

March 9, 2015

Permit Supervisor, Utah Coal Regulatory Program  
Utah Division of Oil, Gas and Mining  
1594 West North Temple, Suite 1210  
PO Box 145801  
Salt Lake City, UT 84114-5801

Re: Mining of Entries and the 1 Right 5 West and 2 Right 5 West Panels, Sufco Mine, Permit Number C/041/0002, Canyon Fuel Company, LLC

Dear Sirs:

Please find enclosed with this letter an amendment to the Sufco Mine Permit to outline past mining and the projected mining for the next five years. The 1 Right and 2 Right Panels of 5 West run north and south are shown crossing leases U-63214 and ML 49443-OBA. These panels are primarily within the boundaries of existing leases and have appeared before on maps as areas designated for mining. The enclosed map designates the timing for mining these panels. The timing shows that only first mining will occur within the remainder of 2015 and approximately the first half of 2016. Longwall mining will follow the completion of the first mining as shown on Plate 5-7.

There are segments of these panel which extend outside the lease boundaries but as stated on Plate 5-7, "Any projected mining shown beyond existing lease boundary lines is subject to future lease modifications and approvals." As previously discussed with Division personnel, Sufco is currently in the process of securing the areas labeled as "proposed" on the enclosed Plate 5-7. Sufco has no intent to mine outside their existing leased boundaries, until the modifications are leased from their respective agencies and approved by the Division.

Please find attached to this letter selected text segments from the Sufco approved M&RP, which have been highlighted to show data currently within the approved permit which discusses information previously collected and incorporated into the M&RP for the Sitla Muddy and the Quitcupah Leases.

If you have questions or need addition information please contact Vicky Miller at (435)286-4481.

CANYON FUEL COMPANY, SUFCO Mine



John Byars  
Technical Services Manager

Encl.

cc: DOGM Correspondence File

**RECEIVED**  
**MAR 10 2015**  
**DIV. OF OIL, GAS & MINING**

# APPLICATION FOR COAL PERMIT PROCESSING

Permit Change  New Permit  Renewal  Exploration  Bond Release  Transfer

**Permittee:** Canyon Fuel Company, LLC

**Mine:** Sufco Mine

**Permit Number:** C/041/0002

**Title:** Mining of Entries and the 1 Right 5 West and 2 Right 5 West Panels

**Description,** Include reason for application and timing required to implement:

**Instructions:** If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

- Yes  No 1. Change in the size of the Permit Area? Acres: \_\_\_\_\_ Disturbed Area: \_\_\_\_\_  increase  decrease.
- Yes  No 2. Is the application submitted as a result of a Division Order? DO# \_\_\_\_\_
- Yes  No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
- Yes  No 4. Does the application include operations in hydrologic basins other than as currently approved?
- Yes  No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
- Yes  No 6. Does the application require or include public notice publication?
- Yes  No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
- Yes  No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
- Yes  No 9. Is the application submitted as a result of a Violation? NOV # \_\_\_\_\_
- Yes  No 10. Is the application submitted as a result of other laws or regulations or policies?

*Explain:* \_\_\_\_\_

- Yes  No 11. Does the application affect the surface landowner or change the post mining land use?
- Yes  No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
- Yes  No 13. Does the application require or include collection and reporting of any baseline information?
- Yes  No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
- Yes  No 15. Does the application require or include soil removal, storage or placement?
- Yes  No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
- Yes  No 17. Does the application require or include construction, modification, or removal of surface facilities?
- Yes  No 18. Does the application require or include water monitoring, sediment or drainage control measures?
- Yes  No 19. Does the application require or include certified designs, maps or calculation?
- Yes  No 20. Does the application require or include subsidence control or monitoring?
- Yes  No 21. Have reclamation costs for bonding been provided?
- Yes  No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
- Yes  No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

**Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you.** (These numbers include a copy for the Price Field Office)

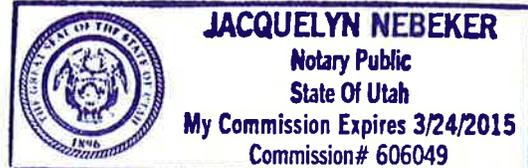
I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

John D. Byars  
Print Name

J. Lopez, mgr. Tech Services, 3-9-15  
Sign Name, Position, Date

Subscribed and sworn to before me this 9 day of March, 2015

Jacquelyn Nebeker  
Notary Public



My commission Expires: \_\_\_\_\_, 20\_\_\_\_ }  
Attest: State of \_\_\_\_\_ } ss:  
County of \_\_\_\_\_

<p><b>For Office Use Only:</b></p>	<p>Assigned Tracking Number:</p>	<p>Received by Oil, Gas &amp; Mining</p> <p style="text-align: center; color: blue; font-weight: bold; font-size: 1.2em;">RECEIVED</p> <p style="text-align: center; color: red; font-weight: bold; font-size: 1.2em;">MAR 10 7</p> <p style="text-align: center; color: blue; font-weight: bold; font-size: 1.2em;">DIV. OF OIL, GAS &amp; MINING</p>
------------------------------------	----------------------------------	--



**CHAPTER 1**  
**GENERAL CONTENTS**

## LIST OF APPENDICES

(Appendices appear in Volume 4)

### Appendix

- 1-1 Legal Right-of-Entry Documents
- 1-2 Lease Documents
- 1-3 Newspaper Advertisement
- 1-4 Filing Fee Receipt

## **CHAPTER 2**

### **SOILS**

## TABLE OF CONTENTS

Section	Page
2.4.2.3 Topsoil Redistribution on Impoundments and Roads	2-28
2.4.3 Soil Nutrients and Amendments	2-28
2.4.4 Soil Stabilization	2-28
2.4.4.1 Protection and Stabilization of Surface Areas	2-28
2.4.4.2 Mulch Application	2-28
2.4.4.3 Rills and Gullies	2-29
2.50 Performance Standards	2-30
2.5.1 Topsoil, Subsoil, and Topsoil Supplements Management	2-30
2.5.2 Stockpiled Topsoil and Subsoil	2-30
References	2-30

## LIST OF PLATES

### Plate

- 2-1 Native Soil Types Present in SUFCO Mine Disturbed Area & Surrounding Area
- 2-2 Soil Types Pines Tract
- 2-3 Soil Types SITLA Muddy Tract

## LIST OF APPENDICES

(Appendices appear in Volume 4)

### Appendix

- 2-1 Prime Farmland Determination Documents
- 2-2 Report of Studies of Vegetation and Soils for SUFCO Mine
- 2-3 Water and Soil Data Report
- 2-4 Submittal of Drainage Plan and Slope Stability for Reclamation for Convulsion Canyon Mine, Sergeant, Hauskins & Beckwith
- 2-5 Final Reclamation Cut and Fill Quantities
- 2-6 Link Canyon Substation Soils Investigation
- 2-7 (Revisions have eliminated this appendix)
- 2-8 Pines Tract Soils Types
- 2-9 Link Canyon Portal Vegetation, Aquatic Fauna, and Soil Investigations
- 2-10 Muddy Tract Soils Types

## CHAPTER 2 SOILS

### 2.10 Introduction

This chapter and Volume 3 of this M&RP contains all pertinent information relating to identification, management, and reclamation activities associated with the soil resources present in the disturbed area of the SUFCO Mine.

### 2.20 Environmental Description

The SUFCO Mine area lies in central Utah at the southern end of the Wasatch Plateau. Topography is dominated by plateaus separated by deeply incised canyons. Canyon walls are generally composed of laterally continuous (several thousand feet) ledge-forming sandstones, interbedded with slope forming shales and siltstones. Topography in the SUFCO Mine area ranges from 6500 to about 9,000 feet above sea level. Soils are generally not cultivated due to their thin nature, shortage of irrigation water, and a short growing season. Residual and colluvial soils are present at the SUFCO Mine surface facilities area. These soils have formed from residual sandstone and shale particles that mixed as they migrated down slope. Soils are usually very shallow, consisting predominantly of sand and silty sand loams which have high percolation rates. The soils are highly susceptible to wind erosion. The inherent erosion hazard from water is low. Rock outcrops consist of alternating layers of sandstone and shale. Subordinate amounts of coal and limestone are also present. The landscape is steep and rocky with massive sandstone ledges, and siltstone/shale slopes. Surface and subsurface layers are often rocky.

#### 2.2.1 Prime Farmland Investigation

No prime farmland exists in the SUFCO Mine disturbed area, Link Canyon disturbed area, or in any of its lease areas. Mining activities will not impact prime farmland. In compliance with R645-302-313, a pre-application investigation was conducted by the Applicant to determine if any prime farmland would be impacted by the project. Based on the federal criteria for determining the presence or absence of prime farmland, the Convulsion Canyon area, Link Canyon, the Pines Tract area, and the SITLA Muddy Tract area cannot be classified as prime farmland. Consultation with

Dr. Theron B. Hutchings, State Soil Scientist for the Soil Conservation Service, substantiated the absence of prime farmland in the Convulsion Canyon and Link Canyon areas. (Appendix 2-1).

### **2.2.2 Soil Survey**

A Level 1 soil survey of the entire SUFCA Mine disturbed area, including the Link Canyon Substations No. 1 and 2, has been conducted. Soil survey data are presented in Appendix 2-2 for the majority of the permit area, Appendix 2-6 for the Link Canyon Substation areas, and are herein summarized in Sections 2.2.2.1 through 2.2.2.3. Survey data includes the following information: taxonomic classification, horizon name and depth, dry and moist color, texture (percent sand, silt, and clay), class, structure, percent rock fragments and organic matter, pH, effervescence, EC, and solubility of calcium, magnesium, and sodium (Appendices 2-2, and 2-6). A cross-reference list of map unit, soil taxonomic classification, and sample site appears in pages 17 through 19 of Appendix 2-2.

A site specific soil survey will be completed for the Overflow Pond prior to disturbance and this information will be utilized in determining topsoil salvage depth. The results of this soil survey will be included in the as-built addendum to be included in Appendix 2-2.

An Order 2 soil survey has been completed for the Link Canyon Substation No. 1 disturbed area and is included in Appendix 2-2. Additionally, an Order 1 soil survey was conducted of the substation Nos. 1 and 2 pad areas and the results are included in Appendix 2-6.

An Order 3 soil survey has been conducted for the Pines Tract and the results are included in Appendix 2-8. (Plate 2-2)

An Order 3 soil survey has been conducted for the SITLA Muddy Tract and the results are included in Appendix 2-10. (Plate 2-3)

#### **2.2.2.1 Soils Map**

Plates 2-1 and 2-2 delineates the soil types present in the disturbed and adjacent areas.

### Pines Tract

The general description of the soils within the Pines Tract is provided in Appendix 2-8.

### SITLA Muddy Tract

The general description of the soils within the SITLA Muddy Tract is provided in Appendix 2-10.

#### **2.2.2.4 Soil Productivity**

In areas where soil disturbance has resulted from mining activities, the soils have lost their native identities. In most cases the soils have been quite thoroughly mixed. As a result, soil textures and horizons have been altered. Textures are now primarily loams and silty clay loams; depths over indurated material or shale are generally greater than 30 inches, except along "cut" slopes of the mountain where geologic strata are exposed.

As a result of this disturbance in "fill" areas, the potential for reclamation has been enhanced. The soils are deeper and the resulting textures are more desirable for plant growth.

