Locations of presently irrigated lands, irrigation ditches, diversions, and ponds.



1927 North American Datum; UTM grid zone 12
Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Long Valley Junction; UT Alton; UT Glendale; UT Bald Knoll; UT

0 ¼ ½ 1 2 Miles
1000 0 2000 4000 6000 8000 10,000 Feet
1,000 Meters 500 0 ½ 1 2 Kilometers

NORTH

BigTopo Map

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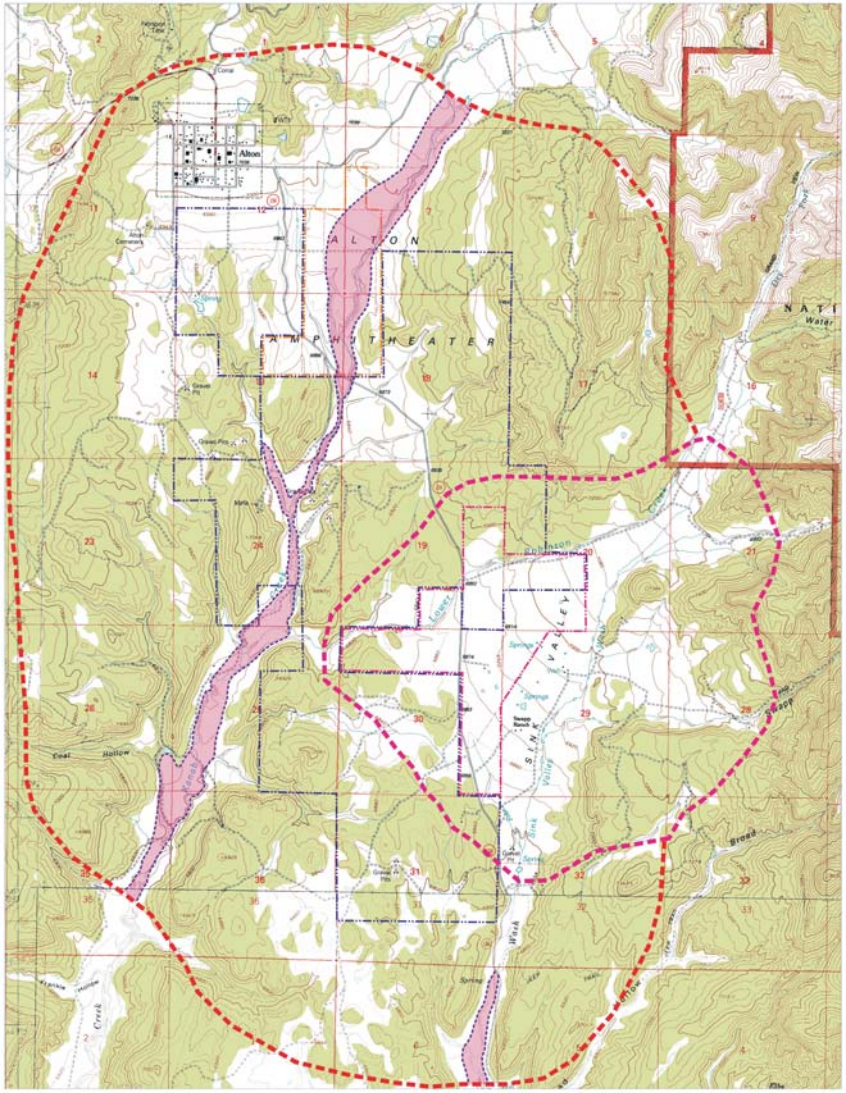
CONSULTANTS IN HYDROGEOLOGY

Lands which appear to have the capability of being flood irrigated

LBA AVF Recon.cdr
21 October 2009

Plate 3 Lands which appear to have the capability of being flood irrigated.



1927 North American Datum; UTM grid zone 12
Generated by BigTopo7 (www.igage.com)
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1,000 Meters 500 0 ½ 1 2 Kilometers

NORTH

BigTopo Map

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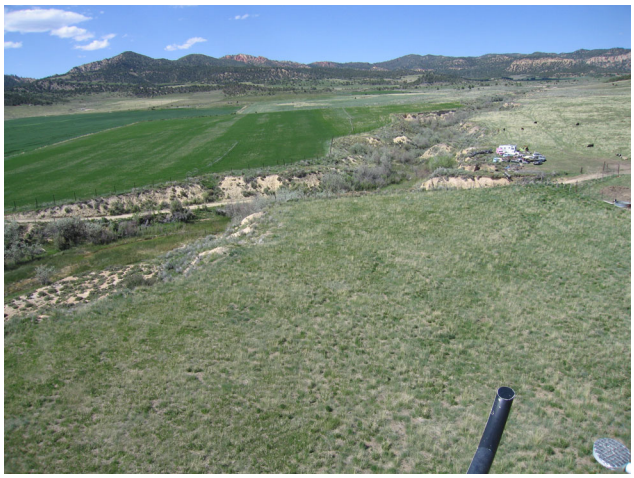
21 October 2009

flood plains and terraces (approximate locations)

Plate 4 Map of flood plain and terrace locations (approximate).

Photograph #1
View of central portion of Area 1.
Note incised Kanab Creek drainage.

Photograph #2
View of central portion of Area 1.
Note incised Kanab Creek drainage
and sprinkler irrigation.



Photograph #3
View looking north from cenral Area 1
near stream monitoring site SW-1.
Note incised Kanab Creek drainage.

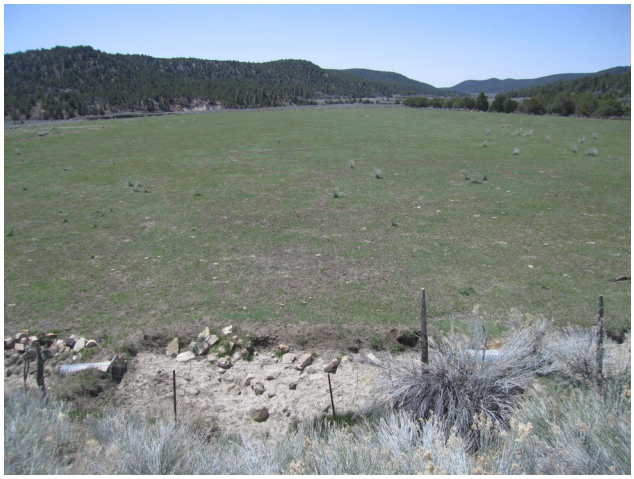
Photograph #4
View looking south in Area 2.
Note narrow valley bottom and
active flood plain area.

Photograph #5
View looking north in Area 2.
Note narrow valley bottom.

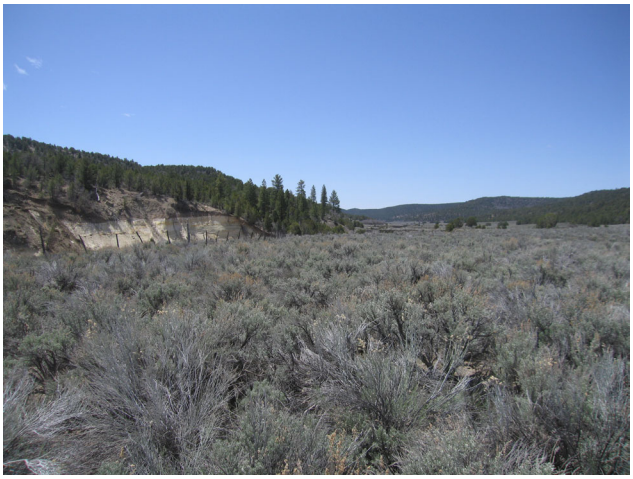
Photograph #6
View looking north in Area 3.
Note narrow valley bottom.

Photograph #7
View looking south in Area 3.

Photograph #8
View looking south in Area 4.
Note flood irrigated pasture/hay
field in foreground.



Photograph #9
View looking south from high bench below pond in southern part of Area 4.
Note irrigation infrastructure in foreground.



Photograph #10
View looking south in southern portion of Area 4.
Note lack of agriculture and bedrock outcrop in incised Kanab Creek steam channel on left.

Photograph #11
View looking south in Area 5.
Note deeply incised Kanab Creek stream channel.

Photograph #12
View looking south from Area 6.
Note deeply incised Sink Valley Wash stream channel.

Photograph #13
Aerial view of Area 6 below the county road crossing of Sink Valley Wash.
Note deeply incised stream channel.

Photograph #14
View looking east in the central upland portion of the Alton Coal LBA area.
Note rolling hills and chipped pinyon And juniper trees.

APPENDIX F.
ALTON COAL TRACT LBA EIS REPORT OF RECONNAISSANCE SURVEYS: VEGETATION AND SPECIAL STATUS SPECIES, WILDLIFE AND SPECIAL STATUS SPECIES, SANDLOVING PENSTEMON, WET MEADOWS

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Attachment 1: Relevé Plot Data
Attachment 2: Vegetation Associations and Species List

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PRELIMINARY THREATENED AND ENDANGERED AND SENSITIVE SPECIES ANALYSIS

On June 7, 2007 personnel from the BLM Kanab Field Office met with personnel from SWCA's Salt Lake City office concerning the Alton Coal Tract LBA EIS. At this meeting BLM requested that SWCA compile a list of Threatened and Endangered and Sensitive (TES) plant and animal species that may be subject to impacts associated with the potential development of the Alton Coal Tract.

SWCA conducted a three-step process to determine which species may be impacted:

Step 1. Development of a comprehensive species list, inclusive of all potentially present species within the affected counties. SWCA personnel compiled a comprehensive list of all potentially impacted TES plant and animal species from the sources listed below. For plants, the comprehensive list was limited to Kane County since ground disturbing activities would be limited to this county and impacts would be expected to be limited to this area. Impacts to plants would not occur along the proposed transportation corridor. For animals, the comprehensive list included Kane, Garfield, and Iron counties. Though new ground disturbance would not be expected in Garfield and Iron counties, the comprehensive list pulls from these counties since impacts may occur from truck collisions with animals.

- **TES Plant Species**
  - Utah Department of Natural Resources, Conservation Data Center (CDC)
  - Inventory of Sensitive Species and Ecosystems in Utah, Endemic and Rare Plants of Utah: An Overview of Their Distribution and Status
  - Kanab Field Office RMP/EIS Final Analysis of the Management Situation (12/2005)
  - Utah Rare Plant Guide (http://www.utahrareplants.org/rpg_species.html; accessed 6/20/2007)
- **TES Animal Species**
  - Utah Department of Natural Resources, Conservation Data Center (CDC)
  - Utah State Listed Species by County (compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System [BIOTICS])
  - County Lists of Utah's Federally Listed Threatened (T), Endangered (E), and Candidate (C) Species
  - Kanab Field Office RMP/EIS Final Analysis of the Management Situation

Step 2. Reduction of the comprehensive species list based on the probability of occurrence as determined through the analysis of SWReGAP data, elevation within the potentially affected area, and known distribution according to the CDC database.

- **TES Plant Species**

  SWCA researched each species on the comprehensive list to determine the probability of occurrence within the Alton Coal Tract LBA. Key factors in determining probability of occurrence were vegetation type (SWReGAP), elevation, and known distribution according to the CDC database. Species were sorted into three groups:

1. Known distribution shown on CDC or SWReGAP, recommend survey/further investigation;
2. Known distribution provided by CDC did not overlap with the project area, but habitat type may occur in the project area, recommend survey/further investigation; and
3. Not likely to occur; do not recommend survey

Additional information on each plant's bloom period (where readily available) was also obtained to provide detail relevant to surveying.

- **TES Animal Species**

  SWCA researched each species on the comprehensive list to determine the probability of occurrence within the Alton Coal Tract LBA and along the proposed transportation route and one alternate transportation route. Key factors in determining probability of occurrence were vegetation type (SWReGAP) and known distribution according to the CDC database. Species were sorted into three groups:

  1. Habitat shown on CDC, recommend survey/further investigation;
  2. Not shown on CDC but habitat may occur, recommend survey/further investigation; and
  3. Not likely to occur, do not recommend survey.

  Additional information on the survey period for each animal was also obtained.

Step 3. Further reduction of the comprehensive species list based on spatial analysis (GIS) modeling coupled with SWReGAP and CDC analyses.

- **TES Plant Species**

  SWCA used a GIS model to determine specific locations of potential occurrences of TES plant species within the Alton Coal Tract LBA. The GIS model included elevation, vegetation type, and species listed in groups 1 and 2 from Step 2.

- **TES Animal Species**

  SWCA used a GIS model to determine specific locations of potential occurrences of TES animal species within the Alton Coal Tract LBA. The GIS model included habitat type and the listed species in groups 1 and 2 from Step 2.

  SWCA used the same model to determine specific locations of potential occurrences of TES animal species along the proposed transportation route and one alternate route. The GIS model included habitat type and the listed species in groups 1, 2 and 3 from Step 2. The model was limited to a 200-foot buffer zone on either side of the roads making up the proposed transportation route and alternate route. Potential occurrences of TES animals for each transportation segment were provided in a memo to the BLM.

At the conclusion of the 3-step analysis process, SWCA presented to BLM a list of species for which surveys were recommended, which BLM further refined based upon personnel knowledge of the resources in the project area. The final list of recommendations was as follows:

Plants

- Paria breadroot
- Sandloving penstemon
- Ruth's sphaeromeria
- Charleston Mountain violet
- Slender (meager) camissonia
- Jones Cycladenia

Animals

- Bald Eagle
- Yellow-Billed Cuckoo
- Mexican Spotted Owl
- Southwestern Willow Flycatcher
- Utah Prairie Dog
- Allen's Big-Eared Bat
- Arizona Toad
- Big Free-Tailed Bat
- Burrowing Owl
- Ferruginous Hawk
- Fringed Myotis
- Greater Sage-Grouse
- Lewis's Woodpecker
- Long-Billed Curlew
- Northern Goshawk
- Spotted Bat
- Three-Toed Woodpecker
- Townsend's Big-Eared Bat
- Western Toad
- Black Swift
- Kit Fox
- Pygmy Rabbit
- Short-Eared Owl
- **Surveys recommended for proposed and alternate transportation routes:**
  - Pygmy Rabbit
  - Utah Prairie Dog
  - Kit Fox
  - Greater Sage Grouse

This list was then further refined through the Reconnaissance Surveys discussed below.

RECONNAISSANCE SURVEYS AND POTENTIAL SPECIES OCCURRENCE DETERMINATIONS

During fall 2007 and spring 2008 three reconnaissance level surveys were conducted on the Alton Coal Tract. These surveys were conducted to

- characterize vegetation communities on the tract
- determine presence/absence of certain wildlife and plant species on the tract, and
- make a preliminary determination of the presence of wet meadow wetlands on the tract.

Surveys were conducted November 16-18, 2007; May 27-30, 2008; and July 2, 2008. The methods, results, and conclusions of these field inventories are reported below by survey date in ascending chronological order.

RECONNAISSANCE SURVEY NOVEMBER 16-18, 2007

From November 16 to 18, 2007, three personnel from SWCA's Salt Lake City Office and one personnel from Mt. Nebo Consulting (surveyors listed in Attachment 1) conducted a reconnaissance-level survey of lands within the Alton Coal Tract LBA. The purpose of the survey was to: 1) provide data for use in alternatives development for the Alton Coal Tact LBA EIS; 2) provide data for Chapters 3 and 4 of the Alton Coal Tract LBA EIS; and 3) narrow the list of species for which species-specific surveys may need to be completed in support of the

Alton Coal Tract LBA EIS and provide documentation of this and target areas for species specific surveys during the appropriate survey period.

WILDLIFE SURVEY NOVEMBER 16-18, 2007

METHODS

Mexican Spotted Owl (MSO)

Using the 1997 and 2000 MSO habitat models (Spotskey and Willey 1997, 2000) two areas in the vicinity of the Alton Coal Tract LBA were identified as potentially suitable nesting habitat (Figure 1). These areas were assessed by recording the presence-absence of the five primary constituent elements (PCEs) identified in the MSO Recovery Plan (USFWS 1995) and other parameters on a standardized field form, to verify their suitability as MSO nesting habitat.

Southwestern Willow Flycatcher and Western Yellow-billed Cuckoo

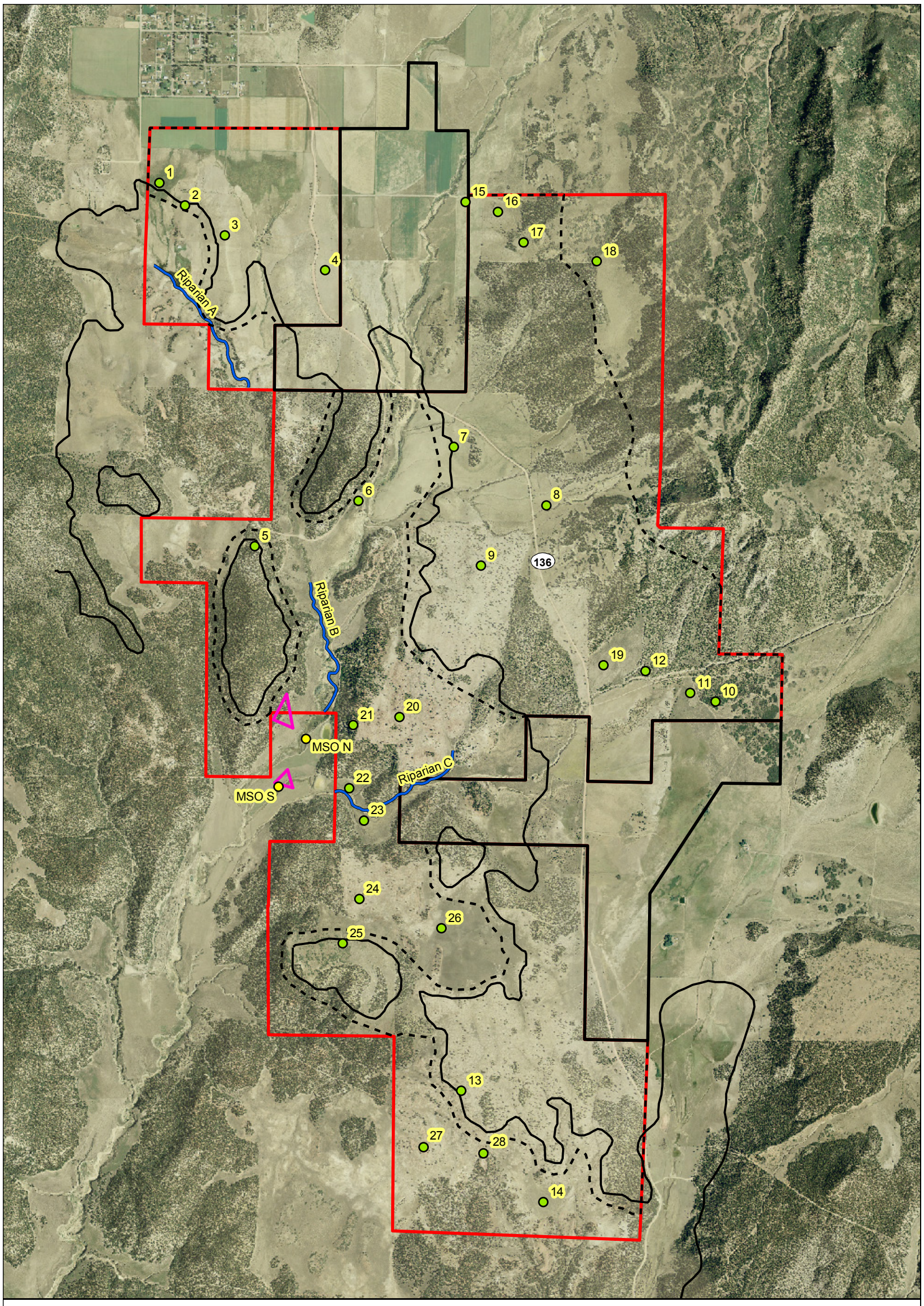
Three riparian areas were identified through SWReGAP as potentially suitable habitat for southwestern willow flycatchers (SWFL) and yellow-billed cuckoos (YBCU). These riparian areas were labeled as Riparian A, Riparian B, and Riparian C (see Figure 1). These three stretches were walked and assessed to verify their suitability as potential stopover and nesting habitat.

The surveyors focused on finding areas containing tamarisk and other species such as Fremont cottonwood *(Populus fremontii)* and black willow *(Salix gooddingii)*, which have the proper structure to be potentially suitable for use by nesting willow flycatchers. For the purposes of the study, potentially suitable habitat was defined as dense, woody, riparian vegetation greater than 3.0 m (9.8 feet) in height with greater than 75% canopy cover.

Pygmy Rabbit

Pygmy rabbits were listed as a potentially occurring species within the tract. Potentially suitable habitat was assessed during other wildlife and general vegetation surveys. According to *Surveying for Pygmy Rabbits* (Ulmschneider et al. 2004):

> The site characteristics of areas inhabited by pygmy rabbits in Utah vary considerably. Burrow habitat in southern, low elevation sites is often limited to the bottom of gentle drainages supporting Wyoming sagebrush amid a black sage, shadscale, and gray molly community of minimal height (28 cm). Understory condition is variable: many sites have grasses and forbs in excellent condition, but some of the most numerous pygmy rabbit populations discovered are in chronically grazed areas (sheep and cattle) being targeted for rehabilitation.



MSO Data Point
Vegetation Data Point
Riparian Data
Coal Line Boundary
LBA
Private
Pit Disturbance
MSO 1997 Model

0 0.25 0.5 1 Kilometers
0 0.2 0.4 0.8 Miles

N

Imagery taken from National Agricultural Imagery Program (NAIP) natural color aerial photography 1-meter resolution, 2006.

Projection: Transverse Mercator
Coordinate System: UTM
Datum: North American Datum of 1983 (NAD 83)

No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

This product may not meet BLM standards for accuracy and content. Different data sources and input scales may cause some misalignment of data layers.

Figure 1. Alton Coal Tract wildlife and vegetation survey map.

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Therefore, areas of large dense sagebrush were of particular concern, and the fact that certain areas are grazed did not affect how the area was assessed as to the possibility of the presence of pygmy rabbits.

RESULTS AND DISCUSSION

Mexican Spotted Owl (MSO)

The two potentially suitable MSO habitat units, A-North and A-South (see Figure 1) were evaluated by recording and ranking the presence-absence of the five primary constituent elements (PCEs) identified in the MSO Recovery Plan (USFWS 2004). Both A-North and A-South received poor ratings and therefore are no longer considered potentially suitable habitat for MSO. It is therefore very unlikely that any MSO occur anywhere near the tract.

Southwestern Willow Flycatcher (SWFL) and Western Yellow-billed Cuckoo (YBCU)

The three riparian areas were walked and evaluated (see Figure 1). Riparian Area A did not contain any tamarisk, willow, or cottonwood trees. Riparian Area B had only sparse cottonwood trees along with relatively common Russian olive trees. Riparian Area C had only one cottonwood tree along the entire stretch. Therefore, all three areas Riparian A, B and C were found to be of no nesting or stopover value to SWFL or YBCU.

Pygmy Rabbit

During the vegetation surveys two different areas were found to be potentially suitable pygmy rabbit habitat (see Figure 1). These areas had relatively large patches of large sagebrush. Potential pygmy rabbit pellets were found and collected. It is possible that these pellets are young or small cottontails.

Table 1. Summary of SWFL, YBCU and MSO Potential to Occur in the LBA

Common Name	Status	Habitat Type	Potential On Tract	Field Surveys Recommended? EIS Analysis?
Mexican Spotted Owl (*Strix occidentalis lucida*)	T	This species utilizes cliff, canyon, riparian, conifer forest, and mixed forest habitats.	No Potential Habitat. Based on fall habitat surveys.	No Field Surveys. No EIS Analysis.
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	E	This species utilizes riparian, forested wetland, shrubland, and mixed woodland habitats.	No Potential Habitat. Based on fall habitat surveys.	No additional Field Surveys. No EIS Analysis.
Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)	C	This species utilizes riparian, forested wetland, scrub-shrub wetland, shrubland, and mixed woodland habitats.	No Potential Habitat. Based on fall habitat surveys.	No additional Field Surveys. No EIS Analysis.

Table 1. Summary of SWFL, YBCU and MSO Potential to Occur in the LBA

Common Name	Status	Habitat Type	Potential On Tract	Field Surveys Recommended? EIS Analysis?
Pygmy Rabbit (*Brachylagus idahoensis*)	SPC	This species utilizes big sagebrush and shrubland habitats.	Two Potential habitat areas	Additional Field Surveys Recommended. EIS Analysis: Yes.

Other Species

Other special status wildlife species with potential to occur in the tract are listed in Table 2.

Table 2. Other Special Status Wildlife Species with Potential to Occur in the LBA

Common Name	Status	Habitat Type	Potential On Tract	Field Surveys Recommended? EIS Analysis?
Bald Eagle (*Haliaeetus leucocephalus*)	Delisted 2008	This species utilizes riparian, riverine, forested wetland, coniferous forest, mixed forest, and woodland habitats.	Potential wintering habitat is present but no known nests	Raptor surveys completed in 2007 and again before project implementation. EIS Analysis: Yes
Allen's Big-eared Bat (*Idionycteris Phyllotis*)	SPC	This species utilizes cliff, canyon, and riparian habitats.	Potential habitat surrounding the tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.
Arizona Toad (*Bufo Microscaphus*)	SPC	This species utilizes open water, riparian, shrubland, desert, and woodland habitats.	Potential Habitat is present	No Field Surveys. EIS Analysis: Yes
Big Free-tailed Bat (*Nyctinomops macrotis*)	SPC	This species utilizes cliff, canyon, and riparian habitats.	Potential habitat surrounding the tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.
Burrowing Owl (*Athene cunicularia*)	SPC	This species utilizes grassland, shrubland, and desert habitats.	Likely to occur on the tract	Field surveys should occur where the ground will be disturbed. EIS Analysis: Yes

Table 2. Other Special Status Wildlife Species with Potential to Occur in the LBA

Common Name	Status	Habitat Type	Potential On Tract	Field Surveys Recommended? EIS Analysis?
Ferruginous Hawk (*Buteo regalis*)	SPC	This species utilizes riparian, cliff, desert, grassland, sagebrush, and shrubland habitats.	Likely to occur on or near the tract. Raptor nest surveys are needed	Raptor surveys completed in 2007 and again before project implementation. EIS Analysis: Yes
Fringed Myotis (*Myotis thysanodes*)	SPC	This species utilizes cliff, canyon, and riparian habitats.	Potential habitat surrounding the Tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.
Greater Sage-grouse (*Centrocercus urophasianus*)	SPC	This species utilizes grassland, sagebrush, shrubland, and riparian habitats.	Individuals and a lek present on the Tract.	Field Surveys: Yes EIS Analysis: Yes
Lewis's Woodpecker (*Melanerpes lewis*)	SPC	This species utilizes coniferous forest, woodland, and shrubland habitats.	The CDC shows primary breeding habitat in and adjacent to the tract.	No Field Surveys. EIS Analysis: Yes
Long-billed Curlew (*Numenius americanus*)	SPC	This species utilizes grassland, wetland, riparian, and shrubland habitats.	Potential habitat	No Field Surveys. EIS Analysis: Yes
Northern Goshawk (*Accipiter gentilis*)	CS	This species utilizes coniferous forest, mixed forest, woodland, and riparian habitats.	Potential habitat surrounding the Tract but not within it.	No Field Surveys. EIS Analysis: Yes
Spotted Bat (*Euderma maculatum*)	SPC	This species utilizes cliff, canyon, and riparian habitats.	Potential habitat surrounding the Tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.
Three-toed Woodpecker (*Picoides tridactylus*)	SPC	This species utilizes coniferous forest, mixed forest, woodland, shrubland, and riparian habitats.	Potential habitat surrounding the Tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.
Townsend's Big-eared Bat (*Corynorhinus townsendii*)	SPC	This species utilizes cliff, canyon, forested, woodland, and riparian habitats.	Potential habitat surrounding the Tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.

Table 2. Other Special Status Wildlife Species with Potential to Occur in the LBA

Common Name	Status	Habitat Type	Potential On Tract	Field Surveys Recommended? EIS Analysis?
Western Toad (*Bufo boreas*)	SPC	This species utilizes open water, springs, wet meadows, riparian, coniferous forest, and woodland habitats.	Potential habitat	No Field Surveys. EIS Analysis of Indirect Effects.
Black Swift (*Cypseloides niger*)	SPC	This species utilizes waterfall, cliff, riparian, coniferous forest, mixed forest, and woodland habitats.	No Potential Habitat. Based on fall habitat surveys.	No Field Surveys. No EIS Analysis.
Kit Fox (*Vulpes macrotis)*	SPC	This species utilizes grassland, desert, shrubland, and savanna habitats.	Potential habitat, but not shown on CDC distribution map	No Field Surveys. EIS Analysis: Yes
Short-eared Owl (*Asio flammeus*)	SPC	This species utilizes sagebrush, grassland, shrubland, and savanna habitat.	Potential habitat, but not shown on CDC distribution map	No Field Surveys. EIS Analysis: Yes
Utah Prairie Dog (*Cynomys parvidens)*	Fed-T	This species inhabits open, grassy habitats and swales within sagebrush communities (Crocker-Bedford and Spillett 1981). It requires well-drained, deep soils suitable for burrowing, and moist herbage, particularly during drought.	Potential habitat not present on the tract. Populations known to occur along the coal haul transportation route adjacent to SR-20 and have high potential to occur along the coal haul transportation route adjacent to Highways 56 and 89.	Field Surveys: Yes EIS Analysis: Yes

SUMMARY OF WILDLIFE SPECIES ELIMINATED FROM DETAILED ANALYSIS

Based on the data gathered by the original preliminary analysis and supplemented by the results of the reconnaissance surveys, the following wildlife and special status species were eliminated from detailed analysis:

Table 3. Wildlife and Special Status Animal Species Eliminated from Detailed Analysis

Common Name ***Scientific Name***	**Status**	**Reason Eliminated**
Bonytail (*Gila elegans*)	Fed-E	No potential habitat in tract or coal haul transportation route
Bonneville Cutthroat trout *(Oncorhynchus clarkia Utah)*	CS	No potential habitat in tract or coal haul transportation route
Colorado pikeminnow (*Ptychocheilus lucius*)	Fed-E	No potential habitat in tract or coal haul transportation route
Desert Sucker *(Catostomus clarkia)*	SPC	No potential habitat in tract or coal haul transportation route
Humpback chub (*Gila cypha*)	Fed-E	No potential habitat in tract or coal haul transportation route
Razorback sucker (*Xyrauchen texanus*)	Fed-E	No potential habitat in tract or coal haul transportation route
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Fed-E	Not likely to occur in tract or coal haul transportation route
Kanab ambersnail (*Oxyloma kanabense*)	Fed-E	Not likely to occur in tract or coal haul transportation route
Leatherside Chub *(Gila copei)*	SPC	No potential habitat in tract or coal haul transportation route
Mexican spotted owl (*Strix occidentalis*)	Fed-T	Not likely to occur in tract or coal haul transportation route
California Condor (*Gymnogyps californianus*)	Fed-Experimental	Not likely to occur in tract or coal haul transportation route
Coral pink sand dunes tiger beetle (*Cicindela limbata albissima*)	Fed-C	Not likely to occur in tract or coal haul transportation route
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	Fed-C	No potential habitat in tract or coal haul transportation route
Desert bighorn sheep (*Ovis canadensis nelsoni*)	UDWR	Not likely to occur in tract or coal haul transportation route
Dark kangaroo mouse (*Microdipodops megacephalus*)	SPC	Not likely to occur in tract or coal haul transportation route
American white pelican (*Pelecanus erythrorhynchos*)	SPC	No potential habitat in tract or coal haul transportation route
Common chuckwalla (*Sauromalus ater*)	SPC	Not likely to occur in tract or coal haul transportation route
Utah physa (*Physella utahensis*)	SPC	Not likely to occur in tract or coal haul transportation route
Virgin Spinedace *(Lepidomeda mollispinis)*	CS	No potential habitat in tract or coal haul transportation route

VEGETATION COMMUNITIES/HABITAT CLASSIFICATION SURVEY NOVEMBER 16-18, 2007

The tract was surveyed over a three day period (November 16–18, 2007), with the main areas of focus being those planned for known surface-disturbing activities.

METHODS

SWCA and Mt. Nebo Scientific ecologists surveyed and collected data on dominant species cover in the various vegetation communities within the tract (see Attachment 1, Relevé Plot Data). Vegetation community classification surveys were conducted by recording plant species present and their general percent cover within an approximate 10 meter radius of the data point. Data points were recorded in areas that typified the overall vegetation community (Figure 2).

The percent cover for each species was classified as rare (<5% cover), few (5%–25% cover), moderate (26%–50% cover), or common (>50% cover). As many data collection points as possible were established in each area of the tract to increase the reliability (for characterization of the affected environment and the analysis of impacts and for photo interpretation) of the data collected. Twenty-six vegetation data points were surveyed during fall 2007 field reconnaissance (see Attachment 1, Relevé Plot Data). Vegetation communities were ground-truthed and delineated on the aerial photograph while recording the data points with a handheld GPS unit as well as driving and walking through the tract.

The information collected was used to delineate the various vegetation communities within the tract. Vegetation data points were plotted on an aerial photo of the area and used to interpret patterns of vegetation cover, which were outlined and digitized onto a map using GIS. The results of the vegetation community delineation are shown in Figure 2.

For consistency, vegetation communities as identified by Mt. Nebo Scientific for other areas in the vicinity of the tract were used with minor modifications. These are sagebrush/grassland, meadows, perennial/annual grasses, pinyon-juniper/sagebrush, mountain brush, rabbitbrush, pinyon-juniper/mountain brush, and pinyon-juniper woodland (see Attachment 2, Vegetation Associations and Species List).

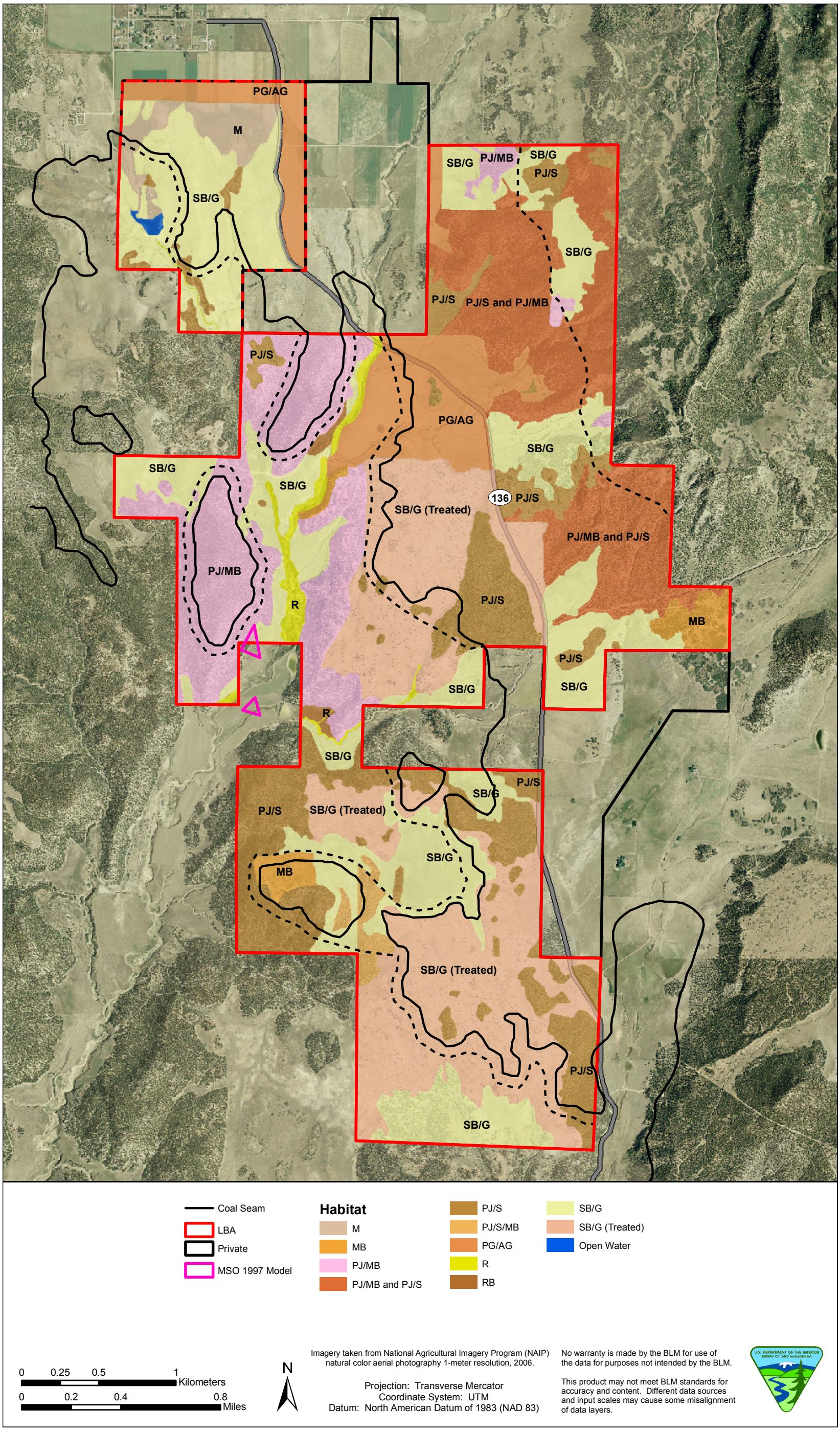

Figure 2. Alton Coal Tract vegetation (habitat) community map.

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RESULTS

Reconnaissance survey data coupled with aerial photo interpretation showed approximately 1,440 acres of pinyon-juniper habitat (including pinyon-juniper/sage and pinyon-juniper/mountain brush vegetation types), 275 acres of perennial/annual grasses, 10 acres of rabbitbrush habitat, 915 acres of sagebrush/grassland habitat, 755 acres of sagebrush/grassland (treated) habitat, 65 acres of meadow habitat, and 60 acres of mountain brush habitat. See Figure 2 for vegetation community delineation results. Table 3 lists the acreages of each of these habitats within the tract.

Table 3. Vegetation Communities and Approximate Acreages with the Alton Coal Tract

	Pinyon-juniper*	Sagebrush/ grassland	Sagebrush/ Grassland (Treated)**	Perennial/ Annual Grasses	Meadow	Mountain Brush	Rabbit-brush
Acres	1,440	915	755	275	65	60	10
% of Total (3,581)	40	25.5	21	7.6	1.8	1.7	0.3

* Pinyon-juniper habitat classification includes pinyon-juniper/sagebrush and pinyon-juniper/mountain brush vegetation communities.

** Sagebrush/Grassland (treated) habitat classification includes areas if sagebrush and grassland vegetation communities where pinyon and juniper trees have been cut or chained and the body of the tree chipped.

SPECIAL STATUS PLANT SPECIES POTENTIAL OCCURRENCE DETERMINATION

Potential for special status plant species identified during the preliminary threatened and endangered and sensitive species analysis was determined using the vegetation communities as delineated during the fall 2007 field reconnaissance visit. Using the known habitat preferences of these species, SWCA was able to determine areas of possible occurrence for these species within the tract.

Based on the *County Lists of Utah's Threatened, Endangered, and Candidate Species* (UDWR 2007), sensitive species lists as published in the BLM Kanab Field Office Draft Resource Management Plan (BLM 2007), the *Utah Rare Plant Guide* (UNPS 2007), and GIS analysis using SWReGAP vegetation data and elevation, the following special status or rare plant species may occur within the Alton Coal Tract LBA: Paria breadroot (*Pediomelum pariense*), sandloving penstemon (*Penstemon ammophilus*), Ruth's sphaeromeria (*Sphaeromeria ruthiae*), Charleston Mountain violet (*Viola charlestonensis*), Slender camissonia (*Camissonia exilis*), and Jones cycladenia (*Cycladenia humilis* var. *jonesii*). The habitat requirements for each of these species are outlined in Table 4 below (UNPS 2007).

Table 4. Habitat Requirements of Certain Special Status or Rare Vegetation Species With Possible Occurrence in the LBA

Species	Elevation Range	Flowering Season	Vegetation Associations	Soils and Geology Associations	Status	Additional surveys recommended?
Paria breadroot (*Pediomelum pariense*)	5,600 to 8,000 feet	June through July	Ponderosa pine and pinyon-juniper	Calcareous or sandy soils on Wasatch limestone	Utah Rare Plant (UNPS 2007)	No
Sandloving penstemon (*Penstemon ammophilus*)	5,900 to 7,200 feet	Late May through June	Ponderosa pine or mixed shrub communities	Blow sand derived from Navajo sandstone	BLM Sensitive Species	Yes
Ruth's sphaeromeria (*Sphaeromeria ruthiae*)	4,400 to 6,600 feet	September	Ponderosa pine, Douglas fir, oak, mountain mahogany, bigtooth maple, box elder, and sandstone crevice communities	Navajo and Kayenta sandstone, on cliffs and boulders	Utah Rare Plant (UNPS 2007)	No
Charleston Mountain violet (*Viola charlestonensis*)	6,500 to 9,500 feet	May through June	Ponderosa pine communities, limestone hills, slopes, and dry washes	Claron and Carmel Limestone	Utah Rare Plant (UNPS 2007)	No

Table 4. Habitat Requirements of Certain Special Status or Rare Vegetation Species With Possible Occurrence in the LBA

Species	Elevation Range	Flowering Season	Vegetation Associations	Soils and Geology Associations	Status	Additional surveys recommended?
Slender camissonia (*Camissonia exilis*)	5,000 to 6,900 feet	Late April to May	Sagebrush, galleta, and pinyon-juniper communities	Gypsiferous strata of Moenkopi, Entrada, Carmel, and other fine-textured substrates (Welsh et al. 2003)	BLM Sensitive Species	No
Jones cycladenia (*Cycladenia humilis* var. *jonesii*)	4,400 to 6,000 feet	Mid-May to June	Eriogonum-Ephedra cool desert shrub and juniper communities	Gypsiferous saline soils on Chinle, Cutler, and Summerville formations	Federally listed as threatened	No

To precisely determine areas of suitable habitat for these species within the Alton Coal Tract, data on surface geology (UGS 1999) and elevation were used in combination with vegetation community data as delineated through survey work. The main types of surface geology in the area are Tropic Shale (Kt) and Dakota formation (Kd), both of which are a mix of shale and sandstone. Other types of surface geology in the tract are Alluvium (Qa) and Mass Movement Deposits (Qms). Alluvium areas are mostly sand and other loose materials deposited in stream beds and washes, and Mass Movement Deposits include rock fall, talus, and colluvium (UGS 1999). Since there are no areas of limestone in the tract, Charleston Mountain violet and Paria breadroot are not likely to occur in the tract. There are also no Chinle, Cutler, or Summerville formations, which excludes Jones' Cycladenia. Finally, the lack of Navajo and Kayenta sandstone, and Moenkopi, Entrada, and Carmel formations excludes Ruth's sphaeromeria and slender camissonia from occurring in the tract. No surveys are recommended for these five species in the 2008 field season.

Possible areas of occurrence for the remaining species, sandloving penstemon, are shown in Figure 3. These potential habitat areas were identified by referencing surface geology information (UGS 1999) and vegetation covers as delineated using data acquired during the fall 2007 field surveys. Based on habitat requirements listed by the Utah Rare Plant Guide (UNPS 2007), sandloving penstemon has a relatively high likelihood of occurrence in Qa surface geology coupled with mountain brush, sagebrush/grass, or rabbitbrush ecology. Sandloving penstemon may also occur, although with lower likelihood, in Qa or Qms surface geology coupled with sagebrush/grassland (treated) or pinyon-juniper/mountain brush communities. Estimated areas of potential habitat for this species are shown in Table 5 and Figure 3.

Table 5. Acres of Potential Occurrence of Special Status or Rare Plant Species in the LBA (see also Figure 3).

	Acres of higher likelihood potential occurrence	Acres of lower likelihood potential occurrence
Sandloving penstemon	625.09	443.26

Surveys for sandloving penstemon are recommended in identified potential habitat during their flowering period (May and June) in the 2008 field season. Recommended areas of focus include locations where potential habitats overlap with proposed impact areas, although surrounding areas may also be surveyed as necessary.

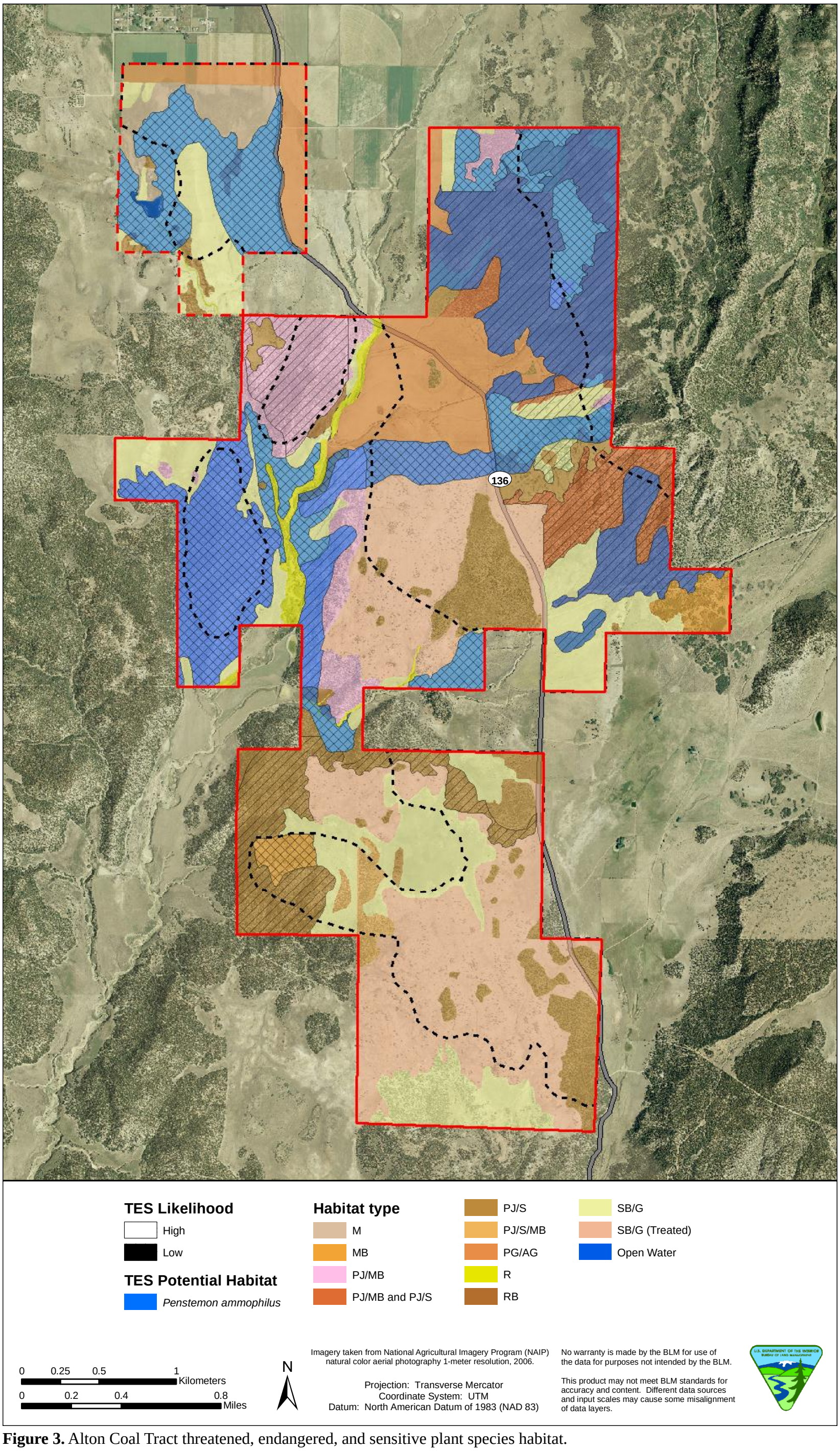

Figure 3. Alton Coal Tract threatened, endangered, and sensitive plant species habitat.

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RARE PLANT SPECIES SURVEY: PENSTEMON AMMOPHILUS *MAY 27-30, 2008*

Based on the recommendation from the habitat classification surveys and special status plant species potential occurrence determinations, a field survey was conducted to further assess the potential for sandloving penstemon to be present in the Alton Coal Tract.

METHODS

Prior to the field survey, known locations of sandloving penstemon were reviewed at the herbarium at Brigham Young University, Provo, Utah. All specimen locations were plotted on a field map. Notes about habitats, associated plant communities, elevation, phenology, geology, soil types and other applicable information were written in a field notebook. Based on the voucher specimens for this plant species, the most appropriate days believed to successfully locate sandloving penstemon in a field survey were chosen for the survey period.

Prior to surveying the Alton Coal Tract, several known locations of the plant were visited to review the specific habitats, identify the current phenology of the species and also to re-create a visual or "target" image for the surveyor. Once these locations, habitats and live plants were visited, the survey then focused on the areas within the Alton Coal Tract.

The field survey for sandloving penstemon was conducted from May 27 - May 30, 2008 by Mt. Nebo Scientific, Inc. Figure 4 identifies the survey area for the sandloving penstemon. These areas were accessed using a 4WD vehicle and an ATV on the roads and trails, then by walking the areas not accessible by the vehicles. Binoculars and spotting scopes were also utilized to assist in the search for suitable habitat for the plants.

RESULTS AND DISCUSSION

Although relatively close in proximity to known populations of the sandloving penstemon, this plant species was not found in the Alton Coal Tract study area shown in Figure 4, nor was the precise habitat of which this plant is currently thought to be limited to, found in the study area. Based on the research and subsequent field survey for the sandloving penstemon, it is believed that there is a very low probability that the species occurs within the Alton Coal Tract study area.

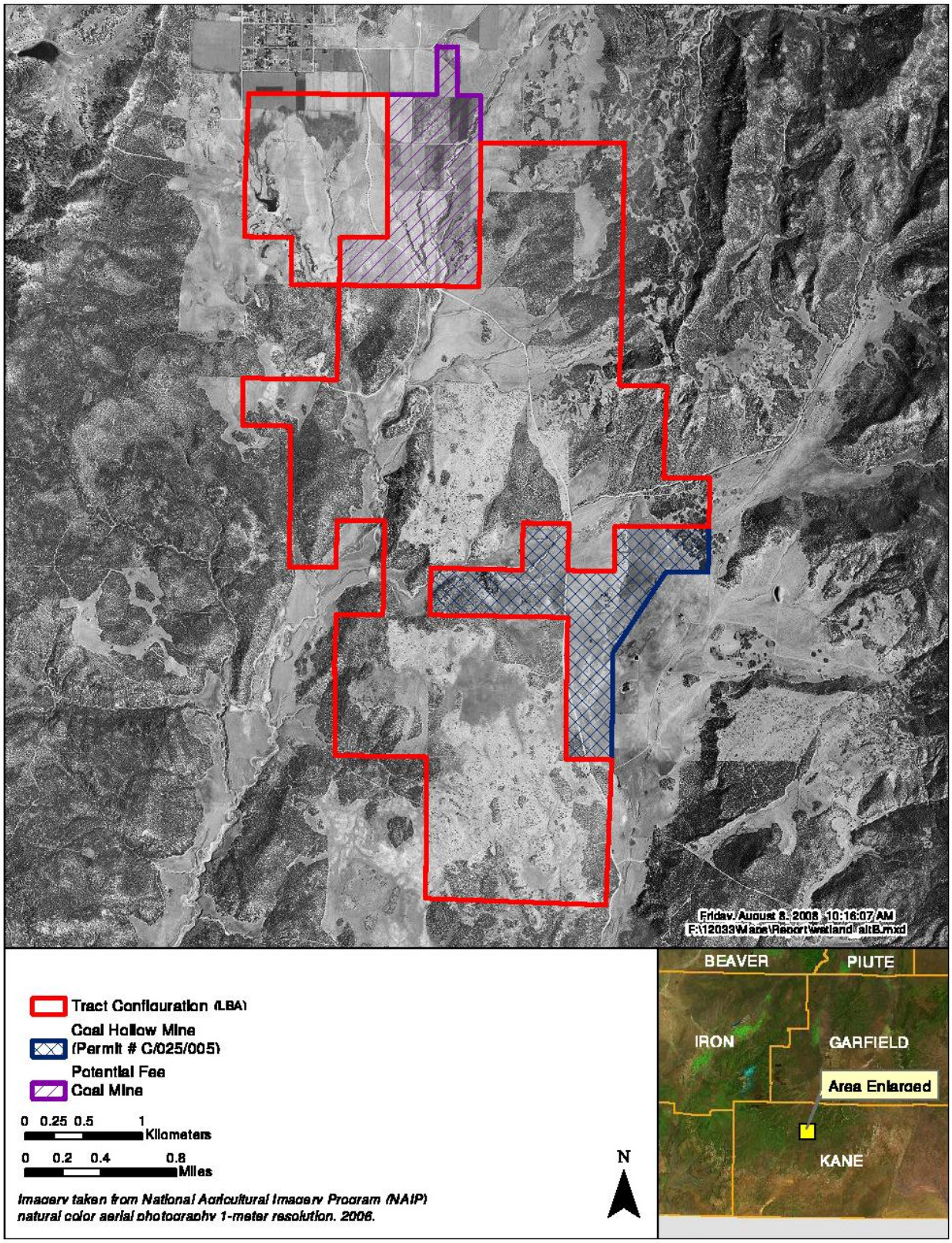

Figure 4. Survey area for sandloving penstemon.

WET MEADOWS OF THE ALTON COAL TRACT: A PRELIMINARY ASSESSMENT JULY 2, 2008

The scope of this study was to provide a preliminary assessment of some specific wet meadows currently used as pasture lands near the northern most boundary of the tract. The scope of the study was to provide a preliminary description of the pastures/meadows from a vegetation aspect with implications regarding their potential for being considered for future wetland studies. Soils and hydrology, two additional components required for wetland determinations, are only cursorily addressed in this study.

The study area was visited in November 2007, June 2008 and July 2008. On July 2, 2008, quantitative and qualitative data were recorded in the wet meadows near the northern boundary of the tract, just south of the Town of Alton, Utah (Figure 5).

METHODS

SAMPLING DESIGN AND TRANSECT/QUADRAT PLACEMENT

Transect lines for vegetation sampling were placed randomly within the boundaries of the meadow areas (see Figure 5). The transect placement technique was employed with the goal to adequately sample the meadows with a representative number of samples for each area. Once transects were established, quadrat locations for sampling were chosen using random numbers from the transect lines with the objective to record data without preconceived bias.

COVER, FREQUENCY AND COMPOSITION

Cover estimates were made using ocular methods with meter square quadrats. Species composition, cover by species, and relative frequencies were also assessed from the quadrats. Additional information was recorded on the raw data sheets notes such as: slope, exposure, grazing use, disturbance and/or other appropriate notes. Plant nomenclature follows Welsh et al. (2003).

RESULTS AND DISCUSSION

The sample areas were comprised of two wet meadows. They were sampled and have been reported separately and were called the “East Pasture" and "West Pasture" (see Figure 5).

WET MEADOWS: EAST PASTURE

The dominant plant species present in the sample quadrats in the East Pasture were wiregrass (*Juncus arcticus*), small-wing sedge (*Carex microptera*) and Missouri iris (*Iris missouriensis*). All species present in the sample quadrats along with their cover and frequency values are shown in Table 1. The total living cover for the East Pasture was estimated at 80.75% (see Table 2). The living understory cover composition was comprised of 85.48% grasses (or grass-like species) and 14.52% forbs (see Table 2). No woody species were present in the sample quadrats.

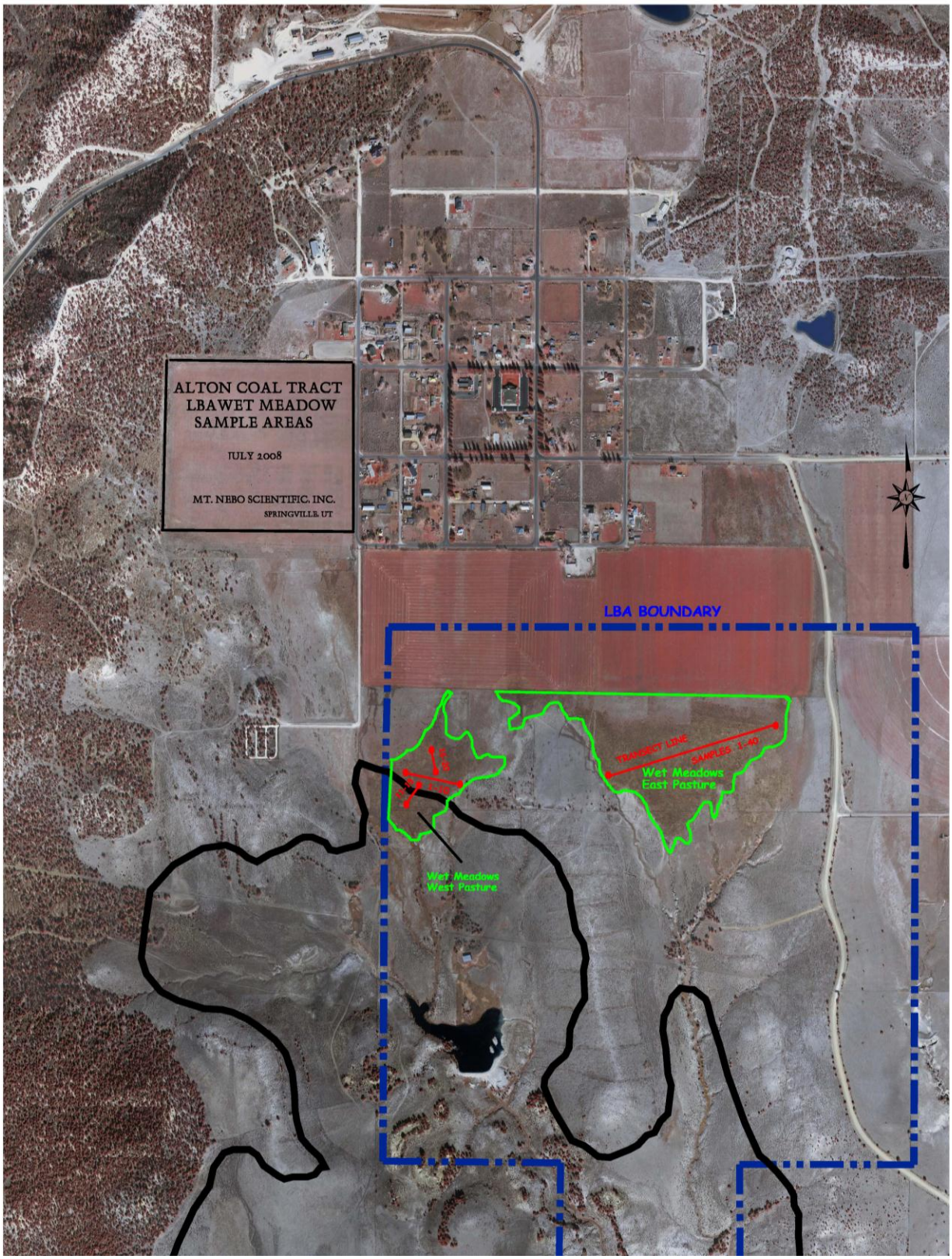

Figure 5. Wetland meadow sample areas.

Table 1. East Pasture Wet Meadow at the Alton Coal Tract. Total Cover, Standard Deviation and Frequency by Species (2008)

	Mean Percent	Standard Deviation	Percent Frequency
Trees and Shrubs			
Forbs			
Chenopodium sp.	0.13	0.78	2.50
Erigeron sp.	3.38	8.47	20.00
Iris missouriensis	7.13	11.88	32.50
Melilotus officinalis	0.25	1.56	2.50
Plantago major	0.25	1.09	5.00
Grasses			
Bromus inermis	3.13	6.39	22.50
Carex microptera	18.50	19.50	60.00
Juncus arcticus	47.50	26.76	90.00

Table 2. East Pasture Wet Meadow at the Alton Coal Tract. Total Cover, Standard Deviation and Sample Size (2008)

	Mean Percent	Standard Deviation	Percent Frequency
A. Total Cover			
Total Living Cover	80.75	10.34	40
Litter	16.20	9.33	40
Bareground	2.03	2.40	40
Rock	1.03	0.16	40
B. % Composition			
Shrubs	0.00	0.00	40
Forbs	14.52	18.08	40
Grasses	85.48	18.08	40

WET MEADOWS: WEST PASTURE

The dominant plant species for the West Pasture was primarily wiregrass (Table 3). Total living cover in this meadow was 78.00% (Table 4). The living cover was comprised almost exclusively of grass or grass-like species, which made up nearly 97% of the living cover by composition (Table 4). Like the East Pasture, no woody species were present in the sample quadrats.

Table 3. West Pasture Wet Meadow at the Alton Coal Tract LBA. Total Cover, Standard Deviation and Frequency by Species (2008)

	Mean Percent	Standard Deviation	Percent Frequency
Trees and Shrubs			
Forbs			
Cirsium sp.	0.75	1.79	15.00
Erigeron sp.	0.85	1.80	20.00
Melilotus officinalis	0.75	2.38	10.00
Grasses			
Bromus inermis	6.40	9.53	50.00
Elymus elymoides	0.25	1.09	5.00
Juncus arcticus	67.50	14.45	100.00
Poa pratensis	1.50	4.77	10.00

Table 4. West Pasture Wet Meadow at the Alton Coal Tract. Total Cover, Standard Deviation and Sample Size (2008)

	Mean Percent	Standard Deviation	Percent Frequency
A. Total Cover			
Total Living Cover	78.00	7.65	20
Litter	15.85	9.60	20
Bareground	5.10	6.63	20
Rock	1.05	0.22	20
B. % Composition			
Shrubs	0.00	0.00	20
Forbs	3.01	4.83	20
Grasses	96.99	4.83	20

DISCUSSION

HYDROPHYTIC VEGETATION

As mentioned, the scope of this report was to provide vegetation information regarding the wet meadows near the northern boundary of the Alton Coal Tract. Quantitative data from sampling the plant communities of the wet meadows can provide insight as to whether these areas may have the potential to be delineated as jurisdictional wetlands and if additional studies should be conducted in the future to make this determination. The U.S. Army Corps of Engineers (COE), the regulatory agency responsible for jurisdiction of wetlands under Section 404 of the Clean Water Act (33 U.S.C. 1344), has recently provided a manual that provides technical guidance

and procedures for identifying and delineating wetlands in the arid west region, of which the Alton Coal Tract is part (U.S. Army Corps of Engineers, 2006).

The COE manual mentioned above has a section regarding hydrophytic vegetation indicators for wetland delineations. This section describes two procedures that may be used to indicate the presence of hydrophytic vegetation, which is one step in determining if a given area would be considered wetland or jurisdictional wetland by definition. Both hydrophytic vegetation indicator procedures utilize quantitative data for their determinations. The first test is called the Dominance Test.

The Dominance Test is the basic hydrophytic vegetation indicator and "should be applied in every wetland determination in the arid west". This test is described by suggesting that the vegetation in a given community is "hydrophytic" if more that 50 percent of the dominant plant species across all strata are rated as:

1. OBL [Obligate Wetland: occurs almost always (estimated probability 99%) under natural condition in wetlands],
2. FACW [Facultative Wetland: usually occurs in wetlands (estimated probability 67%–99%), but occasionally found in non-wetlands], or
3. FAC [Facultative Wetland: Equally likely to occur in wetland or non-wetland (estimated probability 34%–66%)].

When the data from the East Pasture and West Pasture wet meadows were put through the Dominance Test, **both pastures would be considered to support hydrophytic vegetation** by the COE methods.

The second COE hydrophytic vegetation indicator procedure is called the Prevalence Test. This test can be employed on the vegetation in a community if it fails the Dominance Test described above, but meets those requirements for hydric soils and wetland hydrology in the wetland delineation process. The Prevalence Test considers all species in a plant community, however, the indicator categories assigned to the species (OBL, FACW, FAC, etc.) places a "weighted" value on them by using cover values of individual species. In other words, if a given plant species has more cover and is assigned OBL, FACW or FAC it is more likely that the community will be determined to be hydrophytic.

When the quantitative data of the East Pasture and West Pasture wet meadows are computed through the Prevalence Test, **both pastures would be considered as supporting hydrophytic vegetation**.

HYDRIC SOILS

As mentioned previously, the focus of this study was to be on vegetation analyses and *not* on soils or hydrology, two other important aspects for studies when delineating wetlands using COE protocols. Nonetheless, a few holes were dug in the pastures and the soils were examined for redox characteristics. These soil characteristics were present in the limited amount of sample holes observed. These holes were dug at random locations, but the sample number was not enough to be considered an adequate number of samples to determine if the meadows were dominated by hydric soils to be determined as jurisdictional by the COE.

WETLAND HYDROLOGY

This discipline is another crucial consideration necessary for wetland determinations and has not been studied in enough detail to make the determination in the scope of this report. However, when aerial photographs were examined (i.e., Figure 5) and when field observations were considered, it appears that the water supporting wet meadows in the East Pasture and West Pasture is a result of runoff irrigation from the fields directly north and adjacent to the pastures – not the result of water being supplied by natural means such as springs or seeps in the immediate area.

CONCLUSIONS

The quantitative data and the test procedures that determine the presence of hydrophytic vegetation suggests that the wet meadows of the East Pasture and West Pasture are that of wetlands – whether or not they are jurisdictional through the U.S. Army Corps of Engineers has not yet been determined. Cursory thoughts about soils and hydrology also suggest these areas could be considered wetlands. However, because the hydrologic regime may be artificially induced by present and historical irrigation practices, more study is probably warranted if a determination is to be made if the areas would be considered jurisdictional through the COE.

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Attachment 1: Relevé Plot Data

SWCA Surveyors:

Ben Gaddis, M.E.M.

Thomas Sharp, M.S.

Audrey McCulley, B.S.

Mt. Nebo Consulting Surveyors:

Patrick D Collins, Ph. D.

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Releve Plot Data Date	Releve ID	Plant Community	Surveyors	General Notes
11/17/2007	Veg 1	Wiregrass	PDC and AAM	Pasture, grazed, irrigation runoff area
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM	Could have been seeded because lots of AGCR, may not be as "natural" as other ARNO communities. Small scattered JUOS.
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM	Close to native condition as compared to veg 2.
11/17/2007	Veg 4	Pastureland	PDC and AAM	Previously was a sagebrush/grass community. Presently pasture, unirrigated and fenced.
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS	
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM	Heavily grazed, previously s/g community
11/17/2007	Veg 7	Dry pastureland	PDC and AAM	Converted from s/g, scattered PJ, very heavily grazed. Fairly recently worked by tractor.
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM	PJ cleared but not ARNO. Other side of road was cleared of ARNO.
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM	Chipped PJ. To ehn.(?) sage grouse habitat.
11/17/2007	Veg 10	Oakbrush	PDC and AAM	Area adjacent to PJ removed with track hoe and grapple claw to increase sage grouse habitat. Piles of PJ.
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM	
11/18/2007	Veg 12	PJ	PDC and AAM	Lots of bare ground
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM	Lots of bare ground covered with chipped PJ, weeds, and a fair amount oak, used to be mostly PJ with sage but much of the PJ has been cleared.
11/17/2007	Veg A (15)	Pastureland	TS and BTG	Grazed grasses also part of cover. Grazed.
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG	Grazed grasses have moderate cover.
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG	Grazed grasses have abundant cover. PJ near edge of plot.
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG	Grasses have abundant cover. Less grazed than A, B, C.
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG	PJ in surrounding area.
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG	Previously this area was mostly PJ. Currently it is progressing toward a S/G community. Chipped to increase sage grouse habitat.
11/18/2007	Veg G (21)	P-J	PDC and BTG	Some soil pavement present (0.5"). Sparse understory. No forbs or grasses noted here.
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG	
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG	ARNO and CHNA areas interspersed. Few forb species.
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG	
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG	Relatively small area with lots of ARNO.
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG	Very homogenous.

Releve Plot Data	**Releve ID**	**Plant Community**	**Surveyors**	***Achillea millefolium***	***Agropyrum cristatum***	***Artemisia nova***	***Artemisia tridentata***
Date				**ACMI**	**AGCR**	**ARNO**	**ARTR**
11/17/2007	Veg 1	Wiregrass	PDC and AAM				
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM			common	
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM			common	
11/17/2007	Veg 4	Pastureland	PDC and AAM		common	few	
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS			moderate	
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM			rare	few
11/17/2007	Veg 7	Dry pastureland	PDC and AAM		moderate	few	
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM		moderate	common	moderate
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM		moderate	common	
11/17/2007	Veg 10	Oakbrush	PDC and AAM				moderate
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM				
11/18/2007	Veg 12	PJ	PDC and AAM			moderate	
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM			moderate	
11/17/2007	Veg A (15)	Pastureland	TS and BTG			few	
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG			few	
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG			moderate	
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG			common	
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG			common	
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG		few	moderate	moderate
11/18/2007	Veg G (21)	P-J	PDC and BTG			moderate	few
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG				moderate
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG			common	
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG	moderate		few	few
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG		common	common	
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG			common	few

Releve Plot Data	**Releve ID**	**Plant Community**	**Surveyors**	***Artemisia tridentata* var. *vaseyana***	**Aster or composite sp.**	***Astragalus* sp.**	***Atriplex canescens***
Date				**ATRVA**	**ASTER**	**ASTRAGALUS**	**ATCA**
11/17/2007	Veg 1	Wiregrass	PDC and AAM				
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 4	Pastureland	PDC and AAM				
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS				
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM				rare
11/17/2007	Veg 7	Dry pastureland	PDC and AAM				
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM				
11/17/2007	Veg 10	Oakbrush	PDC and AAM				
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM				
11/18/2007	Veg 12	PJ	PDC and AAM				
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM		few	few	
11/17/2007	Veg A (15)	Pastureland	TS and BTG				
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG				
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG				
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG				
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG				
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG				
11/18/2007	Veg G (21)	P-J	PDC and BTG				
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG				
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG				
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG				
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG	moderate			
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG				

Releve Plot Data				***Bromus carinatus***	***Bromus inermis***	***Bromus tectorum***	***Carex* sp.**	***Cercocarpus montanus***
Date	**Releve ID**	**Plant Community**	**Surveyors**	**BRCA**	**BRIN**	**BRTE**	**CAREX**	**CEMO**
11/17/2007	Veg 1	Wiregrass	PDC and AAM					
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM	common				
11/17/2007	Veg 4	Pastureland	PDC and AAM		few			
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS					common
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM				few	
11/17/2007	Veg 7	Dry pastureland	PDC and AAM	few				
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM	moderate				few
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM					
11/17/2007	Veg 10	Oakbrush	PDC and AAM					
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM			common		
11/18/2007	Veg 12	PJ	PDC and AAM					
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM			few		
11/17/2007	Veg A (15)	Pastureland	TS and BTG					
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG					
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG					
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG					
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG					
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG	few		few		
11/18/2007	Veg G (21)	P-J	PDC and BTG					
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG					
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG					
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG					
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG		moderate			few
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG			few		

Releve Plot Data	**Releve ID**	**Plant Community**	**Surveyors**	***Cirsium* sp.**	***Cirsium arvense***	***Chrysothamnus nauseosus***	***Dactylis glomerata***	***Echinocereus* sp.**
Date				**CIRSIUM**	**CIAR**	**CHNA**	**DAGL**	**ECHINOCACTUS**
11/17/2007	Veg 1	Wiregrass	PDC and AAM		rare			
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM			few		
11/17/2007	Veg 4	Pastureland	PDC and AAM	few			few	
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS					rare
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM			common		
11/17/2007	Veg 7	Dry pastureland	PDC and AAM	few		few		
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM					
11/17/2007	Veg 10	Oakbrush	PDC and AAM					
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM	rare		few		
11/18/2007	Veg 12	PJ	PDC and AAM					
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM	moderate				
11/17/2007	Veg A (15)	Pastureland	TS and BTG			moderate		
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG			few		
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG			few		
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG					
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG					
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG	few		few		
11/18/2007	Veg G (21)	P-J	PDC and BTG					
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG			common		
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG			common		
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG	moderate				
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG			moderate		
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG					

Releve Plot Data	**Releve ID**	**Plant Community**	**Surveyors**	***Elymus hispidus***	***Elymus smithii***	***Elymus trachycaulus***	***Elytrigia juncea***	**?**
Date				**ELHI**	**ELSM**	**ELTR**	**ELJU**	**ERCO**
11/17/2007	Veg 1	Wiregrass	PDC and AAM					
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 4	Pastureland	PDC and AAM	moderate			moderate	
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS					
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM			common		
11/17/2007	Veg 7	Dry pastureland	PDC and AAM			moderate	few	
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM		moderate			
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM			few	moderate	few
11/17/2007	Veg 10	Oakbrush	PDC and AAM					
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM			common		
11/18/2007	Veg 12	PJ	PDC and AAM			few		
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg A (15)	Pastureland	TS and BTG					
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG					
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG					
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG					
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG					
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG			few		
11/18/2007	Veg G (21)	P-J	PDC and BTG					
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG					
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG			few		
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG			few		
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG					
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG					

Releve Plot Data	**Releve ID**	**Plant Community**	**Surveyors**	***Erigeron* sp.**	***Eriogonum* sp.**	***Festuca* sp.**	***Grindelia squarrosa***	***Gutierrezia sarothrae***
Date				**ERIGERON**	**ERIOGONUM**	**FESTUCA**	**GRSQ**	**GUSA**
11/17/2007	Veg 1	Wiregrass	PDC and AAM					
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM					few
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM					few
11/17/2007	Veg 4	Pastureland	PDC and AAM					rare
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS	few	rare	few		
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM					
11/17/2007	Veg 7	Dry pastureland	PDC and AAM				rare	few
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM					few
11/17/2007	Veg 10	Oakbrush	PDC and AAM					
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM					few
11/18/2007	Veg 12	PJ	PDC and AAM					few
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg A (15)	Pastureland	TS and BTG					
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG					
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG					
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG					
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG					
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG					
11/18/2007	Veg G (21)	P-J	PDC and BTG					
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG					
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG	few				
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG					
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG					
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG					

Releve Plot Data	**Releve ID**	**Plant Community**	**Surveyors**	***Hordeum jubatum***	***Juncus arcticus***	***Juniperus osteosperma***	***Juniperus scopulorum***
Date				**HOJU**	**JUAR**	**JUOS**	**JUSC**
11/17/2007	Veg 1	Wiregrass	PDC and AAM	moderate	common		
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM			few	
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM			few	
11/17/2007	Veg 4	Pastureland	PDC and AAM			rare	
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS			common	
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM		moderate	few	
11/17/2007	Veg 7	Dry pastureland	PDC and AAM				
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM			few	
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM			few	
11/17/2007	Veg 10	Oakbrush	PDC and AAM			few	moderate
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM		moderate		
11/18/2007	Veg 12	PJ	PDC and AAM			common	rare
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM	few		few	
11/17/2007	Veg A (15)	Pastureland	TS and BTG				
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG				
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG				
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG			few	
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG			few	
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG			few	
11/18/2007	Veg G (21)	P-J	PDC and BTG			common	
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG				
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG				
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG			few	
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG			few	
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG	few			

Releve Plot Data	**Releve ID**	**Plant Community**	**Surveyors**	***Mustard* sp.**	***Opuntia* sp.**	***Penstemon palmeri***	***Peraphyllum ramosissimum***
Date				**MUSTARD**	**OPUNTIA**	**PEPA**	**PERA**
11/17/2007	Veg 1	Wiregrass	PDC and AAM				
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 4	Pastureland	PDC and AAM				
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS		moderate		rare
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM			rare	
11/17/2007	Veg 7	Dry pastureland	PDC and AAM				
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM				
11/17/2007	Veg 10	Oakbrush	PDC and AAM				
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM				
11/18/2007	Veg 12	PJ	PDC and AAM	rare	rare		rare
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM			few	
11/17/2007	Veg A (15)	Pastureland	TS and BTG				
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG				
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG				
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG				
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG				
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG				
11/18/2007	Veg G (21)	P-J	PDC and BTG				
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG				
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG				
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG				
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG		few		
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG				

Releve Plot Data	**Releve ID**	**Plant Community**	**Surveyors**	***Sanguisorba minor***	***Sissymbrium* sp.**	***Sissymbrium altissimum***	***Stipa hymenoides***
Date				**SAMI**	**SISSYMBRIUM**	**SIAL**	**STHY**
11/17/2007	Veg 1	Wiregrass	PDC and AAM				
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 4	Pastureland	PDC and AAM				few
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS				
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM				
11/17/2007	Veg 7	Dry pastureland	PDC and AAM				
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM				
11/17/2007	Veg 10	Oakbrush	PDC and AAM				
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM				
11/18/2007	Veg 12	PJ	PDC and AAM				
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM		moderate		
11/17/2007	Veg A (15)	Pastureland	TS and BTG				
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG				
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG				
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG				
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG				
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG			few	
11/18/2007	Veg G (21)	P-J	PDC and BTG				
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG				
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG				
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG	few			
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG				
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG				

Releve Plot Data	**Releve ID**	**Plant Community**	**Surveyors**	***Symphorocarpus oreophilus***	***Trifolium* sp.**	***Triglochin maritima***	***Verbascum thapsis***	***Yucca* sp.**
Date				**SYOR**	**TRIFOLIUM**	**TRMA**	**VETH**	**YUCCA**
11/17/2007	Veg 1	Wiregrass	PDC and AAM			few		
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 4	Pastureland	PDC and AAM					
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS	few				rare
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM					
11/17/2007	Veg 7	Dry pastureland	PDC and AAM		rare			
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM					
11/17/2007	Veg 10	Oakbrush	PDC and AAM	moderate				
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM					
11/18/2007	Veg 12	PJ	PDC and AAM	few				
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg A (15)	Pastureland	TS and BTG					
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG					
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG					
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG					
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG					
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG					
11/18/2007	Veg G (21)	P-J	PDC and BTG					
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG					
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG					
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG				rare	
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG	few				
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG					

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Attachment 2. Vegetation Associations and Species List

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VEGETATION SURVEY PROTOCOLS FOR ALTON COAL TRACT LBA

Habitat schemes as set by Mt. Nebo Scientific 2007

Sagebrush/Grass
Artemisia tridentata var. *tridentata*- big sagebrush
Artemisia nova- Black sagebrush
Koeleria micrantha- Junegrass
Poa secunda- Sandberg's bluegrass
Chrysothamnus depressus- longflower rabbitbrush
Gutierrezia sarothrae- Broom snakeweed
Eriogonum racemosum- redroot buckwheat
Gillia agreggata
Linum perenne- Flax
Bouteloua gracilis- Sideoats grama
Bromus tectorum- Cheatgrass
Elymus smithii- Western wheatgrass
Elymus trachycaulus- Slender wheatgrass
Hordeum jubatum- Foxtail barley
Poa pratensis- Kentucky bluegrass
Stipa hymenoides- Indian ricegrass

Meadows (Wet and dry)
Carex sp.-Sedges
Juncus arcticus- wiregrass
Gutierrezia sarothrae- Broom snakeweed
Achillea millefolium- yarrow
Aster ascendens- Pacific aster
Artemisia nova- Black sagebrush
Eriogonum racemosum- redroot buckwheat
Linum lewisii- Flax
Potentilla anserina
Bouteloua gracilis- Sideoats grama
Elymus elymoides- Squirreltail
Elymus smithii- Western wheatgrass
Hordeum jubatum- Foxtail barley
Koeleria micrantha- Junegrass
Muhlenbergia asperifolia- Scratchgrass
Poa pratensis- Kentucky bluegrass

Perennial/Annual Grasses
No quantitative vegetation surveys

Pinyon-Juniper/Sagebrush
Artemisia nova- Black sagebrush
Juniperus osteosperma- Utah juniper
Artemisia tridentata var. *tridentata*- big sagebrush
Phlox austromontana- Desert phlox
Pinus edulis- Pinyon pine
Amelanchier utahensis- Utah serviceberry
Gutierrezia sarothrae- Broom snakeweed

Mountain Brush
Quercus gambelii- Gambel oak
Cercocarpus montanus- Alderleaf mountain mahogany
Peraphyllum ramosissimum- Squaw-apple
Amelanchier utahensis- Utah serviceberry
Elymus smithii- Western wheatgrass
Symphorocarpus oreophilus- snowberry
Agropyron cristatum- Crested wheatgrass

Pinyon-Juniper/Mountain Brush ***Transition between pinyon-juniper and mountain brush***
Quercus gambelii- Gambel oak
Juniperus osteosperma- Utah juniper
Amelanchier utahensis- Utah serviceberry
Pinus edulis- Pinyon pine

Pinyon-Juniper Woodland
Juniperus osteosperma- Utah juniper
Pinus edulis- Pinyon pine
Phlox austromontana- Desert phlox

APPENDIX G.
INTERDISCIPLINARY TEAM ANALYSIS RECORD CHECKLIST

INTERDISCIPLINARY TEAM ANALYSIS RECORD CHECKLIST

INSTRUCTIONS: **Follow these instructions and then remove this text box by selecting the box with the left mouse button, then clicking on edit then cut.**

GENERAL INSTRUCTIONS

This Interdisciplinary Team Analysis Record Checklist should be completed at an interdisciplinary team meeting to identify issues, conflicts or potential impacts that may oNPccur as a result of a proposed action. Each item of the analysis checklist will only be completed by the appropriate resource specialist – *NOT BY THE PROJECT LEADER* (unless the project leader is the appropriate specialist). For example, only the Archaeologist should fill out the sections on Cultural Resources and Native American Religious Concerns. The EA/DNA/CX preparer then uses the information from the checklist to guide preparation of the EA/DNA/CX.

SPECIFIC INSTRUCTIONS

Column 1 **- Write in one of the following:**

- "NP" (*not present in project area*);
- "NI" (*present in project area but not impacted by the proposed project*)
- "PI" (*present and potentially impacted by the proposed project*) – this item or resource will be carried forward in the EA as an issue.
- "NC" (*this is for DNAs only – anticipated resource impacts are not changed from those analyzed in the original NEPA document from which you are basing the DNA*).

Column 2 **- List of Critical Elements of the Human Environment/Resources/Other Concerns**
Critical Elements are listed first.

Column 3 **- Date Reviewed**
Enter the date the proposed project is reviewed/checklist is filled out by that particular specialist.

Column 4 **- Signature**
Resource specialist signs in this column (after reviewing proposed project and providing input on whether his/her particular element/resource/concern is present in the project area and may be impacted by the action).

Column 5 **- Review Comments**
This is the rationale section. The resource specialist gives his/her reasoning for the determination made in Column 1. It should include information explaining how he/she came to their conclusion.

- ***NP*** **-** How does specialist know the element/resource/concern is not present? Site visit conducted (if so, list date of visit)? Familiarity with location? Etc.
- ***NI*** **–** What is the rationale/reason why this element/resource/concern would not be impacted by the proposed action? (See EA Template section of the Guidebook for examples.) This rationale must show that serious consideration was given as to why no impacts would be expected – "trust me" statements without substance (such as *"No impacts anticipated as a result of the proposed action"*) are not acceptable.
- ***PI*** – Give a brief summary of what the issue is (this will be carried forth into Chapter I of the EA as the introductory issue statement).
- ***NC*** – Explain why the resource impacts from the current proposed action would be the same as those in the original EA.

INTERDISCIPLINARY TEAM ANALYSIS RECORD CHECKLIST

Project Title: Alton Coal EIS

NEPA Log Number:

File/Serial Number:

Project Leader: Keith Rigtrup

FOR EAs/CXs: NP: not present; NI: resource/use present but not impacted; PI: potentially impacted
FOR DNAs only: NC: no change (anticipated resource impacts not changed from those analyzed in the NEPA document on which the DNA is based)

STAFF REVIEW OF PROPOSAL:

NP/NI/PI NC	Resource	Date Reviewed	Signature	**Review Comments** (required for all NIs and PIs. PIs require further analysis.)
CRITICAL ELEMENTS				
PI	Air Quality *(Carson)*	4/28/08	/s/ C. Gubler	Standard Operating procedures and other mitigating measures would need to be incorporated into the mining operation to ensure that Air quality is maintained.
NP	Areas of Critical Environmental Concern *(Tom C.)*	4/25/08	/s/T. Christensen	
PI	Cultural Resources *(Matt Z.)*	4/25/08	/s/ M. Zweifel	Cultural resource inventories have been completed and numerous cultural resource sites have been identified. A Cultural Resource Management Plan detailing proposed mitigation is under development.
NP	Environmental Justice *(Keith)*	4/28/08	/s/ K. Rigtrup	No low income or minority populations in the project area.
NP	Farmlands (Prime or Unique) *(John)*	4/25/08	/s/ J. Reese	
NI	Floodplains *(Carson)*	4/28/08	/s./ C. Gubler	Flood plains will be put back the same, and on site mitigation will take place as a result of compliance with UDOGM.
PI	Invasive, Non-native Species *(Carson)*	4/28/08	/s./ C. Gubler	Some invasives are found within the LBA, the potential for them to increase is there if mitigating measures are not taken.
PI	Native American Religious Concerns *(Matt Z.)*	4/25/08	/s/ M. Zweifel	Initial Native American consultation has been performed, and will be updated as required. Comments regarding the potential loss of cultural resource sites have been received from at least one Tribe, and Tribal comments and input to the Cultural Resources Management Plan will be sought when a draft plan is available.
NI	Threatened, Endangered or Candidate Plant Species *(Carson)*	4/28/08	/s/ C. Gubler	No Threatened Endangered or Candidate Plant species are known to exist within the project area.
PI	Threatened, Endangered or Candidate Wildlife Species *(Lisa)*	4/24/08	/s/L. Church	Current USFWS list needs to be utilized for analysis. Presence and absence of habitat would need to be determined. No known T and E or C animals in the project area, wintering raptors ie Bald Eagles, may utilize habitat for wintering roosting.
PI	Wastes (hazardous or solid) *(Doug P.)*	4/25/2008	/s/ Doug Powell	Large industrial operations such as the proposed action have a potential for solid and hazardous waste issues. Standard operating procedures and other mitigating measures would need to be incorporated.