Saturation percentages are unavailable. When the original sampling and analyses of soils for the portal yard area were completed, saturation percentage was not required by the regulatory agencies.

Electrical conductivity and other analytical data for soils of the disturbed area, soil types O, W, T, and X, are found in Tables 51, 56, 53, 57, and 58, of Appendix 2-2, respectively. These data reveal a high percentage of rock fragments which may limit fertility for both topsoil and subsoil. Vegetation associated with these soils regarding soil productivity are presented (as recommended by the Soil Conservation Service) in Appendix 2-2 and discussed in Chapter 3 of the Mining Reclamation Plan (MR&P).

#### **2.2.3 Prime Farmland Soil Characterization**

No prime farmland exists in the permit area (see Section 2.2.1).

**CHAPTER 3**

**BIOLOGY**

### LIST OF PLATES

#### Plate

- 3-1 Plant Communities and Reference Areas
- 3-2 Elk Range
- 3-3 Deer Range & Raptor Nests

### LIST OF APPENDICES

(Appendices appear in Volume 5)

#### Appendix

- 3-1 Report of 1983 Field Investigations
- 3-2 Aquatic Resource Inventory of Southern Utah Fuel Company Permit Area
- 3-3 Wildlife Assessment of the Southern Utah Fuel Company Mining Property and Adjacent Areas
- 3-4 Raptor and General Avifauna Studies
- 3-5 Fauna of Southeastern Utah and Life Requisites Regarding their Ecosystems
- 3-6 Vegetation Information Guidelines, Appendix A
- 3-7 Power Line Correspondence
- 3-8 Bat Survey for the SUFCO Mine
- 3-9 Vegetation and Wildlife of the Pines Tract Project.
- 3-10 Monitoring and Mitigation Plan for Mining Under the East Fork of Box Canyon
- 3-11 Muddy Creek Technical Report-Wildlife
- 3-12 Mexican Spotted Owl Survey Muddy Tract
- 3-13 Vegetation and Wildlife of the West Coal Lease Modifications
- 3-14 Monitoring and Mitigation Plan for Undermining the South Fork of Quitcupah 2R2S Block "A" and 3R2S Block "B"

Field sampling of these plant communities was initially done in July of 1983 and the findings were documented in the INV report. A Level II riparian inventory has been conducted along portions of East Fork of Box Canyon (USDA-USFS, 1993). The plant communities and reference areas are outlined on Plate 3-1. In 1999, another vegetation (and wildlife) report (VWP) was prepared for the proposed mine expansion called the Pines Tract Project. Vegetation communities were described and shown on a map included in that document, most of which are also listed in the plant communities shown above. The vegetation types in the SITLA Muddy Tract were identified by Cirrus and reported in EIS documents for the entire BLM and SITLA Muddy Tract. The vegetation types in the SITLA Muddy Tract are illustrated on Plate 3-1. This plate will be updated in the appropriate season of 2006 to more clearly indicate types and extent of vegetation in the SITLA Muddy Tract. As of October 2005, the available Forest Service information used to create the map is essentially correct but Sufco has agreed the vegetation boundaries and descriptions can be further refined. The work to be performed in 2006 will include the evaluation of available aerial photos of the area by a qualified person who then will create an updated vegetation map of the tract. The updated version of the plate will be submitted to the Division before the end of 2006.

A description of the potential impacts of mining on vegetation is included in Section 3.3.3.3 of this permit.

### **3.2.1.2 Land Productivity Prior to Mining**

The land productivity of the mine area was not measured in 1941 when mining began. However, Appendix 2-2 contains a consultant study (EPS, pgs. 45 - 78) compiled in 1980, which states total cover, production pounds per acre and species within the permit area. Additional information was presented in INV Report, August 12, 1983 (Appendix 3-1).

### **3.2.2 Fish and Wildlife Information**

A summary of the fish and wildlife resource information for the permit and adjacent areas is contained in Sections 3.2.2.1 through 3.2.2.3. As mentioned above, a wildlife report was included with a vegetation report in 1999 (VWP) for the proposed mine expansion called the Pines Tract Project. Fish and wildlife resources in the SITLA Muddy tract are as described in Sections 3.2.2.1 through 3.2.2.3 and in the "Muddy Creek Summary Report - Wildlife" prepared by Cirrus and

included as Appendix 3-11. Fish and wildlife resources within the West Coal Lease Modifications are summarized in Appendix 3-13. A description of the potential impacts and mitigation of impacts of mining on fish and wildlife is included in Section 3.3.3.3 of this permit.

Due to either their small size, intermittent flows, poor habitat or water quality, the surface waters in the lease area are not of game fish quality. The low importance of the streams as a fishery resource, has categorized them as being of little value for extensive study. An inventory of the aquatic resources is located in Appendix 3-2. Aquatic resources of the Pines Tract Project are briefly described in the wildlife section of Appendix 3-9. Aquatic resources within the Muddy Tract are summarized in Appendix 3-11. Aquatic resources within the West Coal Lease Modifications are summarized in Appendix 3-13.

#### **3.2.2.1 Level of Detail**

The scope and level of detail within this M&RP are sufficient to design the protection and enhancement plan for wildlife and fish in the area.

This assessment of wildlife resources has been compiled pursuant to guidelines issued by the State of Utah Division of Oil, Gas and Mining (UDOGM). Appendices 3-3, 3-4, 3-5, and 3-9 contain wildlife studies related to their resources in the mine area.

#### **3.2.2.2 Site-specific Resource Information**

The following information was summarized from the WIL, RAP, AQU, and VWP Reports. Additional information is available in Appendix 3-2 through 3-5, and 3-9.

##### Reptiles and Amphibians

Increasing elevation rapidly reduces the number and kind of reptiles and amphibians. Furthermore, in Utah the effects of the more northern latitude reduces the number of reptiles in much the same way as does the increase in elevation.

contribute to large increases in density and species richness for birds when compared to upland areas.

Between 69% to 92% of all amphibian occur in wetland ecosystems. The scaleless, permeable amphibian skin requires constant moisture to retain body fluids. Both water quantity and quality parameters are of importance to the survival of individual amphibians and ultimately populations of the species.

Reptiles are not nearly as dependent on wetlands since their scaly covering provide resistance to desiccation. Riparian areas are heavily utilized (50% to 72% of all species) for the available drinking water, prey, and vegetative resource (cover). The moist soil characteristic of riparian zones also provide preferred nesting habitat for many reptiles.

The riparian areas for the Pines tract Project Area, Link Canyon, and SITLA Muddy Tract are shown on Plate 3-1. A survey for amphibians and mollusks was conducted in the Link Canyon Portal area in June of 2002. No amphibians or mollusks where found in the portal area nor where any protected or sensitive species found in the area. A copy of a report of the investigation is contained in Appendix 2-9.

#### Raptors

Only one nest, that of a Cooper's Hawk, was found in 1980 (Appendix 3-4). The one Cooper's Hawk nest found was in an area seemingly less favorable than surrounding canyons. Quitcupah Canyon appeared to be prime habitat, but no nests were found.

Golden Eagles were seen on nearly every survey day during the 1980 survey by Clayton White of Brigham Young University (Appendix 3-4). The presence of two adults accompanied by a juvenile suggest their nearby breeding, however no nests were located.

Appendix 3-4, Table 1 contains a list and the number of sightings for the birds inventoried during the 1980 raptor survey.

A raptor survey conducted April 14, 1987, located three Golden Eagle nests (Appendix 3-4). Two of the nests were tended and contained greenery, the third had an adult eagle incubating eggs.

**In October of 1988 an environmental assessment of the Quitchupah Lease area was performed by personnel from the Forest Service and Bureau of Land Management. During the assessment 6 Golden Eagle nests were located.**

The SUFCA Mine portions of the annual raptor surveys conducted by UDWR are located in Appendix 3-4 in the Sufco Mine MRP Confidential file. Future annual raptor surveys will be submitted each year in the annual report to the Division.

Most raptor nest locations are located outside the current planned mining subsidence areas. Any raptor nest that has a potential to be disturbed by subsidence will be evaluated with DWR and FWS. An appropriate plan of action will be developed on a case by case basis.

The Prairie Falcon has also been reported by U.S. Forest Service and Bureau of Land Management personnel for the planning unit that encompasses the SUFCA Mine area.

The Quitchupah Drainage, of which Link Canyon is a tributary, was identified in the Quitchupah Creek Road DEIS (2001) as not likely to contain Mexican Spotted Owls and dedicated surveys were not necessary. However, the Manti-La Sal National Forest reported that a Mexican Spotted Owl survey of the area was being conducted as part of their Muddy Creek EIS Data Adequacy study. Results of surveys conducted in 2002 and 2003 indicated no Mexican Spotted Owls were found in the Link Canyon Portal area or the Muddy Tract area (Appendix 3-12). Additionally, Sufco does not plan to conduct construction activities during the nesting and rearing times (February 1 through August 31) of the owl.

The lack of permanently running water has an effect on raptors. Many species, such as accipiters, appear to rely on streams and the associated riparian vegetation (Hennessy, 1978).

by man causes them to use up critical and limited energy reserves that may result in mortality. In less severe cases the fetus being carried by gestating mammals may be reabsorbed or aborted thus reducing reproductive success and productivity of the population. Surface activities are curtailed from November 1 through April 1, and between May 1 and July 1 in the calving area, except in the portal areas, so as not to disturb wintering elk. Employees will be encouraged to report violators to the proper company and management authorities for reprimand or prosecution. Employees should be impressed that they as hunting and recreation users stand to gain the most by preserving what they have in proximity to their places of work and abode.

Livestock and wildlife will be protected from the effects of mining related subsidence to the extent possible. Surface cracks that open to the point of creating a physical hazard to livestock and wildlife will be mitigated. This mitigation may include but not limited to backfilling the cracks with available local native materials and soil, partially backfilling with imported fill, or simply reshaping of the nearby ground surface to lessen the offset or abruptness of the crack faces and depth. The repaired areas will then be reseeded with a seed mix appropriate to the area and one approved by the Division and land owner/agency. Several such mitigation efforts have already been successfully conducted in the Quitchupah and Pines Tract areas.

Subsidence induced seismicity has not been noted to have an adverse impact on livestock or wildlife in the existing mined portions of the Sufco permit area. It is not anticipated the impact to wildlife and livestock due to mining induced seismicity will change or increase as the permit area is expanded into new lease areas.

Any raptor nest that has a potential to be disturbed by subsidence will be evaluated with DWR and FWS. An appropriate plan of action will be developed on a case by case basis. The Division of Oil Gas and Mining will be informed in advance when such an evaluation is necessary. The applicant will obtain any permits necessary for disturbance of the nest if this is the course of action decided upon.

The Link Canyon Substation No. 1 pad area has an old historic golden eagle nest (#31) that was not found during the 1997 Raptor Survey and a tended falcon scrape (#33) within the buffer zone.