NP/NI/PI NC	Resource	Date Reviewed	Signature	**Review Comments** (required for all NIs and PIs. PIs require further analysis**.)**
PI	Water Quality (drinking/ground) *(Carson)*	4/28/08	/s/ C. Gubler	The potential exists for Water Quality to be degraded or impacted as a result of this action. Mitigating measures would need to be incorporated into the project to ensure water quality above and below ground are not impacted.
PI	Wetlands/Riparian Zones *(Lisa)*	4/24/08	/s/ L.Church	Portions of Robinson Creek may be temporarily diverted for life of project will be 404 permitted and restored. Mitigations and reclamation plans would be part of project.
NP	Wild and Scenic Rivers *(Tom C.)*	4/25/08	/s/T. Christensen	
NP	Wilderness *(Tom C.)*	4/25/08	/s/T. Christensen	
OTHER RESOURCES / CONCERNS*				
PI	Rangeland Health Standards and Guidelines *(Carson)*	4/28/08	/s/ C. Gubler	Rangeland Health standards and Guidelines will be affected by the proposed action. Reclamation will have to occur to ensure that the land is returned to a functioning state.
PI	Livestock Grazing *(John)*	4/28/08	/s/ J. Reese	Livestock grazing in the project area may be impacted during mining activities; mitigation may be required with grazing permittees. Reclamation planning would need to consider reconstructing all fences and other range improvements located within effected area.
PI	Woodland / Forestry *(John)*	4/28/08	/s/ J. Reese	Woodland/Forestry in the project area would be impacted by mining activities. The removal of invaded Pinyin and Juniper trees would be a positive impact on the land.
PI	Vegetation *(John)*	4/28/08	/s/ J. Reese	Vegetation in the project area would be impacted by mining activities. Reclamation planning must include a re-vegetation and reseeding plan using species currently on site along with others the BLM specialists feel appropriate for the site.
PI	Fish and Wildlife *(Lisa)*	4/24/08	/s/L.Church	Sage grouse and brooding and winter habitat in the project area may be impacted by mining activities, mitigations could be required. Reclmation planning would need to consider this species, deer, elk, turkeys and other sagebrush obligates, including pygmy rabbits. Raptors may utilize are winter roosting , and or nesting.
PI	Soils *(John)*	4/28/08	/s/ J. Reese	Soils in the project area would be impacted by the mining activities. Reclamation planning must consider a soil stabilization plan which may include re-contouring and the construction of water bars where appropriate. (see vegetation) for re-vegetation requirements.
PI	Recreation *(Tom C.)*	4/25/08	/s/T. Christensen	Minor occasional recreation uses/activities (hunting, nature study, photography, etc.) would be impacted on project site itself. Recreation on adjacent public lands would be affected somewhat by noise, dust and visual intrusions from mining operation.
PI	Visual Resources *(Tom C.)*	4/25/08	/s/T. Christensen	Substantial visual contrast expected due to nature of operation and size of disturbance area. Visual contrasts would remain until site portions are rehabilitated after removal of coal layer.
PI	Geology / Mineral Resources *(Doug P.)*	4/25/2008	/s/ Doug Powell	Geologic and mineral resources would be impacted by the proposed action. Geologic hazards relating to mining may also exist.
	Paleontology *(Alan T.)*			
PI	Lands / Access *(Hugh)*	4/28/2008	/s/ Hugh Wolfe	Possible Re-routing of the county road would be needed. This would create the need for a temporary FLPMA Tile V right-of-way for the length of the project.

NP/NI/PI NC	Resource	Date Reviewed	Signature	**Review Comments** (required for all NIs and PIs. PIs require further analysis**.)**
PI	Fuels / Fire Management *(Carson)*	4/28/08	/s/ C. Gubler	Fuels and Fire management may be impacted by the proposed action, however most impacts would be positive as invaded Pinyon Juniper lands are cleared.
PI	Socio-economics *(Keith)*	4/28/08	/s/ K. Rigtrup	The mining operations would have beneficial economic impacts to local and state tax revenue as well as to local businesses. There could also be social impacts with new workers moving into local communities.
NP	Wilderness characteristics *(Tom C.)*	4/25/08	/s/T. Christensen	

FINAL REVIEW:

Reviewer Title	**Date**	**Signature**	**Comments**
NEPA Coordinator (Dennis)			
Manager ( )			

NOTE: Review Comments should include information explaining how the specialist came to their conclusion - how does he/she know the element/resource is not present (site visit and date of visit, familiarity with location, etc.). For all 'NIs' give a brief explanation as to why that element/resource would not be impacted.

* The list of Other Resources / Concerns to be considered may vary by individual field office. Note: Native American Trust Responsibilities should be considered for FO's with Indian Mineral interests.

APPENDIX H.
COAL HOLLOW DEVELOPMENT ALTON COAL EIS - TRAFFIC TECHNICAL REPORT

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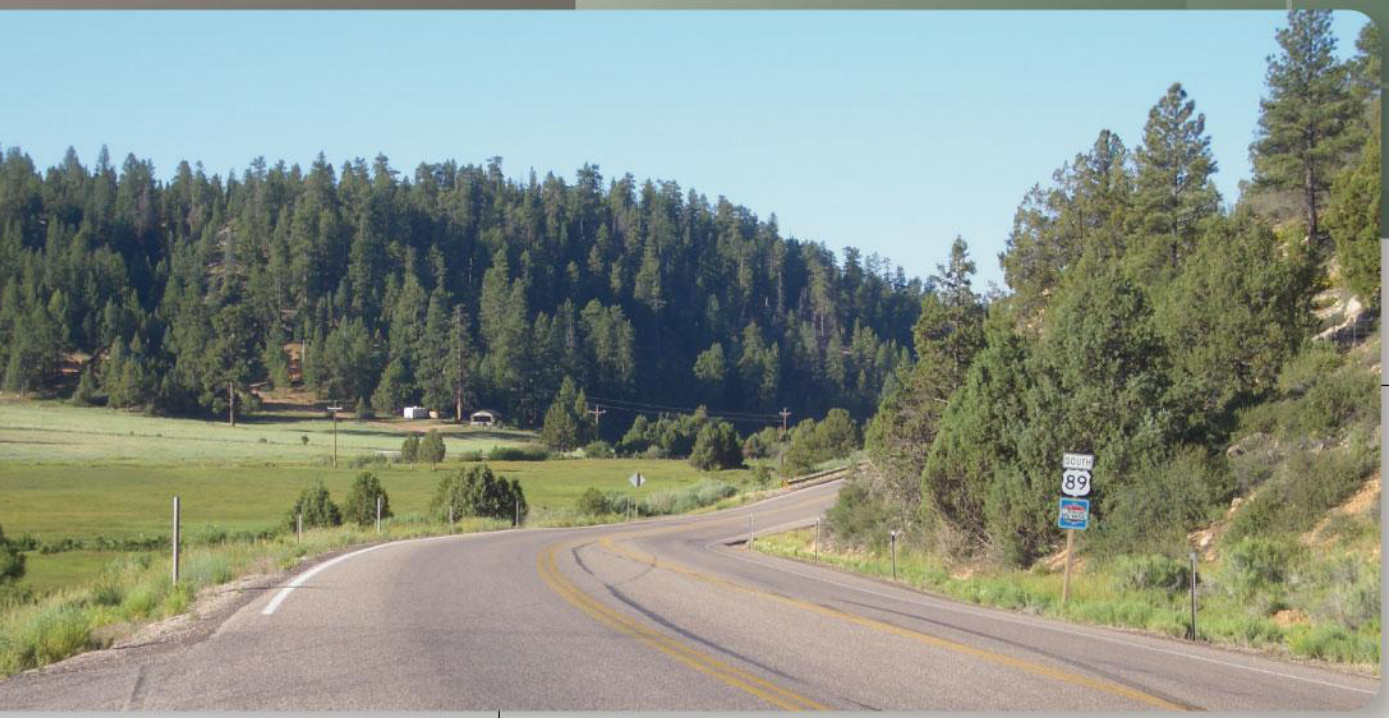

Coal Hollow Development
Alton Coal EIS - Traffic Technical Report

Submitted to:

SWCA Environmental Consultants
July 2008
UT06-721

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Appendix A: Traffic Counts
Appendix B: Detailed of Service Reports
Appendix C: Detailed Crash Data

1. Introduction

This section provides a brief summary of the overall project, the traffic analysis methodology, the analysis scenarios, and the report organization.

1.1. Background

The Alton Coal Development, LLC is proposing a new coal mine near the town of Alton, Utah. The project study area is in Southern Utah south of Panguitch and Bryce Canyon National Park and north of Glendale. Figure 1 displays the study area location.

1.2. Study Purpose and Analysis Scenarios

This report documents the analysis of traffic operations associated with existing conditions, existing plus coal truck conditions, future 2020 background conditions, and future 2020 plus coal truck conditions. These scenarios will provide information on current traffic conditions and for comparison of the additional project coal trucks.

The one signalized intersection that was evaluated along the proposed truck route includes:

1) I-15 SB Off-ramp / SR-56 (Cedar City)

The four unsignalized intersections that were evaluated along the proposed truck route include:

1) US-89 / SR-14
2) US-89 / SR-12
3) US-89 / SR-143 (Main St. Panguitch)
4) US-89 / SR-20

Twenty-four hour pneumatic tube counts were recorded at the following locations:

1) US-89, approximately two miles south of the SR-14 junction
2) US-89, approximately three miles north of the SR-12 junction
3) US-89, approximately two miles south of the SR-20 junction
4) SR-20, just east of the summit (westbound upslope, eastbound downslope)

1.3. Analysis Methodology

The Highway Capacity Manual 2000 (HCM 2000) methodology was used in this study to remain consistent with “state-of-the-practice” professional standards. Synchro and HCS software’s were used to apply this methodology.

1.3.1. Measures of Effectiveness

Two Measures of Effectiveness (MOEs) were used to quantify traffic conditions for the various scenarios. The MOEs for two lane highways are Level of Service (LOS) and Time-Spent-Following, and the MOEs used for intersections are LOS and delay (seconds per vehicle).

Intersection

LOS is a measure of traffic operating conditions, which varies from LOS A (the best) to LOS F (the worst). LOS reflects the amount of congestion and delay motorists experience at intersections. Table 1 describes the LOS and delay criteria from the *HCM 2000* for signalized and unsignalized intersections. The *HCM 2000* methodology has different quantitative evaluations for signalized and unsignalized intersections. For signalized intersections, the LOS is provided for the overall intersection (weighted average of all approach delays).

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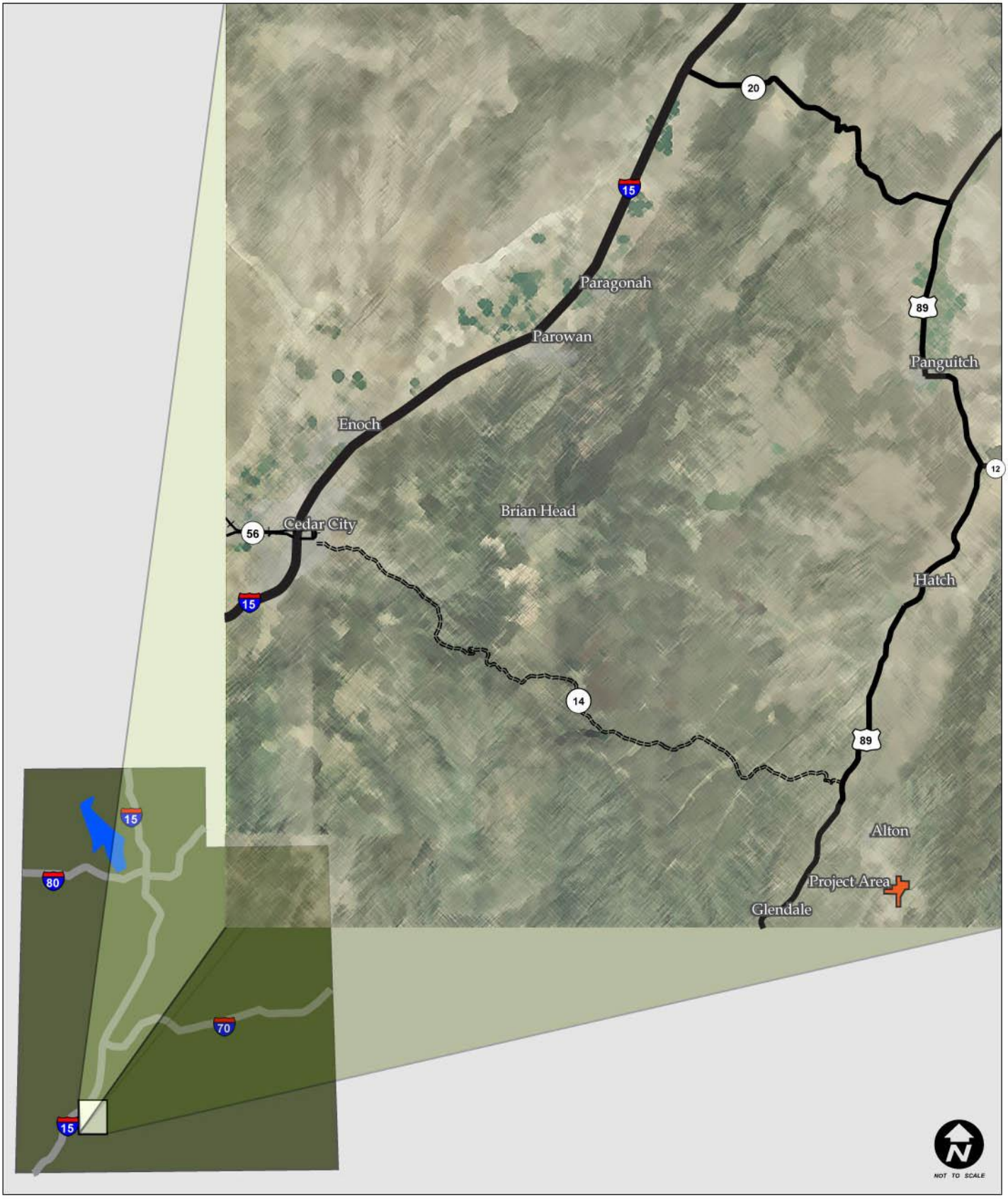

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STUDY AREA
COAL HOLLOW TRAFFIC TECHNICAL REPORT

FIGURE 1

For unsignalized intersections, LOS is reported based on the worst approach. Fehr & Peers has also calculated overall delay values for unsignalized intersections, which provides additional information and represents the overall intersection conditions rather than just the worst approach. Both are reported in their respective tables throughout the report.

Table 1
Intersection Level of Service Descriptions

Level of Service	Description of Traffic Conditions	Signalized Intersections	Unsignalized Intersections
		Average Delay[1] (sec / veh)	Delay[2] (sec / veh)
A	*Free Flow / Insignificant Delay* Extremely favorable progression. Individual users are virtually unaffected by others in the traffic stream.	0 to 10	0 to 10
B	*Stable Operations / Minimum Delays* Good progression. The presence of other users in the traffic stream becomes noticeable.	> 10 to 20	> 10 to 15
C	*Stable Operations / Acceptable Delays* Fair progression. The operation of individual users is affected by interactions with others in the traffic stream.	> 20 to 35	> 15 to 25
D	*Approaching Unstable Flows / Tolerable Delays* Marginal progression. Operating conditions are noticeably more constrained.	> 35 to 55	> 25 to 35
E	*Unstable Operations / Significant Delays Can Occur* Poor progression. Operating conditions are at or near capacity.	> 55 to 80	> 35 to 50
F	*Forced, Unpredictable Flows / Excessive Delays* Unacceptable progression with forced or breakdown of operating conditions.	> 80	> 50

1. Overall intersection LOS and average delay (seconds/vehicle) for all approaches.
2. Worst approach LOS and delay (seconds/vehicle) only.
Source: Fehr & Peers Descriptions, based on *Highway Capacity Manual,* 2000 Methodology (Transportation Research Board).

<u>*Two-Lane Highway Segment*</u>

The MOEs used for two-way segments are: LOS and Percent Time-Spent-Following. LOS is a measure of traffic flow conditions, which varies from LOS A (the best) to LOS F (the worst). For Class I highways, LOS reflects the percent time-spent-following and average travel speed. For Class II highways, LOS is defined by percent time-spent-following. Table 2 shows the association of LOS with Percent Time-Spent-Following and Average Travel Speed based on criteria from the *HCM 2000* for two-lane Class I highways and Table 3 for Class II highways (Chapter 20).

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Table 2 Two-Lane Highways (Class I) Level of Service Descriptions		
Level of Service	**Percent Time-Spent Following**	**Average Travel Speed (mi/h)**
A	0 to 35	> 55
B	> 35 to 50	> 50 to 55
C	> 50 to 65	> 45 to 50
D	> 65 to 80	> 40 to 45
E	> 80	40 to 0
F	See note below[1]	

1. LOS F applies whenever the flow rate exceeds the segment capacity.
Source: *Highway Capacity Manual,* 2000 Methodology (Transportation Research Board).

Table 3 Two-Lane Highways (Class II) Level of Service Descriptions	
Level of Service	**Percent Time-Spent Following**
A	0 to 40
B	> 40 to 55
C	> 55 to 70
D	> 70 to 85
E	> 85
F	See note below[1]

1. LOS F applies whenever the flow rate exceeds the segment capacity.
Source: *Highway Capacity Manual,* 2000 Methodology (Transportation Research Board).

The *HCM 2000* states that Directional Segment methodology addresses three types of directional segments: extended directional segments, specific upgrades, and specific downgrades. The methodology for directional segments is analogous to the two-way segment methodology, except that it estimates traffic performance measures and LOS for one direction of travel at a time. However, the operational assessment of one direction of travel on a two-lane highway necessarily considers the opposing traffic volume.

1.4. Report Organization

The report is organized into the following four sections:

- ***Section 1 - Introduction*** discusses the purpose, analysis methodology, and organization of the report.

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- ***Section 2 - Existing Conditions*** describes the existing roadway network, data collection efforts, traffic characteristics, and results.
- ***Section 3 – Existing Plus Trucks Conditions*** addresses existing volumes with the additional project coal trucks traffic conditions including traffic operational results.
- ***Section 4 – Future 2020 Background Conditions*** addresses future 2020 background (without project coal trucks) traffic conditions including a description of the traffic forecasting process and traffic operational results.
- ***Section 5 – Future 2020 Plus Trucks Conditions*** addresses future 2020 background volumes with the additional project coal trucks traffic conditions including the traffic operational results.
- ***Section 6 – Commonly Used Acronyms*** lists acronyms used in the report and their meanings.
- ***Section 7 - References*** lists the references cited throughout the report.

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2. Existing Conditions

This section of the report describes the existing study area characteristics and summarizes the data collection effort. The purpose of the existing (year 2007) analysis is to evaluate the intersections and roadways during the peak travel periods of the day under existing traffic and geometric conditions. Technical data supporting these findings are included in the appendix.

2.1. Roadway Characteristics

There are four Federal and State roads along the proposed Alton Coal project haul route.

US-89 is a north/south state highway that extends through many cities and jurisdictional boundaries. In the project study area, a majority of US-89 is classified as a Category 2 (System Priority Rural) roadway. However, in the vicinity of towns of Hatch and Panguitch, US-89 is classified as a Category 4 (Regional Rural) roadway on the outskirts of town and a Category 7 (Community Rural) roadway in the center of town. US-89 has a two-lane cross section with occasional passing lanes on steep upgrades. The cross section is expanded to four-lanes through the town of Panguitch. US-89 also serves as the main tourist connection to National Parks such as Bryce Canyon and Zion Canyon. Within the study area, the speed limit is 60 mph except through the town of Hatch and Panguitch, where it is reduced to 40 mph and 35 mph respectively. The existing Average Daily Traffic (ADT) and percent heavy trucks along US-89 is as follows: 4,000 vpd and 18% trucks (South of SR-14 Junction), 4,100 vpd and 21% trucks (North of SR-12 Junction), 3,600 vpd and 25% trucks (South of SR-20 Junction).

SR-20 is an east/west state road that serves as a connector road between I-15 and US-89. SR-20 is classified as a Category 4 (Regional Rural) roadway. SR-20 has a two-lane cross section with a climbing lane for slower traffic on the steep updgrade towards the summit. SR-20 has a posted speed limit of 60 mph from the US-89 junction to the steep upgrade, 35 mph climbing the steep upgrade to the summit, and 65 mph from the summit to I-15. The existing ADT is 2,509 vpd with 27% heavy trucks.

I-15 is a four-lane divided interstate freeway that runs north/south through Utah and also traverses through the States of Idaho to the north and Nevada and Arizona to the south. Along the proposed coal truck haul route, I-15 has a speed limit of 75 mph from SR-20 to Cedar City. The existing ADT between SR-20 and Cedar City is 16,200 vpd with 26% heavy trucks.

SR-56 is an east/west state road that runs from SR-130 in Cedar City to the Nevada Stateline. SR-56 is labeled as 200 North running through the center of Cedar City. SR-56 is classified as a Category 5 (Regional Priority Urban) roadway through the center of Cedar City, a Category 3 (System Priority Urban) on the outskirts of Cedar City, a Category 4 (Regional Rural) outside of Cedar City, and a Category 9 (Other) towards the Nevada Stateline. SR-56 has a posted speed limit of 45 mph on the proposed coal truck haul route. The cross section varies from four-lanes in the center of Cedar City to two-lanes outside of the city. The existing ADT near the I-15 Junction is 8,600 vpd with 10% heavy trucks.

2.2. Land Use Characteristics

The project study area consists of a variety of land uses including residential and commercial through the towns and rural undeveloped areas outside of the towns.

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2.3. Data Collection Effort

The data collection effort for the existing conditions included daily, a.m. and p.m. peak period traffic volumes, intersection geometry, GPS travel time runs, and accident information. This information was used provide a quantitative evaluation of existing traffic conditions.

2.3.1. Daily and Peak Hour Volume Counts

Twenty-four hour traffic counts were conducted from June 19 to June 25, 2007 at three locations on US-89 and one location on SR-20. These locations were selected to provide a general understanding of traffic conditions along the proposed coal truck haul route. Table 4 shows existing directional ADT volumes.

Table 4
Existing Average Daily Traffic (ADT) Volumes

Location	Direction of Travel		Total	Percentage Heavy Trucks
	Northbound[1]	Southbound[2]		
US-89 (south of SR-14)	2,110	1,866	3,978	24%
US-89 (north of SR-12)	2,064	1,998	4,062	26%
US-89 (south of SR-20)	1,790	1,806	3,596	25%
SR-20 (east of summit)	1,242	1,267	2,509	28%

1. Eastbound for the count on SR-20
2. Westbound for the count on SR-20
Source: Fehr & Peers, 2008

Peak period traffic counts were collected on June 19-26, 2007 at the following intersections:

- US-89 / SR-14 – (2-Way Stop)
- US-89 / SR-12 – (One-Way Stop/Yield)
- US-89 / SR-143 (Main St.) – (All-Way Stop)
- US-89 / SR-20 – (One-Way Stop)
- I-15 SB Off-ramp / SR-56 – (Signalized)

These counts were seasonally adjusted using information obtained from the Utah Department of Transportation (UDOT) permanent count stations. The appendix contains the traffic count data.

2.3.2. Intersection Geometry

Intersection geometries were measured during field visits to the study area.

2.4. Crash Information

UDOT Traffic and Safety generated a three-year crash history for US-89, SR-20, I-15, and SR-56. Accident rates are calculated by determining the number of accidents per million vehicle-miles traveled. Severity is a measure of damage that is caused by an accident. A severity of 1 indicates that the accident caused property damage and a severity of 5 indicates that there was a fatality; see Table 5 for these descriptions.

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Table 5 Accident Severity	
Severity	**Description**
1	Property Damage
2	Possible Injury
3	Bruises and Abrasions
4	Broken Bones or Bleeding Wounds
5	Fatal
Source: UDOT, Division of Traffic and Safety CARS Codes, 2001.	

Accidents were summarized for the three-year period from 2003 to 2005. The detailed Operational Safety Report's (OSR) that were done by UDOT can be found in the Appendix. Below is a summary of the OSR's broken down by roadway:

US-89 – Mile Post (MP) 90.04 to 156.36 (Glendale to Jct. SR-20)

- Total Accidents: 287
- Total Fatalities: 0
- 3 Year Accident Average: 95.67

US-89 Summary

	Actual	Expected
Severity Rate:	1.59	1.70
Crash Rate:	2.59	1.46

As shown above, the actual rate of accidents over the three-year study period indicates that there is a higher occurrence of accidents than would be expected and a lower severity rate as would be expected for a roadway similar to SR-20. The OSR states that the predominant crash type is the single vehicle, accounting for 81.2% or 233 of the total number of crashes. The following list shows the breakdown of the single vehicle crashes:

Crash Type	No.	% of Single Vehicle Crashes
1. Wildlife Related	126	51.1
2. Ran Off Road Right	63	27.0
3. Ran Off Road Left	24	10.3
4. Fixed Object	10	4.3
5. Domestic Animal Related	5	2.1
6. Other Object	4	1.7
7. Overturned in Roadway	1	0.5
	233	100.0%

US-20 – MP 0.00 to 20.61 (I-15 to Jct. US-89)

- Total Accidents: 79
- Total Fatalities: 0
- 3 Year Accident Average: 26.33

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US-20 Summary

	Actual	Expected
Severity Rate:	1.50	1.72
Crash Rate:	2.59	1.96

As shown above, the actual rate of accidents over the three-year study period indicates that there is a higher occurrence of accidents than would be expected, but a lower severity rate than would be expected for a roadway similar to SR-20. The OSR states that the predominant crash type is the single vehicle, accounting for 86.1% or 68 of the total number of crashes. The following list shows the breakdown of the single vehicle crashes:

Crash Type	**No.**	**% of Single Vehicle Crashes**
1. Ran Off Road Right	31	45.5
2. Ran Off Road Left	12	17.7
3. Wildlife Related	12	17.7
4. Fixed Object	10	14.7
5. Other Non-Collision	3	4.4
	68	100.0%

The OSR states that there were no clusters of crashes at any location and approximately 70% of these crashes occurred under inclement weather conditions (snowy/icy). The main contributing factor for crashes where vehicles ran off the road was excessive speed.

I-15 – MP 59.05 to 100.2 (Cedar City to SR-20)

- Total Accidents: 441
- Total Fatalities: 14
- 3 Year Accident Average: 147.00

I-15 Summary

	Actual	Expected
Severity Rate:	2.01	1.83
Crash Rate:	0.75	0.87

As shown above, the actual rate of accidents over the three-year study period indicates that there is a lower occurrence of accidents than would be expected, but a higher severity rate than would be expected for a roadway similar to I-15. The OSR states that the predominant crash types are:

- Single Vehicle Crashes, accounting for 77.6% or 342 of the total number of crashes.
- Rear End Crashes, accounting for 11.1% or 49 of the total number of crashes.
- Same Direction Side Swipe, accounting for 9.8% or 43 of the total number of crashes.

The following list shows the breakdown of the single vehicle crashes:

Crash Type	**No.**	**% of Single Vehicle Crashes**
1. Ran Off Road Right	108	31.6
2. Ran Off Road Left	68	19.9
3. Ran Off Road Thru Median	44	12.9
4. Wildlife Related	39	11.4

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5. Other Object	25	7.3
6. Fixed Object	23	6.7
7. Other Non-Collision	22	6.4
8. Overturned in Roadway	10	2.9
9. Pedestrian Related	1	0.3
10. Bicycle Related	1	0.3
11. Domestic Animal Related	1	0.3
	342	100.0%

The OSR states that there were no clusters of crashes at any location. The primary factors for crashes where vehicles ran off the road were:

1. Excessive speed
2. Falling asleep at the wheel
3. Other improper driver behavior

Rear end crashes occurred mostly as some drivers were following too closely and sideswipe crashes were caused primarily by drivers attempting an unsafe passing maneuver.

The total of 12 fatal crashes resulted in 14 fatalities. The following are the crashes that are associated with the fatal crashes:

Crash Type	**No.**
1. Running Off Road	11 (6 caused by falling asleep at the wheel)
2. Rear End	1
3. Pedestrian Related	1
4. Sideswipe	1
	12

SR-56 – MP 9.80 to 61.39

- Total Accidents: 174
- Total Fatalities: 2
- 3 Year Accident Average: 58.00

SR-56 Summary

	Actual	Expected
Severity Rate:	1.69	1.77
Crash Rate:	2.03	2.14

As shown above, the actual rate of accidents over the three-year study period indicates that there is a lower occurrence of accidents than would be expected and a lower severity rate as would be expected for a roadway similar to SR-56. The OSR states that the predominant crash types are:

- Single Vehicle Crashes, accounting for 48.3% or 84 of the total number of crashes.
- Rear End Crashes, accounting for 19.0% or 33 of the total number of crashes.
- Right Angle Crashes, accounting for 16.1% or 28 of the total number of crashes.
- Left Turn Crashes, accounting for 6.90% or 12 of the total number of crashes.

The following list shows the breakdown of the single vehicle crashes:

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Crash Type	No.	% of Single Vehicle Crashes
1. Wildlife Related	34	40.5
2. Ran Off Road Left	16	19.0
3. Ran Off Road Right	16	19.0
4. Domestic Animal Related	6	7.1
5. Fixed Object	4	4.8
6. Other Non-Collision	3	3.6
7. Other Object	2	2.4
8. Bicycle Related	2	2.4
9. Pedestrian Related	1	1.2
	84	100.0%

The OSR states that there were no clusters of crashes at any location. The primary factors for crashes where vehicles ran off the road were:

1. Excessive speed
2. Falling asleep at the wheel
3. Driving Under the Influence (DUI)

Rear end, left turn, and right angle crashes occurred mostly at intersections on the western boundary of Cedar City.

One of the two fatal crashes was the result of a single vehicle that ran off the road. The other fatal crash was the result of an eastbound driver crossing the centerline and impacting the westbound driver head on. Figure 2 shows the study roadways with the associated crash data.

2.4.1 Future Crash Information

It is difficult to project increases in crashes due to the increase in truck traffic from the project. Historic crash data may not be indicative of future crash trends due to the disproportionate increase in truck traffic relative to general traffic. However, based on the projected increase in heavy trucks due to the proposed project, the risk of potential accidents in the study area will likely increase.

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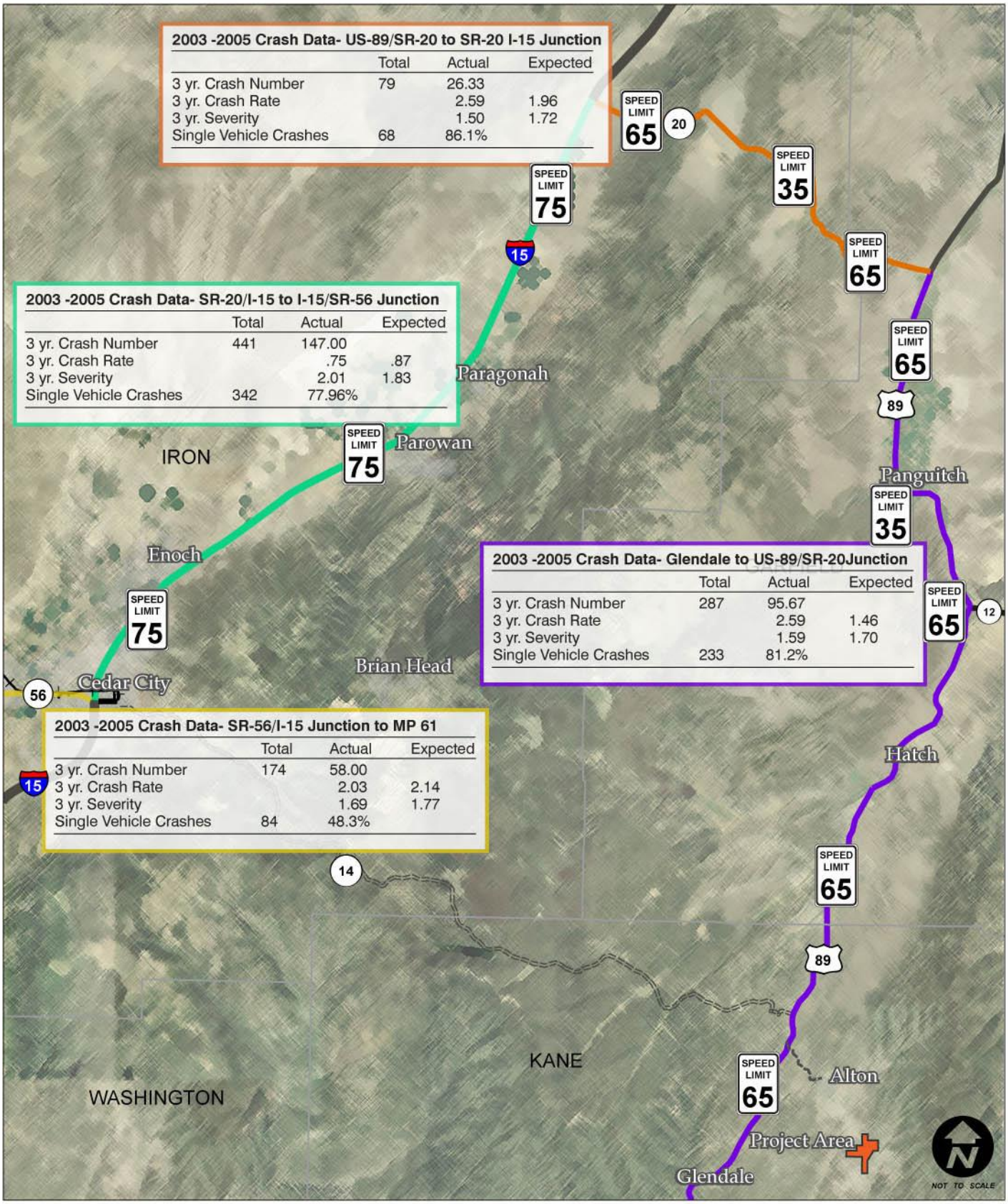

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POSTED SPEEDS AND CRASH DATA
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 2

2.5. Existing Traffic Conditions Results

The existing conditions analysis was done using the Highway Capacity Software (HCS) for the unsignalized intersections and the Synchro 6.0 software for the signalized intersection. HCS was also used for the roadway segment LOS analysis.

2.5.1. Intersection Conditions

Existing conditions MOEs are reported in LOS and delay. Table 6 displays the existing 2007 a.m. LOS and delay (seconds/vehicle) for the study intersections. Figure 3 shows the a.m. and p.m. intersection volumes and LOS results.

Table 6
Existing 2007 a.m. Peak Hour LOS and Delay

Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	A	9.4	A	3.8
US-89 / SR-12	WB	A	9.5	A	5.8
US-89 / SR-143 (Main St.)	SB	A	8.7	A	8.1
US-89 / SR-20	SB	A	9.5	A	8.1
I-15 SB Off-ramp / SR-56				C	21.1

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 6, all intersections operate at LOS C or better during the a.m. peak hour. Table 7 displays the existing 2007 p.m. LOS and delay for the study intersections.

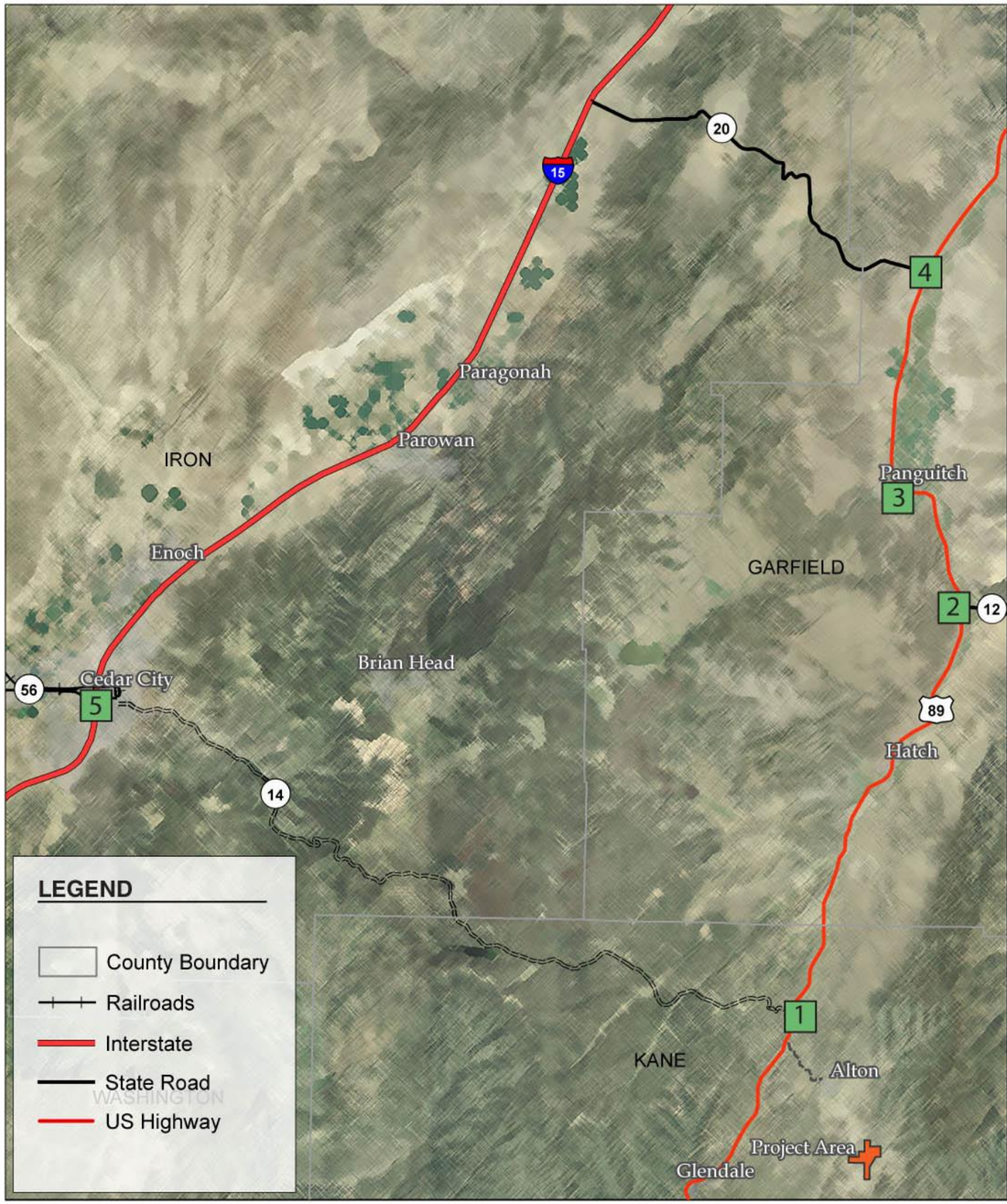
Table 7
Existing 2007 p.m. Peak Hour LOS and Delay

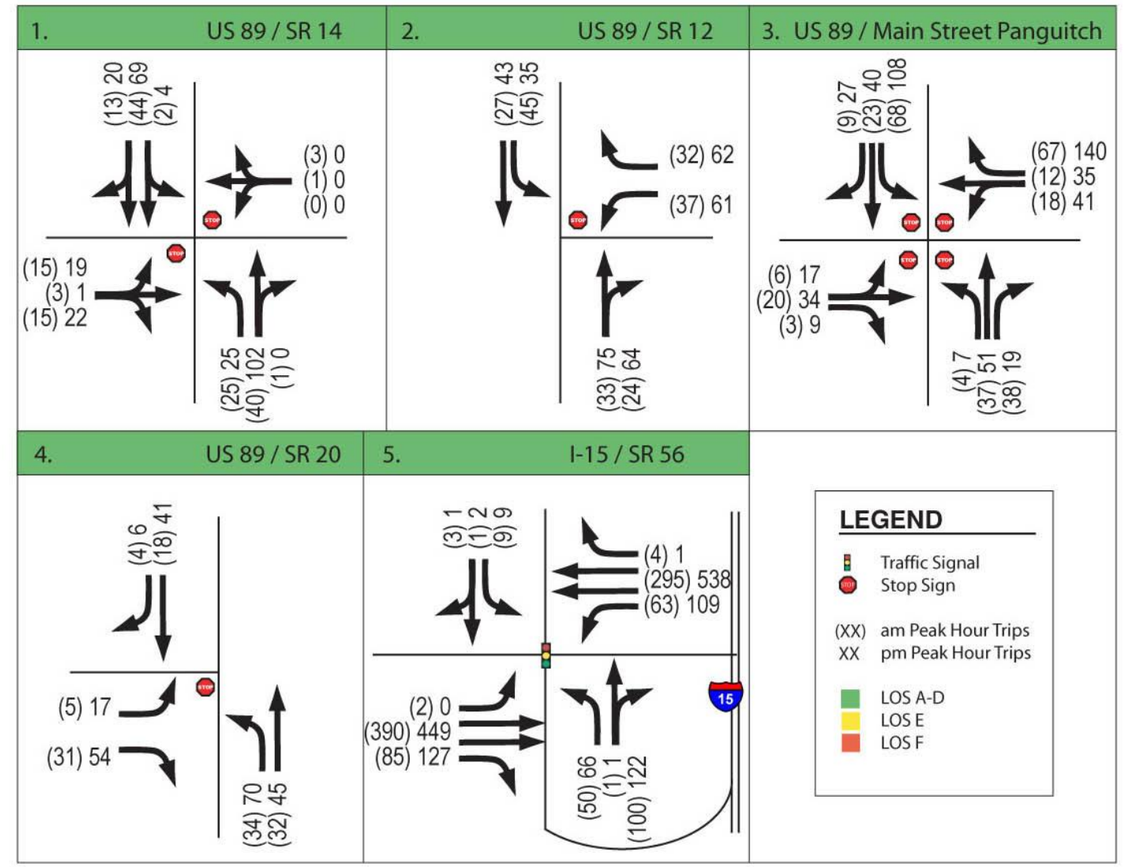
Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	A	9.8	A	2.1
US-89 / SR-12	WB	A	9.7	A	4.8
US-89 / SR-143 (Main St.)	SB	A	9.7	A	9.3
US-89 / SR-20	SB	A	9.8	A	7.5
I-15 SB Off-ramp / SR-56				C	20.6

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 7, all intersections operate at LOS C or better during the p.m. peak hour.





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EXISTING a.m. & p.m. TRAFFIC CONDITIONS
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 3

2.5.2. Directional Segment Conditions

Table 8 displays the existing 2007 weekday and weekend LOS and Percent Time-Spent-Following for the study roadway segments. Figures 4 and 5 show the results of the weekday and weekend directional segment LOS analysis.

Table 8
Existing 2007 Directional Segment
Peak Hour LOS and Percent Time-Spent-Following

Intersection	Weekday			Weekend		
	Direction	LOS	% Time-Spent-Following	Direction	LOS	% Time-Spent-Following
US-89: Alton to SR-14	NB	A	33.3	NB	B	37.5
US-89: SR-14 to Hatch	NB	B	36.4	NB	B	40.6
US-89: Center of Hatch[1]	NB	C	87.0	NB	C	97.0
US-89: Hatch to SR-12	NB	B	39.5	NB	B	41.1
US-89: SR-12 to Panguitch	NB	A	27.6	NB	A	28.4
US-89: Panguitch to SR-20	NB	A	28.4	NB	A	30.8
SR-20: US-89 to Upslope	WB	C	33.4	WB	C	34.2
SR-20: Upslope to Summit[2]	WB	A	10.7	WB	A	13.7
SR-20: Summit to Downslope	WB	C	43.3	WB	C	45.2
SR-20: Downslope to I-15	WB	B	38.7	WB	C	39.0

Notes:
1. The analysis for the center of Hatch was done using HCS HIGHPLAN software due to the reduced highway speeds through town.
2. This segment of roadway was analyzed with a passing lane and as a Class II highway due to the low posted speed limit of 35 mph.

Source: Fehr & Peers, 2008

As shown in Table 8, all roadway segments operate at an LOS C or better except.

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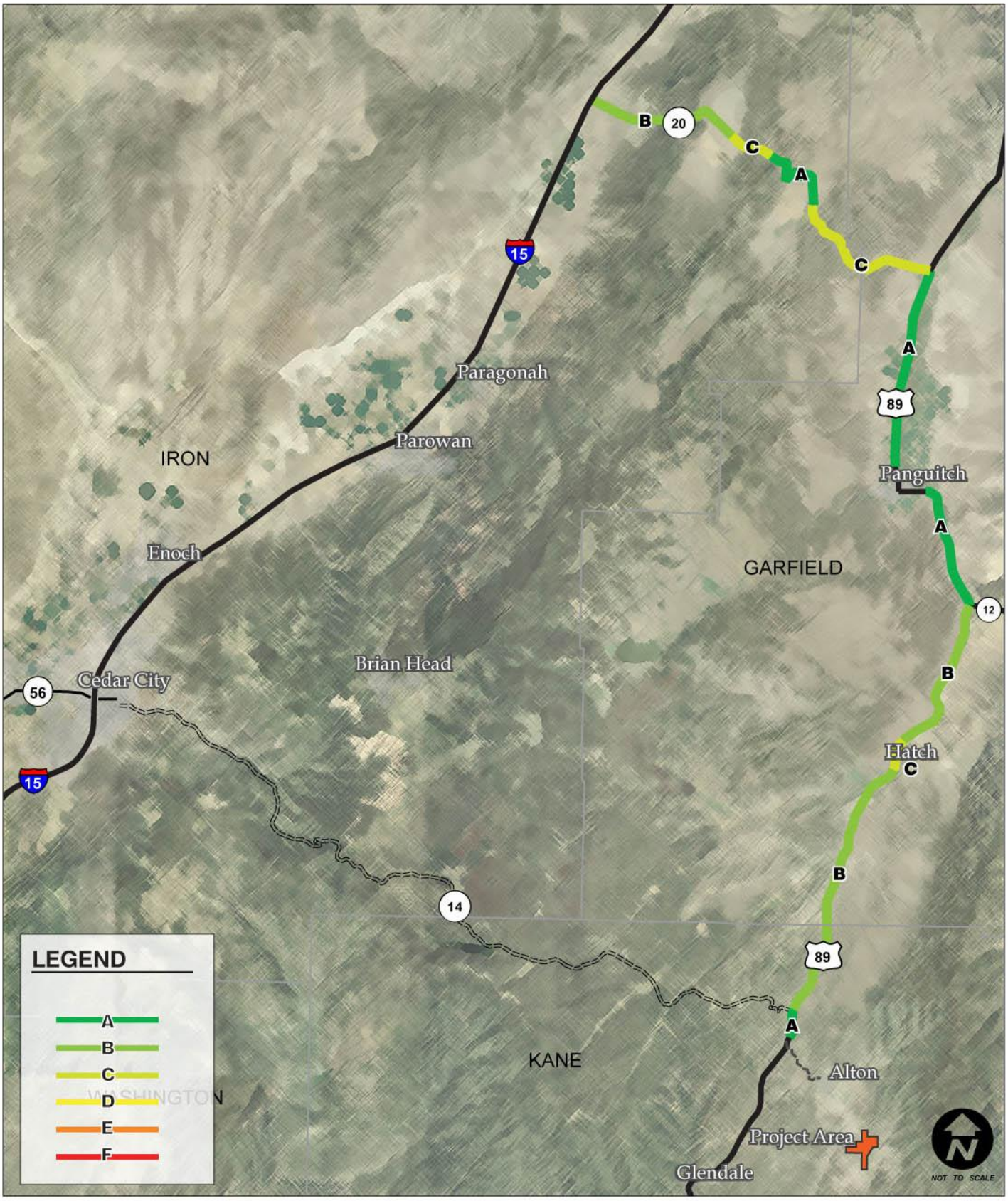

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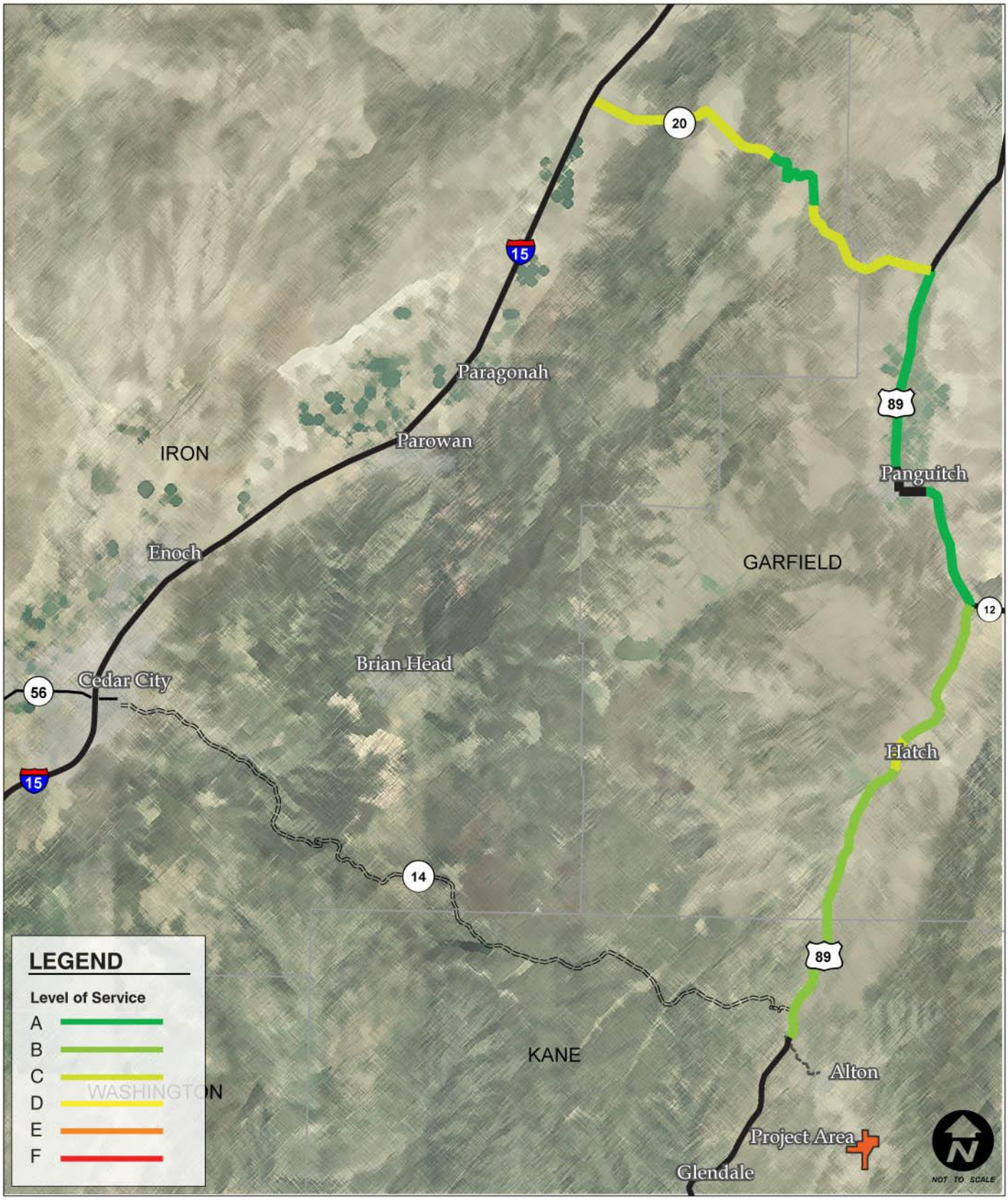
EXISTING WEEKDAY DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT

FIGURE 4



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EXISTING WEEKEND DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT

FIGURE 5

2.6. Travel Time Runs

Travel time runs were performed using a Global Positioning System (GPS) along the proposed coal truck haul route on US-89 and SR-20 traveling northbound on US-89 and westbound on SR-20. One travel time run was performed at free flow speeds and the other was performed while following a heavy truck to best simulate following a coal truck along the haul route.

Free Flow Run

	Travel Time (min)	Avg. Speed (mph)	Posted Speed (mph)
US-89: From Alton to SR-20	36	65	ranges from 35 to 65
SR-20: From US-89 to I-15	20	60	ranges from 35 to 65

Following Heavy Truck

	Travel Time (min)	Avg. Speed (mph)	Posted Speed (mph)
US-89: From Alton to SR-20	38	61	ranges from 35 to 65
SR-20: From US-89 to I-15	24	51	ranges from 35 to 65

This shows that it takes an additional two minutes to travel from Alton to the SR-20 on US-89 while following a heavy truck and an additional four minutes to travel from US-89 to I-15 on SR-20. Figure 6 displays the travel time runs.

2.7. Existing Conditions Summary

Existing conditions at the study intersections have low delays per vehicle and little to no congestion. Existing conditions on the study roadways are low volumes with a substantial amount of capacity for future growth. Traffic generally flows at free flow speeds on all study roadways.

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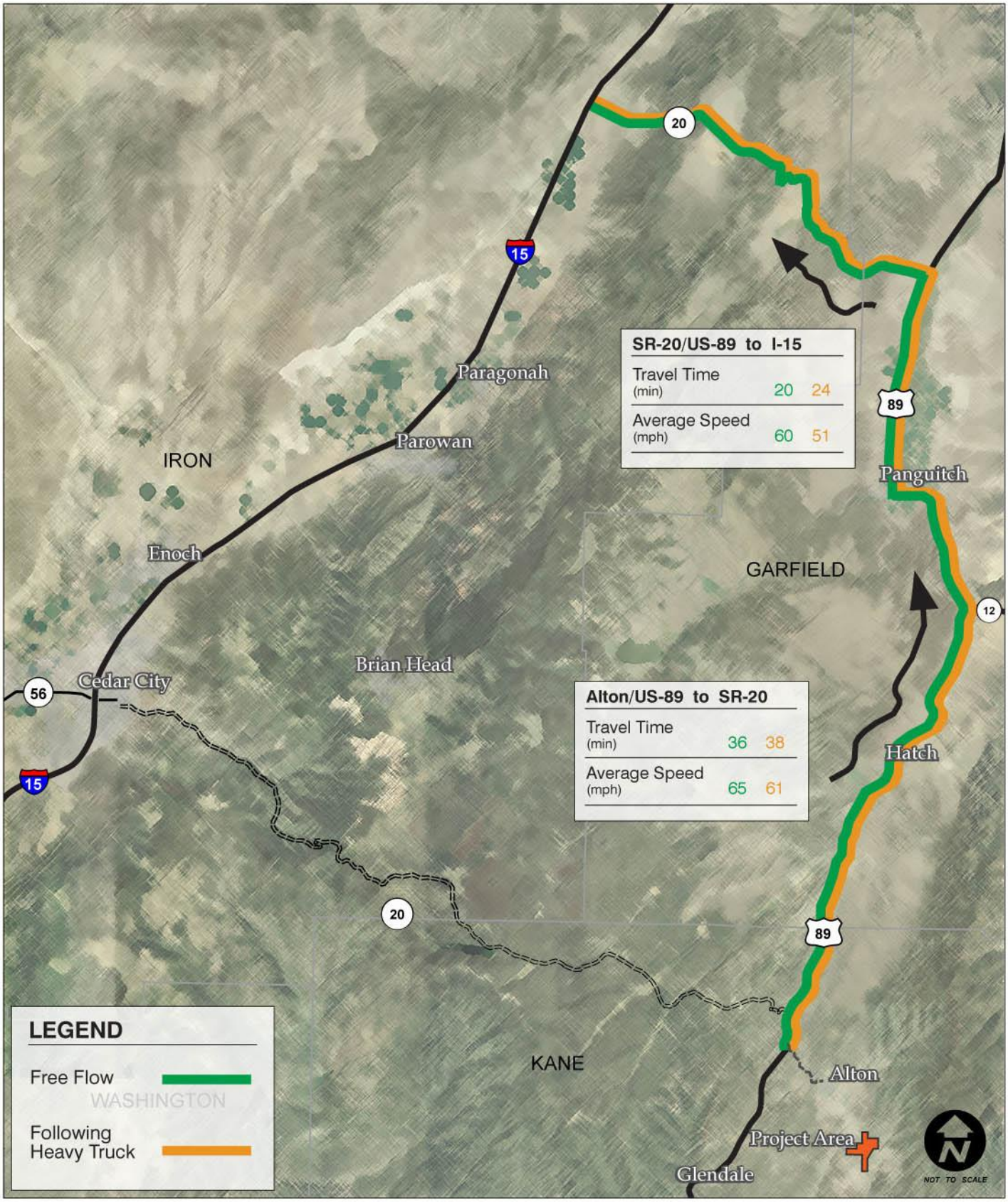

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TRAVEL TIME RUNS
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT

FIGURE 6

3. Existing Plus Trucks Conditions

This section of the report describes the existing plus trucks study area characteristics. The purpose of the existing plus trucks analysis is to evaluate the intersections and roadways during the peak travel periods of the day under existing traffic and geometric conditions plus the additional coal trucks that are proposed with the project coal mine. Technical data supporting these findings are included in the appendix.

Employees
The Alton Coal Development is estimating 100 employees for the mining operation. Based on a proposed estimated employee shift schedule and the typical work week schedule (Monday through Friday), the project could generate between 25 and 50 (depending on how the shift schedules coincide) employee trips in the peak hours.

Due to the expected low number of employee trips generated by the mine development, the available capacity on the US-89 and the road to Alton, and the fact that a certain number of the employee trips will likely be captured internally to the town of Alton itself, no analysis was performed for employee generated traffic.

Trucks
The Alton Coal Development is proposing the mine operate 24 hours/day for six days a week (Monday through Saturday). The development estimates 150 coal trucks a day, or six trucks an hour, will be hauling coal from the mine site in Alton, UT north on US-89, west on SR-20, south on I-15, and west on SR-56 in Cedar City. The coal trucks are proposed to leave the coal mine site at nine and a half to ten minute headways.

3.1. Roadway Characteristics

The study roadways for the existing plus trucks conditions consists of the same geometry as the existing conditions; however, acceleration and deceleration lanes will need to be constructed at the proposed access onto US-89 near Alton.

3.2. Existing Plus Trucks Traffic Conditions Results

The existing plus trucks conditions analysis was done using HCS software for the unsignalized intersections and Synchro 6.0 software was used for the signalized intersection. HCS was also used for the roadway segment LOS analysis. As a conservative measure seven trucks an hour was used in the analysis.

Table 9 shows the increase in the percentage heavy trucks and the percentage increase in trucks with the additional trucks from the proposed development. The estimated 150 trucks were added in each direction to obtain the Existing + Project ADT and percentage of heavy trucks.

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Table 9 Existing + Project Average Daily Traffic (ADT) Volumes					
Location	Direction of Travel		Total	Percentage Heavy Trucks[3]	Percentage Increase in Trucks[4]
	Northbound[1]	Southbound[2]			
US-89 (south of SR-14)	2,260	2,016	4,276	29%	31%
US-89 (north of SR-12)	2,214	2,148	4,362	31%	28%
US-89 (south of SR-20)	1,940	1,956	3,896	31%	33%
SR-20 (east of summit)	1,392	1,417	2,809	36%	43%

1. Eastbound for the count on SR-20
2. Westbound for the count on SR-20
3. The percent heavy trucks from existing volumes plus project truck volumes
4. The percent increase in heavy trucks with the addition of the project

Source: Fehr & Peers, 2008

3.2.1. Intersection Conditions

Existing plus trucks conditions MOEs are reported in LOS and delay. Table 9 displays the existing plus trucks a.m. LOS and delay for the study intersections. Figure 7 shows the a.m. and p.m. intersection volumes and LOS results.

Table 10 Existing Plus Trucks a.m. Peak Hour LOS and Delay					
Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	A	9.5	A	4.1
US-89 / SR-12	WB	A	9.5	A	5.5
US-89 / SR-143 (Main St.)	SB	A	8.9	A	8.3
US-89 / SR-20	SB	A	9.5	A	8.2
I-15 SB Off-ramp / SR-56				C	21.0

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

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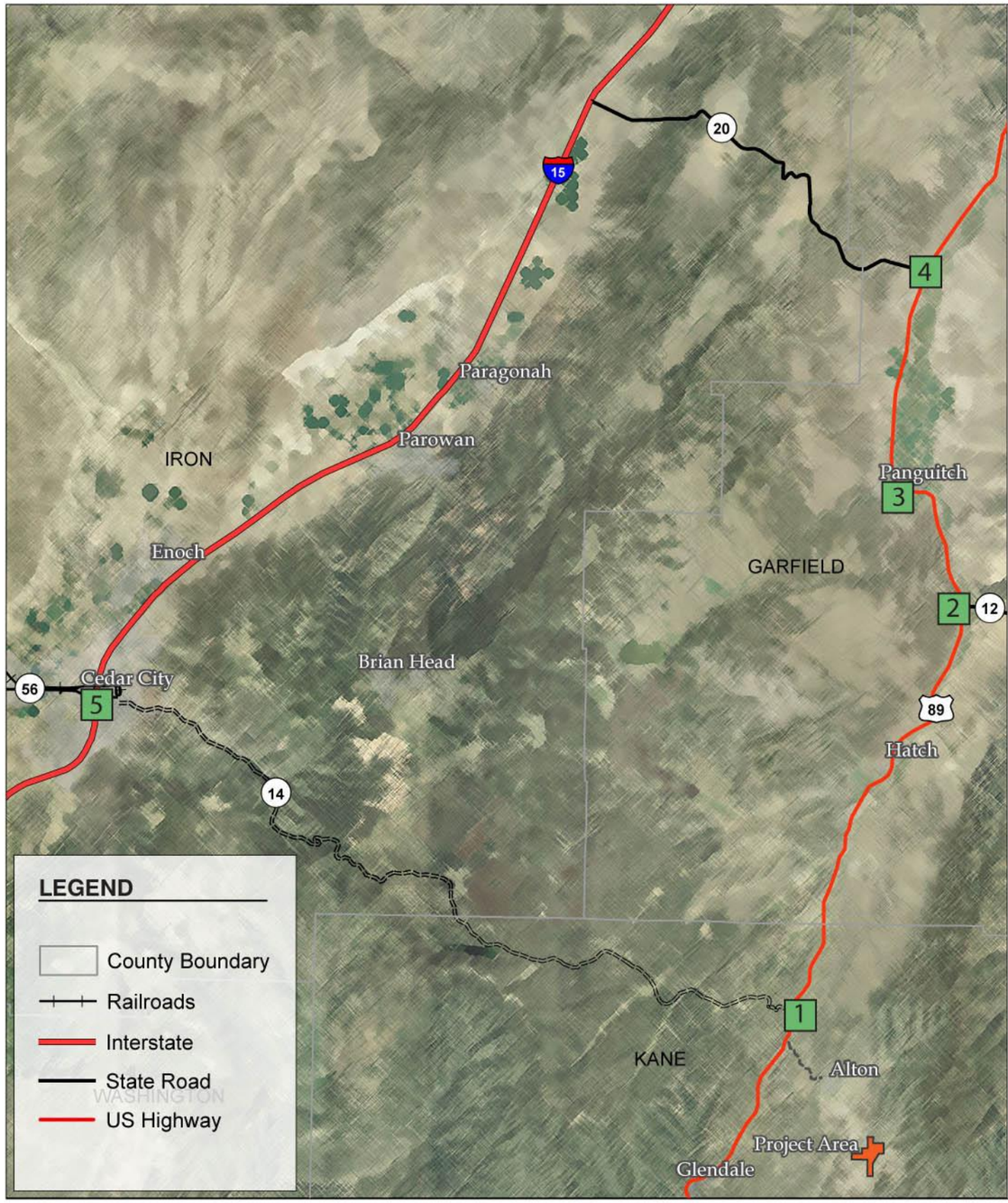

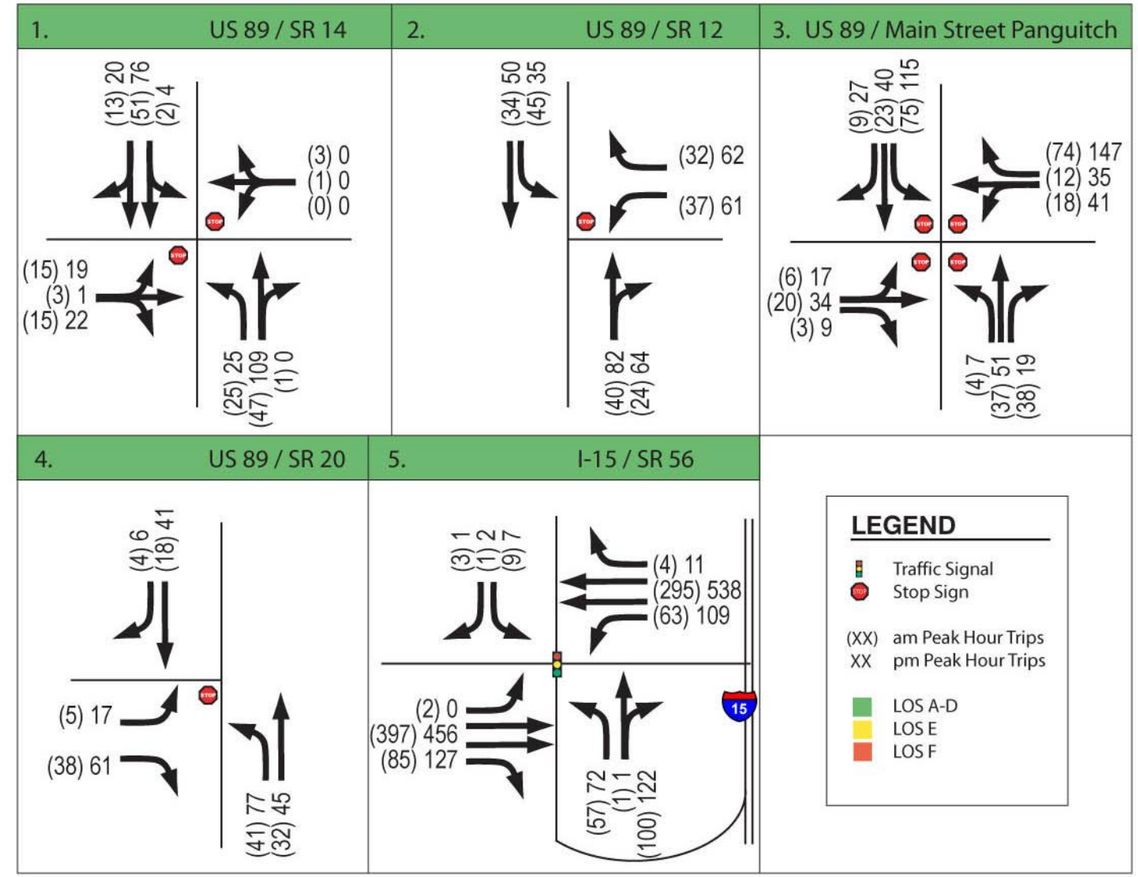

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EXISTING PLUS TRUCKS A.M. & P.M. TRAFFIC CONDITIONS
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORTS

FIGURE 7

As shown in Table 10, all intersections operate at LOS C or better during the a.m. peak hour. Table 10 displays the existing plus trucks p.m. LOS and delay for the study intersections.

Table 11
Existing Plus Trucks p.m. Peak Hour LOS and Delay

Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	A	9.9	A	2.5
US-89 / SR-12	WB	A	9.8	A	4.5
US-89 / SR-143 (Main St.)	SB	B	10.0	A	9.5
US-89 / SR-20	SB	A	9.8	A	7.5
I-15 SB Off-ramp / SR-56				C	20.6

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 11, all intersections operate at LOS C or better during the p.m. peak hour.

3.2.2. Directional Segment Conditions

Existing plus trucks conditions MOEs for the two-lane highway directional segment analysis are reported in LOS and Percent Time-Spent-Following. Table 10 displays the existing plus trucks weekday and weekend LOS and Percent Time-Spent-Following for the study roadway segments. Figures 8 and 9 show the results of the weekday and weekend directional segment LOS analysis.

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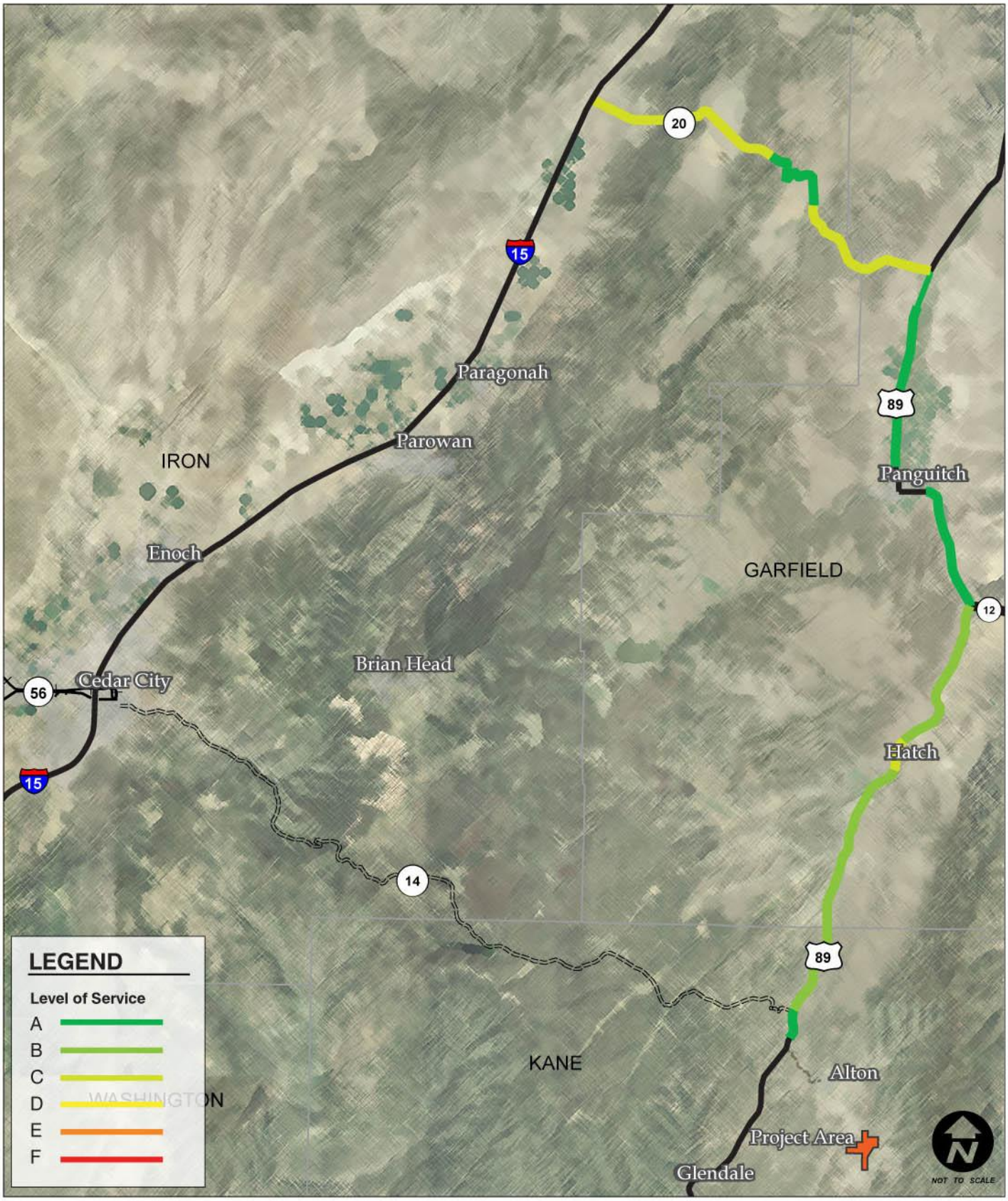

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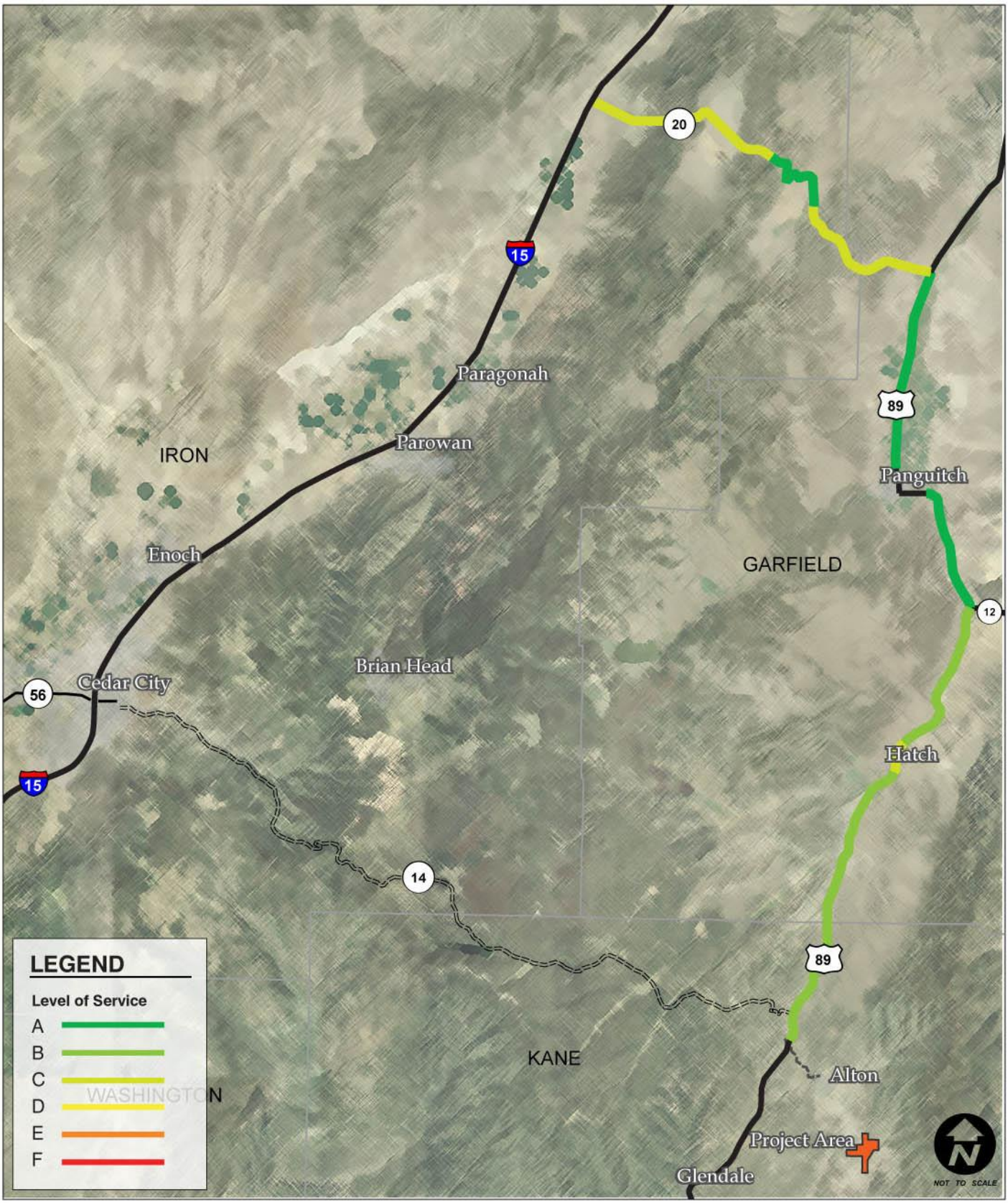
EXISTING PLUS TRUCKS
WEEKDAY DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW TRAFFIC TECHNICAL REPORT

FIGURE 8



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EXISTING PLUS TRUCKS
WEEKEND DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT

FIGURE 9

Table 12
Existing Plus Trucks Directional Segment
Peak Hour LOS and Percent Time-Spent-Following

Intersection	Weekday			Weekend		
	Direction	LOS	% Time-Spent-Following	Direction	LOS	% Time-Spent-Following
US-89: Alton to SR-14	NB	A	34.5	NB	B	38.7
US-89: SR-14 to Hatch	NB	B	37.7	NB	B	41.9
US-89: Center of Hatch[1]	NB	C	91.0	NB	C	97.0
US-89: Hatch to SR-12	NB	B	41.1	NB	B	42.4
US-89: SR-12 to Panguitch	NB	A	28.1	NB	A	29.6
US-89: Panguitch to SR-20	NB	A	30.0	NB	A	31.9
SR-20: US-89 to Upslope	WB	C	34.3	WB	C	35.7
SR-20: Upslope to Summit[2]	WB	A	11.8	WB	A	14.8
SR-20: Summit to Downslope	WB	C	42.8	WB	C	48.7
SR-20: Downslope to I-15	WB	C	40.1	WB	C	40.9

Notes:
1. The analysis for the center of Hatch was done using HCS HIGHPLAN software due to the reduced highway speeds through town.
2. This segment of roadway was analyzed with a passing lane and as a Class II highway due to the low posted speed limit of 35 mph.

Source: Fehr & Peers, 2008

As shown in Table 12, all roadway segments operate at an LOS C or better.

3.3. Existing Plus Trucks Conditions Summary

Existing plus trucks conditions at the study intersections continue to have low delays per vehicle and little to no congestion. The intersections continue to operate at acceptable LOS with the additional heavy coal trucks. Existing plus trucks conditions on the study roadways are low volumes with a substantial amount of capacity for future growth.

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4. Future 2020 Background Conditions

This section of the report describes the future 2020 background study area characteristics. The purpose of the 2020 background analysis is to evaluate the intersections and roadways during the peak travel periods of the day under future 2020 traffic and geometric conditions. Technical data supporting these findings are included in the appendix.

4.1. Roadway Characteristics

The study corridor for the 2020 background conditions consists of the same geometry as the existing conditions.

4.2. Traffic Forecasting Process

Twenty years of UDOT's historic data was used to develop the future 2020 traffic volumes for the roadways and intersections in the study area. The resulting future 2020 a.m. and p.m. peak hour traffic volumes are shown in Figure 10 on page 27. Table 13 shows the future 2020 ADT for the respective roadways.

Traffic volumes for the future year 2020 were forecasted using the following linear growth rates for thirteen years:

- 3.6% for US-89, SR-14 to Garfield County Line
- 1.8% for US-89, Garfield County Line to Hatch
- 2.1% for US-89, Hatch to SR-12
- 1.9% for US-89, SR-12 to east side of Panguitch
- 1.9% for US-89, East side of Panguitch to SR-143
- 1.5% for US-89, SR-143 to north side of Panguitch
- 1.8% for US-89, North side of Panguitch to SR-20
- 2.3% for SR-14, SR-148 to US-89
- 3.5% for SR-20, US-89 to Iron County Line
- 3.6% for SR-20, Iron County Line to I-15
- 1.1% for SR-56, I-15 Junction

Table 13
Future 2020 Average Daily Traffic (ADT) Volumes

Location	Direction of Travel		Total
	Northbound[1]	Southbound[2]	
US-89 (south of SR-14)	3,100	2,750	5,850
US-89 (north of SR-12)	2,600	2,500	5,100
US-89 (south of SR-20)	2,200	2,200	4,400
SR-20 (east of summit)	1,800	1,800	3,600

1. Eastbound for the count on SR-20
2. Westbound for the count on SR-20
Source: Fehr & Peers, 2008

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4.3. Future 2020 Background Traffic Conditions Results

The future 2020 background conditions analysis was done using HCS software for the unsignalized intersections and Synchro 6.0 software was used for the signalized intersection. HCS was also used for the roadway segment LOS analysis.

4.3.1. Intersection Conditions

Future 2020 background conditions MOEs are reported in LOS and delay. Table 14 displays the future 2020 a.m. LOS and delay for the study intersections. Figure 10 shows the future 2020 a.m. and p.m. intersection volumes and LOS results.

Table 14
Future 2020 a.m. Peak Hour LOS and Delay

Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	A	9.9	A	3.6
US-89 / SR-12	WB	A	9.8	A	6.0
US-89 / SR-143 (Main St.)	SB	A	9.1	A	8.4
US-89 / SR-20	NB	A	9.5	A	8.0
I-15 SB Off-ramp / SR-56				C	20.4

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 14, all intersections operate at LOS C or better during the a.m. peak hour. Table 15 displays the future 2020 p.m. LOS and delay for the study intersections.

Table 15
Future 2020 p.m. Peak Hour LOS and Delay

Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	B	10.7	A	2.5
US-89 / SR-12	WB	B	10.1	A	5.0
US-89 / SR-143 (Main St.)	SB	B	10.5	A	9.8
US-89 / SR-20	NB	B	10.1	A	7.7
I-15 SB Off-ramp / SR-56				C	19.5

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 15, all intersections operate at LOS C or better during the p.m. peak hour.

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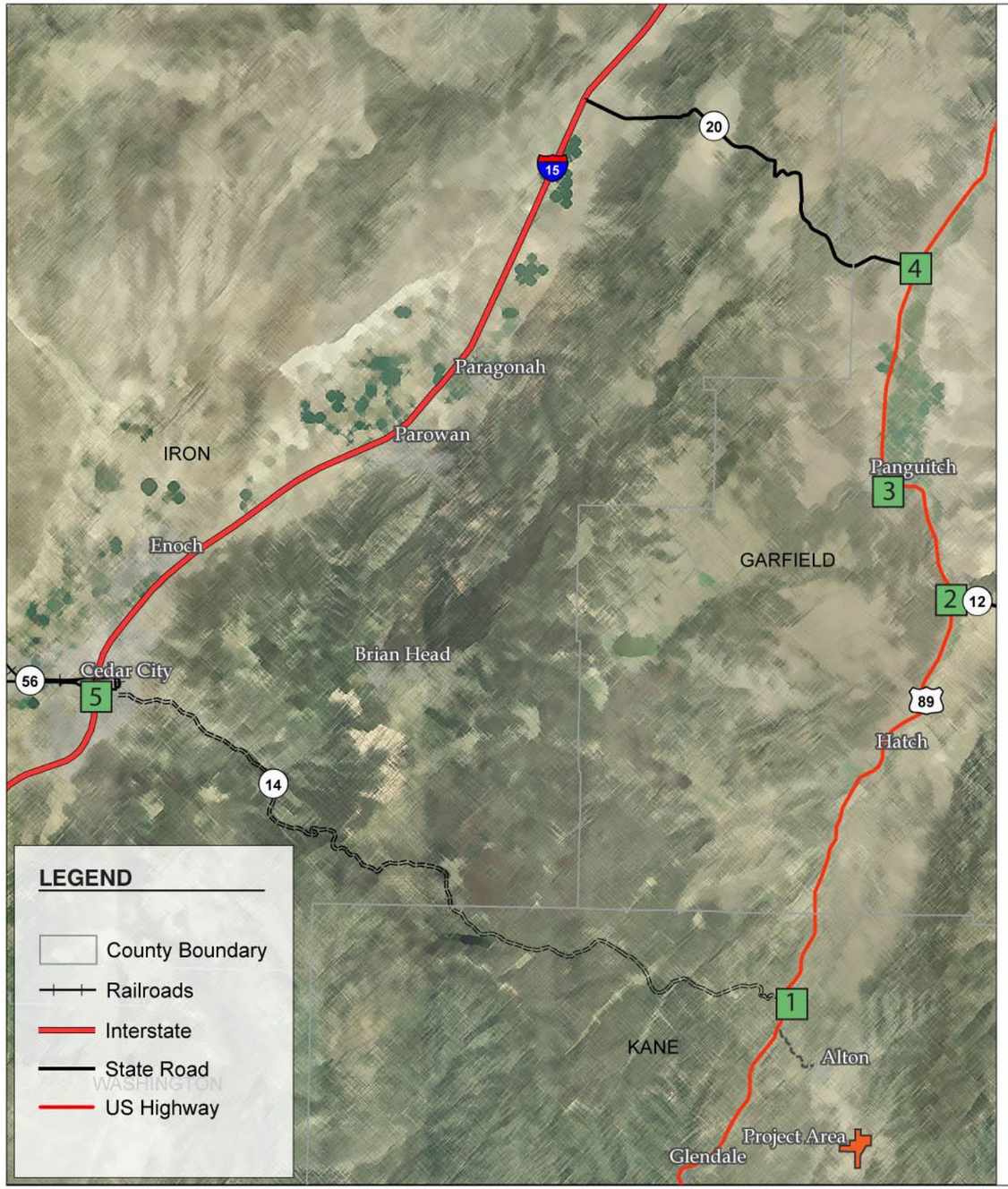

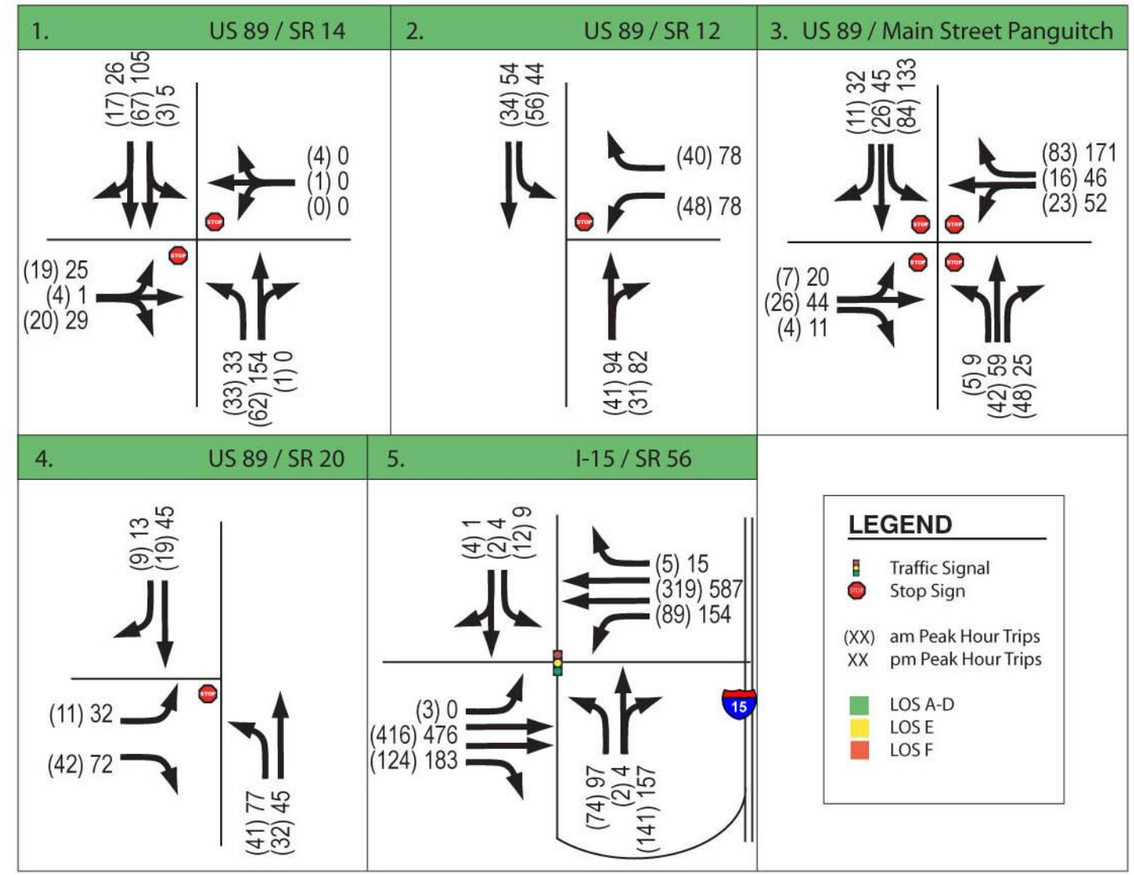

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FUTURE 2020 A.M. & P.M. TRAFFIC CONDITIONS
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 10

4.3.2. Directional Segment Conditions

Future 2020 background conditions MOEs for the two-lane highway directional segment analysis are reported in LOS and Percent Time-Spent-Following. Table 16 displays the future 2020 weekday and weekend LOS and Percent Time-Spent-Following for the study roadway segments. Figures 11 and 12 show the results of the weekday and weekend directional segment LOS analysis.

Table 16
Future 2020 Directional Segment
Peak Hour LOS and Percent Time-Spent-Following

Intersection	Weekday			Weekend		
	Direction	LOS	% Time-Spent-Following	Direction	LOS	% Time-Spent-Following
US-89: Alton to SR-14	NB	B	45.8	NB	C	51.4
US-89: SR-14 to Hatch	NB	B	49.4	NB	C	54.8
US-89: Center of Hatch[1]	NB	C	95.0	NB	C	99.0
US-89: Hatch to SR-12	NB	B	47.5	NB	B	49.0
US-89: SR-12 to Panguitch	NB	A	33.0	NB	A	34.8
US-89: Panguitch to SR-20	NB	A	32.0	NB	B	39.9
SR-20: US-89 to Upslope	WB	D	35.7	WB	D	49.5
SR-20: Upslope to Summit[2]	WB	A	14.2	WB	A	18.5
SR-20: Summit to Downslope	WB	C	48.8	WB	D	63.0
SR-20: Downslope to I-15	WB	C	40.9	WB	C	55.2

Notes:
1. The analysis for the center of Hatch was done using HCS HIGHPLAN software due to the reduced highway speeds through town.
2. This segment of roadway was analyzed with a passing lane and as a Class II highway due to the low posted speed limit of 35 mph.

Source: Fehr & Peers, 2008

As shown in Table 16, all roadway segments operate at an LOS D or better.

4.4. Future 2020 Background Conditions Summary

Future 2020 background conditions at the study intersections continue to have low delays per vehicle and little to no congestion. Future 2020 conditions on the study roadways continue to have relatively low traffic volumes and traffic is expected to travel at free flow speeds.