Construction associated with the reopening of the western Link Canyon Mine portal, will require minimizing activities that disturb big game from December 1 to April 15. Construction activities from January 1 to August 15 will require a clearance from the DWR and US Fish and Wildlife Service because of potential disturbance to nesting raptors. This proposed project is located in a MMA (Minerals Management Area) in the Manti-La Sal forest plan (Figure 3-15, Management Area Direction, Manti-La Sal National Forest Pines Tract Project, Final Environmental Impact Statement, January 1999). A GWR (General Big-Game Winter Range) Management Unit is located adjacent to the MMA Management Unit. Although this direction does not apply to the adjacent MMA Management Unit where the current proposal is located, the Manti-La Sal National Forest Record of Decision considered this management direction. Direction for operations in adjacent GWR Management Units calls for minimizing potential conflicts. The current proposal will have negligible effects to wintering big game because there will be very little activity at the site following the initial short-term construction activity (pages 14-15, Manti-La Sal National Forest, SUFCO Mine Link Canyon Portal Record of Decision, Oct. 10, 2002). The area will be surveyed for raptor nests. If any are found within the prescribed buffer zone, they will be monitored for activity and work at the portal site will occur following the same guidelines as those described for the Link Canyon Substation.

Mining within the SITLA Muddy Tract will be limited to underground activities; no surface disturbance, other than exploration drilling, is anticipated in this area. Exploration drilling is typically handled by the Division under a separate permit application process. No known raptor nests are known to exist within the SITLA Muddy tract where subsidence will occur. However, if future raptor monitoring finds any raptor nest that has a potential to be disturbed by subsidence, the nest and potential damage will be evaluated with DWR and FWS. An appropriate plan of action will be developed on a case by case basis. The Division of Oil Gas and Mining will be informed in advance when such an evaluation is necessary. The applicant will obtain any permits necessary for disturbance of the nest if this is the course of action decided upon.

Generally, vegetation within the lease and permit areas outside of disturbed areas is protected from mining related impacts, such as subsidence, by the depth of overburden and depth of soil. Experience in mining the Pines and Quitcupah leases has shown that upland vegetation does not appear to be significantly affected by subsidence. Cracks that form in the soil tend to heal quickly

and the majority of the vegetation in the area of surface cracks does not appear to be suffering from undue stress. The only cases of damage to vegetation related to mining appears to occur when subsidence cracks form in areas where a brittle sandstone body is near the surface with little soil cover and a crack either visibly bifurcates a plants root system or opens wide enough for soils and small plants to fall into. In a few locations, tree roots have been weakened by surface cracks and have resulted in the trees toppling shortly after the cracking occurs. This impact appears to be typically limited to areas near a canyon rim such as in the West and East Forks of Box Canyon. In areas where there are at least a few feet of soils over bedrock, such as in the previously mined portions of the Quitchupah Lease, this phenomenon has not been observed. Significant impacts to upland vegetation from subsidence are not anticipated in the SITLA Muddy Tract since most of the tract area has a relatively thick mantle of soils.

The depth of overburden in the SITLA Muddy Tract ranges from 900 to nearly 2200 feet. Areas projected to be undermined are covered by a minimum of 1000 feet to a maximum of 2100 feet. Most of the vegetation in the tract is found to be growing in the Price River and the North Horn Formations where the depth of cover is at least 1000 feet. Where these formations are exposed to mining induced subsidence in the Sufco area, the formations tend to react more plastic than brittle and subsidence crack formation is often muted. Subsidence cracks in thick soils and heavily weathered bedrock near the ground surface will frequently heal or fill in a relatively short period of time. Because of the depth and type of cover, Sufco anticipates there will be little impact to upland vegetation due to the subsidence. Subsidence cracks that form that are determined to be a safety hazard will be mitigated as discussed previously in this section.

The applicant has implemented a program to monitor the effect of subsidence on the vegetative communities. The applicant uses color infrared photography (CIR) to document changes to vegetation. This CIR coverage was begun in 1987 and will be updated at least every 5 years.

The riparian vegetation within upper Box Canyon adjacent to the 150 acre lease modification is of special concern to the permitting agencies and the permittee. Because of this concern, SUFACO commits to monitoring the effects of subsidence on the riparian vegetation within the upper Box Canyon by including this area within the color infrared photography monitoring program described

in the preceding paragraph. Previous infrared surveys have included most of the 150 acre lease modification area and upper Box Canyon. These previous surveys will be used to provide baseline data for the monitoring of subsidence effects, if they occur, on the riparian vegetation within the area. This data will be reviewed by qualified personnel to make determinations concerning the effects of subsidence on the riparian vegetation.

A survey will be conducted to locate representative populations of vegetation growing within bedding planes and fractures in the walls of Box Canyon. The location of the populations will be recorded using a topographic map and a GPS survey will be used to verify the coordinates. Photographs of the vegetation will be taken during the survey. The survey will be conducted during the growing season. This survey may coincide with the survey for the Link Trail Columbine as discussed previously in this chapter. A report of this survey will be included in the SUFCO annual report.

The applicant has implemented a program to monitor surface flowing water to determine diminished flows resulting from mine-related subsidence. The plan is incorporated as part of the over all surface water monitoring program. Monitoring with respect to wildlife watering sources has been discussed in Appendix 7-2. The applicant will cooperate with regulatory agencies to develop and provide alternative water sources for wildlife if mine-related subsidence disturbs the present sources.

In areas where wetlands and habitats of unusually high value for fish and wildlife exist, more intensive water and subsidence monitoring may occur when deemed necessary by the permittee, Division, and/or landowner/manager. This type of monitoring has already taken place in the East Fork of Box Canyon in the Pines Tract area and is described in detail in Chapter 5 Section 5.2.5.1 and Chapter 7 Section 7.3.1.2. Only two short segments of Cowboy Creek are within the SITLA Muddy Tract. Both segments are located on the eastern portion of the tract. One segment is located in the northeast 1/4 of Section 7, T21 S, R 5 E and the other is in the eastern 1/4 of Section 5 Section 7, T 21 S, R 5 E. Both of these segments of stream are perennial and contain riparian vegetation in the channel bottom and on the banks of the channel. Additionally, there are several low flow springs within the SITLA Muddy Tract supporting riparian vegetation. The locations of these springs are identified on Plate 7-3. The riparian vegetation associated with Cowboy Creek and the springs is identified on Plate 3-1.

As discussed in the SITLA Muddy Tract PHC (Appendix 7-20), springs in the area occur within the North Horn and Price River Formations. The springs typically occur on the down gradient end of a perched aquifer where the beds containing the water are truncated by surface topography. Most of the springs occur in areas where overburden depths are approximately 1500 feet or greater. Sufco has undermined a few springs where the cover was greater than 800 feet, most of them occurring in the East Fork of Box Canyon. A few of the springs that discharged at or near the Blackhawk Formation - Castlegate Sandstone contact moved down-gradient. The remainder that discharge from the Castlegate Sandstone where the overburden is greater than 800 feet do not appear to have been significantly impacted by subsidence (PHC Appendix 7- 20 and personal communication with Erik Petersen of Petersen Hydrologic, Inc., Lehi, Utah, October 2005). Based on this experience, Sufco believes undermining the springs supporting associated riparian vegetation in the SITLA Muddy Tract will not significantly impact the vegetation.

Sufco has undermined a portion of the East Fork of Box Canyon where the flow is perennial. In the segment of the stream supported the Blackhawk Formation, subsidence related cracking of the brittle sandstone and silty sandstone beds did result in a temporary diversion of surface water into the subsurface. However, it was observed the water resurfaced down-gradient where the channel down cut through the brittle sandstone layers and encountered more plastic siltstones and shales. Mine personnel successfully repaired the channel floor with bentonite and native soils and restored the flow to the surface. Subsequent spring runoff also appears to have aided in natural repairing of the channel floor. Initial annual monitoring of the vegetation in the lower East Fork of the Box Canyon, begun in late 2003 and early 2004, has indicated the riparian vegetation adjacent to the stream channel does not appear to have been significantly impacted by subsidence.

Based on the experience to date (Fall 2005) of undermining the East Fork of Box Canyon, subsidence of the short segments of Cowboy Creek present in the SITLA Muddy tract is not anticipated to

**Potential Barriers.** The mine has been operating approximately 55 years and little should now be done to change the design of the portal facilities to lessen the impacts. The wildlife inhabiting and utilizing the area of concern have likely acclimated to the present facilities and consequently adjusted their behavior including migration so that a modification of the facilities to providing corridors would be more adverse than leaving the facilities as they are.

**Pond Protection.** Fences or other appropriate methods will be used to exclude wildlife from ponds containing hazardous concentrations of toxic-forming materials. However, at this time the applicant has no ponds containing hazardous concentrations of toxic-forming materials.

#### **REFERENCES:**

Blumer, Ralph J., 1979. Environmental Analysis, pp 25-26.

Hennessy, S. P., 1978. Ecological relationships of accipters in northern Utah -- with special emphasis on the effects of human disturbance. MS thesis, unpubl., Utah State Univ., p 66.

**USDA, Forest Service, Intermountain Region 1988. Environmental Assessment for SUFCO Mine Coal Lease Application U-63214 Quitchupah Tract.**

Utah Division of Wildlife Resources, Department of Natural Resources, 1991. Utah Big Game Annual Report 1991. Publication 91-12.

**CHAPTER 4**  
**LAND USE AND AIR QUALITY**

### TABLE OF CONTENTS

Section	Page
4.10 Land Use	4-1
4.1.1 Environmental Description	4-1
4.1.1.1 Premining Land Use	4-1
4.1.1.2 Previous Mining Activity	4-12A
4.1.2 Reclamation Plan	4-13
4.1.2.1 Postmining Land Use Plan	4-13
4.1.2.2 Land Owner or Surface Manager Comments	4-16
4.1.2.3 Suitability and Capability	4-16
4.1.3 Performance Standards	4-16
4.1.3.1 Postmining Land Use	4-16
4.1.3.2 Determining Premining Uses of Land	4-17
4.1.3.3 Criteria for Alternative Postmining Land Uses	4-17
4.1.4 Alternative Land Use	4-17
4.20 Air Quality	4-18
4.2.1 Air Quality Standards	4-18
4.2.2 Compliance Efforts	4-18
4.2.3 Monitoring Program	4-20
References	4-21

### LIST OF PLATES

Plate

- 4-1A Land Uses - Quitchupah Tract
- 4-1B Land Uses - Pines Tract & SITLA Muddy Tract

### LIST OF APPENDICES

(Appendices appear in Volume 6)

Appendix

- 4-1 Utah Big Game Annual Report, 1991, Deer Herd Unit #43, Elk Herd Unit #14
- 4-2 Cultural and Historical Resources
- 4-3 Assessment of Particulate Emissions Report
- 4-4 Division of Air Quality Approval Order
- 4-5 Cultural Resource Memorandum of Agreement

The pinyon/juniper woodland occurs on steep unstable slopes and is considered unsuitable for grazing although it is grazed within the allotment. The vegetation condition within the pinyon/juniper woodland type was considered good. Forage production (mainly Indian rice-grass and bluebunch wheatgrass) is low. Arnold et. al. (1964), Jameson and Dodd (1964), and Jameson (1971) found that as tree canopy increased, understory vegetation decreased. Phillips (1965) found that mature stands with a 74 per unit crown canopy produced 96 pounds of forage per acre while stands with 1-2 percent cover produced from 418-577 pounds per acre. Lewis et. al. (1965-1967) found production values between 40 and 460 pounds per acre in stands sampled. Areas where trees had been removed produced as much as 900 pounds per acre. Canopy cover of pinyon and juniper in the SUFCO Mine Quitchupah lease area fairly dense and forage production in the type would generally be less than 100 lbs./acre in an average year. Assuming 50 percent utilization and 25 lbs./animal/day, it would take 15 acres to carry an animal for a month (WESTECH, 1978).