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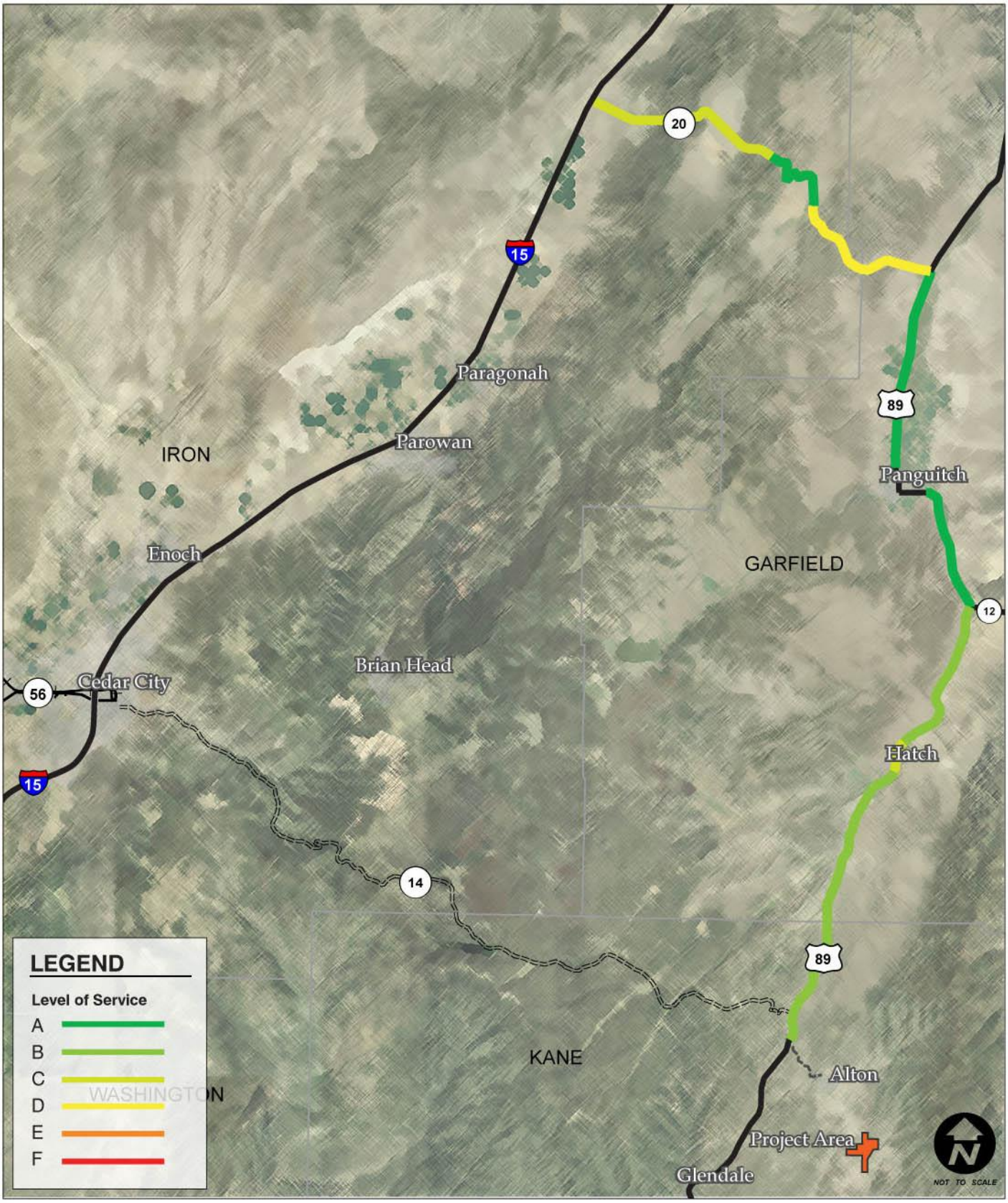

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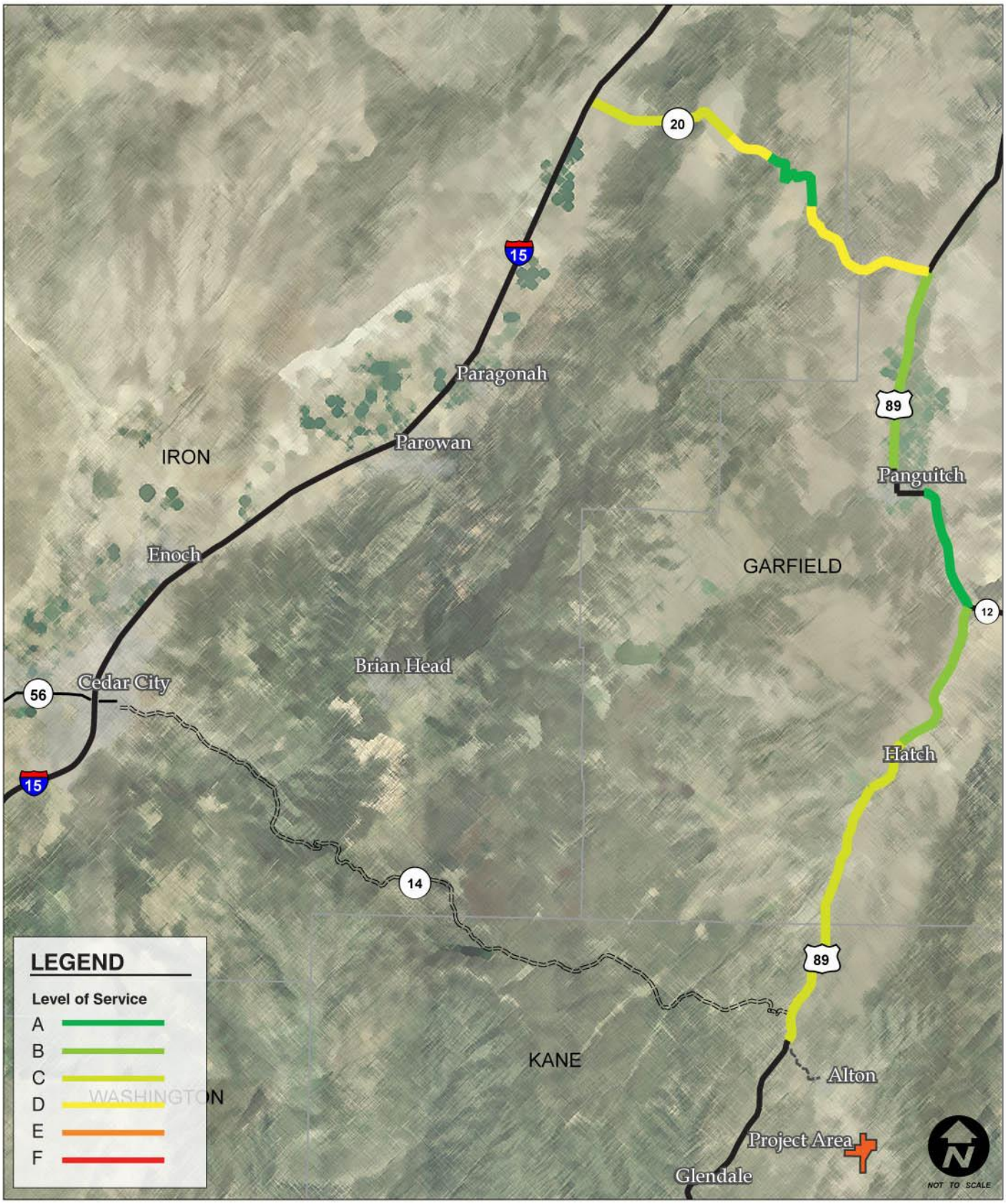
FUTURE 2020 BACKGROUND
WEEKDAY DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW TRAFFIC TECHNICAL REPORT

FIGURE 11



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FUTURE 2020 BACKGROUND
WEEKEND DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT

FIGURE 12

5. Future 2020 Plus Trucks Conditions

This section of the report describes the future 2020 plus trucks study area characteristics. The purpose of the future 2020 plus trucks analysis is to evaluate the intersections and roadways during the peak travel periods of the day under future 2020 traffic and geometric conditions plus the additional coal trucks that are proposed with the project coal mine. Technical data supporting these findings are included in the appendix.

5.1. Roadway Characteristics

The study roadways for the future 2020 plus trucks conditions consists of the same geometry as the existing plus trucks conditions.

5.2. Future 2020 Plus Trucks Traffic Conditions Results

The future 2020 plus trucks conditions analysis was done using HCS software for the unsignalized intersections and Synchro 6.0 software was used for the signalized intersection. HCS was also used for the roadway segment LOS analysis. As a conservative measure seven trucks an hour was used in the analysis.

5.2.1. Intersection Conditions

Future plus trucks conditions MOEs are reported in LOS and delay. Table 17 displays the future 2020 plus trucks a.m. LOS and delay for the study intersections. Figure 13 shows the a.m. and p.m. intersection volumes and LOS results.

Table 17
Future 2020 Plus Trucks a.m. Peak Hour LOS and Delay

Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	B	10.0	A	3.4
US-89 / SR-12	WB	A	9.9	A	5.2
US-89 / SR-143 (Main St.)	SB	A	9.3	A	8.6
US-89 / SR-20	NB	A	9.6	A	7.9
I-15 SB Off-ramp / SR-56				C	20.2

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 17, all intersections operate at LOS C or better during the a.m. peak hour.

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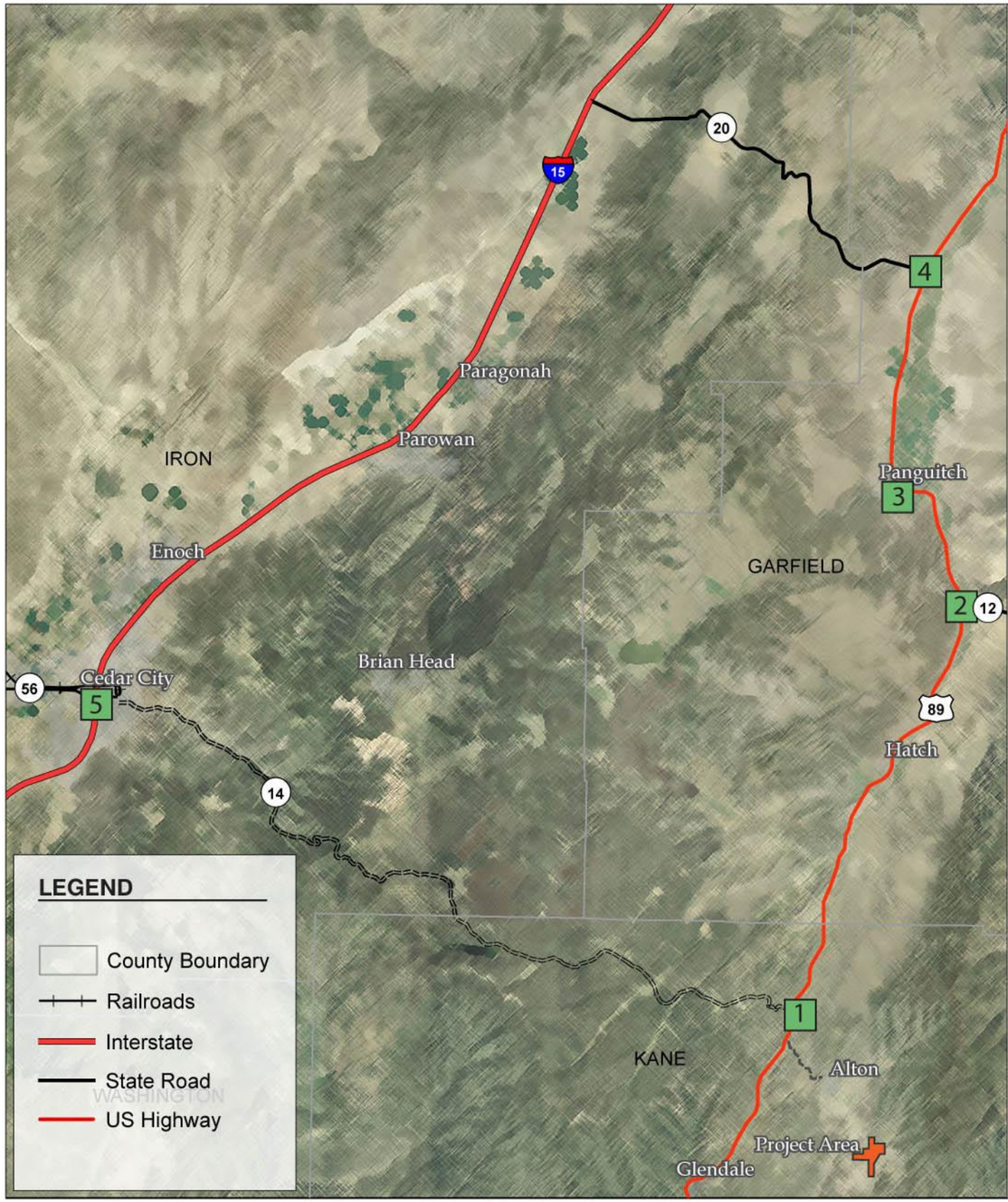

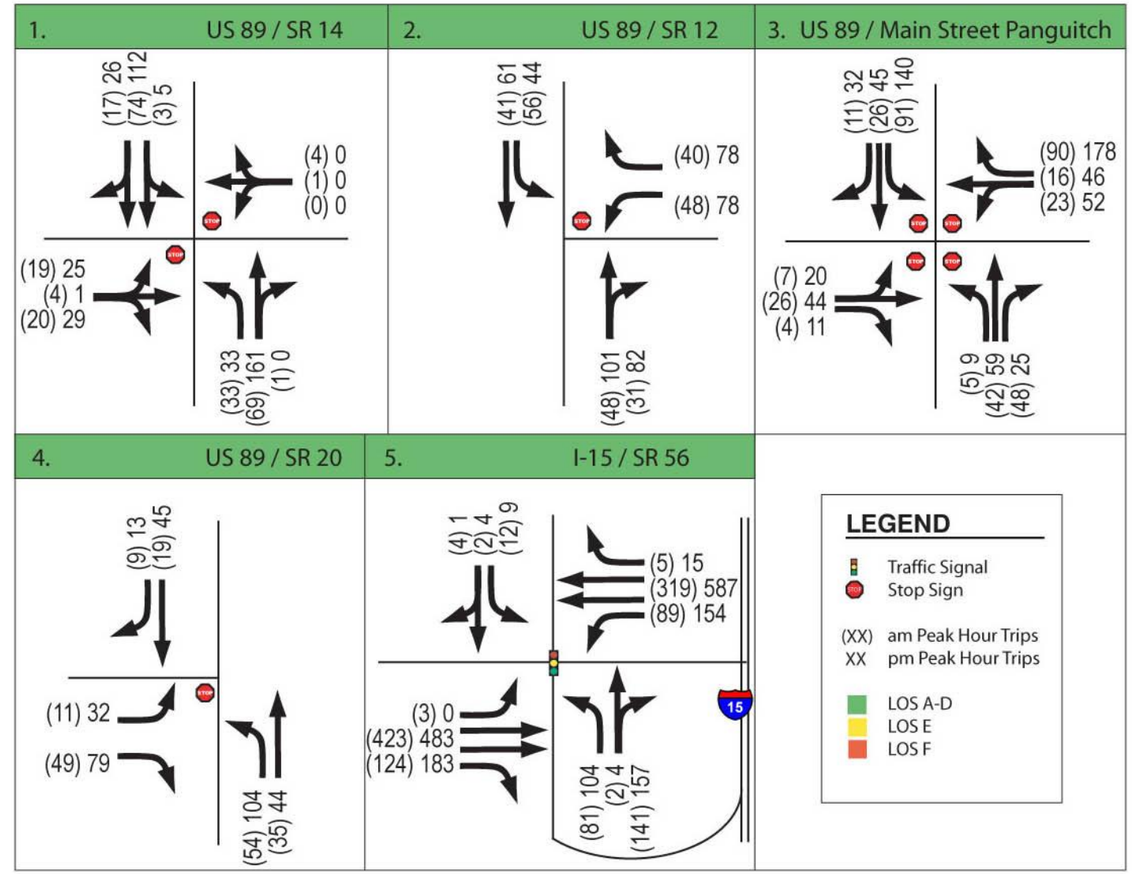

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FUTURE 2020 PLUS TRUCKS A.M. & P.M. TRAFFIC CONDITIONS
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 13

Table 18 displays the future 2020 plus trucks p.m. LOS and delay for the study intersections.

Table 18
Future 2020 Plus Trucks p.m. Peak Hour LOS and Delay

Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	B	10.8	A	2.4
US-89 / SR-12	WB	B	10.2	A	4.9
US-89 / SR-143 (Main St.)	SB	B	10.8	B	10.0
US-89 / SR-20	NB	B	10.2	A	7.7
I-15 SB Off-ramp / SR-56				B	19.4

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 18, all intersections operate at LOS B or better during the p.m. peak hour.

5.2.2. Directional Segment Conditions

Future 2020 plus trucks conditions MOEs for the two-lane highway directional segment analysis are reported in LOS and Percent Time-Spent-Following. Table 19 displays the existing plus trucks weekday and weekend LOS and Percent Time-Spent-Following for the study roadway segments. Figures 14 and 15 show the results of the weekday and weekend directional segment LOS analysis.

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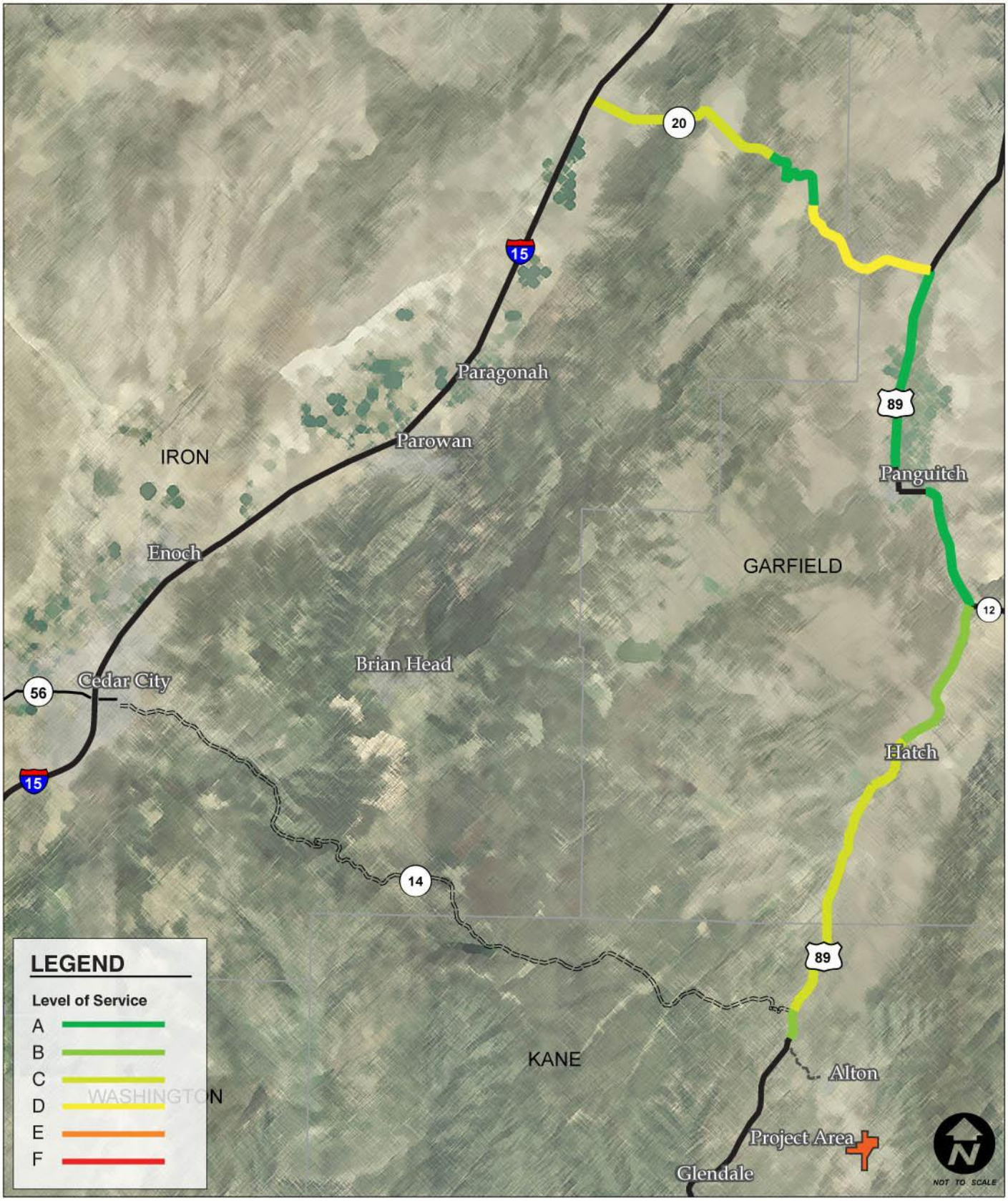

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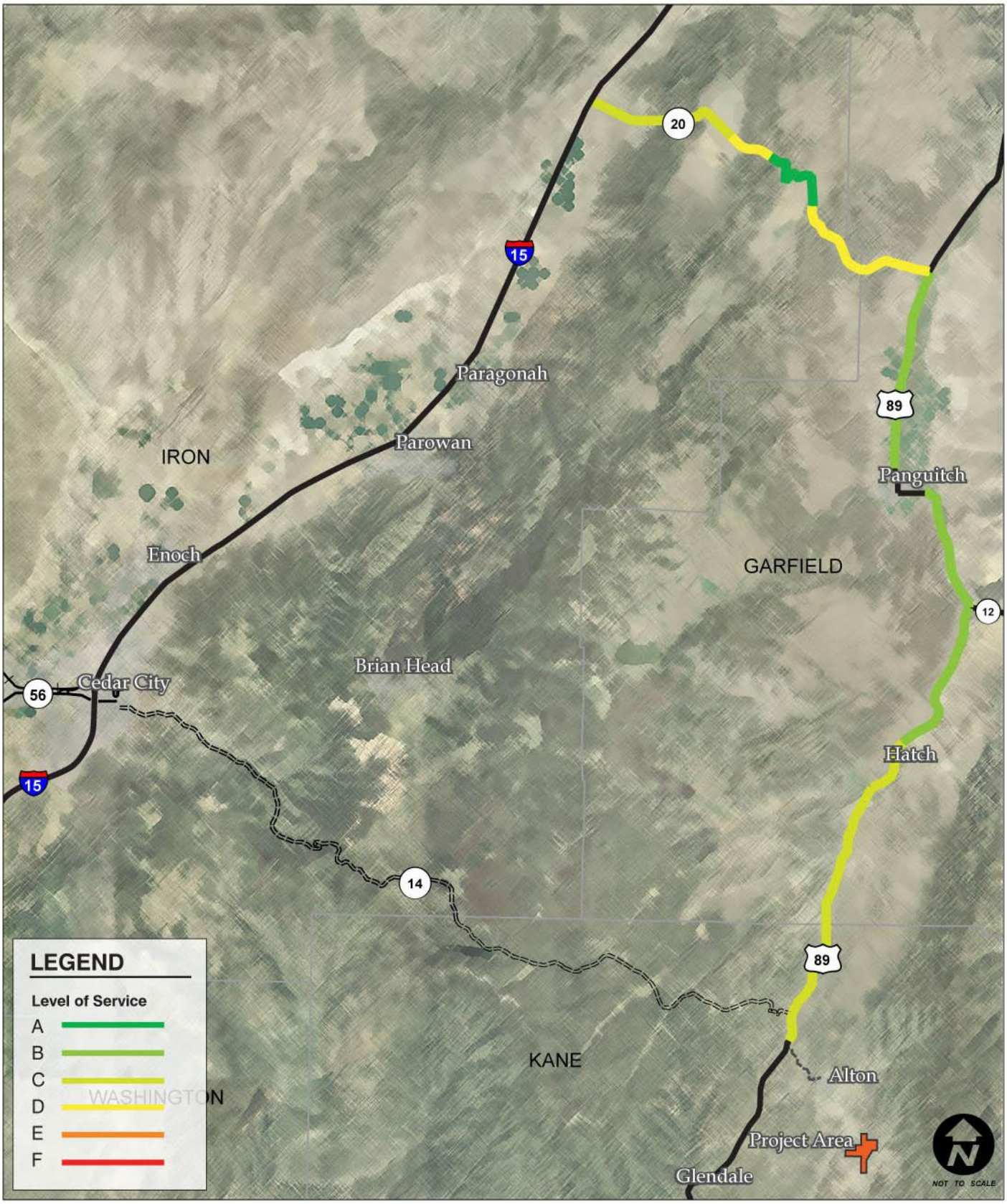
FUTURE 2020 PLUS TRUCKS
WEEKDAY DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW DEVELPMENT TRAFFIC TECHNICAL REPORT

FIGURE 14



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FUTURE 2020 PLUS TRUCKS
WEEKEND DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW TRAFFIC TECHNICAL REPORT

FIGURE 15

Table 19
Future 2020 Plus Trucks Directional Segment
Peak Hour LOS and Percent Time-Spent-Following

Intersection	Weekday			Weekend		
	Direction	LOS	% Time-Spent-Following	Direction	LOS	% Time-Spent-Following
US-89: Alton to SR-14	NB	B	47.0	NB	C	52.4
US-89: SR-14 to Hatch	NB	C	50.3	NB	C	55.6
US-89: Center of Hatch[1]	NB	C	96.0	NB	C	99.0
US-89: Hatch to SR-12	NB	B	48.7	NB	B	49.8
US-89: SR-12 to Panguitch	NB	A	34.1	NB	B	35.7
US-89: Panguitch to SR-20	NB	A	33.8	NB	B	41.0
SR-20: US-89 to Upslope	WB	D	36.8	WB	D	50.9
SR-20: Upslope to Summit[2]	WB	A	15.4	WB	A	19.7
SR-20: Summit to Downslope	WB	C	50.3	WB	D	65.8
SR-20: Downslope to I-15	WB	C	42.5	WB	C	56.6

Notes:
1. The analysis for the center of Hatch was done using HCS HIGHPLAN software due to the reduced highway speeds through town.
2. This segment of roadway was analyzed with a passing lane and as a Class II highway due to the low posted speed limit of 35 mph.

Source: Fehr & Peers, 2008

As shown in Table 19, all roadway segments operate at an LOS D or better.

5.3. Future 2020 Plus Trucks Conditions Summary

Future 2020 plus trucks conditions at the study intersections continue to have low delays per vehicle and little to no congestion. Future 2020 plus trucks conditions on the study roadways continue to have relatively low traffic volumes and traffic is expected to travel at free flow speeds. Based upon the accident history, there are not a lot of accidents involving truck traffic.

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6. Commonly Used Acronyms

Table 20 Commonly Used Acronyms	
Acronym	**Definition**
ADT	Average Daily Traffic
GPS	Global Positioning System
HCM 2000	Highway Capacity Manual 2000
HCS	Highway Capacity Software
LOS	Level of Service
MOE	Measures of Effectiveness
MP	Mile Post
OSR	Operational Safety Report
UDOT	Utah Department of Transportation

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7. References

Transportation Research Board. Highway Capacity Manual 2000. Washington, D. C.: National Research Council, 2000.

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APPENDIX I.

AN ASSESSMENT OF THE IMPACT OF POTENTIAL MINING OPERATIONS AT THE ALTON COAL TRACT ON THE DARK SKIES OF BRYCE CANYON NATIONAL PARK AND CEDAR BREAKS NATIONAL MONUMENT

CONTENTS

APRIL 29, 2009 REPORT: ASSESSMENT OF THE IMPACT OF POTENTIAL MINING OPERATIONS AT THE ALTON COAL TRACT ON THE DARK SKIES OF BRYCE CANYON NATIONAL PARK AND CEDAR BREAKS NATIONAL MONUMENT

Attachment 1. 3/26/2008 Memo from National Park Service Night Sky Program Manager to SWCA Project Manager: Discussion of second observation point, Alton coal mine night sky aesthetic analysis, and graphic attachment accompanying memo

Attachment 2. 4/28/2009 Correspondence between National Park Service Air Resources Division and BLM Project Manager re: Alton Coal Mine Lightscape Analysis

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AN ASSESSMENT OF THE IMPACT OF POTENTIAL MINING OPERATIONS AT THE ALTON COAL TRACT ON THE DARK SKIES OF BRYCE CANYON NATIONAL PARK AND CEDAR BREAKS NATIONAL MONUMENT

NIGHT SKY FROM YOVIMPA POINT, BRYCE CANYON NATIONAL PARK
(NPS NIGHT SKY TEAM IMAGE)

FINAL REPORT

Prepared by Dark Sky Partners, LLC
for
SWCA Environmental Consultants

April 2009

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EXECUTIVE SUMMARY

This study presents results from computer calculations of the sky brightness due to mining operations in the Alton Coal Tract when viewed from Yovimpa Point in Bryce Canyon National Park and from Brianhead Peak near Cedar Breaks National Monument. Two scenarios were suggested by Alton Coal Development for analysis, one for *typical* lighting and one for *brightest* expected lighting. The calculations show that, under the *typical* lighting scenario, the lighting would not produce a sky glow visible above the horizon from Yovimpa Point; any sky glow would be seen only when looking just above the mine site and just below the distant horizon. The predicted sky glow would be less than that produced by several small towns in the general area that are usually not discernable according to the National Park Service, and significantly less than the visible glow arising from the distant large cities of St.George and Cedar City, Utah. Under the *brightest* lighting scenario described in this report, the sky glow seen from Yovimpa Point is found to be comparable to that produced by small, local towns but still less than that of the larger distant towns.

From Brianhead Peak, the analysis shows that the mine lighting under the *typical* lighting scenario would produce less sky glow than that produced by nearby towns. Under the *brightest* lighting scenario the sky glow would be comparable with that produced by several nearby towns

A separate analysis by SWCA shows that intervening terrain would prevent direct visibility of lights in the Alton Coal Tract from Yovimpa Point, but the same does not hold true for Brianhead Peak. If visible, the unshielded 1000 watt metal halide lights suggested for potential use at the active mine site are likely to be the brightest artificial lights visible in the night landscape and would look significantly brighter than the planet Venus.

Options that could reduce the sky glow and direct fixture brightness associated with lighting in the Alton Coal Tract lighting are presented.

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I. INTRODUCTION

Dark night skies are increasingly recognized as one of the premier attractions of National Parks and Monuments, particularly those in the western U.S. Bryce Canyon National Park (BCNP) and Cedar Breaks National Monument (CBNM) are two premier dark sky sites; BCNP in particular attracts many thousands of visitors annually to enjoy a nearly pristine dark sky experience. Unfortunately, many other dark sky sites have been adversely affected by light pollution, from the intrusion of visible light sources into the naturally dark night landscape, the direct illumination of the park or portions of the park by lighting located within or outside of the park, and artificial sky glow arising from light emitted directly from fixtures or reflected from the ground and scattered (re-directed) toward the ground by atmospheric molecules and aerosols. Increasingly, proposed developments that could impact dark sky sites are now being required to address the potential impact of new outdoor lighting on dark skies as part of the environmental assessment process.

This study examines the sky glow that would arise from surface coal mining operations in the Alton Coal Tract (ACT) south of Alton, UT. The Tract is shown in Figure 1, along with nearby Bryce Canyon National Park and Cedar Breaks National Monument. Details of the ACT, showing the potential areas for mining as well as those for the mine headquarters, are shown in Figure 2. The sky glow created by the lighting described in this report is calculated using a sophisticated model describing the interaction of light emitted near the ground and interacting with objects and surfaces near the ground, the atmosphere of molecules and aerosols over the mine site and between the mine site and points of observation. These models are described in detail in published papers by Garstang (1986, 1989, 1991) and by Luginbuhl et al. (2009b). These models have been incorporated into a computer program by Dark Sky Partners LLC (DSP).

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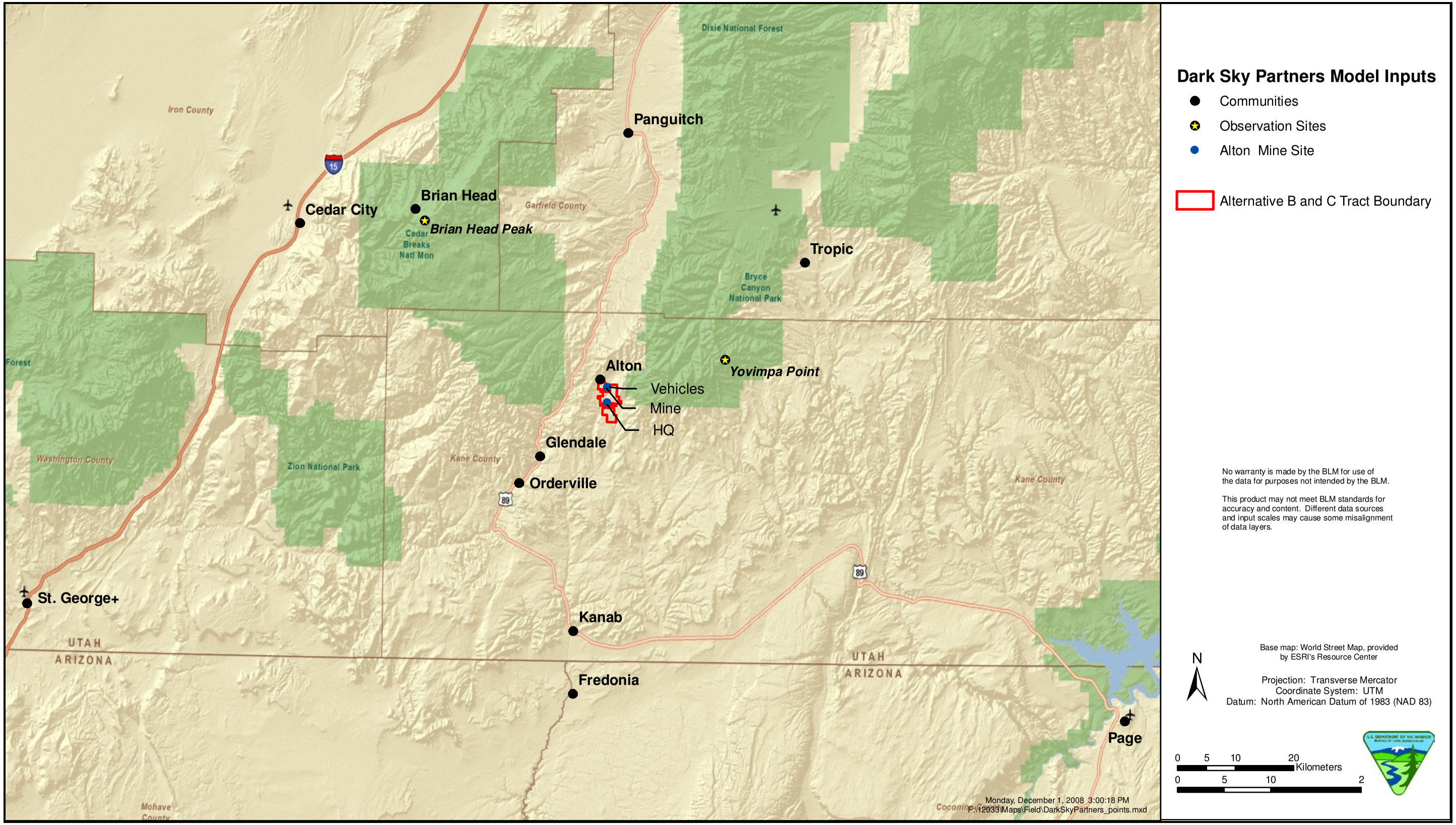

Figure 1. The location of the Alton Coal Tract, Yovimpa Point and Brianhead Peak, together with regional towns and cities included in sky glow models.

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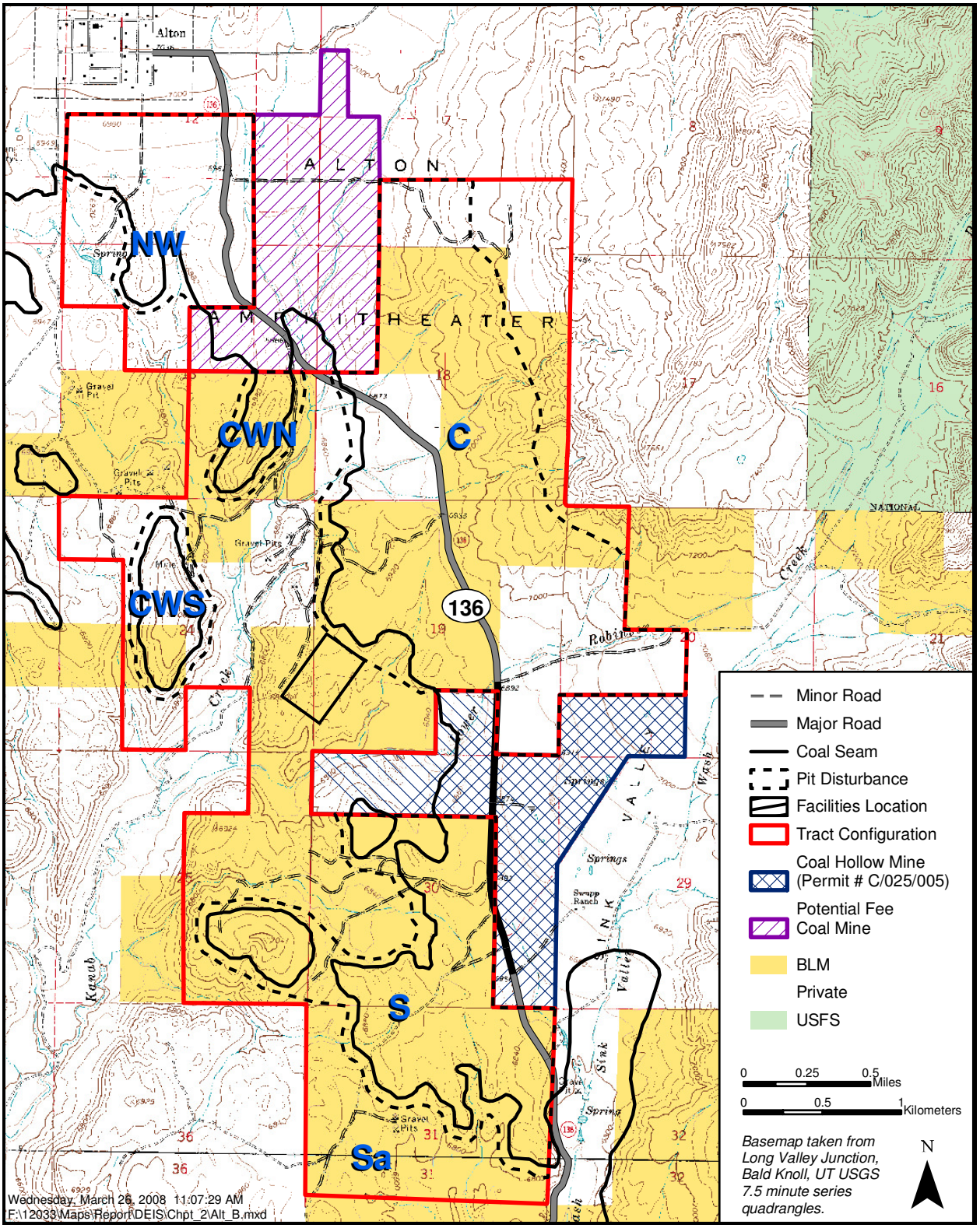

Figure 2. Details of the Alton Coal Tract and potential headquarters (facilities) site.

II. STUDY METHODOLOGY

A. The Numerical Model

R. Garstang (Garstang 1986, 1989, 1991) developed and published a model for calculating sky brightness arising from artificial outdoor lighting. This model has been recently improved by Luginbuhl et al. (2009b) to include effects on light propagation caused by blocking of the light emissions by objects near the ground, such as buildings, vegetation and terrain, an improvement essential to accurately connect light emissions measured at the light sources (lamps) with the resultant sky glow. A computer program based on this improved model, developed by Dark Sky Partners LLC, calculates the sky brightness observable from any location and toward any viewing direction due to light emitted from cities and towns or any specific light source or sources (i.e. fixtures). This program allows modeling of specific sources of artificial lighting such as shopping centers, housing developments or industrial projects, with the capability of specifying details such as amounts, spatial distribution, and shielding characteristics of lighting sources (Davis et al. 2006). This computer program was used to assess the impact of lighting at potential ACT mining operations on dark skies of BCNP and CBNM.

B. Data Input for the Model

The inputs for the computer model include parameters describing the atmosphere and ground reflectivity, the location and amounts of light emitted (measured in lumens), the fraction of this light that escapes directly upward into the night sky (the uplight fraction), and the locations from which the sky is observed.

Atmosphere and Ground

Table 1 shows the parameters characterizing the atmosphere and ground; these values were kept constant for all locations. The parameter that describes the amount of aerosol (particulates) or clarity of the atmosphere, K, was set to 0.05. This is lower than the value used by Garstang for typical western cities (K=0.5), but is based on observations made by the National Park Service (NPS) Night Sky Team at CBNM and describes the 90th percentile (i.e. the K value was observed to be larger than this 90% of the time), and was recommended by NPS as the most appropriate condition for the analysis. Such a low value is not entirely unexpected due to the extreme clarity of the air in this region and at these altitudes. (It is important to recognize the modeling does not account for increased aerosols that may result from some weather conditions, air pollution, or the mining operations themselves.) The E_b and β parameters describe blocking of light emitted from light fixtures due to near-ground factors (vegetation, terrain), and affect both the amount of light escaping into the sky as well as the angular distribution of this upward-directed light. The values indicated for these parameters produced the best agreement between the model calculations and sky brightness measurements in the work described by Luginbuhl et al. (2009b), except that for this study the β parameter has been increased from their best value of 0.0 to 0.1 to compensate for the relatively un-vegetated and open nature of the near-ground environment in this region. The ground reflectivity of 0.15 is typical of a wide variety of surfaces (except snow) including terrain, vegetation, dirty concrete and aged asphalt hardtop, and has been found to adequately characterize ground reflectivity for all warm season light pollution modeling efforts to date (Garstang 1986, 1989, 1991, Luginbuhl et al. 2009b and references therein).

These atmospheric parameters describe very clear conditions and will lead to modeling results that will show smaller impacts from potential lighting in the ACT as well as from nearby towns than will typically be the case. The NPS night sky team purpose in recommending these clear conditions for the analysis is to show what the impacts would be during the "best" observation nights, when the air is clearest and the stars most visible. It is important to recognize that 90% of the time the air will be less clear, and the impacts larger.

Some of the towns in this region lie within narrow valleys or canyons, and thus light emitted from them would suffer, in some directions, considerably greater blocking by the terrain. There has been no attempt to model this effect on a town-by-town basis in this study.

Table 1. Atmospheric and Ground Parameters

Parameter	Value
K	0.05
E_b	0.40
β	0.10
Ground Reflectivity	0.15

Alton Coal Tract Lighting

The number and types of lights to be modeled as representative of lighting in the ACT were discussed and agreed to through telecoms with Alton Coal Development (ACD), SWCA, NPS, and BLM on September 25 and 30, 2008 and subsequent emails. The parameters listed in Tables 1 through 4 were distributed to these agencies for review and final approval.

Lighting required for nighttime mining operations on the tract would consist of three types of lights: 1) fixed lights at the mine headquarters for parking, walkway, security and general nighttime activity; 2) portable light towers with individually aimable fixtures located at the active mine site that would be moved as the mining operations shift; and 3) lighting (i.e. headlights) on mining vehicles, also assumed to be located at the active mine site.

The fixed lights at the headquarters buildings would utilize 250 watt metal halide lamps producing 25,000 lumens each, contained within fully shielded fixtures, i.e. none of the light is emitted directly upward. The portable lights would utilize 1000 watt metal halide lamps producing 110,000 lumens each. These fixtures are mounted with adjustable gimbals, allowing the fixtures to be aimed in different directions and at different angles relative to the horizon (see Appendix A). Although DSP contacted Baldor Electric Company, a manufacturer of a potential portable lighting system suggested by ACD representatives, the representatives of Baldor were unable to produce the photometric information needed to accurately evaluate the fraction of light directed upward as a function of aiming angle of the fixtures. Therefore, for this study DSP is forced to estimate this fractional uplight value. We assume that they would typically be aimed at 30° below the horizon and direct 30% of the light upward, but they may at times be directed essentially straight sideways toward the horizon, as is often observed when such lights are used on construction sites. The *typical* case (see Tables 2 and 3) is intended to represent most of the mining operations while the *brightest* case, utilizing the larger number of lights indicated, is for occasional intense activities, described by ACD representatives as expected to occur less than 10% of the time. The *brightest* case scenario also

considers that the portable lights are aimed horizontally, producing a larger uplight fraction (0.50). These figures are summarized in Table 2.

For the vehicular lighting we have no specific information either on the manufacturers and types of the mining vehicles to be used, nor for the lighting that would be installed on this equipment. To estimate the light output from the vehicles, we scale the lumens from values typical of automobile headlights. From Schoettle et al. (2004), car headlights average 3786 effective lumens/vehicle with an uplight fraction of 0.11. We assume the same uplight fraction, but increase the light output from each mine vehicle to 10,000 lumens, about three times that of a typical car. All vehicular lighting is assumed to be located at the active mining site, i.e. no attempt has been made to model lighting produced when the vehicles are transporting materials on roadways.

Table 2 gives the details of how the total lumens were calculated for the mine lighting sources, while Table 3 gives the locations and lighting associated with all modeled light sources, including both scenarios detailed for the ACT as well as 11 towns and cities expected to be contributors to sky glow in the region (see below). Though there is a specific location indicated for the active mine site in Table 3, it is expected that active mining would occur at many sites within the tract. This location is chosen to provide specific inputs to the model and to give results representative of the lighting impacts of potential mining operations within the ACT.

Table 2. Details of Alton Coal Tract Lighting (MH=metal halide; INC=incandescent).

Description	Lamp	lumens each	Number	total lm	fraction up
Typical Case					
Fixed lighting	250W MH	25000	4	100000	0.00
Portable towers	1000W MH	110000	4	440000	0.30
Headlights	INC	10000	20	200000	0.11
Brightest Case					
Fixed lighting	250W MH	25000	6	150000	0.00
Portable towers	1000W MH	110000	12	1320000	0.50
Headlights	INC	10000	36	360000	0.11

Towns

The light outputs for all towns included in this study were calculated assuming 2500 lm per capita with 10% uplight fraction. These are typical values for communities without any outdoor lighting controls (Luginbuhl et al 2009a and references therein).

Observation Points

The observation sites listed in Table 4 were set in consultation with NPS and BLM representatives. These sites were chosen to provide a representative evaluation of the sky glow impacts of lighting in the ACT for visitors to BCNP and CBNM. For further discussion of the observation points see below and the memo presented in Appendix B.

All calculations are for the Johnson V bandpass, an astronomically defined wavelength vs. sensitivity response similar to the dark-adapted human eye. Though the system is not strictly equivalent to the sensitivity function for the human eye, it is reasonably close and has become the standard for both astronomical measurements of sky brightness and those produced by the National Park Service (Duriscoe, Luginbuhl & Moore, 2007).

Table 3. Light Source Locations and Outputs.

Site	Latitude dms	Longitude dms	Elevation m	Azimuth[1] deg	Distance[1] km	Population	Typical lumens	Typical uplight	Brightest lumens	Brightest uplight
Alton Tract										
HQ	+37 24 11	–112 28 05	2090	249/134	21.5/44.5		100000	0.00	150000	0.00
mine	+37 25 37	–112 28 06	2110	256/131	20.7/42.6		440000	0.30	1320000	0.50
vehicles	+37 25 37	–112 28 06	2110	256/131	20.7/42.6		200000	0.11	360000	0.11
Towns										
Alton	+37 26 21	–112 28 59	2156	260/131	21.7/40.8	141	352500	0.10		
Brianhead	+37 41 55	–112 50 58	2993	295/319	59.3/2.6	125	312500	0.10		
Cedar City	+37 40 22	–113 04 28	1777	287/268	76.8/21.5	27823	69557500	0.10		
Fredonia	+36 57 00	–112 31 35	1426	204/162	63.3/85.6	1096	2740000	0.10		
Glendale	+37 19 05	–112 35 50	1763	242/153	35.9/45.3	336	840000	0.10		
Kanab	+37 02 50	–112 31 39	1512	208/159	53.7/75.4	3769	9422500	0.10		
Orderville	+37 16 33	–112 38 15	1661	238/159	41.3/48.2	599	1497500	0.10		
Page	+36 54 57	–111 27 26	1321	131/125	92.9/148.3	6904	17260000	0.10		
Panguitch	+37 49 22	–112 26 08	2019	336/65	42.6/38.1	1473	3682500	0.10		
St. George[2]	+37 06 04	–113 34 31	895	251/226	125.1/92.1	121356	303390000	0.10		
Tropic	+37 37 30	–112 05 13	1933	38/95	21.7/65.8	464	1160000	0.10		

[1] Azimuth and distance from Yovimpa Point/Brianhead Peak
[2] Includes towns of St George, Ivins, Santa Clara, Springdale, Washington, Hurricane, LaVerkin, Toquerville

Table 4. Observation Sites

Observation Site	Latitude dms	Longitude dms	Elevation m
Yovimpa Point	+37 28 20	–112 14 25	2770
Brianhead Peak	+37 40 52	–112 49 50	3446

III. Impact of Potential Alton Coal Tract Lighting on Night Sky Brightness

We calculated predicted sky brightness for both the *typical* and *brightest* ACT lighting (see Tables 2 and 3) as seen from the two observation points listed in Table 4. For each case, we calculated the sky brightness from the horizon directly above the mine site (zenith angle of 89°) to the horizon directly opposite (zenith angle of –89°), passing through the zenith. We show both the total sky brightness in nanoLamberts[1] (nL) and the fractional increase in sky brightness due to lighting as listed in Table 3. Though the ACT appears about 1.8° below the true horizon or at about 91.8° zenith angle from the two observation points of Table 4 (see e.g. Appendix B), the calculations do not extend beyond 89° zenith angle due to model limitations (see discussion below).

For reference, we compare these predicted profiles to the artificial sky brightening predicted toward each of the eleven nearby towns and cities identified in Figure 1 and Table 3. Fractional brightness increases for all town calculations are as compared against the natural condition, i.e. to the sky with no towns present. The fractional brightness increases for all ACT calculations are as compared with the current condition, i.e. including any towns or cities whose sky glow may overlap with that produced by the tract lighting. This is the most appropriate way to judge the impacts, as the sky glow arising from towns is viewed against a (generally) unpolluted horizon, while the sky glow produced by lighting installed in the ACT would be added to that already present.

To understand the visual impact of the numbers and ratios described in the following two subsections, readers should be aware that a brightness ratio of 1.1:1 (or 10%) is only just perceptible to most people when the two sources of light can be directly compared, with one appearing directly adjacent to the other. In this sense a 10% brightening may seem to be likewise only just perceptible. A brightness ratio of 50% (1.5:1) would be perceptible to most observers. However, a natural visual reference for the sky brightness impacts described here is the natural largely un-polluted night skies in this region. Here, the impact of a sky glow "dome" comparable to, say, the sky glow produced by a town already visible from the observation point may be best judged by considering the impacts this other town or towns have on the night landscape. For this purpose we have included the sky glow predictions for the eleven towns listed in Table 3.

A. Bryce Canyon National Park

The observation point chosen to examine impacts at Bryce Canyon National Park is Yovimpa Point, located near the southern end of the park and relatively close (21 km) to the mine site. Yovimpa Point is also used by the park for night sky observation and interpretation.

Figure 3 shows the variation in sky brightness along the semi-circle passing through the mine site (right side of the graph), the zenith (middle of the graph) and ending at the horizon opposite the mine site (left side of the graph). The lowest curve shows the natural condition, i.e. the sky glow that would be observed without any artificial light in the region.

The predicted current sky glow arising from natural air glow plus artificial sky glow from the 11 cities and towns listed in Table 3, as well as the effect of the two lighting scenarios at the mine site,

[1] A nanoLambert (nL) is a unit of luminance or surface brightness. 1 Lambert = 1 lumen/sq cm for a uniformly diffusing surface. An naturally dark sky has a brightness of about 54 nL at the zenith, rising (due to natural causes) to approximately 100 nL 10° above the horizon (see the lowest curve in Figure 3).

are shown as the three increasingly brighter curves lying above the natural curve and distinguishable particularly toward the ACT (right side of the graph). This figure shows that there is essentially no increase in sky brightness from the zenith to the horizon opposite the tract location.

To more clearly display the effects of the ACT lighting on the night sky, Figure 4 displays fractional sky brightness increases, i.e. ratios of the predicted sky brightness to either the current or natural condition. The two ACT lighting scenarios are displayed as ratios of the predicted brightness along this semi-circle to the brightness already there, i.e. the current condition. For comparison, the ratios of brightness produced by the towns and cities listed in Table 3 are compared to the natural condition, i.e. the sky glow that would be present with no other artificial light sources. This figure displays only zenith angles from 80° – 89° to the horizon in the direction of the light source. A value of 1.10 means that the indicated condition is 10% brighter than the reference condition; 1.05 is 5% brighter.

From Figure 4 and Table 5 it can be seen that the *typical* lighting condition would brighten the sky by about 1% at a zenith angle of 80° (or an altitude of 10° above the horizon), increasing to 10% at a zenith angle of 89° (1° above the horizon). At zenith angles of less than 71°, the sky brightness increase is less than 1%. Under the *brightest* lighting condition the sky would brighten by about 3% at zenith angle of 80°, and by 31% at a zenith angle of 89°. This increased sky brightening falls to less than 1% at zenith angles less than 45° in the direction of the ACT. Looking at the other cities and towns included in Table 3, we see that the lighting at the ACT is superimposed fairly closely on the sky glow produced by Alton town and St. George, Utah (see further discussion below). At 85° zenith angle, these two towns contribute an approximate 10% and 35% brightening over the natural condition, respectively, though the brightest centers of these sky glow domes are located a few degrees right and left of the site analyzed here.

Here we must point out that the model predictions for angles within 10° of the horizon must be considered with caution. Localized and unpredictable variations in very low altitude atmospheric dust content, caused for example by low-level winds or by the mining operations themselves, and blocking by vegetation or terrain, including (variable) terrain relief produced by the mining operations, can make these values much larger or much smaller than predicted here. The values indicated in the study should be taken only as a general indication, useful for comparing one lighting scenario to another or for comparing one town to another, but not likely accurate to better than 50% in predicting absolute sky brightnesses for any given night. Because of these uncertainties calculations were not made for angles greater than 89° from the zenith or 1° altitude.

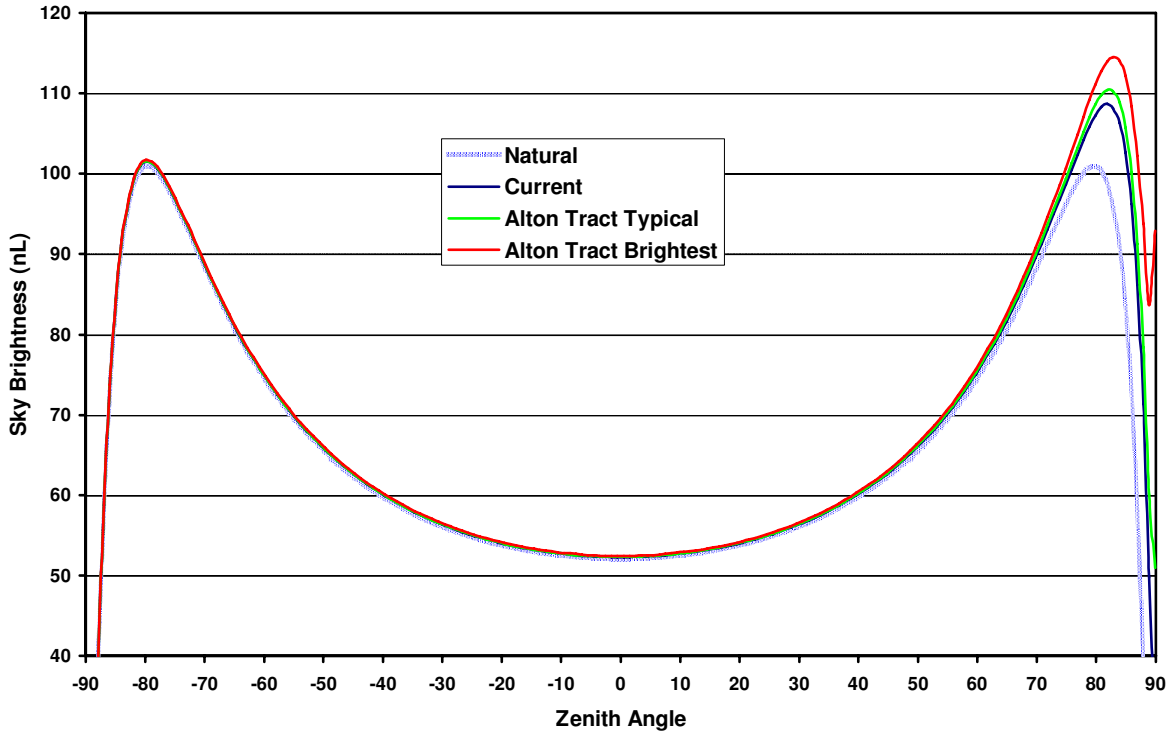

Figure 3. Horizon to horizon sky brightness at Yovimpa Point on the semi-circle originating toward the Alton site (azimuth 256°, zenith angle 90°) and ending at the point on the horizon opposite (azimuth 76°, zenith angle –90°). The blue line shows the predicted current sky brightness profile arising from the 11 existing cities and towns listed in Table 3; the green and red lines show the predicted additional contributions of the two Alton tract lighting conditions described in the text.

With these uncertainties in mind, Figure 4 shows that the greatest sources of sky glow at this site arise from Cedar City and St. George, Utah, located 77 km and 125 km distant at azimuth 287° and 251°. At 5° above the horizon in the direction of either of these two cities the sky appears about 35% brighter than the natural condition. The predicted sky glow produced by the *typical* mine lighting scenario does not reach this level at any calculated point, rising to 20% above the natural condition when viewed 1° above the horizon in the direction of the site (azimuth 256°). The impact appears to be smaller than the sky glow predicted for all of the towns and cities in this region, and by coincidence would be more difficult to discern due to its chance alignment with the brighter sky glow a rising from St. George. The *brightest* lighting scenario would produce a larger impact, rising to almost 70% brighter than the natural condition when viewed 1° above the horizon toward the mine, and 30% when viewed 2° above the horizon. The increase does not fall below 10% until the viewing angle increases to about 5° above the horizon. Under this condition the sky glow appears comparable to that visible from the towns of Orderville and Fredonia, and to that produced by a distant cities of Kanab and Page, Arizona. NPS personnel (Moore, personal communication) indicate that some of these towns do not produce a visible sky glow from this location. This may be due to terrain blocking by the nearby valley walls.

An important consideration, decreasing the likely visibility of above-horizon sky glow from both lighting scenarios within the ACT, is that the site detailed in Table 3, at azimuth 256°, is coincidentally closely aligned with St. George from this viewing location. However, since the ACT appears about 1.5° below the distant horizon, any artificial "sky" glow appearing immediately above

the mining operations would appear projected against the landscape, below and distinct from the distant St. George sky glow, and thus more visible.

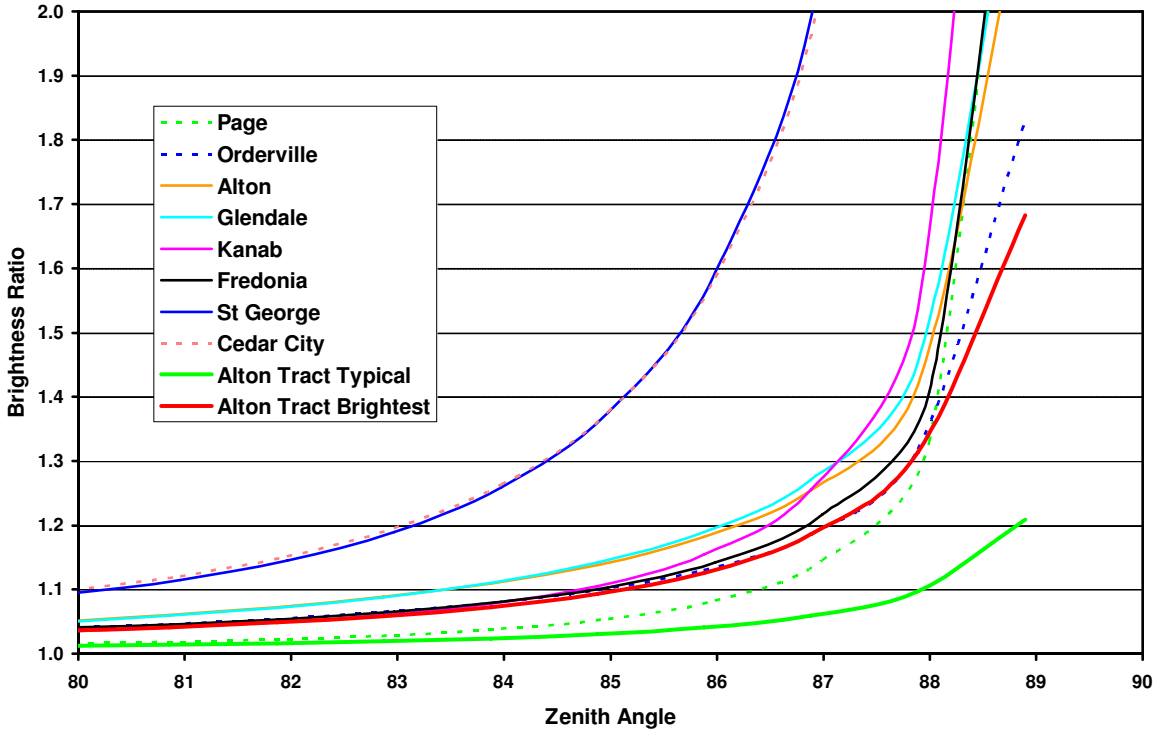

Figure 4. Brightness ratio as viewed from Yovimpa Point toward the Alton site as well as toward a selection of regional towns/cities indicated in the key. The Brightness Ratio display for the towns is as compared to the natural condition (i.e., no towns): the Brightness Ratio for the Alton tract conditions is to the current condition (i.e., including sky glow from St. George, Kanab, etc.).

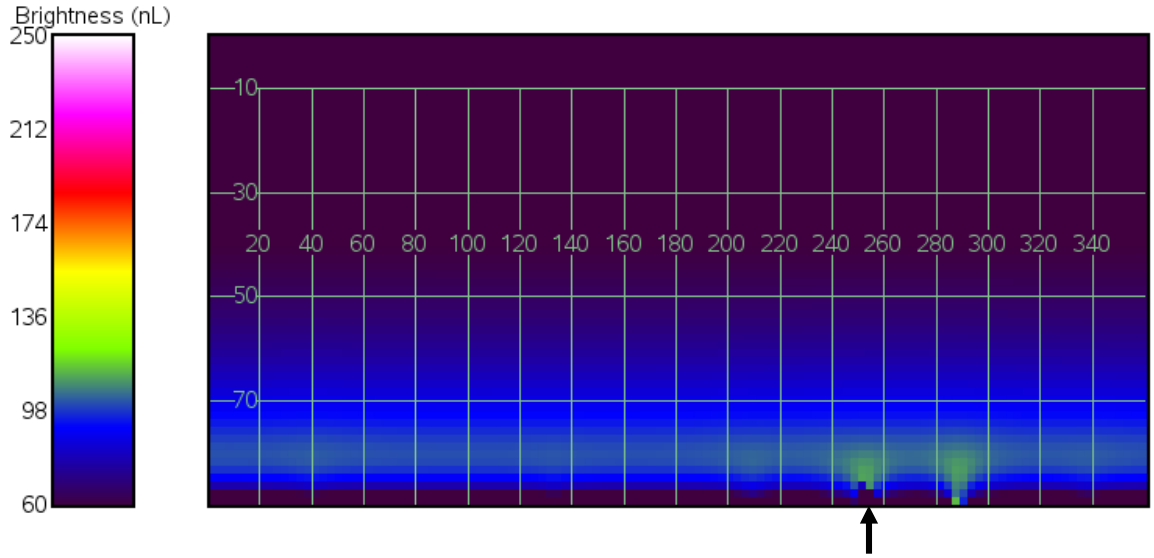

Figure 5. An all-sky false-color panoramic map of the predicted current sky glow visible from Yovimpa Point. The grid and numbers on this and the following images indicate altitude and azimuth; the arrow indicates the azimuth of the Alton mine site in Table 3.

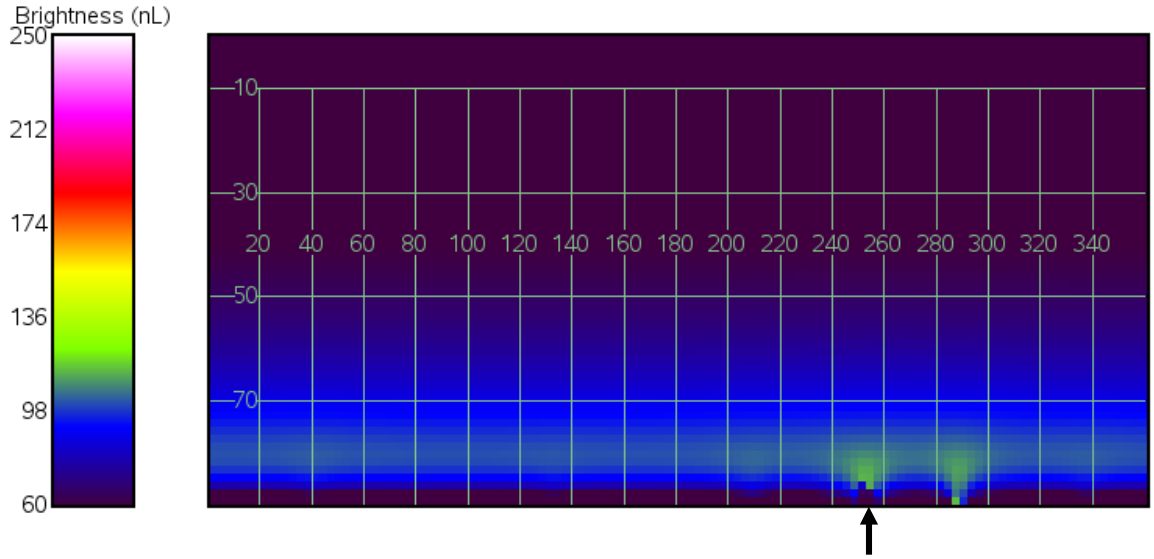

Figure 6. As Figure 5, with *typical* lighting at the Alton tract.

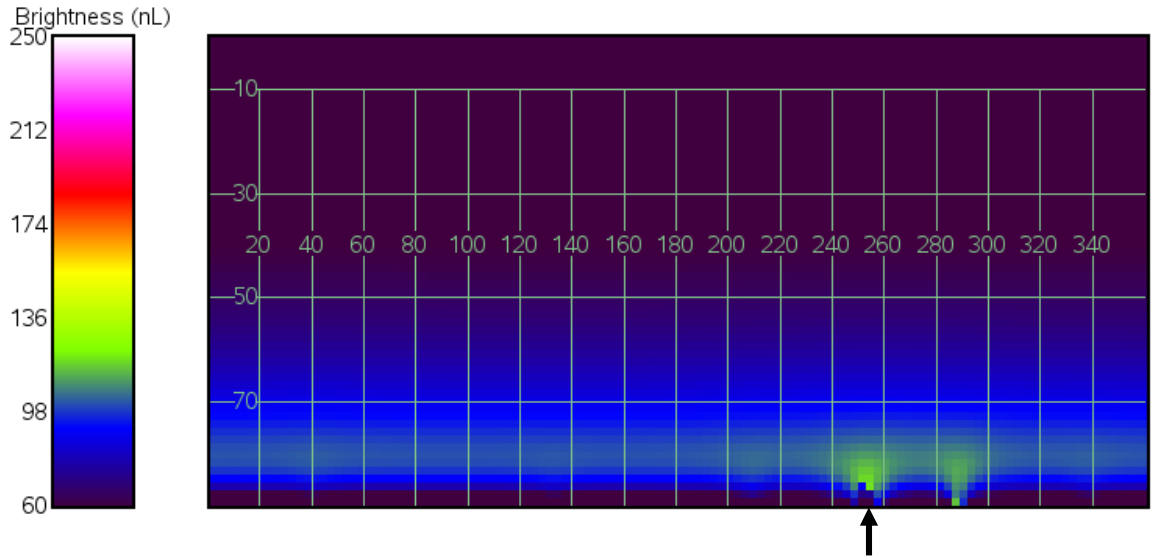

Figure 7. As Figure 5, with *brightest* lighting at the Alton tract.

Figures 5, 6 and 7 are false-color maps showing sky brightness over the entire sky as viewed from Yovimpa Point. Figure 5 shows the current condition, while Figures 6 and 7 show the addition of the *typical* and *brightest* lighting scenarios at the mine site. An increase in the sky glow above the ACT site (azimuth 256°, indicated by the arrow) is discernible in Figures 6 and 7, though this relatively nearby lighting is viewed against the distant and brighter sky glow arising from St. George at azimuth 251° and a small contribution from Alton town at azimuth 260°. The other distinct sky glow dome at azimuth 287° arises from Cedar City.

Table 5. Sky brightness ratios as viewed from Yovimpa Point at selected zenith angles toward the Alton site

Zenith Angle	Brightness Ratio (predicted/current)	
(degrees)	Typical	Brightest
0	1.00	1.00
45	1.00	1.01
60	1.00	1.01
80	1.01	1.03
85	1.02	1.07
87	1.04	1.13
89	1.10	1.31

B. Cedar Breaks National Monument

The observation point chosen to examine impacts at Cedar Breaks National Monument was the subject of some additional consideration (see Appendix B.). Brianhead Peak, located approximately 1.5 kilometers north of the park boundary in the Dixie National Forest, was chosen for its proximity to CBNM and the availability of NPS night sky team data for this site.

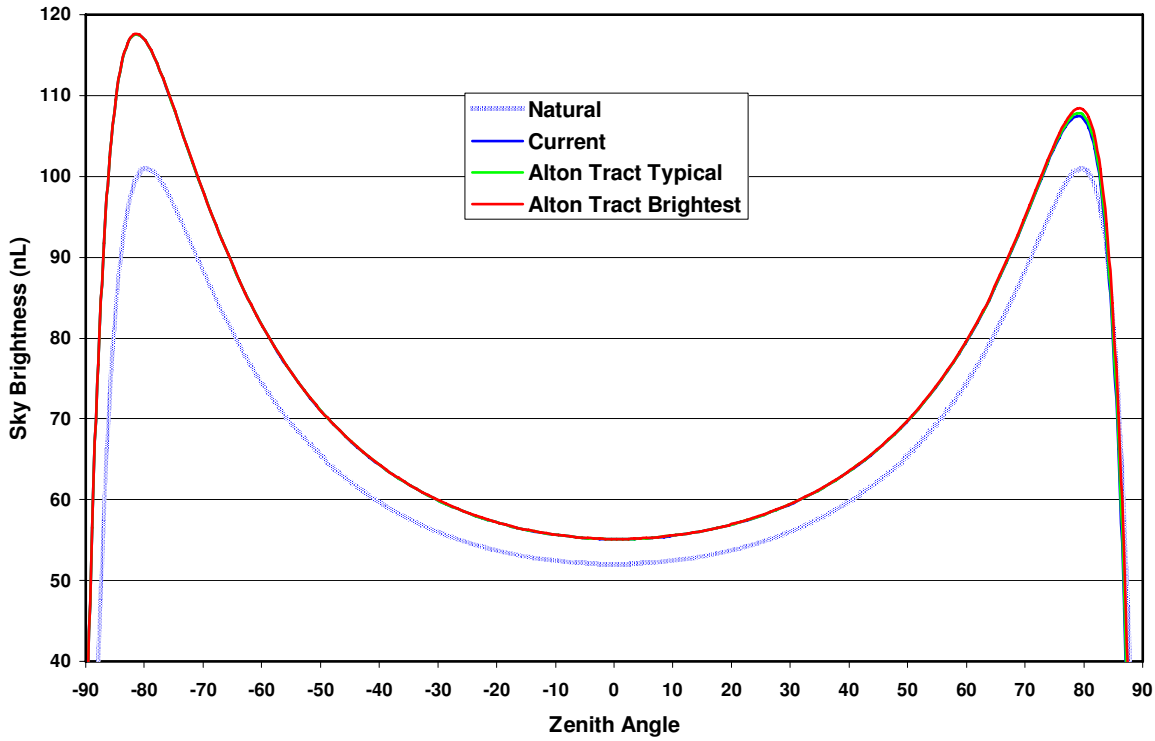

Figure 8. Horizon to horizon sky brightness at Brianhead Peak on the semi-circle originating toward the Alton site (azimuth 131°, zenith angle 90°) and ending at the point on the horizon opposite (azimuth 311°, zenith angle –90°). The green line shows the predicted current sky brightness profile arising from the 11 existing cities and towns listed in Table 3; the blue and red lines show the predicted additional contributions of the two Alton tract lighting conditions described in the text.

Figure 8 shows the sky brightness along the semi-circle originating at the ACT site (right side of the graph), passing through the zenith and ending up at the horizon opposite the mine site (cf. Figure 3). From this figure is clear that this is a much more heavily light-polluted site due mostly to the proximity of Cedar City and St. George, Utah, with the zenith appearing approximately 6% brighter than the natural condition with or without lighting at the ACT. This brightening rises to approximately 25% and 80% above natural condition when viewed 10° above the horizon toward St. George and Cedar City, respectively (see Figures 9 and 10).

Figures 9 and 10 display the fractional sky brightness increase over the current condition for the two ACT lighting scenarios, and over the natural condition for the semi-circles toward the indicated cities and towns. Here we can see that sky glow produced by the *typical* ACT lighting scenario is fainter than from all other sources in the study. Seven light domes are calculated to be brighter than that predicted for the *brightest* lighting scenario at the mine site, including, in decreasing order (name@azimuth), Cedar City @268°, St. George @226°, Brian Head @319°, Orderville @159°, Panguitch @65°, Fredonia @162°, and Glendale @153°.

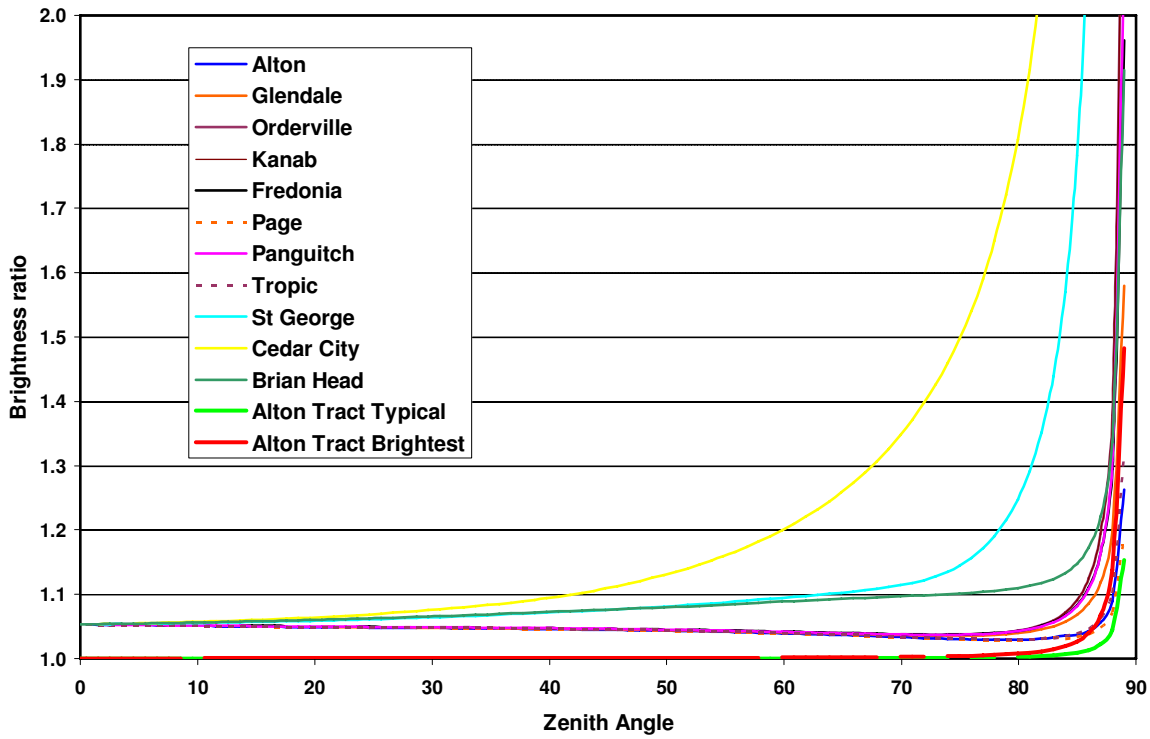

Figure 9. Brightness ratio as viewed from Brianhead Peak toward the Alton site as well as toward a selection of regional towns/cities indicated in the key. The Brightness Ratio display for the towns is as compared to the natural condition (i.e., no towns): the Brightness Ratio for the Alton tract conditions is to the current condition (i.e., including sky glow from cities and towns). Zenith angles from 80°–90° are detailed in Figure 10.

Figures 11 and 12 show false-color maps of sky brightness over the entire sky as viewed from Brianhead Peak; Figure 11 represents the current condition, while Figure 12 includes the addition of the *brightest* lighting at the ACT. This representation does not show any discernible increase in sky glow above the ACT (indicated by the arrow).

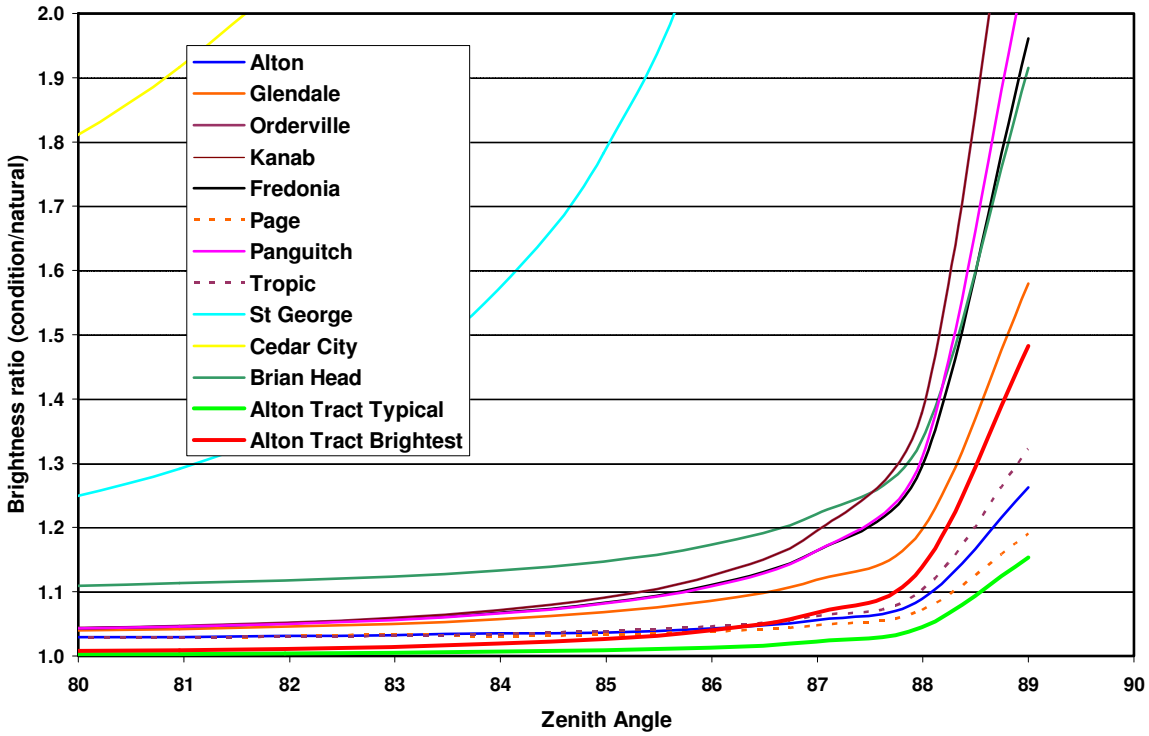

Figure 10. As Figure 9, from zenith angles 80°-90°.

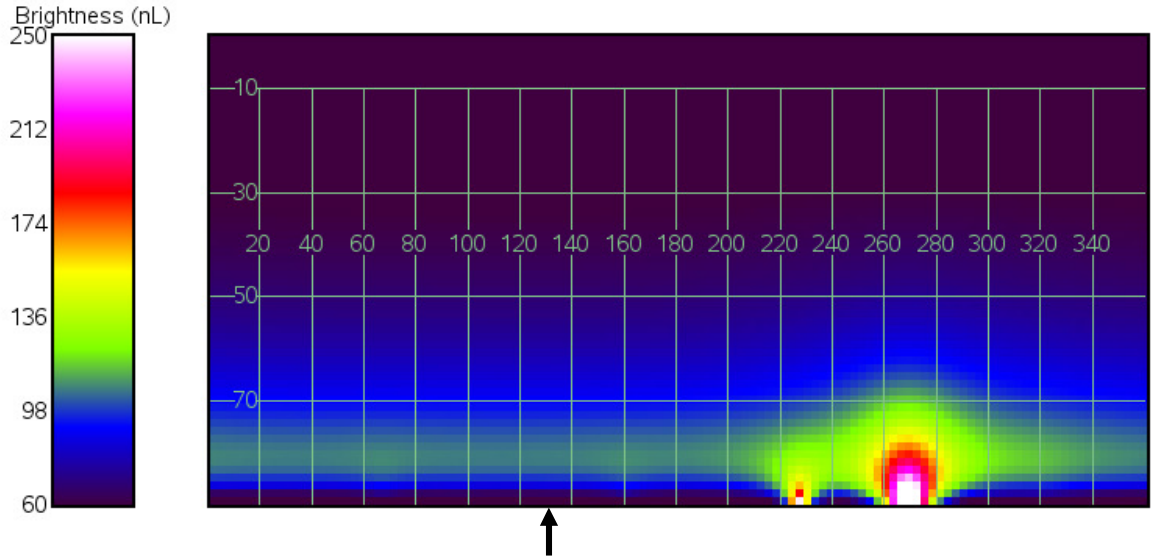

Figure 11. An all-sky false-color panoramic map of the predicted current sky glow visible from Brianhead Peak. The grid and numbers on this and the following image indicate altitude and azimuth; the arrow indicates the azimuth of the Alton mine site in Table 3.

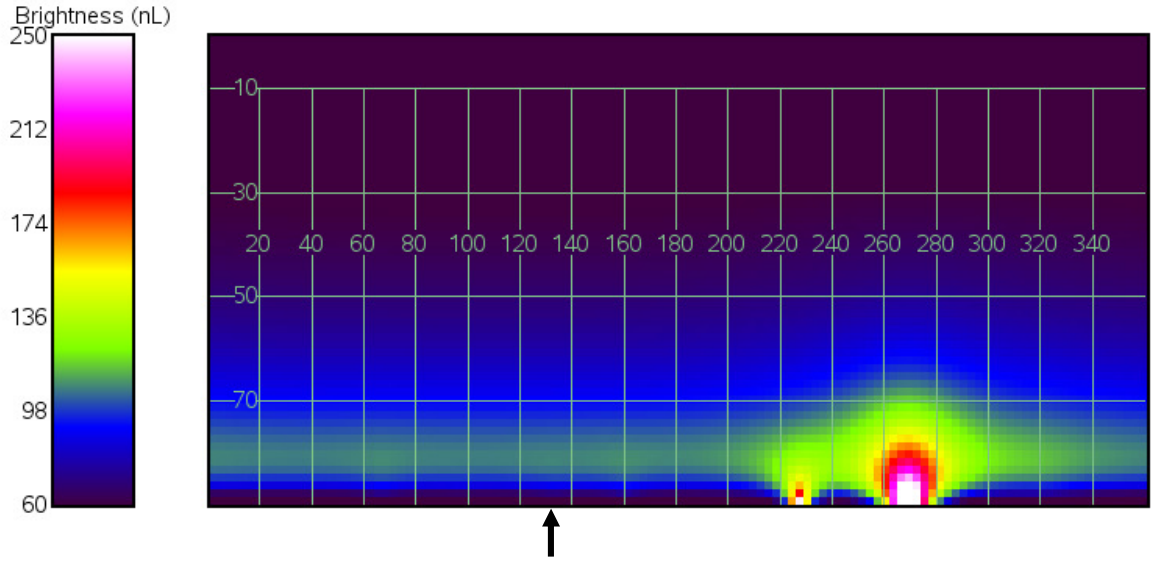

Figure 12. As Figure 11, with *brightest* lighting at the Alton tract.

Table 6. Sky brightness ratios as viewed from Brianhead Peak at selected zenith angles toward the Alton site

Zenith Angle	Brightness Ratio	
(degrees)	Typical	Brightest
0	1.00	1.00
45	1.00	1.00
60	1.00	1.00
80	1.00	1.01
85	1.01	1.03
87	1.02	1.06
89	1.13	1.42

IV. Impact of Potential Alton Coal Tract Lighting on the Viewshed

Though not directly apart of the analysis forthis report based on DSP sky brightness modelling, the question has been raised of the potential direct visibility of light fixtures in the ACT from BCNP and CBNM. To address this concern SWCA performed a viewshed analysis to determine what parts of the ACT might be directly visible from the observation points of Table 4 (see Appendix C) and conversely what parts of BCNP and CBNM might be visible from within the ACT.

The results of this analysis show that no part of the ACT is directly visible from Yovimpa Point or any part of BCNP due to intervening terrain, and thus no light fixtures used in the ACT would be directly visible from BCNP.

The analysis shows however that a portion of the potential mining sites in the ACT are directly visible from Brianhead Peak near CBNM and more importantly from portions of the Markagunt Plateau in the northeast portion of CBNM itself. Light fixtures used in these portions of the ACT could therefore be directly visible from within CBNM. The unshielded portable fixtures particularly, using1000 watt 110,000 lumen lamps, would almost certainly be the brightest artificial light sources visible in the night landscape. Though a precise calculation of the brightness of these lights would require detailed specification of the fixtures' photometric properties, aiming configuration and other details, an order-of-magnitude calculation yields that the lights would appear significantly brighter than the planet Venus, the brightest object in the night sky after the moon. This calculation assumes the Brightest Case lighting described in Table 2 and that the lights are pointing toward Brianhead Peak.

V. Potential Mitigation Strategies

In rough order of importance or mitigation effectiveness, the following strategies could be employed to decrease the impacts of the lighting used at the Alton Coal mine site on BCNP and CBNM.

A. Hours of operation

Performing mining operations during daylight hours only would allow the elimination of 86%-92% of the total lighting, and completely eliminate all unshielded lighting. The sky glow reduction arising from the ACT would be reduced by somewhat more than this figure due to the elimination of unshielded floodlighting at the ACT site. Alternatively, mining activities could be reduced during hours of night visitor use.

B. Lamp type

All of the lighting suggested for the mine operations, excepting only that on the mining vehicles themselves, is to be provided by metal halide lamps. For the *typical* scenario 73% of the lighting would come from metal halide lamps, while in the *brightest* scenario this figure would be 88% (see Table 3). Luginbuhl et al. (2008) have shown that, at small zenith angles (i.e. near the zenith) and under clear atmospheric conditions appropriate to this region, the visible sky glow produced by metal halide lighting is approximately 3 times that produced by high-pressure sodium lighting, and 12 times that produced by low-pressure sodium lighting, on a lumen-for-lumen basis. At high zenith angles (i.e. at viewing angles more directly toward the light sources) this effect would decrease. Nonetheless, a reasonable way to decrease sky glow impacts from lighting in the ACT would be to use low-pressure sodium lighting at the mine headquarters and high-pressure sodium for the portable floodlights used at the active mine site.