A large part of the flatter upland area is dominated by sagebrush/ grassland. The U.S. Forest Service (unpublished, 1971) has mapped this area as suitable rangeland with vegetation condition. The sagebrush/grassland type within the SUFCO Mine Quitchupah lease area is the most desirable type for grazing, producing the most available forage per acre for livestock. It generally has lower vegetation condition than other types indicating it receives heavier grazing pressure. Three transects established in 1971 by the U.S. Forest Service on the SUFCO Mine Quitchupah lease area averaged 1100 lbs/acre (dry weight). Of this, about 940 lbs/acre was perennial grasses and sedges. The transects established, however, are in areas where shrub coverage is low and forage production would probably be lower for most of the sagebrush/grassland type where shrub coverage is higher. For this type, it would take 2-3 acres to carry an animal for a month. The U.S. Forest Service estimates a carrying capacity of 0.5 animal units per month (AUM) per acre (B. Bass personal correspondence, 1979).

The aspen type is an important producer of forage for big game and domestic stock. A high percentage of the production is forbs which makes this type more desirable to big game and sheep. Mature aspen with a herbaceous understory in good to excellent condition will produce from 1,000

to 1,800 lbs/acre air dry forage (Lewis, 1971). The U.S. Forest Service estimates that in this area, aspen type produces 1,000 to 1,500 lbs/acre with 0.6 to 0.65 AUM/acre (M. Stubbs personal correspondence, 1979). **Most of the aspen stands in the SUFCA Mine Quitchupah lease area serial with vegetation condition (U.S. Forest Service, unpublished, 1971).**

The ponderosa pine, mountain shrub and coniferous forest types are generally lower forage producers although the extent of these types on the study area makes them an important component of the grazing system. Portions of these types, especially along the steep canyon walls, have been rated unsuitable for grazing and receive little grazing pressure due to limited accessibility to livestock. Areas of these types on more gentle slopes receive heavier grazing as indicated by lower vegetation condition. These areas provide some forage for livestock and are valuable forage producers for big game. Julander (1955) estimated forage production for mountain brush and oak types. He found that the mountain brush type produced 723 lbs/acre (green weight) of which 11 lbs/acre were grasses. He found that grasses are preferred forage for cattle and are selected as their key forage species. Where grasses were unavailable, however, cattle used forb and shrub species resulting in competition with big game species.

Valley bottoms receive little grazing pressure except in the vicinity of water sources where pressure is locally heavy. Valley bottoms are generally narrow and represent limited available forage. Steep slopes receive limited grazing pressure from livestock because of the steep inclines and lack of water. Flatter mesa tops and rolling terrain receive heavier pressure because of easier movement by livestock and more available forage. Grazing pressure is heaviest around water sources in these more accessible areas.

Very little of the SUFCA Mine area is in vegetation communities capable of producing timber products. The pinyon/juniper woodland community generally occurs on steep, unstable slopes making it undesirable for accessibility.

The coniferous forest type also occurs on steep slopes and generally in small stands. Economics of harvesting these stands would result in a high cost/benefit ratio. Other than very limited

consumption for posts and poles, this type receives no use in the area as a timber producer. Christmas tree cutting, however, is higher in this community type than others in the area.

The ponderosa pine type is the only vegetation community receiving substantial use for timber production. This type generally occurs on flatter sandy sites and is readily accessible. Large, mature (250 + years) trees have been harvested on a selective basis. Pine regeneration in cut over stands is sparse and mountain mahogany and manzanita appear to be increasing in the understory. Within the SUFCO Mine Quitchupah lease area approximately 528 thousand board feet (MBF) have been harvested between 1977 and 1978 with average volumes of 1.3 average net volume/acre (M. Stubbs personal correspondence, 1979). Quaking aspen stands receive limited local pressure for posts and poles.

The vegetation communities supported in the Pines Tract area and SITLA Muddy Tract area are discussed in Chapter 3 of this M&RP.

**Land Use Description.** The leased areas lie within the Manti-La Sal and Fishlake National Forests and are subject to the Land and Resource Management plans prepared by the agency. These plans identify the principle use of the lease areas as rangeland with small areas set aside for timber harvesting and as general big game range. Recreation in the lease areas includes camping, firewood gathering, hunting, some snowmobiling, and sight seeing from late spring to late fall. Yearly recreation use is light, but during deer and elk hunts, use is extremely heavy.

There are no developed or inventoried recreation campgrounds on the lease areas. The mining operation will not impact any of these uses and will preserve the uses into the postmining period.

The timber on the lease areas are open grown Ponderosa pine. All commercial stands occur on the benches. Trees are of low quality because of the poor tree growing site. Cutting is limited to older over-matured trees and occurs infrequently. No adverse timber impacts are anticipated.

The aesthetic value of the area has been categorized by the U.S. Forest Service as follows:

"The mesa rim and deep canyons can be seen as background from Emery (Dog Valley). They are classified as distinctive with variety. Activity from the proposal will not be visually evident from the valley. The lease area is seen as middle ground from a few remote spots on the Duncan Mountain Road. This scene area is presently classified in Sensitivity Level 2 (Average Sensitivity). The visual objective as recommended by the Land Use Plan is 2 (Modification). This permits activities to visually dominate the characteristic landscape. Very few people visit the area and those that do, come for something other than scenic attractions."

With the inclusion of the Pines Tract into the SUFCO lease and permit areas "changes in the existing landscape could include escarpment failures. This is not expected to change the visual character of the region."

A portion of the surface area is grazed by cattle under the Quitchupah Grazing Association allotment (Fishlake National Forest). The allotment covers approximately 43,156 acres, it presently supports 813 head of cattle from June 11 through September 30, for a total of 2,981 cow months (Bob Tuttle, Fishlake National Forest).

The Emery allotment (Manti-La Sal Forest) supports 1,300 head of cattle. This allotment is under an intensive rest-rotation management system, placing the cattle in the mine area for approximately one month a year. Several ranches in Emery County are dependent on the allotment. Structural range improvements include one watering trough (spring fed) and two cattle guards on the access route into the lease.

The number of hunters in the Salina Planning Unit increased 122 percent from 1969 to 1972 (U.S. Forest Service, 1976). In Deer Unit #43/45 (Salina) 9,383 hunters were recorded afield during the 1990 hunting season. The Fishlake Elk Herd Unit #14 hosted 4,027 hunters during the 1990 season. Additional hunter use information reported by the Utah Division of Wildlife Resources can be found in the Utah Big Game Annual Report for 1991 (Appendix 4-1).

### **Pines Tract Area**

The existing land uses in the Pines Tract area include: timber production, livestock grazing, wildlife habitat, recreation, transportation corridors and underground coal mining (SUFCO Mine). **The existing land uses not previously discussed are the transportation corridors and underground coal mining (SUFCO Mine, Quitchupah Lease).** The roads/transportation corridors are generally single-lane native surface forest development roads which are passable during the drier months of the year. The forest development roads connect with local roads that access major highways.

In the late 1970s two Roadless Area Review and Evaluation (RARE) II areas were inventoried. Neither area was designated as wilderness, nor were they classified as roadless or semi-primitive recreation management areas under the Forest Plan in 1986 (Pines Tract Project EIS, 1999).

The Pines grazing unit is part of the Emery C&H grazing allotment. The Pines unit supports 1,387 head of cattle during the early grazing season. Eight ponds for livestock and wildlife use have been developed in the Pines Tract area (see Chapter 3, Appendix 3-9, Figure 2 - Springs, Seeps and Riparian Areas). The Link Canyon troughs and the Joe Mill ponds are the most reliable sources of developed water within the tract area.

The limited amount of perennial water within the analysis area reduces the potential for many species of fish to be present. However, Muddy Creek and the lower portion of Box Canyon Creek support fish populations.

The Sevier County Zoning Resolution designates the area as GRF-1. The primary uses designated for GRF-1 areas include gravel pits, clay pits, rock quarries, oil and gas wells, mines, mineral reduction, processing structures and facilities. There are no oil or gas leases associated with the Pines Tract area.

### **Muddy Tract Area**

**The existing land uses in the SITLA Muddy Tract area include: timber production, livestock grazing, wildlife habitat, recreation, transportation corridors and underground coal mining (SUFCO Mine).**

The roads/transportation corridors are generally single-lane native surface forest development and maintenance roads which are passable during the drier months of the year. The roads are classified by the Forest as Level 2 roads and generally no restrictions are placed on these roads for public use. The Forest does recommend the use of high clearance vehicles for most of the roads in the SITLA Muddy Tract area and to avoid use when the road surfaces are wet. However, if the permittee is using the roads for other than periodic monitoring, special use permits must be obtained from the Forest. Many of the forest development roads connect with local roads that access major highways.

In the late 1970s two Roadless Area Review and Evaluation (RARE) II areas within the SITLA Muddy Tract region were inventoried. Neither area was designated as wilderness, nor were they classified as roadless or semi-primitive recreation management areas under the 1986 Forest Plan Revision (Pines Tract Project EIS, 1999). Recent re-inventories (July 2004) of Roadless Areas by the Manti LaSal National Forest as part of their Forest Plan Revision to be completed by the end of 2006 have included nearly all of the SITLA Muddy Tract as potentially "roadless". This designation excludes the existing Forest Development Roads 044, 2033, and 010 that lie within the eastern and northern portions of the SITLA Muddy Tract. Only a small segment of land west and north of the Main Fork of Box Canyon and western SITLA Muddy Tract boundary, east of Forest Road 044, and south of the southern boundary of sections 2, 3, and 4 of T 21 S., R 5 E., SLM is identified as not being included in the proposed roadless area. Currently, the Forest typically administers most of the areas identified as having "roadless" characteristics as though the areas were officially accepted as roadless. This action is being taken to preserve, where possible, unroaded characteristics of portions of the Forest.

The SITLA Muddy Tract area is part of the Emery C&H grazing allotment. The SITLA Muddy Tract unit supports 1,387 head of cattle during the early grazing season. Three ponds for livestock and wildlife use have been developed in the SITLA Muddy Tract area.

The limited amount of perennial water within the analysis area reduces the potential for many species of fish to be present. However, Muddy Creek and the lower portion of Box Canyon Creek support fish populations.

There are no oil or gas leases associated with the SITLA Muddy Tract area.

**Cultural and Historic Resources Information.** Cultural resource information and maps identifying cultural and historical study areas are located in Appendix 4-2. An intensive cultural resource evaluation of five coal exploration well locations has been conducted on the Quitcupah Lease by Dr. Richard Hauck of AERC (see Appendix 4-2). As part of this evaluation he also made a record search at the State Historic Preservation office and the National Register of Historic Places. No sites were found that would be effected by the drilling activity. A ten percent cultural resource potential survey was completed by Les Sikle, Forest Archeologist, Manti-La Sal National Forest. A copy of his report is included in Appendix 4-2 along with the Utah State Historical Society's concurrence letter.

An intensive cultural resource evaluation of a proposed breakout, substation and power line in the Link Canyon Locality conducted by Dr. Richard Hauck of AERC is included in Appendix 4-2. No cultural or paleontological resources were observed within the proposed Link Canyon development area during the archaeological survey.

A cultural resource evaluation of the Link Canyon Mine portals area in Link Canyon was conducted by John Senulis of Senco-Phoenix. A copy of his report is included in Appendix 4-2. The conclusion of his evaluation of the portal site was that no cultural or paleontological resources are present. Many of his conclusions were based on work previously performed in the immediate portal area and surrounding areas by Dames and Moore, AERC, JBR, and the BLM.