C. Portable fixture shielding

The uplight fraction from these very poorly shielded fixtures could be improved with the addition of shields on the upward portion of the luminaires, conceptually following the huge improvements in sports lighting technology seen in the last five to 10 years. If the shields are not available from the manufacturer, it may not be an unreasonable number to have manufactured. It may be possible to entirely replace the stock flood light fixtures with higher quality partially shielded or completely shielded floodlights generally used for sports lighting (see Appendix C for an example). Though the precise reduction in sky glow and the brightness of directly visible light fixtures is difficult to precisely quantify, a reduction of sky glow under the *typical* lighting scenario of three quarters (75%), and the intensity of directly visible fixtures by an order of magnitude (10 times) could be easily expected. The sky glow and direct fixture brightness reduction under the *brightest* scenario would be greater.

D. Portable fixture aiming

Keeping the portable light fixtures located at the active mine site aimed as far as possible below the horizon and away from the directions toward these parks could substantially reduce sky glow and direct visibility impacts. Without specific photometric information for the fixtures or information on aiming constraints the improvements expected cannot be quantified, and practically assuring that such aiming is maintained could be problematic.

E. Dust reduction

Methods to mitigate dust reduction such as paving heavily used roads, wetting the ground or limiting operation during windy conditions can considerably decrease aerosol/dust concentrations in the lower atmosphere and therefore light scattered toward the observation points from the mine site. The sky glow reductions from this mitigation are unknown.

F. Headquarters lighting

Depending on activity expected at the headquarters building during nighttime hours, it may be possible to reduce or eliminate much of the lighting planned in this area, which amounts to 8%-14% of the total lighting. Particularly lighting used for security purposes can be reduced or eliminated by limiting access to the site through physical means such as fences and gates or security patrols.

VI. Discussion and Conclusions

The calculations performed for this study indicate that the outdoor lighting for mining operations within the ACT would produce a detectable sky glow when viewed from Yovimpa Point in BCNP for only the *brightest* lighting scenario analyzed. Under this scenario, sky glow produced by lighting in the ACT would appear similar to that produced by the towns of Orderville, Utah, and Fredonia and Page, Arizona, but less than that produced by the distant large cities of St. George and Cedar City, Utah.

Though sky glow produced by ACT lighting under the *typical* scenario might otherwise be visible from Yovimpa Point, the chance alignment of the ACT site and the distant city of St. George would likely render the predicted small increase visually undetectable against the brighter sky glow arising from St. George.

From Brianhead Peak near CBNM the *typical* lighting scenario produces a sky glow fainter than any nearby town, and we judge it unlikely to be visually detectable above the horizon. The *brightest* scenario produces a sky glow comparable to nearby small towns, and would likely be visible under some conditions and by some observers when looking at or above the horizon.

A viewshed analysis indicates that light fixtures used in some areas of the ACT would probably be directly visible from both Brianhead Peak and from some locations within CBNM. There would be no direct visibility of fixtures within the ACT from BCNP. If visible, the unshielded 1000 watt metal halide lights suggested for potential use at the active mine site would probably be the brightest artificial light sources visible in the night landscape.

Though the sky glow impacts of the potential lighting appear small, particularly when considering the *typical* lighting expected to be used 90% of the time that the mine is active, the unusually pristine nature of the nighttime landscapes in this region, combined with the high resource value attached to natural nightscapes by BCNP mean that even small impacts may be of concern.

Options that could produce significant reductions in these impacts are available. Though restriction of mining operations to daylight hours may be unlikely, improved shielding and restrictions on vertical aiming angles and azimuths for the portable mine lighting, combined with the potential to use yellow light sources such as high-pressure and low-pressure sodium instead of metal halide lamps could reduce impacts substantially.

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Appendix A:
Portable Light Tower for Potential Use at Alton Coal Tract

VIII. APPENDICES

Appendix A. Portable light tower for potential use at the Alton Coal Tract

BALDOR

PL6000K

Baldor POW'R LITE Light Tower

Baldor's compact mobile light tower provides 4000 watts of light anywhere you need it: Construction, Emergency, Industrial, Mining, Civil Engineering and Event Lighting. With metal-halide lamps the Baldor POW'R LITE models will provide light coverage for over 5-7 acres.

- **Baldor's 6kW Generator –** powered by an 1800 RPM liquid-cooled Kubota diesel engine. The Baldor Generator and Kubota engine arebacked by a 3-Year Limited Warranty.
- **Baldor's new elliptical light fixtures –** provide a more efficient light pattern than conventional round fixtures. The 4 – 1000 Watt metal halidelamps are supported on both ends to enhancedurability and long life.
- **Corrosion resistant aluminum enclosure –** heavy duty 12 gauge side panels and lockable doors. Durable powder coat finish.
- **Convenience outlets –** 2000 watts, 120 VAC and 240 VAC.
- **Designed for easy service –** the side fender and side panel are easily removed allowing full access in minutes for engine/alternator service.
- **Mast and outriggers –** zinc plated for long life.
- **30' extended light tower –** Tower rotates 360 degrees
- **4-section mast –** allows for compact trailering length. Coiled mast cords.
- **Dual forklift pockets –** located on light mast and bottom of trailer for easy lifting.
- **Internal control panel –** protects against elements. Hour meter and keylock standard.
- **Engine shutdown –** low oil/high temperature shutdown protection.
- **50 Gallon fuel tank –** provides 100 hours of runtime and outside fill cap.
- **Radiator fill** – easily accessible from end panel cutout.
- **Battery included.**

Mast/Enclosure

Lighting Coverage	5-7 Acres @ 0.5 foot candles
Mast Height	30'
Mast Material	Zinc Plated
Mast Sections	4
Tower Rotation	360 Deg
Mast Cord	Coiled
Enclosure Material	12 Gauge
Finish/Coating Enclosure	Powder Coat
Finish/Coating Hardware	Zinc Plated
Lockable Doors	Yes
Hinge Material	Aluminum
Fenders	Steel
Outrigger System	3 Point
Forklift Pockets	Standard
Maximum Wind Load	65 MPH

Engine Specifications

Manufacturer	Kubota
Model	D905E
Cylinders	3
Induction System	Naturally Aspirated
Displacement, cc (cu. in.)	898 cc (54)
EPA Emissions Level	Tier 2
HP @ Rated Speed	17
RPM	1800
Bore and Stroke	2.83" x 2.90"
Lubrication Capacity (with filter)	5.4 Qts
Battery Recommendation (min. cold cranking amps)	525

- Battery, battery rack, and cable supplied
- Spin-on oil filter
- Thermostat controlled liquid cooling system
- Glow plugs
- 12V engine alternator
- 12V starter motor

Trailer

Standard Hitch	2" Ball
Trailer Tongue	Removable
Trailer Lights	DOT Approved
Transport Tie-downs	Standard
Tires	205 / 75D14
Towing Speed (MPH)	60

Fuel System Specifications

Fuel Consumption	**GPH**
Full Load	0.5
Approximate Run Time	**Hours**
Full Load	100
Fuel Capacity	
Gallons	50
Fuel	Diesel

Weights and Dimensions

Weight Without Fuel	1800
Dimensions Stowed (L x W x H)	162" x 54" x 73"
Dimensions Extended (L x W x H)	106" x 122" x 396"

Sound Level

Sound level dB(A) 72
Measured @ 7 meters, full load

Engine, Generator Instrumentation

Digital controller with integral hour meter, operator keylock, engine preheat, and engine start selection. Low oil, high temperature, low battery, and overspeed protection with LED indicators.

Receptacle Specifications

120 Volt 20 Amp Duplex GFCI	1
120/240 Volt 30 Amp Twistlock (L630R)	1
Voltage Regulation	± 5%
Frequency	60 Hz

Baldor reserves the right to implement specifications or design changes without notice.

WARNING: Do not connect generator to any building's electrical system unless a disconnect switch has been installed.

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Appendix B:
Discussion for Second Observation Point,
Alton Coal Tract Night Sky Aesthetic Analysis

Appendix B. Discussion of second observation point, Alton Coal Tract night sky aesthetic analysis

9/26/2008

TO: Ben Gaddis, SWCA Environmental Consultants, and discussion group

FM: Chad Moore, NPS Night Sky Program Manager

RE: Discussion of second observation point, Alton Coal Mine night sky aesthetic analysis

Three National Park Service sites have the potential to be impacted by the proposed Alton Coal Mine— Bryce Canyon National Park, Cedar Breaks National Monument, and Zion National Park. Bryce Canyon has the most pristine night skies of the three, and is the closest to the Alton project site. Clearly that is the most important park to analyze impacts to, and there appears to be agreement that Yovimpa Point near the southern end of the park is appropriate for an observation point. This observation point will be modeled by Dark Sky Partners LLC in order to assess night sky aesthetic impacts.

The NPS Night Sky Program recommended today during a teleconference that a second observation point be established. Of the other two parks, Cedar Breaks is more likely to be impacted than Zion. Zion National Park has a slightly brighter (ie. More light polluted) night sky than Cedar Breaks and the majority of the park is at a lower elevation. This lower elevation will minimize potential light pollution from the Alton site due to terrain shielding, and any perceived impact will be proportionally less as compared to the existing sky. Night sky brightness data does exist at two potentially useful sites within Zion— at Lava Point and near the east entrance; so if desired, Zion National Park could be included in Dark Sky Partner's analysis.

Cedar Breaks has several panoramas along the rim, though none of them offer 360 degree views. Because of this, the NPS Night Sky Program chose Brianhead Peak as a representative site. Brianhead allows the NPS system to capture the entire 360 degree panorama from one location, but it is located on Dixie National Forest land approximately 1 mile away from and 1000' above the park boundary. If the modeling by Dark Sky Partners was based on a second observation point at Brianhead, there was concern that results might not be representative of conditions at Cedar Breaks.

The difficulty with using a site within Cedar Breaks is that no all-sky brightness data exists there. With winter approaching, it is unlikely that suitable data could be acquired there before June 2009. While models produced from an observation point within the park (as opposed to at Brianhead Peak) would be slightly more accurate, the portion of the impact to the current condition would be less accurate since no data exists.

To further the discussion, a rough map and sight profile was created for the proposed observation points. Comparing Brianhead with Point Sublime within Cedar Breaks shows that Brianhead has an elevation above the proposed Alton Coal Mine of 4407', while Point Sublime is 3450'. Higher elevation observation points tend to be more exposed to

light pollution, though the difference is relatively minor. Brianhead peak has a slightly higher angle of view to the project site, 1.8 degrees vs. 1.6 degrees from Sublime Point. This is a very small difference and unlikely to have an impact on the modeled sky brightness in my opinion. The third difference is that Brianhead peak is further away, roughly 26.5 miles vs. 24 miles. Using the approximation of Walkers Law, this should result in Brianhead having 22% greater attenuation in light from the project site than Sublime Point; in other words showing less impact. Keep in mind that Cedar Breaks covers a area that ranges from 23 miles to 27 miles distant, so no single observation point will be representative of the entire park. Fourth difference is that Brianhead has slightly less terrain blocking than the Sublime Point observation site. The exact difference between the two will require a far more detailed analysis than is provided here. However, at 1000' above the project site, both sites have a clear view. Since the model employed by Dark Sky Partners begins at the horizon extending upward, I suspect that the terrain blocking issue is moot (though it is certainly a parameter that should be adequately modeled at the Yovimpa Point site at Bryce Canyon). A fifth and final difference between the two sites is that the Brianhead site is likely to have more light pollution than the Cedar Breaks site due to the proximity of the small town of Brian Head. This should result in any analysis at Brianhead showing proportionally less impact to the entire sky.

Either approach has some drawbacks. However, I do not believe that an analysis at Brianhead would overestimate impacts at the nearby park. It appears with this cursory analysis to be more likely to underestimate impacts. The preference of the National Park Service is to exercise the model at a point where we have data and then to be as transparent as possible about how this is extrapolated to represent conditions across a park.

See the graphic attachment (Fig. B-1).

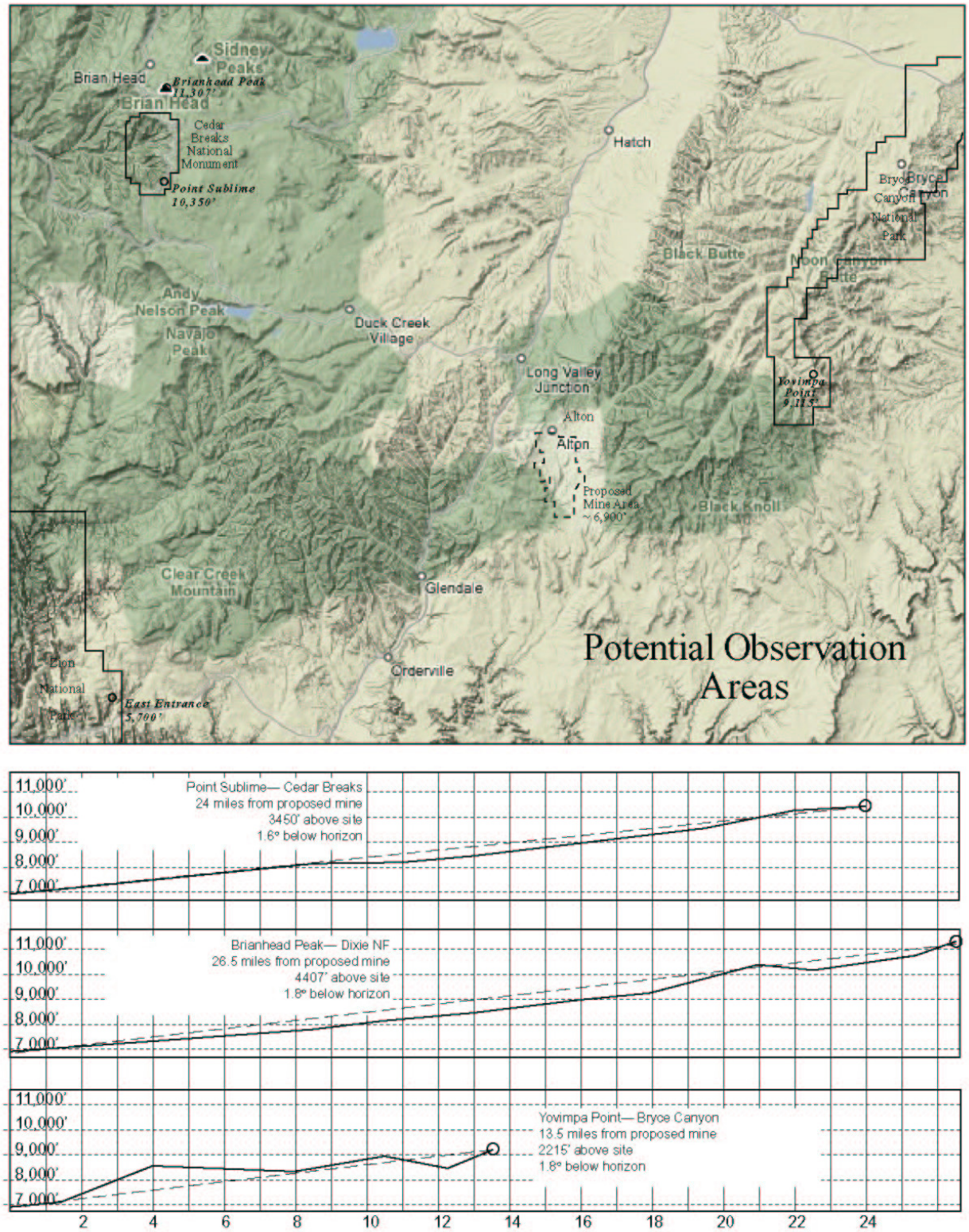

Figure B-1. Observation points and lines-of-site

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Appendix C:
Viewshed Analysis

Appendix C. Viewshed Analysis

The following viewshed analysis is provided by SWCA.

Methods

The viewshed analyses were performed on a mosaic of 5-meter Digital Elevation Model (DEM) datasets using the Spatial Analyst tool within ESRI ArcGIS Desktop. The DEM has a vertical Root Mean Square Error (RMSE) of 4 meters. To account for this potential error plus the height of an observer, the observation points were offset above the DEM by 6 meters. The model accounts for the curvature of Earth, but not tree-cover/obstruction or atmospheric conditions. This provides a conservative estimate of visibility.

One analysis was conducted to model a viewshed as "seen" from 11 observation points within the tract (Figures C-1 and C-3). It indicates any area that may be visible from at least 1 of the 11 points. Ten of the points are within the pit disturbance areas, each representing a location with the greatest local elevation or a location at/near the perimeter of the potential disturbance area. One point represents the center of the area proposed for the facilities location. The extent of the analysis includes both Bryce Canyon National Park and Brian Head Peak.

A separate analysis was conducted to model the viewshed from the highest point of Brian Head Peak, and indicates areas that may be visible from that 1 observation point (Figures C-2 and C-4).

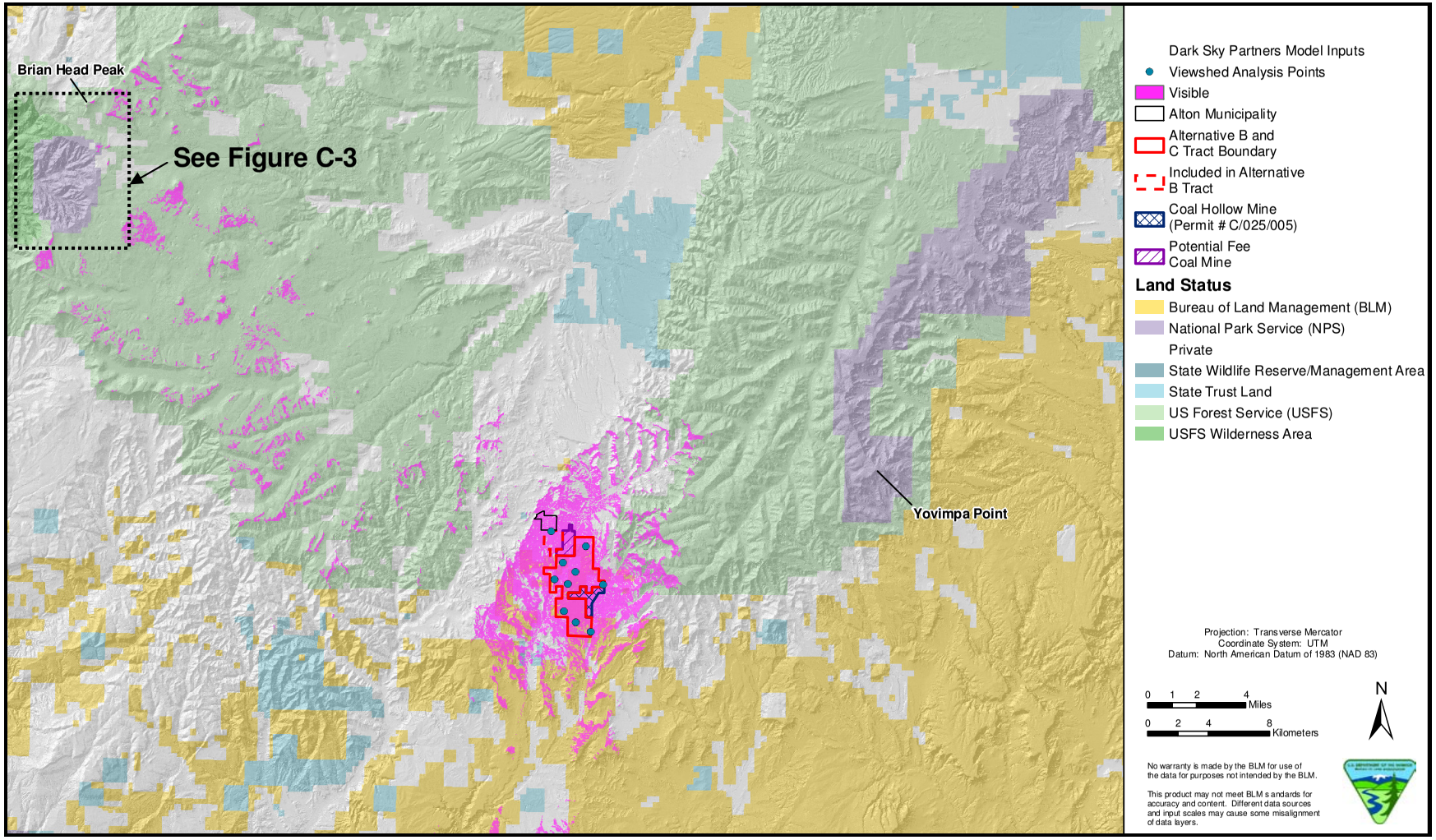

Figure C-1. Points visible (line of sight) from select locations within the Alton Coal Tract (indicated in pink). For detail within Cedar Breaks National Monument see Figure C-3.

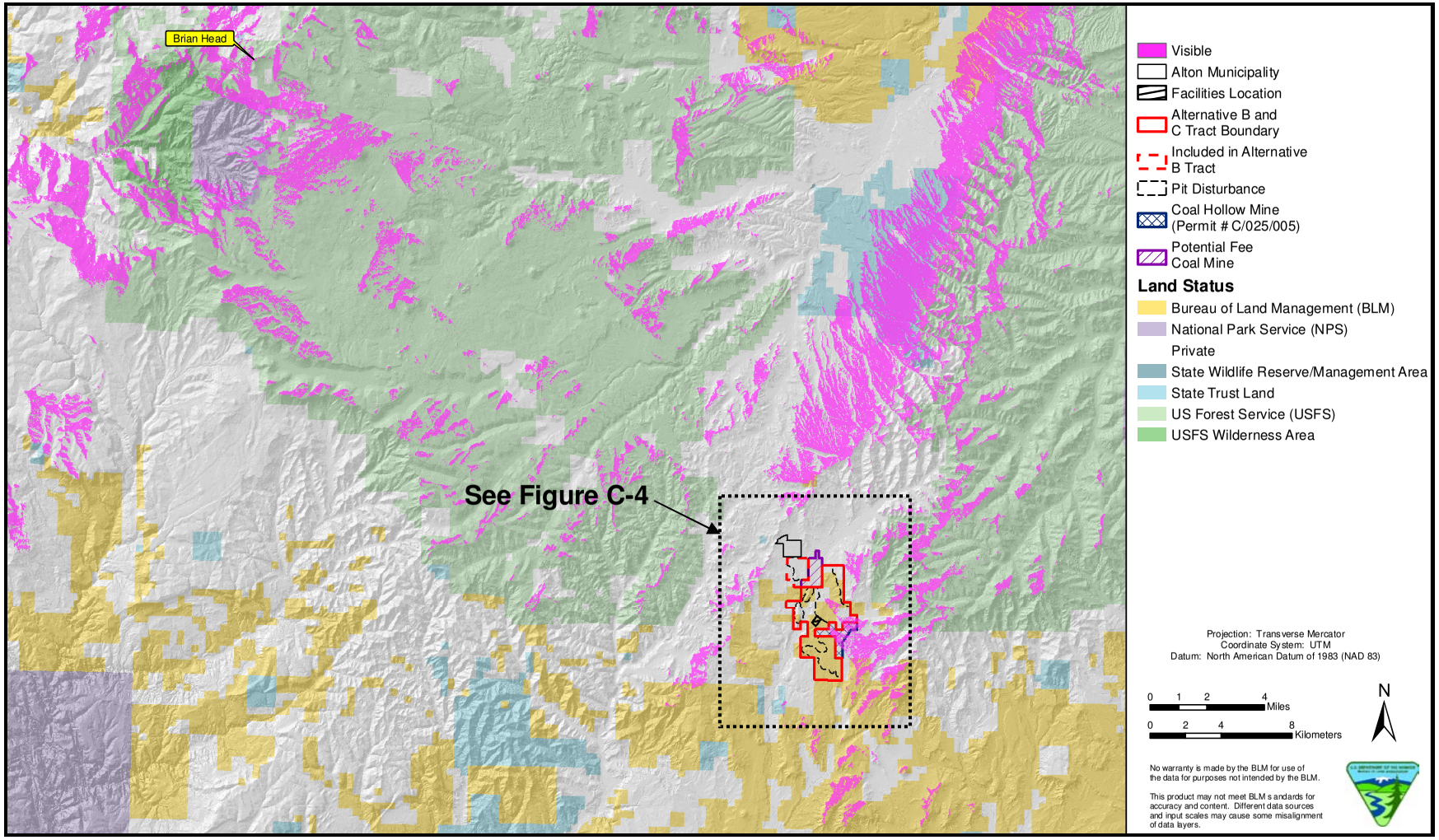

Figure C-2. Points visible (line of sight) from Brianhead Peak (indicated in pink). For detail within the Alton Coal Tract see Figure C-4.

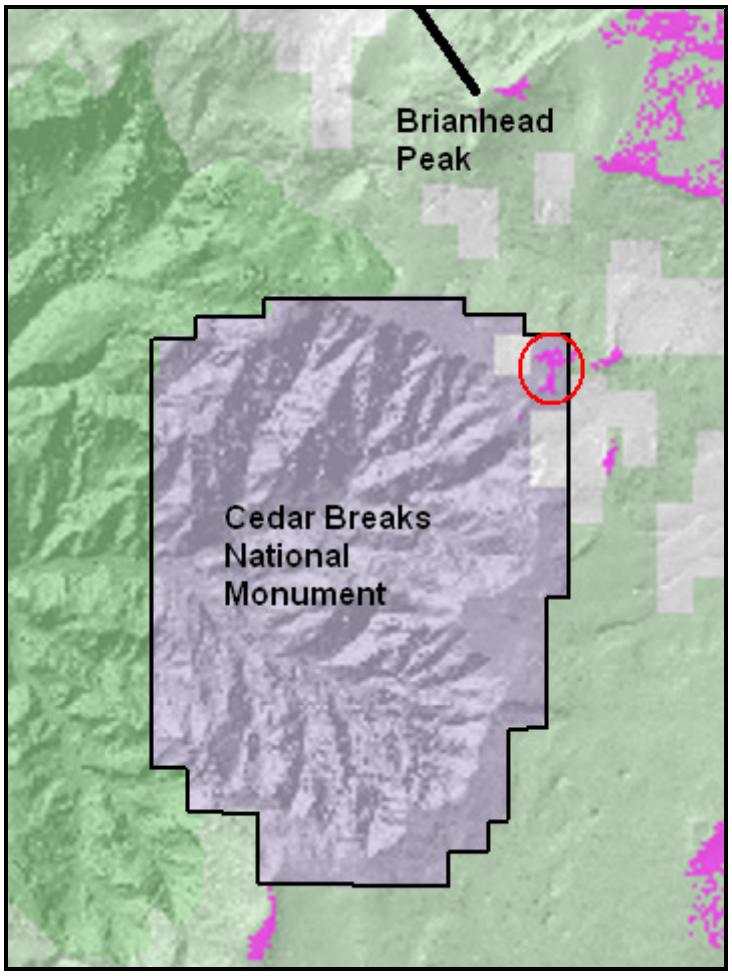

Figure C-3. Portion of Figure C-1 showing Cedar Breaks National Monument (CBNM). The red circle shows a portion of the Markagunt Plateau within CBNM that potentially has direct line-of-sight to portions of the Alton Coal Tract.

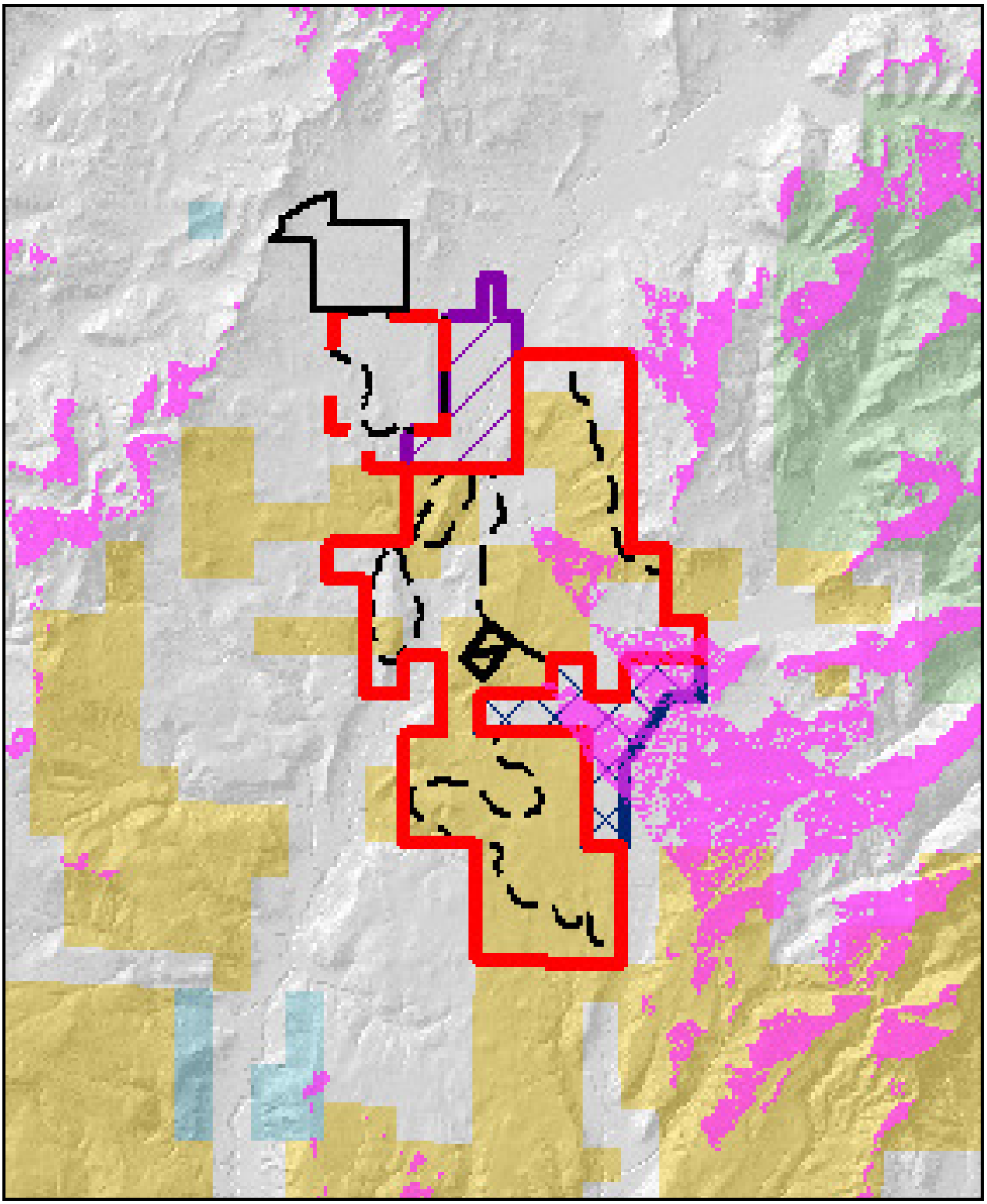

Figure C-4. Detail of Figure C-2 covering Alton Town and the Alton Coal Tract.

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Appendix D:
Shielded Floodlight Fixtures

Appendix D. Shielded floodlight fixtures

MUSCO Lighting
100 1st Avenue West
P.O. Box 808
Oskaloosa, Iowa 52577

800/825-6030
641/673-0411
Fax: 641/673-4852

LSG product

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ATTACHMENT 1.

3/26/2008 MEMO FROM NATIONAL PARK SERVICE NIGHT SKY PROGRAM MANAGER TO SWCA PROJECT MANAGER: DISCUSSION OF SECOND OBSERVATION POINT, ALTON COAL MINE NIGHT SKY AESTHETIC ANALYSIS, AND GRAPHIC ATTACHMENT ACCOMPANYING MEMO

9/26/2008

TO: Ben Gaddis, SWCA Environmental Consultants, and discussion group

FM: Chad Moore, NPS Night Sky Program Manager

RE: Discussion of second observation point, Alton Coal Mine night sky aesthetic analysis

Three National Park Service sites have the potential to be impacted by the proposed Alton Coal Mine— Bryce Canyon National Park, Cedar Breaks National Monument, and Zion National Park. Bryce Canyon has the most pristine night skies of the three, and is the closest to the Alton project site. Clearly that is the most important park to analyze impacts to, and there appears to be agreement that Yovimpa Point near the southern end of the park is appropriate for an observation point. This observation point will be modeled by Dark Sky Partners LLC in order to assess night sky aesthetic impacts.

The NPS Night Sky Program recommended today during a teleconference that a second observation point be established. Of the other two parks, Cedar Breaks is more likely to be impacted than Zion. Zion National Park has a slightly brighter (ie. More light polluted) night sky than Cedar Breaks and the majority of the park is at a lower elevation. This lower elevation will minimize potential light pollution from the Alton site due to terrain shielding, and any perceived impact will be proportionally less as compared to the existing sky. Night sky brightness data does exist at two potentially useful sites within Zion— at Lava Point and near the east entrance; so if desired, Zion National Park could be included in Dark Sky Partner's analysis.

Cedar Breaks has several panoramas along the rim, though none of them offer 360 degree views. Because of this, the NPS Night Sky Program chose Brianhead Peak as a representative site. Brianhead allows the NPS system to capture the entire 360 degree panorama from one location, but it is located on Dixie National Forest land approximately 1 mile away from and 1000' above the park boundary. If the modeling by Dark Sky Partners was based on a second observation point at Brianhead, there was concern that results might not be representative of conditions at Cedar Breaks.

The difficulty with using a site within Cedar Breaks is that no all-sky brightness data exists there. With winter approaching, it is unlikely that suitable data could be acquired there before June 2009. While models produced from an observation point within the park (as opposed to at Brianhead Peak) would be slightly more accurate, the portion of the impact to the current condition would be less accurate since no data exists.

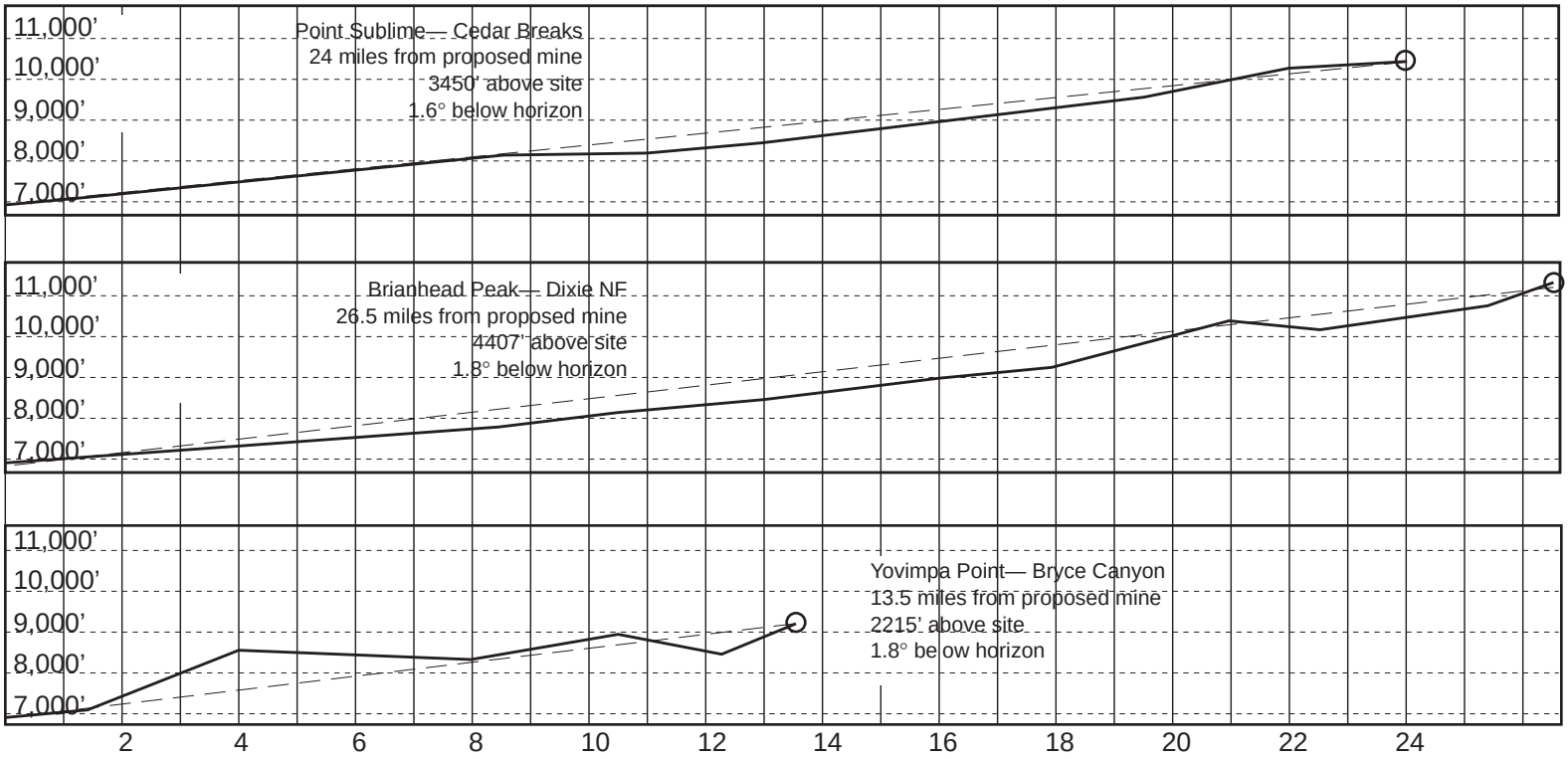
To further the discussion, a rough map and sight profile was created for the proposed observation points. Comparing Brianhead with Point Sublime within Cedar Breaks shows that Brianhead has an elevation above the proposed Alton Coal Mine of 4407', while Point Sublime is 3450'. Higher elevation observation points tend to be more exposed to light pollution, though the difference is relatively minor. Brianhead peak has a slightly higher angle of view to the project site, 1.8 degrees vs. 1.6 degrees from Sublime Point. This is a very small difference and unlikely to have an impact on the modeled sky brightness in my opinion. The third difference is that Brianhead peak is further away,

roughly 26.5 miles vs. 24 miles. Using the approximation of Walkers Law, this should result in Brianhead having 22% greater attenuation in light from the project site than Sublime Point; in other words showing less impact. Keep in mind that Cedar Breaks covers a area that ranges from 23 miles to 27 miles distant, so no single observation point will be representative of the entire park. Fourth difference is that Brianhead has slightly less terrain blocking than the Sublime Point observation site. The exact difference between the two will require a far more detailed analysis than is provided here. However, at 1000' above the project site, both sites have a clear view. Since the model employed by Dark Sky Partners begins at the horizon extending upward, I suspect that the terrain blocking issue is moot (though it is certainly a parameter that should be adequately modeled at the Yovimpa Point site at Bryce Canyon). A fifth and final difference between the two sites is that the Brianhead site is likely to have more light pollution than the Cedar Breaks site due to the proximity of the small town of Brian Head. This should result in any analysis at Brianhead showing proportionally less impact to the entire sky.

Either approach has some drawbacks. However, I do not believe that an analysis at Brianhead would overestimate impacts at the nearby park. It appears with this cursory analysis to be more likely to underestimate impacts. The preference of the National Park Service is to exercise the model at a point where we have data and then to be as transparent as possible about how this is extrapolated to represent conditions across a park.

See the graphic attachment

Sidney Peaks
Brian Head
Brianhead Peak 11,307'
Brian Head
Cedar Breaks National Monument
Point Sublime 10,350'
Hatch
Bryce Canyon National Park
Bryce Canyon
Black Butte
Noon Canyon Butte
Andy Nelson Peak
Navajo Peak
Duck Creek Village
Long Valley Junction
Yovimpa Point 9,115'
Alton
Alton
Proposed Mine Area ~ 6,900'
Black Knoll
Clear Creek Mountain
Glendale
Orderville
Zion National Park
East Entrance 5,700'
Potential Observation Areas


11,000'
10,000'
9,000'
8,000'
7,000'
Point Sublime— Cedar Breaks
24 miles from proposed mine
3450' above site
1.6° below horizon
Brianhead Peak— Dixie NF
26.5 miles from proposed mine
4407' above site
1.8° below horizon
Yovimpa Point— Bryce Canyon
13.5 miles from proposed mine
2215' above site
1.8° be ow horizon
2
4
6
8
10
12
14
16
18
20
22
24

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ATTACHMENT 2.

4/28/2009 CORRESPONDENCE BETWEEN NATIONAL PARK SERVICE AIR RESOURCES DIVISION AND BLM PROJECT MANAGER RE: ALTON COAL MINE LIGHTSCAPE ANALYSIS

United States Department of the Interior
NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, Colorado 80225

4/28/2009

Keith Rigtrup
BLM Project Manager, Alton Coal LBA EIS
BLM Color Country District
176 East DL Sargent Drive
Cedar City, UT 84721

Subject: Alton Coal Mine Lightscape Analysis

Keith,
The mission of the National Park Service includes the mandate to protect scenery. The protection of scenery extends across both day and night, horizontally as viewed from within parks, as well as upward to the sky. Natural Lightscapes are important to national park visitors and are also an element of a natural ecosystem. Such lightscapes are under substantial threat and modification by outdoor lighting. If not properly contained and controlled, light can impact lightscapes up to 300 kilometers away, as has been observed with the impact of large cities on remote parks. Even a small number of lights can potential cause an impact if they are proximal to natural areas.

Through discussion with the BLM and SWCA Environmental Consultants, it was determined that the proposed development of the Alton Coal Mine had the potential to impact natural lightscapes at three national park units— Bryce Canyon National Park, Cedar Breaks National Monument, and Zion National Park. Bryce Canyon has the most pristine night skies of the three, is the closest to the Alton project site, and this resource is highly valued by park visitors and park management. It was decided that Zion would be omitted from the technical analysis since impacts were expected to be the least among the three parks and impacts could likely be extrapolated from Cedar Breaks and Bryce Canyon data. Midway through the technical analysis process, it was determined that both the indirect impact to the night sky (skyglow) and the direct impact to the nighttime viewshed (glare) should be considered. The National Park Service coordinated with Dark Sky Partners LLC (DSP) who were contracted to produce a computer model predicting the impact of the proposed mine lighting. The following is a response to the modeling report "An Assessment of the Impact of Potential Mining Operations at the Alton Coal Tract on the Dark Skies of Bryce Canyon National Park and Cedar Breaks National Monument" and suggested impact findings.

The National Park Service worked with DSP to verify the model input parameters, particularly the atmospheric clarity or "K" factor. The assumptions about light fixture output, position, and pointing appear to be reasonable and the NPS has confidence in the computer model performance based on past collaborations.

The NPS Night Sky Program is working toward a comprehensive and peer-reviewed framework for assessing lightscape impacts, however this product is not yet available and likely more than a year away from fruition. We present here a simple method of weighting the impact of the proposed mine lighting.

Bryce Canyon

Yovimpa Point at the southern end of Bryce Canyon National Park was chosen for the analysis. This site is important from a visitor perspective, and has several night sky brightness data sets collected from there. From this location, given the typical pit location within the mining tract, the light pollution generated by the proposed project is superimposed in the sky against the existing glow from St. George. For this impact analysis, we considered the impact as if the mine skyglow was shifted to the side of the existing St. George glow. This was done for four reasons. 1) The NPS guidance on environmental impact analysis directs us to measure against natural background conditions, 2) small changes in the viewing location from within the park would shift the light dome left or right, 3) changes in the light source within the mine complex would have a similar directional shift, and 4) other light pollution sources have the potential to reduce their light pollution and thus their impact on the parks. In fact, many suburbs of St. George are in the process of changing streetlights to become more night-sky friendly.

The *typical* scenario as modeled by DSP shows that the brightness ratio would only exceed 10% over natural conditions in the lowermost 2 degrees of sky. In the experience of the Night Sky Program and in relative comparison to the other small population centers brightness ratios, such a change to the natural lightscape is unlikely to be noticed by a casual observer, but would likely be noticeable to a keen or trained observer. The extent of the light dome would be well restricted to the lowermost section of sky, and would be less than the glow from almost all small towns surrounding the park. These factors lead us to conclude that the impact prescribed to the mine lighting would not be annoying or measurably reduce the perceived aesthetic quality of the night sky. As such, the impact of the *typical* lighting scenario should be **negligible**.

The *brightest* scenario shows that the brightness would exceed 10% over natural condition in the lowermost 5 degrees of sky. The glow would be comparable to Page, and somewhat less than the combined glow of Kanab and Fredonia. These towns are easily visible to a dark-adapted visitor at Yovimpa Point, and in several other locations in the park as well. Such city glows impact a small fraction of the sky— a much smaller fraction than the light domes from either St. George or Cedar City, and thus have relatively smaller impact. The impact upon the zenith or any area above 20 degrees angular elevation is likely to be unmeasureable and is certainly not noticeable at those higher angles. As pointed out in the analysis by DSP and discussions through the modeling process, the exact impact is highly dependent on very small variations of the placement of the mine lights and their aiming. These factors lead us to conclude that the impact prescribed to the mine lighting would be intermittently and infrequently noticeable and measurable, and would have a perceived impact upon the aesthetic quality of the night sky. As such, we suggest that under the *brightest* scenario, there would be an occasional **minor** impact, which would usually fall below the threshold of **negligible** at most times.

The mine would not be directly visible from Yovimpa Point nor any other area from within the park boundary. Thus, there should be no impact of direct glare from the proposed mine. If future expansions of the mine are proposed that are within the viewshed of the park, the impact of direct glare must be reconsidered and may become a substantial lightscape impact.

Cedar Breaks

Night Sky Brightness data for Cedar Breaks was collected just outside the park boundary atop Brianhead Peak. Using off-site locations is often practiced by the NPS Night Sky Program in order to get a better view of light sources near the horizon. When most light sources are distant, this

approach makes sense and introduces fairly little bias. Thus for assessing the impact of the Alton Mine lighting, Brianhead Peak was chosen.

Cedar Breaks and Brianhead Peak are further from the mine site than Yovimpa Point, and the modeling results show that the skyglow impact produced by both the *typical* and *brightest* scenarios are small. Based on comparisons with other light sources around the park, and the experience of NPS field personnel, a trained observer would likely be unable to detect the *typical* scenario, which of course would be invisible to a casual visitor. Both keen and casual observers would be likely to see the *brightest* scenario, but the impact would be restricted to the lowermost degree of sky and it is not likely to be perceived as annoying even if the light from Cedar City and St. George were removed. In almost all locations within the park, except for the NE corner which is open meadowland and slopes toward the Alton Mine, this skyglow would be obscured by trees or terrain. We suggest that the combination of the limited skyglow and infrequent spatial and temporal visibility combine to render both the *typical* and *brightest* scenarios as **negligible**.

The question of direct glare at Cedar Breaks was also assessed. When by chance pointed directly toward the park, the Alton Mine lights would be very bright. A rough calculation, assuming that 2 of the 4 lights on the portable stanchion were aimed at the park, they would appear as bright as a negative 4.3 magnitude star. This is roughly as bright as the planet Venus and would dominate the nocturnal landscape when looking SE, and is also likely to cast a faint shadow. If considered in isolation, this would be a worrisome impact, however, this lightscape change is only under the infrequent and intermittent *brightest* scenario. Additionally, only one small location within the park would be subject to this lightscape impact. This is the meadow area near the road junction of highways 143 and 148. This section is traveled by visitors at night, but it is not an area where visitors are likely to be seeking natural lightscapes among the occasionally headlights of oncoming cars. During infrequent occurrences at this one location the impact is likely to be **minor to moderate**, though the sum total impact to the park averaged over time and space should be **negligible**.

We would also like to point out that the direct glare from the Alton Mine lighting would often be visible (to varying degrees) from Brianhead Peak and from numerous other locations within the Dixie National Forest. Because the scope of the DSP report and this letter includes only NPS administered lands, this impact was not assessed.

Zion

Though not analyzed, we can interpolate the lightscape impact to Zion national park based on the model runs from Yovimpa Point and Brianhead Peak. In both scenarios, and considering both skyglow and direct glare, the impact to Zion is expected to be **negligible**.

Mitigation

The conditions above where impacts to national parks are not negligible can be effectively mitigated. The National Park Service concurs with the mitigations suggested in the report by Dark Sky Partners. Assuming that reducing hours of operation at night is impractical for the mine operators, reducing lamp intensities and shielding fixtures would in combination sharply reduce both skyglow and direct glare. Retrofitting the proposed portable lighting unit with shielded fixture heads is recommended (see Appendix D), as well as addressing fixed lighting throughout the site.

Conclusions

As presented, lightscape impacts to national parks will be negligible to minor. The intervening terrain blocks much light that would otherwise be a substantial problem for these two parks. The report by Dark Sky Partners has lowered our initial concern over the impact to the outstanding natural lightscapes found in Bryce Canyon, Cedar Breaks, and Zion national parks. However, the report also underscores the necessity to this kind of analysis, especially when in close proximity to parks and where terrain does not fortuitously block stray light. Though the environmental impact is relatively small, we encourage simple and relatively low initial cost mitigations that will sensibly reduce this project's environmental impact.

cc:
Benjamin Gaddis
SWCA Environmental Consultants

Eddie Lopez
Bryce Canyon National Park

Paul Roelant
Cedar Breaks National Park

Jock Whitworth
Zion National Park

APPENDIX J.
VISUAL CONTRAST RATING WORKSHEETS

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)	05.13.2008
District	Kanab Field Office
Resource Area	
Activity (program)	Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name Alton Coal EIS	4. Location UTM - 12 S 0369399 4144477	5. Location Sketch See attached photo
2. Key Observation Point #1 Town of Alton, east side, looking south		
3. VRM Class IV		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Gently rolling hills throughout north south trending valley. Somewhat jagged low rising mountain ranges in the BG.	Distinct stands of rounded juniper interspersed with taller pinyon and low rounded sagebrush and grasses in MG and BG. Tall conical fir trees on mountains to the west.	Bucolic setting. Rectangular geometric structures in town of Alton. Low, flat agricultural fields in FG.
LINE	Hills throughout valley form gentle undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Long angular lines of juniper post barbed wire fences. Geometrical lines of agricultural fields in FG.
COLOR	Area is currently covered in vegetation. Some dull grays and tans visible on mountains in the BG.	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Reflective silver irrigation lines. Buildings and homes are metal, white, tan and earth tones. Vibrant bright green fields in FG.
TEX-TURE	Mountains in BG medium to coarse.	Dense stands of juniper and sage. Medium stands of fir.	Structures are smooth in BG, rougher in the FG. Smooth fields in FG.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators. Flat, rectangular entrance sign to tract would be visible from this point.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X					X				X			
	Line	X					X					X		
	Color		X					X				X		
	Texture		X					X				X		

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

Looking Southwest down KFO Route 116.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)	05.13.2008 – 12:22
District	Kanab Field Office
Resource Area	
Activity (program)	Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name Alton Coal EIS	4. Location UTM - 12 S 0368817 4144280	5. Location Sketch See attached photo
2. Key Observation Point #2 Town of Alton, south end of main street, looking south		
3. VRM Class IV		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Gently rolling hills throughout north south trending valley. Somewhat jagged low rising mountain ranges in MG to the west.	Distinct stands of rounded juniper interspersed with taller pinyon and low rounded sagebrush and grasses in MG and BG. Tall conical fir trees on mountains to the west.	Bucolic setting. Rectangular geometric structures in town of Alton. Low, flat agricultural fields in FG.
LINE	Hills throughout valley form gentle undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Angular lines of juniper post barbed wire fences. Lines of irrigation set-up on a diagonal with large round wheels. Geometrical lines of agricultural fields in FG. Tall vertical trees associated with homes in town.
COLOR	Area is currently covered in vegetation. Some dull grays and tans visible on mountains in the BG.	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Reflective silver irrigation lines. Buildings and homes are metal, white, tan and earth tones. Vibrant bright green fields in FG.
TEX-TURE	Mountains in BG medium to coarse.	Dense stands of juniper and sage. Medium stands of fir.	Structures are smooth in BG, rougher in the FG. Smooth fields in FG.

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LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? __X_ Yes __ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X				X				X				
	Line	X					X				X			
	Color	X					X				X			
	Texture		X				X				X			

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

Looking south from community of Alton.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)	05.13.2008 – 12:360
District	Kanab Field Office
Resource Area	
Activity (program)	Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name	4. Location	5. Location Sketch
Alton Coal EIS	UTM - 12 S 0368843 4145062	See attached photo
2. Key Observation Point #3 Town of Alton, North end of main street, looking south		
3. VRM Class IV		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Gently rolling hills throughout north south trending valley. Sheer sandstone cliff face visible to the east. Somewhat jagged low rising mountain ranges in the BG.	Distinct stands of rounded juniper interspersed with taller pinyon and low rounded sagebrush and grasses in MG and BG. Tall conical fir trees on mountains to the west.	Bucolic setting. Rectangular geometric structures in town of Alton. Mix of new and old homes.
LINE	Hills throughout valley form gentle undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Tall complex trees surrounding homes. Long angular lines of juniper post barbed wire fences. Banded line of road through town. Geometrical lines of agricultural fields in FG.
COLOR	Area is currently covered in vegetation. Some dull grays and tans visible on mountains in the BG where dirt roadways cross terrain.	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Reflective black asphalt road through center of town. Reflective metal roofs. Buildings and homes are metal, white, tan and earth tones. Vibrant bright green fields in FG.
TEX-TURE	Mountains in BG medium to coarse.	Dense stands of juniper and sage. Medium stands of fir.	Structures are smooth in BG, rougher in the FG. Smooth road, rooftops in FG.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X					X					X		
	Line	X					X					X		
	Color		X					X				X		
	Texture		X					X				X		

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

Looking southeast from north end of Alton.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)	05.12.2008 – 1:15
District	Kanab Field Office
Resource Area	
Activity (program)	Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name Alton Coal EIS	4. Location UTM - 12 S 0371206 4138776	5. Location Sketch
2. Key Observation Point #4 From KFO Route 116, looking west and north		
3. VRM Class IV		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Broad, gently rolling hills throughout north south trending valley. Somewhat rugged low rising mountain ranges to the west in the BG.	Patchy stands of juniper interspersed with single trees and low rounded sagebrush and grasses in MG and BG.	Dirt roads cut a narrow band across rolling hills.
LINE	Undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Medium sweeping line of two track dirt road. Horizontal and Vertical lines of wood and wire strand fences.
COLOR	Much of the area is covered in vegetation. Some bright reds and tans are apparent on mountains in the BG	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Tannish gray two track dirt roads – brown and rust colored fence lines.
TEX-TURE	Mountains in BG medium to coarse.	Medium coarse stands of juniper. Dense sagebrush	Structures are smooth in BG, rougher in the FG. Smooth two track roads.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X					X				X			
	Line	X					X				X			
	Color		X					X			X			
	Texture		X				X				X			

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

From KFO Route 116, looking west and north.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)	05.13.2008
District	Kanab Field Office
Resource Area	
Activity (program)	Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name Alton Coal EIS	4. Location UTM - 12 S 0369897 4142626 Elevation 6,877’	5. Location Sketch See attached photo
2. Key Observation Point #5 From KFO Route 116, looking west and north		
3. VRM Class IV		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Broad, gently rolling hills throughout north south trending valley. Somewhat rugged low rising mountain ranges to the west in the BG.	Patchy stands of juniper interspersed with single trees and low rounded sagebrush and grasses in MG and BG.	Dirt roads cut a narrow band across rolling hills.
LINE	Undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Medium sweeping line of two track dirt road. Horizontal and Vertical lines of wood and wire strand fences.
COLOR	Much of the area is covered in vegetation. Some bright reds and tans are apparent on mountains in the BG	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Tannish gray two track dirt roads – brown and rust colored fence lines.
TEX-TURE	Mountains in BG medium to coarse.	Medium coarse stands of juniper. Dense sagebrush	Structures are smooth in BG, rougher in the FG. Smooth two track roads.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators. Sharp geometric lines of operations and maintenance facilities.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators. Square, cleared areas for equipment parking and storage.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators and buildings. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X					X			X				
	Line	X				X				X				
	Color	X					X			X				
	Texture	X					X			X				

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternatives call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

Looking northwest from KFO Route 116 within the tract.

Form 8400-4 (September 1985) UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date (of field work) 05.13.2008 7:00 am District Kanab Field Office Resource Area Activity (program) Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name Alton Coal EIS	4. Location UTM - 12 S 0370961 4141190 Elevation 6,946’	5. Location Sketch See attached photo
2. Key Observation Point #6 From KFO Route 116 at cattle guard, looking northeast, north, and north west		
3. VRM Class IV		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Broad, gently rolling hills throughout north south trending valley. Somewhat rugged low rising mountain ranges to the west in the BG.	Patchy stands of juniper interspersed with single trees and low rounded sagebrush and grasses in MG and BG.	Dirt roads cut a narrow band across rolling hills.
LINE	Undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Medium sweeping line of two track dirt road. Horizontal and Vertical lines of wood and wire strand fences.
COLOR	Much of the area is covered in vegetation. Some bright reds and tans are apparent on mountains in the BG	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Tannish gray two track dirt roads – brown and rust colored fence lines.
TEX-TURE	Mountains in BG medium to coarse.	Medium coarse stands of juniper. Dense sagebrush	Structures are smooth in BG, rougher in the FG. Smooth two track roads.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.

TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X				X				X				
	Line	X				X				X				
	Color		X					X			X			
	Texture		X					X				X		

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

From KFO Route 116 at cattle guard, looking northeast, north, and north west.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)	05.13.2008 8:17 am
District	Kanab Field Office
Resource Area	
Activity (program)	Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name Alton Coal EIS	4. Location UTM - 12 S 0371658 4137465	5. Location Sketch See attached photo
2. Key Observation Point #7 From KFO Route 116 at the south end of the tract looking north.		
3. VRM Class IV		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Broad, gently rolling hills throughout north south trending valley. Somewhat rugged low rising mountain ranges to the west in the BG.	Thick, dense stands of conical shaped junipers. Wide open valley extending to the north full of low grasses mixed with rounded sagebrush.	Dirt road cut a wide band along dense trees through FG. Short vertical fence lines cutting across open valley.
LINE	Undulating, sweeping horizontal lines. Alluvial fans sweep down from mountains at an angle to the valley floor.	Long sweeping line of trees following lines of KFO Route 116. Diffuse edge of stands of juniper sweeping down hills diagonal to mountains in the west.	Medium sweeping line of two track dirt road. Horizontal and Vertical lines of wood and wire strand fences. Geometric ranch structures in the MG.
COLOR	Much of the area is covered in vegetation. Some faint reds and tans are apparent on mountains in the BG	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Tannish gray graded dirt road – brown and rust colored fence lines and structures.
TEX-TURE	Mountains in BG medium to coarse.	Medium coarse stands of juniper. Dense sagebrush	Structures are smooth in BG, rougher in the FG. Smooth graded road.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X				X				X				
	Line	X				X				X				
	Color	X					X				X			
	Texture	X					X				X			

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

Looking northwest from the south end of the tract on KFO Route 116.

APPENDIX K.

AIR RESOURCES IMPACT ASSESSMENT TECHNICAL REPORT FOR THE ALTON COAL LEASE BY APPLICATION DRAFT ENVIRONMENTAL IMPACT STATEMENT

AIR RESOURCES IMPACT ASSESSMENT TECHNICAL REPORT FOR THE ALTON COAL LEASE BY APPLICATION

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared for

Bureau of Land Management
Kanab Field Office
Kanab, Utah

Bureau of Land Management
Utah State Office
Salt Lake City, Utah

Prepared by

Marquez Environmental Services, Inc.
Golden, Colorado

September 2010

In coordination with

SWCA Environmental Consultants
Salt Lake City, Utah

AIR RESOURCES IMPACT ASSESSMENT TECHNICAL REPORT FOR THE ALTON COAL LEASE BY APPLICATION DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared for

Bureau of Land Management
Kanab Field Office
Kanab, Utah

And

Bureau of Land Management
Utah State Office
Salt Lake City, Utah

Prepared By

Marquez Environmental Services, Inc.
Golden, Colorado

In Coordination with

SWCA Environmental Consultants
Salt Lake City, Utah
SWCA Project 12033

September 2010

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ABBREVIATIONS

ACD	Alton Coal Development, L.L.C.
ANC	Acid neutralizing capacity
AQRV	Air quality related value
ARS	Air resource specialists
BACT	Best achievable control technology
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CO	Carbon monoxide
DAT	Deposition analysis threshold
Dv	Deciview
EIS	Environmental impact statement
EPA	Environmental Protection Agency
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FLM	Federal land managers
HAP	Hazardous air pollutant
HNO_3	Nitric acid
IDLH	Immediately Dangerous to Life or Health
IWAQM	Interagency Workgroup on Air Quality Modeling
kg/ha/yr	Kilograms per hectare per year
LAC	Level of acceptable change
LBA	Lease by Application
LNCM	Lands necessary to conduct mining
LOP	Life of project
MEI	Maximally exposed individual
MEQ	Microequivalents per liter

MLA	Mineral Leasing Act of 1920
MLE	Most likely exposure
N	Nitrogen
NAAQS	National ambient air quality standards
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NO_2	Nitrogen dioxide
NO_3	Nitrate
NO_x	Oxides of nitrogen
NH_4	Ammonia
NSR	New Source Review
OSM	Office of Surface Mining Reclamation and Enforcement
O_3	Ozone
PAP	Permit application package
PM_{10}	Particulate matter less than or equal to a nominal 10 microns in aerodynamic size
$PM_{2.5}$	Particulate matter less than or equal to a nominal 2.5 microns in aerodynamic size
ppb	Parts per billion
Protocol	Air resources impact assessment protocol
PSD	Prevention of significant deterioration
QA/QC	Quality assurance/quality control
REL	Reference exposure level
RfC	Reference concentrations for chronic inhalation
RFD	Reasonably foreseeable development
RFFA	Reasonably foreseeable future actions
RMP	Resource management plan
S	Sulfur
SO_2	Sulfur dioxide

SO_4	Sulfate
TSP	Total suspended particulate
UAAQS	Utah ambient air quality standards
UDNR-DOGM	Utah Department of Natural Resources – Division of Oil, Gas, and Mining
$\mu g/m^3$	Micrograms per cubic meter
URF	Unit risk factor
USGS	U.S. Geological Survey
VOC	Volatile organic compound

1 INTRODUCTION

Marquez Environmental Services, Inc. (MESI) has prepared this Air Resources Impact Assessment Technical Report to quantify potential air resource impacts from mining operations on and related to the Alton Coal Lease by Application Tract (the Alton Coal Tract or tract). The analysis provided herein was performed in accordance with the Air Resources Impact Assessment Protocol (Protocol) prepared by SWCA Environmental Consultants (SWCA) in partnership with MESI, with exceptions and justifications for changes noted herein. The methodologies in the protocol were provided prior to study initiation to ensure that the approach, input data, and computation methods are acceptable to the Bureau of Land Management (BLM). Air resource stakeholders had the opportunity to review the Protocol and provide input before the study was initiated. The tract location in southwestern Utah requires the examination of mining and cumulative source impacts within the proposed air resources modeling domain shown on Map 1.1 from emission sources in southwestern Utah (all maps are contained in Appendix A).

The analysis was based on a conceptual mine design and a set of planned and known mitigation strategies. The analysis is intended to be conservative to accommodate foreseeable emissions under a various mining scenarios. A detailed mine plan has not yet been developed. An approved detailed mine plan would be subject to state permitting requirements and would be subject to appropriate dispersion modeling at that time, as well as detailed operation and mitigation strategies.

The modeling domain was dimensioned in accordance with guidance provided by an interagency air resources stakeholder group. The modeling area covers nearly 40 million acres of land including sensitive areas such as Bryce Canyon National Park, Capitol Reef National Park, Great Basin National Park, Grand Canyon National Park, and Zion National Park, and various other public lands surrounding the tract (see Map 1.1). The air impact assessment used the EPA's recommended guideline model, AERMOD, to analyze potential near-field impacts of mining operations on the tract on ambient levels of criteria pollutants near the Alton Coal Tract. In addition to the near-field analysis, potential impacts from mining operations on the tract on air quality related values (AQRV) at more distant, sensitive locations were analyzed. This far-field modeling analysis used the CALMET/CALPUFF modeling systems.

1.1 Work Tasks

The air resources analysis addressed the impacts to ambient air quality and AQRVs from (1) potential air emissions from coal mining on the tract; (2) potential air emissions from transporting mined coal from the mine site to the reasonably foreseeable loadout location (see Map 1.5); and (3) air emissions from other documented regional emission sources in the modeling domain (cumulative air resource impacts). Ambient air quality impacts were quantified and compared to applicable state and federal standards, and AQRV impacts (impacts on visibility [regional haze], acid deposition, and potential increases in acidification to acid sensitive lakes) were quantified and compared to applicable thresholds as defined in the Federal Land Managers' (FLMs') Air Quality Related Values Workgroup (FLAG), IWAQM guidance documents (FLAG 2000; IWAQM 1998), and other state and federal agency guidance. Carbon dioxide emissions resulting from mining and transporting coal and from coal combustion were estimated and are included in the EIS greenhouse gas analysis. Impact assessment criteria are discussed further in Section 5.0.

The assessment of impacts included completion of the following tasks:

- Generate emission inventories for mining operations on the tract and coal haul transportation operations on the reasonably foreseeable coal haul transportation route (see Section 2.0);
- Compile a regional emission inventory including specified permitted sources, reasonably foreseeable development (RFD), and reasonably foreseeable future actions (RFFA) (see Section 2.0);
- Assess near-field ambient impacts from emissions resulting from mining operations on the tract and coal haul transportation operations on the reasonably foreseeable coal haul transportation route (see Sections 3.0 and 5.0);
- Assess far-field ambient direct and cumulative impacts including pollutant concentration, visibility and acid deposition impacts at Class I areas and at selected Class II areas within the modeling domain (see Sections 4.0 and 5.0);
- Estimate carbon dioxide emissions resulting from mining and transporting coal, and coal combustion.

2 EMISSION INVENTORY

The project emission inventory considered emissions of oxides of nitrogen (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less a nominal 10 micrometers in aerodynamic diameter (PM_{10}), particulate matter less a nominal 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$), volatile organic compounds (VOCs), hazardous air pollutants (HAPs) (i.e., acetaldehyde, acrolein, benzene, formaldehyde, toluene, and xylenes for generators), and carbon dioxide (CO_2). Emission estimates were compiled for mining and related operations and for other existing and reasonably foreseeable future sources.

Although it is recognized that secondarily formed $PM_{2.5}$ and ozone emissions will be generated, only primary pollutant emissions were included as part of the emissions inventory. The $NO_{x,,}$ SO_x, and VOC gases emitted have the potential to secondarily form $PM_{2.5}$ particles. $PM_{2.5}$ formation from these precursors is highly uncertain, and varies both regionally and seasonally due to atmospheric conditions. Typically, emission inventory calculations lead to higher values than those derived from receptor models, and there is no consensus on differences in $PM_{2.5}$ emission estimates from re-entrained dust (FHA, 2010). Ozone formed secondarily from photochemical reactions occurs away from a source and is therefore, not regarded as a near field pollutant.

The pollutants considered in the impacts analysis are discussed in Sections 3.0 and 4.0. Results of the mining emission inventory are included in Appendix B.

2.1 Project Emissions

Emissions from construction activities and coal production activities were considered as project emissions. Primary sources are related either to fuel use in internal combustion engines or to dust emitted into the air from various sources. Both of these sources are described in detail below. For coal production emissions the maximum development year was considered as representative of all years of mining. This approach results in a more conservative estimate of yearly emissions and a more conservative analysis. However, most years of mining would result in fewer emissions than the maximum development year.

2.1.1 *Construction Emissions*

The initial construction activities would include development of the access road, site preparation for the fixed facilities (e.g., crushers, conveyors, generators, office and maintenance buildings, etc.), development of the main haul road, delivery of materials and equipment to the mine, and other construction vehicle activity. Because detailed construction plans have not been developed, the construction emission inventory focused exclusively on particulate matter. The total suspended particulate (TSP) emission factor for heavy-construction operations from Section 13.2.3 of *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Areas Sources* (AP-42) (EPA 2008) is E = 1.2 tons/acre/month. Based on the emission factors for unpaved roads (AP-42, Section 13.2.2), the PM_{10} emission factor is 30% of the TSP factor, and the $PM_{2.5}$ emission factor is 10% of the PM_{10} factor. For the purpose of this inventory, it was assumed that 36 acres would be disturbed by construction activities. Six acres would be disturbed each month for six months. For a copy of AP-42 Sections 13.2.2, Unpaved Roads, and 13.2.3, see Appendix C.

2.1.2 *Production Emissions*

Sources of pollutant emissions during coal production include particulate matter emissions and fuel-combustion emissions. Both surface and underground mining were considered. For surface mining, both a 200-foot and 300-foot overburden thickness was evaluated for Alternatives B and C. Emissions were calculated for 24 hours per day, 7 days per week, 52 weeks per year. The total number of operating days per year was assumed to be 365.

Particulate matter emissions from surface mining (fugitive dust) can come from

- topsoil loading, unloading, and hauling (two options: scrapers or front-end loader and trucks);
- overburden blasting, overburden truck loading, unloading, and hauling;
- coal loading, unloading, hauling, crushing, screening, conveying, and storage;
- vehicle traffic on improved and unimproved gravel or dirt roads as well as paved roads;
- wind erosion of disturbed areas;
- train loading;
- bulldozer and front-end loading activities; and
- underground mining operations.

Emissions were calculated for 200-foot and 300-foot overburden removal thickness for Alternatives B and C. Dust mitigation measures such as watering and chemical spraying were considered in the emissions inventory. The fugitive dust emission factors for particulate sources were taken from AP-42 Sections 13.2.1 and 13.2.2 as well as Section 11.9 – Western Surface Coal Mining (see Appendix C) (EPA 2008). Use of these emission factors requires detailed specifications for production activities and equation variables. Because no detailed mine plan has been developed, a list of assumptions was established for the reasonable maximum year of mining activities. These assumptions are provided in tabular form in Appendix B along with the results of the emission inventory. On-road motor vehicle emissions for employee vehicles and haul trucks were calculated using Utah Department of Environmental Quality, Division of Air Quality (DAQ) mobile source emission factors.

Particulate emissions from underground mining were estimated for additional coal handling, loading, and hauling. Because no detailed conceptual underground mining plan exists, it is assumed that the auger mining method would be used. The auger mining assumption is conservative. Other methods could be used, but auger mining would probably result in the most coal dust emissions. Coal haul trucks and coal loading for the underground operations were assumed to be the same as the surface mining operations. The train loading emission factor from AP-42 11.9-4 was used to estimate emissions from coal dumping from two highwall miners.

Fuel-combustion emissions (NO_x, SO_2, CO, PM_{10}, $PM_{2.5}$, VOCs, HAPs, and CO_2) can come from generators and vehicles. Generating capacity requirements for the surface mining operations were assumed to be 2,000 kW, and the underground mining operations were assumed to require an additional 3,000 kW of power. New Source Performance Standards (NSPS) required by 40 CFR 60 Subpart IIII were applied to the generators; however, the regulation requires the use of Tier 4 emission standards developed by the Environmental Protection Agency (EPA 2004) for nonroad diesel engines. The Tier 4 standards were used for the generators and the nonroad diesel engines. Use of ultra-low-sulfur diesel fuel for vehicles and generators was also considered in the inventory. Vehicle and generator emission factors were derived from the above referenced rules as well as manufacturer information for specific vehicles and equipment that match the assumptions in Appendix B.

From a modeling perspective and in line with the logistics of auger or highwall mining, the generators would be located outside the underground workings.

On-road vehicles would include coal haul trucks (see Appendix B) and employee vehicles. The coal haul trucks would travel 110 miles each way. The average employee would travel 30 miles each way. On-road motor vehicle emissions were calculated using the Utah Division of Environmental Quality (UDEQ) 2005 mobile source (Mobile 6) emission factors for Kane County. These data were the most recent available. The Mobile 6 sulfur dioxide emission factors were adjusted to account for a more restrictive gasoline sulfur standard than was assumed in the state's analysis. The Mobile 6 data did not include emission factors for HAPs.

2.2 Cumulative Emission Inventory

The cumulative emission inventory is composed of 1) an inventory of the currently planned coal haul transportation route emissions; and 2) an inventory of proposed emission sources within a 300 × 300–km area (see Map 1.1). The cumulative inventory includes the identification/evaluation of permitted source changes (increases or decreases), RFFA, and RFD. A summary of the cumulative emission inventory is presented in Appendix D.

2.2.1 *Existing Source Modifications Inventory/Reasonably Foreseeable Future Actions Inventory*

It is assumed that all existing permitted emission sources are included in the background concentrations estimates presented in Table 3.1. There will be some reasonable emission variations over time for these sources. Unless information obtained from the state(s) shows that a source went through a permit modification, the emission changes are assumed to be part of expected variation and are not included in the inventory of changed or added sources.

As such, the emission inventory was developed for Title V major modifications and new minor or major source permits that occurred after September 1, 2008. The data were obtained from the state air quality regulators (e.g., Utah, Nevada, and Arizona) within the emission inventory domain shown in Map 1.1.

2.2.2 *Reasonable Future Development Sources*

RFD sources are proposed sources and include new sources expected from BLM- and USFS-related activity such as oil and gas development and mining. Oil and gas commissions in the various states and other state agencies also provided information on planned new emission-producing sources. Due to the uncertainty in projected traffic increases on the existing road network, only project related transportation increases were considered. RFFA and RFD data sources are listed in Table 2.1.

Table 2.1. Sources of Information for Potential Reasonably Foreseeable Future Actions and Reasonably Foreseeable Development in the Modeling domain

NEPA Documents, Land Use Plans, and Personnel	Disposition	Notes	Reference
Oil and Gas Leasing on Lands Administered by the Dixie National Forest DEIS	Dixie and Fishlake NF oil field development are included as point sources in cumulative modeling. Tables in Appendix D (see Tables for Dixie Point Sources, Volume Sources, and Area Sources; Fishlake Point Sources, Volume Sources, and Area Sources).		USFS 2008.
BLM Kanab Field Office RMP	90 new production wells over 20 years (4.5 wells per year); no production or drilling of coalbed methane wells; no oil wells.	In addition to Oil and Gas, the following sources are included in the Kanab report:	BLM 2006.
BLM Kanab Field Office Mineral Potential Report	**Use highest projected pollutant emissions for oil and gas + area sources listed below; incorporate as an area source (2631 acres ~4 square miles=total area disturbed by new wildcat drilling, O and G development wells, and seismic data in KPA); Tables in Appendix D.**	Coal Mining: the projected mine is Alton	BLM 2006.
	- Will include Lands and Realty, Livestock grazing, off-hwy vehicles, resource roads, saleable minerals, vegetation	Lands and Realty, Livestock Grazing: small area source, Off highway vehicles	
	- Eliminated coal mining (projected mine is Alton)	Resource Roads, Saleable Minerals, Vegetation	
	- Eliminated prescribed burning because it is intermittent and regulated such that it occurs during favorable met conditions.	Prescribed burns: 103,000 cumulative acres	
	See Kanab Tables in Appendix D		

Table 2.1. Sources of Information for Potential Reasonably Foreseeable Future Actions and Reasonably Foreseeable Development in the Modeling domain

NEPA Documents, Land Use Plans, and Personnel	Disposition	Notes	Reference
BLM Richfield Field Office RMP	Oil Well and non- oil well activities, Alt A and B have the same emissions; 30 wells per year; Disturbance area not available so ratioed from Kanab - 6X as big as Kanab.	In addition to Oil and Gas, the following sources are included in the Richfield report:	BLM 2008b.
	Use highest projected pollutant emissions for oil and gas + area sources listed below; incorporate as an area source (24 square miles); Tables in Appendix D.	Coal: Appears these are the coal mines north of I70 that are not in our domain	
	- Will include Lands and Realty, Livestock grazing, off-hwy vehicles, resource roads, saleable minerals, vegetation	Lands and Realty, Livestock Grazing: small area source, Off highway vehicles	
	- Eliminated coal mining (outside domain)	Resource Roads, Saleable Minerals, Vegetation	
	See Richfield Tables in Appendix D		
BLM Cedar City Field Office Personnel	No sources to add: Geothermal activity is not included for the following reasons: Emissions from geothermal are from short term drilling. Area has been developed for geothermal so activity is a continuation of an on-going development pattern, therefore should be considered part of baseline.	Four new geothermal wells annually in Sulfurdale Area	BLM 2009.
BLM St. George Field Office Personnel	No sources to add	Kanab data and Utah DEQ (St George turbines) represent activity in this area. Lorraine Christian did not provide additional data.	BLM 2009a.
BLM Ely Field Office	No sources to add	No contact; very edge of domain; narrow eastern part of Nevada; indications from other Nevada research indicate there is little if any activity in this area; therefore this was not pursued further.	
BLM Las Vegas Field Office	No sources to add	Lisa Christiansen did not provide additional data.	BLM 2009a.
BLM Arizona Strip Field Office	No sources to add: EIS for the Arizona Strip did not consider Air Quality	Lorraine Christian did not provide additional data.	BLM 2007; 2009b.
Utah DEQ: Permit Actions	Two new gas turbines at St George City Power; Table attached (see Utah Tab)	Stack height and diameter estimated; other stack parameters available	UDAQ 2009.

Table 2.1. Sources of Information for Potential Reasonably Foreseeable Future Actions and Reasonably Foreseeable Development in the Modeling domain

NEPA Documents, Land Use Plans, and Personnel	Disposition	Notes	Reference
Arizona DEQ: Permit Actions	EPA PSD permit: Modification to Navajo Generating Station carbon monoxide increase 36,750 TPY, NOx decrease 22,386 TPY; Three emission units: each 775 feet tall, 34.75 feet in diameter, 122 deg F, exhaust, 2,130,000 ACFM, 106 ft/sec; Coordinates of the center stack are: UTM Zone 12, 465346 E, 4084322 N. no new Title V sources	AZ DEQ did not provide additional data.	EPA 2009; ADEQ 2009.
Nevada DEQ: Permit Actions	No sources to add	Have list of Mesquite/Bunkerville sources; Clark City sources existed prior to cut-off date; no new sources in Lincoln City portion of domain; Toquop Energy Project is outside domain.	CCN 2009; NDEP 2009.
Utah DOT	No Sources to add	Studies are primarily for the northern corridors. Exceptions: St George Dixie Drive Interchange EA had a Finding of No Significant Impact (8/25/2009). The project is not expected to have air quality impacts.	

3 CRITERIA POLLUTANT NEAR-FIELD MODELING

Near-field analysis, as used here, means the airshed within a 50 × 50–km area with the Alton Coal Tract in the center. Near-field analysis was conducted to assess impacts to public health and welfare and to estimate potential impacts to lakes and viewsheds in nearby (near-field) national parks.

To disclose the environmental consequences of the development of the Alton Coal Lease, a detailed analysis of the potential near-field impacts of the applicable pollutants was required. In particular, a near-field ambient air quality impact assessment was performed to quantify maximum-modeled pollutant impacts near the tract. To demonstrate that air quality–related standards and parameters are protected requires the development of short-term (hourly and daily) and long-term emission rates of regulated pollutants, application of regulatory-approved models to quantify predicted concentrations, and a comparison of predicted impacts plus applicable background concentrations (RFD/RFFA sources) with applicable standards.

The EPA's guideline model, AERMOD (version 09292), was the refined air dispersion model used to assess these near-field impacts and to verify compliance with the applicable NAAQS in the ambient airshed that encloses the Alton Coal Lease Tract. As development of the lease spans a 19–23-year window with varying degrees of surface disturbance and associated air emissions, the modeling analysis focused on the reasonable maximum development year (therefore, the reasonable maximum emission year) for the mine. Using this anticipated maximum potential emission year, the AERMOD dispersion model was used to analyze potential near-field impacts from direct emissions of PM_{10}, $PM_{2.5}$, nitrogen dioxide (NO_2), carbon monoxide, and sulfur dioxide. Regulatory changes to the NAAQS NO_2 and SO_2 standards occurred during the project analysis. Due to the timing of these regulatory changes in relation to the project analysis, assessment of the new 1-hour NO_2 and SO_2 standards was not incorporated in the draft EIS. Photochemical conversion of NO_x and VOCs to O_3 and the secondary formation of $PM_{2.5}$ concentrations from NO_x and SO_2 emissions were not included in the analysis. These chemical reactions are not considered to be near-field impacts, and they cannot be simulated with the recommended near-field model (AERMOD).

For each modeled pollutant, a significant impact analysis was conducted to help assess the areal extent of the potential impact of emissions associated with the development of the Alton Coal Lease Tract. The AERMOD predicted concentrations were used to verify compliance/non-compliance with the applicable NAAQS, Class II PSD increments, and other standards deemed applicable such as visibility parameters defined by the FLAG. The analysis considered existing regional sources using background ambient pollutant concentrations and RFD sources. An inventory of representative background pollutant concentrations was compiled from the involved agencies (e.g., UDAQ and BLM) to represent cumulative near-field impacts from the existing regional sources surrounding the proposed tract (see Table 3.1). In addition, a proposed inventory of RFD sources was incorporated into the final cumulative dispersion modeling analysis. The following paragraphs outline our proposed approach in detail.

3.1 Modeling Methodology

The most recent version of the EPA-promulgated AERMOD dispersion model (version 09292) was used for this analysis. AERMOD was run in regulatory default mode and deposition was only considered for assessing the final PM_{10} modeled ambient air impacts. Deposition was not considered for any other pollutants, including $PM_{2.5}$. The BEEST (Oris Solutions, version 9.82a) graphical modeling interface was used to set up the near-field modeling runs, including the source layout of the overburden removal areas,

coal pits, reclamation area, facilities area, and onsite road layouts. However, for the final cumulative near-field model runs it was necessary to utilize the BEEST generated input files and run AERMOD on machines equipped with multi-core processors to complete all of the runs. The same source locations in the near-field analysis were incorporated into the far-field CALPUFF modeling. Base elevations for all sources associated with the Alton Coal Tract were determined using the AERMAP terrain processor. Thus, for consistency, the modeled receptor grid and modeled mine source elevations were determined using the same method by utilizing the seamless National Elevation Data (NED) terrain files downloaded from the USGS as derived from satellite data.

Appropriate surface characteristics representative of the terrain surrounding the surface meteorological station, Cedar City, were provided by Mr. Dave Prey of UDAQ (UDAQ 2009) as part of the AERMOD-ready dataset. No changes were made to any of the meteorological files provided by UDAQ. Given the expansive nature of the surface-mining operations that may occur on the Alton Coal Tract, building downwash was not a factor in determining reasonable maximum development year potential impacts at the lands necessary to conduct mining (LNCM) boundaries (for Maximum Development Year Layout see Map 1.6).

3.1.1 *Receptors*

As part of this near-field modeling analysis, a defined Cartesian receptor grid and reasonable estimate of the proposed facility boundary was established to ascertain the potential impacts in publicly accessible areas surrounding the Alton Coal Tract. Receptors were placed along the proposed LNCM boundary. Because the primary pollutants of concern are fugitive dust, including PM_{10} and $PM_{2.5}$, maximum impacts from the proposed mining sources would be along or near the LNCM boundary. Nested receptor grids were used beyond the fence line, centered on the Alton Coal Tract LNCM. A fine grid using 100-m spacing was used out to 1 km from the LNCM boundary, and a coarse grid using 500-m spacing was employed from 1 km out to 10 km from the applicable LNCM. Finally, an outer grid with 1,000-m spacing from 10 km out to 25 km and 2,500-m spacing out to 50km was used. Individual discrete receptors were placed within each Class I area and selected Class II area. Specifically, receptors from the NPS website were used for modeling potential impacts at Class I areas. Furthermore, additional receptors with 500-m spacing were placed along the western boundary of the Bryce Canyon National Park, as this is the closest aspect to the Alton Coal Tract of all of the Class I areas of concern.

Receptors were placed along the SR-136 road, which will have to be relocated during the lifetime of the mine and will still be open to public use. This road will run through the tract and will remain at least 100 feet from the right-of-way (ROW). Modeled receptors were placed at 100-m intervals along the proposed relocated road in the tract and extend up to the intersection with Main Street in the Town of Alton. Potential receptors along the road were assumed to be a minimum of 25 m from the edge of the road.

Receptor elevations were determined utilizing the seamless National Elevation Data (NED) terrain files downloaded from the USGS website. Terrain data were processed with the AERMAP terrain processor utilizing the NED files in GeoTIFF format as required in the most recent version of AERMAP. This processor assigns an actual satellite-derived elevation to each receptor.

3.1.2 *Meteorological Data*

Based on correspondence with Mr. David Prey of the UDAQ, the surface meteorological data most representative for this site are from Cedar City, Utah (UDAQ 2008). These surface data were processed with upper air data collected at Desert Rock, Nevada, which is the closest upper air station to Cedar City. For this near-field analysis, a four-year meteorological dataset (from 2005–2008) was utilized. These data

were processed by the air group at UDAQ and received via email in August of 2009 (UDAQ 2009). No additional processing had to be completed and the data were model-ready for use in AERMOD.

The AERMET system uses both surface and upper air measurements to estimate profiles of wind, turbulence, and temperature in the planetary boundary layer. Minimum meteorological data requirements to run AERMET generally include horizontal wind speed, horizontal wind direction, ambient temperature, surface characteristics (albedo, Bowen ratio, and surface roughness), solar radiation and temperature change with height or cloud cover, and a morning upper air sounding. The surface characteristics determinations were made by UDAQ as part of their processing of the four-year meteorological dataset. These surface characteristics are representative of the area around Cedar City, the surface meteorological station. A representative windrose from Cedar City (Figure 3.1) indicates that prevailing winds are from the south-southwest. A distinct bimodal trend is not apparent at this location.

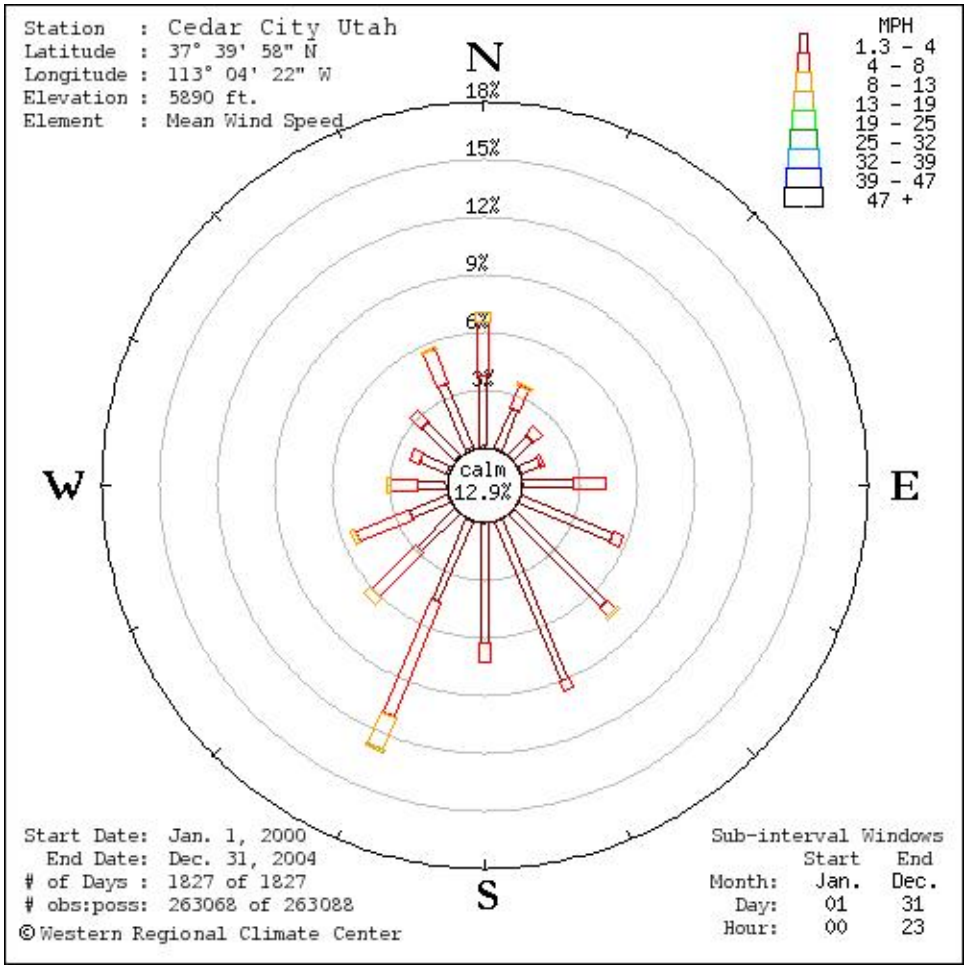

Figure 3.1. Windrose generated from Cedar City meteorological data.