There are no cemeteries, public parks, historic places, or areas within the boundaries of any units of the National System of Trails or the Wild and Scenic Rivers System located in areas to be affected by the SUFCO Mine. The Applicant agrees, however, to notify the regulatory authority and

Sufco intends to undermine portions of the East Fork of Box Canyon beginning in the Fall of 2003 as they extract coal from the 3LPE and 4LPE longwall panels. This change in the mining plan will change the required monitoring schedule in accordance with the Memorandum of Agreement for site 42SV2430/ML-3446 - Elusive Peacock which will be undermined under the 3LPE longwall panel. In accordance with pages 11-12 of the MOA the required monitoring schedule of this site will change from Monitor Schedule A (Sites in areas that will be mined using full-support methods) to Monitor Schedule B (Sites in areas which will be mined under and subsided) requiring the implementation of additional monitoring of the site. Monitoring results will be provided in DOGM Annual Reports. (2003, 2004, 2005, 2006, and indefinitely until movement ceases)

Historic properties documented in the Pines Tract area include 42SV2424, a sawmill, and site 42SV2391 a complex of trash scatters. Both sites are considered ineligible for the NRHP.

The Applicant agrees, however, to notify the regulatory authority and the Utah State Historical Preservation Office (SHPO) of previously unidentified cultural resources discovered in the course of mining operations. The Applicant also agrees to have any such cultural resources evaluated in terms of National Register of Historic Places eligibility criteria.

### **Muddy Creek Coal Tract Area**

**Cultural and Historic Information.** Cultural resource information and maps identifying cultural and historical study areas are located in Appendix 4-2. Cirrus Ecological Solutions, LC conducted an intensive evaluation of the Muddy Tract Area. Thirty-four sites were documented during the evaluation.

The three sites located in the SITLA Muddy Tract lease area are located on or near the east rim of Box Canyon. The sites include two significant lithic scatters (42SV2554 and 42SV2597 ), and a non-significant lithic scatter (42SV2594). None of these three sites will be undermined under the present mine plan.

REFERENCES:

- Arnold, J. F., D. A. Jameson and E. Reid, 1964. Production research report No. 84. USDA Forest Service.
- Jameson, D. A. 1971. Optimum stand selection for juniper control on south western woodland ranges. *Journal Range Mgmt.* 24:94-99.
- Jameson, D. A. and J. D. Dodd, 1964. Herbage production differs with soils in the pinyon-juniper type of Arizona. *USDA Forest Service Res. Note RM-131.*
- Julander, O. 1955. Deer and cattle range relations in Utah. *Forest Science* 1 (2):130-139.
- Lewis, M. E. 1971. Flora and major plant communities of the Ruby-East Humboldt Mountains. U.S. Forest Service, Region 4.
- Lewis, M. E., O. C. Olson, U. H. Johnson, L. E. Horton, and T. A. Phillips. 1965-1967. Pinyon-juniper condition standards studies. Forest Service, R-4 - reports and data.
- Phillips, T. A. 1965. Black pine juniper study. Unpub. Forest Service report.
- U.S. Forest Service. 1971. Unpublished data, Range suitability and condition map, Quitcupah C & H allotment, Fishlake National Forest, Grazing impact analyzes, and record of permanent line transects.
- U.S. Forest Service. 1976. Final environmental statement for land use plan, Salina Planning Unit, Fishlake National Forest. USDA, Forest Service, Intermountain Regional.
- U.S. Forest Service. 1986. Land and resource management plan, Fishlake National Forest. USDA, Forest Service, Intermountain Region.
- U.S. Forest Service. 1986. Land and resource management plan, Manti-La Sal National Forest. USDA, Forest Service, Intermountain Region.
- U.S. Forest Service. 1999. Final Environmental Impact Statement, Pines Tract Project, Manti-La Sal National Forest. USDA, Forest Service. Western Regional.
- WESTECH. 1978. Environmental assessment and impact evaluation of underground coal mining at the Southern Utah Fuel Company Mine property in central Utah. Technical report prepared for Coastal States Energy Company.
- WESTECH. 1978. Environmental assessment and monitoring for the Southern Utah Fuel Company Mine near Salina, Utah. Technical report prepared for Coastal States Energy Company.

**CHAPTER 5**  
**ENGINEERING**

### LIST OF PLATES

- 5-2D Detail of Link Canyon Surface Facilities
- 5-2E Detail of Link Canyon Surface Facilities No. 2
- 5-2F Detail of Link Canyon Portal Facilities
- 5-3A Post-Reclamation Surface Configuration
- 5-3B Extended Post-Reclamation Surface Configuration
- 5-4 Post-Reclamation Cross Sections
- 5-5 Existing Surface and Subsurface Facilities and Features
- 5-6 Land Ownership and Permit Area Map
- 5-7 Upper Hiawatha Mine Plan - 5 Year Projection
- 5-8 Lower Hiawatha Mine Plan - 5 Year Projection
- 5-9 Transportation Facility Cross Sections
- 5-10A Potential Subsidence Limits - Quitchupah Tract
- 5-10B Potential Subsidence Limits - Pines Tract
- 5-10C Potential Subsidence Limits - SITLA Muddy Tract & Greens Hollow Tract
- 5-11 Overburden Isopach Map

### LIST OF APPENDICES

(Appendices appear in Volume 6)

#### Appendix

- 5-1 Primary Road Certification
- 5-2 Approximate Original Contour Variance Request
- 5-3 Sevier County Landfill Disposal Agreement

will not allow mining to occur at the minimum height without putting quality at unacceptable levels. Much of the seam height in these areas is between 4-6 feet. Reserves are also lost to burn in these areas as a result of several promontories in the area which allow greater exposure of the outcrop to the atmosphere.

Mining is not planned on the northern portion of the SITLA Muddy Tract Lease ML 49443-OBA in the Upper Hiawatha Seam as a result of a sand channel and seam height that will not allow mining to occur.

The Lower Hiawatha seam will be mined in the northwest portion of the lease area where the interburden thickness between the Upper and Lower Hiawatha seams exceeds 30 feet. The mine plans are columnized or stacked where both seams are to be extracted. The Duncan seam does not contain sufficient minable reserves to warrant mining within the lease area.

The Duncan seam occurs about 100 to 130 feet above the Upper Hiawatha seam in a small portion of lease U-28297. The unsplit area of the Duncan seam is of small extent, probably less than 50 acres. Federal Lease U-28297 grants Canyon Fuel Company, LLC SUFCA Mine only the right to mine the Upper Hiawatha seam.

The Quitchupah Tract Resource Recovery and Protection Plan (R2P2) for Canyon Fuel Company, LLC SUFCA Mine is on file with the Bureau of Land Management. The R2P2 contains detailed mine plan and reserve calculations for all of the Quitchupah Tract leases operated by Canyon Fuel Company, LLC SUFCA Mine.

The Pines Tract Resource Recovery and Protection Plan (R2P2) for Canyon Fuel Company, LLC SUFCA Mine is on file with the Bureau of Land Management. The R2P2 contains detailed mine plan and reserve calculations for the Pines Tract lease operated by Canyon Fuel Company, LLC SUFCA Mine.

The SITLA Muddy Tract Plan of Operations Resource Recovery and Protection Plan (R2P2) for Canyon Fuel Company, LLC SUFACO Mine is on file with the State of Utah, School and Institutional Trust Lands Administration. The Plan of Operations Resource Recovery and Protection Plan (R2P2) contains detailed mine plan and reserve calculations for the SITLA Muddy Tract lease operated by Canyon Fuel Company, LLC SUFACO Mine.

### **5.2.3 Mining Methods**

A combination of room-and-pillar and longwall mining methods are used in the SUFACO Mine. The use of these two mining methods has been selected to maximize coal recovery and enhance production rates within the specific geologic constraints of the lease area.

**Mining Methods.** As noted in Section 5.2.3, both room-and-pillar and longwall mining methods are used in the SUFACO Mine. The size, sequence, and timing for the development of the underground workings are shown on Plates 5-7 and 5-8.

**Physical Conditions Affecting Subsidence.** A detailed description of the physical conditions in the lease and permit areas that influence subsidence (i.e., overburden lithology and thickness, coal seam thickness, etc.) is provided in Chapter 6.

**Subsidence Control Measures.** Most of the land within the lease area will eventually be affected by subsidence. Anticipated areas of subsidence and those areas planned for protection from subsidence are shown on Plates 5-10A, 5-10B & 5-10C. The primary areas where subsidence is not anticipated are the areas overlying the pre-1977 workings in Lease SL-062583 shown on Plate 5-1 (referred to herein as the "Old Mine") and certain lease areas underlying Quitchupah Canyon, Box Canyon, and Muddy Creek.

The "Old Mine" area was mined in such a manner that coal pillars were left for support throughout the entire workings. Since these pillars are large enough to support the overburden and further mining is not anticipated in these workings, the surface area above the workings should not experience any subsidence.

Where perennial streams are not undermined they will be protected from subsidence by establishing stream buffer corridors within the mine from which only limited coal recovery will occur. Support pillars will be left in these locations to preclude subsidence. Underground stream buffers will only be crossed to the extent necessary to allow access to reserves. This access will consist of entries and cross cuts with support pillars. Entries that cross through the underground stream buffer corridors with less than 300 feet of cover will be sealed and/or backfilled upon abandonment using the best available technology to prevent disturbance of the overlying streams.

Protected cultural resource sites (see Plates 5-10AC, 5-10BC & 5-10CC located in the Sufco Mine MRP Confidential file) will be designed to include a buffer zone to protect the area from the effects

Three longwall panels were completed in 1987 as part of the project. The area of proposed escarpment subsidence (the "Experimental Mining Practice" area) is shown on Plate 5-1. The north ends of two of the longwall panels extended beyond the escarpment toward the canyon. The third longwall panel was located entirely beyond the cliff beneath the canyon wall.

To date, monitoring efforts associated with the experimental mining practice have established that subsidence has occurred in a predictable manner varying from one foot to seven feet with minimal surface disturbance. One of the independent sandstone blocks fell from the escarpment during subsidence and a few tension cracks were created along the cliff face. No other visible signs of mining were found even though the surface elevations have dropped several feet in some areas of the experiment. Monitoring stations have moved horizontally from a few tenths of a foot to nearly three feet. Post-mining monitoring of the surface above the longwall panels is continuing. A report which describes the experimental project and its results in greater detail has been prepared for submittal to the UDOGM.

**Subsidence Monitoring.** In 1976 (i.e., prior to the onset of subsidence), SUFCO Mine began collecting baseline topographic data from the lease area using conventional survey methods. The use of conventional survey methods for subsidence monitoring continued until 1985 (i.e., at the beginning of longwall mining), when the lease area was flown to establish a set of baseline photography and a grid of surface elevations. Where possible, elevations were photogrammetrically determined from this baseline photography on an approximate 200-foot grid. These original horizontal and vertical data, together with the original conventional-survey data, serve as the comparative database for determining ground movement in subsequent years. A baseline was also established to monitor changes in vegetative cover with the use of color infrared aerial photography (CIR). The first baseline was done in 1987 for the existing leases. **The baseline for the Quitchupah lease was flown in 1988 with CIR. The applicant will follow up with CIR coverage of the leases at least every five years.** The CIR photographs are stored at the SUFCO Mine. CIR photography was taken in 1990, 1995, 1999, 2003 (East Fork Box Canyon only), and 2004. The next projected CIR flight dates will be in 2008, 2013, and 2018.

described in the plan as it pertains to the undermining of the South Fork of Quitcupah 2R2S Block "A" and 3R2S Block "B"

Sufco will conduct longwall mining operations in such a manner as to minimize surface disturbance while mining within the 15-degree angle-of-draw area that includes the South Fork stream channel. This will be accomplished by advancing the longwall on a schedule where mining will not be suspended for a period to exceed 48 hours.

A bi-weekly (once every two weeks) report on the impacts to stream flow and required mitigation, if any, will be submitted via e-mail to the Division and the forest detailing the results of the inspections while mining is occurring under the stream channel. The reports will include, but not necessarily be limited to: a map illustrating the current location of the longwall face; descriptions and dates of field activities; noted changes in stream and local geomorphology; location, width, frequency of cracks; and a description of repairs, if any, conducted. If the prescribed inspections cannot be conducted, the reason for the missed inspection and a record of the attempt to conduct the inspection will be submitted to the Division and the forest in the report. The Division and the forest will be notified immediately after mining-induced cracks, if any, are found in the South Fork stream channel and the steps taken or planned to be taken as mitigation. Thereafter, the Division and the forest will be advised of continuing mitigation efforts, if needed, in the report.

Though not anticipated, short segments of Cowboy Creek could be subsided in the SITLA Muddy Tract. If this is anticipated to occur, Sufco, will submit a plan for mitigation to address, if it occurs, adverse impacts to Cowboy Creek. With the approval of the Division and concurrence of the Forest, Sufco will instigate a flow monitoring plan similar to the plan implemented prior to the undermining of the East Fork of Box Canyon. If mitigation of surface cracks are required, methods similar to those proposed and implemented in the East Fork of Box Canyon as described above could be used.

Mining within the area of the East Fork of the Box Canyon, South Fork of Quitcupah and within the area of Cowboy Canyon in the SITLA Muddy Tract will be conducted in accordance with State and Federal rules and regulations and the requirements and stipulations presented in the BLM's Conditions of Approval of the Resource Recovery and Protection Plan (July 31, 2003) located in Appendix 1-2. A survey of the water quality and quantity of surface and groundwater, including State

appropriated waters, within the SITLA Muddy Tract has been completed. The results of the area survey are included in the PHC for the SITLA Muddy Tract and included in Appendix 7-20. Ground and surface waters in the tract that have attached rights are listed in Appendix 7-1.

A discussion regarding the methods Sufco would employ to mitigate and replace an adversely affected State appropriated water supply is provided in Chapter 7, Section 7.3.1.8.

#### 5.2.5.2 Subsidence Control

**Adopted Control Measures.** As indicated above, SUFCA Mine has adopted subsidence-control measures in areas where surface resources are to remain protected. These controls consist primarily of leaving support pillars in place in those areas designated on Plates 5-10A, 5-10B & 5-10C as not planned for subsidence. Based on experience and data collected from the lease area, the design of support pillars for those areas where subsidence is not planned has been based on the following equations:

$$SF = SD/OS \quad (5-1)$$

where SF = safety factor against pillar failure (fraction)

SD = support strength density (psi)  
=  $(Y_c)(1-ER)$

$Y_c$  = average compressive yield strength of the coal (psi)  
= 3090 psi for the Upper Hiawatha seam

ER = extraction ratio (fraction)  
=  $1-(A_p/A_t)$

$A_p$  = pillar area (ft<sup>2</sup>)

$A_t$  = area supported by pillar (ft<sup>2</sup>)

OS = overburden stress (psi)  
=  $(d)(D_o)/144$

d = overburden depth (ft)

$D_o$  = overburden density (lb/ft<sup>3</sup>)  
= 160 lb/ft<sup>3</sup> for the lease area

**CHAPTER 6**  
**GEOLOGY**

Three coal seams with thickness greater than five feet (the Upper Hiawatha Seam and two others of lesser importance; the Lower Hiawatha Seam and the Duncan Seam) are found in the Blackhawk Formation within the mine property ( Figure 6-1). The Upper Hiawatha Seam is the only one of the three which is minable within most of the mine property boundary. This seam has a thickness of between 9 and 18 feet over most of the property but thins sufficiently due to a mid-seam parting in the southeastern portion of the property that it becomes unminable. The Lower Hiawatha Seam occurs in the interval between the Upper Hiawatha Seam and the Star Point Sandstone. It is 2 to 29 feet above the Star Point Sandstone. The interval between the two coal seams varies between 5.6 and 70 feet. The Lower Hiawatha Seam is thin and discontinuous, varying in thickness from 0 to 17.2 feet. The seam is rendered unminable over much of the property due to partings. The Lower Hiawatha seam is only considered to be mineable where the interburden between the Upper Hiawatha seam is greater than 30 feet. This condition and a sufficient mining height occurs only in the northwest corner of the SUFCO Mine property.

The third coal seam occurs 100 to 130 feet above the Upper Hiawatha and has been informally named the Duncan Seam by the SUFCO Mine. The Duncan seam occurs in a small portion of lease U-28297. Because it is of such limited lateral extent, it cannot be correlated with any coal seams in areas surrounding the SUFCO Mine property. It has a maximum thickness of ten feet and is not mineable because of its limited lateral extent. The unsplit area of the Duncan seam is of small extent, probably less than 50 acres. The Duncan zone may correlate with the Muddy coal seam which occurs north of the SITLA lease.

The Upper Member of the Blackhawk Formation generally forms a steep, irregular slope between the cliffs of the underlying Star Point Sandstone and the overlying Castlegate Sandstone. Ledges of sandstone up to 50 feet thick break the slope. In some exposures, the unit is nearly vertical where the Star Point below has sheared off and erosion has not brought the slope to equilibrium. In Convulsion and Quitcupah Canyons, there are large areas of coal burn where the coal has burned naturally and baked the enveloping clays and sandstones to form a resistant reddish clinker layer. These areas are generally steeper than the surrounding slopes. Vegetative cover is generally sparse such that the Blackhawk strata can be easily seen except on some north-facing slopes where vegetation masks the unit.

The Duncan Coal Seam will not be mined as a part of the SUFCA Mine operations because it is discontinuous and has insufficient minable reserves. The Lower Hiawatha Coal Seam will only be mined in the western portion of the Quitchupah lease because this is the only area where the coal is thick enough to mine and there is sufficient interburden between the Upper and Lower Hiawatha seams to allow mining. The Lower Hiawatha seam may also occur in minable thickness at the northern edge of the SITLA lease but it is not currently under lease (only the Upper Hiawatha seam is under lease).

**Cross-Sections, Maps and Plans.** The cross-sections and maps are discussed in Section 6.2.4 and are located at the end of this chapter. The applicant request's that this information remain confidential.

**Drill Logs and Chemical Analyses.** See Section 6.2.4.3 and Appendices 6-1 and 6-2. The applicant requests that this information remain confidential and that public access to these sections be limited to only persons with an interest which is or may be adversely affected as provided under Section 40-10-10(4) of the Act.

#### **6.2.4.2 Test Boring and Drillhole Data (overburden removed)**

SUFCA Mine does not plan to remove any overburden above the coal seam to be mined. Regulations related to overburden removal do not apply to this M&RP.

#### **6.2.4.3 Test Boring and Drillhole Data (overburden not removed)**

The drill logs and chemical analyses required by regulations R645-301-624.310 through R645-301-624.330 are presented in Appendices 6-1 and 6-2.

**Lithologic Logs.** Lithologic logs of drillholes are presented in Appendix 6-1. The applicant requests that this information be kept confidential and that public access to these sections be limited to only persons with an interest which is or may be adversely affected as provided under Section 40-10-10(4) of the Act.

## **6.30 Operation Plan**

### **6.3.1 Casing and Sealing of Exploration Holes**

The information addressing regulations for casing and sealing of exploration holes is found in Section 7.6.5 of this M&RP. This includes both the temporary and permanent casing and sealing of exploration holes. The applicant believes all exploration boreholes that have not been used for piezometers have been plugged properly prior to abandonment as required by the regulatory authority. This plugging was the final step in the drilling process prior to abandonment of the well.

### **6.3.2 Subsidence Monitoring**

Subsidence and subsidence monitoring points are discussed in detail in Section 5.2.5 of this M&RP. The extent of the subsidence is shown on Plate 5-10. Subsidence monitoring is performed on an annual basis and the results of the monitoring are reported in the annual report.

Surface cracking related to mine subsidence has occurred above the existing mine workings at the Sufco mine. The cracks are surveyed and illustrated on the Mine Subsidence Map included in the annual report. Subsidence cracks that form due to mining generally occur over mined panels and above the inside edges of the gateroads. Where the overlying topography is relatively flat, such as in the Pines tract, cracks will form in the soils and bedrock parallel, sub-parallel and perpendicular to the long axis of the panel. In this type of area, the cracks will typically have minimal aperture and minor vertical offset. Subsidence in areas of the Quitcupah and Pines Tract where a deep drainage with steep canyon walls capped by Castlegate Sandstone exist, cracks have formed parallel to the drainage rim and may or may not be parallel to the axis of the panel. Occasionally, these cracks remain open after subsidence is complete. Sufco has repaired several cracks on the rim above the East Fork of Box Canyon where it was determined they presented a safety hazard.

Where bedrock is exposed at the surface and the local joint pattern is evident, subsidence fractures appear to be parallel or sub-parallel to the orientation of the panel. The cracks typically form an en echelon pattern on either side of the joint and may intersect with the joint. After the crack intersects the joint, it will travel within the joint itself for a short distance. However, the crack will

reappear in the bedrock again outside of the joint as the en echelon pattern continues. In the Pines Tract and Quitchupah areas, jointing generally does not appear to have significant effect on the location or propagation of subsidence related fractures. Exceptions to this occur where the Castlegate Sandstone has been subsided at or near the rim of steep drainages or canyons. In these areas, large blocks of sandstone have been observed to rotate toward the drainage during subsidence. Often, after subsidence is complete, the blocks remain at their new attitudes leaving an opening between the block and the in-place sandstone. Where the aperture is deemed hazardous, Sufco has backfilled the openings.

Subsidence in the Muddy tract area will occur in the Price River and North Horn Formations. Because these formations consist of ledge/slope forming interbedded sandstone, siltstone, shale and limestone and are typically overlain by a mantle of soil, little bedrock is exposed at the surface. Therefore, it would be difficult to determine the relationship of subsidence crack formation and bedrock jointing. It would be appropriate to assume, however, that subsidence cracks will form in this tract similarly to those found in the previously mined and subsided areas of the Sufco mine.

### **6.3.3 Exploration Drilling**

The purpose of exploration drilling is to obtain stratigraphic and coal quality information to make for more accurate mine planning and maintain a high level of miner safety. The exploration area is located within the current mining permit boundary of Permit ACT/041/002 as shown on Plate 6-1. The SUFACO Mine is planning to drill up to 5 drill holes over the next 5 years. In the case of the SITLA lease, drilling will be conducted as approved under a Division-approved Minor Coal Exploration Permit. As in the past, drilling on federal leases with USFS administered surface will continue to be permitted through the BLM Exploration Plan process. The SUFACO Mine understands that UDOGM, the BLM, and the USFS all have an important role in approval of drilling and will continue to work diligently to ensure requirements of all involved agencies are met prior to conducting surface exploration work.