3.1.3 *Alton Coal Lease Emission Inventory*

The proposed emission inventory development for the reasonable maximum development year of mining operations on the Alton Coal Tract is provided in Chapter 2 and Appendix B. Based on proposed development projections, the model year chosen for the emission inventory is the reasonable maximum

development year of mine progression. It is anticipated that the maximum development year would occur near the end of overall mine development. However, the reasonable maximum development year of mine progression is intended to be representative of the potential emissions associated with any single year of mining.

Because the exact location of fugitive dust and tailpipe emissions from project traffic and coal removal is impossible to pinpoint, a series of area or volume sources was used to estimate emissions from these sources. The total annual fugitive dust and tailpipe emissions were apportioned equally to be representative of area sources in the tract. Travel distances were based on the assumptions in the inventory development. For the purpose of modeling the coal loading and overburden removal activities areas, the open pit source option in AERMOD was utilized, given that both of these activities will occur well below grade in the main pit.

It was anticipated that some blasting will occur as part of the overburden and coal removal process. These emissions represent short-term sources of nitrogen oxides and PM_{10} that were modeled as area sources in this near-field analysis.

Electrical power generation for mining operations will be supplied through a combination of diesel generators as described in Section 2. The two generators were modeled as point sources at the anticipated location within the facilities area.

Base elevations for all sources associated with the Alton Coal Tract were determined using the AERMAP terrain processor. Thus, the modeled receptor grid and modeled mine source elevations were determined using the same method and most recent NED data available from the USGS website for consistency.

3.1.4 *Cumulative Sources (RFD, RFFA, and existing source modifications)*

The cumulative impacts modeling analysis considered both the maximum development year from the proposed Alton tract development sources as well as an inventory of proposed emission sources. These sources were described in Section 2. For the purpose of this analysis, it is assumed that all existing permitted emission sources are included in the background concentration estimates presented in Table 3.1.

For the near-field analysis, emissions from hauling coal along the circuitous route from the town of Alton to the rail loadout facility near Cedar City were not explicitly modeled, given the vast number of additional volumes sources that needed to be added to the model. Any impacts from the offsite coal haul road are remote and will not impact the modeled concentrations around the proposed Alton mine. However, the potential impacts from coal hauling on this long road were assessed by modeling an individual segment of road as a means of verifying that the coal haul truck traffic would not pose any NAAQS issues (see Section 3.1.6). Refer to Section 4.0 for a discussion of the planned coal haul transportation route and how it was handled in the far-field modeling.

Table 3.1. Near-field Analysis Background Ambient Air Quality Concentrations (µg/m^3)

Pollutant	Averaging Period	Measured Background Concentration
Carbon monoxide[1]	1-hour	1 ppm (1,150 µg/m^3)
	8-hour	1 ppm (1,150 µg/m^3)
NO_2[1]	Annual	17 µg/m^3
PM_{10}[2]	24-hour	72 µg/m^3
$PM_{2.5}$[3]	24-hour	8.6 µg/m^3
	Annual	3.6 µg/m^3
SO_2[1]	3-hour	20 µg/m^3
	24-hour	10 µg/m^3
	Annual	5 µg/m^3

[1] UDAQ 2008. Data based on estimates from the UDAQ.

[2] UDAQ 2010. PM_{10} data from UDAQ used for private Alton Mine.

[3] Measured $PM_{2.5}$ data obtained from NPS website for Bryce Canyon National Park.

3.1.5 *Criteria Pollutant NAAQS Analysis – AERMOD Results*

Background pollutant concentrations were used as an indicator of existing conditions in the region, and were assumed to include those from industrial emission sources in operation and from mobile, urban, biogenic, and other non-industrial emission sources. These background concentrations were added to modeled near-field mining–related impacts to calculate total ambient air quality impacts.

The primary pollutants of concern for this analysis are PM_{10}, $PM_{2.5}$, carbon monoxide, nitrogen dioxide, and sulfur dioxide. Model-predicted concentrations resulting from emissions due to mining operations on the tract were added to the currently acceptable background levels, and the resulting cumulative concentrations were compared to the relevant NAAQS to determine potential health impacts at nearby receptors. For this air resources assessment, modeled concentrations are compared to the PSD increments. These comparisons are made for informational purposes only, and the analyses described herein are not intended to be, nor should be interpreted as a regulatory increment consumption analysis. Modeled concentrations using the indicated averaging periods were compared to the following applicable thresholds.

Table 3.2. Applicable Ambient Air Quality Criteria

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)[1]	PSD Class II increment ($\mu g/m^3$) [2]
NO_2 [3]	Annual	100	25
PM_{10}	24-hour (highest fifth high)	150	30
$PM_{2.5}$	Annual	15	N/A
	24-hour (average of highest 1st high)	35	N/A
CO	8-hour (highest second high)	10,000	N/A
	1-hour (highest second high)	40,000	N/A
SO_2 [3]	Annual	80	20
	24-hour (highest second high)	365	91
	3-hour (highest second high)	1,300	512

[1] National Ambient Air Quality Standards from 40 CFR Part 50

[2] PSD increments from 40 CFR Part 51.166

[3] The impacts assessment does not include the recently promulgated 1-hour NO2 and SO2 standards due to their promulgation dates.

Compliance with the respective annual standards was based on the highest modeled value for each year of the four-year meteorological dataset. Demonstration of compliance with the short-term NAAQS (24-hour, 8-hour, 3-hour, and 1-hour) for carbon monoxide, nitrogen dioxide, and sulfur dioxide was based on the highest second-high modeled concentration for each year of the four-year meteorological period, added to the respective background concentrations listed above. Per an EPA memo from March 23, 2010, *Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS*, compliance demonstrations with the 24-hour $PM_{2.5}$ standard can use the average of the first highest 24-hour concentration in each year over the length of the meteorological data period. This approach is a conservative surrogate for comparison to the highest second-high modeled concentration for each modeled year. Finally, compliance with the 24-hour PM_{10} standard was verified against the highest fifth-high modeled concentration over the 4-year period (as documented in EPA 40 CFR Part 51, Appendix W). Only four years of meteorological data were available for the modeling. Based on UDAQ recommendations, the highest fifth high concentration was used for the comparison to the NAAQS, rather than the highest sixth high associated with five years of meteorological data. All modeled concentrations were rounded to match the form of the appropriate NAAQS. A detailed description of the modeling results for each pollutant follows.

3.1.5.1 PM_{10} AERMOD RESULTS

The modeled PM_{10} concentrations associated with the maximum development year are summarized here. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance under each action alternative. Alternative B is based on the assumption that one primary pit would be used for the coal extraction, whereas Alternative C is based on the assumption that there would two pits used for the coal extraction. Results are presented in the tables below for the 24-hour highest fifth-high PM_{10} concentration over the four-year modeled dataset for both 200-foot and 300-foot scenarios.

Table 3.3. Highest Fifth-high PM_{10} Modeling Results

200-foot Overburden Removal Scenario, Alternative B							
Pollutant	**Modeled Years**	**Receptor Location**		**Modeled ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**Total ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**
		UTME	**UTMN**				
PM_{10}	2005-2008	368000	4142900	82.7	72	150	150
200-foot Overburden Removal Scenario, Alternative C							
Pollutant	**Modeled Years**	**Receptor Location**		**Modeled ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**Total ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**
		UTME	**UTMN**				
PM_{10}	2005-2008	368000	4142900	83.6	72	160	150

Table 3.4. Highest Fifth-high PM_{10} Modeling Results

300-foot Overburden Removal Scenario, Alternative B							
Pollutant	**Modeled Years**	**Receptor Location**		**Modeled ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**Total ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**
		UTME	**UTMN**				
PM_{10}	2005-2008	368000	4142900	86.3	72	160	150
300-foot Overburden Removal Scenario, Alternative C							
Pollutant	**Modeled Years**	**Receptor Location**		**Modeled ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**Total ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**
		UTME	**UTMN**				
PM_{10}	2005-2008	368000	4142900	92.9	72	160	150

The 200-foot overburden scenario under Alternative B complies with the NAAQS at all modeled receptors. However, under the dual pit Alternative C, there is a modeled exceedance off of the northwest side of the LNCM. Similarly, the 300-foot modeling results indicate modeled exceedances at a few receptors off of the northwest side of the LNCM.

3.1.5.2 $PM_{2.5}$ AERMOD RESULTS

Modeled $PM_{2.5}$ concentrations associated with the maximum development year are summarized here. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance under each action alternative. Alternative B is based on the assumption that one primary pit would be used for the coal extraction, whereas Alternative C is based on the assumption that there would be two pits used for the coal extraction. Model results in the tables below for the 24-hour averaging period indicate the highest first-high for each modeled year for both 200-foot and 300-foot scenarios. For

comparison to the NAAQS, the average of the high first-high 24-hour values is compared to the standard of 35 µg/m^3.

Table 3.5. $PM_{2.5}$ Modeling Results

200-foot Overburden Removal Scenario, Alternative B

Pollutant	Model Year	Average Period	Receptor Location UTME	Receptor Location UTMN	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
$PM_{2.5}$	2005	24-hour	370466	4142644	17.2	8.6	26	35
		Annual	370466	4142644	4.2	3.6	8	15
	2006	24-hour	370466	4142644	21.0	8.6	30	35
		Annual	370466	4142644	4.4	3.6	8	15
	2007	24-hour	370466	4142644	17.3	8.6	26	35
		Annual	370466	4142644	4.7	3.6	8	15
	2008	24-hour	370466	4142644	21.8	8.6	30	35
		Annual	370466	4142644	4.2	3.6	8	15
	Average	24-hour			19.3	8.6	28	35

200-foot Overburden Removal Scenario, Alternative C

Pollutant	Model Year	Average Period	Receptor Location UTME	Receptor Location UTMN	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
$PM_{2.5}$	2005	24-hour	370466	4142644	18.8	8.6	27	35
		Annual	370466	4142644	4.5	3.6	8	15
	2006	24-hour	370466	4142644	22.9	8.6	32	35
		Annual	370466	4142644	4.8	3.6	8	15
	2007	24-hour	370466	4142644	18.9	8.6	28	35
		Annual	370466	4142644	5.1	3.6	9	15
	2008	24-hour	370466	4142644	23.7	8.6	32	35
		Annual	370466	4142644	4.6	3.6	8	15
	Average	24-hour			21.1	8.6	30	35

Table 3.6. $PM_{2.5}$ Modeling Results

300-foot Overburden Removal Scenario, Alternative B

Pollutant	Model Year	Average Period	Receptor Location		Modeled (µg/m³)	Background (µg/m³)	Total (µg/m³)	NAAQS (µg/m³)
			UTME	UTMN				
$PM_{2.5}$	2005	24-hour	370494	4143467	21.5	8.6	30	35
		Annual	370478	4142741	5.0	3.6	9	15
	2006	24-hour	370465	4142595	23.8	8.6	32	35
		Annual	370470	4142741	5.5	3.6	9	15
	2007	24-hour	370470	4142741	20.4	8.6	29	35
		Annual	370470	4142741	6.0	3.6	10	15
	2008	24-hour	370600	4143660	25.1	8.6	34	35
		Annual	370470	4142741	5.8	3.6	9	15
	Average	24-hour			22.7	8.6	31	35

300-foot Overburden Removal Scenario, Alternative C

Pollutant	Model Year	Average Period	Receptor Location		Modeled (µg/m³)	Background (µg/m³)	Total (µg/m³)	NAAQS (µg/m³)
			UTME	UTMN				
$PM_{2.5}$	2005	24-hour	370494	4143467	23.3	8.6	32	35
		Annual	370478	4142741	5.4	3.6	9	15
	2006	24-hour	370465	4142595	25.7	8.6	34	35
		Annual	370470	4142741	6.0	3.6	10	15
	2007	24-hour	370470	4142741	22.1	8.6	31	35
		Annual	370470	4142741	6.5	3.6	10	15
	2008	24-hour	370600	4143660	27.0	8.6	36	35
		Annual	370470	4142741	6.2	3.6	10	15
	Average	24-hour			24.5	8.6	33	35

Both the 200-foot and 300-foot modeled concentrations comply with the NAAQS at all modeled receptors and for both action alternatives.

3.1.5.3 NITROGEN DIOXIDE AERMOD RESULTS

The modeled nitrogen dioxide concentrations associated with the maximum development year are summarized below in Table 3.7 and 3.8. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. Because the estimated nitrogen oxide emissions for Alternative B and C are the same, separate model runs were not necessary within each of the overburden scenarios. A 75% ozone correction was applied to all annual nitrogen oxide modeling results in accordance with EPA's Ambient Ratio Method as a way to estimate ambient annual nitrogen dioxide concentrations from

modeled nitrogen oxides emission rates. For comparison to the annual NAAQS, the highest annual concentration from each modeled year was compared to the standard of 100 µg/m^3.

Table 3.7. Annual Maximum Nitrogen Dioxide Modeling Results

200-foot Overburden Removal Scenario

Pollutant	Model Year	Receptor Location UTME	Receptor Location UTMN	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
NO_2	2005	370466	4142644	27.8	17	45	100
	2006	370466	4142644	29.6	17	47	
	2007	370466	4142644	31.6	17	49	
	2008	371610	4140400	30.2	17	47	

Table 3.8. Annual Maximum Nitrogen Dioxide Modeling Results

300-foot Overburden Removal Scenario

Pollutant	Model Year	Receptor Location UTME	Receptor Location UTMN	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
NO_2	2005	370473	4142837	83.9	17	101	100
	2006	370471	4142789	92.7	17	110	
	2007	370471	4142789	99.9	17	117	
	2008	370471	4142789	97.4	17	114	

The 200-foot modeled concentrations indicate compliance with the annual NAAQS at all modeled receptors. However, under the 300-foot overburden removal scenario, there are a few exceedances of the annual NAAQS along the northwest side of the LNCM just west of the primary pit activity area.

3.1.5.4 CARBON MONOXIDE AERMOD RESULTS

The modeled carbon monoxide concentrations associated with the maximum development year are summarized below. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. Because the estimated carbon monoxide emissions for Alternative B and C are the same, separate model runs were not necessary within each of the overburden scenarios. The applicable averaging periods for comparison to the carbon monoxide NAAQS include the 1-hour and 8-hour averaging periods.

Table 3.9. Carbon Monoxide Modeling Results

200-foot Overburden Removal Scenario

Pollutant	Model Year	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
			UTME	UTMN				
CO	2005	1-hour	370487	4143273	2,283	1,150	3,433	40,000
		8-hour	370471	4142789	582	1,150	1,732	10,000
	2006	1-hour	370484	4143176	2,567	1,150	3,717	40,000
		8-hour	370466	4142644	485	1,150	1,635	10,000
	2007	1-hour	370481	4143079	2,639	1,150	3,789	40,000
		8-hour	371610	4140400	519	1,150	1,669	10,000
	2008	1-hour	370479	4143031	2,416	1,150	3,566	40,000
		8-hour	370466	4142644	486	1,150	1,636	10,000

Table 3.10. Carbon Monoxide Modeling Results

300-foot Overburden Removal Scenario

Pollutant	Model Year	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
			UTME	UTMN				
CO	2005	1-hour	370700	4143660	5,358	1,150	6,508	40,000
		8-hour	370474	4142789	1,383	1,150	2,533	10,000
	2006	1-hour	370700	4143660	5,643	1,150	6,793	40,000
		8-hour	370700	4143660	1,060	1,150	2,210	10,000
	2007	1-hour	370650	4143660	4,980	1,150	6,130	40,000
		8-hour	370473	4142837	1,047	1,150	2,197	10,000
	2008	1-hour	370650	4143660	5,249	1,150	6,399	40,000
		8-hour	370700	4143660	939	1,150	2,089	10,000

Both 200-foot and 300-foot modeled concentrations indicate compliance with the 1-hour and 8-hour NAAQS at all modeled receptors.

3.1.5.5 SULFUR DIOXIDE AERMOD RESULTS

The modeled sulfur dioxide concentrations associated with the maximum development year are summarized below. The potential sulfur dioxide emissions associated with the mining activities are nominal but modeling was still completed. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. Because the estimated sulfur dioxide emissions for Alternative B and C are the same, separate model runs were not necessary within each of the overburden scenarios. The applicable averaging periods for comparison to the sulfur dioxide NAAQS include the 3-hour, 24-hour, and annual averaging periods.

Table 3.11. Sulfur Dioxide Modeling Results

200-foot Overburden Removal Scenario

Pollutant	Model Year	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
			UTME	UTMN				
SO_2	2005	3-hour	370479	4143031	1.49	20	21	1,300
		24-hour	370466	4142644	0.41	10	10	365
		Annual	370466	4142644	0.09	5	5	80
	2006	3-hour	370484	4143176	1.51	20	22	1,300
		24-hour	370466	4142644	0.41	10	10	365
		Annual	370466	4142644	0.09	5	5	80
	2007	3-hour	370481	4143079	1.64	20	22	1,300
		24-hour	370466	4142644	0.41	10	10	365
		Annual	370466	4142644	0.10	5	5	80
	2008	3-hour	370478	4142983	1.47	20	21	1,300
		24-hour	370468	4142692	0.47	10	10	365
		Annual	371610	4140400	0.09	5	5	80

Table 3.12. Sulfur Dioxide Modeling Results

300-foot Overburden Removal Scenario

Pollutant	Model Year	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
			UTME	UTMN				
SO_2	2005	3-hour	370700	4143660	1.71	20	22	1,300
		24-hour	370473	4142837	0.45	10	10	365
		Annual	370471	4142789	0.11	5	5	80
	2006	3-hour	370700	4143660	1.90	20	22	1,300

Table 3.12. Sulfur Dioxide Modeling Results

300-foot Overburden Removal Scenario								
Pollutant	**Model Year**	**Average Period**	**Receptor Location**		**Modeled ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**Total ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**
			UTME	**UTMN**				
		24-hour	370471	4142789	0.47	10	10	365
		Annual	370471	4142789	0.13	5	5	80
	2007	3-hour	370600	4143660	1.84	20	22	1,300
		24-hour	370650	4143660	0.47	10	10	365
		Annual	370471	4142789	0.14	5	5	80
	2008	3-hour	370700	4143700	1.76	20	22	1,300
		24-hour	370494	4143467	0.46	10	10	365
		Annual	370471	4142789	0.13	5	5	80

Both 200-foot and 300-foot modeled concentrations indicate compliance with the respective 3-hour, 24-hour and annual NAAQS at all modeled receptors.

3.1.6 *Assessing Coal Haul Road Impacts*

The haul roads within the mine and the access road were included in the mine modeling. Due to model limitations, the entire long haul road could not be incorporated into the model. Impacts associated with the circuitous, offsite coal haul road were assessed using two methods. First, the long haul road was incorporated in the near-field modeling by attaching 39 volume sources depicting a segment of the long haul road starting from the intersection of the access road and long haul road. This segment of the long haul road extended into the less densely spaced receptors and was included to assure that impacts from the long haul road were incorporated at the high receptor locations during the maximum emissions year.

In addition, to assess potential impacts from this paved coal haul road in areas well removed from the proposed mining activity area, another method was used to determining maximum potential impacts at receptors along the road. In particular, a 1 km segment of theoretical road, using emissions determined in the inventory, was modeled using receptors spaced at 25-m intervals out to 250 m from the edge of the road. It was assumed that the closest potential receptor to the paved roadway used for coal transport would not be any closer than 25 m from the edge of the road to account for roadway easements. Also, a few different source-receptor elevation couplings were used to verify that the impacts from the coal truck traffic would not pose any violations of the applicable NAAQS. Per the AERMOD users manual guidance (EPA 2004b), in the case of long and narrow volume sources such as a haul road, the spacing between individual volume sources should not be greater than twice the width of the volume source. Given the modeled haul road width of up to 30 m, the 1 km segment of road was broken up into 50-m segments, for a total of 20 volume sources. The total emissions for the length of the road were then apportioned accordingly down to 1 km segments and then down to 50-m segments. The 1 km road segment was modeled at the same elevation as the receptors, 25 m above and below the receptors, and both 50 m above and below the receptors. Given the relatively hilly nature of the haul road route close to Alton, an assumed hill height of 300 m was used as input to AERMOD, which requires this parameter. In addition, both a north-south and east-west road orientations were modeled to verify that any juxtaposition of the road and receptors would be captured.

The modeled PM_{10}, $PM_{2.5}$, nitrogen dioxide and carbon monoxide impacts associated with the coal haul road truck traffic do not contribute to offsite NAAQS compliance concerns. The apportioned modeled emission rates from each 50 m spaced volume source along the 1 km road are the same for all coal removal scenarios and are as follows:

- 0.00914 g/s PM_{10}
- 0.000365 g/s $PM_{2.5}$
- 0.001449 g/s nitrogen dioxide
- 0.001582 g/s carbon monoxide

The highest modeled concentrations occurred when the source-receptor elevations were set to the same elevation, assumed flat terrain. In addition, of the two modeled orientations of the road (north-south and east-west), the maximum impacts were associated with the theoretically placed north-south oriented road, which was expected based on the Cedar City windrose. The maximum modeled concentrations always occurred at a the closest row of receptors located 25 m from the edge of the haul road and when the source-receptor pairings were all at the same elevation. Table 3.13 lists the maximum modeled concentrations for each pollutant and applicable averaging period, all of which comply with the NAAQS.

Table 3.13. Haul Road Only (representative segment) Maximum Modeling Results

Pollutant	Modeled Years	Averaging Period	Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM_{10}	2005-2008	24-hour	55.1	72	127	150
$PM_{2.5}$	2005-2008	24-hour	1.8	8.6	10	35
		Annual	0.7	3.6	4	15
NO_2	2005-2008	Annual	3.2	17	20	100
CO	2005-2008	1-hour	53	1,150	1,181	40,000
		8-hour	17	1,150	1,166	10,000

* All max modeled values occur when source-receptors are at same elevation

sulfur dioxide emissions from the additional coal truck traffic on the paved haul road were not modeled as they were deemed insignificant. This analysis verifies that there should be no NAAQS concerns associated with the long, paved haul road and it also alleviates the issue of having to model a 100-mile long volume source, which severely impacts the AERMOD model iteration time by orders of magnitude.

3.1.7 *HAP Impact Assessment*

Hazardous air pollutants can cause various adverse health effects. They are not part of the NAAQS, but high levels at the property boundary could indicate the need for further analysis and/or mitigation strategies. Therefore, HAPs have been included in the emission inventory and were modeled in the AERMOD near-field analysis. The modeled concentrations have been compared with known health exposure levels as a means of assessing potential impacts. The Reference Exposure Levels (RELs) are for assessing acute inhalation exposures (i.e. one-hour average) and represent the concentration at or below which no adverse health effects are expected. The Reference Concentrations (RfC) represent an estimate of the chronic inhalation exposure (i.e. annual average) rate to humans, including sensitive subgroups (children and elderly), without an appreciable risk of harmful effects. Both the RfC and REL guideline values listed below are for non-cancer effects.

Table 3.14. Acute RELs

HAP	Averaging Period	REL (µg/m^3)
Benzene	1-hour	1,300 [1]
Toluene	1-hour	37,000 [1]
Xylene	1-hour	22,000 [1]
n-Hexane	1-hour	390,000 [2]
Formaldehyde	1-hour	94 1

[1] EPA Air Toxics Database, Table 2 (EPA 2007).

[2] No REL available for these HAPs. Values shown are from Immediately Dangerous to Life or Health (IDLH/10), EPA Air Toxics Database, Table 2 (EPA 2007).

Table 3.15. Non-carcinogenic HAP RfCs

HAP	Averaging Period	Non-carcinogenic RfC 1 (µg/m^3)
Benzene	Annual	30
Toluene	Annual	5,000
Xylenes	Annual	100
n-Hexane	Annual	700
Formaldehyde	Annual	9.8

EPA Air Toxics Database, Table 1 (EPA 2007).

In addition to the RfC and REL, the State of Utah has adopted Toxic Screening Levels (TSLs), which are applied during the air permitting process to assist in the evaluation of potential HAP emissions. The TSLs are derived from Threshold Limit Values (TLVs) published in the American Conference of Government Industrial Hygienists (ACGIH) – "Threshold Limit Values for Chemical Substances and Physical Agents." These TLVs are based on exposure limits to a healthy adult in the work place. The TSLs adopted by UDAQ are more stringent and represent screening levels that, if exceeded, would suggest that additional information is needed to substantiate that the model-predicted concentrations would not expose sensitive individuals to potential health risks. Thus, the TSLs in Table 3.16 were compared against modeled concentrations for each HAP in the emissions inventory.

Table 3.16. Utah Toxic Screening Levels (TSLs)

HAP	Averaging Period	Toxic Screening Levels [1] (µg/m^3)
Benzene	24-hour	53
Toluene	24-hour	2,512
Xylene	24-hour	14,473
n-Hexane	24-hour	5,875
Formaldehyde	1-hour	37

[1] Utah Department of Environmental Quality (2007).

To assess long-term exposure from carcinogenic HAP emissions, traditional risk assessment methods were used and the risk for the maximally exposed individual (MEI) and most likely exposure (MLE) were compared to the significance criterion of one additional cancer per one million exposed persons (1x10-6). For the MEI risk, it is assumed that a person is exposed continuously for the life of the mine, assumed to be up to 23 years in this case. For the MLE risk, an exposure adjustment is made to assess the amount of time that a family stays away from the home (64% of the day) and how long a family lives at a given residence (nine years) (EPA 2007). Exposure adjustment factors of 0.33 for the MEI (23/70) and 0.095 for the MLE [(9/70)*((0.64*1)+(0.36*0.25))] were applied to the estimated cancer risk to account for the actual time that an individual could be exposed during a 70-year lifetime. Table 3.17 lists the applicable chronic inhalation cancer risk factors for benzene and formaldehyde.

Table 3.17. Carcinogenic HAP RfCs and Exposure Adjustment Factors

Analysis[1]	HAP Constituent	Carcinogenic Annual RfC (Risk Factor) [2] 1/(µg/m^3)	Exposure Adjustment Factor
MLE	Benzene	7.8 × 10-6	0.0949
MLE	Formaldehyde	1.3 × 10-5	0.0949
MEI	Benzene	7.8 × 10-6	0.33
MEI	Formaldehyde	1.3 × 10-5	0.33

[1] MLE = most likely exposure; MEI = maximally exposed individual.

[2] EPA Air Toxics Database, Table 1 (EPA 2007).

3.1.8 *HAP AERMOD Results*

The potential emissions of HAPs associated with this project are relatively insignificant. The only quantifiable source of HAPs from the Alton Coal lease in the emissions inventory is the proposed generators. The potential HAP emissions are the same for the 200-foot and 300-foot overburden scenarios, as well as the Alternative B and C pit layouts. As such, only one model iteration was completed for each HAP to estimate potential impacts in the immediate vicinity of the mine. No additional background sources were modeled given the localized nature of the mine impacts. As seen in Tables 3.18a and 3.18b, no adverse impacts associated specifically with the Alton sources are anticipated.

Table 3.18a. HAPs AERMOD Modeling Results

Pollutant	Model Years	Average Period	Receptor Location		Modeled (µg/m$^{3)}$	Threshold (µg/m^3)
			UTME	UTMN		
Benzene	2005-2008	1-hour	371800	4140300	0.440	1,300 (REL)
		24-hour	368400	4142500	0.046	53 (TSL)
		Annual	370060	4140000	0.003	30 (RfC)
Toluene	2005-2008	1-hour	371800	4140300	0.160	37,000 (REL)
		24-hour	368400	4142500	0.017	2,512 (TSL)
		Annual	370060	4140000	0.001	5,000 (RfC)
Xylenes	2005-2008	1-hour	371800	4140300	0.110	22,000 (REL)
		24-hour	368400	4142500	0.011	14,473 (TSL)
		Annual	370060	4140000	0.001	100 (RfC)
Formaldehyde	2005-2008	1-hour	371800	4140300	0.045	37 (TSL)
		Annual	370060	4140000	0.0003	9.8 (RfC)

Table 3.18b. HAPs Risk Analysis

Analysis[1]	HAP Constituent	Carcinogenic Annual RfC (Risk Factor)[2] 1/(µg/m^3)	Exposure Adjustment Factor	Modeled (µg/m^3)	Calculated Risk	Significance Criterion
MLE	Benzene	7.80E-06	0.0949	0.003	2.2E-09	1.00E-06
MLE	Formaldehyde	5.50E-09	0.0949	0.0003	1.6E-13	1.00E-06
MEI	Benzene	7.80E-06	0.33	0.003	7.7E-09	1.00E-06
MEI	Formaldehyde	5.50E-09	0.33	0.0003	5.4E-13	1.00E-06

[1] MLE = most likely exposure; MEI = maximally exposed individual.

[2] EPA Air Toxics Database, Table 1 (EPA 2007).

3.2 Near-field VISCREEN Analysis

The VISCREEN model was designed to determine whether a plume from a facility may be visible from a given vantage point. The primary variables that affect whether a plume is visible or not at a given location include the quantity of emissions, type of emissions, relative location of the emission source and the observer, and the background visibility range. Typically, VISCREEN is used for analyzing plume impacts from point sources. However, it can also be applied to virtual point sources, such as mining operations.

Specifically, VISCREEN was used to assess potential visibility impacts within the near-field modeling grid at Bryce Canyon National Park. The closest distance to Bryce Canyon National Park is approximately 18 km east-northeast of the proposed Alton mine. Two levels of VISCREEN were used for

this analysis of the of the visibility impacts from the proposed mining of the Alton Coal Tract. The primary pollutants of concern that impact visibility in the near-field are particulate matter and nitrogen oxide.

3.2.1 *Level-1 Analysis*

The Level-1 screening used the maximum hourly emission rates of PM_{10} and nitrogen oxide as determined in the emission inventory section, a default particle size and density, and conservative meteorological conditions to assess potential plume impacts on visibility in Bryce Canyon National Park. The most conservative meteorological conditions are assumed to be category F stability and a wind speed of 1.0 m/s. The default thresholds used to determine if Level-1 screening results are favorable, include the following:

- A Delta E value of <= 2, and
- A green contrast value of <= absolute value of 0.05.

The Delta E value is the color difference parameter and was developed to specify the perceived magnitude of color and brightness changes. The Delta E value is used as the basis for determining the perceptibility of plume visual impacts. The green contrast value is the contrast at a given wavelength of two colored objects such as plume/sky or plume/terrain. If all Delta E and green contrast values are below the respective thresholds within the Bryce Canyon National Park Class I area, then the visibility impacts are not expected to be significant.

The PM_{10} and nitrogen oxide emission rates used for this analysis are 152 tpy and 209 tpy, respectively, which correspond to the emissions under the 200-foot overburden scenario under Alternative B. A second screening was performed for the 300-foot overburden scenario under Alternative B, which utilized PM_{10} and nitrogen oxide emission rates used of 200 tpy and 550 tpy, respectively. The default Level-1 screening criteria were used. In addition, a background visibility range of 200 km was used for the VISCREEN analysis based on typical annual background visibility at Bryce Canyon per FLAG guidance. The default background ozone concentration of 40 ppb was utilized. The results of the Level-1 analysis indicate potential visibility impacts above the significance thresholds within the Bryce Canyon National Park Class I area. As a result, a Level-2 analysis was conducted as described below for both the 200-foot overburden removal and the 300-foot overburden removal Alternative B scenarios.

3.2.2 *Level-2 Analysis*

The Bryce Canyon National Park is located approximately 18 km northeast of the proposed Alton mine and also several hundred meters higher than the mine location. Because the Level-1 analysis indicates potential visibility impacts inside of Bryce Canyon National Park, an additional Level-2 screening is warranted. The Level-2 screening allows the use of user-specified particle size, density, and the most conservative meteorological conditions specific to the proposed Alton Coal tract development area. Specifically for Level-2 screening, the VISCREEN model is used to find the maximum wind speed during the daytime (D stability) where delta-E and contrast in the park could potentially be exceeded.

Meteorological data for the Level-2 screening were based on the four years of hourly surface data from the Cedar City, Utah airport for the 2005-2008 met dataset used in the near-field modeling. The hourly data were extracted and summarized for each of the sixteen wind directions and a joint frequency and cumulative frequency developed to summarize the most conservative meteorological combinations of stability, wind direction and wind speed. These calculations were performed using the CEMP website that allows the user to query data and obtain frequency distributions. The worst-case 1-percentile meteorology (occurs on approximately 4 days a year) is assumed to be indicative of worst-day plume visual impacts. In

accordance with EPA guidance, dispersion conditions with transport times of more than 12 hours to reach the Class I areas of concern were not considered in the cumulative frequency. In this case, given the short distance to Bryce Canyon National Park, all wind speeds of 1 mph or greater are capable of transporting plume impacts to the park. Also, the meteorological wind direction that could potentially transport the plume to the park ranges from approximately 210 degrees to approximately 260 degrees. For the Level-2 analysis, only daylight hours from 6am to 6pm are considered as potential periods when plume visual impacts could occur within the Class I area. It should be noted that the most stable daytime stability class is considered to be slightly stable, or category D.

Using this screening, the 1-percentile atmospheric stability and wind speed are determined to be Stability D with wind speed of 2 m/sec. However, because Bryce Canyon National Park has an elevation more than 500 m above the Alton Coal Tract, when determining most conservative dispersion characteristics, the most conservative stability class should be shifted one class less stable (VISCREEN Users Manual, EPA 1992). This shift is applicable when considering an observer located on terrain at least 500 m above the emission source under stable conditions. This adjustment is made to account for the existence of complex terrain and try to simulate conditions that could facilitate transport of a relatively stable plume to a sensitive area (e.g., Bryce Canyon National Park), which must be lifted over or around elevated terrain. Thus, for the Level-2 most conservative meteorology a stability class of C with wind speed of 2 m/second was utilized. The Level-2 VISCREEN visual impacts using this most conservative dispersion category inside of Bryce Canyon National Park are summarized below:

Table 3.19a. Visual Impacts inside of Bryce Canyon National Park, 200-foot Overburden Results

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	157	35	11	6.21	0.267	0.13	0.005
SKY	140	157	35	11	3.41	0.074	0.13	-0.002
TERRAIN	10	84	18	84	6.8	0.691	0.28	0.003
TERRAIN	140	84	18	84	4.05	0.029	0.28	0.00

These results demonstrate that the maximum impacts inside of Bryce Canyon National Park from a potential Alton mine plume under the 200-foot overburden removal scenario will be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.

A similar Level-2 screening analysis was performed for the 300-foot overburden removal scenario under Alternative B. Emissions are substantially higher under this scenario with potential PM_{10} and nitrogen oxide emission rates of 200 tpy and 550 tpy, respectively. Again, a stability class of C and wind speed of 2 m/s was utilized as representative of the most conservative meteorology, as described above. The Level-2 VISCREEN visual impacts inside of Bryce Canyon National Park are summarized below.

Table 3.19b. Visual Impacts inside of Bryce Canyon National Park, 300-foot Overburden Results

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	157	35	11	6.21	0.372	0.13	0.006
SKY	140	157	35	11	3.41	0.149	0.13	-0.003
TERRAIN	10	84	18	84	6.8	0.904	0.28	0.004
TERRAIN	140	84	18	84	4.05	0.041	0.28	0.000

These results demonstrate that the maximum impacts inside of Bryce Canyon National Park from a potential Alton mine plume under the 300-foot overburden removal scenario will be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.

3.3 Near-field Class I and Class II Area Impacts

AERMOD was also used to model impacts at the Class I and sensitive Class II areas within the 50 km near-field domain. Bryce Canyon National Park is a Class I area approximately 18 km to the northeast of the Alton Tract, whereas Grand Staircase-Escalante National Monument is a sensitive Class II area that lies farther to the east. The following tables (3.20 and 3.21) summarize the Alton source only impacts under the 200-foot overburden scenario for both action alternatives. None of the increment levels are exceeded.

Table 3.20. Alton Tract Near-Field Class I and Class II Impacts, 200-foot Overburden, Alternative B

High First-Highs

Pollutant	Averaging Period	Bryce Canyon National Park			
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)
PM_{10}	Annual	0.01	0.017	0.01	0.00
	24-hour	0.27	0.368	0.34	0.41
SO_2	Annual	0.00	0.00	0.00	0.00
	24-hour	0.00	0.00	0.00	0.00
	3-hour	0.01	0.02	0.01	0.03
NO_x	Annual	0.02	0.01	0.01	0.01
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00
	24-hour	0.06	0.08	0.07	0.09
CO	8-hour	2.9	3.9	4.1	4.6
	1-hour	18	27	25	31

Table 3.20. Alton Tract Near-Field Class I and Class II Impacts, 200-foot Overburden, Alternative B

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon National Park				Class I Increment	Exceed Increment?
		2005 (μg/m^3)	2006 (μg/m^3)	2007 (μg/m^3)	2008 (μg/m^3)		
PM_{10}	Annual	0.01	0.02	0.01	0.01	4	N
	24-hour	0.15	0.18	0.21	0.23	8	N
SO_2	Annual	0.00	0.00	0.00	0.00	2	N
	24-hour	0.00	0.00	0.00	0.00	5	N
	3-hour	0.00	0.01	0.01	0.01	25	N
NO_x	Annual	0.03	0.01	0.01	0.01	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00	NA	NA
	24-hour	0.03	0.04	0.04	0.05	NA	NA
CO	8-hour	1.3	1.5	1.8	2.7	NA	NA
	1-hour	7.7	12	14	16	NA	NA

Class II Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Grand Staircase-Escalante NM				Class II Increment	Exceed Increment?
		2005 (μg/m^3)	2006 (μg/m^3)	2007 (μg/m^3)	2008 (μg/m^3)		
PM_{10}	Annual	0.22	0.26	0.23	0.31	17	N
	24-hour	1.70	2.14	1.99	2.02	30	N
SO_2	Annual	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	91	N
	3-hour	0.10	0.12	0.09	0.12	512	N
NO_x	Annual	0.55	0.65	0.53	0.71	25	N
$PM_{2.5}$	Annual	0.06	0.07	0.06	0.07	NA	NA
	24-hour	0.58	0.84	0.61	0.67	NA	NA
CO	8-hour	28	27	25	33	NA	N
	1-hour	169	207	160	226	NA	N

Table 3.21. Alton Tract Near-Field Class I and Class II Impacts, 200-foot Overburden, Alternative C

High First-Highs

Pollutant	Averaging Period	Bryce Canyon National Park			
		2005 (μg/m^3)	2006 (μg/m^3)	2007 (μg/m^3)	2008 (μg/m^3)
PM_{10}	Annual	0.01	0.01	0.01	0.01
	24-hour	0.29	0.39	0.37	0.45
SO_2	Annual	0.00	0.00	0.00	0.00
	24-hour	0.00	0.00	0.00	0.00
	3-hour	0.00	0.02	0.01	0.02
NO_x	Annual	0.02	0.03	0.01	0.01
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00
	24-hour	0.06	0.08	0.08	0.10
CO	8-hour	2.9	3.9	4.1	4.6
	1-hour	18	27	25	31

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon National Park				Class I Increment	Exceed Increment?
		2005 (μg/m^3)	2006 (μg/m^3)	2007 (μg/m^3)	2008 (μg/m^3)		
PM_{10}	Annual	0.01	0.01	0.01	0.01	4	N
	24-hour	0.16	0.20	0.23	0.21	8	N
SO_2	Annual	0.00	0.00	0.00	0.00	2	N
	24-hour	0.00	0.00	0.00	0.00	5	N
	3-hour	0.00	0.01	0.01	0.01	25	N
NO_x	Annual	0.02	0.01	0.03	0.01	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00	NA	NA
	24-hour	0.03	0.04	0.05	0.05	NA	NA
CO	8-hour	1.3	1.5	1.8	2.7	NA	NA
	1-hour	7.7	12	14	16	NA	NA

Table 3.21. Alton Tract Near-Field Class I and Class II Impacts, 200-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM				Class II Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.24	0.28	0.25	0.33	17	N
	24-hour	1.87	2.34	2.17	2.23	30	N
SO_2	Annual	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	91	N
	3-hour	0.10	0.12	0.09	0.12	512	N
NO_x	Annual	0.55	0.65	0.53	0.71	25	N
$PM_{2.5}$	Annual	0.07	0.08	0.07	0.10	NA	NA
	24-hour	0.84	1.15	0.89	0.94	NA	NA
CO	8-hour	28	27	25	33	NA	N
	1-hour	169	207	160	226	NA	N

The following tables (3.22 and 3.23) summarize the Alton source only impacts under the 300-foot overburden scenario for both action alternatives. None of the increment levels are exceeded.

Table 3.22. Alton Tract Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative B

High First-Highs

Pollutant	Averaging Period	Bryce Canyon National Park			
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)
PM_{10}	Annual	0.01	0.01	0.01	0.01
	24-hour	0.39	0.51	0.49	0.59
SO_2	Annual	0.00	0.00	0.00	0.00
	24-hour	0.00	0.00	0.00	0.00
	3-hour	0.01	0.02	0.02	0.02
NO_x	Annual	0.04	0.03	0.03	0.04
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00
	24-hour	0.08	0.10	0.10	0.12
CO	8-hour	5.9	7.8	8.8	9.6
	1-hour	36	55	53	67

Table 3.22. Alton Tract Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative B

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon National Park				Class I Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.01	0.01	0.01	0.010	4	N
	24-hour	0.21	0.274	0.29	0.347	8	N
SO_2	Annual	0.00	0.00	0.00	0.000	2	N
	24-hour	0.00	0.00	0.00	0.002	5	N
	3-hour	0.01	0.01	0.01	0.010	25	N
NO_x	Annual	0.04	0.03	0.03	0.035	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.002	NA	NA
	24-hour	0.04	0.05	0.06	0.066	NA	NA
CO	8-hour	2.7	3.7	3.4	5.3	NA	NA
	1-hour	16	26	27	32	NA	NA

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significant levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM				Class II Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.29	0.33	0.29	0.39	17	N
	24-hour	2.43	2.90	2.88	2.81	30	N
SO_2	Annual	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	91	N
	3-hour	0.12	0.13	0.11	0.15	512	N
NO_x	Annual	1.36	1.57	1.26	1.73	25	N
$PM_{2.5}$	Annual	0.07	0.08	0.07	0.09	NA	NA
	24-hour	0.79	1.07	0.83	0.87	NA	NA
CO	8-hour	65	57	51	67	NA	N
	1-hour	387	441	361	497	NA	N

Table 3.23. Alton Tract Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class I High First-Highs

Pollutant	Averaging Period	Bryce Canyon National Park			
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)
PM_{10}	Annual	0.01	0.01	0.01	0.01
	24-hour	0.41	0.54	0.52	0.62
SO_2	Annual	0.00	0.00	0.00	0.00
	24-hour	0.00	0.00	0.00	0.00
	3-hour	0.01	0.02	0.02	0.02
NO_x	Annual	0.04	0.03	0.03	0.04
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00
	24-hour	0.08	0.11	0.11	0.13
CO	8-hour	5.9	7.8	8.8	9.61
	1-hour	36	55	53	67

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon National Park				Class I Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.01	0.01	0.00	0.01	4	N
	24-hour	0.22	0.29	0.31	0.36	8	N
SO_2	Annual	0.00	0.00	0.00	0.00	2	N
	24-hour	0.00	0.00	0.00	0.00	5	N
	3-hour	0.01	0.01	0.01	0.01	25	N
NO_x	Annual	0.04	0.03	0.03	0.04	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00	NA	NA
	24-hour	0.04	0.06	0.06	0.07	NA	NA
CO	8-hour	2.8	3.7	3.5	5.3	NA	NA
	1-hour	16	26	27	32	NA	NA

Table 3.23. Alton Tract Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM				Class II Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.31	0.35	0.31	0.42	17	N
	24-hour	2.60	3.11	3.11	3.05	30	N
SO_2	Annual	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	91	N
	3-hour	0.12	0.13	0.11	0.15	512	N
NO_x	Annual	1.36	1.57	1.26	1.73	25	N
$PM_{2.5}$	Annual	0.07	0.08	0.07	0.10	NA	NA
	24-hour	0.84	1.15	0.89	0.94	NA	NA
CO	8-hour	65	57	51	67	NA	N
	1-hour	387	441	361	497	NA	N

The cumulative near-field runs including the Alton sources and all regional background sources (Kanab, Richfield, Fishlake, Dixie, Navajo Generating Station, and St. George) indicate that all of the Class I and Class II increments are not exceeded. See Table 3.24 below.

Table 3.24. Alton Tract Cumulative Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon National Park				Maximum Regional Impact ($\mu g/m^3$)*	Maximum Total ($\mu g/m^3$)	Class I Increment	Exceed Increment?
		2005 ($\mu g/m^3$)	2006 ($\mu g/m^3$)	2007 ($\mu g/m^3$)	2008 ($\mu g/m^3$)				
PM_{10}	Annual	0.01	0.01	0.01	0.01	0.00	0.01	4	N
	24-hour	0.22	0.29	0.31	0.37	0.05	0.42	8	N
SO_2	Annual	0.00	0.00	0.00	0.00	0.00	0.01	2	N
	24-hour	0.00	0.00	0.00	0.00	0.01	0.01	5	N
	3-hour	0.01	0.01	0.01	0.01	0.05	0.06	25	N
NO_x	Annual	0.04	0.03	0.03	0.04	0.00	0.04	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	0.04	0.06	0.06	0.07	0.02	0.09	NA	NA
CO	8-hour	3.0	3.7	3.5	6.0	25	31	NA	NA
	1-hour	19	26	27	48	43	91	NA	NA

Table 3.24. Alton Tract Cumulative Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM				Maximum Regional Impact ($\mu g/m^3$)	Maximum Total ($\mu g/m^3$)	Class II Increment	Exceed Increment?
		2005 ($\mu g/m^3$)	2006 ($\mu g/m^3$)	2007 ($\mu g/m^3$)	2008 ($\mu g/m^3$)				
PM_{10}	Annual	0.31	0.36	0.31	0.42	0.00	0.42	17	N
	24-hour	2.61	3.11	3.11	3.05	0.05	3.16	30	N
SO_2	Annual	0.00	0.00	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	0.01	0.03	91	N
	3-hour	0.12	0.13	0.11	0.15	0.05	0.20	512	N
NO_x	Annual	1.37	1.58	1.26	1.73	0.00	1.73	25	N
$PM_{2.5}$	Annual	0.08	0.09	0.07	0.10	0.00	0.10	NA	NA
	24-hour	0.84	1.15	0.89	0.94	0.02	1.17	NA	NA
CO	8-hour	65	57	51	67	25	92	NA	N
	1-hour	387	441	367	497	44	541	NA	N

* - The maximum regional impact is the highest 1st-high from the 3 CALPUFF model years, 2001-2003

4 FAR-FIELD ANALYSIS

The purpose of the far-field analysis is to quantify potential air quality impacts to both ambient air concentrations and AQRVs from air pollutant emissions of nitrogen oxide, carbon monoxide, sulfur dioxide, PM_{10}, and $PM_{2.5}$ that are expected to result from mining operations on the tract. Ambient air quality impacts beyond the tract and throughout the modeling domain were analyzed, as were AQRVs at Class I areas and selected Class II areas. Cumulative impacts also were quantified by including in the analyses other documented sources of air pollutant emissions within the modeling domain (identified in Map 1.1). The analyses were performed using the EPA-recommended CALMET/CALPUFF/ CALPOST modeling system (V5.8 Level 070623) to predict air quality direct and cumulative impacts at far-field PSD Class I areas and selected Class II areas. Except where explicit reference to pre- and post-processors is necessary for clarity, in this Technical Report the term "CALPUFF" is generally used to represent the entire modeling system, including the pre- and post-processors. The PSD Class I areas and Class II areas of special interest to be analyzed are shown on Map 1.1 and include the following:

- Bryce Canyon National Park (Class I) –(See Section 4.2.3)
- Zion National Park (Class I)
- Capitol Reef National Park (Class I)
- Grand Canyon National Park (Class I)
- Grand Staircase-Escalante National Monument (Class II)
- Navajo Lake (Acid deposition on a sensitive lake)
- A 4 km spaced grid of receptors located over the near-field modeling domain (Class II) to include potential far-field impacts in the near-field cumulative results (i.e., evaluate source impacts from sources greater than 50 km from the Alton mine)

In addition, analyses were performed for one lake (Navajo Lake in Dixie National Forest, Utah) to allow for the assessment of potential lake acidification from atmospheric deposition impacts. Sulfur and nitrogen deposition on the lake surface was calculated using CALPUFF. However, there are currently no data on acid neutralizing capacity (ANC) for Navajo Lake. To assess potential lake acidification it would be necessary to gather ANC data for the lake.

CALPUFF was used to model dispersion of nitrogen oxide, carbon monoxide, sulfur dioxide, PM_{10} and $PM_{2.5}$ from mining operations on the Alton Coal Tract, associated activities such as coal haulage, and regional emissions as described in Section 2.0. Photochemical conversion of NO_x and VOCs to O_3 and the secondary formation of $PM_{2.5}$ concentrations from NO_x and SO_2 emissions were not included in the Protocol. These chemical reactions cannot be simulated with the recommended far-field model (CALPUFF). A description of the emission inventory procedures is included in Section 2.0 of this Technical Report. CALPUFF results were post-processed with CALPOST to derive

- air concentrations for comparison to ambient air standards, significance thresholds, and Class I and II increments;
- AQRV impacts due to deposition rates for comparison to sulfur (S) and nitrogen (N) deposition thresholds[1]; and

[1] For Navajo Lake, deposition rates for S and N will be calculated. However, ANC calculations will not be performed until there are sufficient data for the lake.

- AQRV impacts due to light extinction change for comparison to visibility impact thresholds in Class I and other sensitive areas.

A discussion of the post-processing methodology used is provided in Section 4.3.

4.1 Modeling Methodology

The far-field analysis used the CALPUFF modeling system, which incorporates a non-steady-state puff-model approach for simulating the dispersion of pollutants to assess potential air quality impacts. The model is best applied when assessing complex flow situations, far-field impacts, and situations where winds are calm. CALPUFF is also appropriate for estimating AQRV impacts such as degradation of visibility and deposition of inorganic compounds resulting from fuel combustion (e.g., nitrates formed from nitrogen oxide). The CALPUFF modeling system has three main components: CALMET (a diagnostic 3D meteorological model); CALPUFF (the transport and dispersion model); and CALPOST (a post-processing package). CALMET is a meteorological model that includes a diagnostic wind field generator containing objective analysis and parameterized treatments of slope flows, kinematic terrain effects, terrain blocking effects, a divergence minimization procedure, and a micrometeorological model for overland and overwater. CALPUFF is a non-steady-state Lagrangian Gaussian puff model containing modules for complex terrain effects, overwater transport, coastal interaction effects, building downwash effects, and wet and dry removal. CALPOST is a post-processing program with options for the computation of time-averaged concentrations and deposition fluxes predicted by the CALPUFF model. CALPOST computes visibility impacts in accordance with IWAQM and FLAG recommendations.

As mentioned, three consecutive years (2001–2003) of MM5 model meteorological data were used as input to the CALMET model simulations. CALPUFF then used the meteorological fields generated by CALMET to assess the far-field impacts of the pollutants of concern on the Class I areas and selected Class II areas. CALPOST was used to process the hourly concentration or deposition output files generated by CALPUFF to present the data in the desired averaging period for each pertinent pollutant or AQRV. The modeling domain is shown in Map 1.1.

The CALMET and CALPUFF models were used in this analysis following the methods described herein as well as the following guidance sources:

- *Guideline on Air Quality Models, 40 Code of Federal Regulations (CFR), Part 51*, Appendix W, November 9, 2005;
- *Interagency Work Group on Air Quality Modeling Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts*, EPA-454/R-98-019, Office of Air Quality Planning and Standards, December 1998 (IWAQM 1998); and
- *FLAG, Phase I Report*, December 2000 (FLAG 2000).

4.2 Model Inputs

Model inputs consisted of meteorological data and terrain data (see Section 4.2.1), estimated emissions from mining operations on the tract (see Section 4.2.2.1), cumulative emissions (see Section 4.2.2.2), receptors (see Section 4.2.3), and background data (see Section 4.2.4). Each of these is discussed below.

4.2.1 *Meteorological Data Selection and Settings*

The Arizona-New Mexico CALMET dataset developed by the Western Regional Air Partnership (WRAP) was used to produce three years of CALMET wind fields. Supplementing the WRAP data are 7 upper air stations that were used in the Navajo Generating Station (NGS) BART modeling. The original WRAP modeling did not include upper air stations, and the availability of upper air data for the Arizona-New Mexico domain was one of the primary factors for its selection.

The EPA approved version of CALMET (5.8 – Level 070623) was used to generate the meteorological data fields. The CALMET fields were reproduced exactly as they were in the NGS modeling – with identical MM5, surface, upper air, precipitation and geophysical data.

As an “initial guess” field, three years of MM5 data (2001–2003) were used. CALMET uses the MM5 (36-km resolution) data as an “initial guess” field for the fine grid (4 km) wind field simulations using a diagnostic wind field module. The CALMET methodology accounts for local terrain effects on the wind field (e.g., CALMET includes the local up- and down-valley diurnal flow that is missed by most meteorological observations and coarse grid simulations). The meteorological grid size is 288 x 225 cells (using 4-km spacing). The computational grid is a subset of the meteorological grid, due to the large areal extent of the domain and the extremely long run times that would have resulted had the entire domain been included. The computational grid begins at cell 93,126 and extends to 197,225. The computational grid extents are sufficient to cover all areas of interest, plus an additional 50 km buffer on all sides. The cell face heights (in meters) were set to 0, 20, 100, 200, 350, 500, 750, 1000, 2000, 3000, 4000, and 5000. The meteorological domain is illustrated in Map 1.7.

4.2.2 *Emissions*

Estimated emissions based on the emission inventory described in Section 2.0 were used per FLAG guidance and standard CALPUFF procedure. The sections below describe the consideration of mining-related and cumulative emissions in the modeling.

4.2.2.1 MINING-RELATED EMISSIONS

Pollutant emission rates estimated as described in Section 2.0 were input to CALPUFF to predict air quality impacts (concentrations of pollutants) from mining and related activities. Mining operations were modeled as a combination of point, area and volume sources within the tract.

Alton generators were modeled as point sources, and roads as volume sources. All other emissions associated with the mine were modeled as area sources. One slight difference from the near-field modeling is that the near-field modeling included the use of "AREAPOLY" sources - irregular shaped area sources with multiple vertices. CALPUFF has no areapoly type of input. So, in some cases several area sources were necessary to cover the same area one near-field areapoly source covered.

Coal haulage–related emissions were modeled as volume sources along the reasonably foreseeable coal haul transportation route. Volume spacing along this route was varied, with a 2 km spacing the usual, but a decreased spacing of 500 m near and between several developed areas: Panguitch, Paragonah, Parowan, Enoch and Cedar City. The increased density of receptors near these towns allowed for a more detailed appraisal of potential impacts on certain sensitive entities, such as schools and hospitals.

Several small sources located offsite from the Alton facilities were included in the far-field modeling that were not included in the near-field modeling. These include coal dumping at the loadout, coal storage at

the loadout, and train loading. These emissions were combined into a single area source and located near the end of the long haul road near Cedar City.

4.2.2.2 CUMULATIVE SOURCE EMISSIONS

Regional sources not included in the background concentrations—including new minor sources, major modifications to Title V permitted sources, RFD, and RFFA—inventoried according to the methodology described in Section 2.0, were input to the CALPUFF model as point area or volume sources, as appropriate. As part of the emission inventory, source location and stack exit parameter data were obtained.

Pollutant emissions from stacks were generally modeled as point sources in the CALPUFF model. Multiple stacks within single facilities were modeled individually with the stack parameters identified in the emission inventory compilation process. The Fishlake and Dixie oil field developments stacks were modeled differently. Because there were quite a number of stacks present at each, emissions were combined into a single, conservative stack. This approach allowed CALPUFF to treat the emissions as stack emissions, while at the same time reducing model run time issues.

Fugitive emissions (e.g., well heaters, other surface mines, gravel pits, etc.) were modeled as area sources, with emissions aggregated into single area sources. The area source locations were either source location-specific or regional, depending on the nature of the fugitive emission sources. For example, the BLM Kanab Field Office and the BLM Richfield Field Office RMPs were each modeled as single, large regional area sources. Multiple disturbed areas at the Fishlake and Dixie oil field developments (both the volume and area sources compiled in the emission inventories) were modeled as aggregate area sources situated at the development locations. The choice to model in aggregate instead of individually once again improved run time performance, and will not significantly impact concentration calculations, because the transport distances are large. The locations of area sources input to the model can be found in Appendix D.

Regional paved and unpaved roadway travel, urban, biogenic, and other non-industrial sources are considered to be included in the ambient air background concentrations described in this Technical Report. Therefore, those fugitive sources were not modeled.

4.2.3 *Receptors*

Model receptors were input to CALPUFF where concentration, deposition, and other impacts were calculated. At the selected PSD Class I, and other sensitive Class II areas, ambient air and AQRV impacts were determined. The Class I and Class II areas of special interest within the modeling domain that were modeled include:

- Bryce Canyon National Park (Class I)
- Zion National Park (Class I)
- Capitol Reef National Park (Class I)
- Grand Canyon National Park (Class I)
- Grand Staircase-Escalante National Monument (Class II)
- Navajo Lake (Acid deposition on a sensitive lake)
- A 4 km spaced grid of receptors located over the near-field modeling domain (Class II)

CALPUFF modeling used receptors provided by the National Park Service for each of the areas above, except for Navajo Lake, where a single receptor was located at its location, and the gridded receptors. In addition, the Grand Staircase-Escalante receptors included in the far-field analysis were only those ones that are greater than 50 km from the Alton project. Bryce Canyon receptors were included in the CALPUFF receptor list, but no post-processing was performed because the entire area is well within 50 km. Zion National Park has a portion of its area within 50 km, and a portion outside 50 km. For the post-processing the entire park was considered, regardless of whether the particular receptor was plus or minus 50 km. This approach was used for the simplicity of dealing with all receptors in one pass, and also because it produces conservative results.

Because there are a number of regional sources that are farther than 50 km from the Alton facility, and AERMOD is not approved for use beyond 50 km, CALPUFF was used to generate a 4 km-spaced receptor grid over the near-field modeling domain to include potential far-field impacts in the near-field cumulative results. This grid was used to calculate total cumulative impacts from all sources. The near-field cumulative modeling included only the Kanab Field Office RMP as it was the only regional source within 50 km.

4.2.4 *Background Data*

4.2.4.1 CRITERIA POLLUTANTS

Background values for criteria pollutants were used as described in Table 4.1 below.

4.2.4.2 CHEMICAL SPECIES

The CALPUFF chemistry algorithms require hourly estimates of background ozone concentrations for the conversion of sulfur dioxide and nitrogen oxide to sulfates and nitrates, respectively. An extensive hourly ozone database was developed for use in the WRAP modeling, and that data were used for model years 2001-2003.

A background ammonia concentration of 1.0 ppb, as suggested in IWAQM for “arid lands,” was used.

Table 4.1. Far-field Analysis Background Ambient Air Quality Concentrations (µg/m^3)

Pollutant	Averaging Period	Measured Background Concentration
CO[1]	1-hour	1 ppm (1,150 µg/m^3)
	8-hour	1 ppm (1,150 µg/m^3)
NO_2[1]	Annual	17 µg/m^3
PM_{10}[3]	24-hour	72 µg/m^3
	Annual	36 µg/m^3
$PM_{2.5}$[2]	24-hour	8.6 µg/m^3
	Annual	3.6 µg/m^3
SO_2[1]	3-hour	20 µg/m^3
	24-hour	10 µg/m^3
	Annual	5 µg/m^3

[1] UDAQ 2008. Data based on estimates from the UDAQ.

[2] Measured $PM_{2.5}$ data obtained from NPS website for Bryce Canyon National Park.

[3] UDAQ 2010. PM_{10} data based on monitoring at St. George, Utah and used for private Alton Mine.

4.2.4.3 VISIBILITY

CALPOST was used to estimate change in light extinction from CALPUFF model concentration results. FLAG background visibility data were used for this analysis. The visibility calculation method used CALPOST visibility method 6 (MVISBK=6, i.e., method 6) for computing light extinction change in combination with FLAG background data. Method 6 uses monthly averaged humidity factors, and is not sensitive to synoptic weather events that lead to high extinction events and subsequent explanation as to why certain events should be discounted. A second visibility calculation used the FLAG background data in combination with hourly relative humidity data from the CALMET windfields (MVISBK=2; i.e., method 2).

The FLAG method 6 uses seasonal natural background visibility conditions and relative humidity factors at Class I areas. FLAG method 2 uses the seasonal natural background visibility conditions and hourly relative humidity data from surface observations in the CALMET wind field data. For the FLAG methods utilized in this analysis, estimated natural background visibility values provided in Appendix 2.B of FLAG (2000) were used. For FLAG method 6, monthly relative humidity factors provided in the *Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule* (EPA 2003b) were used. Because natural background data are provided for Federal Class I areas only, data from the nearest Federal Class I area were used for the sensitive Class II areas. In this case, the Grand Staircase-Escalante Class II receptors used Capitol Reef National Park background data. The natural background visibility data, in units of inverse megameters (Mm^{-1}), were used with the FLAG visibility analysis for each area analyzed are shown in Table 4.2

Table 4.2. FLAG Report Background Extinction Values[1]

Site	Season	Hygroscopic (Mm-1)	Non-hygroscopic (Mm-1)
Bryce Canyon National Park	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Zion National Park	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Capitol Reef National Park	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Grand Canyon National Park	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5

[1] FLAG (2000).

4.2.4.4 DEPOSITION

No background data were used in determining deposition impacts at either the Class I/Class II areas or at Navajo Lake. Total sulfur (S) and nitrogen (N) impacts were quantified for the tract proper and cumulative source scenarios, and compared to the minimum green line values outlined in *A Screening Procedure to Evaluate Air Pollution Effects on Class I Wilderness Areas* (Fox et al, 1989).

4.2.4.5 LAKE CHEMISTRY

Navajo Lake is the only known lake to be potentially impacted by acid deposition. This site was identified as a sensitive receptor, and acid deposition rates on the lake were calculated. There are no data on lake chemistry at Navajo Lake to assess potential impacts related to ANC.

4.3 Post-processing

For each far-field sensitive area, CALPUFF-modeled concentration impacts were post-processed with CALPOST and POSTUTIL, as necessary, to derive (1) concentrations for comparison to ambient air quality standards, and PSD Class I and II Increments; (2) deposition rates for comparison to sulfur and nitrogen deposition levels of concern; and (3) light extinction changes for comparison to visibility impact thresholds.

4.3.1 *Concentration*

CALPOST was used to process the CALPUFF concentration output files to compute appropriate concentration values for sulfur dioxide (3-hour, 24-hour, and annual average), $PM_{2.5}$ (24-hour and annual average), nitrogen dioxide (annual average), PM_{10} (24-hour and annual average) and carbon monoxide (1-hour and 8-hour averages).

The NAAQS and ambient standards adopted by state regulatory agencies set absolute upper limits for specific air pollutant concentrations (expressed in $\mu g/m^3$) at all locations with public access. Modeled concentrations occurring from construction, mining operations, and cumulative sources were added to the existing ambient air quality background concentrations shown in Table 3.1 and Table 4.2, and the total concentrations are compared to the corresponding NAAQS shown in Table 4.3. Ambient air quality standards, significance levels, and PSD Class II Increments are shown in Table 4.3.

Table 4.3. Ambient Standards, Class II PSD Increments Comparison to Near-field Analysis Results ($\mu g/m^3$)[1]

Pollutant/Averaging Time	National Ambient Air Quality Standards	PSD Class II Increments
CO		
1-hour[1]	40,000	--
8-hour[1]	10,000	--
NO_2		
Annual[2]	100	25

Table 4.3. Ambient Standards, Class II PSD Increments Comparison to Near-field Analysis Results (µg/m^3)[1]

Pollutant/Averaging Time	National Ambient Air Quality Standards	PSD Class II Increments
Ozone (O_3)		
1-hour	235	--
8-hour[3]	157	--
PM_{10}		
24-hour[1]	150	30
Annual[4]	50	17
$PM_{2.5}$		
24-hour	35	NA
Annual	15	NA
SO_2		
3-hour[1]	1,300	512
24-hour[1]	365	91
Annual[2]	80	20

[1] No more than one exceedance per year.

[2] Annual arithmetic mean.

[3] Average of annual fourth-highest daily maximum 8-hour average.

[4] Standard revoked.

Under federal and state PSD regulations, increases in ambient air concentrations in Class I areas are limited by PSD Class I Increments. Specifically, emissions associated with a particular development may increase ambient concentrations above baseline levels only within those specific increments developed for sulfur dioxide, PM_{10}, and nitrogen dioxide. PSD Class I Increments are set forth in federal and state PSD regulations, and are shown in Table 4.5. PSD Class II Increments are applicable in Class II areas and are shown in Table 4.3.

Table 4.4. PSD Class I Increments (μg/m^3)

Pollutant	**Averaging Period**	**Class I Increment**
SO_2	Annual	2
	24-hour	5
	3-hour	25
PM_{10}	Annual	4
	24-hour	8
NO_2	Annual	2.5

Modeled concentrations predicted in Federal PSD Class I areas from mining operations on the tract proper were compared to Class I Increments, and cumulative modeling results predicted within Federal PSD Class I areas were compared to Class I Increments. Project and cumulative impacts predicted at sensitive areas designated as PSD Class II areas were compared to Class II Increments.

Tables 4.5-4.8 summarize the Alton tract impact in the Class I areas and at Grand Staircase-Escalante NM. There is one table for each of the operational scenarios, i.e., 200-foot overburden removal, Alternative B; 200-foot overburden removal, Alternative C; 300-foot overburden removal, Alternative B; and 300-foot overburden removal, Alternative C. Impacts were significantly less than the Class I increments in all cases. Impacts at Grand Staircase-Escalante were far below the Class II increments.

Table 4.5a. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative B

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP		
			2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01
	24-hour	*	1.01	1.17	0.95	0.25	0.15	0.19	0.13	0.17	0.12
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO_x	Annual	*	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.04	0.05	0.04	0.02	0.01	0.02	0.01	0.01	0.01
CO	8-hour	*	1.63	1.40	1.46	0.39	0.33	0.36	0.26	0.23	0.27
	1-hour	*	4.91	5.90	5.12	2.37	1.03	1.48	0.54	0.42	0.50

Table 4.5b. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative B

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP			Class I Increment	Exceed Increment?
			2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01	4	N
	24-hour	*	0.85	1.06	0.82	0.11	0.11	0.14	0.12	0.12	0.09	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	N
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.0	N
NO_x	Annual	*	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	2.5	N
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	*	0.03	0.04	0.03	0.01	0.01	0.01	0.01	0.01	0.01	NA	NA
CO	8-hour	*	1.12	0.86	1.21	0.28	0.25	0.25	0.16	0.18	0.20	NA	NA
	1-hour	*	3.68	2.35	2.51	1.59	0.79	1.36	0.45	0.41	0.41	NA	NA

Table 4.5c. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative B

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM			Class II Increment	Exceed Increment?
		2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	0.026	0.031	0.029	17	N
	24-hour	0.149	0.238	0.226	30	N
SO_2	Annual	0.000	0.000	0.000	20	N
	24-hour	0.000	0.000	0.000	91	N
	3-hour	0.001	0.001	0.001	512	N
NO_x	Annual	0.004	0.003	0.003	25	N
$PM_{2.5}$	Annual	0.002	0.002	0.002	NA	NA
	24-hour	0.012	0.015	0.017	NA	NA
CO	8-hour	0.302	0.411	0.520	500	N
	1-hour	0.745	0.831	0.960	2000	N

Table 4.6a. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative C

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP		
			2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01
	24-hour	*	1.01	1.17	0.95	0.25	0.15	0.19	0.14	0.17	0.12
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO_x	Annual	*	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.04	0.05	0.04	0.02	0.01	0.02	0.01	0.01	0.01
CO	8-hour	*	1.63	1.40	1.46	0.39	0.33	0.36	0.26	0.23	0.27
	1-hour	*	4.91	5.90	5.12	2.37	1.03	1.48	0.54	0.42	0.50

Table 4.6b. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative C

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP			Class I Increment	Exceed Increment?
			2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01	4	N
	24-hour	*	0.85	1.06	0.82	0.12	0.12	0.14	0.12	0.13	0.09	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	N
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25	N
NO_x	Annual	*	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	2.5	N
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	*	0.03	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	NA	NA
CO	8-hour	*	1.12	0.86	1.21	0.28	0.25	0.25	0.16	0.18	0.20	NA	NA
	1-hour	*	3.68	2.35	2.51	1.59	0.79	1.36	0.45	0.41	0.41	NA	NA

Table 4.6c. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM			Class II Increment	Exceed Increment ?
		2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	0.03	0.03	0.03	17	N
	24-hour	0.15	0.24	0.23	30	N
SO_2	Annual	0.00	0.00	0.00	20	N
	24-hour	0.00	0.00	0.00	91	N
	3-hour	0.00	0.00	0.00	512	N
NO_x	Annual	0.00	0.00	0.00	25	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	NA	NA
	24-hour	0.01	0.02	0.02	NA	NA
CO	8-hour	0.30	0.41	0.52	500	N
	1-hour	0.74	0.83	0.96	2000	N

Table 4.7a. Alton Tract Far-field Class I and Class II Impacts, 300-foot Overburden, Alternative B

Class I High First-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP		
		*	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01
	24-hour	*	1.01	1.17	0.95	0.29	0.16	0.21	0.14	0.18	0.13
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO_x	Annual	*	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.05	0.05	0.04	0.03	0.01	0.02	0.01	0.01	0.01
CO	8-hour	*	3.00	2.49	2.65	0.79	0.58	0.63	0.44	0.39	0.49
	1-hour	*	11.16	6.23	10.31	5.04	2.02	2.89	0.92	0.98	0.89

Table 4.7b. Alton Tract Far-field Class I and Class II Impacts, 300-foot Overburden, Alternative B

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP			Class I Increment	Exceed Increment ?
		*	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01	4	N
	24-hour	*	0.85	1.06	0.82	0.13	0.13	0.15	0.12	0.13	0.10	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	N
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25	N
NO_x	Annual	*	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.5	N
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	*	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	NA	NA
CO	8-hour	*	2.04	1.54	2.27	0.54	0.42	0.44	0.29	0.30	0.37	NA	NA
	1-hour	*	6.95	4.54	5.60	3.17	1.42	2.70	0.76	0.73	0.70	NA	NA

Table 4.7c. Alton Tract Far-field Class I and Class II Impacts, 300-foot Overburden, Alternative B

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM			Class II Increment	Exceed Increment?
		2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	0.03	0.03	0.03	17	N
	24-hour	0.15	0.24	0.23	30	N
SO_2	Annual	0.00	0.00	0.00	20	N
	24-hour	0.00	0.00	0.00	91	N
	3-hour	0.00	0.00	0.00	512	N
NO_x	Annual	0.01	0.01	0.01	25	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	NA	NA
	24-hour	0.01	0.02	0.02	NA	NA
CO	8-hour	0.56	0.72	0.93	500	N
	1-hour	1.32	1.65	1.78	2000	N

Table 4.8a. Alton Tract Far-field Class I and Class II Impacts, 300-foot overburden, Alternative C

Class I High First-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP		
		*	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01
	24-hour	*	1.01	1.17	0.95	0.30	0.17	0.21	0.14	0.18	0.13
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO_x	Annual	*	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.05	0.05	0.05	0.03	0.01	0.02	0.01	0.01	0.01
CO	8-hour	*	3.00	2.49	2.65	0.79	0.58	0.63	0.44	0.39	0.49
	1-hour	*	11.16	6.23	10.31	5.04	2.02	2.89	0.92	0.98	0.89

Table 4.8b. Alton Tract Far-field Class I and Class II Impacts, 300-foot overburden, Alternative C

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP			Class I Increment	Exceed Increment ?
		*	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01	4	N
	24-hour	*	0.85	1.06	0.82	0.13	0.13	0.15	0.12	0.13	0.10	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	N
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25	N
NO_x	Annual	*	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.5	N
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	*	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	NA	NA
CO	8-hour	*	2.04	1.54	2.27	0.54	0.42	0.44	0.29	0.30	0.37	NA	NA
	1-hour	*	6.95	4.54	5.60	3.17	1.42	2.70	0.76	0.73	0.70	NA	NA

Table 4.8c. Alton Tract Far-field Class I and Class II Impacts, 300-foot overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM			Class II Increment	Exceed Increment ?
		2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	0.03	0.03	0.03	17	N
	24-hour	0.16	0.24	0.23	30	N
SO_2	Annual	0.00	0.00	0.00	20	N
	24-hour	0.00	0.00	0.00	91	N
	3-hour	0.00	0.00	0.00	512	N
NO_x	Annual	0.01	0.01	0.01	25	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	NA	NA
	24-hour	0.02	0.02	0.02	NA	NA
CO	8-hour	0.56	0.72	0.93	500	N
	1-hour	1.32	1.65	1.78	2000	N

Because the results of the Alton alone modeling showed values far below the relevant increments, cumulative results were only produced for the maximum emission rate case (300-foot overburden removal, Alternative C) and are presented in Table 4.9. Once again the impacts are significantly below both the Class I and Class II increments.

Even though there are no increments for $PM_{2.5}$ or carbon monoxide, results are presented in the above tables so that a general impression of impact levels can be conveyed.

These demonstrations are informational only and not regulatory PSD increment consumption analyses, which would be completed as necessary during state permitting processes.

Table 4.9a. Cumulative Far-field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP			Class I Increment	Exceed Increment ?
		*	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	*	0.09	0.15	0.11	0.01	0.02	0.01	0.02	0.02	0.02	4	N
	24-hour	*	0.85	1.06	0.82	0.13	0.14	0.16	0.15	0.18	0.14	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	5	N
	3-hour	*	0.01	0.01	0.00	0.01	0.01	0.01	0.06	0.06	0.04	25	N
NO_x	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.01	2.5	N
$PM_{2.5}$	Annual	*	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	*	0.06	0.06	0.09	0.01	0.02	0.02	0.05	0.04	0.04	NA	NA
CO	8-hour	*	11.00	13.47	20.18	25.05	23.89	20.33	15.55	16.36	16.26	NA	NA
	1-hour	*	65.05	88.59	107.81	55.85	59.20	50.62	42.41	33.56	37.27	NA	NA

Table 4.9b. Cumulative Far-field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM			Class II Increment	Exceed Increment ?
		2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	0.03	0.04	0.03	17	N
	24-hour	0.17	0.25	0.23	30	N
SO_2	Annual	0.00	0.00	0.00	20	N
	24-hour	0.01	0.01	0.01	91	N
	3-hour	0.07	0.04	0.06	512	N
NO_x	Annual	-0.04	-0.01	-0.02	25	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	NA	NA
	24-hour	0.03	0.03	0.02	NA	NA
CO	8-hour	52.04	38.29	38.83	500	N
	1-hour	117.55	106.03	117.59	2000	N

4.3.1.1 CUMULATIVE CONCENTRATIONS IN THE NEAR FIELD

Receptors were set in the near field to assess impacts from far field cumulative sources on near field receptors near the tract. Figures 4.1 and 4.2 illustrate the results of this analysis. Maximum near field impacts due to near field cumulative sources occurred north of the Alton tract along the haul road as described in Section 3.The PM_{10} impacts near the tract from the far field cumulative sources would be 0.01 to 0.02 µg/m^3, whereas the NO_x impacts would be -0.01 to -0.02 µg/m^3. Negative NO_x values indicate an improvement due to the large reduction in NO_x emissions at the Navajo Generating Station in New Mexico. The results indicate that there would be virtually no impact in the near field due to the far field cumulative sources.

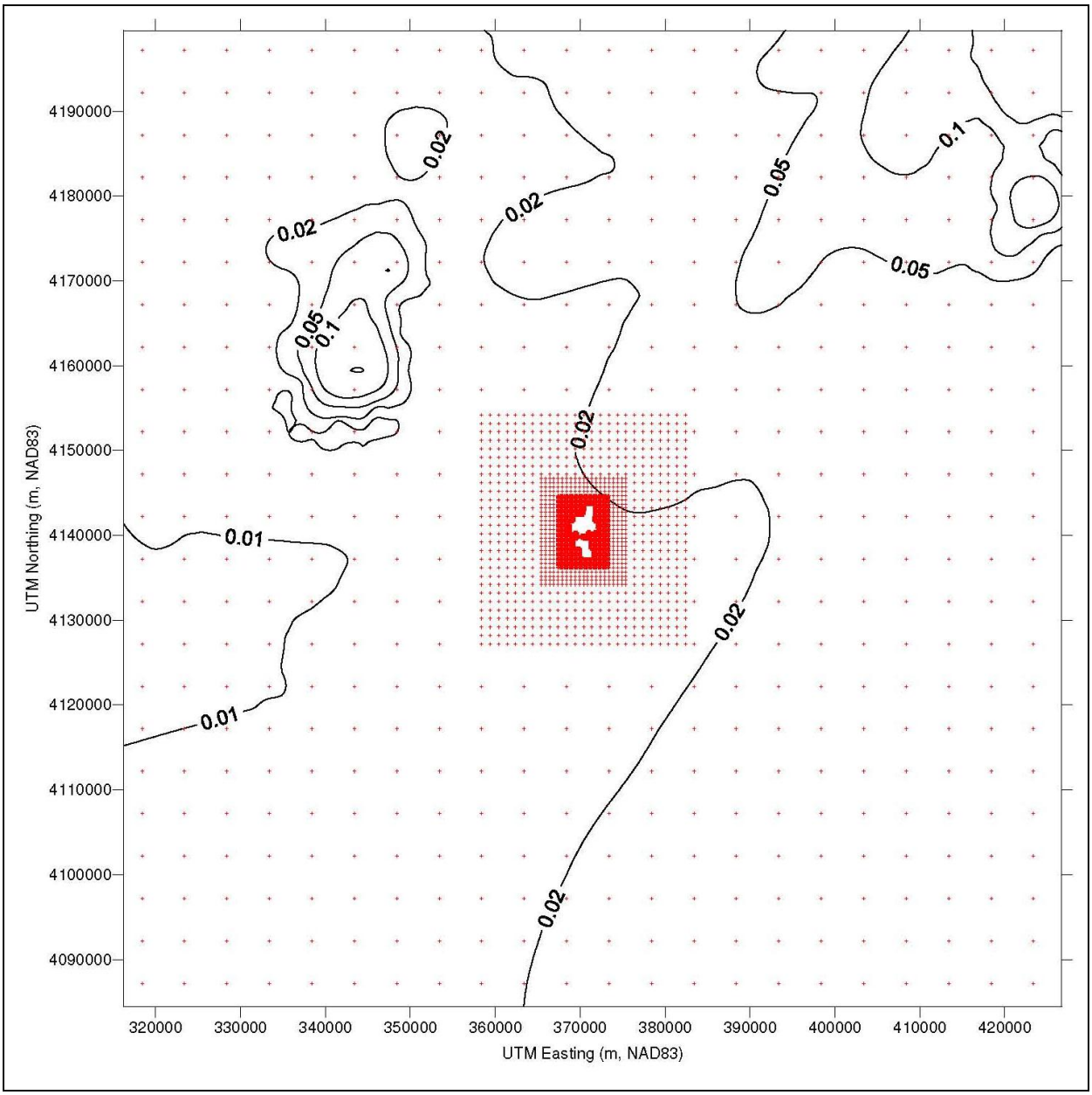

Figure 4.1. Maximum 2001-2003 PM_{10} impact (µg/m^3) from far-field sources.

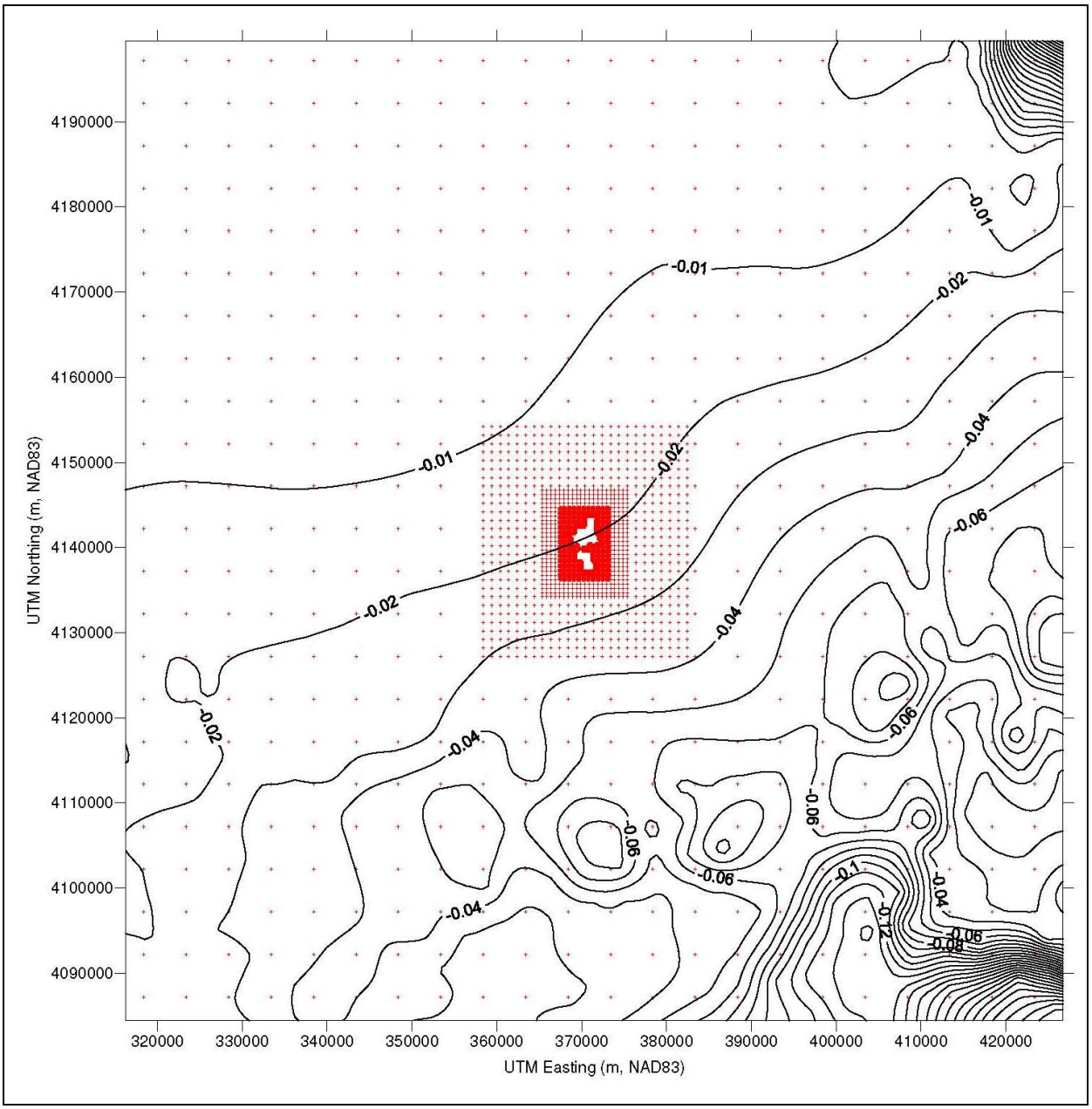

Figure 4.2. Maximum 2001–2003 NO_x impact (µg/m^3) from far-field sources.

4.3.2 *Deposition*

The POSTUTIL utility provided with the CALPUFF modeling system was used following IWAQM guidance to estimate total S and N fluxes from CALPUFF-predicted wet and dry fluxes of sulfur dioxide, SO_4, nitrogen oxide, nitrate (NO_3), and nitric acid (HNO_3). CALPOST was used to summarize the annual S and N deposition values from the POSTUTIL program.

Maximum predicted S and N deposition impacts were estimated for two direct project and cumulative source scenarios: the 200-foot overburden under Alternative B and the 300-foot overburden under Alternative C. As above, this approach gives a good representation of impacts from both the lowest and highest Alton emission scenarios.

Predicted direct project impacts were compared to the minimum "green line" deposition analysis thresholds for total N and S deposition in the western U.S., which are defined as 3.0 kilogram per hectare per year (kg/ha-year) for both N and S (Fox et al, 1989). The green line represents a value below which no significant change in the forest ecosystem will occur. These results are presented in Tables 4.10-4.29. Impacts for both S and N deposition are below the minimum green line value in all cases.