Drill site preparation, drilling, and final reclamation work will last approximately two weeks per year. Reclamation will be concurrent with drilling to minimize the duration of the project.

**CHAPTER 7**  
**HYDROLOGY**

**LIST OF TABLES (Continued)**

Table	Page
7-5A East Fork of Box Canyon Monitoring and Mitigation .....	7-51D
7-6 Summary of Watershed Data .....	7-68
7-7 Stage-Capacity Curve for the Concrete Sediment Trap .....	7-71
7-8 Stage-Capacity Data for the Sedimentation Pond .....	7-72
7-8A Stage-Capacity Data for the Overflow Pond .....	7-73A
7-9 Summary of Diversion Ditches .....	7-79
7-10 Summary of Diversion Culverts .....	7-80

**LIST OF PLATES**

Plate
7-1 (Revisions have eliminated this plate)
<b>7-2A Surface and Groundwater Rights - Quitchupah Tract</b>
<b>7-2B Surface and Groundwater Rights - Pines Tract &amp; SITLA Muddy Tract</b>
7-3 Hydrologic Monitoring Stations
7-4 Sedimentation Pond Topography
7-4A Overflow Pond Topography
7-5 Sedimentation Pond Cross Sections
7-5A Overflow Pond Cross Sections and Details
7-5B Overflow Pond Details
7-5B Overflow Pond Details
7-6 East Spring Canyon Drainage Details
7-7 (Revisions have eliminated this plate)

- 7-8 Watersheds Draining to The East Spring Canyon Surface Facilities
- 7-9 Link Canyon Watershed

**LIST OF APPENDICES**  
(Appendices appear in Volumes 7, 8 and 9)

Appendix

- 7-1 Water Rights Data
- 7-2 Hydrometrics Reports
- 7-3 Groundwater Level Data
- 7-4 Water Quality Data Summaries
- 7-5 Climatological Data
- 7-6 Spill Prevention Control and Countermeasure Plan
- 7-7 UPDES Permit
- 7-8 1980 Valley Engineering, Inc. Report
- 7-9 1979 Merrick and Company Report
- 7-10 Hydrologic Design Methods
- 7-11 Runoff Calculations
- 7-12 Diversion Ditch Calculations
- 7-13 Diversion Culvert Calculations
- 7-14 Sedimentation Pond Calculations
- 7-15 Alternative Sediment Control Measures Calculations and Designs
- 7-16 Small Area Exemption Demonstration Calculations
- 7-17 Investigation of Surface and Groundwater Systems in the Vicinity of the SUFCA Mine, Sevier County, Utah: Probable Hydrologic Consequences of Coal Mining at the SUFCA Mine and Recommendations for Surface and Groundwater Monitoring**

- 7-18 Investigation of Surface and Groundwater Systems in the Pines Tract Area, Sevier County, Utah: Probable Hydrologic Consequences of Coal Mining in the Pines Tract and Recommendations for Surface and Groundwater Monitoring
- 7-19 Probable Hydrologic Consequences of Longwall Mining of the 3 Left Panel Modification Area at the SUFCO Mine

**LIST OF APPENDICES** (Continued)  
(Appendices appear in Volumes 7, 8 and 9)

Appendix

- 7-20 Investigation of Surface and Groundwater Systems in the SITLA Muddy Tract Area, Sevier County, Utah: Probable Hydrologic Consequences of Coal Mining in the SITLA Muddy Tract and Recommendations for Surface and Groundwater Monitoring
- 7-21 Muddy Tract Hydrologic Baseline Data (Includes SITLA Tract baseline data)
- 7-22 Investigation Plan for Springs Pines 105, Joes Mill Pond, Pines 310, and 311
- 7-23 Overflow Pond Calculations
- 7-24 Investigation of Surface and Groundwater Systems in the West Lease Modifications Area, Sevier County, Utah: Probable Hydrologic Consequences of Coal Mining in the West Lease Modifications and Recommendations for Surface and Groundwater Monitoring
- 7-25 North Water Mitigation Plan
- 7-26 Probable Hydrologic Consequences of Longwall Coal Mining of 2R2S Block "A" at the Canyon Fuel Company, LLC Sufco Mine, Salina, Utah

base. The sandstone is conglomeratic, forms prominent cliffs along the outcrop, and is well cemented with calcareous cement.

A limited number of springs issue from the Castlegate Sandstone in the Quitchupah lease area, with flow generally less than 1 gpm. In the Pines Tract area, several springs issue from and near the base of the Castlegate Sandstone. The waters from these springs feed the Main Fork and East Fork of Box Canyon Creek. Base flow from these springs is generally less than 1 to 2 gpm with a few flowing at rates of 5 to 6 gpm.

Based on information from the exploration drill holes and observation wells in the lease area, the Castlegate Sandstone contains small quantities of groundwater. No significant quantities of groundwater (more than 2 gpm) were encountered in any of the exploration holes nor was groundwater identified in all drill holes.

Of the observation wells completed in the Castlegate Sandstone in the lease area, two (US-77-9 and 89-16-1W) have been dry during their entire period of record. Two additional wells (US-77-8 and 89-20-2W) have only a brief period of record (due to lack of water or time since installation, respectively). Hydrographs of the remaining two Castlegate Sandstone observation wells (US-80-2 and US-80-4) are presented in Figure 7-2. Water-level data for all wells are provided in Appendix 7-3. Seasonal fluctuations of groundwater levels in these wells have typically been less than one foot.

Coal exploration holes drilled in and near the Pines Tract by the USGS, have geophysical logs indicating similar conditions for the Castlegate Sandstone. Exploration Hole W-TP-4-EW found fluids present at a depth of 82 feet below ground surface, within the Castlegate Sandstone. Exploration holes W-TP-3-EW and W-TP-2-EW did not encounter fluids within the Castlegate Sandstone.

This formation is not considered to be a significant regional aquifer. It is assumed that the groundwater occurrence within the Castlegate Sandstone is limited to isolated perched zones contained in the more permeable sandstone lenses or within weathered bedrock and fractures/joints at and near the escarpments within Box Canyon. Because groundwater occurrence within the Castlegate Sandstone is not continuous over the permit and adjacent areas, no potentiometric surface could be developed for the unit.

found in groundwater samples only for sulfate and TDS concentrations (with recommended standards of 250 mg/l and 500 mg/l, respectively). All of the sulfate exceedances and most of the TDS exceedances occurred in groundwater collected from monitoring wells at the waste-rock disposal site. These exceedances are probably due to the natural dissolution of marine salts known to exist in the local strata (Waddell et al., 1981).

#### 7.2.4.2 Surface Water Information

##### WATER QUANTITY

Major surface drainages in the permit and adjacent areas are depicted in Figure 7-4. As indicated, the lease area exists entirely within the Muddy Creek watershed. Most of the lease area drains southward into Quitchupah Creek via the North Fork of Quitchupah Creek and various ephemeral tributaries. Quitchupah Creek flows southeastward into Ivie Creek which in turn flows eastward into Muddy Creek. The northeast portion of the lease area, including the majority of the Pines Tract, drains into Muddy Creek via Box Canyon.

Based on flow data obtained during the collection of water-quality samples, the following streams are considered perennial within the lease area:

- North Fork of Quitchupah Creek (as measured at stations SUFCA-007 and SUFCA-042)
- South Fork of the North Fork of Quitchupah Creek (as measured at station SUFCA-006)
- Quitchupah Creek (as measured at stations SUFCA-041 and SUFCA-046)

Note that the waste-rock disposal area sedimentation pond does not have a UPDES permit since this is a total-containment, non-discharge facility (see Volume 3 of this M&RP).

### WATER QUALITY

Surface-water quality samples have been collected in the permit and adjacent areas from stations located on Quitchupah Creek, the North and South Forks of Quitchupah Creek, mine discharges into the North Fork of Quitchupah Creek, and Box Canyon. Historical data from these sources are summarized in Appendices 7-4, 7-17 and 7-18.

Historical data collected from stations SUFACO-006 (upper South Fork of Quitchupah Creek) and SUFACO-007 (upper North Fork of Quitchupah Creek) indicate that water in the upper reaches of this drainage is predominantly a calcium-bicarbonate chemical type with an average TDS concentration that varies from about 330 to 470 mg/l. The pH of this water is slightly alkaline, averaging 7.9 to 8.0. Total iron concentrations at these stations typically ranges from 1.7 to 3.0 mg/l, with dissolved iron concentrations averaging 0.03 to 0.04 mg/l. Total manganese concentrations at these stations average 0.11 to 0.12 mg/l, with dissolved manganese concentrations averaging 0.02 to 0.05 mg/l.

Alkalinity typically exceeds acidity at these upper stations by a factor of approximately 25. TDS concentrations tend to be inversely proportional to flow, while total iron and manganese concentrations are typically directly proportional to flow. Consistent seasonal variations in pH, dissolved iron, and dissolved manganese concentrations are not apparent.

The historical mine discharge at SUFACO-021 (UPDES monitoring station 003) is a calcium-bicarbonate-sulfate water with an average TDS concentration of 603 mg/l and an average pH of 7.4. Sulfate concentrations in the mine-water discharge average 236 mg/l. This compares with an average sulfate concentration of 81 mg/l between stations SUFACO-006 and -007 and an average of 66 mg/l in the mine inflow (station SUFACO-062). This increase in sulfate (and TDS) in the mine-water discharge as compared with adjacent surface and underground water may be the result of dissolution of the calcium-sulfate based rock dust used in the mine.

- Contamination from acid- or toxic-forming materials;
- Increased sediment yield from disturbed areas;
- Increased total dissolved solids concentrations;
- Flooding or stream flow alteration;
- Impacts to groundwater or surface water availability;
- Hydrocarbon contamination from above ground storage tanks or from the use of hydrocarbons in the permit area;
- Contamination of surface and groundwater from road salting; and
- Contamination of surface water from coal spillage due to hauling operations.

These potential impacts are addressed in the following sections of this M&RP.

#### **7.2.8.2 Baseline Hydrologic and Geologic Information**

Baseline geologic information is presented in Chapter 6 of this M&RP. Baseline hydrologic information is presented in Sections 7.2.4.1 and 7.2.4.2 of this M&RP. The baseline monitoring sources are believed to be representative of existing ground water and surface water. An additional inventory is not planned unless circumstances dictate a need for change.

#### **7.2.8.3 PHC Determination**

**Potential Impacts to the Hydrologic Balance.** Potential impacts to the hydrologic balance are addressed in the following subsections of this M&RP and in Appendices 7-17, 7-18, 7-19, 7-20 and 7-24. Appendices 7-18, 7-20 and 7-24 contain PHC determinations for mining activities in the Pines Tract, SITLA Muddy Tracts and West Coal Lease Modifications, respectively.

**Acid- or Toxic- Forming Materials.** Information on acid-and toxic-forming materials is presented in Chapter 6. These data reveal boron, sodium absorption ratio, and specific conductance exceedances of the Table 2 guidelines for management of topsoil and overburden (Leatherwood and Duce, 1988) in waste rock from the SUFACO mine. As noted in Section 7.2.4.2 of this M&RP, the alkalinity of the mine discharge water typically exceeds the acidity of this water by a factor of 20.