Table 4.10a. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.32E-13	3,600	8,760	7.32E-06	7.32E-05
2002	2.55E-13	3,600	8,760	8.05E-06	8.05E-05
2003	2.68E-13	3,600	8,760	8.45E-06	8.45E-05

Table 4.10b. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.11E-11	3,600	8,760	9.82E-04	9.82E-03
2002	3.94E-11	3,600	8,760	1.24E-03	1.24E-02
2003	3.71E-11	3,600	8,760	1.17E-03	1.17E-02

Table 4.10c. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	7.32E-05	2001	9.82E-03
2002	8.05E-05	2002	1.24E-02
2003	8.45E-05	2003	1.17E-02
Max. Annual Dep.	8.45E-05	Max. Annual Dep.	1.24E-02
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.11a. Soils And Vegetation Deposition Impacts At Bryce Canyon, 300-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.57E-13	3,600	8,760	8.10E-06	8.10E-05
2002	2.81E-13	3,600	8,760	8.86E-06	8.86E-05
2003	2.95E-13	3,600	8,760	9.30E-06	9.30E-05

Table 4.11b. Soils And Vegetation Deposition Impacts At Bryce Canyon, 300-foot Overburden, Alternative C

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	6.64E-11	3,600	8,760	2.10E-03	2.10E-02
2002	8.29E-11	3,600	8,760	2.62E-03	2.62E-02
2003	7.68E-11	3,600	8,760	2.42E-03	2.42E-02

Table 4.11c. Soils And Vegetation Deposition Impacts At Bryce Canyon, 300-foot Overburden, Alternative C

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.10E-05	2001	2.10E-02
2002	8.86E-05	2002	2.62E-02
2003	9.30E-05	2003	2.42E-02
Max. Annual Dep.	9.30E-05	Max. Annual Dep.	2.62E-02
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.12a. Soils And Vegetation Deposition Impacts At Capitol Reef, 200-foot Overburden, Alternative B

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.09E-14	3,600	8,760	3.44E-07	3.44E-06
2002	9.34E-15	3,600	8,760	2.94E-07	2.94E-06
2003	1.13E-14	3,600	8,760	3.57E-07	3.57E-06

Table 4.12b. Soils And Vegetation Deposition Impacts At Capitol Reef, 200-foot Overburden, Alternative B

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.33E-12	3,600	8,760	4.21E-05	4.21E-04
2002	1.13E-12	3,600	8,760	3.55E-05	3.55E-04
2003	1.37E-12	3,600	8,760	4.32E-05	4.32E-04

Table 4.12c. Soils And Vegetation Deposition Impacts At Capitol Reef, 200-foot Overburden, Alternative B

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.44E-06	2001	4.21E-04
2002	2.94E-06	2002	3.55E-04
2003	3.57E-06	2003	4.32E-04
Max. Annual Dep.	3.57E-06	Max. Annual Dep.	4.32E-04
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.13a. Soils And Vegetation Deposition Impacts At Capitol Reef, 300-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.21E-14	3,600	8,760	3.83E-07	3.83E-06
2002	1.03E-14	3,600	8,760	3.26E-07	3.26E-06
2003	1.26E-14	3,600	8,760	3.98E-07	3.98E-06

Table 4.13b. Soils And Vegetation Deposition Impacts At Capitol Reef, 300-foot Overburden, Alternative C

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.65E-12	3,600	8,760	8.35E-05	8.35E-04
2002	2.18E-12	3,600	8,760	6.88E-05	6.88E-04
2003	2.76E-12	3,600	8,760	8.72E-05	8.72E-04

Table 4.13c. Soils And Vegetation Deposition Impacts At Capitol Reef, 300-foot Overburden, Alternative C

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.83E-06	2001	8.35E-04
2002	3.26E-06	2002	6.88E-04
2003	3.98E-06	2003	8.72E-04
Max. Annual Dep.	3.98E-06	Max. Annual Dep.	8.72E-04
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.14a. Soils And Vegetation Deposition Impacts At Escalante, 200-foot Overburden, Alternative B

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.63E-14	3,600	8,760	8.30E-07	8.30E-06
2002	2.86E-14	3,600	8,760	9.02E-07	9.02E-06
2003	3.00E-14	3,600	8,760	9.46E-07	9.46E-06

Table 4.14b. Soils And Vegetation Deposition Impacts At Escalante, 200-foot Overburden, Alternative B

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.832E-12	3,600	8,760	1.21E-04	1.21E-03
2002	4.038E-12	3,600	8,760	1.27E-04	1.27E-03
2003	4.115E-12	3,600	8,760	1.30E-04	1.30E-03

Table 4.14c. Soils And Vegetation Deposition Impacts At Escalante, 200-foot Overburden, Alternative B

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.30E-06	2001	1.21E-03
2002	9.02E-06	2002	1.27E-03
2003	9.46E-06	2003	1.30E-03
Max. Annual Dep.	9.46E-06	Max. Annual Dep.	1.30E-03
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.15a. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.92E-14	3,600	8,760	9.21E-07	9.21E-06
2002	3.16E-14	3,600	8,760	9.98E-07	9.98E-06
2003	3.33E-14	3,600	8,760	1.05E-06	1.05E-05

Table 4.15b. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	6.95E-12	3,600	8,760	2.19E-04	2.19E-03
2002	7.45E-12	3,600	8,760	2.35E-04	2.35E-03
2003	7.62E-12	3,600	8,760	2.40E-04	2.40E-03

Table 4.15c. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	9.21E-06	2001	2.19E-03
2002	9.98E-06	2002	2.35E-03
2003	1.05E-05	2003	2.40E-03
Max. Annual Dep.	1.05E-05	Max. Annual Dep.	2.40E-03
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.16a. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	7.66E-15	3,600	8,760	2.42E-07	2.42E-06
2002	8.15E-15	3,600	8,760	2.57E-07	2.57E-06
2003	8.83E-15	3,600	8,760	2.79E-07	2.79E-06

Table 4.16b. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.86E-13	3,600	8,760	2.79E-05	2.79E-04
2002	8.79E-13	3,600	8,760	2.77E-05	2.77E-04
2003	9.15E-13	3,600	8,760	2.89E-05	2.89E-04

Table 4.16c. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.42E-06	2001	2.79E-04
2002	2.57E-06	2002	2.77E-04
2003	2.79E-06	2003	2.89E-04
Max. Annual Dep.	2.79E-06	Max. Annual Dep.	2.89E-04
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.17a. Soils And Vegetation Deposition Impacts At Grand Canyon, 300-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	8.64E-15	3,600	8,760	2.73E-07	2.73E-06
2002	9.11E-15	3,600	8,760	2.87E-07	2.87E-06
2003	9.91E-15	3,600	8,760	3.13E-07	3.13E-06

Table 4.17b. Soils And Vegetation Deposition Impacts At Grand Canyon, 300-foot Overburden, Alternative C

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.90E-12	3,600	8,760	5.99E-05	5.99E-04
2002	1.84E-12	3,600	8,760	5.80E-05	5.80E-04
2003	1.93E-12	3,600	8,760	6.09E-05	6.09E-04

Table 4.17c. Soils And Vegetation Deposition Impacts At Grand Canyon, 300-foot Overburden, Alternative C

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.73E-06	2001	5.99E-04
2002	2.87E-06	2002	5.80E-04
2003	3.13E-06	2003	6.09E-04
Max. Annual Dep.	3.13E-06	Max. Annual Dep.	6.09E-04
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.18a. Soils And Vegetation Deposition Impacts At Zion, 200-foot Overburden, Alternative B

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	7.36E-14	3,600	8,760	2.32E-06	2.32E-05
2002	6.06E-14	3,600	8,760	1.91E-06	1.91E-05
2003	5.81E-14	3,600	8,760	1.83E-06	1.83E-05

Table 4.18b. Soils And Vegetation Deposition Impacts At Zion, 200-foot Overburden, Alternative B

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.21E-11	3,600	8,760	3.82E-04	3.82E-03
2002	9.51E-12	3,600	8,760	3.00E-04	3.00E-03
2003	9.10E-12	3,600	8,760	2.87E-04	2.87E-03

Table 4.18c. Soils And Vegetation Deposition Impacts At Zion, 200-foot Overburden, Alternative B

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.32E-05	2001	3.82E-03
2002	1.91E-05	2002	3.00E-03
2003	1.83E-05	2003	2.87E-03
Max. Annual Dep.	2.32E-05	Max. Annual Dep.	3.82E-03
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.19a. Soils And Vegetation Deposition Impacts At Zion, 300-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	8.40E-14	3,600	8,760	2.65E-06	2.65E-05
2002	6.77E-14	3,600	8,760	2.14E-06	2.14E-05
2003	6.49E-14	3,600	8,760	2.05E-06	2.05E-05

Table 4.19b. Soils And Vegetation Deposition Impacts At Zion, 300-foot Overburden, Alternative C

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.77E-11	3,600	8,760	8.73E-04	8.73E-03
2002	2.09E-11	3,600	8,760	6.58E-04	6.58E-03
2003	1.97E-11	3,600	8,760	6.22E-04	6.22E-03

Table 4.19c. Soils And Vegetation Deposition Impacts At Zion, 300-foot Overburden, Alternative C

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.65E-05	2001	8.73E-03
2002	2.14E-05	2002	6.58E-03
2003	2.05E-05	2003	6.22E-03
Max. Annual Dep.	2.65E-05	Max. Annual Dep.	8.73E-03
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	5.0000E-03
Above Green Line?	NO	Above Green Line?	NO

Table 4.20a. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	6.06E-13	3,600	8,760	1.91E-05	1.91E-04
2002	9.22E-13	3,600	8,760	2.91E-05	2.91E-04
2003	8.19E-13	3,600	8,760	2.58E-05	2.58E-04

Table 4.20b. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.20c. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.91E-04	2001	0.0E+00
2002	2.91E-04	2002	0.0E+00
2003	2.58E-04	2003	0.0E+00
Max. Annual Dep.	2.91E-04	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.21a. Soils and Vegetation Deposition Impacts at Bryce Canyon, 300-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	6.30E-13	3,600	8,760	1.99E-05	1.99E-04
2002	9.47E-13	3,600	8,760	2.99E-05	2.99E-04
2003	8.45E-13	3,600	8,760	2.67E-05	2.67E-04

Table 4.21b. Soils and Vegetation Deposition Impacts at Bryce Canyon, 300-foot Overburden, Alternative C, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.00E+00	3,600	8,760	0.00E+00	0.00E+00
2002	3.49E-11	3,600	8,760	1.10E-03	1.10E-02
2003	1.75E-11	3,600	8,760	5.53E-04	5.53E-03

Table 4.21c. Soils and Vegetation Deposition Impacts at Bryce Canyon, 300-foot Overburden, Alternative C, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.99E-04	2001	0.00E+00
2002	2.99E-04	2002	1.10E-02
2003	2.67E-04	2003	5.53E-03
Max. Annual Dep.	2.99E-04	Max. Annual Dep.	1.10E-02
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.22a. Soils and Vegetation Deposition Impacts at Capitol Reef, 200-foot Overburden, Alternative B, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.84E-12	3,600	8,760	5.80E-05	5.80E-04
2002	2.03E-12	3,600	8,760	6.40E-05	6.40E-04
2003	2.12E-12	3,600	8,760	6.67E-05	6.67E-04

Table 4.22b. Soils and Vegetation Deposition Impacts at Capitol Reef, 200-foot Overburden, Alternative B, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.22c. Soils and Vegetation Deposition Impacts at Capitol Reef, 200-foot Overburden, Alternative B, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	5.80E-04	2001	0.0E+00
2002	6.40E-04	2002	0.0E+00
2003	6.67E-04	2003	0.0E+00
Max. Annual Dep.	6.67E-04	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.23a. Soils and Vegetation Deposition Impacts at Capitol Reef, 300-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.84E-12	3,600	8,760	5.80E-05	5.80E-04
2002	2.03E-12	3,600	8,760	6.40E-05	6.40E-04
2003	2.12E-12	3,600	8,760	6.68E-05	6.68E-04

Table 4.23b. Soils and Vegetation Deposition Impacts at Capitol Reef, 300-foot Overburden, Alternative C, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.23c. Soils and Vegetation Deposition Impacts at Capitol Reef, 300-foot Overburden, Alternative C, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	5.80E-04	2001	0.0E+00
2002	6.40E-04	2002	0.0E+00
2003	6.68E-04	2003	0.0E+00
Max. Annual Dep.	6.68E-04	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.24a. Soils and Vegetation Deposition Impacts at Escalante, 200-foot Overburden, Alternative B, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.60E-12	3,600	8,760	8.19E-05	8.19E-04
2002	2.81E-12	3,600	8,760	8.86E-05	8.86E-04
2003	3.04E-12	3,600	8,760	9.58E-05	9.58E-04

Table 4.24b. Soils and Vegetation Deposition Impacts at Escalante, 200-foot Overburden, Alternative B, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.24c. Soils and Vegetation Deposition Impacts at Escalante, 200-foot Overburden, Alternative B, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.19E-04	2001	0.0E+00
2002	8.86E-04	2002	0.0E+00
2003	9.58E-04	2003	0.0E+00
Max. Annual Dep.	9.58E-04	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.25a. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.60E-12	3,600	8,760	8.20E-05	8.20E-04
2002	2.81E-12	3,600	8,760	8.86E-05	8.86E-04
2003	3.04E-12	3,600	8,760	9.59E-05	9.59E-04

Table 4.25b. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.25c. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.20E-04	2001	0.0E+00
2002	8.86E-04	2002	0.0E+00
2003	9.59E-04	2003	0.0E+00
Max. Annual Dep.	9.59E-04	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.26a. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.96E-13	3,600	8,760	6.19E-06	6.19E-05
2002	2.94E-13	3,600	8,760	9.28E-06	9.28E-05
2003	2.76E-13	3,600	8,760	8.69E-06	8.69E-05

Table 4.26b. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.26c. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	6.19E-05	2001	0.0E+00
2002	9.28E-05	2002	0.0E+00
2003	8.69E-05	2003	0.0E+00
Max. Annual Dep.	9.28E-05	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.27a. Soils and Vegetation Deposition Impacts at Grand Canyon, 300-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.97E-13	3,600	8,760	6.22E-06	6.22E-05
2002	2.95E-13	3,600	8,760	9.31E-06	9.31E-05
2003	2.77E-13	3,600	8,760	8.72E-06	8.72E-05

Table 4.27b. Soils and Vegetation Deposition Impacts at Grand Canyon, 300-foot Overburden, Alternative C, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.27c. Soils and Vegetation Deposition Impacts at Grand Canyon, 300-foot Overburden, Alternative C, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	6.22E-05	2001	0.0E+00
2002	9.31E-05	2002	0.0E+00
2003	8.72E-05	2003	0.0E+00
Max. Annual Dep.	9.31E-05	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.28a. Soils and Vegetation Deposition Impacts at Zion, 200-foot Overburden, Alternative B, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.91E-13	3,600	8,760	9.18E-06	9.18E-05
2002	2.87E-13	3,600	8,760	9.05E-06	9.05E-05
2003	2.79E-13	3,600	8,760	8.80E-06	8.80E-05

Table 4.28b. Soils and Vegetation Deposition Impacts at Zion, 200-foot Overburden, Alternative B, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.28c. Soils and Vegetation Deposition Impacts at Zion, 200-foot Overburden, Alternative B, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	9.18E-05	2001	0.0E+00
2002	9.05E-05	2002	0.0E+00
2003	8.80E-05	2003	0.0E+00
Max. Annual Dep.	9.18E-05	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.29a. Soils and Vegetation Deposition Impacts at Zion, 300-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	3.02E-13	3,600	8,760	9.51E-06	9.51E-05
2002	2.94E-13	3,600	8,760	9.27E-06	9.27E-05
2003	2.86E-13	3,600	8,760	9.02E-06	9.02E-05

Table 4.29b. Soils and Vegetation Deposition Impacts at Zion, 300-foot Overburden, Alternative C, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.29c. Soils and Vegetation Deposition Impacts at Zion, 300-foot Overburden, Alternative C, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	9.51E-05	2001	0.0E+00
2002	9.27E-05	2002	0.0E+00
2003	9.02E-05	2003	0.0E+00
Max. Annual Dep.	9.51E-05	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Total deposition impacts from direct project and regional sources were also compared to the Fox et al, green lines, and are presented in Tables 4.20-4.29. Background deposition values were never provided, and hence not considered. Once again all S deposition impacts are below the green line thresholds. All N deposition impacts are also considerably below the green line values. The improvements in the cumulative cases versus the Alton alone cases is due to the large nitrogen oxide emission decrease from the Navajo generating station. In fact, the majority of the N deposition values turned out to be 0 - signifying that the Navajo emission decrease over the annual period exceeded the increased impacts from other sources. CALPUFF was used to predict annual deposition fluxes of S and N at Navajo Lake for one scenario - the 300-foot overburden Alternative C case. This is the highest emission scenario for Alton, and provides a conservative estimate. These results are shown in Table 4.30. However, because no data on lake chemistry at Navajo Lake are available, no estimates of ANC change in Navajo Lake were performed.

Table 4.30a. Deposition Impacts at Navajo Lake, 300-foot Overburden, Alternative C (tract only)

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	5.39E-14	3,600	8,760	1.70E-06	1.70E-05
2002	5.01E-14	3,600	8,760	1.58E-06	1.58E-05
2003	4.59E-14	3,600	8,760	1.45E-06	1.45E-05

Table 4.30b. Deposition Impacts at Navajo Lake, 300-foot Overburden, Alternative C (tract only)

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.39E-11	3,600	8,760	4.40E-04	4.40E-03
2002	1.19E-11	3,600	8,760	3.74E-04	3.74E-03
2003	1.04E-11	3,600	8,760	3.29E-04	3.29E-03

4.3.3 *Visibility*

CALPOST was run using the FLAG data to calculate the change in light extinction from natural background conditions. This procedure computes light extinction changes from seasonal estimates of natural background aerosol concentrations and either monthly relative humidity factors (method 6) or hourly relative humidity data from the CALMET. visb.dat file (method 2), and CALPUFF-predicted particle species concentrations. Seasonal background extinction values used for the FLAG method are shown in Table 4.3. Those values were input to CALPOST as variables BKSO4 (dry hygroscopic - the value from Table 4.3 divided by 3) and BKSOIL (non-hygroscopic). Using these parameters, CALPOST calculated the change in daily (24-hour) visibility at each receptor, with the results reported in percent change in light extinction and change in deciview (dv). The CALPOST switch "MVISBK" was set to 6 in one test (method 6) and set to 2 in the other test (method 2). The relative humidity data cutoff in CALPOST was set to 90 for the method 2 test. The FLAG method conservatively assumes that the seasonal natural visibility conditions occur every day during the entire season.

Atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are set forth in FLAG (2000). The thresholds are defined as 5% and 10% of the reference background visibility (or 0.5 and 1.0 dv) for sources as a result of mining operations on the tract alone and cumulative source impacts, respectively. In general, if impacts are greater than these thresholds, FLMs may consider the conditions (magnitude, frequency, duration, etc.) of the impact on a case-by-case basis. These thresholds and the FLAG guidelines were developed for NSR applications where an AQRV analysis is required as part of a PSD permit application.

Visibility results for the Alton tract alone are presented in Table 4.31 (200-foot overburden removal, Alternative B) and Table 4.32 (300-foot overburden removal, Alternative C). These tables represent both the lowest and highest emission cases, and summarize method 2 and method 6 processing. For the 200-foot overburden scenario under Alternative B, only Zion NP has an extinction change that exceeds 5%. Results from the 300-foot overburden scenario under Alternative C show that in addition to Zion NP, Grand Canyon NP and Grand Staircase-Escalante also have extinctions in excess of 5%. There are no extinction changes exceeding 10% in any of the areas of interest (maximum change of 5.45% at Grand Canyon).

Cumulative visibility results are presented in Tables 4.33 and 4.34 (the same two Alton emission cases as above). For the 200-foot overburden scenario under Alternative B, no areas with the exceptions of Capital Reef and Bryce Canyon National Parks exceed the 10% change threshold. The same holds true for the 300-foot overburden scenario under Alternative C. Capitol Reef NP has visibility extinction changes that surpass 10%, on only one day during the modeled three year period(maximum of 17.56% for method 2 and 10.74% for method 6). This impact is due to one of the regional sources, as the Alton alone impacts at Capitol Reef NP were small (maximum change of 1.80%). This single impact at Capitol Reef occurred on Dec 4, 2001 – and was located at receptor number 1431 – on the northeast side of the park (the opposite side from the Alton complex). Bryce Canyon had a total of four days using method 2 processing that exceeded a 10% change for the 300-foot overburden scenario, and also four days using method 6. For the 200-foot overburden case, Bryce Canyon only had one day that exceeded 10%, and that was using method 2.

Table 4.31. Tract-only Visibility Impacts, 200-foot Overburden, Alternative B

METHOD 2	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Capitol Reef NP	0	0	0.95	0	0	1.08	0	0	0.87
Grand Canyon NP	0	0	2.42	0	0	1.70	0	0	1.75
Zion NP	1	0	5.13	2	0	5.33	0	0	4.46
Grand Staircase-Escalante NM	0	0	1.55	0	0	2.77	0	0	2.06
METHOD 6	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Capitol Reef NP	0	0	1.13	0	0	1.19	0	0	0.96
Grand Canyon NP	0	0	2.85	0	0	1.32	0	0	1.37
Zion NP	0	0	4.89	1	0	5.38	0	0	4.59
Grand Staircase-Escalante NM	0	0	1.50	0	0	2.13	0	0	2.54

Table 4.32. Tract-only Visibility Impacts, 300-foot Overburden, Alternative C

METHOD 2	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change(%)**	**# Days > 5%**	**# Days > 10%**	**Max Change(%)**	**# Days > 5%**	**# Days > 10%**	**Max Change(%)**
Capitol Reef NP	0	0	1.68	0	0	1.50	0	0	1.61
Grand Canyon NP	0	0	4.44	0	0	3.32	0	0	3.39
Zion NP	1	0	5.15	2	0	5.33	0	0	4.46
Grand Staircase-Escalante NM	0	0	2.75	1	0	5.37	0	0	3.70
METHOD 6	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Capitol Reef NP	0	0	1.69	0	0	1.71	0	0	1.80
Grand Canyon NP	1	0	5.45	0	0	2.35	0	0	2.35
Zion NP	0	0	4.91	1	0	5.38	0	0	4.74
Grand Staircase-Escalante NM	0	0	2.69	0	0	3.83	0	0	4.84

Table 4.33. Cumulative Visibility Impacts, 200-foot Overburden, Alternative B

METHOD 2	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon NP	0	0	4.73	6	1	13.45	2	0	5.92
Capitol Reef NP	3	1	17.14	2	0	7.12	3	0	7.84
Grand Canyon NP	0	0	2.45	0	0	1.54	0	0	2.14
Zion NP	1	0	5.00	2	0	5.36	0	0	4.47
Grand Staircase-Escalante NM	1	0	5.31	3	0	5.37	0	0	4.87
METHOD 6	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon NP	0	0	4.74	5	0	9.63	1	0	5.57
Capitol Reef NP	2	1	10.48	3	0	6.50	6	0	7.33
Grand Canyon NP	0	0	2.87	0	0	1.86	0	0	2.01
Zion NP	0	0	4.78	1	0	5.38	0	0	4.61
Grand Staircase-Escalante NM	0	0	4.96	2	0	5.87	3	0	6.18

Table 4.34. Cumulative Visibility Impacts, 300-foot Overburden, Alternative C

METHOD 2	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon NP	4	0	7.92	14	3	29.07	6	1	12.44
Capitol Reef NP	3	1	17.56	2	0	7.16	4	0	7.85
Grand Canyon NP	0	0	4.47	0	0	2.17	0	0	3.78
Zion NP	2	0	5.64	2	0	5.36	0	0	4.47
Grand Staircase-Escalante NM	1	0	5.95	4	0	5.79	1	0	5.02
METHOD 6	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon NP	3	0	7.11	17	4	21.67	4	0	8.97
Capitol Reef NP	2	1	10.74	3	0	6.55	6	0	7.34
Grand Canyon NP	1	0	5.48	0	0	2.46	0	0	2.71
Zion NP	0	0	4.92	1	0	5.38	0	0	4.61
Grand Staircase-Escalante NM	0	0	4.96	2	0	5.92	4	0	6.21

5 ASSESSMENT OF AIR QUALITY IMPACTS

5.1 Near-field Air Quality Impacts

Near-field analysis means the airshed within a 50 × 50–km area with the Alton Coal Tract in the center. Near-field analysis was conducted to assess impacts to public health and welfare and to estimate potential impacts to lakes and viewsheds in nearby (near-field) national parks.

In particular, a near-field ambient air quality impact assessment was performed to quantify maximum-modeled pollutant impacts near the tract. To demonstrate that air quality–related values and standards are protected requires the development of short-term (hourly and daily) and long-term emission rates of regulated pollutants, application of regulatory-approved models to quantify predicted concentrations, and a comparison of predicted impacts plus applicable background concentrations (RFD/RFFA sources) with applicable standards.

The EPA's guideline model, AERMOD, was the refined air dispersion model used to assess these near-field impacts and to verify compliance with the applicable NAAQS in the ambient airshed that encloses the Alton Coal Lease Tract. The modeling analysis focused on the reasonable maximum development year (therefore, the maximum emission year) for the mine. Using this anticipated maximum potential emission year, the AERMOD dispersion model was used to analyze potential near-field impacts of PM_{10}, $PM_{2.5}$, nitrogen dioxide, carbon monoxide, and sulfur dioxide. Photochemical conversion of NO_x and VOCs to O_3 and the secondary formation of $PM_{2.5}$ concentrations from NO_x and SO_2 emissions were not included in the Protocol. These chemical reactions are not considered to be near-field impacts, and they cannot be simulated with the recommended near-field model (AERMOD).

Compliance with the respective annual standards was based on the highest modeled value for each year of the four-year meteorological dataset. Demonstration of compliance with the short-term NAAQS (24-hour, 8-hour, 3-hour, and 1-hour) for carbon monoxide, nitrogen dioxide, and sulfur dioxide was based on the highest second-high modeled concentration for each year of the four-year meteorological period, added to the respective background concentrations

Compliance demonstrations with the 24-hour $PM_{2.5}$ standard use the average of the first highest 24-hour concentration in each year over the length of the meteorological data period. Compliance with the 24-hour PM_{10} standard was verified against the highest fifth-high modeled concentration over the 4-year period. All modeled concentrations were rounded to match the form of the appropriate NAAQS.

5.1.1 *PM_{10} AERMOD Results*

The modeled PM_{10} concentrations associated with the maximum development year are summarized below. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance under each action alternative. Results are presented below for the 24-hour highest fifth-high PM_{10} concentration over the four-year modeled dataset for both 200-foot and 300-foot scenarios.

Table 5.1. Highest Fifth-high PM_{10} Modeling Results

Overburden Thickness (feet)	Alternative	Modeled (µg/m3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
200	B	82.7	72	150	150
200	C	83.6	72	160	150
300	B	86.3	72	160	150
300	C	92.9	72	160	150

The 200-foot modeled concentrations indicate compliance with the NAAQS at all modeled receptors. However, the 300-foot results indicate a modeled exceedance at a receptor along the northwest side of the LNCM.

5.1.2 *$PM_{2.5}$ AERMOD Results*

The modeled $PM_{2.5}$ concentrations associated with the maximum development year are summarized below. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance under each action alternative. Model results in the tables below for the 24-hour averaging period indicate the average first-high concentration over all modeled years for both 200-foot and 300-foot scenarios. The highest predicted annual concentration over all modeled years for both 200-foot and 300-foot scenarios is presented in the table. Model results in the tables below for the 24-hour averaging periods represent the average concentrations over the four-year meteorological dataset for both 200-foot and 300-foot scenarios.

Table 5.2. $PM_{2.5}$ Modeling Results

Overburden Depth (feet)	Alternative	Averaging Period	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
200	B	Annual	4.7	3.6	8	15
		24-hour	19.3	8.6	28	35
	C	Annual	5.1	3.6	9	15
		24-hour	21.1	8.6	30	35
300	B	Annual	6.0	3.6	10	15
		24-hour	22.7	8.6	31	35
	C	Annual	6.5	3.6	10	15
		24-hour	24.5	8.6	33	35

Both the 200-foot and 300-foot modeled concentrations indicate compliance with the NAAQS at all modeled receptors and for both Alternative B and Alternative C.

5.1.3 *Nitrogen Dioxide AERMOD Results*

The maximum-modeled nitrogen oxide concentrations associated with the maximum development year are summarized below. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. The estimated nitrogen oxide emissions are the same for each overburden scenario under both action alternatives. A 75% ozone correction was applied to all annual nitrogen oxide modeling results in accordance with EPA's Ambient Ratio Method as a way to estimate ambient annual nitrogen dioxide concentrations from modeled nitrogen oxides emission rates.

Table 5.3. Annual Maximum Nitrogen Dioxide Modeling Results

Overburden Thickness (feet)	Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
200	31.6	17	49	100
300	99.9	17	117	100

The 200-foot modeled concentrations indicate compliance with the annual NAAQS at all modeled receptors. However, under the 300-foot overburden removal scenario, there are a few exceedances of the annual NAAQS. The disparity between the 200-foot and 300-foot scenarios is due to the higher emissions associated with the 300-foot scenario in conjunction with the location of the additional emissions on-site.

5.1.4 *Carbon Monoxide AERMOD Results*

The maximum-modeled carbon monoxide concentrations associated with the maximum development year are summarized below. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. The estimated carbon monoxide emissions are the same for each overburden scenario under both action alternatives. Separate model runs were not necessary within each of the overburden removal depth scenarios.

Table 5.4. Carbon Monoxide Modeling Results

Overburden Thickness (feet)	Averaging Period	Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
200	8-hour	582	1,150	1,732	10,000
	1-hour	2,639	1,150	3,789	40,000
300	8-hour	582	1,150	1,732	10,000
	1-hour	2,639	1,150	3,789	40,000

Both 200-foot and 300-foot modeled concentrations indicate compliance with the 1-hour and 8-hour NAAQS at all modeled receptors.

5.1.5 *Sulfur Dioxide AERMOD Results*

The modeled sulfur dioxide concentrations associated with the maximum development year are summarized below. The potential sulfur dioxide emissions associated with the mining activities are nominal but modeling was still completed. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. Because the estimated sulfur dioxide emissions for Alternative B and C are the same, separate model runs were not necessary within each of the overburden scenarios. The applicable averaging periods for comparison to the sulfur dioxide NAAQS include the 3-hour, 24-hour, and annual averaging periods.

Table 5.5. Sulfur Dioxide Modeling Results

Overburden Thickness (feet)	Averaging Period	Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
200	3-hour	1.64	20	22	1,300
	24-hour	0.47	10	10	365
	Annual	0.10	5	5	80
300	3-hour	1.90	20	22	1,300
	24-hour	0.47	10	10	365
	Annual	0.14	5	5	80

Both 200-foot and 300-foot modeled concentrations indicate compliance with the 1-hour and 8-hour NAAQS at all modeled receptors.

5.1.6 *HAP Impact Assessment*

Hazardous air pollutants can cause various adverse health effects. They are not part of the NAAQS, but high levels at the property boundary could indicate the need for further analysis and/or mitigation strategies. Therefore, HAPs have been included in the emission inventory and were modeled in the AERMOD near-field analysis. The modeled concentrations were compared with known health exposure levels as a means of assessing potential impacts.

The potential emissions of HAPs associated with this project are relatively insignificant. The only quantifiable source of HAPs from the Alton Coal lease in the emissions inventory is the proposed generators. The potential HAP emissions are the same for both the 200-foot and 300-foot overburden removal scenarios, as well as the Alternative B and C pit layouts. As seen in Tables 5.6a and 5.6b, no adverse impacts associated specifically with the Alton sources are anticipated.

Table 5.6a. Hazardous Air Pollutants AERMOD Modeling Results

Pollutant	Model Years	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Threshold ($\mu g/m^3$)[1]
			UTME	UTMN		
Benzene	2005-2008	1-hour	371800	4140300	0.440	1,300 (REL)
		24-hour	368400	4142500	0.046	53 (TSL)
		Annual	370060	4140000	0.003	30 (RfC)
Toluene	2005-2008	1-hour	371800	4140300	0.160	37,000 (REL)
		24-hour	368400	4142500	0.017	2,512 (TSL)
		Annual	370060	4140000	0.001	5,000 (RfC)
Xylenes	2005-2008	1-hour	371800	4140300	0.110	22,000 (REL)
		24-hour	368400	4142500	0.011	14,473 (TSL)
		Annual	370060	4140000	0.001	100 (RfC)
Formaldehyde	2005-2008	1-hour	371800	4140300	0.045	37 (TSL)
		Annual	370060	4140000	0.0003	9.8 (RfC)

[1] REL = recommended exposure limit; TSL = Toxic Screening Level; RfC = Reference Concentration

Table 5.6b HAPs Risk Assessment

Analysis[1]	HAP Constituent	Carcinogenic Annual RfC (Risk Factor)[2] $1/(\mu g/m^3)$	Exposure Adjustment Factor	Modeled ($\mu g/m^3$)	Calculated Risk	Significance Criterion
MLE	Benzene	7.80E-06	0.0949	0.003	2.2E-09	1.00E-06
MLE	Formaldehyde	5.50E-09	0.0949	0.0003	1.6E-13	1.00E-06
MEI	Benzene	7.80E-06	0.33	0.003	7.7E-09	1.00E-06
MEI	Formaldehyde	5.50E-09	0.33	0.0003	5.4E-13	1.00E-06

[1] MLE = most likely exposure; MEI = maximally exposed individual.

[2] EPA Air Toxics Database, Table 1 (EPA 2007).

5.1.7 *Near-Field VISCREEN Analysis*

VISCREEN was used to assess potential visibility impacts within the near-field modeling grid at Bryce Canyon National Park. The primary pollutants of concern that may impact visibility in the near-field are particulate matter and nitrogen oxide.

The Level-2 VISCREEN visual impacts using this most conservative dispersion category inside of Bryce Canyon National Park are summarized below in Tables 5.7a and 5.7b.

Table 5.7a Visual Impacts Inside of Bryce Canyon National Park, 200-foot Overburden Results

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	157	35	11	6.21	0.267	0.13	0.005
SKY	140	157	35	11	3.41	0.074	0.13	-0.002
TERRAIN	10	84	18	84	6.8	0.691	0.28	0.003
TERRAIN	140	84	18	84	4.05	0.029	0.28	0.00

Table 5.7b. Visual Impacts inside of Bryce Canyon National Park, 300-foot Overburden Results

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	157	35	11	6.21	0.372	0.13	0.006
SKY	140	157	35	11	3.41	0.149	0.13	-0.003
TERRAIN	10	84	18	84	6.8	0.904	0.28	0.004
TERRAIN	140	84	18	84	4.05	0.041	0.28	0.000

These results demonstrate that the maximum impacts inside of Bryce Canyon National Park from a potential Alton mine plume under the 200-foot and 300-foot overburden removal scenarios will be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.

5.1.8 *Far-field Analysis*

The purpose of the far-field analysis is to quantify potential air quality impacts to both ambient air concentrations and AQRVs from air pollutant emissions of nitrogen oxide, carbon monoxide, sulfur dioxide, PM_{10}, and $PM_{2.5}$ that are expected to result from mining operations on the tract. Photochemical conversion of NO_x and VOCs to O_3 and the secondary formation of $PM_{2.5}$ concentrations from NO_x and SO_2 emissions were not included in the Protocol. These chemical reactions cannot be simulated with the recommended far-field model (CALPUFF).

The analyses were performed using the EPA-recommended CALMET/CALPUFF/CALPOST modeling system to predict air quality direct and cumulative impacts at far-field PSD Class I areas and selected Class II areas. The term “CALPUFF” is generally used to represent the entire modeling system, including the pre- and post-processors.

5.1.8.1 CLASS I AND CLASS II INCREMENTS

Under federal and state PSD regulations, increases in ambient air concentrations in Class I areas are limited by PSD Class I Increments. Specifically, emissions associated with a particular development may

increase ambient concentrations above baseline levels only within those specific increments developed for sulfur dioxide, PM_{10}, and nitrogen dioxide. The modeling results for the maximum cumulative scenario are presented in Table 5.8.

Table 5.8. Class I and Class II Results

Pollutant	Averaging Period	Class I Analysis Results		Class II Analysis Results	
		Cumulative Concentration	Class I Increment	Cumulative Concentration	Class II Increment
PM_{10}	Annual	0.15	4	0.04	17
	24-hour	1.06	8	0.25	30
SO_2	Annual	0.00	2	0.001	20
	24-hour	0.02	5	0.01	91
	3-hour	0.06	25	0.07	512
NO_x	Annual	0.01	2.5	-0.01	25
$PM_{2.5}$	Annual	0.01	NA	0.004	NA
	24-hour	0.09	NA	0.03	NA
CO	8-hour	25	NA	52	NA
	1-hour	108	NA	118	NA

All of the results for the Alton alone modeling showed values far below the relevant increments. Cumulative results were produced for the maximum emission rate case (300-foot overburden removal, Alternative C) and are presented above. The impacts are significantly below both the Class I and Class II increments. Even though there are no increments for $PM_{2.5}$ or carbon monoxide, results are presented in the above table to convey a general impression of impact levels.

5.1.9 *Visibility*

Atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are set forth in FLAG (2000). The thresholds are defined as 5% and 10% of the reference background visibility (or 0.5 and 1.0 dv) for sources as a result of mining operations on the tract alone and cumulative source impacts, respectively.

Visibility results for the Alton tract alone are presented in Table 5.9 (200-foot overburden removal, Alternative B and 300-foot overburden removal, Alternative C). These results represent both the lowest and highest emission cases, and summarize method 2 and method 6 processing. For the 200-foot overburden scenario under Alternative B, only Zion NP has an extinction change that exceeds 5%. The 300-foot Alternative C results show that in addition to Zion NP, Grand Canyon NP and Grand Staircase-Escalante also have extinctions in excess of 5%. There are no extinction changes exceeding 10% in any of the areas of interest (maximum change of 5.5% at Grand Canyon).

Table 5.9. Visibility Results, Alton

Method 2	**200-foot Overburden, Alternative B**		**300-foot Overburden, Alternative C**	
Class I/Class II Area	**# Days > 5%**	**Max Change (%)**	**# Days > 5%**	**Max Change (%)**
Capitol Reef NP	0	1.1	0	1.5
Grand Canyon NP	0	1.7	0	3.3
Zion NP	2	5.3	2	5.3
Grand Staircase-Escalante NM	0	2.8	1	5.4
Method 6	**200-foot Overburden, Alternative B**		**300-foot Overburden, Alternative C**	
Class I/Class II Area	**# Days > 5%**	**Max Change (%)**	**# Days > 5%**	**Max Change (%)**
Capitol Reef NP	0	1.2	0	1.7
Grand Canyon NP	0	1.3	1	5.5
Zion NP	1	5.4	0	4.9
Grand Staircase-Escalante NM	0	2.1	0	2.7

Cumulative visibility results are presented in Table 5.10 (the same two Alton emission cases as above). For the 200-foot overburden scenario under Alternative B, all areas except Grand Canyon NP have extinction changes that exceed 5%. For the 300-foot overburden scenario under Alternative C, all areas have changes that exceed 5%. Only Capitol Reef and Bryce Canyon National Parks have visibility extinction changes that surpass 10%., For Capitol Reef, that is only on one day (maximum of 17.6% for method 2 and 10.7% for method 6). This impact is due to one of the regional sources, as the Alton alone impacts at Capitol Reef NP were small (maximum change of 1.80%). Bryce Canyon had a total of four days using method 2 processing that exceeded a 10% change for the 300-foot overburden scenario, and also four days using method 6. For the 200-foot overburden case, Bryce Canyon only had one day that exceeded 10%, and that was using method 2.

Table 5.10. Visibility Results - Cumulative

Method 2	**200-foot Overburden, Alternative B**			**300-foot Overburden, Alternative C**		
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon NP	8	1	13.5	24	4	29.1
Capitol Reef NP	3	1	17.1	3	1	17.6
Grand Canyon NP	0	0	2.5	0	0	4.5
Zion NP	1	0	5.0	2	0	5.6
Grand Staircase-Escalante NM	1	0	5.3	1	0	6.0
Method 6						
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon NP	6	0	9.6	24	4	21.7
Capitol Reef NP	2	1	10.5	2	1	10.7
Grand Canyon NP	0	0	2.9	1	0	5.5
Zion NP	0	0	4.8	0	0	4.9
Grand Staircase-Escalante NM	0	0	5.0	0	0	5.0

5.1.10 *Deposition*

Maximum predicted S and N deposition impacts were estimated for two direct project and cumulative source scenarios: the 200-foot overburden, Alternative B and the 300-foot overburden, Alternative C. As above, this approach gives a good representation of impacts from both the lowest and highest Alton emission scenarios.

Predicted direct project impacts were compared to the Fox et al, green line deposition values for total N and S deposition in the western U.S., which are defined as 3.00 kilogram per hectare per year (kg/ha-year) for both N and S. These results are presented in Table 5.11. Impacts for S deposition are below the green line value in all cases. The same is true for N deposition - no impacts exceed the green line value.

Total deposition impacts from direct project and regional sources were also compared to the green line value. Once again all S and N deposition impacts are below the green line thresholds. The improvements in the cumulative cases versus the Alton alone cases are due to the large nitrogen oxide emission decrease from the Navajo generating station. In fact, the majority of the N deposition values turned out to be 0 - signifying that the Navajo decrease over the annual period exceeded the positive impacts of the other sources.

Table 5.11. Deposition Results

Location	Overburden Thickness (feet)	Alt.	Alton Coal Tract				Cumulative Sources			
			Maximum Dry and Wet Annual S Deposition, (kg/ha-yr)	>Green Line?	Maximum Dry and Wet Annual N Deposition, (kg/ha-yr)	>Green Line?	Maximum Dry and Wet Annual S Deposition, (kg/ha-yr)	>Green Line?	Maximum Dry and Wet Annual N Deposition, (kg/ha-yr)	>Green Line?
Bryce Canyon	200	B	0.0001	No	0.0124	No	0.0003	No	0.0000	No
	300	C	0.0001	No	0.0262	No	0.0003	No	0.0110	No
Capitol Reef	200	B	0.0000	No	0.0004	No	0.0007	No	0.0000	No
	300	C	0.0000	No	0.0009	No	0.0007	No	0.0000	No
Grand Staircase Escalante	200	B	0.0000	No	0.0013	No	0.0010	No	0.0000	No
	300	C	0.0000	No	0.0024	No	0.0010	No	0.0000	No
Grand Canyon	200	B	0.0000	No	0.0003	No	0.0001	No	0.0000	No
	300	C	0.0000	No	0.0006	No	0.0001	No	0.0000	No
Zion	200	B	0.0000	No	0.0038	No	0.0001	No	0.0000	No
	300	C	0.0000	No	0.0087	No	0.0001	No	0.0000	No
Navajo Lake	300	C	0.0000	No	0.0044	No				

5.1.11 *Acid Neutralizing Capacity*

CALPUFF was used to predict annual deposition fluxes of S and N at Navajo Lake for one scenario - the 300-foot overburden scenario under Alternative C. This scenario produces the highest emissions for Alton, and provides a conservative estimate. These results are shown in Table 5.11. Because no data on lake chemistry at Navajo Lake are available, no estimates of acid neutralizing capacity change in Navajo Lake were performed.

5.2 Greenhouse Gases

Naturally occurring greenhouse gases (GHGs) include water vapor, carbon dioxide, methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Other man-made greenhouse gases include, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). Water vapor accounts for the largest percentage of greenhouse effect. Next to water vapor, carbon dioxide is the most abundant GHG. Because carbon dioxide is relatively stable in the atmosphere and uniformly mixed throughout the troposphere and stratosphere, the climatic impact of carbon dioxide emissions does not depend on the carbon dioxide source location on earth. The Proposed Actions would produce GHG emissions from the combustion of fuel by the vehicles and generators.

Research on how emissions of GHGs influence global climate change and associated effects has focused on the overall impact of emissions from aggregate regional or global sources. This approach is required primarily because GHG emissions from single sources are small relative to aggregate emissions. The climate change research community has not yet developed tools specifically intended for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. The current tools for simulating climate change generally focus on global and regional-scale modeling. Global and regional-scale models lack the capability to represent explicitly many important small-scale processes. As a result, confidence in regional- and sub-regional-scale projections is lower than at the global scale. There is thus limited scientific capability in assessing, detecting, or measuring the relationship between emissions of GHGs from a specific single source and any localized impacts.

Globally, approximately 30,377 million (MM) metric tons of carbon dioxide was added to the atmosphere through the combustion of fossil fuels in 2008 (EPA 2010). The highest on-site plus off-site carbon dioxide emission from the alternatives evaluated occur in the 300-foot overburden thickness alternatives (i.e, Alternatives B and C). The 77,153 tons (69,992 metric tons) of carbon dioxide calculated for these alternatives represents approximately 0.00023% of the global emissions, an insignificant fraction of that total.

The annual coal production from the Alton Mine is estimated to be approximately 2 million tons. The annual worldwide primary coal production based on 2008 data is approximately 7.3 billion tons (EIA 2008). The coal produced for the Alton mine could therefore be expected to produce approximately 0.028% of the total worldwide production.

Because site-specific data are not available, EPA's default emission factor of 4,810 pounds per ton of coal for subbituminous coal (EPA 2008) was used to approximate the annual emissions from combusting the 2 million tons of coal produced at the Alton Mine.

2 MMtons/yr Coal * 4,810 $lbCO_2$/ton of Coal / 2,000 lb/ton = 4.8 MM TPY CO_2

The resulting emissions of 4.8 million tons carbon dioxide per year (4.4 MM metric tons) would be emitted by the end user of the coal produced at the Alton Mine. This total represents 0.014% of the total carbon dioxide emissions from global fossil fuel combustion. A summary of these comparisons is presented in Table 5.12.

Table 5.12. Greenhouse Gas Comparisons

Comparison	Global	Alton Project	Alton Coal	Alton % of Global
CO2 Emissions from Fossil Fuel Combustion, MM metric tons/yr	30,377	0.067	4.4	0.015
Annual Coal Production, million tons	7271	2	–	0.028

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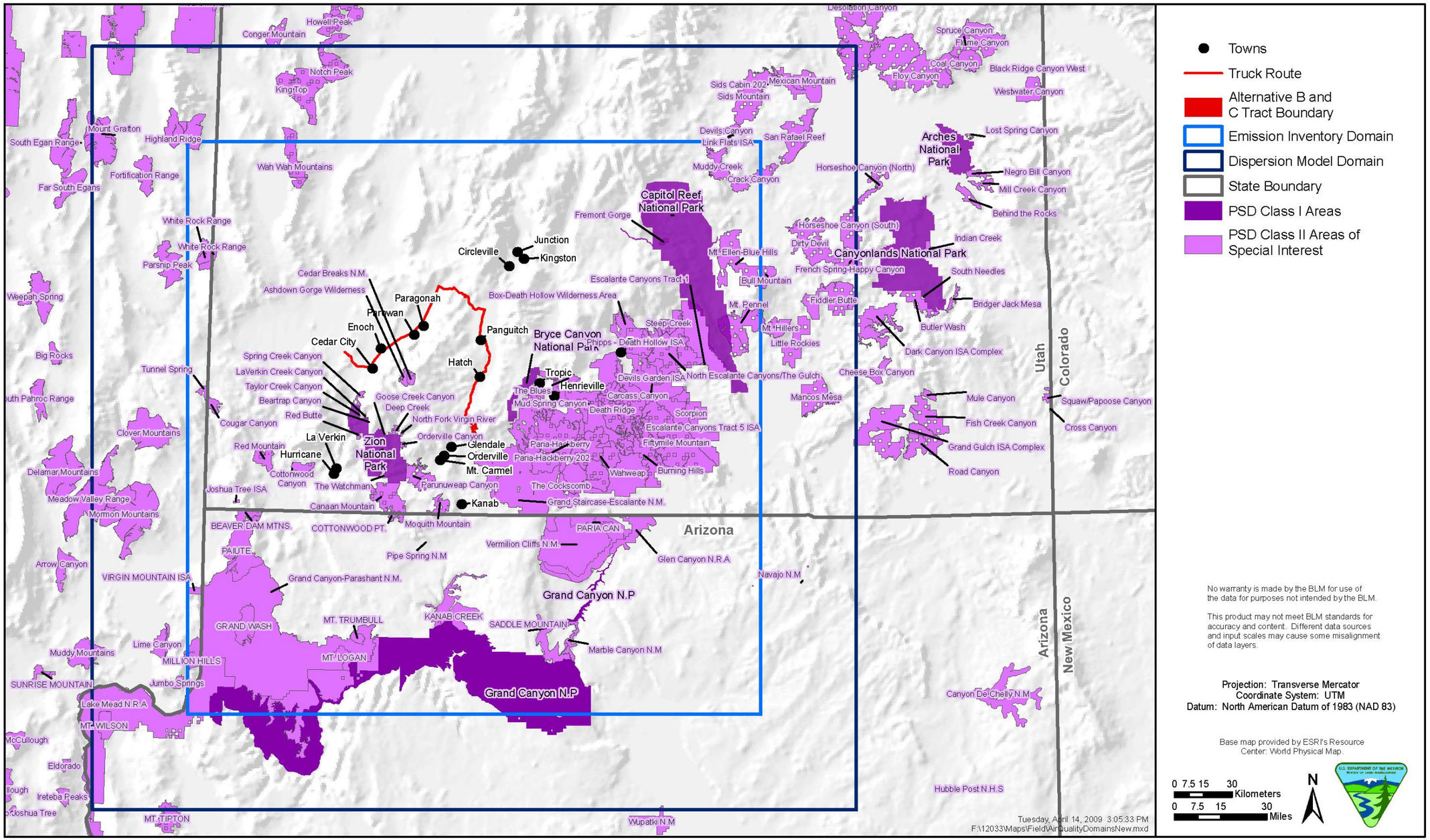
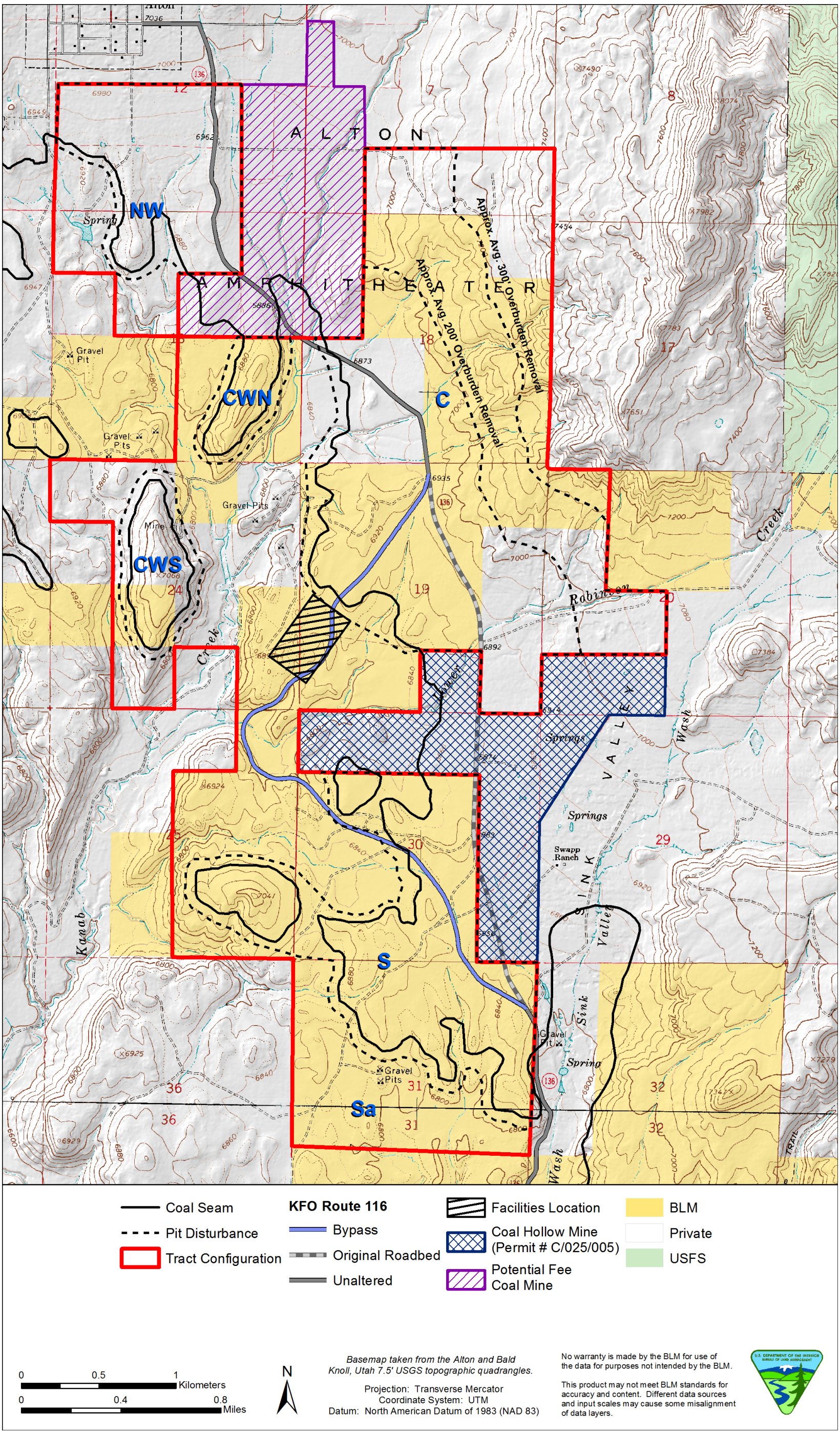
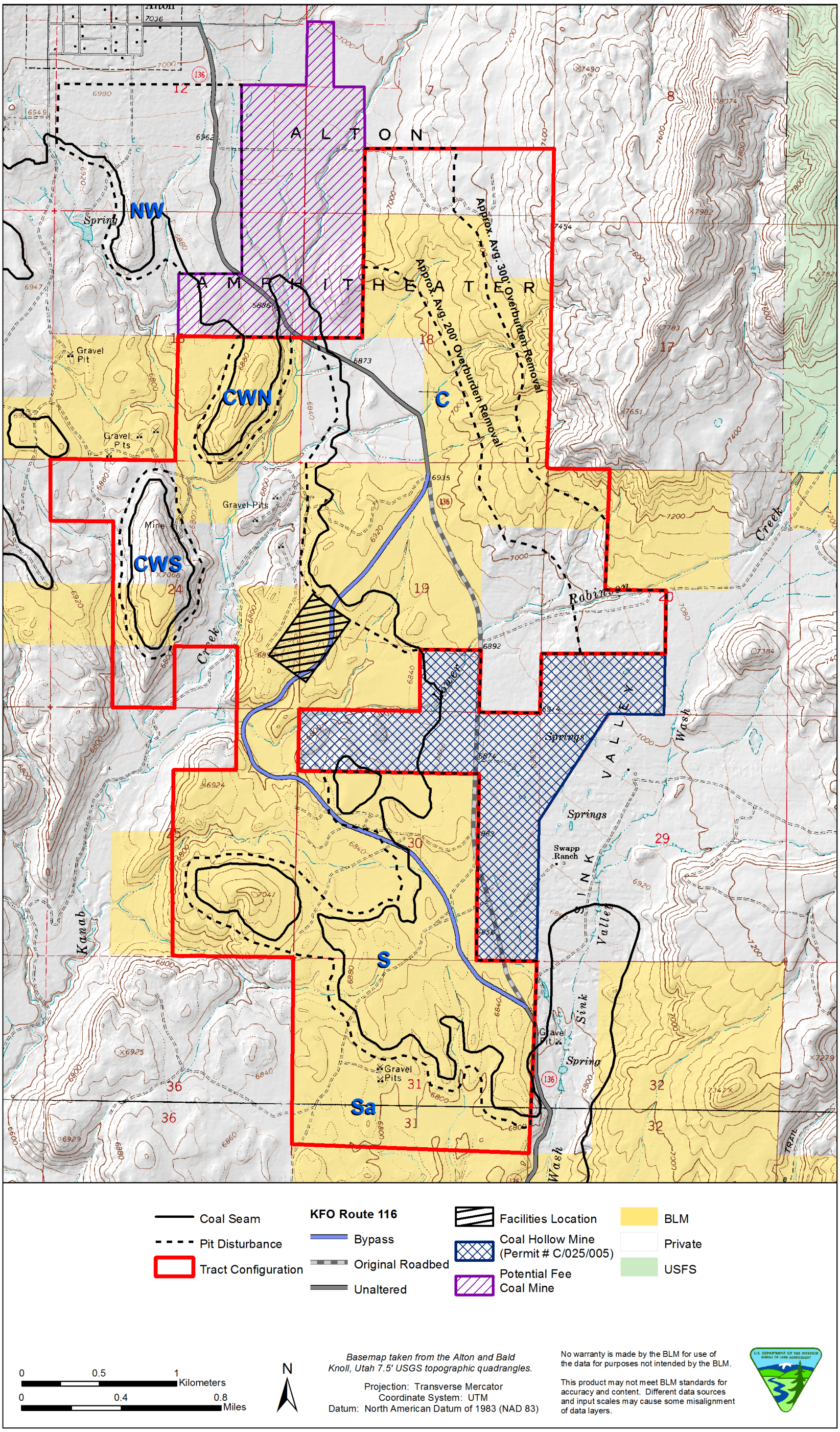
Appendix A: Maps



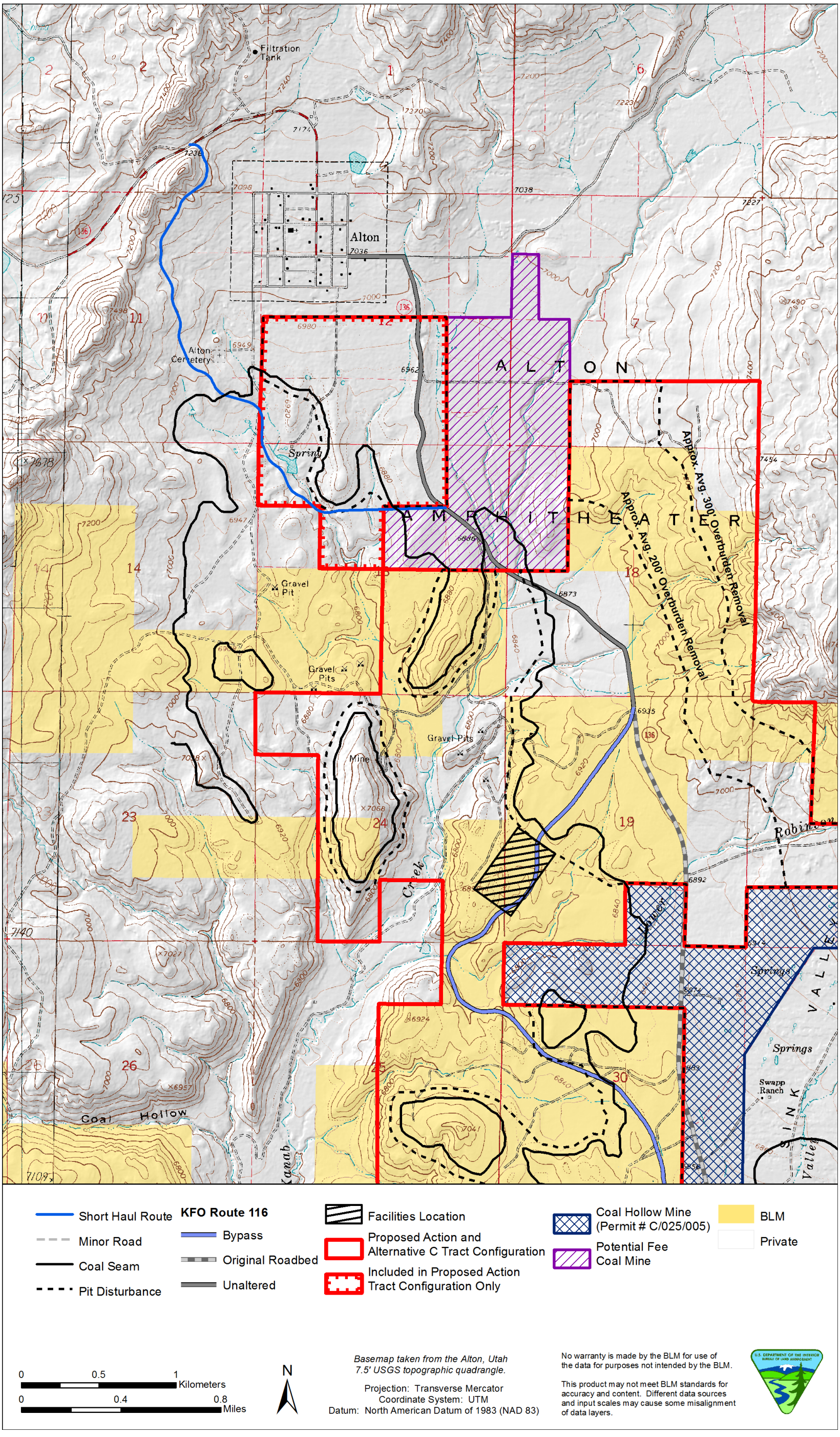
Map 1.1. Emission inventory and modeling domain (air resource modeling domain).



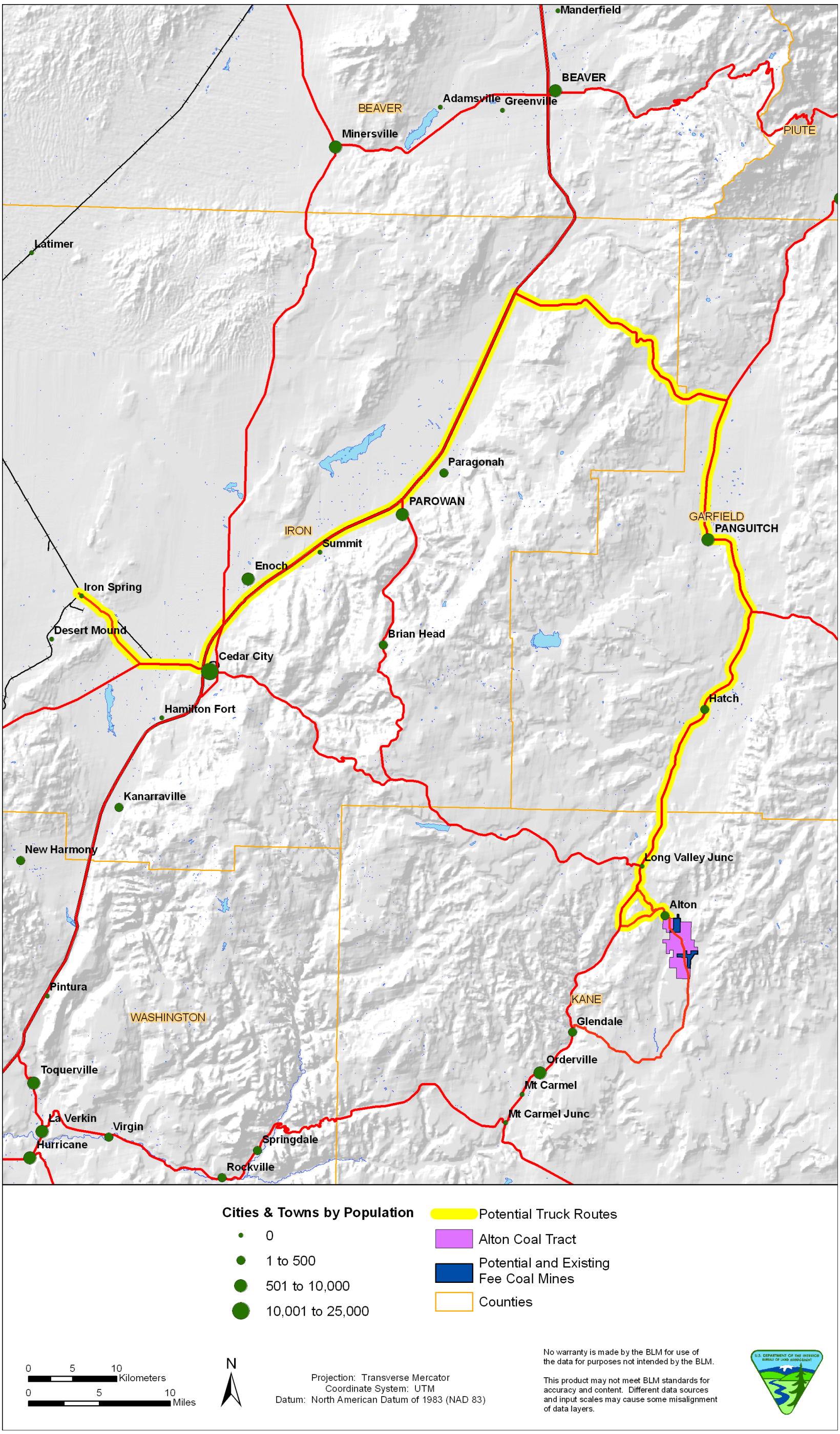
Map 1.2. Alton Coal Tract under Alternative B.



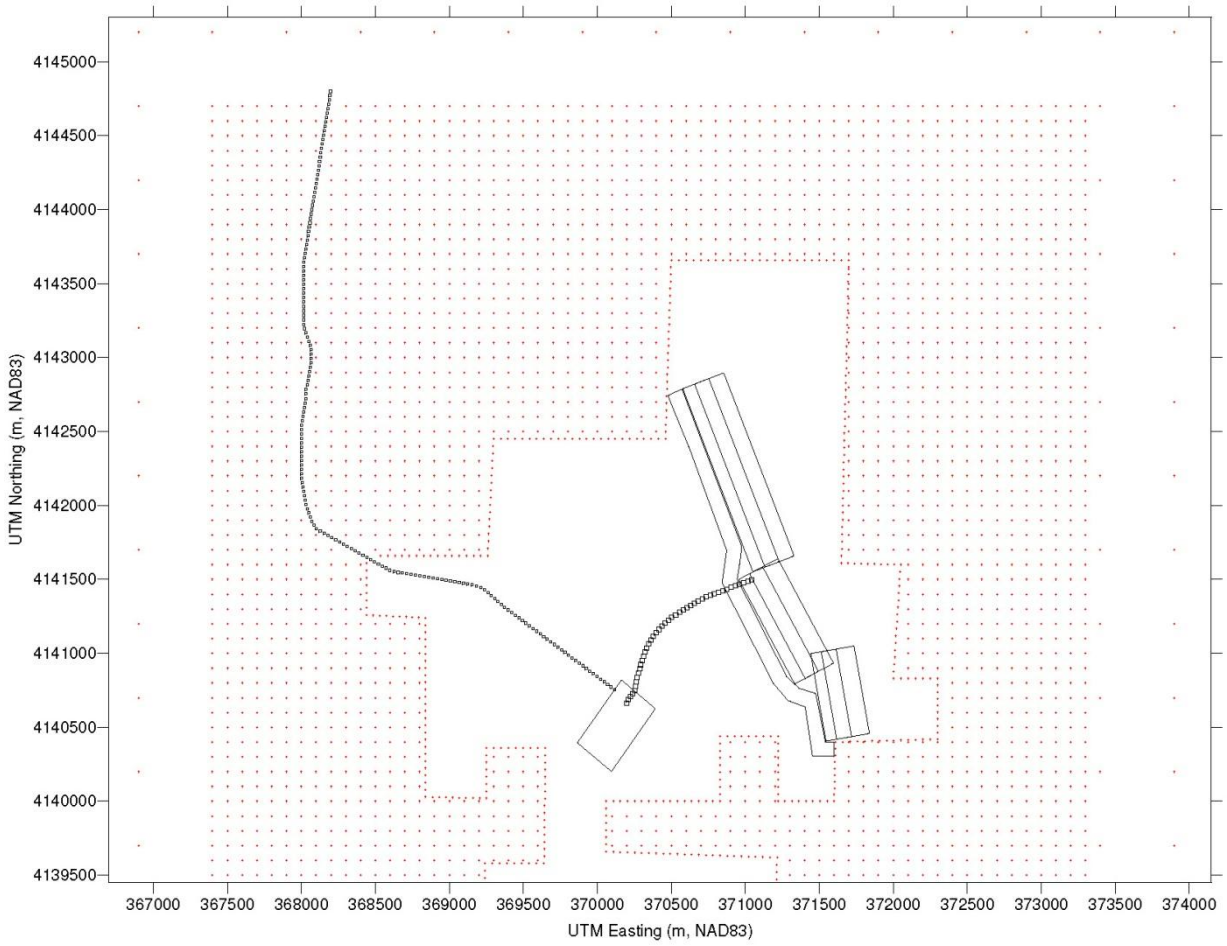
Map 1.3. Alton Coal Tract under Alternative C.



Map 1.4. Reasonably foreseeable short haul route (mine site to KFO Route 116 north of the Town of Alton).

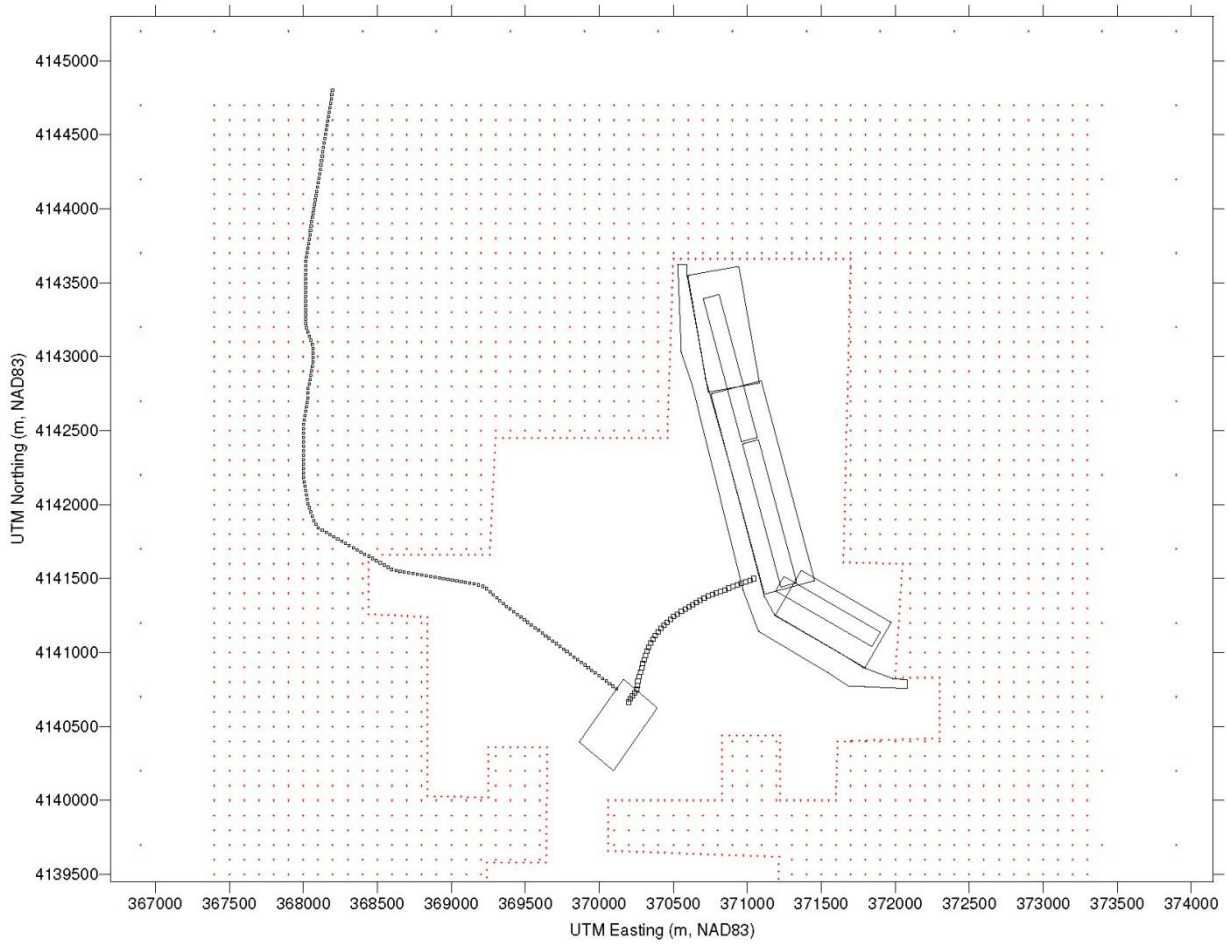


Map 1.5. Reasonably foreseeable rail loadout facility and coal haul transportation route.



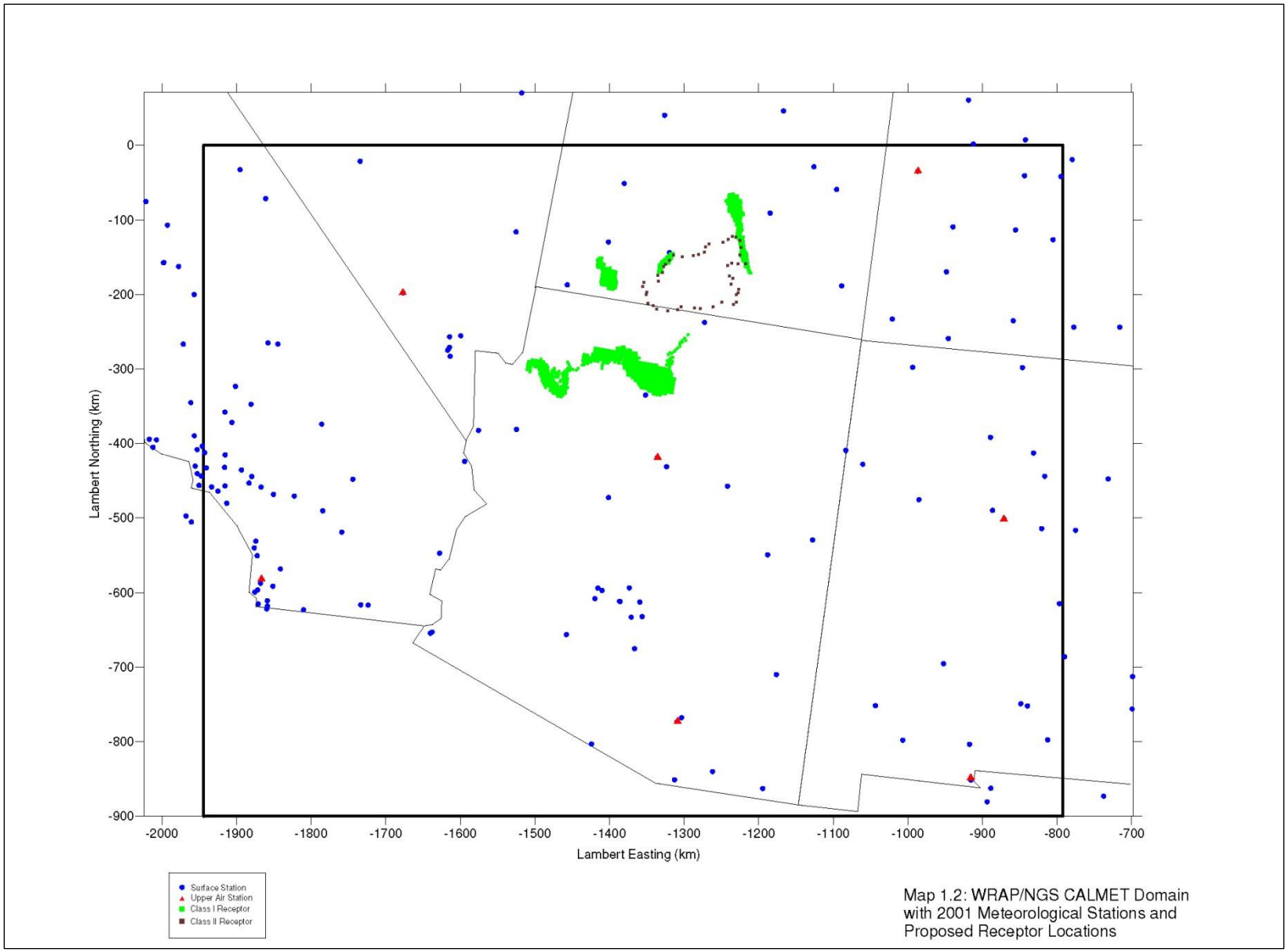
Map 1.6a - Alton Coal Tract Layout
200 Foot Overburden Removal Scenarios

Map 1.6a. Maximum development year layout (200-foot overburden scenario).



Map 1.6b - Alton Coal Tract Layout
300 Foot Overburden Removal Scenarios

Map 1.6b. Maximum development year layout (300-foot overburden removal scenario).



Map 1.7. WRAP/NGS CALMET domain with 2001 meteorological stations and proposed receptor locations.

Appendix B: Mining Emission Inventory Results

Alton 200-foot Overburden Scenario, Alternative B

Alton Tract - Alternative B

AERMOD Area Source CO Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual CO Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.2878	0.1439	0.0576			0.0863		0.2878
Bulldozers	0.8702	0.4351	0.2610	0.1740				0.8702
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.4453			0.4453				0.4453
Coal Loading	0.4550		0.4550					0.4550
Blasting	0.2891	0.2024	0.0867					0.2891
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.3188						0.3188	0.3188
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0151	0.0076	0.0030			0.0045		0.0151
Total	**8.23**	**4.27**	**2.46**	**0.62**	**0.00**	**0.56**	**0.32**	8.2331
	286.18							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		4 2699	2 4624	0 6193	0 0000	0 5627	0 3188	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		3 39995E-06	8 10024E-06	2 34246E-06	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 00853	0 00223	
						0 01076	Haul road and access road overlap	

Alton Tract - Alternative B

AERMOD Area Source NOx Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual NOx Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0329	0.0164	0.0066			0.0099		0.0329
Bulldozers	0.0994	0.0497	0.0298	0.0199				0.0994
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.0509			0.0509				0.0509
Coal Loading	0.0520		0.0520					0.0520
Blasting	0.0734	0.0513	0.0220					0.0734
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.1230						0.1230	0.1230
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0339	0.0169	0.01			0.0102		0.0339
Total	**6.03**	**3.62**	**1.72**	**0.07**	**0.00**	**0.50**	**0.12**	6.03
	209.69							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		3 6230	1 7192	0 0708	0 0000	0 4964	0 1230	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		2 88486E-06	5 6556E-06	2 6771E-07	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 0075	0 00086	
						0 00838	Haul road and access road overlap	

Alton Tract - Alternative B

AERMOD Area Source PM-10 Modeling Emissions

		Emissions by Area (g/s)							
Emission Activities	**Total Annual PM-10 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	**Check**	
Graders	0 0390	0 0195	0 0078			0 0117		0 0390	
Bulldozers	0 4846	0 2423	0 1454	0 0969				0 4846	
Overburden Loading	0 1156	0 0809	0 0347					0 1156	
Overburden Haul Truck	0 8578	0 4615	0 3963					0 8578	
Topsoil Scraping	0 2956			0 2956				0 2956	
Coal Loading	0 0060		0 0060					0 0060	
Blasting (within pit)	0 0073	0 0051	0 0022					0 0073	
Wind Erosion	0 2854	0 1427	0 0856	0 0571				0 2854	
Coal Processing (increase to 25' release height)	0 3351				0 3351			0 3351	
Access Road Traffic	1 4287						1 4287	1 4287	
Coal Haul Truck	0 3647	0 0303	0 1218			0 2126		0 3647	
Service Vehicles (separated from graders line item)	0 1415	0 0590	0 0471			0 0354		0 1415	
Total Emissions by Area	**4.3613**	**1.04**	**0.85**	**0.45**	**0.34**	**0.26**	**1.43**	4 3613	
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**		
Area (m^2)		806,600	274,081	274,713	152,856				
Emissions (g/s)		1 0413	0 8469	0 4496	0 3351	0 2597	1 4287		
Initial Lateral Width (m)									
Road Segment Length (m)									
Model Emission Rate (g/s-m2)		1 29098E-06	3 08996E-06	1 63661E-06	2 19215E-06				
Road Segments						44	140		
Volume Source Emission Rate (g/s)						0 0059	0 01021		
Open Pits Source Calculations	have to model volume sources as independent adjacent sources with emissions input as g/s (BEEST figures out g/sec-m2 by area and volume inputs)								
Coal Pit Volumes(Assumes 180ft Depth)	**Leg 1**	**Leg 2**	**Leg 3**						
Xinit(m)	100.58	100.58	100.58						
Yinit(m)	1325	800	600						
Depth(m)**	54.9	54.9	54.9	**Total Volume of Open pits**					
Volume (m3)	7,311,643	4,414,577	3,310,933	15037152.55					
Equivalent Surface Area (m2)	133268.5	80464	60348	274080.5					
Emissions (g/s)	0.411794851	0.248630854	0.18647314	0.8469	(Matches main coal pit emissions above)				
Model Emission Rate (g/s-m2)				3.0900E-06					
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**						
Assumes 120 foot average depth									
Xinit(m)	296	296	296						
Yinit(m)	1325	800	600						
Depth(m) **	36.58	36.58	36.58	**Total Volume of Open pits**					
Volume (m3)	14,345,107	8,661,197	6,495,898	29502201.60					
Equivalent Surface Area (m2)	392200	236800	177600	806600					
Total (g/s)	0.506323242	0.305704599	0.229278449	1.0413	(Matches total development area emissions above)				

Model Emission Rate (g/s-m2)				1.2910E-06					
** The BEEST AERMOD processor figures out the pit depth by using the input volume and surface area for the source									

Alton Tract - Alternative B

AERMOD Area Source PM-2.5 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual PM-2.5 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0027	0.0014	0.0005			0.0008		0.0027
Bulldozers	0.2652	0.1326	0.0796	0.0530				0.2652
Overburden Loading	0.0175	0.0123	0.0053					0.0175
Overburden Haul Truck	0.0858	0.0462	0.0396					0.0858
Topsoil Scraping	0.0296			0.0296				0.0296
Coal Loading	0.0009		0.0009					0.0009
Blasting	0.0004	0.0003	0.0001					0.0004
Wind Erosion	0.0428	0.0214	0.0128	0.0086				0.0428
Coal Processing	0.0338				0.0338			0.0338
Access Road Traffic	0.1463						0.1463	0.1463
Coal Haul Truck	0.0365	0.0030	0.0122			0.0213		0.0365
Service Vehicles (separated from graders line item)	0.0141	0.0071	0.0028			0.0042		0.0141
Total, g/sec	**0.676**	**0.22**	**0.15**	**0.09**	**0.03**	**0.03**	**0.15**	0.6757
Total, ton/yr	23.49							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		806,600	274,081	274,713	152,856			
Emissions (g/s)		0 2242	0 1539	0 0912	0 0338	0 0263	0 1463	
Initial Lateral Width (m)								
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		2 77941E-07	5 61463E-07	3 3186E-07	2 21334E-07			
Road Segments						44	144	
Volume Source Emission Rate (g/s)						0 00060	0 00102	
						0 001614	Haul road and access road overlap	
Open Pits								
Coal Pit Volumes (210' below grade)	**Leg 1**	**Leg 2**	**Leg 3**					
Xinit(m)	110	110	110					
Yinit(m)	1000	1000	750					
Depth(m)	62.5	62.5	62.5					
Volume (m3)	6873240	6873240	5154930	18901410				
Equivalent Surface Area (m2)	110000	110000	82500	302500				
Emissions at Pit Bottom (g/s)				0.0009				
Emissions assumed at 1/2 depth of pit g/s)				0.1380				
Emissions (g/s)	0.013772862	0.050500493	0.03787537	0.1389	0.102148725			
Model Emission Rate (g/s-m2)				4.5910E-07				
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**					
assume 100' below grade								
Xinit(m)	350	350	350					

Yinit(m)	800	1400	700					
Depth(m)	30	30	30					
Volume (m3)	8,400,000	14,700,000	7,350,000					
Equivalent Surface Area (m2)	280000	490000	245000	1015000				
emissions in main pit overburden removal area (g/s)				0.0584				
other emissions assumed at 1/2 depth of main pit area				0.1557				
Total (g/s)	0.05905856	0.10335248	0.05167624	0.2141				
Model Emission Rate (g/s-m2)				2.1092E-07				

Alton Tract - Alternative B

AERMOD Area Source SO2 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual SO2 Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0001	0.0001	0.0000			0.0000		0.0001
Bulldozers	0.0012	0.0006	0.0004	0.0002				0.0012
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	0.0014	0.0010	0.0004					0.0014
Topsoil Scraping	0.0004			0.0004				0.0004
Coal Loading	0.0006		0.0006					0.0006
Blasting	0.0086	0.0060	0.0026					0.0086
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.0002						0.0002	0.0002
Coal Haul Truck	0.0003	0.0000	0.0001			0.0002		0.0003
Service Vehicles (separated from graders line item)	0.0000	0.0000	0.0000			0.0000		0.0000
Total	**0.0129**	**0.0078**	**0.0041**	**0.0006**	**0.0000**	**0.0002**	**0.0002**	0.0129
	0.45							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		0 0078	0 0041	0 0006	0 0000	0 0002	0 0002	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		6 1817E-09	1 34214E-08	2 34853E-09	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 000004	0 000001	
						0 000005	Haul road and access road overlap	

Alton 200-foot Overburden Scenario, Alternative C

Alton Tract - Alternative C
AERMOD Area Source CO Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual CO Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.2878	0.1439	0.0576			0.0863		0.2878
Bulldozers	0.8702	0.4351	0.2610	0.1740				0.8702
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.4453			0.4453				0.4453
Coal Loading	0.4550		0.4550					0.4550
Blasting	0.2891	0.2024	0.0867					0.2891
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.3188						0.3188	0.3188
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0151	0.0076	0.0030			0.0045		0.0151
Total	**8.23**	**4.27**	**2.46**	**0.62**	**0.00**	**0.56**	**0.32**	8.2331
	286.18							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		4 2699	2 4624	0 6193	0 0000	0 5627	0 3188	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		3 39995E-06	8 10024E-06	2 34246E-06	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 00853	0 00223	
						0 01076	Haul road and access road overlap	

Alton Tract - Alternative C

AERMOD Area Source NOx Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual NOx Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0329	0.0164	0.0066			0.0099		0.0329
Bulldozers	0.0994	0.0497	0.0298	0.0199				0.0994
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.0509			0.0509				0.0509
Coal Loading	0.0520		0.0520					0.0520
Blasting	0.0734	0.0513	0.0220					0.0734
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.1230						0.1230	0.1230
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0339	0.0169	0.01			0.0102		0.0339
Total	**6.03**	**3.62**	**1.72**	**0.07**	**0.00**	**0.50**	**0.12**	6.03
	209.69							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		3 6230	1 7192	0 0708	0 0000	0 4964	0 1230	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		2 88486E-06	5 6556E-06	2 6771E-07	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 0075	0 00086	
						0 00838	Haul road and access road overlap	

Alton Tract - Alternative C

AERMOD Area Source PM-10 Modeling Emissions

		Emissions by Area (g/s)								
Emission Activities	**Total Annual PM-10 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	**Check**		
Graders	0 0390	0 0195	0 0078			0 0117		0 0390		
Bulldozers	0 4846	0 2423	0 1454	0 0969				0 4846		
Overburden Loading	0 1156	0 0809	0 0347					0 1156		
Overburden Haul Truck	0 8578	0 4615	0 3963					0 8578		
Topsoil Scraping	0 2956			0 2956				0 2956		
Coal Loading	0 0060		0 0060					0 0060		
Blasting (within pit)	0 0073	0 0051	0 0022					0 0073		
Wind Erosion	0 5708	0 2854	0 1712	0 1142				0 5708		
Coal Processing (increase to 25' release height)	0 3351				0 3351			0 3351		
Access Road Traffic	1 4287						1 4287	1 4287		
Coal Haul Truck	0 3647	0 0303	0 1218			0 2126		0 3647		
Service Vehicles (separated from graders line item)	0 1415	0 0590	0 0471			0 0354		0 1415		
Total Emissions by Area	**4.6467**	**1.18**	**0.93**	**0.51**	**0.34**	**0.26**	**1.43**	4 6467		
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**			
Area (m^2)		806,600	274,081	274,713	152,856					
Emissions (g/s)		1.1840	0.9325	0.5067	0.3351	0.2597	1.4287			
Initial Lateral Width (m)										
Road Segment Length (m)										
Model Emission Rate (g/s-m2)		1.4679E-06	3.40236E-06	1.84439E-06	2.19215E-06					
Road Segments						44	140			
Volume Source Emission Rate (g/s)						0.0059	0.01021			
Open Pits Source Calculations	have to model volume sources as independent adjacent sources with emissions input as g/s (BEEST figures out g/sec-m2 by area and volume inputs)									
Coal Pit Volumes(Assumes 180ft Depth)	**Leg 1**	**Leg 2**	**Leg 3**							
Xinit(m)	100.58	100.58	100.58							
Yinit(m)	1325	800	600							
Depth(m)**	54.9	54 9	54.9	**Total Volume of Open pits**						
Volume (m3)	7,311,643	4,414,577	3,310,933	15037152.55						
Equivalent Surface Area (m2)	133268.5	80464	60348	274080.5						
Emissions (g/s)	0.453427041	0.27376727	0 205325452	0.9325	(Matches main coal pit emissions above)					
Model Emission Rate (g/s-m2)				3.4024E-06						
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**							
Assumes 120 foot average depth										
Xinit(m)	296	296	296							
Yinit(m)	1325	800	600							
Depth(m) **	36.58	36.58	36 58	**Total Volume of Open pits**						
Volume (m3)	14,345,107	8,661,197	6,495,898	29502201.60						
Equivalent Surface Area (m2)	392200	236800	177600	806600						
Total (g/s)	0 575710224	0.347598626	0 260698969	1.1840	(Matches total development area emissions above)					
Model Emission Rate (g/s-m2)				1.4679E-06						

** The BEEST AERMOD processor figures out the pit depth by using he input volume and surface area for the source										

Alton Tract - Alternative C

AERMOD Area Source PM-2.5 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual PM-2.5 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0027	0.0014	0.0005			0.0008		0.0027
Bulldozers	0.2652	0.1326	0.0796	0.0530				0.2652
Overburden Loading	0.0175	0.0123	0.0053					0.0175
Overburden Haul Truck	0.0858	0.0462	0.0396					0.0858
Topsoil Scraping	0.0296			0.0296				0.0296
Coal Loading	0.0009		0.0009					0.0009
Blasting	0.0004	0.0003	0.0001					0.0004
Wind Erosion	0.0856	0.0428	0.0257	0.0171				0.0856
Coal Processing	0.0338				0.0338			0.0338
Access Road Traffic	0.1463						0.1463	0.1463
Coal Haul Truck	0.0365	0.0030	0.0122			0.0213		0.0365
Service Vehicles (separated from graders line item)	0.0141	0.0071	0.0028			0.0042		0.0141
Total, g/sec	**0.718**	**0.25**	**0.17**	**0.10**	**0.03**	**0.03**	**0.15**	0.7185
Total, ton/yr	24.97							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		806,600	274,081	274,713	152,856			
Emissions (g/s)		0 2456	0 1667	0 0997	0 0338	0 0263	0 1463	
Initial Lateral Width (m)								
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		3 04478E-07	6 08322E-07	3 63027E-07	2 21334E-07			
Road Segments						44	144	
Volume Source Emission Rate (g/s)						0 00060	0 00102	
						0 001614	Haul road and access road overlap	
Open Pits								
Coal Pit Volumes (210' below grade)	**Leg 1**	**Leg 2**	**Leg 3**					
Xinit(m)	110	110	110					
Yinit(m)	1000	1000	750					
Depth(m)	62.5	62.5	62.5					
Volume (m3)	6873240	6873240	5154930	18901410				
Equivalent Surface Area (m2)	110000	110000	82500	302500				
Emissions at Pit Bottom (g/s)				0.0009				
Emissions assumed at 1/2 depth of pit g/s)				0.1508				
Emissions (g/s)	0.015046561	0.055170725	0.041378044	0.1517	0.111595331			
Model Emission Rate (g/s-m2)				5.0155E-07				
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**					
assume 100' below grade								
Xinit(m)	350	350	350					

Yinit(m)	800	1400	700					
Depth(m)	30	30	30					
Volume (m3)	8,400,000	14,700,000	7,350,000					
Equivalent Surface Area (m2)	280000	490000	245000	1015000				
emissions in main pit overburden removal area (g/s)				0.0584				
other emissions assumed at 1/2 depth of main pit area				0.1771				
Total (g/s)	0.064963451	0.113686039	0.05684302	0.2355				
Model Emission Rate (g/s-m2)				2.3201E-07				

Alton Tract - Alternative C

AERMOD Area Source SO2 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual SO2 Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0001	0.0001	0.0000			0.0000		0.0001
Bulldozers	0.0012	0.0006	0.0004	0.0002				0.0012
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	0.0014	0.0010	0.0004					0.0014
Topsoil Scraping	0.0004			0.0004				0.0004
Coal Loading	0.0006		0.0006					0.0006
Blasting	0.0086	0.0060	0.0026					0.0086
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.0002						0.0002	0.0002
Coal Haul Truck	0.0003	0.0000	0.0001			0.0002		0.0003
Service Vehicles (separated from graders line item)	0.0000	0.0000	0.0000			0.0000		0.0000
Total	**0.0129**	**0.0078**	**0.0041**	**0.0006**	**0.0000**	**0.0002**	**0.0002**	0.0129
	0.45							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		0 0078	0 0041	0 0006	0 0000	0 0002	0 0002	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		6 1817E-09	1 34214E-08	2 34853E-09	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 000004	0 000001	
						0 000005	Haul road and access road overlap	

Alton 300-foot Overburden Scenario, Alternative B

Alton Tract - Alternative B

AERMOD Area Source CO Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual CO Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.2878	0.1439	0.0576			0.0863		0.2878
Bulldozers	1.0442	0.5221	0.3133	0.2088				1.0442
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	14.6594	10.2616	4.3978					14.6594
Topsoil Scraping	0.4453			0.4453				0.4453
Coal Loading	0.4550		0.4550					0.4550
Blasting	0.2891	0.2024	0.0867					0.2891
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.3188						0.3188	0.3188
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0151	0.0076	0.0030			0.0045		0.0151
Total	**18.18**	**11.20**	**5.45**	**0.65**	**0.00**	**0.56**	**0.32**	18.1801
	631.94							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		11 1980	5 4465	0 6541	0 0000	0 5627	0 3188	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		8 91646E-06	1 79166E-05	2 47411E-06	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 00853	0 00223	
						0 01076	Haul road and access road overlap	

Alton Tract - Alternative B

AERMOD Area Source NOx Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual NOx Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0329	0.0164	0.0066			0.0099		0.0329
Bulldozers	0.1193	0.0597	0.0358	0.0239				0.1193
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	14.6594	10.2616	4.3978					14.6594
Topsoil Scraping	0.0509			0.0509				0.0509
Coal Loading	0.0520		0.0520					0.0520
Blasting	0.0734	0.0513	0.0220					0.0734
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.1230						0.1230	0.1230
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0339	0.0169	0.01			0.0102		0.0339
Total	**15.83**	**10.47**	**4.66**	**0.07**	**0.00**	**0.50**	**0.12**	15.83
	550.09							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		10 4740	4 6571	0 0748	0 0000	0 4964	0 1230	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		8 34001E-06	1 53199E-05	2 82755E-07	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 0075	0 00086	
						0 00838	Haul road and access road overlap	

Alton Tract - Alternative B

AERMOD Area Source PM-10 Modeling Emissions

		Emissions by Area (g/s)							
Emission Activities	**Total Annual PM-10 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	**Check**	
Graders	0 0390	0 0195	0 0078			0 0117		0 0390	
Bulldozers	0 5815	0 2908	0 1745	0 1163				0 5815	
Overburden Loading	0 1908	0 1336	0 0572					0 1908	
Overburden Haul Truck	1 6041	0 8630	0 7411					1 6041	
Topsoil Scraping	0 3683			0 3683				0 3683	
Coal Loading	0 0060		0 0060					0 0060	
Blasting (within pit)	0 0073	0 0051	0 0022					0 0073	
Wind Erosion	0 3437	0 1718	0 1031	0 0687				0 3437	
Coal Processing (increase to 25' release height)	0 3351				0 3351			0 3351	
Access Road Traffic	1 4287						1 4287	1 4287	
Coal Haul Truck	0 7294	0 0605	0 2436			0 4252		0 7294	
Service Vehicles (separated from graders line item)	0 1415	0 0590	0 0471			0 0354		0 1415	
Total Emissions by Area	**5.7753**	**1.60**	**1.38**	**0.55**	**0.34**	**0.47**	**1.43**	5 7753	
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**		
Area (m^2)		806,600	274,081	274,713	152,856				
Emissions (g/s)		1 6033	1 3826	0 5533	0 3351	0 4723	1 4287		
Initial Lateral Width (m)									
Road Segment Length (m)									
Model Emission Rate (g/s-m2)		1 98774E-06	5 04454E-06	2 01420E-06	2 19215E-06				
Road Segments						44	140		
Volume Source Emission Rate (g/s)						0 0107	0 01021		
Open Pits Source Calculations	have to model volume sources as independent adjacent sources with emissions input as g/s (BEEST figures out g/sec-m2 by area and volume inputs)								
Coal Pit Volumes(Assumes 180ft Depth)	**Leg 1**	**Leg 2**	**Leg 3**						
Xinit(m)	100.58	100.58	100.58						
Yinit(m)	1325	800	600						
Depth(m)**	54.9	54.9	54.9	**Total Volume of Open pits**					
Volume (m3)	7,311,643	4,414,577	3,310,933	15037152.55					
Equivalent Surface Area (m2)	133268.5	80464	60348	274080.5					
Emissions (g/s)	0.672278452	0.405903971	0.304427978	1.3826	(Matches main coal pit emissions above)				
Model Emission Rate (g/s-m2)				5.0445E-06					
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**						
Assumes 120 foot average depth									
Xinit(m)	296	296	296						
Yinit(m)	1325	800	600						
Depth(m) **	36.58	36.58	36.58	**Total Volume of Open pits**					
Volume (m3)	14,345,107	8,661,197	6,495,898	29502201.60					
Equivalent Surface Area (m2)	392200	236800	177600	806600					
Total (g/s)	0.77959016	0.470695946	0.353021959	1.6033	(Matches total development area emissions above)				

Model Emission Rate (g/s-m2)				1.9877E-06					
** The BEEST AERMOD processor figures out the pit depth by using the input volume and surface area for the source									

Alton Tract - Alternative B

AERMOD Area Source PM-2.5 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual PM-2.5 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0 0027	0 0014	0 0005			0 0008		0 0027
Bulldozers	0 3183	0 1591	0 0955	0 0637				0 3183
Overburden Loading	0 0289	0 0202	0 0087					0 0289
Overburden Haul Truck	0 1604	0 0863	0 0741					0 1604
Topsoil Scraping	0 0368			0 0368				0 0368
Coal Loading	0 0009		0 0009					0 0009
Blasting	0 0004	0 0003	0 0001					0 0004
Wind Erosion	0 0516	0 0258	0 0155	0 0103				0 0516
Coal Processing	0 0338				0 0338			0 0338
Access Road Traffic	0 1463						0 1463	0 1463
Coal Haul Truck	0 0729	0 0061	0 0244			0 0425		0 0729
Service Vehicles (separated from graders line item)	0 0141	0 0071	0 0028			0 0042		0 0141
Total, g/sec	**0.867**	**0.31**	**0.22**	**0.11**	**0.03**	**0.05**	**0.15**	0 8672
Total, ton/yr	30 14							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		806,600	274,081	274,713	152,856			
Emissions (g/s)		0.3062	0.2225	0.1108	0.0338	0.0476	0.1463	
Initial Lateral Width (m)								
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		3.79651E-07	8.11793E-07	4.03302E-07	2.21334E-07			
Road Segments						44	144	
Volume Source Emission Rate (g/s)						0.00108	0.00102	
						0.002097	Haul road and access road overlap	
Open Pits								
Coal Pit Volumes (210' below grade)	**Leg 1**	**Leg 2**	**Leg 3**					
Xinit(m)	110	110	110					
Yinit(m)	1000	1000	750					
Depth(m)	62 5	62 5	62.5					
Volume (m3)	6873240	6873240	5154930	18901410				
Equivalent Surface Area (m2)	110000	110000	82500	302500				
Emissions at Pit Bottom (g/s)				0.0009				
Emissions assumed at 1/2 depth of pit g/s)				0.1944				
Emissions (g/s)	0.019369262	0.071020628	0.053265471	0.1953	0.143655361			
Model Emission Rate (g/s-m2)				6.4564E-07				
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**					
assume 100' below grade								
Xinit(m)	350	350	350					
Yinit(m)	800	1400	700					
Depth(m)	30	30	30					
Volume (m3)	8,400,000	14,700,000	7,350,000					
Equivalent Surface Area (m2)	280000	490000	245000	1015000				
emissions in main pit overburden removal area (g/s)				0.1065				
other emissions assumed at 1/2 depth of main pit area				0.1866				
Total (g/s)	0.08085511	0.141496442	0.070748221	0.2931				
Model Emission Rate (g/s-m2)				2 8877E-07				

Alton Tract - Alternative B

AERMOD Area Source SO2 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual SO2 Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0001	0.0001	0.0000			0.0000		0.0001
Bulldozers	0.0015	0.0007	0.0004	0.0003				0.0015
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	0.0043	0.0030	0.0013					0.0043
Topsoil Scraping	0.0004			0.0004				0.0004
Coal Loading	0.0006		0.0006					0.0006
Blasting	0.0086	0.0060	0.0026					0.0086
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.0002						0.0002	0.0002
Coal Haul Truck	0.0003	0.0000	0.0001			0.0002		0.0003
Service Vehicles (separated from graders line item)	0.0000	0.0000	0.0000			0.0000		0.0000
Total	**0.0160**	**0.0099**	**0.0050**	**0.0007**	**0.0000**	**0.0002**	**0.0002**	0.0160
	0.56							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		0 0099	0 0050	0 0007	0 0000	0 0002	0 0002	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		7 88455E-09	1 65062E-08	2 53601E-09	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 000004	0 000001	
						0 000005	Haul road and access road overlap	

Alton 300-foot Overburden Scenario, Alternative C

Alton Tract - Alternative C
AERMOD Area Source CO Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual CO Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.2878	0.1439	0.0576			0.0863		0.2878
Bulldozers	1.0442	0.5221	0.3133	0.2088				1.0442
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	14.6594	10.2616	4.3978					14.6594
Topsoil Scraping	0.4453			0.4453				0.4453
Coal Loading	0.4550		0.4550					0.4550
Blasting	0.2891	0.2024	0.0867					0.2891
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.3188						0.3188	0.3188
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0151	0.0076	0.0030			0.0045		0.0151
Total	**18.18**	**11.20**	**5.45**	**0.65**	**0.00**	**0.56**	**0.32**	18.1801
	631.94							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		11 1980	5 4465	0 6541	0 0000	0 5627	0 3188	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		8 91646E-06	1 79166E-05	2 47411E-06	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 00853	0 00223	
						0 01076	Haul road and access road overlap	

Alton Tract - Alternative C

AERMOD Area Source NOx Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual NOx Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0329	0.0164	0.0066			0.0099		0.0329
Bulldozers	0.1193	0.0597	0.0358	0.0239				0.1193
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	14.6594	10.2616	4.3978					14.6594
Topsoil Scraping	0.0509			0.0509				0.0509
Coal Loading	0.0520		0.0520					0.0520
Blasting	0.0734	0.0513	0.0220					0.0734
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.1230						0.1230	0.1230
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0339	0.0169	0.01			0.0102		0.0339
Total	**15.83**	**10.47**	**4.66**	**0.07**	**0.00**	**0.50**	**0.12**	15.83
	550.09							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		10 4740	4 6571	0 0748	0 0000	0 4964	0 1230	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		8 34001E-06	1 53199E-05	2 82755E-07	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 0075	0 00086	
						0 00838	Haul road and access road overlap	

Alton Tract - Alternative C

AERMOD Area Source PM-10 Modeling Emissions

		Emissions by Area (g/s)							
Emission Activities	**Total Annual PM-10 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	**Check**	
Graders	0 0390	0 0195	0 0078			0 0117		0 0390	
Bulldozers	0 5815	0 2908	0 1745	0 1163				0 5815	
Overburden Loading	0 1908	0 1336	0 0572					0 1908	
Overburden Haul Truck	1 6041	0 8630	0 7411					1 6041	
Topsoil Scraping	0 3683			0 3683				0 3683	
Coal Loading	0 0060		0 0060					0 0060	
Blasting (within pit)	0 0073	0 0051	0 0022					0 0073	
Wind Erosion	0 6874	0 3437	0 2062	0 1375				0 6874	
Coal Processing (increase to 25' release height)	0 3351				0 3351			0 3351	
Access Road Traffic	1 4287						1 4287	1 4287	
Coal Haul Truck	0 7294	0 0605	0 2436			0 4252		0 7294	
Service Vehicles (separated from graders line item)	0 1415	0 0590	0 0471			0 0354		0 1415	
Total Emissions by Area	**6.1190**	**1.78**	**1.49**	**0.62**	**0.34**	**0.47**	**1.43**	6 1190	
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**		
Area (m^2)		806,600	274,081	274,713	152,856				
Emissions (g/s)		1.7752	1.4857	0.6221	0.3351	0.4723	1.4287		
Initial Lateral Width (m)									
Road Segment Length (m)									
Model Emission Rate (g/s-m2)		2.20078E-06	5.42073E-06	2.26441E-06	2.19215E-06				
Road Segments						44	140		
Volume Source Emission Rate (g/s)						0.0107	0.01021		
Open Pits Source Calculations	have to model volume sources as independent adjacent sources with emissions input as g/s (BEEST figures out g/sec-m2 by area and volume inputs)								
Coal Pit Volumes(Assumes 180ft Depth)	**Leg 1**	**Leg 2**	**Leg 3**						
Xinit(m)	100.58	100.58	100.58						
Yinit(m)	1325	800	600						
Dep h(m)**	54.9	54 9	54.9	**Total Volume of Open pits**					
Volume (m3)	7,311,643	4,414,577	3,310,933	15037152.55					
Equivalent Surface Area (m2)	133268.5	80464	60348	274080.5					
Emissions (g/s)	0.722412548	0.436173614	0.327130211	1.4857	(Matches main coal pit emissions above)				
Model Emission Rate (g/s-m2)				5.4207E-06					
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**						
Assumes 120 foot average depth									
Xinit(m)	296	296	296						
Yinit(m)	1325	800	600						
Dep h(m) **	36.58	36.58	36.58	**Total Volume of Open pits**					
Volume (m3)	14,345,107	8,661,197	6,495,898	29502201.60					
Equivalent Surface Area (m2)	392200	236800	177600	806600					
Total (g/s)	0.863146988	0.521145351	0.390859013	1.7752	(Matches total development area emissions above)				
Model Emission Rate (g/s-m2)				2.2008E-06					
** The BEEST AERMOD processor figures out the pit depth by using the input volume and surface area for the source									

Alton Tract - Alternative C
AERMOD Area Source PM-2.5 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual PM-2.5 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0027	0.0014	0.0005			0.0008		0.0027
Bulldozers	0.3183	0.1591	0.0955	0.0637				0.3183
Overburden Loading	0.0289	0.0202	0.0087					0.0289
Overburden Haul Truck	0.1604	0.0863	0.0741					0.1604
Topsoil Scraping	0.0368			0.0368				0.0368
Coal Loading	0.0009		0.0009					0.0009
Blasting	0.0004	0.0003	0.0001					0.0004
Wind Erosion	0.1031	0.0516	0.0309	0.0206				0.1031
Coal Processing	0.0338				0.0338			0.0338
Access Road Traffic	0.1463						0.1463	0.1463
Coal Haul Truck	0.0729	0.0061	0.0244			0.0425		0.0729
Service Vehicles (separated from graders line item)	0.0141	0.0071	0.0028			0.0042		0.0141
Total, g/sec	**0.919**	**0.33**	**0.24**	**0.12**	**0.03**	**0.05**	**0.15**	0.9187
Total, ton/yr	31.94							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		806,600	274,081	274,713	152,856			
Emissions (g/s)		0 3320	0 2380	0 1211	0 0338	0 0476	0 1463	
Initial Lateral Width (m)								
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		4 11608E-07	8 68222E-07	4 40835E-07	2 21334E-07			
Road Segments						44	144	
Volume Source Emission Rate (g/s)						0 00108	0 00102	
						0 002097	Haul road and access road overlap	
Open Pits								
Coal Pit Volumes (210' below grade)	**Leg 1**	**Leg 2**	**Leg 3**					
Xinit(m)	110	110	110					
Yinit(m)	1000	1000	750					
Depth(m)	62.5	62.5	62.5					
Volume (m3)	6873240	6873240	5154930	18901410				
Equivalent Surface Area (m2)	110000	110000	82500	302500				
Emissions at Pit Bottom (g/s)				0.0009				
Emissions assumed at 1/2 depth of pit g/s)				0.2099				
Emissions (g/s)	0.02090307	0.07664459	0.057483442	0.2108	0.155031102			
Model Emission Rate (g/s-m2)				6.9677E-07				
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**					
assume 100' below grade								
Xinit(m)	350	350	350					

Yinit(m)	800	1400	700					
Depth(m)	30	30	30					
Volume (m3)	8,400,000	14,700,000	7,350,000					
Equivalent Surface Area (m2)	280000	490000	245000	1015000				
emissions in main pit overburden removal area (g/s)				0.1065				
other emissions assumed at 1/2 depth of main pit area				0.2123				
Total (g/s)	0.087965866	0.153940266	0.076970133	0.3189				
Model Emission Rate (g/s-m2)				3.1416E-07				

Alton Tract - Alternative C

AERMOD Area Source SO2 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual SO2 Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0001	0.0001	0.0000			0.0000		0.0001
Bulldozers	0.0015	0.0007	0.0004	0.0003				0.0015
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	0.0043	0.0030	0.0013					0.0043
Topsoil Scraping	0.0004			0.0004				0.0004
Coal Loading	0.0006		0.0006					0.0006
Blasting	0.0086	0.0060	0.0026					0.0086
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.0002						0.0002	0.0002
Coal Haul Truck	0.0003	0.0000	0.0001			0.0002		0.0003
Service Vehicles (separated from graders line item)	0.0000	0.0000	0.0000			0.0000		0.0000
Total	**0.0160**	**0.0099**	**0.0050**	**0.0007**	**0.0000**	**0.0002**	**0.0002**	0.0160
	0.56							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		0 0099	0 0050	0 0007	0 0000	0 0002	0 0002	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		7 88455E-09	1 65062E-08	2 53601E-09	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 000004	0 000001	
						0 000005	Haul road and access road overlap	

Appendix C: AP-42 Emission Factor Sections

Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors

Prepared by

Midwest Research Institute
(Chatten Cowherd, MRI Project Leader)

For
Western Governors' Association
Western Regional Air Partnership (WRAP)
1515 Cleveland Place, Suite 200
Denver, Colorado 80202

Attn: Richard Halvey

MRI Project No. 110397

February 1, 2006
Finalized November 1, 2006

Responses to Comments Received on Proposed AP-42 Revisions

Commenter and Date	Source Category	Comment	Response
John Hayden, National Stone, Sand and Gravel Association (NSSGA); June 14, 2006	Unpaved Roads	NSSGA-sponsored tests (report dated Oct. 15, 2004) at California aggregate producing plants support the proposed fine fractions.	This comment reference a test report prepared by Air Control Techniques for the National Stone, Sand & Gravel Association, dated October 4, 2004. The report gives the results of tests to determine unpaved road emissions factors for controlled (wet suppression only) haul roads at two aggregate processing plants. A variation of the plume profiling method using TEOM continuous monitors with PM-2.5 and PM-10 inlets was employed. Tests with road surface moisture content below 1.5 percent were considered to be uncontrolled. Based on the example PM-10 concentration profiles presented in the report, the maximum roadside PM-10 dust concentrations in the subject study were in the range of 300 micrograms per cubic meter. This is an order of magnitude lower than the concentrations typically found in other unpaved road emission factor studies. For the range of plume concentrations measured in the NSSGA-sponsored test program, an average fine fraction (PM-2.5/PM-10 ratio) of 0.15 was reported. This fine fraction value is consistent with the results of the MRI dust tunnel testing in the same concentration range. At plume concentrations more typical of unpaved road emission factor studies, the proposed value of 0.1 is applicable. There is no need for any revisions to the proposed changes to AP-42 as a result of the cited study.
Hao Quinn, Sacramento Metro AQMD; July 20, 2006	Paved vs. unpaved roads	For a particular industrial facility, the PM-10 emission factor equations show higher emissions from paved roads rather than unpaved roads.	***This comment does not relate to the proposed changes to the fine particle fractions***. It is possible that the emissions from a heavily loaded paved road can exceed emissions from an unpaved road with a low-to-moderate silt content at the same industrial facility, even if traveled by the same vehicles. This is the case in the cited example, for which the paved road silt loading is 70 g/m^2.

Commenter and Date	Source Category	Comment	Response
Brian Leahy, Horizon Environmental; July 26, 2006	Unpaved roads	The k value for PM-2.5 does not appear to have changed in the proposed revision.	The latest (2003) approved AP-42 k values for PM-2.5 in Table 13.2.2-2 are 0.23 and 0.27 lb/VMT for industrial and public roads, respectively. The proposed values are 0.15 and 0.18 lb/VMT, which are equivalent to 10 percent of the respective k values for PM-10. There is no need for revisions to the proposed changes to AP-42 as a result of this comment.
Shengxin Jin, NYSDOT Environmental Analysis Bureau; undated	Paved roads	The conversion of proposed k values from g/VMT to g/VKT does not appear correct	Regarding the revised k values for PM-2.5, when the k value of 0.66 g/VKT is multiplied by 1.6 km/mi, it becomes 1.06 g/VMT, which rounds to 1.1 g/VKT given in the proposed revision. Because the k values are given only to two significant figures, the converted values can vary by up to five digits in the second figure, depending on which direction the units conversion is made. For example, when k value of 1.1 g/VKT is divided by 1.6 km/mi, the resulting value rounds to 0.69 g/VKT, but if 1.06 g/VKT is divided by 1.6 km/mi, the resulting value rounds to 0.66 g/VKT. There is no need for revisions to the proposed changes to AP-42 as a result of this comment.
		The stated silt loading impact of antiskid abrasive does not appear correct	***This comment does not relate to the proposed changes to the fine particle fractions***. The commenter is correct in that 500 lb/mi of antiskid abrasive with a 1% silt content produces a silt loading in the range of 0.5 g/m^2 rather than 2 g/m^2. EPA may elect to make a separate modification to correct this discrepancy at a later time.

Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors

ABSTRACT

A number of fugitive dust studies have indicated that the $PM_{2.5}$ / PM_{10} ratios measured by US EPA federal reference method (FRM) samplers are significantly lower than predicted by AP-42 emission factors. As a result, the $PM_{2.5}$ emission estimates are biased high. The controlled exposure study described in this report was conducted to compare fine fraction ratios derived from FRM samplers to those derived from the cyclone/impactor method that had been used to develop AP-42 emission factors for fugitive dust sources. The study was conducted by the Midwest Research Institute using the same cyclone/impactor samplers and operating method that generated the original AP-42 emission factors and associated $PM_{2.5}$ / PM_{10} ratios. This study was sponsored by the Western Regional Air Partnership.

The study found that concentration measurements used to develop $PM_{2.5}$ emission factors in AP-42 were biased high by a factor of two, as compared to $PM_{2.5}$ measurements from FRM samplers. This factor-of-two bias helps to explain why researchers have often seen a discrepancy in the proportion of fugitive dust found in $PM_{2.5}$ emission inventories and modeled ambient air impacts, as compared to the proportion on ambient filter samples. This study also shows that the $PM_{2.5}$ / PM_{10} ratios for fugitive dust should be in the range of 0.1 to 0.15. Currently, the ratios in AP-42 range from 0.15 to 0.4 for most fugitive dust sources.

It is recommended that the results of this study be used to revise the AP-42 $PM_{2.5}$ emission factors for the following four fugitive dust source categories: paved roads, unpaved roads (public and industrial), aggregate handling and storage piles, and industrial wind erosion (AP-42 Sections 13.2.1, 13.2.2, 13.2.4, & 13.2.5, respectively). Emission estimates for other fugitive dust producing activities, such as construction and demolition will also be affected since they are based on these four source categories.

INTRODUCTION

The Dust Emissions Joint Forum (DEJF) of the Western Regional Air Partnership (WRAP) is engaged in gathering and improving data pertaining to the $PM_{2.5}$ and PM_{10} components of fugitive dust emissions. Most of the $PM_{2.5}$ emission factors in EPA's AP-42 guidance for fugitive dust sources (USEPA, 2005) were determined by using high-volume samplers, each fitted with a cyclone precollector and cascade impactor. Typically, AP-42 recommends that $PM_{2.5}$ emission factors for dust sources be calculated

by using PM_{10} emission factor equations along with $PM_{2.5}/PM_{10}$ ratios that have been published by EPA in AP-42.

Beginning with the introduction of the cyclone/impactor method, it was realized particle bounce from the cascade impactor stages to the backup filter may have resulted in inflated $PM_{2.5}$ concentrations, even though steps were taken to minimize particle bounce. This led to an EPA-funded field study in the late 1990s (MRI, 1997) to gather comparative particle sizing data in dust plumes downwind of paved and unpaved roads around the country. The test results indicated that dichotomous samplers produced consistently lower $PM_{2.5}/PM_{10}$ ratios than generated with the cyclone/impactor system. Dichotomous samplers are federal reference method (FRM) samplers that are used to measure compliance with federal air quality standards for particulate matter measured as $PM_{2.5}$ and PM_{10}. Pending the eventual collection of additional data, the decision was made that the true ratios would best be represented by an averaging of the cyclone/impactor data with the dichotomous sampler data.

Based on the results of the EPA-funded field program, modifications were made to the appropriate sections of AP-42 for dust emissions from paved and unpaved roads. The $PM_{2.5}/PM_{10}$ ratio for emissions from unpaved roads (dominated by fugitive dust) was reduced from 0.26 to 0.15, and the $PM_{2.5}/PM_{10}$ ratio for the dust component of emissions from paved roads was reduced from 0.46 to 0.25. In the 2003 revision to AP-42, the non-dust component of paved road emissions was assigned a $PM_{2.5}/PM_{10}$ ratio of 0.76, accounting for vehicle exhaust and brake and tire wear.

Subsequent to the modifications of the $PM_{2.5}/PM_{10}$ ratios in AP-42, additional field test results (mostly from ambient air samplers) indicated that further reductions to the ratios were warranted (Pace, 2005). For example, ambient air monitoring data suggested that the fine fraction dust mass is of the order of 10 percent of the PM_{10} mass, based on chemical fingerprinting of the collected fine and coarse fractions of PM_{10} impacted by dust sources. It is important to note, however, that particle size data applicable to fugitive dust emission factors should be gathered either from the emissions plume or near the point where emissions are generated (within 10 m of the downwind edge of the source).

METHODOLOGY

This led DEJF to fund Midwest Research Institute (MRI) in conducting a controlled study of particle sizing in dust plumes. The objective of the study was to resolve the fine particle bias in the cyclone/impactor system, so that reliable $PM_{2.5}/PM_{10}$ ratios could be developed for as many dust source categories as possible. For this purpose, an air exposure chamber connected to a recirculating supply air stream was used in conjunction with a fluidization system for generating well-mixed dust plumes from a variety of western soils and road surface materials. R&P Model 2000 Partisol samplers were selected as the ground-truthing FRM samplers for PM_{10} and $PM_{2.5}$.

This study was performed in two phases (see below), as described in the attached test report (Cowherd and Donaldson, 2005). The test report serves as the background document to support the recommended revisions to AP-42, and it contains all the quality assurance procedures and results of the testing.

Phase I – Compare $PM_{2.5}$ Measured by Cyclone/Impactor to FRM Sampler

In the first testing phase of the project, $PM_{2.5}$ measurements using the high-volume cascade impactors were compared to simultaneous measurements obtained with EPA FRM samplers for $PM_{2.5}$. As stated above, these tests were conducted in a flow-through wind tunnel and exposure chamber, where the PM_{10} concentration level and uniformity were controlled. The results of the tests provided the basis for quantifying more effectively any sampling bias associated with the cascade impactor system.

Phase 2 – Compare $PM_{2.5}$ to PM_{10} Ratios for Different Geologic Soils

With the same test setup, a second phase of testing was performed with reference method samplers, for the purpose of measuring $PM_{2.5}$ to PM_{10} ratios for fugitive dust from different geologic sources in the West. This testing provided needed information on the magnitude and variability of this ratio, especially for source materials that are recognized as problematic with regard to application of mitigative dust control measures.

RESULTS

The tests that were performed are listed in Tables 6 and 7 of the attached report. The Phase I tests were performed in March and April of 2005. The Phase II tests were performed in June through August of 2005. A total of 100 individual tests were performed, including 17 blank runs (for quality assurance purposes). The raw and intermediate test data are summarized in the tables presented in Appendix A of the attached report.

Based on the 100 wind tunnel tests that were performed in the wind tunnel study, the findings support the following conclusions:

1. $PM_{2.5}$ concentrations measured by the high-volume cyclone/impactor system used to develop AP-42 emission factors for fugitive dust sources have a positive bias by a factor of 2, as compared to the $PM_{2.5}$ concentration measurements from reference-method samplers (see Figure 1). The geometric mean bias is 2.01 and the arithmetic mean bias is 2.15.
2. The $PM_{2.5}$ bias associated with the cyclone/impactor system, as measured under controlled laboratory conditions with dust concentrations held at nearly steady values, closely replicates the bias observed in the prior EPA-funded field study at distributed geographic locations across the country.

3. The $PM_{2.5}/PM_{10}$ ratios measured by the FRM samplers in the current study for a variety of western soils show a decrease in magnitude with increasing PM_{10} concentration (see Figure 2). Soils with a nominally spherical shape are observed to have somewhat lower ratios (at given PM_{10} concentrations) than soils with angular shape. A very similar dependence of $PM_{2.5}/PM_{10}$ ratio on PM_{10} concentration was also observed in the prior field study that used dichotomous samplers as FRM devices.
4. The test data from the current study support a $PM_{2.5}/PM_{10}$ ratio in the range of 0.1 to 0.15 for typical uncontrolled fugitive dust sources (see Figure 2). The $PM_{2.5}/PM_{10}$ ratio of 0.1 is also supported by numerous other studies including the prior EPA-funded field study that used dichotomous samplers as reference devices. It is possible that a ratio as low as 0.05 (as was found in the prior field tests of unpaved road emission factors) might be appropriate for very dusty sources, but this would require extrapolation of the current test data from the wind tunnel study.

DISCUSSION

Peer Review

The test report on the wind tunnel study (Cowherd and Donaldson, 2005) was issued first in draft form for external peer review. Three peer reviewers (having no prior contact with the study) were selected by the DEJF: Patrick Gaffney (California Air Resources Board), John Kinsey (U.S. Environmental Protection Agency), and Mel Zeldin (Private Consultant). In addition, peer review comments were provided by Duane Ono (Great Basin UAPCD) and Richard Countess (Countess Environmental) who helped to develop this study. After the review comments on the draft test report were received, comment/ response logs were prepared by MRI, listing each comment and the response to each comment. The next step was to modify the draft test report in accordance with the responses to the review comments. The final test report was issued on October 12, 2005.

Recommended Particle Size Ratios

Based on the results of the WRAP/DEJF study (see attached test report) and the prior EPA-funded field study, it is proposed that new $PM_{2.5}/PM_{10}$ ratios be adopted for several categories of (uncontrolled) fugitive dust sources, as addressed in AP-42. The proposed ratios (given to the nearest 0.05) are summarized in Table 1. It should be noted that these fine fraction ratios and the emission factors could change in the future if field studies show other differences than those identified through this study.

The proposed $PM_{2.5}/PM_{10}$ ratios in Table 1, apply to dry surface materials, having moisture contents in the range of 1% or less. Such materials when exposed to energetic disturbances produce dust plumes with core PM_{10} concentrations in the range of 5,000 micrograms per cubic meter, near the point of emissions generation. The wind tunnel test data show that dust plumes with lower core concentrations have higher $PM_{2.5}/PM_{10}$

ratios. This might occur, for example, at higher soil (or other surface material) moisture contents. However, the emissions from such sources typically are substantially lower with correspondingly less impact on the ambient environment.

Table 1. Proposed Particle Size Ratios for AP-42

Fugitive dust source category	AP-42 section	$PM_{2.5}/PM_{10}$ Ratio	
		Current	Proposed
Paved Roads	13.2.1	0.25	0.15
Unpaved Roads (Public & Industrial)	13.2.2	0.15	0.1
Construction & Demolition	–	0.208 [1]	0.1
Aggregate Handling & Storage Piles	13.2.4	0.314	0.1 (traffic) 0.15 (transfer)
Industrial Wind Erosion	13.2.5	0.40	0.15
Agricultural Tilling	–	0.222 [2]	0.2 (no change)
Open Area Wind Erosion	–	-	0.15

Notes:

[1] AP-42 Section 13.2.3 suggests using emission factors for individual dust producing activities, e.g., materials handling and unpaved roads. The WRAP Fugitive Dust Handbook recommends using a fine fraction ratio of 0.208 from a report prepared for the US EPA, Estimating Particulate Matter Emissions from Construction Operations (MRI, 1999).

[2] Agricultural tilling was dropped from the 5th edition of AP-42. The WRAP Fugitive Dust Handbook recommends using a fine fraction ratio of 0.222 from Section 7.4 of the California Air Resources Board's Emission Inventory Methodology (CARB, 2003).

The justification for each proposed ratio in Table 1 is provided by source category in the sections below. In each case, reference is made to test reports that contain supporting data.

Paved Roads

For the dust component of particulate emissions from paved roads, a $PM_{2.5}/PM_{10}$ ratio of 0.15 is recommended. The proposed ratio is based on the factor-of-two bias in the cyclone/impactor data for the wind tunnel study, which tested western soils and road surface materials. As shown in Table 1, the current AP-42 ratio is 0.25. It should be recalled that the nondust component of paved road particulate emissions has been assigned a much higher ratio of 0.76, based on inputs from the EPA's MOBILE 6 model.

Unpaved Roads

For the dust component of particulate emissions from unpaved roads, which dominates the total particulate emissions from this source category, a $PM_{2.5}/PM_{10}$ ratio of 0.1 is recommended. The proposed ratio is justified from the test results of the wind tunnel study for a variety of western surface materials. It is also consistent with the factor-of-two bias in the cyclone/impactor data from the wind tunnel study and with the results of the prior field study that used dichotomous samplers as FRM devices (MRI, 1997).

Construction and Demolition

The dust component of particulate emissions from construction and demolition dominate the total particulate emissions from this source category. A $PM_{2.5}/PM_{10}$ ratio of 0.1 is recommended for dust emissions from construction and demolition. The proposed ratio is justified by the fact that the dominant dust source associated with construction and demolition projects is emissions from vehicle travel over unpaved surfaces. This is shown by case studies that calculate particulate emissions from representative construction activities (road, building, and nonbuilding construction). For example, the fine fraction ratio for scraper travel averages about 0.2 (Muleski et al., 2005), before correcting for the factor-of- two bias in the cyclone/impactor system. Moreover this includes the diesel emissions that are contained within the fine fraction component.

It should be noted that if large open areas are disturbed (such as in land clearing) and left unprotected, and the areas are exposed to high winds, open area wind erosion can also be an important contributor to dust emissions from this source category. The recommended fine fraction ratio identified below should be used for the open area wind erosion component.

Aggregate Handling and Storage Piles

Although usually not a major source in comparison with traffic around storage piles, the transfer of aggregate associated with bucket loaders and unloaders or conveyor transfer points is addressed directly in this section of AP-42. A $PM_{2.5}/PM_{10}$ ratio of 0.15 is recommended for transfer operations. This is half the current value in AP-42 and reflects adjustment for the factor-of-two bias in the cyclone/impactor test results.

The dominant dust component of particulate emissions from aggregate handling and storage piles typically consists of loader and truck traffic around the storage piles. AP-42 refers the reader to the unpaved roads section to find appropriate emission factors. A $PM_{2.5}/PM_{10}$ ratio of 0.1 is recommended for this source. The proposed ratio is consistent with that recommended above for traffic on unpaved surfaces.

Industrial Wind Erosion

For the dust component of particulate emissions from industrial wind erosion, a $PM_{2.5}/PM_{10}$ ratio of 0.15 is recommended. Industrial wind erosion is associated with crushed aggregate materials, such as coal or metallic ore piles. Examples would include open storage piles at mining operations. The proposed ratio is justified by portable wind tunnel tests of industrial aggregate materials which produced $PM_{2.5}/PM_{10}$ ratios averaging 0.4, as indicated by the current AP-42 fine fraction ratio given in Table 1. When these results are corrected for the bias associated with the cyclone/impactor system at very high PM_{10} concentrations observed in the effluent from the portable wind tunnel (exceeding 10,000 $\mu g/m^3$), the result is 0.15.

Agricultural Tilling

For the dust component of particulate emissions from agricultural tilling and related land preparation activities, which dominates the total particulate emissions from this source category, no new $PM_{2.5}/PM_{10}$ ratio can be recommended at this time, because of the lack of published test data. However, the current factor of 0.2, as listed in Table 1, appears to be generally consistent with the results of the current wind tunnel tests. It was found that the agricultural soils tested in the wind tunnel produced slightly higher ratios than the other test materials. In addition, the dust plume core concentrations from agricultural operations are generally observed to be less intense because of the lower equipment speeds involved and the lack of repeated travel over the same routes.

Open Area Wind Erosion

For the dust component of particulate emissions from open area wind erosion (not currently addressed in AP-42), a $PM_{2.5}/PM_{10}$ ratio of 0.15 is recommended. Open area wind erosion is associated with exposed soils that have been disturbed, removing the protection afforded by natural crusting. Examples would include freshly tilled agricultural fields prior to planting of crops. The proposed ratio is justified by wind tunnel tests of exposed soils (MRI, 1994), which produced $PM_{2.5}/PM_{10}$ ratios averaging 0.3. When these results are corrected for the bias associated with the cyclone/impactor system, the ratio becomes 0.15. This is consistent with the $PM_{2.5}/PM_{10}$ ratios in the range of 0.12 measured during dust storms on Owens Dry Lake (Ono, 2005).

Specific Revisions to AP-42

This section presents a listing of specific revisions to AP-42, for the purpose of incorporating the proposed $PM_{2.5}/PM_{10}$ ratios. As shown in Table 2, five subsections of AP-42 Section 13.2, Fugitive Dust, are impacted by the proposed changes. However, one of the five sections (13.2.3, Heavy Construction Operations) is impacted only indirectly because it refers to other sections of AP-42 for fugitive dust emission factors.

In most cases, the change in the $PM_{2.5}/PM_{10}$ ratio is accomplished by changing the appropriate PM-2.5 particle size multiplier (k-factor) for the respective emission factor equation. In addition, the changes need to be referenced to the WRAP test report (Cowherd and Donaldson, 2005).

Table 2. Specific revisions to AP-42 that are incorporated into the AP-42 sections included in Attachment A.

Source category	Sub-section	Title	Revision	Comments
13.2.1 Paved Roads	13.2.1.3	*Predictive Emission Factor Equation*	In Table 13.2.1-1, reduce k values for PM-2.5 by 40 percent, e.g., the new value is 1.1 g/VMT (and equivalent values for the other units)	Add ref. number for WRAP test report
	13.2.1.5	*Changes since Fifth Edition*	Modify statement (1) to reflect change in fine fraction	
		References	Add WRAP test report as Ref. 22	
13.2.2 Unpaved Roads	13.2.2.2	*Emission Calculation and Correction Parameters*	In Table 13.2.2-2, reduce k values for PM-2.5 by 33%, e.g., the new value is 0.15 lb/VMT for industrial roads and 0.18 lb/VMT for public roads (and equivalent values for the other units)	Add ref. number for WRAP test report
	13.2.2.4	*Updates since Fifth Edition*	Add sentences describing change in fine fraction	
		References	Add WRAP test report	
13.2.3 Heavy Construction Operations	–	–	No changes required	Refers to other AP-42 sections for emission factors
13.2.4 Aggregate Handling and Storage Piles	13.2.4.3	*Predictive Emission Factor Equations*	In k-factor table for Equation 1 for transfer operations, change PM-2.5 multiplier to 0.053 (dimensionless)	Add ref. number for WRAP test report
		References	Add WRAP test report	
13.2.5 Industrial Wind Erosion	13.2.5.2	*Emissions and Correction Parameters*	In k-factor table for Equation 1, change PM-2.5 multiplier to 0.075 (dimensionless)	Add ref. number for WRAP test report
		References	Add WRAP test report	

CONCLUSION

This study found that concentration measurements used to develop $PM_{2.5}$ emission factors for AP-42 were biased high by a factor of two, as compared to $PM_{2.5}$ measurements from FRM samplers. This factor-of-two bias helps to explain why researchers have often seen a similar discrepancy in the proportion of fugitive dust found in $PM_{2.5}$ emission inventories and modeled ambient impacts, as compared to the proportion observed on ambient filter samples. This study also shows that the $PM_{2.5}$ / PM_{10} ratios for fugitive dust should be in the range of 0.1 to 0.15. Currently, the fine fraction ratios in AP-42 range from 0.15 to 0.4 for most fugitive dust sources.

It is recommended that the results of this study by used to revise the AP-42 $PM_{2.5}$ emission factors for the following four fugitive dust source categories: paved roads, unpaved roads (public and industrial), aggregate handling and storage piles, and industrial wind erosion (AP-42 Sections 13.2.1, 13.2.2, 13.2.4, & 13.2.5, respectively). Emission estimates for other fugitive dust producing activities, such as construction and demolition, will also be affected since they are based on these four source categories. It is recommended that revisions to the current AP-42 sections for these fugitive dust sources be adopted as shown in Attachment A to this report.

IMPLICATIONS

The proposed revisions to AP-42 are needed to ensure the most accurate $PM_{2.5}$ and PM_{10} fugitive dust emissions inventories that are possible for regional haze regulatory purposes, given the available resources and the significant contribution of fugitive dust to visibility impairment. In particular, the revisions will affect the quantity of dust apportioned to the fine ($PM_{2.5}$) versus coarse ($PM_{2.5\text{-}10}$) size modes, which have significantly different effects on visibility and long-range transport potentials. This will reduce $PM_{2.5}$ emission estimates for fugitive dust sources to about half their current level. It will also increase the coarse-mode size fraction for fugitive dust, which would be important in the event that a PM coarse standard is adopted by the US EPA and emission inventories are developed.

The revisions will be helpful in developing accurate emission inventories for PM nonattainment, maintenance, and action plan areas throughout the country. Finally, the proposed modifications to the fine fractions associated with EPA's AP-42 emission factors will ensure widespread availability of the most recent and accurate scientific information.

References

Cowherd, C. and J. Donaldson. 2005. *Analysis of the Fine Fraction of Particulate Matter in Fugitive Dust.* Final report prepared for the Western Governors' Association, Western Regional Air Partnership (WRAP), MRI Project No. 110397, October 12, 2005. **[Describes wind tunnel study to determine fine fraction ratios]**

Midwest Research Institute. 1994. *OU3 Wind tunnel Study: Test Report.* Prepared for EG&G Rocky Flats, Golden CO. **[Describes portable wind tunnel tests of emissions from soils and sediments]**

Midwest Research Institute. 1997. *Fugitive Particulate Matter Emissions.* Final report prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park NC. April, 1997. **[Prior emission factor field study for paved and unpaved roads, comparing performance of cyclone/impactor system with reference method samplers for PM2.5]**

Muleski, G. E., C. Cowherd, and J. S. Kinsey. 2005. "Particulate Emissions from Construction Activities*," J. Air & Waste Manage. Assoc.* **55:** 772-783. **[Summarizes field test results for emissions from major components of construction projects]**

Ono, Duane. 2005. "Ambient PM2.5/PM10 ratios for Dust Events from the Keeler Dunes." Great Basin UAPCD, Bishop, CA. **[Describes FRM test results for high-wind events on Owens Dry Lake]**

Pace, T. G. 2005. "Examination of Multiplier Used to Estimate $PM_{2.5}$ Fugitive Dust Emissions from PM_{10}." Presented at the EPA Emission Inventory Conference. Las Vegas NV. April 2005. **[Summarizes other field studies that can be used to develop $PM_{2.5}/PM_{10}$ ratios for fugitive dust emissions]**

USEPA. 2005. *Compilation of Air Pollutant Emission Factors, AP-42.* 6th Edition. Research Triangle Park, NC. **[EPA's emission factor handbook]**

CARB, 2003. *Emission Inventory Procedural Manual Volume III: Methods for Assessing Area Source Emissions,* California Air Resources Board, Sacramento, CA. November. **[Summarizes the recommended calculation procedures for agricultural emissions and other sources]**

Midwest Research Institute. 1999. *Estimating Particulate Matter Emissions from Construction Operations*. Prepared for USEPA, Research Triangle Park NC, September. **[Gives field test results for construction operations]**

Figure 1. Phase I test results show that the Cyclone/ Impactor method measured $PM_{2.5}$ concentrations that were two times higher than those measured by Federal Reference Method samplers when simultaneously exposed to the well-mixed dust environment in the wind tunnel.

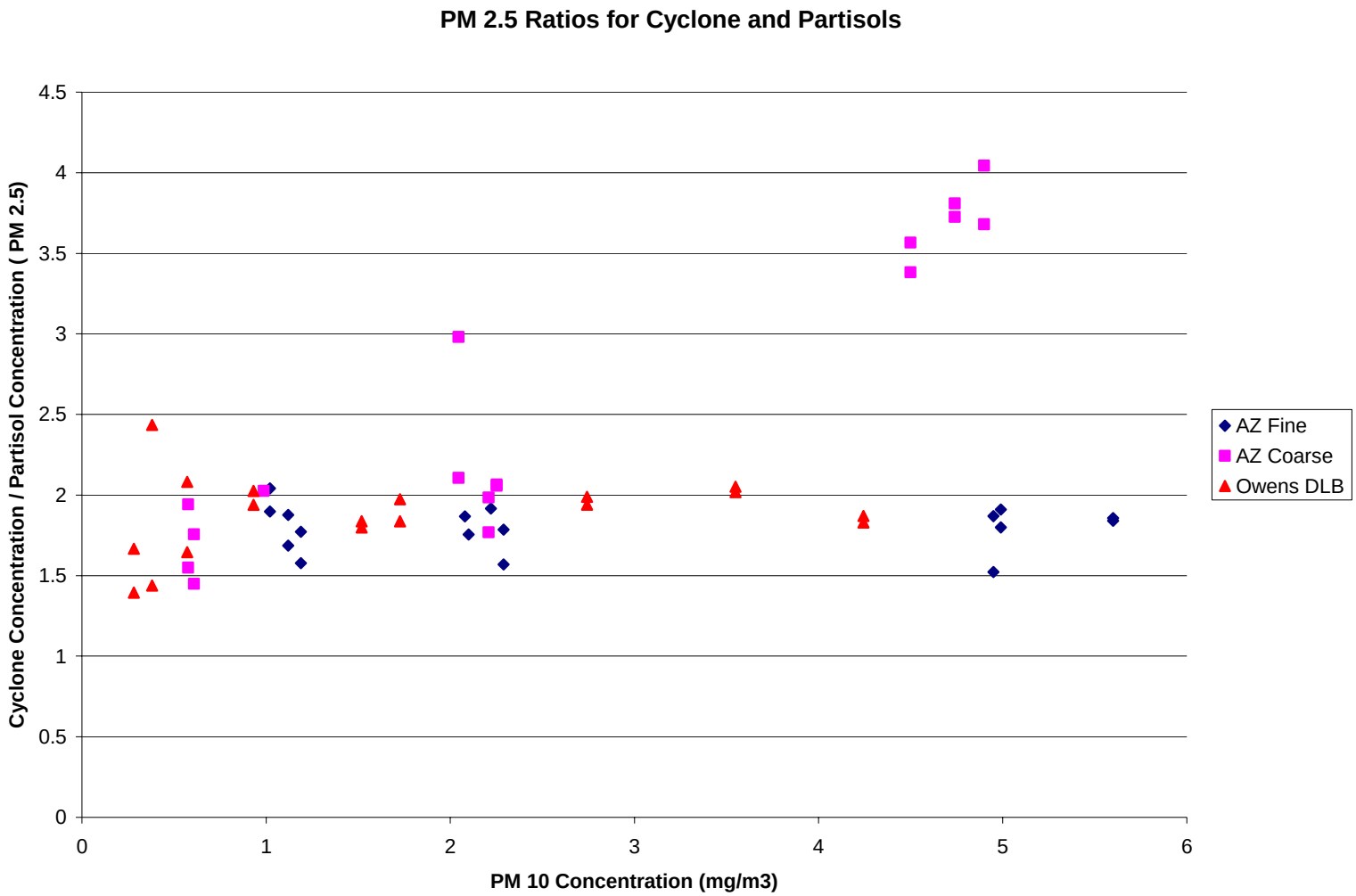
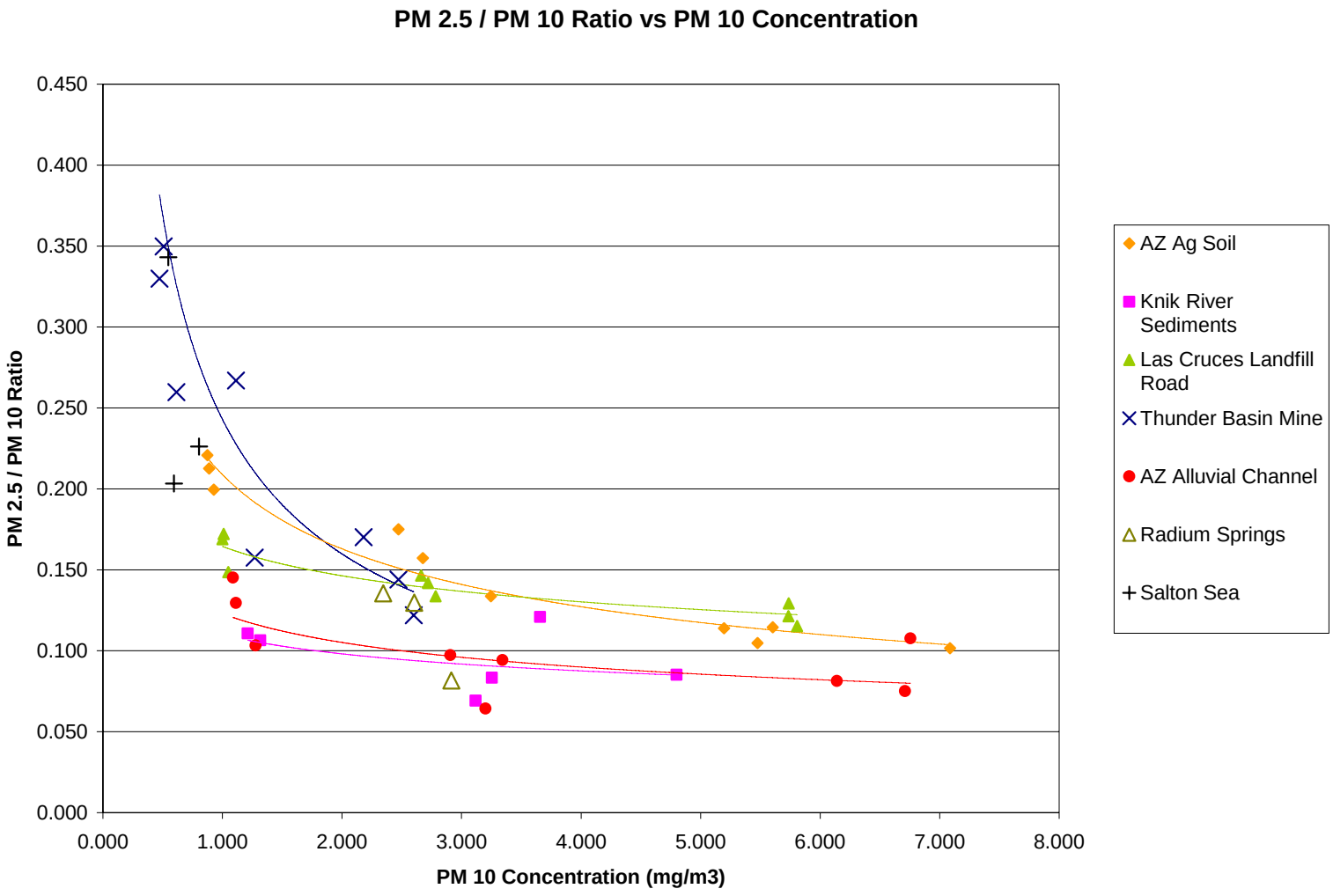


Figure 2. Phase II tests show that the $PM_{2.5}/PM_{10}$ ratio decreased with increasing PM concentrations, and could be expected to be in the range of 0.1 at concentrations that are typical of fugitive dust emission plumes.



11.9 Western Surface Coal Mining

11.9.1 General[1]

There are 12 major coal fields in the western states (excluding the Pacific Coast and Alaskan fields), as shown in Figure 11.9-1. Together, they account for more than 64 percent of the surface minable coal reserves in the United States.[2] The 12 coal fields have varying characteristics that may influence fugitive dust emission rates from mining operations including overburden and coal seam thicknesses and structure, mining equipment, operating procedures, terrain, vegetation, precipitation and surface moisture, wind speeds, and temperatures. The operations at a typical western surface mine are shown in Figure 11.9-2. All operations that involve movement of soil or coal, or exposure of erodible surfaces, generate some amount of fugitive dust.

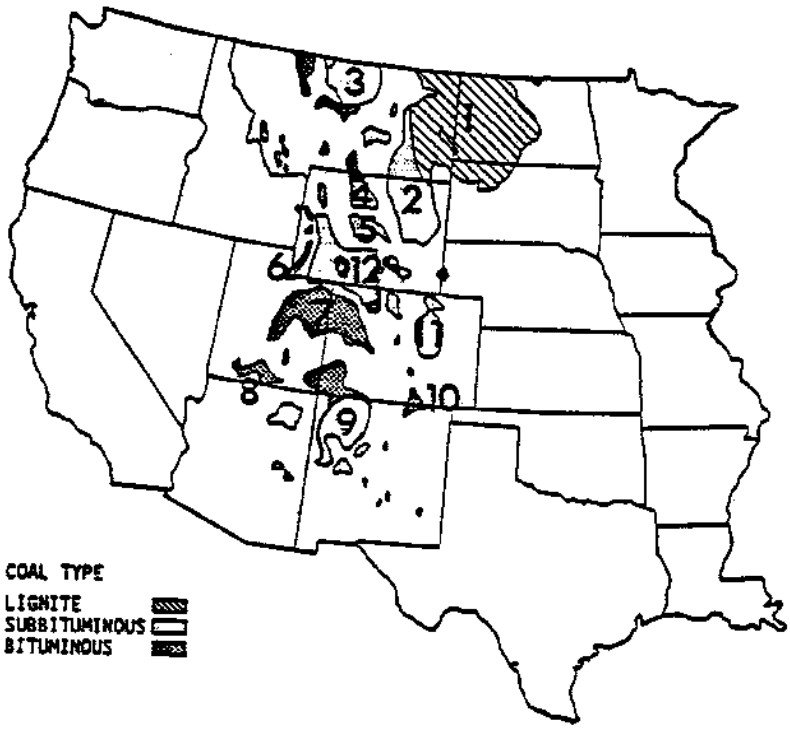
The initial operation is removal of topsoil and subsoil with large scrapers. The topsoil is carried by the scrapers to cover a previously mined and regraded area as part of the reclamation process or is placed in temporary stockpiles. The exposed overburden, the earth that is between the topsoil and the coal seam, is leveled, drilled, and blasted. Then the overburden material is removed down to the coal seam, usually by a dragline or a shovel and truck operation. It is placed in the adjacent mined cut, forming a spoils pile. The uncovered coal seam is then drilled and blasted. A shovel or front end loader loads the broken coal into haul trucks, and it is taken out of the pit along graded haul roads to the tipple, or truck dump. Raw coal sometimes may be dumped onto a temporary storage pile and later rehandled by a front end loader or bulldozer.

At the tipple, the coal is dumped into a hopper that feeds the primary crusher, then is conveyed through additional coal preparation equipment such as secondary crushers and screens to the storage area. If the mine has open storage piles, the crushed coal passes through a coal stacker onto the pile. The piles, usually worked by bulldozers, are subject to wind erosion. From the storage area, the coal is conveyed to a train loading facility and is put into rail cars. At a captive mine, coal will go from the storage pile to the power plant.

During mine reclamation, which proceeds continuously throughout the life of the mine, overburden spoils piles are smoothed and contoured by bulldozers. Topsoil is placed on the graded spoils, and the land is prepared for revegetation by furrowing, mulching, etc. From the time an area is disturbed until the new vegetation emerges, all disturbed areas are subject to wind erosion.

11.9.2 Emissions

Predictive emission factor equations for open dust sources at western surface coal mines are presented in Tables 11.9-1 and 11.9-2. Each equation applies to a single dust-generating activity, such as vehicle traffic on haul roads. The predictive equation explains much of the observed variance in emission factors by relating emissions to three sets of source parameters: (1) measures of source activity or energy expended (e. g., speed and weight of a vehicle traveling on an unpaved road); (2) properties of the material being disturbed (e. g., suspendable fines in the surface material of an unpaved road); and (3) climate (in this case, mean wind speed).



	Coal field	Strippable reserves (10^6 tons)
1	Fort Union	23,529
2	Powder River	56,727
3	North Central	All underground
4	Bighorn Basin	All underground
5	Wind River	3
6	Hams Fork	1,000
7	Uinta	308
8	Southwestern Utah	224
9	San Juan River	2,318
10	Raton Mesa	All underground
11	Denver	All underground
12	Green River	2,120

Figure 11.9-1. Coal fields of the western United States.[3]

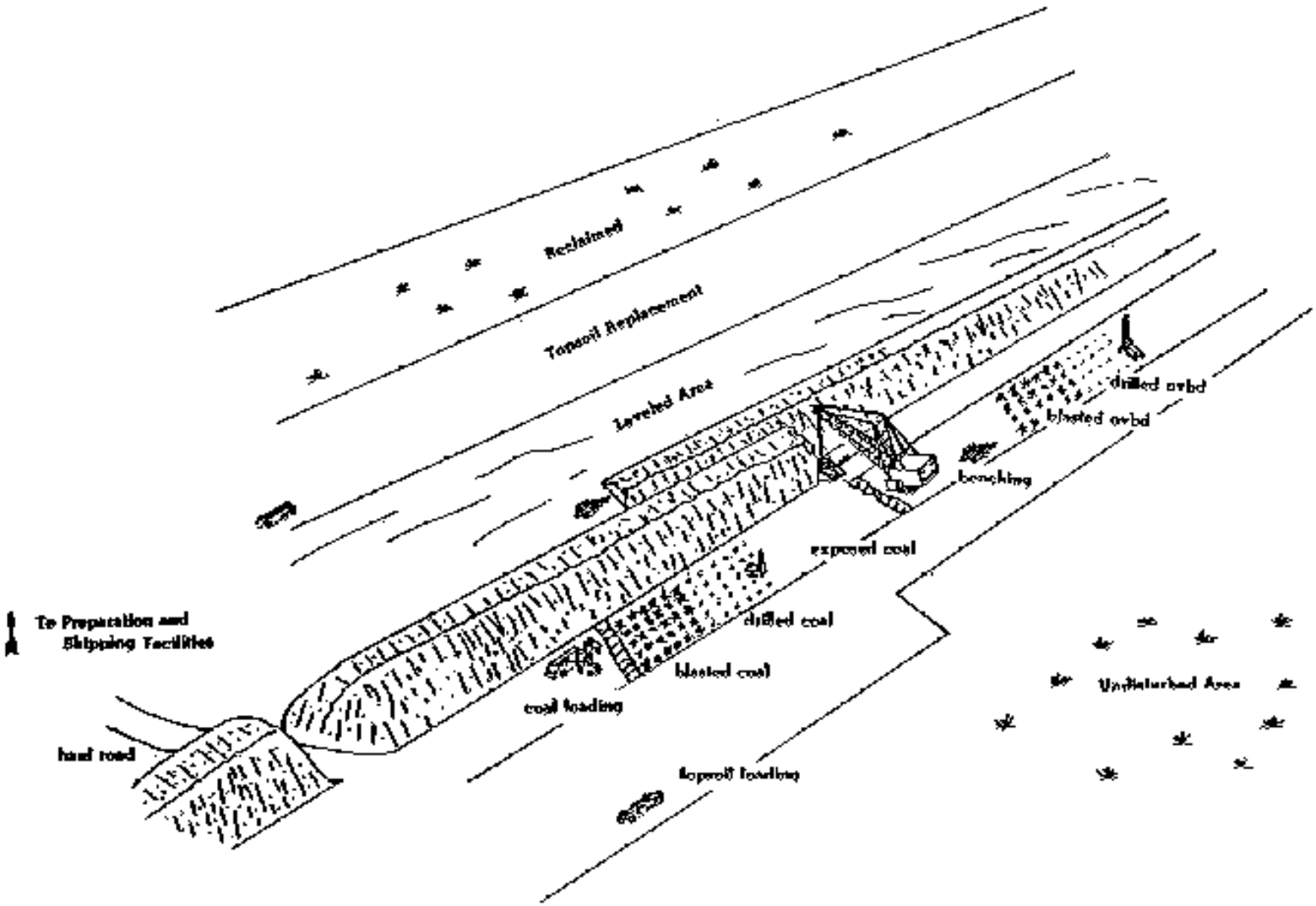


Figure 11.9-2. Operations at typical western surface coal mines.

The equations may be used to estimate particulate emissions generated per unit of source extent or activity (e. g., distance traveled by a haul truck or mass of material transferred). The equations were developed through field sampling of various western surface mine types and are thus applicable to any of the surface coal mines located in the western United States.

In Tables 11.9-1 and 11.9-2, the assigned quality ratings apply within the ranges of source conditions that were tested in developing the equations given in Table 11.9-3. However, the equations should be derated 1 letter value (e. g., A to B) if applied to eastern surface coal mines.

In using the equations to estimate emissions from sources found in a specific western surface mine, it is necessary that reliable values for correction parameters be determined for the specific sources of interest if the assigned quality ratings of the equations are to be applicable. For example, actual silt content of coal or overburden measured at a facility should be used instead of estimated values. In the event that site-specific values for correction parameters cannot be obtained, the appropriate geometric mean values from Table 11.9-3 may be used, but the assigned quality rating of each emission factor equation should be reduced by 1 level (e. g., A to B).

Emission factors for open dust sources not covered in Table 11.9-3 are in Table 11.9-4. These factors were determined through source testing at various western coal mines.

The factors in Table 11.9-4 for mine locations I through V were developed for specific geographical areas. Tables 11.9-5 and 11.9-6 present characteristics of each of these mines (areas). A "mine-specific" emission factor should be used only if the characteristics of the mine for which an emissions estimate is needed are very similar to those of the mine for which the emission factor was developed. The other (nonspecific) emission factors were developed at a variety of mine types and thus are applicable to any western surface coal mine.

As an alternative to the single valued emission factors given in Table 11.9-4 for train or truck loading and for truck or scraper unloading, two empirically derived emission factor equations are presented in Section 13.2.4 of this document. Each equation was developed for a source operation (i. e., batch drop and continuous drop, respectively) comprising a single dust-generating mechanism that crosses industry lines.

Because the predictive equations allow emission factor adjustment to specific source conditions, the equations should be used in place of the single-valued factors in Table 11.9-4 for the sources identified above, if emission estimates for a specific western surface coal mine are needed. However, the generally higher quality ratings assigned to the equations are applicable only if: (1) reliable values of correction parameters have been determined for the specific sources of interest, and (2) the correction parameter values lie within the ranges tested in developing the equations. Caution must be exercised so that only the unbound (sorbed) moisture (i. e., not any bound moisture) is used in determining the moisture content for input to the Chapter 13 equations.

Table 11.9-1 (English Units). EMISSION FACTOR EQUATIONS FOR UNCONTROLLED OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES[a]

Operation	Material	Emissions By Particle Size Range (Aerodynamic Diameter)[b,c]				Units	EMISSION FACTOR RATING
		Emission Factor Equations		Scaling Factors			
		TSP ≤30 µm	≤15 µm	≤10 µm[d]	≤2.5 µm/TSP[e]		
Blasting[f]	Coal or overburden	$0.000014(A)^{1.5}$	ND	0.52[e]	0.03	lb/blast	C_DD
Truck loading	Coal	$\frac{1.16}{(M)^{1.2}}$	$\frac{0.119}{(M)^{0.9}}$	0.75	0.019	lb/ton	BBCC
Bulldozing	Coal	$\frac{78.4\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{18.6\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.022	lb/hr	CCDD
	Overburden	$\frac{5.7\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{1.0\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.105	lb/hr	BCDD
Dragline	Overburden	$\frac{0.0021\ (d)^{1.1}}{(M)^{0.3}}$	$\frac{0.0021\ (d)^{0.7}}{(M)^{0.3}}$	0.75	0.017	lb/yd^3	BCDD
Vehicle traffic[g]							
Grading		$0.040\ (S)^{2.5}$	$0.051\ (S)^{2.0}$	0.60	0.031	lb/VMT	CCDD
Active storage pile[h] (wind erosion and maintenance)	Coal	0.72 u	ND	ND	ND	$\frac{lb}{(acre)(hr)}$	C[i]_ _ _

[a] Reference 1, except as noted. VMT = vehicle miles traveled. ND = no data. Quality ratings coded where "Q, X, Y, Z" are ratings for ≤30 µm, ≤15 µm, ≤10 µm, and ≤2.5 µm, respectively. See also note below.

[b] Particulate matter less than or equal to 30 µm in aerodynamic diameter is sometimes termed "suspendable particulate" and is often used as a surrogate for TSP (total suspended particulate). TSP denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Symbols for equations:

A = horizontal area (ft^2), with blasting depth ≤ 70 ft. Not for vertical face of a bench.
M = material moisture content (%)
s = material silt content (%)
u = wind speed (mph)
d = drop height (ft)
W = mean vehicle weight (tons)
S = mean vehicle speed (mph)
w = mean number of wheels

Table 11.9-1 (cont.).

[d] Multiply the ≤15-µm equation by this fraction to determine emissions, except as noted.
[e] Multiply the TSP predictive equation by this fraction to determine emissions.
[f] Blasting factor taken from a reexamination of field test data reported in Reference 1. See Reference 4.
[g] To estimate emissions from traffic on unpaved surfaces by vehicles such as haul trucks, light-to-medium duty vehicles, or scrapers in the travel mode, see the unpaved road emission factor equation in AP-42 Section 13.2.2.
[h] Coal storage pile factor taken from Reference 5. To estimate emissions on a shorter time scale (e. g., worst-case day), see the procedure presented in Section 13.2.5.
[i] Rating applicable to mine types I, II, and IV (see Tables 11.9-5 and 11.9-6).

Note: Section 234 of the Clean Air Act of 1990 required EPA to review and revise the emission factors in this Section (and models used to evaluate ambient air quality impact), to ensure that they did not overestimate emissions from western surface coal mines. Due to resource and technical limitations, the haul road emission factors were isolated to receive the most attention during these studies, as the largest contributor to emissions. Resultant model evaluation with revised emission factors have improved model prediction for total suspended particulate (TSP); however, there is still a tendency for overprediction of particulate matter impact for PM-10, for as yet undetermined causes, prompting the Agency to make a policy decision not to use them for regulatory applications to these sources. However, the technical consideration exists that no better alternative data are currently available and the information should be made known. Users should accordingly use these factors with caution and awareness of their likely limitations.

Table 11.9-2 (Metric Units). EMISSION FACTOR EQUATIONS FOR UNCONTROLLED OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES[a]

Operation	Material	Emissions By Particle Size Range (Aerodynamic Diameter)[b,c]				Units	EMISSION FACTOR RATING
		Emission Factor Equations		Scaling Factors			
		TSP ≤30 µm	≤15 µm	≤10 µm[d]	≤2.5 µm/TSP[e]		
Blasting[f]	Coal or overburden	$0.00022(A)^{1.5}$	ND	0.52[e]	0.03	kg/blast	C_DD
Truck loading	Coal	$\frac{0.580}{(M)^{1.2}}$	$\frac{0.0596}{(M)^{0.9}}$	0.75	0.019	kg/Mg	BBCC
Bulldozing	Coal	$\frac{35.6\ (s)^{1.2}}{(M)^{1.4}}$	$\frac{8.44\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.022	kg/hr	CCDD
	Overburden	$\frac{2.6\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{0.45\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.105	kg/hr	BCDD
Dragline	Overburden	$\frac{0.0046\ (d)^{1.1}}{(M)^{0.3}}$	$\frac{0.0029\ (d)^{0.7}}{(M)^{0.3}}$	0.75	0.017	kg/m^3	BCDD
Vehicle traffic[g]							
Grading		$0.0034\ (S)^{2.5}$	$0.0056\ (S)^{2.0}$	0.60	0.031	kg/VKT	CCDD
Active storage pile[h] (wind erosion and maintenance)	Coal	1.8 u	ND	ND	ND	$\frac{kg}{(hectare)(hr)}$	C[i]_ _ _

[a] Reference 1, except as noted. VKT = vehicle kilometers traveled. ND = no data. Quality ratings coded as "QXYZ", where Q, X, Y, and Z are quality ratings for ≤30 µm, ≤15 µm, ≤10 µm, and ≤2.5 µm, respectively. See also note below.

[b] Particulate matter less than or equal to 30 µm in aerodynamic diameter is sometimes termed "suspendable particulate" and is often used as a surrogate for TSP (total suspended particulate). TSP denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Symbols for equations:

A = horizontal area (m^2), with blasting depth ≤ 21 m. Not for vertical face of a bench.
M = material moisture content (%)
s = material silt content (%)
u = wind speed (m/sec)
d = drop height (m)
W = mean vehicle weight (Mg)
S = mean vehicle speed (kph)
w = mean number of wheels

Table 11.9-2 (cont.).

[d] Multiply the ≤ 15-µm equation by this fraction to determine emissions, except as noted.
[e] Multiply the TSP predictive equation by this fraction to determine emissions.
[f] Blasting factor taken from a reexamination of field test data reported in Reference 1. See Reference 4.
[g] To estimate emissions from traffic on unpaved surfaces by vehicles such as haul trucks, light-to-medium duty vehicles, or scrapers in the travel mode, see the unpaved road emission factor equation in AP-42 Section 13.2.2
[h] Coal storage pile factor taken from Reference 5. To estimate emissions on a shorter time scale (e. g., worst-case day), see the procedure presented in Section 13.2.5.
[i] Rating applicable to mine types I, II, and IV (see Tables 11.9-5 and 11.9-6).

Note: Section 234 of the Clean Air Act of 1990 required EPA to review and revise the emission factors in this Section (and models used to evaluate ambient air quality impact), to ensure that they did not overestimate emissions from western surface coal mines. Due to resource and technical limitations, the haul road emission factors were isolated to receive the most attention during these studies, as the largest contributor to emissions. Resultant model evaluation with revised emission factors have improved model prediction for total suspended particulate (TSP); however, there is still a tendency for overprediction of particulate matter impact for PM-10, for as yet undetermined causes, prompting the Agency to make a policy decision not to use them for regulatory applications to these sources. However, the technical consideration exists that no better alternative data are currently available and the information should be made known. Users should accordingly use these factors with caution and awareness of their likely limitations.

Table 11.9-3 (Metric And English Units). TYPICAL VALUES FOR CORRECTION FACTORS APPLICABLE TO THE PREDICTIVE EMISSION FACTOR EQUATIONS[a]

Source	Correction Factor	Number Of Test Samples	Range	Geometric Mean	Units
Blasting	Area blasted	17	100 – 6,800	1,590	m^2
	Area blasted	17	1100 – 73,000	17,000	ft^2
Coal loading	Moisture	7	6.6 - 38	17.8	%
Bulldozers					
Coal	Moisture	3	4.0 - 22.0	10.4	%
	Silt	3	6.0 - 11.3	8.6	%
Overburden	Moisture	8	2.2 - 16.8	7.9	%
	Silt	8	3.8 - 15.1	6.9	%
Dragline	Drop distance	19	1.5 - 30	8.6	m
	Drop distance	19	5 - 100	28.1	ft
	Moisture	7	0.2 - 16.3	3.2	%
Scraper	Silt	10	7.2 - 25.2	16.4	%
	Weight	15	33 - 64	48.8	Mg
	Weight	15	36 - 70	53.8	ton
Grader	Speed	7	8.0 - 19.0	11.4	kph
	Speed		5.0 - 11.8	7.1	mph
Haul truck	Silt content	61	1.2 – 19.2	4.3	%
	Moisture	60	0.3 – 20.1	2.4	%
	Weight	61	20.9 – 260	110	mg
	Weight	61	23.0 – 290	120	ton

[a] Reference 1,6.

Table 11.9-4 (English And Metric Units). UNCONTROLLED PARTICULATE EMISSION FACTORS FOR OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES

Source	Material	Mine Location[a]	TSP Emission Factor[b]	Units	EMISSION FACTOR RATING
Drilling	Overburden	Any	1.3	lb/hole	C
			0.59	kg/hole	C
	Coal	V	0.22	lb/hole	E
			0.10	kg/hole	E
Topsoil removal by scraper	Topsoil	Any	0.058	lb/ton	E
			0.029	kg/Mg	E
		IV	0.44	lb/ton	E
			0.22	kg/Mg	E
Overburden replacement	Overburden	Any	0.012	lb/ton	C
			0.0060	kg/Mg	C
Truck loading by power shovel (batch drop)[c]	Overburden	V	0.037	lb/ton	E
			0.018	kg/Mg	E
Train loading (batch or continuous drop)[c]	Coal	Any	0.028	lb/ton	E
			0.014	kg/Mg	E
		III	0.0002	lb/ton	E
			0.0001	kg/Mg	E
Bottom dump truck unloading (batch drop)[c]	Overburden	V	0.002	lb/ton	E
			0.001	kg/Mg	E
	Coal	IV	0.027	lb/ton	E
			0.014	kg/Mg	E
		III	0.005	lb/ton	E
			0.002	kg/Mg	E
		II	0.020	lb/ton	E
			0.010	kg/Mg	E
		I	0.014	lb/T	E
			0.0070	kg/Mg	E
		Any	0.066	lb/T	D
			0.033	kg/Mg	D

Table 11.9-4 (cont.).

Source	Material	Mine Location[a]	TSP Emission Factor[b]	Units	EMISSION FACTOR RATING
End dump truck unloading (batch drop)[c]	Coal	V	0.007 0.004	lb/T kg/Mg	E E
Scraper unloading (batch drop)[c]	Topsoil	IV	0.04 0.02	lb/T kg/Mg	E E
Wind erosion of exposed areas[d]	Seeded land, stripped overburden, graded overburden	Any	0.38 0.85	T/(acre)(yr) Mg/(hectare)(yr)	C C

[a] Roman numerals I through V refer to specific mine locations for which the corresponding emission factors were developed (Reference 5). Tables 11.9-4 and 11.9-5 present characteristics of each of these mines. See text for correct use of these "mine-specific" emission factors. The other factors (from Reference 7, except for overburden drilling from Reference 1) can be applied to any western surface coal mine.
[b] Total suspended particulate (TSP) denotes what is measured by a standard high volume sampler (see Section 13.2).
[c] Predictive emission factor equations, which generally provide more accurate estimates of emissions, are presented in Chapter 13.
[d] To estimate wind erosion on a shorter time scale (e. g., worst-case day), see Section 13.2.5.

Table 11.9-5 (Metric And English Units). GENERAL CHARACTERISTICS OF SURFACE COAL MINES REFERRED TO IN TABLE 11.9-4[a]

Mine	Location	Type Of Coal Mined	Terrain	Vegetative Cover	Surface Soil Type And Erodibility Index	Mean Wind Speed		Mean Annual Precipitation	
						m/s	mph	cm	in.
I	N.W. Colorado	Subbitum.	Moderately steep	Moderate, sagebrush	Clayey loamy (71)	2.3	5.1	38	15
II	S.W. Wyoming	Subbitum.	Semirugged	Sparse, sagebrush	Arid soil with clay and alkali or carbonate accumulation (86)	6.0	13.4	36	14
III	S.E. Montana	Subbitum.	Gently rolling to semirugged	Sparse, moderate, prairie grassland	Shallow clay loamy deposits on bedrock (47)	4.8	10.7	28 - 41	11 - 16
IV	Central North Dakota	Lignite	Gently rolling	Moderate, prairie grassland	Loamy, loamy to sandy (71)	5.0	11.2	43	17
V	N.E. Wyoming	Subbitum.	Flat to gently rolling	Sparse, sagebrush	Loamy, sandy, clayey, and clay loamy (102)	6.0	13.4	36	14

[a] Reference 4.

Table 11.9-6 (English Units). OPERATING CHARACTERISTICS OF THE COAL MINES REFERRED TO IN TABLE 11.9-4[a]

Parameter	Required Information	Units	Mine I	Mine II	Mine III	Mine IV	Mine V
Production rate	Coal mined	10^6 ton/yr	1.13	5.0	9.5	3.8	12.0[b]
Coal transport	Avg. unit train frequency	per day	NA	NA	2	NA	2
Stratigraphic data	Overburden thickness	ft	21	80	90	65	35
	Overburden density	lb/yd^3	4000	3705	3000	ND	ND
	Coal seam thicknesses	ft	9,35	15,9	27	2,4,8	70
	Parting thicknesses	ft	50	15	NA	32,16	NA
	Spoils bulking factor	%	22	24	25	20	ND
	Active pit depth	ft	52	100	114	80	105
Coal analysis data	Moisture	%	10	18	24	38	30
	Ash	%, wet	8	10	8	7	6
	Sulfur	%, wet	0.46	0.59	0.75	0.65	0.48
	Heat content	Btu/lb	11000	9632	8628	8500	8020
Surface disposition	Total disturbed land	acre	168	1030	2112	1975	217
	Active pit	acre	34	202	87	ND	71
	Spoils	acre	57	326	144	ND	100
	Reclaimed	acre	100	221	950	ND	100
	Barren land	acre	ND	30	455	ND	ND
	Associated disturbances	acre	12	186	476	ND	46
Storage	Capacity	ton	NA	NA	ND	NA	48000
Blasting	Frequency, total	per week	4	4	3	7	7[b]
	Frequency, overburden	per week	3	0.5	3	NA	7[b]
	Area blasted, coal	ft^2	16000	40000	ND	30000	ND
	Area blasted, overburden	ft^2	20000	ND	ND	NA	ND

[a] Reference 5. NA = not applicable. ND = no data.
[b] Estimate.

11.9.3 Updates Since the Fifth Edition

The Fifth Edition which was released in January 1995 reformatted the section that was dated September 1988. Revisions to this section since these dates are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section. These and other documents can be found on the CHIEF WEB site (home page http://www.epa.gov/ttn/chief/).

Supplement E

- The predictive equations for emission factors for haul trucks and light/medium duty vehicles were removed and replaced with a footnote refering users to the recently revised unpaved road section in the Miscellaneous Sources chapter.

- The emission factor quality ratings were revised based upon a revised predictive equation and single value criteria.

- The typographical errors for the TSP equation and the omission of the PM-2.5 scaling factor for blasting were corrected.

References For Section 11.9

1. K. Axetell and C. Cowherd, *Improved Emission Factors For Fugitive Dust From Western Surface Coal Mining Sources*, 2 Volumes, EPA Contract No. 68-03-2924, U. S. Environmental Protection Agency, Cincinnati, OH, July 1981.

2. *Reserve Base Of U. S. Coals By Sulfur Content: Part 2, The Western States*, IC8693, Bureau Of Mines, U. S. Department Of The Interior, Washington, DC, 1975.

3. *Bituminous Coal And Lignite Production And Mine Operations - 1978*, DOE/EIA-0118(78), U. S. Department Of Energy, Washington, DC, June 1980.

4. G. E. Muleski, *Update Of AP-42 Emission Factors For Western Surface Coal Mines And Related Sections*, Summary Report, Prepared for Emission Factors And Inventory Group (MD-14), Emissions, Modeling And Analysis Division, Office Of Air Quality, Planning, And Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711.

5. K. Axetell, *Survey Of Fugitive Dust From Coal Mines*, EPA-908/1-78-003, U. S. Environmental Protection Agency, Denver, CO, February 1978.

6. G. E. Muleski, *et al.*, *Surface Coal Mine Emission Factor Field Study*, EPA-454/R-95-010, U. S. Environmental Protection Agency, Research Triangle Park, NC, January 1994.

7. D. L. Shearer, *et al.*, *Coal Mining Emission Factor Development And Modeling Study*, Amax Coal Company, Carter Mining Company, Sunoco Energy Development Company, Mobil Oil Corporation, and Atlantic Richfield Company, Denver, CO, July 1981.

13.2.1 Paved Roads

13.2.1.1 General

Particulate emissions occur whenever vehicles travel over a paved surface such as a road or parking lot. Particulate emissions from paved roads are due to direct emissions from vehicles in the form of exhaust, brake wear and tire wear emissions and resuspension of loose material on the road surface. In general terms, resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface (i.e., the surface loading). In turn, that surface loading is continuously replenished by other sources. At industrial sites, surface loading is replenished by spillage of material and trackout from unpaved roads and staging areas. Figure 13.2.1-1 illustrates several transfer processes occurring on public streets.

Various field studies have found that public streets and highways, as well as roadways at industrial facilities, can be major sources of the atmospheric particulate matter within an area.[1-9] Of particular interest in many parts of the United States are the increased levels of emissions from public paved roads when the equilibrium between deposition and removal processes is upset. This situation can occur for various reasons, including application of granular materials for snow and ice control, mud/dirt carryout from construction activities in the area, and deposition from wind and/or water erosion of surrounding unstabilized areas. In the absence of continuous addition of fresh material (through localized trackout or application of antiskid material), paved road surface loading should reach an equilibrium value in which the amount of material resuspended matches the amount replenished. The equilibrium surface loading value depends upon numerous factors. It is believed that the most important factors are: mean speed of vehicles traveling the road; the average daily traffic (ADT); the number of lanes and ADT per lane; the fraction of heavy vehicles (buses and trucks); and the presence/absence of curbs, storm sewers and parking lanes.[10]

The particulate emission factors presented in the previous version of this section of AP-42, dated October 2002, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material. EPA included these sources in the emission factor equation for paved roads since the field testing data used to develop the equation included both the direct emissions from vehicles and emissions from resuspension of road dust.

This version of the paved road emission factor equation only estimates particulate emissions from resuspended road surface material[28]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOBILE6.2 [27]. This approach eliminates the possibility of double counting emissions. Double counting results when employing the previous version of the emission factor equation in this section and MOBILE6.2 to estimate particulate emissions from vehicle traffic on paved roads. It also incorporates the decrease in exhaust emissions that has occurred since the paved road emission factor equation was developed. The previous version of the paved road emission factor equation includes estimates of emissions from exhaust, brake wear, and tire wear based on emission rates for vehicles in the 1980 calendar year fleet. The amount of PM released from vehicle exhaust has decreased since 1980 due to lower new vehicle emission standards and changes in fuel characteristics.

13.2.1.2 Emissions And Correction Parameters

Dust emissions from paved roads have been found to vary with what is termed the "silt loading" present on the road surface as well as the average weight of vehicles traveling the road. The term silt loading (sL) refers to the mass of silt-size material (equal to or less than 75 micrometers [μm] in physical diameter) per unit area of the travel surface. The total road surface dust loading consists of loose material that can be collected by broom sweeping and vacuuming of the traveled portion of the paved road. The silt fraction is determined by measuring the proportion of the loose dry surface dust that passes through a 200-mesh screen, using the ASTM-C-136 method. Silt loading is the product of the silt fraction and the total loading, and is abbreviated "sL". Additional details on the sampling and analysis of such material are provided in AP-42 Appendices C.1 and C.2.

The surface sL provides a reasonable means of characterizing seasonal variability in a paved road emission inventory. In many areas of the country, road surface loadings [11-21] are heaviest during the late winter and early spring months when the residual loading from snow/ice controls is greatest. As noted earlier, once replenishment of fresh material is eliminated, the road surface loading can be expected to reach an equilibrium value, which is substantially lower than the late winter/early spring values.