### 7.3.1.2 Water Monitoring

**Groundwater Monitoring.** Groundwater monitoring is proposed to be conducted in the SUFCO permit and adjacent areas according to the water monitoring plans presented in Tables 7-2 through 7-5A and for the rock waste disposal site in Section 4.7.2 in Volume 3 of this M&RP. These tables are based on the studies done by Mayo and Associates (Appendices 7-17 and 7-18) and supersede previous plans.

The location of the monitoring points are presented on Plate 7-3. The location of the monitoring wells for the rock waste disposal site are presented on Map 2, Volume 3 of this M&RP. The monitoring plans were developed based on information presented in the PHC determinations, the baseline hydrologic data, and the geology chapter of this M&RP.

The monitoring programs provide data that are reviewed and compared to the baseline data. Any significant changes are evaluated to determine their impact on the hydrologic balance. These comparisons have taken the form of reports prepared by Hydrometrics early in the permit term (1978-1987). Results of these evaluations are submitted periodically to the UDOGM. The annual Water Quality Report submitted to the Division contains the monitoring data.

Baseline data collected for the Pines Tract area included performing field surveys to identify existing springs. Additionally, springs identified in the USGS publication "Hydrology and Effects of Mining in the Quitcupah and Pines -Coal Lease Tracts, Central Utah" (Thiros and Cordy, 1991) were searched for and, when found, included in the baseline survey. Those springs identified and found within the Pines Tract in the above referenced publication are labeled on Plate 7-3 with the prefix "GW - ". During the baseline surveys, several springs identified in the publication could not be found as illustrated on the document maps or by using the printed location descriptions. It is assumed the springs that could not be found have a) stopped flowing; b) were miss mapped; or c) were in close proximity to springs found during the baseline surveys but could not be positively identified as USGS located springs and were therefore given new number designations.

Baseline data collected for the Muddy Tract area is located in the "Coal Tract Evaluations on the Manti-La Sal National Forest" report prepared for the Manti-La Sal National Forest by Cirrus

Ecological Solutions, LC. Those springs identified and found within the Muddy Tract in the above referenced publication are labeled on Plate 7-3 with the prefix "M- ".

Sampling for the SUFCO Mine and adjacent areas is accomplished in accordance with the schedule outlined on Tables 7-2 through 7-5A. Sampling for the waste rock disposal site is

carbonate alkalinity are included in the operational monitoring plans. Contributions to alkalinity from hydroxide, silicate, borate, and organic ligands are trivial.

- Mayo did not include dissolved iron and dissolved manganese in the operational monitoring plan because iron and manganese do not readily exist in dissolved form in basic (pH>7) waters but exist instead as hydroxide complexes. All waters in the lease area are basic. Measurements of total iron and manganese quantify both the dissolved and complex forms of these elements.

Equipment, structures, and other devices used in conjunction with monitoring the quality and quantity of the surface water in the permit and adjacent areas have been installed, maintained, and operated in accordance with accepted procedures. This equipment will be removed by SUFCA when no longer needed.

#### Stock Water Ponds

Several stock watering ponds are located in the Pines Tract and Quitchupah Lease area. Surface cracking due to mining related subsidence within the Quitchupah Lease has apparently adversely affected a few of the ponds. Action has been taken by SUFCA in the past to mitigate the damage, including applying bentonitic seals to the pond floors and hauling water for livestock. However, ranchers and State and Federal agencies have erroneously claimed that subsidence has adversely affected several ponds outside of the mining areas. In order to more adequately monitor the effects of mining on the stock watering ponds, SUFCA has been negotiating with DOGM, USFS, and the local rancher's association to create a workable monitoring plan for the ponds that can be agreed upon by all participants. DOGM has taken the lead in this process, and as of May 2000, a plan had not yet been finalized. In the interim, SUFCA commits to visiting the ponds within the Pines Tract and Quitchupah Lease area as soon as they are accessible in the spring of each year (typically late April to early May),

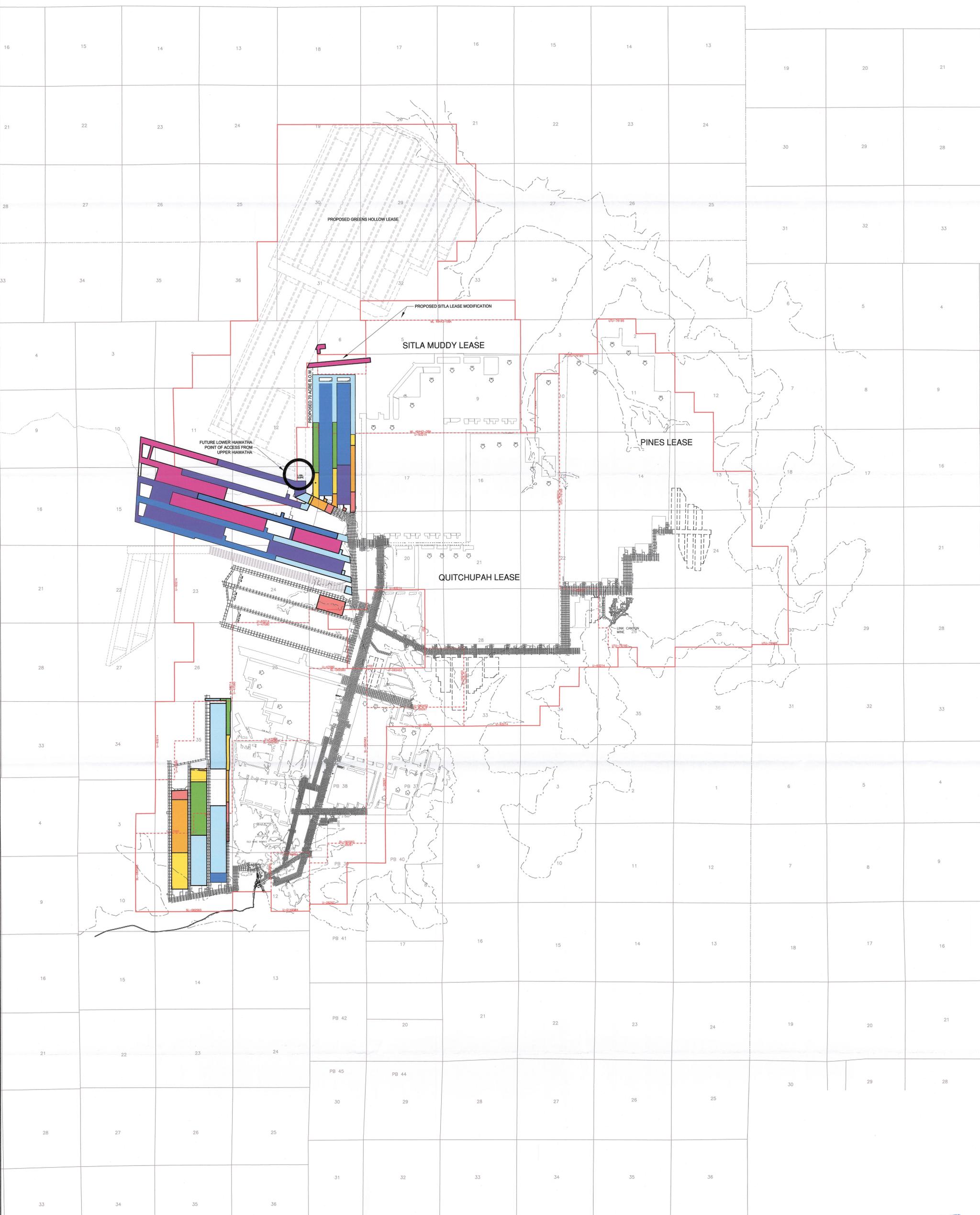
SUFCO. 1992. Chris Kravitz, SUFCO, personal communication with Mindy Rosseland, EarthFax Engineering. Salt Lake City, Utah.

Thiros, S.A. and Cordy, G.E. 1991. Hydrology and Potential Effects of Mining in the Quitchupah and Pines Coal-Lease Tracts, Central Utah. U.S. Geological Survey Water-Resources Investigations Report 90-4084. Salt Lake City, Utah.

Utah Division of Water Resources. 1977. Hydrologic Inventory of the Dirty Devil Study Unit. Utah Department of Natural Resources. Salt Lake City, Utah.

Waddell, K.M., Vickers, H.L., Upton, R.T., and Contratto, P.K., 1979. Selected hydrologic data, Wasatch Plateau-Book Cliffs coal fields area, Utah: Utah Basic-Data Release 31. Utah Water Resources. Salt Lake City, Utah.

Waddell, K.M., P.K. Contratto, C.T. Sumsion, and J.R. Butler. 1981. Hydrologic Reconnaissance of the Wasatch Plateau-Book Cliffs Coal-Fields Area, Utah. U.S. Geological Survey Water-Supply Paper 2068. Washington, D.C.



**EXPLANATION**

- SUFCO EXTERIOR LEASE BOUNDARY
- - - SUFCO INTERIOR LEASE BOUNDARY
- - - ESCARPMENT
- - - OUTCROP

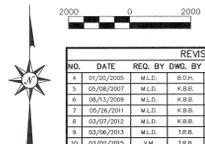
**MINING LEGEND**

- 1ST QUARTER 2015
- 2ND QUARTER 2015
- 3RD QUARTER 2015
- 4TH QUARTER 2015
- 2016
- 2017
- 2018
- 2019

**NOTES:**  
 1. GREENS HOLLOW PROJECTIONS ARE SUBJECT TO FUTURE PERMITTING OF THE GREENS HOLLOW TRACT.  
 2. ANY PROJECTED MINING SHOWN BEYOND EXISTING LEASE BOUNDARY LINES IS SUBJECT TO FUTURE LEASE MODIFICATIONS AND APPROVALS.



I CERTIFY THE ITEMS SHOWN ON THIS DRAWING ARE ACCURATE TO THE BEST OF MY KNOWLEDGE.



REVISIONS				
NO.	DATE	REQ. BY	DWG. BY	REMARKS
1	01/26/2015	M.L.D.	B.D.H.	
2	05/08/2015	M.L.D.	K.B.S.	
3	06/13/2015	M.L.D.	K.B.S.	
4	06/13/2015	M.L.D.	K.B.S.	
5	06/13/2015	M.L.D.	K.B.S.	
6	06/13/2015	M.L.D.	K.B.S.	
7	06/26/2015	M.L.D.	K.B.S.	
8	06/26/2015	M.L.D.	K.B.S.	
9	06/26/2015	M.L.D.	K.B.S.	
10	03/03/2015	Y.M.	T.R.B.	ADDED TO ACRE B.O.W. AREA FOR 5 WEST

Canyon Fuel Company, LLC  
 SUFCO Mine  
 597 South SR 24 - Sny, UT 84654  
 (435) 286-4950 Phone  
 (435) 286-4499 Fax

**UPPER HIAWATHA MINE PLAN  
5 YEAR PROJECTION**

PEN. NO.	DATE	SCALE	DATE	DRAWN BY	ENGINEER	CHECKED BY	SHEET NO.
9394094-8200	3/5/2015	1" = 2,000'	3/5/2015	B.D.H./T.R.B.	J.D.B.	Y.M.	PLATE 5-7v10
DWT SEC.	PROJECT NUMBER	FILE NAME					
###	###	H:\DRAWINGS\MRP\PLATES\PLATE 5-7v10.dwg					

RECEIVED  
 MAR 10 2015  
 DIV. OF OIL, GAS & MINING