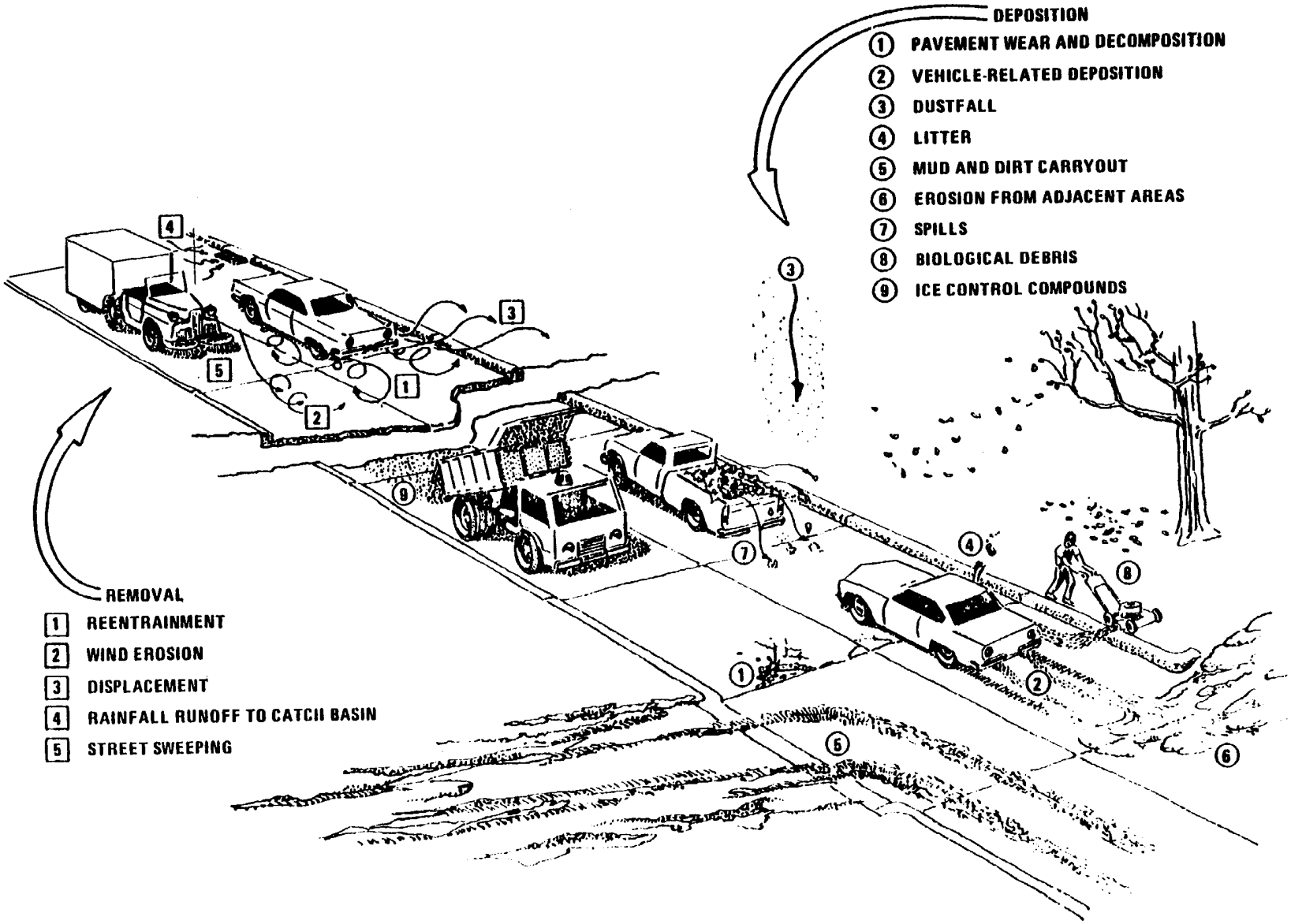


Figure 13.2.1-1. Deposition and removal processes.

13.2.1.3 Predictive Emission Factor Equations [10]

The quantity of particulate emissions from resuspension of loose material on the road surface due to vehicle travel on a dry paved road may be estimated using the following empirical expression:

$$E = k\left(\frac{sL}{2}\right)^{0.65} \times \left(\frac{W}{3}\right)^{1.5} - C \qquad (1)$$

where: E = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see below),
sL = road surface silt loading (grams per square meter) (g/m^2),
W = average weight (tons) of the vehicles traveling the road, and
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

It is important to note that Equation 1 calls for the average weight of all vehicles traveling the road. For example, if 99 percent of traffic on the road are 2 ton cars/trucks while the remaining 1 percent consists of 20 ton trucks, then the mean weight "W" is 2.2 tons. More specifically, Equation 1 is *not* intended to be used to calculate a separate emission factor for each vehicle weight class. Instead, only one emission factor should be calculated to represent the "fleet" average weight of all vehicles traveling the road.

The particle size multiplier (*k*) above varies with aerodynamic size range as shown in Table 13.2.1-1. To determine particulate emissions for a specific particle size range, use the appropriate value of k shown in Table 13.2.1-1.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA's MOBILE6.2 model [28]. The emission factor also varies with aerodynamic size range

Table 13.2-1.1. PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Size range[a]	Particle Size Multiplier k[b]		
	g/VKT	g/VMT	lb/VMT
PM-2.5[c]	0.66	1.1	0.0024
PM-10	4.6	7.3	0.016
PM-15	5.5	9.0	0.020
PM-30[d]	24	38	0.082

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.

[c] Ratio of PM-2.5 to PM-10 taken from Reference 22.

[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

as shown in Table 13.2.1-2.

Table 13.2.1-2. EMISSION FACTOR FOR 1980'S VEHICLE FLEET EXHAUST, BRAKE WEAR AND TIRE WEAR

Particle Size Range[a]	*C*, Emission Factor for Exhaust, Brake Wear and Tire Wear[b]		
	g/VMT	g/VKT	lb/VMT
$PM_{2.5}$	0.1617	0.1005	0.00036
PM_{10}	0.2119	0.1317	0.00047
PM_{15}	0.2119	0.1317	0.00047
PM_{30}[c]	0.2119	0.1317	0.00047

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.
[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT).
[c] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Equation 1 is based on a regression analysis of numerous emission tests, including 65 tests for PM-10.[10] Sources tested include public paved roads, as well as controlled and uncontrolled industrial paved roads. All sources tested were of freely flowing vehicles traveling at constant speed on relatively level roads. No tests of "stop-and-go" traffic or vehicles under load were available for inclusion in the data base. The equations retain the quality rating of A (B for PM-2.5), if applied within the range of source conditions that were tested in developing the equation as follows:

Silt loading:	0.03 - 400 g/m^2 0.04 - 570 grains/square foot (ft^2)
Mean vehicle weight:	1.8 - 38 megagrams (Mg) 2.0 - 42 tons
Mean vehicle speed:	16 - 88 kilometers per hour (kph) 10 - 55 miles per hour (mph)

Note: There may be situations where low silt loading and/or low average weight will yield calculated negative emissions from equation 1. If this occurs, the emissions calculated from equation 1 should be set to zero.

Users are cautioned that application of equation 1 outside of the range of variables and operating conditions specified above, e.g., application to roadways or road networks with speeds below 10 mph and with stop-and-go traffic, will result in emission estimates with a higher level

of uncertainty. In these situations, users are encouraged to consider alternative methods that are equally or more plausible in light of local emissions data and/or ambient concentration or compositional data.

To retain the quality rating for the emission factor equation when it is applied to a specific paved road, it is necessary that reliable correction parameter values for the specific road in question be determined. With the exception of limited access roadways, which are difficult to sample, the collection and use of site-specific silt loading (sL) data for public paved road emission inventories are strongly recommended. The field and laboratory procedures for determining surface material silt content and surface dust loading are summarized in Appendices C.1 and C.2. In the event that site-specific values cannot be obtained, an appropriate value for a paved public road may be selected from the values in Table 13.2.1-3, but the quality rating of the equation should be reduced by 2 levels. Also, recall that Equation 1 refers to emissions due to freely flowing (not stop-and-go) traffic at constant speed on level roads.

Equation 1 may be extrapolated to average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual (or other long-term) average emissions are inversely proportional to the frequency of measurable (> 0.254 mm [0.01 inch]) precipitation by application of a precipitation correction term. The precipitation correction term can be applied on a daily or an hourly basis [26].

For the daily basis, Equation 1 becomes:

$$E_{ext} = \left[k \left(\frac{sL}{2} \right)^{0.65} \left(\frac{W}{3} \right)^{1.5} - C \right] \left(1 - \frac{P}{4N} \right) \qquad (2)$$

where *k*, *sL*, *W*, *and C* are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as *k*,
P = number of “wet” days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Note that the assumption leading to Equation 2 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2. However, Equation 2 above incorporates an additional factor of "4" in the denominator to account for the fact that paved roads dry more quickly than unpaved roads and that the precipitation may not occur over the complete 24-hour day.

For the hourly basis, equation 1 becomes:

$$E_{ext} = \left[k \left(\frac{sL}{2} \right)^{0.65} \left(\frac{W}{3} \right)^{1.5} - C \right] \left(1 - \frac{1.2P}{N} \right) \qquad (3)$$

where k, sL, and W, and *C* are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as *k*,
P = number of hours with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N = number of hours in the averaging period (e.g., 8760 for annual, 2124 for season 720 for monthly).

Note: In the hourly moisture correction term (1-1.2P/N) for equation 3, the 1.2 multiplier is applied to account for the residual mitigative effect of moisture. For most applications, this equation will produce satisfactory results. However, if the time interval for which the equation is applied is short, e.g., for one hour or one day, the application of this multiplier makes it possible for the moisture correction term to become negative. This will result in calculated negative emissions which is not realistic. Users should expand the time interval to include sufficient "dry" hours such that negative emissions are not calculated. For the special case where this equation is used to calculate emissions on an hour by hour basis, such as would be done in some emissions modeling situations, the moisture correction term should be modified so that the moisture correction "credit" is applied to the first hours following cessation of precipitation. In this special case, it is suggested that this 20% "credit" be applied on a basis of one hour credit for each hour of precipitation up to a maximum of 12 hours.

Note that the assumption leading to Equation 3 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2.

Figure 13.2.1-2 presents the geographical distribution of "wet" days on an annual basis for the United States. Maps showing this information on a monthly basis are available in the *Climatic Atlas of the United States*[23] . Alternative sources include other Department of Commerce publications (such as local climatological data summaries). The National Climatic Data Center (NCDC) offers several products that provide hourly precipitation data. In particular, NCDC offers *Solar and Meteorological Surface Observation Network 1961-1990* (SAMSON) CD-ROM, which contains 30 years worth of hourly meteorological data for first-order National Weather Service locations. Whatever meteorological data are used, the source of that data and the averaging period should be clearly specified.

It is emphasized that the simple assumption underlying Equations 2 and 3 has not been verified in any rigorous manner. For that reason, the quality ratings for Equations 2 and 3 should be downgraded one letter from the rating that would be applied to Equation 1.

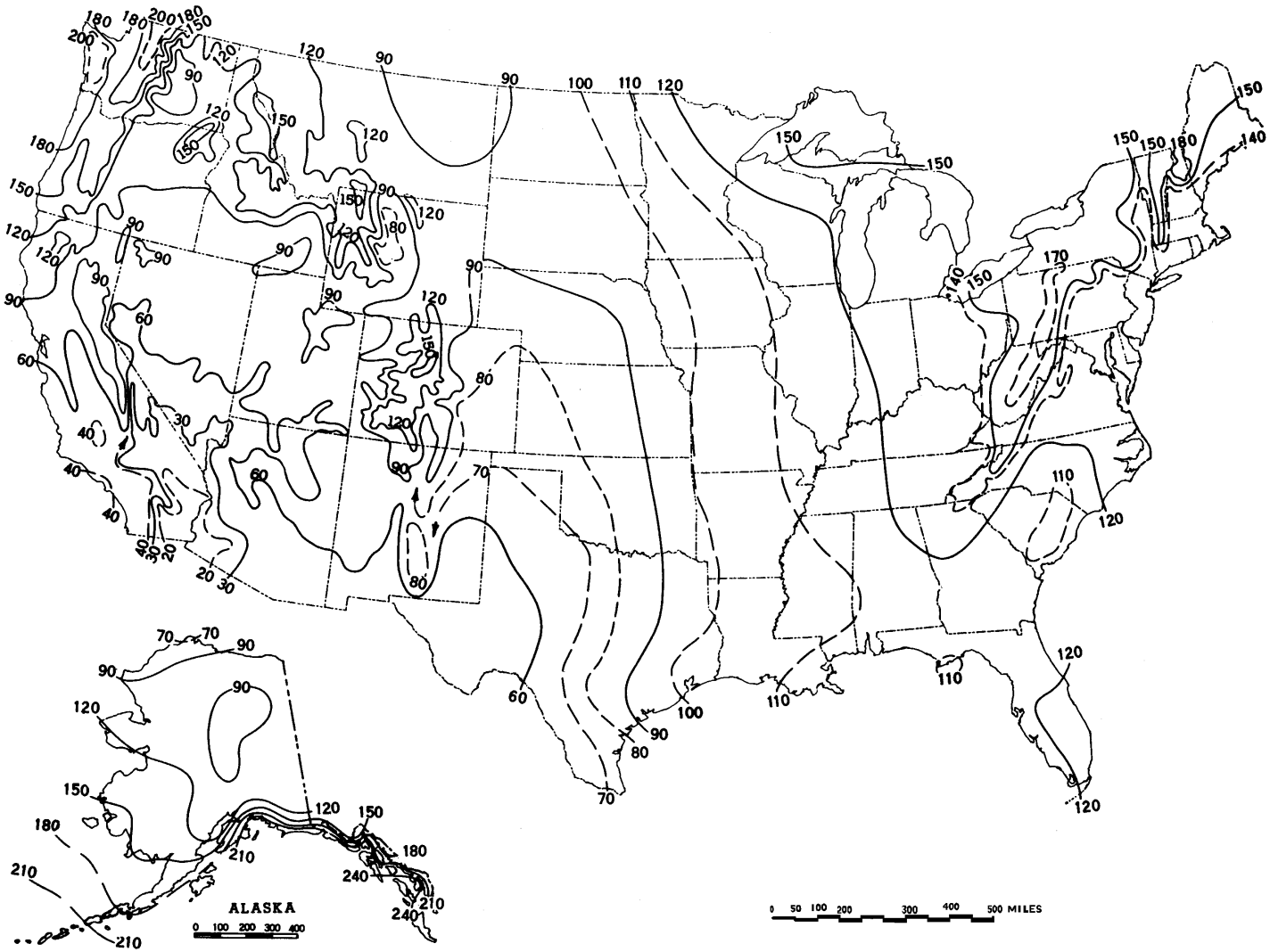


Figure 13.2.1-2. Mean number of days with 0.01 inch or more of precipitation in the United States.

Table 13.2.1-3 presents recommended default silt loadings for normal baseline conditions and for wintertime baseline conditions in areas that experience frozen precipitation with periodic application of antiskid material[24]. The winter baseline is represented as a multiple of the non-winter baseline, depending on the ADT value for the road in question. As shown, a multiplier of 4 is applied for low volume roads (< 500 ADT) to obtain a wintertime baseline silt loading of 4 X 0.6 = 2.4 g/m^2.

Table 13.2.1-3. Ubitiguous Silt Loading Default Values with Hot Spot Contributions from Anti-Skid Abrasives (g/m^2)

ADT Category	< 500	500-5,000	5,000-10,000	> 10,000
Ubiquitous Baseline g/m^2	0.6	0.2	0.06	0.03 0.015 limited access
Ubitiguous Winter Baseline Multiplier during months with frozen precipitation	X4	X3	X2	X1
Initial peak additive contribution from application of antiskid abrasive (g/m^2)	2	2	2	2
Days to return to baseline conditions (assume linear decay)	7	3	1	0.5

It is suggested that an additional (but temporary) silt loading contribution of 2 g/m^2 occurs with each application of antiskid abrasive for snow/ice control. This was determined based on a typical application rate of 500 lb per lane mile and an initial silt content of 1 % silt content. Ordinary rock salt and other chemical deicers add little to the silt loading, because most of the chemical dissolves during the snow/ice melting process.

To adjust the baseline silt loadings for mud/dirt trackout, the number of trackout points is required. It is recommended that in calculating PM-10 emissions, six additional miles of road be added for each active trackout point from an active construction site, to the paved road mileage of the specified category within the county. In calculating PM-2.5 emissions, it is recommended that three additional miles of road be added for each trackout point from an active construction site.

It is suggested the number of trackout points for activities other than road and building construction areas be related to land use. For example, in rural farming areas, each mile of paved road would have a specified number of trackout points at intersections with unpaved roads. This value could be estimated from the unpaved road density (mi/sq. mi.).

The use of a default value from Table 13.2.1-3 should be expected to yield only an order-of-magnitude estimate of the emission factor. Public paved road silt loadings are dependent

upon: traffic characteristics (speed, ADT, and fraction of heavy vehicles); road characteristics (curbs, number of lanes, parking lanes); local land use (agriculture, new residential construction) and regional/seasonal factors (snow/ice controls, wind blown dust). As a result, the collection and use of site-specific silt loading data is highly recommended. In the event that default silt loading values are used, the quality ratings for the equation should be downgraded 2 levels.

Limited access roadways pose severe logistical difficulties in terms of surface sampling, and few silt loading data are available for such roads. Nevertheless, the available data do not suggest great variation in silt loading for limited access roadways from one part of the country to another. For annual conditions, a default value of 0.015 g/m^2 is recommended for limited access roadways.[9,22] Even fewer of the available data correspond to worst-case situations, and elevated loadings are observed to be quickly depleted because of high traffic speeds and high ADT rates. A default value of 0.2 g/m^2 is recommended for short periods of time following application of snow/ice controls to limited access roads.[22]

The limited data on silt loading values for industrial roads have shown as much variability as public roads. Because of the variations of traffic conditions and the use of preventive mitigative controls, the data probably do not reflect the full extent of the potential variation in silt loading on industrial roads. However, the collection of site specific silt loading data from industrial roads is easier and safer than for public roads. Therefore, the collection and use of site-specific silt loading data is preferred and is highly recommended. In the event that site-specific values cannot be obtained, an appropriate value for an industrial road may be selected from the mean values given in Table 13.2.1-4, but the quality rating of the equation should be reduced by 2 levels.

Table 13.2.1-4 (Metric And English Units). TYPICAL SILT CONTENT AND LOADING VALUES FOR PAVED ROADS AT INDUSTRIAL FACILITIES [a]

Industry	No. Of Sites	No. Of Samples	Silt Content (%)		No. Of Travel Lanes	Total Loading x 10^{-3}			Silt Loading (g/m^2)	
			Range	Mean		Range	Mean	Units[b]	Range	Mean
Copper smelting	1	3	15.4-21.7	19.0	2	12.9-19.5 45.8-69.2	15.9 55.4	kg/km lb/mi	188-400	292
Iron and steel production	9	48	1.1-35.7	12.5	2	0.006-4.77 0.020-16.9	0.495 1.75	kg/km lb/mi	0.09-79	9.7
Asphalt batching	1	3	2.6-4.6	3.3	1	12.1-18.0 43.0-64.0	14.9 52.8	kg/km lb/mi	76-193	120
Concrete batching	1	3	5.2-6.0	5.5	2	1.4-1.8 5.0-6.4	1.7 5.9	kg/km lb/mi	11-12	12
Sand and gravel processing	1	3	6.4-7.9	7.1	1	2.8-5.5 9.9-19.4	3.8 13.3	kg/km lb/mi	53-95	70
Municipal solid waste landfill	2	7	—	—	2	—	—	—	1.1-32.0	7.4
Quarry	1	6	—	—	2	—	—	—	2.4-14	8.2

[a] References 1-2,5-6,11-13. Values represent samples collected from *industrial* roads. Public road silt loading values are presented in Table-13.2.1-2. Dashes indicate information not available.

[b] Multiply entries by 1000 to obtain stated units; kilograms per kilometer (kg/km) and pounds per mile (lb/mi).

13.2.1.4 Controls[6,25]

Because of the importance of the silt loading, control techniques for paved roads attempt either to prevent material from being deposited onto the surface (preventive controls) or to remove from the travel lanes any material that has been deposited (mitigative controls). Covering of loads in trucks, and the paving of access areas to unpaved lots or construction sites, are examples of preventive measures. Examples of mitigative controls include vacuum sweeping, water flushing, and broom sweeping and flushing. Actual control efficiencies for any of these techniques can be highly variable. Locally measured silt loadings before and after the application of controls is the preferred method to evaluate controls. It is particularly important to note that street sweeping of gutters and curb areas may actually increase the silt loading on the traveled portion of the road. Redistribution of loose material onto the travel lanes will actually produce a short-term increase in the emissions.

In general, preventive controls are usually more cost effective than mitigative controls. The cost-effectiveness of mitigative controls falls off dramatically as the size of an area to be treated increases. The cost-effectiveness of mitigative measures is also unfavorable if only a short period of time is required for the road to return to equilibrium silt loading condition. That is to say, the number and length of public roads within most areas of interest preclude any widespread and routine use of mitigative controls. On the other hand, because of the more limited scope of roads at an industrial site, mitigative measures may be used quite successfully (especially in situations where truck spillage occurs). Note, however, that public agencies could make effective use of mitigative controls to remove sand/salt from roads after the winter ends.

Because available controls will affect the silt loading, controlled emission factors may be obtained by substituting controlled silt loading values into the equation. (Emission factors from controlled industrial roads were used in the development of the equation.) The collection of surface loading samples from treated, as well as baseline (untreated), roads provides a means to track effectiveness of the controls over time.

13.2.1.5 Changes since Fifth Edition

The following changes were made since the publication of the Fifth Edition of AP-42:

1) The particle size multiplier was reduced by approximately 55% as a result of emission testing specifically to evaluate the PM-2.5 component of the emissions.

2) Default silt loading values were included in Table 13.2.1-2 replacing the Tables and Figures containing silt loading statistical information.

3) Editorial changes within the text were made indicating the possible causes of variations in the silt loading between roads within and among different locations. The uncertainty of using the default silt loading value was discussed.

4) Section 13.2.1.1 was revised to clarify the role of dust loading in resuspension. Additional minor text changes were made.

5) Equations 2 and 3, Figure 13.2.1-2, and text were added to incorporate natural mitigation into annual or other long-term average emission factors.

6) The emission factor equation was adjusted to remove the component of particulate emissions from exhaust, brake wear, and tire wear. The parameter *C* in the new equation varies with aerodynamic size range of the particulate matter. Table 13.2.1-2 was added to present the new coefficients.

7) The default silt loading values in Table 13.2.1-3 were revised to incorporate the results from a recent analysis of silt loading data.

8) The PM-2.5 particle size multiplier was reduced by 40% as the result of wind tunnel studies of a variety of dust emitting surface materials.

9) References were rearranged and renumbered.

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13.2.2 Unpaved Roads

13.2.2.1 General

When a vehicle travels an unpaved road, the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

The particulate emission factors presented in the previous draft version of this section of AP-42, dated October 2001, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material[25]. EPA included these sources in the emission factor equation for unpaved public roads (equation 1b in this section) since the field testing data used to develop the equation included both the direct emissions from vehicles and emissions from resuspension of road dust.

This version of the unpaved public road emission factor equation only estimates particulate emissions from resuspended road surface material [23, 26]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOBILE6.2 [24]. This approach eliminates the possibility of double counting emissions. Double counting results when employing the previous version of the emission factor equation in this section and MOBILE6.2 to estimate particulate emissions from vehicle traffic on unpaved public roads. It also incorporates the decrease in exhaust emissions that has occurred since the unpaved public road emission factor equation was developed. The previous version of the unpaved public road emission factor equation includes estimates of emissions from exhaust, brake wear, and tire wear based on emission rates for vehicles in the 1980 calendar year fleet. The amount of PM released from vehicle exhaust has decreased since 1980 due to lower new vehicle emission standards and changes in fuel characteristics.

13.2.2.2 Emissions Calculation And Correction Parameters[1-6]

The quantity of dust emissions from a given segment of unpaved road varies linearly with the volume of traffic. Field investigations also have shown that emissions depend on source parameters that characterize the condition of a particular road and the associated vehicle traffic. Characterization of these source parameters allow for "correction" of emission estimates to specific road and traffic conditions present on public and industrial roadways.

Dust emissions from unpaved roads have been found to vary directly with the fraction of silt (particles smaller than 75 micrometers [μm] in diameter) in the road surface materials.[1] The silt fraction is determined by measuring the proportion of loose dry surface dust that passes a 200-mesh screen, using the ASTM-C-136 method. A summary of this method is contained in Appendix C of AP-42. Table 13.2.2-1 summarizes measured silt values for industrial unpaved roads. Table 13.2.2-2 summarizes measured silt values for public unpaved roads. It should be noted that the ranges of silt content vary over two orders of magnitude. Therefore, the use of data from this table can potentially introduce considerable error. Use of this data is strongly discouraged when it is feasible to obtain locally gathered data.

Since the silt content of a rural dirt road will vary with geographic location, it should be measured for use in projecting emissions. As a conservative approximation, the silt content of the parent soil in the area can be used. Tests, however, show that road silt content is normally lower than in the surrounding parent soil, because the fines are continually removed by the vehicle traffic, leaving a higher percentage of coarse particles.

Other variables are important in addition to the silt content of the road surface material. For example, at industrial sites, where haul trucks and other heavy equipment are common, emissions are highly correlated with vehicle weight. On the other hand, there is far less variability in the weights of cars and pickup trucks that commonly travel publicly accessible unpaved roads throughout the United States. For those roads, the moisture content of the road surface material may be more dominant in determining differences in emission levels between, for example a hot, desert environment and a cool, moist location.

The PM-10 and TSP emission factors presented below are the outcomes from stepwise linear regressions of field emission test results of vehicles traveling over unpaved surfaces. Due to a limited amount of information available for PM-2.5, the expression for that particle size range has been scaled against the result for PM-10. Consequently, the quality rating for the PM-2.5 factor is lower than that for the PM-10 expression.

Table 13.2.2-1. TYPICAL SILT CONTENT VALUES OF SURFACE MATERIAL ON INDUSTRIAL UNPAVED ROADS[a]

Industry	Road Use Or Surface Material	Plant Sites	No. Of Samples	Silt Content (%)	
				Range	Mean
Copper smelting	Plant road	1	3	16 - 19	17
Iron and steel production	Plant road	19	135	0.2 - 19	6.0
Sand and gravel processing	Plant road	1	3	4.1 - 6.0	4.8
	Material storage area	1	1	-	7.1
Stone quarrying and processing	Plant road	2	10	2.4 - 16	10
	Haul road to/from pit	4	20	5.0-15	8.3
Taconite mining and processing	Service road	1	8	2.4 - 7.1	4.3
	Haul road to/from pit	1	12	3.9 - 9.7	5.8
Western surface coal mining	Haul road to/from pit	3	21	2.8 - 18	8.4
	Plant road	2	2	4.9 - 5.3	5.1
	Scraper route	3	10	7.2 - 25	17
	Haul road (freshly graded)	2	5	18 - 29	24
Construction sites	Scraper routes	7	20	0.56-23	8.5
Lumber sawmills	Log yards	2	2	4.8-12	8.4
Municipal solid waste landfills	Disposal routes	4	20	2.2 - 21	6.4

[a]References 1,5-15.

The following empirical expressions may be used to estimate the quantity in pounds (lb) of size-specific particulate emissions from an unpaved road, per vehicle mile traveled (VMT):

For vehicles traveling on unpaved surfaces at industrial sites, emissions are estimated from the following equation:

$$E = k\,(s/12)^a (W/3)^b \tag{1a}$$

and, for vehicles traveling on publicly accessible roads, dominated by light duty vehicles, emissions may be estimated from the following:

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C \tag{1b}$$

where k, a, b, c and d are empirical constants (Reference 6) given below and

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

The source characteristics s, W and M are referred to as correction parameters for adjusting the emission estimates to local conditions. The metric conversion from lb/VMT to grams (g) per vehicle kilometer traveled (VKT) is as follows:

1 lb/VMT = 281.9 g/VKT

The constants for Equations 1a and 1b based on the stated aerodynamic particle sizes are shown in Tables 13.2.2-2 and 13.2.2-4. The PM-2.5 particle size multipliers (k-factors) are taken from Reference 27.

Table 13.2.2-2. CONSTANTS FOR EQUATIONS 1a AND 1b

Constant	Industrial Roads (Equation 1a)			Public Roads (Equation 1b)		
	PM-2.5	PM-10	PM-30*	PM-2.5	PM-10	PM-30*
k (lb/VMT)	0.15	1.5	4.9	0.18	1.8	6.0
a	0.9	0.9	0.7	1	1	1
b	0.45	0.45	0.45	-	-	-
c	-	-	-	0.2	0.2	0.3
d	-	-	-	0.5	0.5	0.3
Quality Rating	B	B	B	B	B	B

*Assumed equivalent to total suspended particulate matter (TSP)
"-" = not used in the emission factor equation

Table 13.2.2-2 also contains the quality ratings for the various size-specific versions of Equation 1a and 1b. The equation retains the assigned quality rating, if applied within the ranges of source conditions, shown in Table 13.2.2-3, that were tested in developing the equation:

Table 13.2.2-3. RANGE OF SOURCE CONDITIONS USED IN DEVELOPING EQUATION 1a AND 1b

Emission Factor	Surface Silt Content, %	Mean Vehicle Weight		Mean Vehicle Speed		Mean No. of Wheels	Surface Moisture Content, %
		Mg	ton	km/hr	mph		
Industrial Roads (Equation 1a)	1.8-25.2	1.8-260	2-290	8-69	5-43	4-17[a]	0.03-13
Public Roads (Equation 1b)	1.8-35	1.4-2.7	1.5-3	16-88	10-55	4-4.8	0.03-13

[a] See discussion in text.

As noted earlier, the models presented as Equations 1a and 1b were developed from tests of traffic on unpaved surfaces. Unpaved roads have a hard, generally nonporous surface that usually dries quickly after a rainfall or watering, because of traffic-enhanced natural evaporation. (Factors influencing how fast a road dries are discussed in Section 13.2.2.3, below.) The quality ratings given above pertain to the mid-range of the measured source conditions for the equation. A higher mean vehicle weight and a higher than normal traffic rate may be justified when performing a worst-case analysis of emissions from unpaved roads.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA's MOBILE6.2 model [23]. The emission factor also varies with aerodynamic size range

as shown in Table 13.2.2-4

Table 13.2.2-4. EMISSION FACTOR FOR 1980'S VEHICLE FLEET EXHAUST, BRAKE WEAR AND TIRE WEAR

Particle Size Range[a]	*C*, Emission Factor for Exhaust, Brake Wear and Tire Wear[b] lb/VMT
$PM_{2.5}$	0.00036
PM_{10}	0.00047
PM_{30}[c]	0.00047

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.
[b] Units shown are pounds per vehicle mile traveled (lb/VMT).
[c] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

It is important to note that the vehicle-related source conditions refer to the average weight, speed, and number of wheels for all vehicles traveling the road. For example, if 98 percent of traffic on the road are 2-ton cars and trucks while the remaining 2 percent consists of 20-ton trucks, then the mean weight is 2.4 tons. More specifically, Equations 1a and 1b are *not* intended to be used to calculate a separate emission factor for each vehicle class within a mix of traffic on a given unpaved road. That is, in the example, one should *not* determine one factor for the 2-ton vehicles and a second factor for the 20-ton trucks. Instead, only one emission factor should be calculated that represents the "fleet" average of 2.4 tons for all vehicles traveling the road.

Moreover, to retain the quality ratings when addressing a group of unpaved roads, it is necessary that reliable correction parameter values be determined for the road in question. The field and laboratory procedures for determining road surface silt and moisture contents are given in AP-42 Appendices C.1 and C.2. Vehicle-related parameters should be developed by recording visual observations of traffic. In some cases, vehicle parameters for industrial unpaved roads can be determined by reviewing maintenance records or other information sources at the facility.

In the event that site-specific values for correction parameters cannot be obtained, then default values may be used.In the absence of site-specific silt content information, an appropriate mean value from Table 13.2.2-1 may be used as a default value, but the quality rating of the equation is reduced by two letters. Because of significant differences found between different types of road surfaces and between different areas of the country, use of the default moisture content value of 0.5 percent in Equation 1b is discouraged. The quality rating should be downgraded two letters when the default moisture content value is used. (It is assumed that readers addressing industrial roads have access to the information needed to develop average vehicle information in Equation 1a for their facility.)

The effect of routine watering to control emissions from unpaved roads is discussed below in Section 13.2.2.3, “Controls”. However, all roads are subject to some natural mitigation because of rainfall and other precipitation. The Equation 1a and 1b emission factors can be extrapolated to annual

average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual average emissions are inversely proportional to the number of days with measurable (more than 0.254 mm [0.01 inch]) precipitation:

$$E_{ext} = E\ [(365 - P)/365] \qquad (2)$$

where:

E_{ext} = annual size-specific emission factor extrapolated for natural mitigation, lb/VMT

E = emission factor from Equation 1a or 1b

P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation (see below)

Figure 13.2.2-1 gives the geographical distribution for the mean annual number of "wet" days for the United States.

Equation 2 provides an estimate that accounts for precipitation on an annual average basis for the purpose of inventorying emissions. It should be noted that Equation 2 does not account for differences in the temporal distributions of the rain events, the quantity of rain during any event, or the potential for the rain to evaporate from the road surface. In the event that a finer temporal and spatial resolution is desired for inventories of public unpaved roads, estimates can be based on a more complex set of assumptions. These assumptions include:

1. The moisture content of the road surface material is increased in proportion to the quantity of water added;
2. The moisture content of the road surface material is reduced in proportion to the Class A pan evaporation rate;
3. The moisture content of the road surface material is reduced in proportion to the traffic volume; and
4. The moisture content of the road surface material varies between the extremes observed in the area. The CHIEF Web site (http://www.epa.gov/ttn/chief/ap42/ch13/related/c13s02-2.html) has a file which contains a spreadsheet program for calculating emission factors which are temporally and spatially resolved. Information required for use of the spreadsheet program includes monthly Class A pan evaporation values, hourly meteorological data for precipitation, humidity and snow cover, vehicle traffic information, and road surface material information.

It is emphasized that <u>the simple assumption underlying Equation 2 and the more complex set of assumptions underlying the use of the procedure which produces a finer temporal and spatial resolution</u> have not been verified in any rigorous manner. For this reason, the quality ratings for either approach should be downgraded one letter from the rating that would be applied to Equation 1.

13.2.2.3 Controls[18-22]

A wide variety of options exist to control emissions from unpaved roads. Options fall into the following three groupings:

1. <u>Vehicle restrictions</u> that limit the speed, weight or number of vehicles on the road;

2. Surface improvement, by measures such as (a) paving or (b) adding gravel or slag to a dirt road; and

3. Surface treatment, such as watering or treatment with chemical dust suppressants.

Available control options span broad ranges in terms of cost, efficiency, and applicability. For example, traffic controls provide moderate emission reductions (often at little cost) but are difficult to enforce. Although paving is highly effective, its high initial cost is often prohibitive. Furthermore, paving is not feasible for industrial roads subject to very heavy vehicles and/or spillage of material in transport. Watering and chemical suppressants, on the other hand, are potentially applicable to most industrial roads at moderate to low costs. However, these require frequent reapplication to maintain an acceptable level of control. Chemical suppressants are generally more cost-effective than water but not in cases of temporary roads (which are common at mines, landfills, and construction sites). In summary, then, one needs to consider not only the type and volume of traffic on the road but also how long the road will be in service when developing control plans.

Vehicle restrictions. These measures seek to limit the amount and type of traffic present on the road or to lower the mean vehicle speed. For example, many industrial plants have restricted employees from driving on plant property and have instead instituted bussing programs. This eliminates emissions due to employees traveling to/from their worksites. Although the heavier average vehicle weight of the busses increases the base emission factor, the decrease in vehicle-miles-traveled results in a lower overall emission rate.

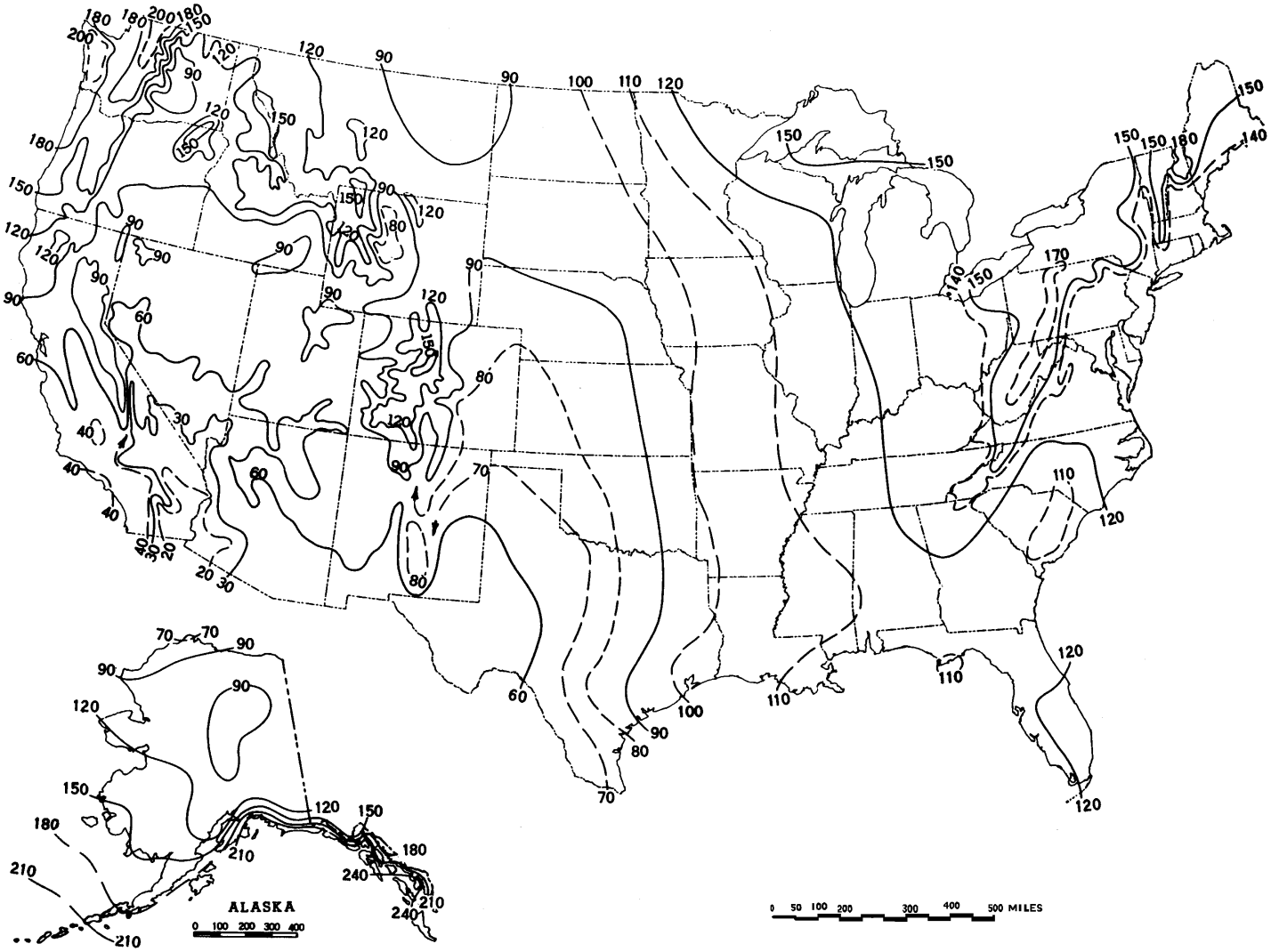

Figure 13.2.2-1. Mean number of days with 0.01 inch or more of precipitation in United States.

Surface improvements. Control options in this category alter the road surface. As opposed to the "surface treatments" discussed below, improvements are relatively "permanent" and do not require periodic retreatment.

The most obvious surface improvement is paving an unpaved road. This option is quite expensive and is probably most applicable to relatively short stretches of unpaved road with at least several hundred vehicle passes per day. Furthermore, if the newly paved road is located near unpaved areas or is used to transport material, it is essential that the control plan address routine cleaning of the newly paved road surface.

The control efficiencies achievable by paving can be estimated by comparing emission factors for unpaved and paved road conditions. The predictive emission factor equation for paved roads, given in Section 13.2.1, requires estimation of the silt loading on the traveled portion of the paved surface, which in turn depends on whether the pavement is periodically cleaned. Unless curbing is to be installed, the effects of vehicle excursion onto unpaved shoulders (berms) also must be taken into account in estimating the control efficiency of paving.

Other improvement methods cover the road surface with another material that has a lower silt content. Examples include placing gravel or slag on a dirt road. Control efficiency can be estimated by comparing the emission factors obtained using the silt contents before and after improvement. The silt content of the road surface should be determined after 3 to 6 months rather than immediately following placement. Control plans should address regular maintenance practices, such as grading, to retain larger aggregate on the traveled portion of the road.

Surface treatments refer to control options which require periodic reapplication. Treatments fall into the two main categories of (a) "wet suppression" (i. e., watering, possibly with surfactants or other additives), which keeps the road surface wet to control emissions and (b) "chemical stabilization/ treatment", which attempts to change the physical characteristics of the surface. The necessary reapplication frequency varies from several minutes for plain water under summertime conditions to several weeks or months for chemical dust suppressants.

Watering increases the moisture content, which conglomerates particles and reduces their likelihood to become suspended when vehicles pass over the surface. The control efficiency depends on how fast the road dries after water is added. This in turn depends on (a) the amount (per unit road surface area) of water added during each application; (b) the period of time between applications; (c) the weight, speed and number of vehicles traveling over the watered road during the period between applications; and (d) meteorological conditions (temperature, wind speed, cloud cover, etc.) that affect evaporation during the period.

Figure 13.2.2-2 presents a simple bilinear relationship between the instantaneous control efficiency due to watering and the resulting increase in surface moisture. The moisture ratio "M" (i.e., the x-axis in Figure 13.2.2-2) is found by dividing the surface moisture content of the watered road by the surface moisture content of the uncontrolled road. As the watered road surface dries, both the ratio M and the predicted instantaneous control efficiency (i.e., the y-axis in the figure) decrease. The figure shows that between the uncontrolled moisture content and a value twice as large, a small increase in moisture content results in a large increase in control efficiency. Beyond that, control efficiency grows slowly with increased moisture content.

Given the complicated nature of how the road dries, characterization of emissions from watered roadways is best done by collecting road surface material samples at various times between water truck passes. (Appendices C.1 and C.2 present the sampling and analysis procedures.) The moisture content measured can then be associated with a control efficiency by use of Figure 13.2.2-2. Samples that reflect average conditions during the watering cycle can take the form of either a series of samples between water applications or a single sample at the midpoint. It is essential that samples be collected during periods with active traffic on the road. Finally, because of different evaporation rates, it is recommended that samples be collected at various times during the year. If only one set of samples is to be collected, these must be collected during hot, summertime conditions.

When developing watering control plans for roads that do not yet exist, it is strongly recommended that the moisture cycle be established by sampling similar roads in the same geographic area. If the moisture cycle cannot be established by similar roads using established watering control plans, the more complex methodology used to estimate the mitigation of rainfall and other precipitation can be used to estimate the control provided by routine watering. An estimate of the maximum daytime Class A pan evaporation (based upon daily evaporation data published in the monthly Climatological Data for the state by the National Climatic Data Center) should be used to insure that adequate watering capability is available during periods of highest evaporation. The hourly precipitation values in the spreadsheet should be replaced with the equivalent inches of precipitation (where the equivalent of 1 inch of precipitation is provided by an application of 5.6 gallons of water per square yard of road). Information on the long term average annual evaporation and on the percentage that occurs between May and October was published in the Climatic Atlas (Reference 16). Figure 13.2.2-3 presents the geographical distribution for "Class A pan evaporation" throughout the United States. Figure 13.2.2-4 presents the geographical distribution of the percentage of this evaporation that occurs between May and October. The U. S. Weather Bureau Class A evaporation pan is a cylindrical metal container with a depth of 10 inches and a diameter of 48 inches. Periodic measurements are made of the changes of the water level.

The above methodology should be used <u>only for prospective analyses</u> and for designing watering programs for existing roadways. The quality rating of an emission factor for a watered road that is based on this methodology should be downgraded two letters. Periodic road surface samples should be collected and analyzed to verify the efficiency of the watering program.

As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. These materials suppress emissions by changing the physical characteristics of the existing road surface material. Many chemical unpaved road dust suppressants form a hardened surface that binds particles together. After several applications, a treated road often resembles a paved road except that the surface is not uniformly flat. Because the improved surface results in more grinding of small particles, the silt content of loose material on a highly controlled surface may be substantially higher than when the surface was uncontrolled. For this reason, the models presented as Equations 1a and 1b cannot be used to estimate emissions from chemically stabilized roads. Should the road be allowed to return to an

uncontrolled state with no visible signs of large-scale cementing of material, the Equation 1a and 1b emission factors could then be used to obtain conservatively high emission estimates.

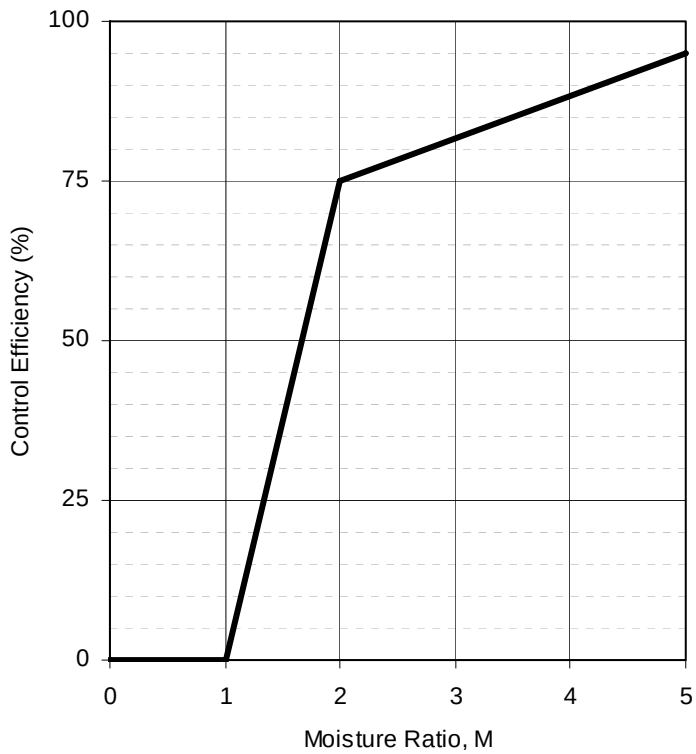

Figure 13.2.2-2. Watering control effectiveness for unpaved travel surfaces

The control effectiveness of chemical dust suppressants appears to depend on (a) the dilution rate used in the mixture; (b) the application rate (volume of solution per unit road surface area); (c) the time between applications; (d) the size, speed and amount of traffic during the period between applications; and (e) meteorological conditions (rainfall, freeze/thaw cycles, etc.) during the period. Other factors that affect the performance of dust suppressants include other traffic characteristics (e. g., cornering, track-on from unpaved areas) and road characteristics (e. g., bearing strength, grade). The variabilities in the above factors and differences between individual dust control products make the control efficiencies of chemical dust suppressants difficult to estimate. Past field testing of emissions from controlled unpaved roads has shown that chemical dust suppressants provide a PM-10 control efficiency of about 80 percent when applied at regular intervals of 2 weeks to 1 month.

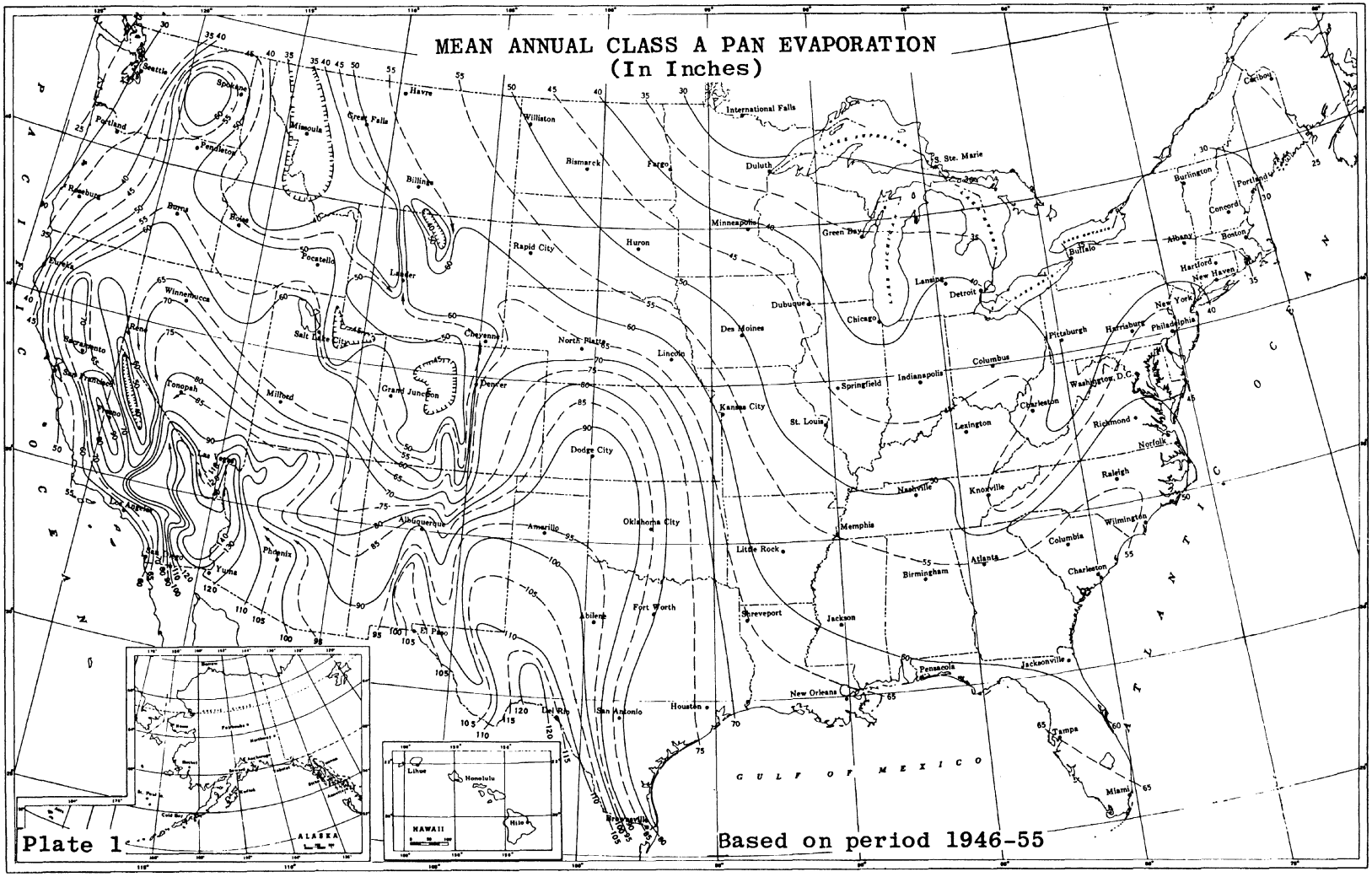

Figure 13.2.2-3. Annual evaporation data.

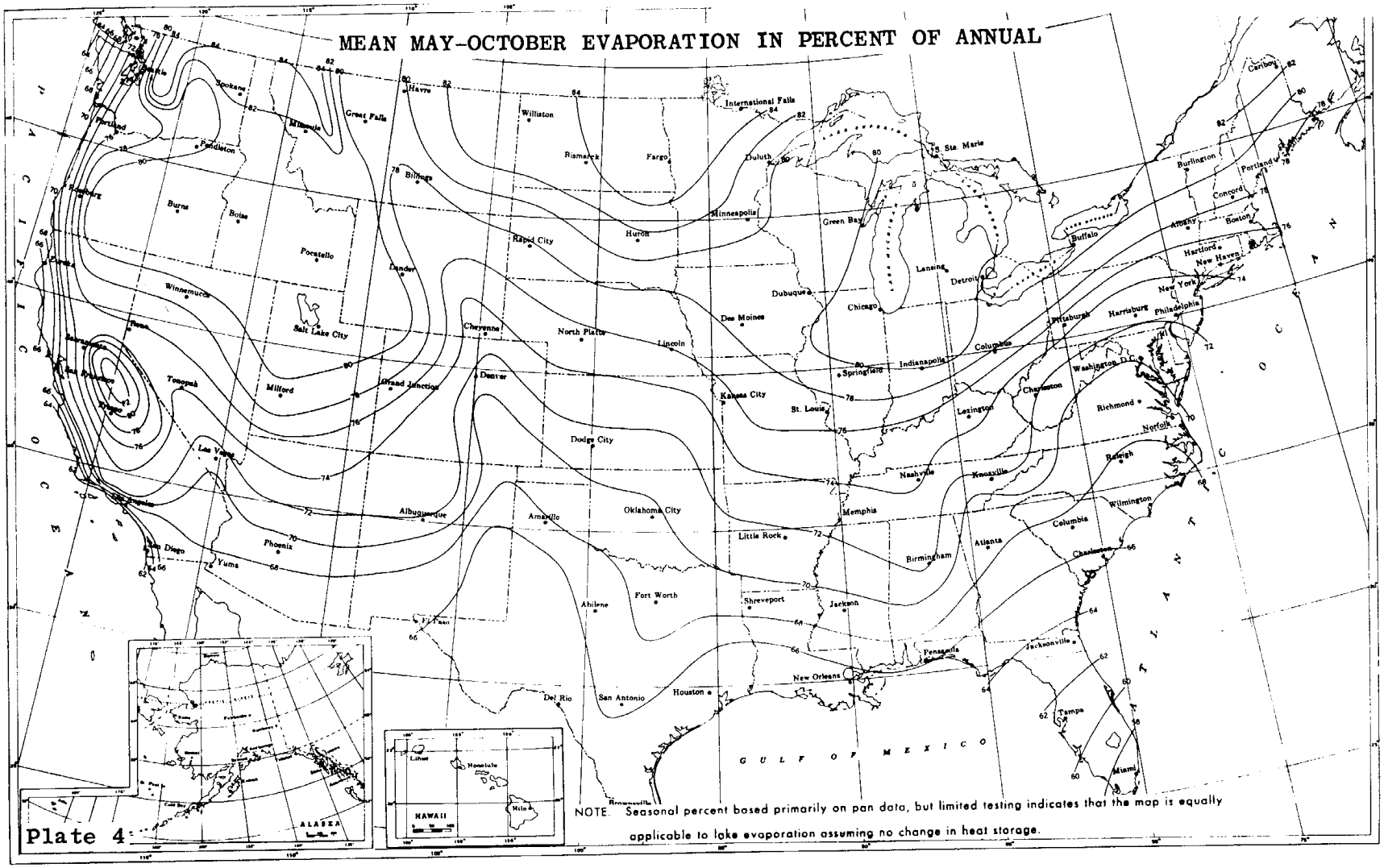

Figure 13.2.2-4. Geographical distribution of the percentage of evaporation occurring between May and October.

Petroleum resin products historically have been the dust suppressants (besides water) most widely used on industrial unpaved roads. Figure 13.2.2-5 presents a method to estimate average control efficiencies associated with petroleum resins applied to unpaved roads.[20] Several items should be noted:

1. The term "ground inventory" represents the total volume (per unit area) of petroleum resin concentrate (*not solution*) applied since the start of the dust control season.

2. Because petroleum resin products must be periodically reapplied to unpaved roads, the use of a time-averaged control efficiency value is appropriate. Figure 13.2.2-5 presents control efficiency values averaged over two common application intervals, 2 weeks and 1 month. Other application intervals will require interpolation.

3. Note that zero efficiency is assigned until the ground inventory reaches 0.05 gallon per square yard (gal/yd^2). Requiring a minimum ground inventory ensures that one must apply a reasonable amount of chemical dust suppressant to a road before claiming credit for emission control. Recall that the ground inventory refers to the amount of petroleum resin concentrate rather than the total solution.

As an example of the application of Figure 13.2.2-5, suppose that Equation 1a was used to estimate an emission factor of 7.1 lb/VMT for PM-10 from a particular road. Also, suppose that, starting on May 1, the road is treated with 0.221 gal/yd^2 of a solution (1 part petroleum resin to 5 parts water) on the first of each month through September. Then, the average controlled emission factors, shown in Table 13.2.2-5, are found.

Table 13.2-2-5. EXAMPLE OF AVERAGE CONTROLLED EMISSION FACTORS FOR SPECIFIC CONDITIONS

Period	Ground Inventory, gal/yd^2	Average Control Efficiency, %[a]	Average Controlled Emission Factor, lb/VMT
May	0.037	0	7.1
June	0.073	62	2.7
July	0.11	68	2.3
August	0.15	74	1.8
September	0.18	80	1.4

[a] From Figure 13.2.2-5, $\leq$10 µm. Zero efficiency assigned if ground inventory is less than 0.05 gal/yd^2. 1 lb/VMT = 281.9 g/VKT. 1 gal/yd^2 = 4.531 L/m^2.

Besides petroleum resins, other newer dust suppressants have also been successful in controlling emissions from unpaved roads. Specific test results for those chemicals, as well as for petroleum resins and watering, are provided in References 18 through 21.

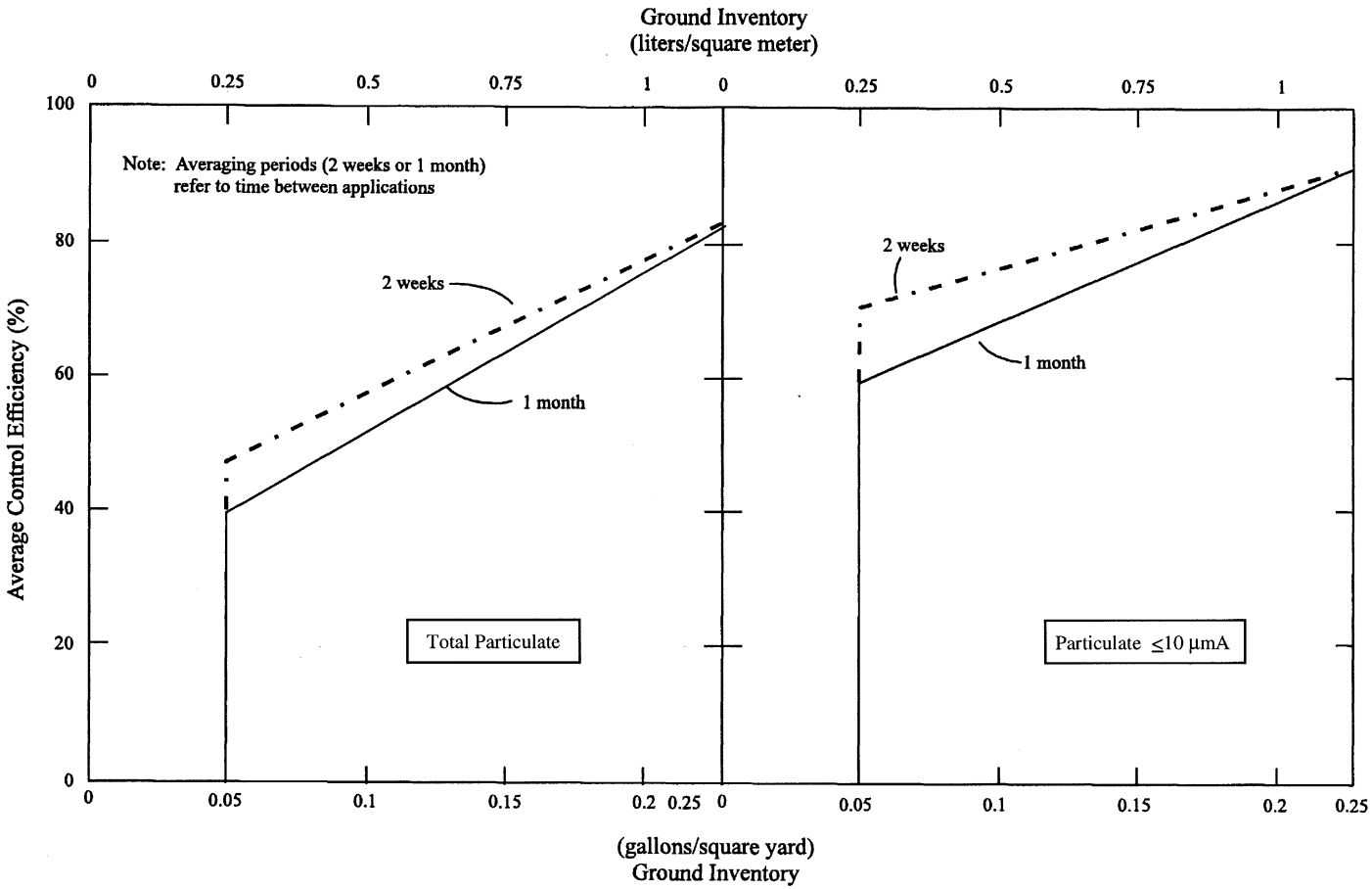

Figure 13.2.2-5. Average control efficiencies over common application intervals.

13.2.2.4 Updates Since The Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the background report for this section (Reference 6).

October 1998 (Supplement E)– This was a major revision of this section. Significant changes to the text and the emission factor equations were made.

October 2001 – Separate emission factors for unpaved surfaces at industrial sites and publicly accessible roads were introduced. Figure 13.2.2-2 was included to provide control effectiveness estimates for watered roads.

December 2003 – The public road emission factor equation (equation 1b) was adjusted to remove the component of particulate emissions from exhaust, brake wear, and tire wear. The parameter C in the new equation varies with aerodynamic size range of the particulate matter. Table 13.2.2-4 was added to present the new coefficients.

January 2006 – The PM-2.5 particle size multipliers (i.e., factors) in Table 13.2.2-2 were modified and the quality ratings were upgraded from C to B based on the wind tunnel studies of a variety of dust emitting surface materials.

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13.2.3 Heavy Construction Operations

13.2.3.1 General

Heavy construction is a source of dust emissions that may have substantial temporary impact on local air quality. Building and road construction are 2 examples of construction activities with high emissions potential. Emissions during the construction of a building or road can be associated with land clearing, drilling and blasting, ground excavation, cut and fill operations (i.e., earth moving), and construction of a particular facility itself. Dust emissions often vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A large portion of the emissions results from equipment traffic over temporary roads at the construction site.

The temporary nature of construction differentiates it from other fugitive dust sources as to estimation and control of emissions. Construction consists of a series of different operations, each with its own duration and potential for dust generation. In other words, emissions from any single construction site can be expected (1) to have a definable beginning and an end and (2) to vary substantially over different phases of the construction process. This is in contrast to most other fugitive dust sources, where emissions are either relatively steady or follow a discernable annual cycle. Furthermore, there is often a need to estimate areawide construction emissions, without regard to the actual plans of any individual construction project. For these reasons, following are methods by which either areawide or site-specific emissions may be estimated.

13.2.3.2 Emissions And Correction Parameters

The quantity of dust emissions from construction operations is proportional to the area of land being worked and to the level of construction activity. By analogy to the parameter dependence observed for other similar fugitive dust sources,[1] one can expect emissions from heavy construction operations to be positively correlated with the silt content of the soil (that is, particles smaller than 75 micrometers [µm] in diameter), as well as with the speed and weight of the average vehicle, and to be negatively correlated with the soil moisture content.

13.2.3.3 Emission Factors

Only 1 set of field studies has been performed that attempts to relate the emissions from construction directly to an emission factor.[1-2] Based on field measurements of total suspended particulate (TSP) concentrations surrounding apartment and shopping center construction projects, the approximate emission factors for construction activity operations are:

E = 2.69 megagrams (Mg)/hectare/month of activity
E = 1.2 tons/acre/month of activity

These values are most useful for developing estimates of overall emissions from construction scattered throughout a geographical area. The value is most applicable to construction operations with: (1) medium activity level, (2) moderate silt contents, and (3) semiarid climate. Test data were not sufficient to derive the specific dependence of dust emissions on correction parameters. Because the above emission factor is referenced to TSP, use of this factor to estimate particulate matter (PM) no greater than 10 µm in aerodynamic diameter (PM-10) emissions will result in conservatively high

estimates. Also, because derivation of the factor assumes that construction activity occurs 30 days per month, the above estimate is somewhat conservatively high for TSP as well.

Although the equation above represents a relatively straightforward means of preparing an areawide emission inventory, at least 2 features limit its usefulness for specific construction sites. First, the conservative nature of the emission factor may result in too high an estimate for PM-10 to be of much use for a specific site under consideration. Second, the equation provides neither information about which particular construction activities have the greatest emission potential nor guidance for developing an effective dust control plan.

For these reasons, it is strongly recommended that when emissions are to be estimated for a particular construction site, the construction process be broken down into component operations. (Note that many general contractors typically employ planning and scheduling tools, such as critical path method [CPM], that make use of different sequential operations to allocate resources.) This approach to emission estimation uses a unit or phase method to consider the more basic dust sources of vehicle travel and material handling. That is to say, the construction project is viewed as consisting of several operations, each involving traffic and material movements, and emission factors from other AP-42 sections are used to generate estimates. Table 13.2.3-1 displays the dust sources involved with construction, along with the recommended emission factors.[3]

In addition to the on-site activities shown in Table 13.2.3-1, substantial emissions are possible because of material tracked out from the site and deposited on adjacent paved streets. Because all traffic passing the site (i. e., not just that associated with the construction) can resuspend the deposited material, this "secondary" source of emissions may be far more important than all the dust sources actually within the construction site. Furthermore, this secondary source will be present during all construction operations. Persons developing construction site emission estimates must consider the potential for increased adjacent emissions from off-site paved roadways (see Section 13.2.1, "Paved Roads"). High wind events also can lead to emissions from cleared land and material stockpiles. Section 13.2.5, "Industrial Wind Erosion", presents an estimation methodology that can be used for such sources at construction sites.

13.2.3.4 Control Measures[4]

Because of the relatively short-term nature of construction activities, some control measures are more cost effective than others. Wet suppression and wind speed reduction are 2 common methods used to control open dust sources at construction sites, because a source of water and material for wind barriers tend to be readily available on a construction site. However, several other forms of dust control are available.

Table 13.2.3-2 displays each of the preferred control measures, by dust source.[3-4] Because most of the controls listed in the table modify independent variables in the emission factor models, the effectiveness can be calculated by comparing controlled and uncontrolled emission estimates from Table 13.2.3-1. Additional guidance on controls is provided in the AP-42 sections from which the recommended emission factors were taken, as well as in other documents, such as Reference 4.

Table 13.2.3-1. RECOMMENDED EMISSION FACTORS FOR CONSTRUCTION OPERATIONS[a]

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
I. Demolition and debris removal	1. Demolition of buildings or other (natural) obstacles such as trees, boulders, etc.			
	a. Mechanical dismemberment ("headache ball") of existing structures	NA		—
	b. Implosion of existing structures	NA		—
	c. Drilling and blasting of soil	Drilling factor in Table 11.9-4		-1
		Blasting factor NA	Blasting factor in Tables 11.9-1 and 11.9-2 not considered appropriate for general construction activities	NA
	d. General land clearing	Dozer equation (overburden) in Tables 11.9-1 and 11.9-2		-1/-2[c]
	2. Loading of debris into trucks	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	3. Truck transport of debris	Unpaved road emission factor in Section 13.2.2, or paved road emission factor in Section 13.2.1		-0/-1[c]
	4. Truck unloading of debris	Material handling emission factor equation in Section 13.2.4	May occur offsite	-0/-1[c]

Table 13.2.3-1 (cont.).

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
II. Site Preparation (earth moving)	1. Bulldozing	Dozer equation (overburden) in Tables 11.9-1 and 11.9-2		-1/-2[c]
	2. Scrapers unloading topsoil	Scraper unloading factor in Table 11.9-4		-1
	3. Scrapers in travel	Scraper (travel mode) expression in Tables 11.9-1 and 11.9-2		-0/-1[c]
	4. Scrapers removing topsoil	5.7 kg/vehicle kilometer traveled (VKT) (20.2 lb/vehicle mile traveled [VMT])		E[d]
	5. Loading of excavated material into trucks	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	6. Truck dumping of fill material, road base, or other materials	Material handling emission factor equation in Section 13.2.4	May occur offsite	-0/-1[c]
	7. Compacting	Dozer equation in Tables 11.9-1 and 11.9-2	Emission factor downgraded because of differences in operating equipment	-1/-2[c]
	8. Motor grading	Grading equation in Tables 11.9-1 and 11.9-2		-1/-2[c]

Table 13.2.3-1 (cont.).

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
III. General Construction	1. Vehicular traffic	Unpaved road emission factor in Section 13.2.2, or paved road emission factor in Section 13.2.1		-0/-1[c] -0/-1[c]
	2. Portable plants			
	a. Crushing	Factors for similar material/operations in Section 11.19.2		-1/-2[c]
	b. Screening	Factors for similar material/operations in Section 11.19.2		-1/-2[c]
	c. Material transfers	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	3. Other operations	Factors for similar material/operations in the Mineral Products Industry, Chapter 11 of this document		—

[a] NA = not applicable.
[b] Refers to how many additional letters the emission factor should be downrated (beyond the guidance given in the other sections of AP-42) for application to construction activities. For example, "-2" means that an A-rated factor should be considered of C quality in estimating construction emissions. All emission factors assumed to have site-specific input values; otherwise, additional downgrading of one letter should be employed. Note that no rating can be lower than E.
[c] First value for cases with independent variables within range given in AP-42 section; second value for cases with at least 1 variable outside the range.
[d] Rating for emission factor given. Reference 5.
[e] In the event that individual operations cannot be identified, one may very conservatively overestimate PM-10 emissions by using Equation 1.

Table 13.2.3-2. CONTROL OPTIONS FOR GENERAL CONSTRUCTION OPEN SOURCES OF PM-10

Emission Source	Recommended Control Method(s)
Debris handling	Wind speed reduction Wet suppression[a]
Truck transport[b]	Wet suppression Paving Chemical stabilization[c]
Bulldozers	Wet suppression[d]
Pan scrapers	Wet suppression of travel routes
Cut/fill material handling	Wind speed reduction Wet suppression
Cut/fill haulage	Wet suppression Paving Chemical stabilization
General construction	Wind speed reduction Wet suppression Early paving of permanent roads

[a] Dust control plans should contain precautions against watering programs that confound trackout problems.
[b] Loads could be covered to avoid loss of material in transport, especially if material is transported offsite.
[c] Chemical stabilization usually cost-effective for relatively long-term or semipermanent unpaved roads.
[d] Excavated materials may already be moist and not require additional wetting. Furthermore, most soils are associated with an "optimum moisture" for compaction.

References For Section 13.2.3

1. C. Cowherd, Jr., *et al.*, *Development Of Emissions Factors For Fugitive Dust Sources*, EPA-450/3-74-03, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

2. G. A. Jutze, *et al.*, *Investigation Of Fugitive Dust Sources Emissions And Control*, EPA-450/3-74-036a, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

3. *Background Documentation For AP-42 Section 11.2.4, Heavy Construction Operations*, EPA Contract No. 69-D0-0123, Midwest Research Institute, Kansas City, MO, April 1993.

4. C. Cowherd, *et al.*, *Control Of Open Fugitive Dust Sources*, EPA-450/3-88-008, U. S. Environmental Protection Agency, Research Triangle Park, NC, September 1988.

5. M. A. Grelinger, *et al.*, *Gap Filling PM-10 Emission Factors For Open Area Fugitive Dust Sources*, EPA-450/4-88-003, U. S. Environmental Protection Agency, Research Triangle Park, NC, March 1988.

Appendix D: Cumulative Emission Sources

Dixie NF 20-Well Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Stk. Ht.	Temp.	Exit Vel.	Stk. Dia.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
POINT SOURCES		(m)	(m)	(ft)	(ft)	(°F)	(fps)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
DRE	Drill Dig Engine	427831	4209861	9448	15	950.0	75	1.0	0.56	0.56	19.2	0.32
FLARE	Production Flare	427781	4209911	9480	100	1000.0	55	1.5	0	0	2.45	0
CM1	Compressor Engine	427831	4209961	9455	25	760.0	95	1.0	0.05	0.05	3.98	0
HT1	Heater Treater	426936	4208986	9472	20	180.0	15	0.7	0	0	0.05	0
HT2	Heater Treater	427489	4208796	9416	20	180.0	15	0.7	0	0	0.05	0
HT3	Heater Treater	428269	4208686	9431	20	180.0	15	0.7	0	0	0.05	0
HT4	Heater Treater	428861	4208911	9486	20	180.0	15	0.7	0	0	0.05	0
HT5	Heater Treater	429086	4209503	9524	20	180.0	15	0.7	0	0	0.05	0
HT6	Heater Treater	429086	4210319	9462	20	180.0	15	0.7	0	0	0.05	0
HT7	Heater Treater	428861	4210911	9542	20	180.0	15	0.7	0	0	0.05	0
HT8	Heater Treater	428269	4211136	9472	20	180.0	15	0.7	0	0	0.05	0
HT9	Heater Treater	427453	4211136	9538	20	180.0	15	0.7	0	0	0.05	0
HT10	Heater Treater	426861	4210911	9425	20	180.0	15	0.7	0	0	0.05	0
HT11	Heater Treater	426636	4210319	9409	20	180.0	15	0.7	0	0	0.05	0
HT12	Heater Treater	426636	4209508	9381	20	180.0	15	0.7	0	0	0.05	0
HT13	Heater Treater	427236	4209286	9383	20	180.0	15	0.7	0	0	0.05	0
HT14	Heater Treater	428486	4209286	9440	20	180.0	15	0.7	0	0	0.05	0
HT15	Heater Treater	428486	4210536	9527	20	180.0	15	0.7	0	0	0.05	0
HT16	Heater Treater	427236	4210536	9447	20	180.0	15	0.7	0	0	0.05	0
HT17	Heater Treater	427161	4209911	9373	20	180.0	15	0.7	0	0	0.05	0
HT18	Heater Treater	427861	4209211	9386	20	180.0	15	0.7	0	0	0.05	0
HT19	Heater Treater	428561	4209911	9464	20	180.0	15	0.7	0	0	0.05	0
HT20	Heater Treater	427861	4210611	9554	20	180.0	15	0.7	0	0	0.05	0
DHY1	Dehydrator	426906	4208956	9482	30	200.0	8	1.0	0	0	0.05	0
DHY4	Dehydrator	428831	4208881	9488	30	200.0	8	1.0	0	0	0.05	0
DHY7	Dehydrator	428831	4210881	9507	30	200.0	8	1.0	0	0	0.05	0
DHY10	Dehydrator	426831	4210881	9420	30	200.0	8	1.0	0	0	0.05	0
WP1	Well Pump	426906	4209016	9472	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP2	Well Pump	427459	4208826	9418	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP3	Well Pump	428239	4208716	9426	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP4	Well Pump	428831	4208941	9482	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP5	Well Pump	429056	4209533	9524	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP6	Well Pump	429056	4210349	9462	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP7	Well Pump	428831	4210941	9544	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP8	Well Pump	428239	4211166	9471	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP9	Well Pump	427423	4211166	9533	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP10	Well Pump	426831	4210941	9422	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP11	Well Pump	426606	4210349	9409	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP12	Well Pump	426606	4209538	9380	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP13	Well Pump	427206	4209316	9380	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP14	Well Pump	428456	4209316	9440	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP15	Well Pump	428456	4210566	9524	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP16	Well Pump	427206	4210566	9447	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP17	Well Pump	427131	4209941	9372	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP18	Well Pump	427831	4209241	9390	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP19	Well Pump	428531	4209941	9459	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP20	Well Pump	427831	4210641	9551	10	775.0	45	0.7	0.33	0.33	4.65	0.31

From Table 4.1-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Dixie data. For combustion sources, PM2.5 assumed to equal PM10.

Dixie NF 20-Well Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Release Ht.	Horz. Dim.	Vert. Dim.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
VOLUME SOURCES		(m)	(m)	(ft)	(ft)	(ft)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
ORD1	outer road	427831	4208536	9414	2.0	100	6.0	0.5705	0.0570	0.0560	
ORD2	outer road	427183	4208891	9445	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD3	outer road	426719	4209207	9476	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD4	outer road	426456	4209911	9427	2.0	100	6.0	0.5705	0.0570	0.0560	
ORD5	outer road	426719	4210615	9413	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD6	outer road	427127	4211024	9483	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD7	outer road	427831	4211286	9477	2.0	100	6.0	0.5705	0.0570	0.0560	
ORD8	outer road	428535	4211024	9469	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD9	outer road	428944	4210615	9469	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD10	outer road	429206	4209911	9471	2.0	100	6.0	0.5705	0.0570	0.0560	
ORD11	outer road	428944	4209207	9495	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD12	outer road	428535	4208799	9460	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD1	inner road	427519	4209249	9391	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD2	inner road	427169	4209599	9367	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD3	inner road	427169	4210224	9392	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD4	inner road	427519	4210574	9511	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD5	inner road	428144	4210574	9567	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD6	inner road	428494	4210224	9521	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD7	inner road	428494	4209599	9452	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD8	inner road	428144	4209249	9393	2.0	75	6.0	0.5705	0.0570	0.0560	

From Table 4.1-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Dixie data. For unpaved road sources, PM2.5 assumed to equal 10% of PM10

MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1, unpaved roads)

Dixie NF 20-Well Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Release Ht.	Radius of Circle	Vert. Dim.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
CIRCULAR SOURCES		(m)	(m)	(ft)	(ft)	(ft)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
WELLPAD1	Disturbed Area - Well Pad	426831	4208911	9491	0	282.7	2.00	0.02	0.002		
WELLPAD2	Disturbed Area - Well Pad	427423	4208686	9430	0	282.7	2.00	0.02	0.002		
WELLPAD3	Disturbed Area - Well Pad	428239	4208686	9428	0	282.7	2.00	0.02	0.002		
WELLPAD4	Disturbed Area - Well Pad	428831	4208911	9485	0	282.7	2.00	0.02	0.002		
WELLPAD5	Disturbed Area - Well Pad	429056	4209503	9524	0	282.7	2.00	0.02	0.002		
WELLPAD6	Disturbed Area - Well Pad	429056	4210319	9462	0	282.7	2.00	0.02	0.002		
WELLPAD7	Disturbed Area - Well Pad	428831	4210911	9526	0	282.7	2.00	0.02	0.002		
WELLPAD8	Disturbed Area - Well Pad	428239	4211136	9474	0	282.7	2.00	0.02	0.002		
WELLPAD9	Disturbed Area - Well Pad	427423	4211136	9533	0	282.7	2.00	0.02	0.002		
WELLPAD10	Disturbed Area - Well Pad	426831	4210911	9422	0	282.7	2.00	0.02	0.002		
WELLPAD11	Disturbed Area - Well Pad	426606	4210319	9409	0	282.7	2.00	0.02	0.002		
WELLPAD12	Disturbed Area - Well Pad	426606	4209508	9385	0	282.7	2.00	0.02	0.002		
WELLPAD13	Disturbed Area - Well Pad	427206	4209286	9385	0	282.7	2.00	0.02	0.002		
WELLPAD14	Disturbed Area - Well Pad	428456	4209286	9437	0	282.7	2.00	0.02	0.002		
WELLPAD15	Disturbed Area - Well Pad	428456	4210536	9532	0	282.7	2.00	0.02	0.002		
WELLPAD16	Disturbed Area - Well Pad	427206	4210536	9442	0	282.7	2.00	0.02	0.002		
WELLPAD17	Disturbed Area - Well Pad	427131	4209911	9372	0	282.7	2.00	0.02	0.002		
WELLPAD18	Disturbed Area - Well Pad	427831	4209211	9386	0	282.7	2.00	0.02	0.002		
WELLPAD19	Disturbed Area - Well Pad	428531	4209911	9458	0	282.7	2.00	0.02	0.002		
WELLPAD20	Disturbed Area - Well Pad	427831	4210611	9550	0	282.7	2.00	0.02	0.002		
CENTPROC	50 acres dist center proc	427831	4209911	9453	0	832.6	2.00	0.169	0.0169		

From Table 4.1-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Dixie data. For construc & demolition, PM2.5 assumed to equal 10% of PM10.

MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1, Construc & Demolition)

Fishlake NF Directional Drilling Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Stack Ht.	Temp.	Exit Vel.	Stk. Dia.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
POINT SOURCES		(m)	(m)	(ft)	(ft)	(°F)	(fps)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
DRE	Drill Rig Engine	381262	4277427	8200	15	950.0	75	1.0	0.56	0.56	19.2	0.32
PFLAR	Production Flare	381212	4277417	8184	100	1000.0	55	1.5	0	0	2.45	0
COMPR	Compressor Engine	381312	4277417	8222	25	760.0	95	1.0	0.05	0.05	3.98	0
HT1	Heater Treater	380332	4276797	8081	20	180.0	15	0.67	0	0	0.05	0
HT2	Heater Treater	380392	4276797	8081	20	180.0	15	0.67	0	0	0.05	0
HT3	Heater Treater	380392	4276737	8081	20	180.0	15	0.67	0	0	0.05	0
HT4	Heater Treater	380332	4276737	8081	20	180.0	15	0.67	0	0	0.05	0
HT5	Heater Treater	382332	4277497	8521	20	180.0	15	0.67	0	0	0.05	0
HT6	Heater Treater	382392	4277497	8483	20	180.0	15	0.67	0	0	0.05	0
HT7	Heater Treater	382392	4277437	8481	20	180.0	15	0.67	0	0	0.05	0
HT8	Heater Treater	382332	4277437	8519	20	180.0	15	0.67	0	0	0.05	0
HT9	Heater Treater	381032	4278147	8162	20	180.0	15	0.67	0	0	0.05	0
HT10	Heater Treater	381092	4278147	8151	20	180.0	15	0.67	0	0	0.05	0
HT11	Heater Treater	381092	4278087	8163	20	180.0	15	0.67	0	0	0.05	0
HT12	Heater Treater	381032	4278087	8166	20	180.0	15	0.67	0	0	0.05	0
DHY1	Dehydrator	381262	4277467	8213	30	200.0	8	1.0	0	0	0.05	0
DHY2	Dehydrator	381262	4277367	8203	30	200.0	8	1.0	0	0	0.05	0
WP1	Well Pump	380312	4276817	8081	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP2	Well Pump	380412	4276817	8082	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP3	Well Pump	380412	4276717	8081	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP4	Well Pump	380312	4276717	8081	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP5	Well Pump	382312	4277517	8531	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP6	Well Pump	382412	4277517	8481	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP7	Well Pump	382412	4277417	8472	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP8	Well Pump	382312	4277417	8525	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP9	Well Pump	381012	4278167	8164	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP10	Well Pump	381112	4278167	8151	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP11	Well Pump	381112	4278067	8166	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP12	Well Pump	381012	4278067	8172	10	775.0	45	0.67	0.33	0.33	4.65	0.31

From Table 4.2-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Fishlake data. For combustion sources, PM2.5 assumed to equal PM10.

Fishlake NF Directional Drilling Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Release Ht.	Horz. Dim.	Vert. Dim.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
VOLUME SOURCES		(m)	(m)	(ft)	(ft)	(ft)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
ORD1	outer road	381262	4276042	8116	2.0	100	6.0	0.0443	0.0044	0.0588	
ORD2	outer road	380558	4276305	8097	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD3	outer road	380150	4276713	8072	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD4	outer road	379887	4277417	8052	2.0	100	6.0	0.0443	0.0044	0.0588	
ORD5	outer road	380150	4278121	8283	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD6	outer road	380558	4278530	7977	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD7	outer road	381262	4278792	8219	2.0	100	6.0	0.0443	0.0044	0.0588	
ORD8	outer road	381966	4278530	8318	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD9	outer road	382375	4278121	8527	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD10	outer road	382637	4277417	8468	2.0	100	6.0	0.0443	0.0044	0.0588	
ORD11	outer road	382375	4276713	8450	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD12	outer road	381966	4276305	8200	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD1	inner road	380950	4276755	8184	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD2	inner road	380600	4277105	8144	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD3	inner road	380600	4277730	8225	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD4	inner road	380950	4278080	8194	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD5	inner road	381575	4278080	8334	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD6	inner road	381925	4277730	8439	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD7	inner road	381925	4277105	8321	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD8	inner road	381575	4276755	8249	2.0	75	6.0	0.0443	0.0044	0.0588	

From Table 4.2-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Fishlake data. For unpaved road sources, PM2.5 assumed to equal 10% of PM10.

MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1, unpaved roads)

Fishlake NF Directional Drilling Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Release Ht.	Radius of Circle	Vert. Dim.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
CIRCULAR SOURCES		(m)	(m)	(ft)	(ft)	(ft)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
WELLPAD1	Disturbed Area - Well Pad	380362	4276767	8081	0	282.7	2.00	0.1357	0.01357		
WELLPAD2	Disturbed Area - Well Pad	382362	4277467	8498	0	282.7	2.00	0.1357	0.01357		
WELLPAD3	Disturbed Area - Well Pad	381062	4278117	8156	0	282.7	2.00	0.1357	0.01357		
CENTPROC	50 acres dist center proc	381262	4277417	8199	0	832.6	2.00	1.1804	0.11804		

From Table 4.2-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Fishlake data. For construc & demolition, PM2.5 assumed to equal 10% of PM10.

MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1, Construc & Demolition)

KANAB RMP
EMISSIONS CALCULATIONS
SUMMARY OF ALL ACTIVITIES
LONG-TERM DEVELOPMENT

Kanab Field Office Emissions Summary
Difference between Alternative A and Baseline

Activity	PM_{10}	$PM_{2.5}$	NOx	SO2	CO	VOC	HAPs[b]
	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Oil and Gas Well Development and Exploration							
Conventional Natural Gas -Construction	0	0	0	0	0	0	0
Conventional Natural Gas - Operations	6	1	5	0	2	4	0
Conventional Natural Gas - Maintenance	0	0	0	0	0	0	0
Sub-total: Conventional Natural Gas	**6**	**1**	**6**	**0**	**2**	**4**	**0**
Non-Oil and Gas Well Activities							
Coal Mining[a]	0	0	0	0	0	0	0
Lands & Reality	0	0	0	0	0	0	0
Livestock Grazing	0	0	0	0	0	0	0
Off-Highway Vehicles (OHV)[a]	8	8	4		690	254	25
Resource Roads	0	0	0	0	0	0	0
Saleable Minerals							
Vegetation	0	0	0	0	0	0	0
Prescribed burning	0	0	0	0	0	0	0
Sub-total: Non-Oil and Gas Well Activities	**8**	**8**	**4**	**0**	**690**	**254**	**25**
Total: Delta (Alternative A - Baseline)	**15**	**10**	**10**	**0**	**692**	**258**	**26**
	g/sec	**g/sec**	**g/sec**	**g/sec**	**g/sec**	**g/sec**	**g/sec**
Total: Delta (Alternative A - Baseline)	**0.425**	**0.273**	**0.291**	**0.003**	**19.896**	**7.424**	**0.742**

Assume Area Source **4.00** **sq mi** **(approximate area of oil and gas disturbance)**

RICHFIELD EIS-ALTERNATIVE A EMISSION CALCULATIONS SUMMARY OF ALL ACTIVITIES LONG TERM DEVELOPMENT

Richfield Difference between 2022 Alternative A and Baseline 2007.

Activity	PM10	PM2.5	NOx	SO2	CO	VOC	HAPsb
	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Oil Well Development and Exploration							
Oil Welll - Construction	23.90	7.35	185.93	3.13	24.21	7.48	0.75
Oil Well- Operations	7.29	1.71	41.50	0.70	9.61	1.23	0.12
Oil Well - Maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total: Oil Wells	**31.19**	**9.05**	**227.42**	**3.83**	**33.82**	**8.72**	**0.87**
Non-Oil Well Activities							
Coal Mining[a]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lands & Reality	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Livestock Grazing	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-Highway Vehicles (OHV)[a]	5.75	5.75	3.08		524.20	168.41	16.84
Resource Roads	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saleable Minerals	0.00	0.00					
Vegetation	21.01	3.15	0.00	0.00	0.00	0.00	0.00
Sub-total: Non-Oil Well Activities	**26.76**	**8.90**	**3.08**	**0.00**	**524.20**	**168.41**	**16.84**
Total: Delta (Alternative A - Baseline)	**57.95**	**17.96**	**230.50**	**3.83**	**558.03**	**177.13**	**17.71**
	g/sec	**g/sec**	**g/sec**	**g/sec**	**g/sec**	**g/sec**	**g/sec**
Total: Delta (Alternative A - Baseline)	**1.665**	**0.516**	**6.624**	**0.110**	**16.035**	**5.090**	**0.509**

Assume Area Source **24.00** **sq mi** **(estimated area of oil and gas disturbance)**

National System of Public Lands
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT