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TECHNICAL REPORT AND EIS SUMMARY FOR VEGETATION AND WILDLIFE

Submitted to:

UNITED STATES FOREST SERVICE MANTI-LASAL DISTRICT AND BUREAU OF LAND MANAGEMENT UTAH STATE OFFICE

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1. INTRODUCTION

Canyon Fuel Company, LLC (CFC), submitted a Federal Lease Application to the Bureau of Land Management (BLM) for the Flat Canyon Tract (Tract) in March of 1998. A joint Manti-LaSal Forest Service (FS)/BLM Tract Delineation Team (TDT) ratified the Tract boundaries as submitted by CFC in August 1999.

The Tract is just west of the Wasatch Plateau Known Recoverable Coal Resource Area. The surface of the area is managed by the FS and the mineral estate by the BLM. The FS and BLM (Utah State Office) jointly determined that an Environment Impact Statement would be required as a basis for leasing decisions. The Office of Surface Mining (OSM) and Bureau of Reclamation (BOR) will participate as co-operating agencies.

The Tract encompasses some 2,692 acres immediately west of the existing CFC Skyline Mine as shown generally on Figure 1.1 and more particularly on Figure 1.2. Effects of mining the Tract may spill over into neighboring areas. The greater area of influence is termed the Reasonably Foreseeable Development Scenario Area (RFDS Area). While the terms Tract and RFDS Area define slightly different footprints, they are often used interchangeably in this Report.

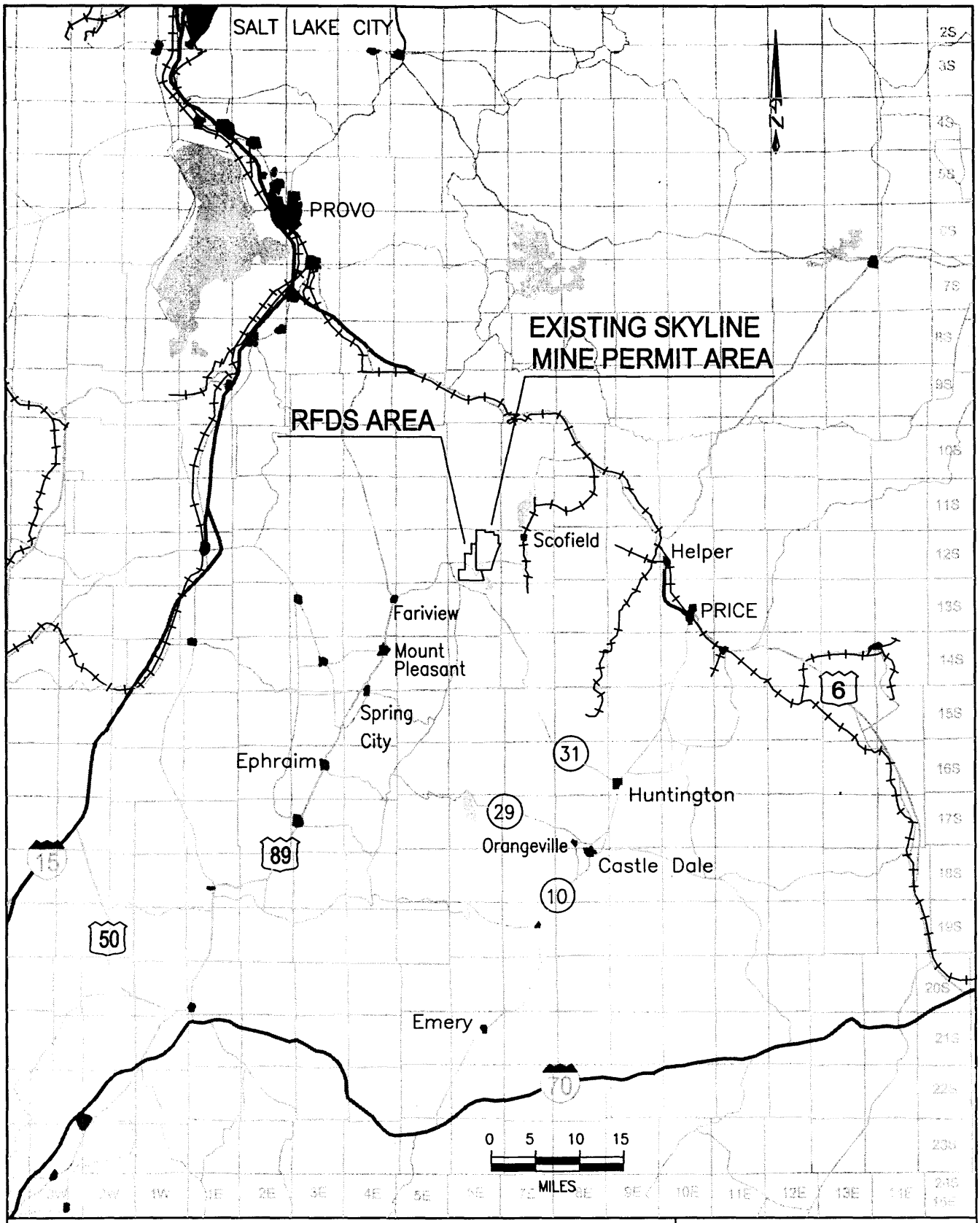
The EIS Summary is attached as Appendix A. The Table of Resource Element evaluation is attached as Appendix B.

1.1 AUTHORS

This Technical Report was prepared by NorWest Mine Services, Inc. (NorWest). Primary authors are, in alphabetical order:

- James (Jim) Alto – Co-Project Manager – NorWest;
- Randolph (Randy) Gainer – V.P. – Maxim Technologies, Inc.
- Conrad (Con) Houser – Co-Project Manager – NorWest;
- Kelly Payne – Hydrogeologist – NorWest;
- Patrick Mullen – Senior Biologist – Maxim Technologies, Inc.

Resumes for each of these individuals are attached as Appendix C to this Report.



LEGEND

RAILROAD
HIGHWAY
ROAD
LAKE/RIVER
CITY

DETAIL AREA

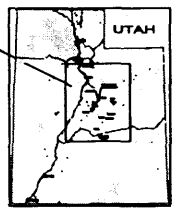
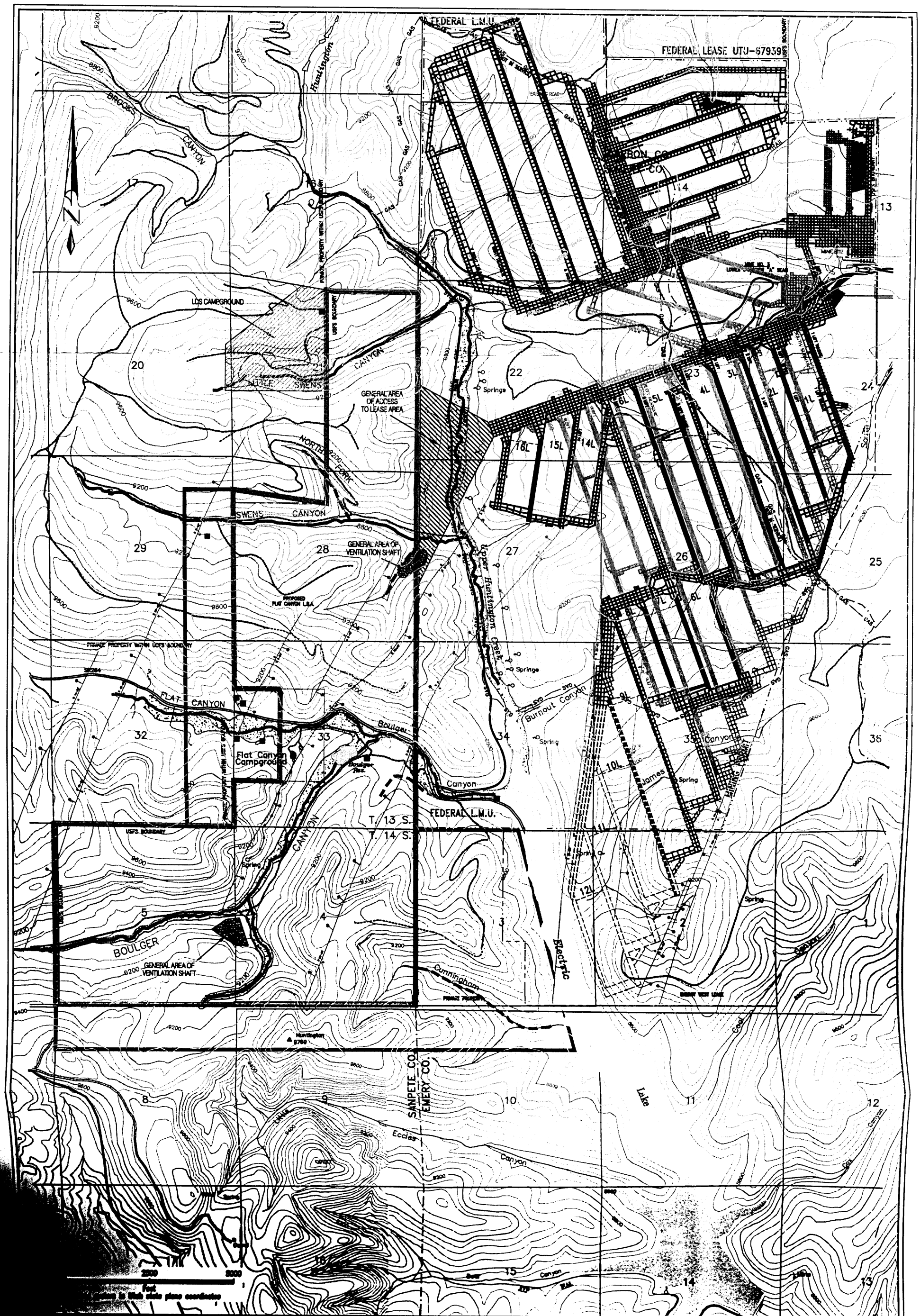


FIGURE 1.1
PROJECT LOCATION MAP

DATE: 10/18/2000
FILE: 2439LOCATION

NorWest



LEGEND

- LBA
- SEASONALLY FORBEARABLE DEVELOPMENT AREA
- CABIN / BUILDING
- PAVED HIGHWAY
- UNPAVED HIGHWAY
- RIVER/CREEK
- LAKE/RESERVOIR
- GAS PIPELINE (operational)
- GAS PIPELINE (not in service)
- WATER PIPELINE
- EXISTING MINE WORKINGS, MINE 1
- EXISTING MINE WORKINGS, MINE 2
- EXISTING MINE WORKINGS, MINE 3
- PROPOSED MINE WORKINGS, MINE 2 (existing leases)
- ESTIMATED PERIMETER of PERENNIAL STREAM ALLUVIUM
- MAJOR FAULTS
- PERENNIAL STREAM
- POSSIBLE PERENNIAL STREAM

FIGURE 1.2

DETAILED PROJECT LOCATION MAP

DATE: 10/18/2000	SCALE 1"=2640'	NorWest
FILE: VW1-2.DWG		

1.2 PROPOSED ACTION

The FS and BLM propose to offer the Tract for competitive leasing based on CFC's application for lease as modified by the Interagency Tract Delineation Team. Only when or if it is determined that lease of this Tract, with special stipulations established by FS and BLM, can meet the primary objectives of all supervising agencies, will the Tract be offered.

1.3 PURPOSE AND NEED

The FS and BLM propose to offer the Tract for competitive leasing based on CFC's application for lease as modified by the Interagency Tract Delineation Team. The Tract would be accessed from the existing Skyline Mine. The TDT concluded that "no other independent access to the coal appears to be feasible." If a company other than CFC were to acquire the Tract, the most likely access to coal reserves would be through a 1200 foot shaft in the Boulger Canyon area between Boulger Reservoir and Electric Lake, as the coal does not outcrop. This is unlikely to be economically feasible (see the TDT's Reasonable Foreseeable Development Scenario discussed below).

Successful acquisition of the Tract by CFC would extend the life of the Skyline Mine by over six years, based on the reserves defined by the BLM Tract Delineation Report and an annual production rate of about 6 million tons per annum projected by CFC. However, if the BLM special stipulations are applied for resource protection then the reserves and mine life could be significantly reduced.

The Skyline Mine is a longwall operation. This technique for coal extraction would be extended into the Tract. Mine water discharge would be either from the existing permitted discharge point in Eccles Canyon or a proposed discharge into Electric Lake in the Huntington Creek drainage.

Surface disturbance associated with the development of facilities and exploration drilling on the Tract would be small: being limited to a number of exploratory drill holes and one or two passive ventilation shafts being the only newly constructed facilities. The location of the exploratory holes are preliminary and subject to change depending on geologic and environmental considerations.

Each drill hole would require a pad with an area of about one-half acre, approximately 100 feet by 200 feet and a temporary access road about 1,000 feet in length. If 10 additional holes are drilled, the area disturbed would be about 7.4 acres including drill pads and roads.

Ventilation shafts would not be constructed until underground mining progressed to each location and additional ventilation was required for safe operations. The general area proposed for location of these shafts is shown in Figure 1.2. The construction footprint for each ventilation shaft would be approximately one acre. Total disturbance for access roads to each ventilation shaft would be about 1,000 feet by 16 feet, or 0.36 acres for both shafts. The two shafts would be used for the life of the mine and would be abandoned and reclaimed thereafter. Disturbance and reclamation would be completed in accordance with permits issued by the FS and the State of Utah.

Total new surface disturbance for the Tract would be approximately 9.8 acres. This disturbance is related to predicted surface facilities only and does not include subsidence.

1.4 REASONABLE FORESEEABLE DEVELOPMENT SCENARIO (RFDS) - SUMMARY

These mining limits should not be regarded as rigid, as it may be possible to extract coal with a thickness down to 6 feet, or greater than 12.5 feet in some cases. Additional coal resources, not amenable to longwall mining, may be recovered by room and pillar methods with partial or full extraction.

The Tract covers an area of 2,692 acres and would be mined using longwall methods with multiple seam mining of two seams over the majority of the area. A total of 36 million tons of coal are estimated to be recoverable. Continuous miners would be used for mine development. The mining height would be in the range of seven feet to 12.5 feet and vary for each seam. Combined extraction of two seams could be as much as 22.5 feet of coal in some areas.

The Tract would be accessed from the existing Skyline Mine (Federal Leases U-044076 and U-0147570) adjacent to the Huntington Creek drainage. Development with full support room and pillar mining under the existing lease would be used to preclude subsidence of this Creek. The location of the general area where development is proposed to pass under Huntington Creek is shown on Figure 1.2.

1.5 REVIEWING AGENCY OBJECTIVES

The primary objectives of the BLM are to ensure:

- maximum economic recovery (MER) of the coal is achieved;
- the environment is protected; and
- all potential impacts resulting from mining are addressed and resolved.

To meet these objectives, the EIS must evaluate the Tract based on the following assumptions:

- assume full extraction mining to determine all potential surface impacts;
- surface areas determined to be not conducive to full extraction mining must be re-evaluated for impacts from partial extraction, first mining, or development mining;
- protective non-subsidence buffer zones must be considered (with appropriate angle-of-draw) for protection of sensitive resources, where these resources are protected by applicable laws, regulations, and management direction if the need is indicated or effects are relatively uncertain;
- geologic conditions that could limit coal extraction (other than coal thickness, interburden and depth) have only been considered where the data is thought to be sufficiently reliable;
- drilling of about 10 additional exploration holes would be necessary to delineate the reserves; and,
- development of two passive vent holes.

The Forest Service has a wide range of Forest Management goals including the following:

- manage geologic resources to meet resource needs and minimize adverse effects;
- maintain satisfactory watershed conditions while providing favorable conditions for water flow;
- provide for production of mineral resources consistent with applicable laws, regulations, and Forest Plan management direction; and,
- provide for public safety.

Where there is conflict between MER and the other objectives, the EIS must consider the effects of a reasonable range of alternatives, including no action, to allow for informed scientifically based decisions to be made.

1.6 ALTERNATIVES

Four alternatives were developed to address the significant issues associated with this proposed lease action and to meet the requirements of NEPA. This Technical Report will address Alternatives 2 and 3 and make recommendations to help FS and BLM compile special lease stipulations needed for inclusion in Alternative 4.

1.6.1 No Action

This alternative provides a baseline for estimating the effects of the action alternatives. Under this alternative, the lease Tract would not be offered for leasing and there would be no mining.

1.6.2 Offer The Tract For Leasing As Delineated With Special Lease Stipulations

Under this alternative the Tract would be offered for competitive leasing, as delineated, with standard terms and conditions and special stipulations to protect non-mineral resources and uses. Subsidence of perennial drainages, Boulger Dam and Reservoir, Flat Canyon Campground, State Highway SR 264 and Mainline #41 gas transmission pipeline would not be allowed.

1.6.3 Offer The Tract For Leasing As Delineated Without Special Lease Stipulations

Under this alternative the Tract would be offered for competitive leasing, as delineated by the TDT with standard lease terms and conditions. No special stipulations would be included. Longwall (full-extraction) mining would be allowed throughout the Tract resulting in subsidence of perennial drainages, Boulger Dam and Reservoir, and Flat Canyon Campground. It would be analyzed as the basis for comparison with other action alternatives that would include special stipulations needed to protect non-mineral resources and uses.

1.6.4 Offer The Tract With A Specific List Of Special Stipulations Needed To Protect Non-Mineral Resources

This alternative will be developed to address significant social, economic, or environmental issues or opportunities.

1.7 STATEMENT OF ISSUES AND EVALUATION CRITERIA

- Subsidence and other mining-caused changes to surface and ground water could affect vegetation, especially riparian vegetation/wetlands.

Evaluation Criteria: Riparian vegetation, wetlands, and other species and area (acres) affected, changes in species diversity and wetland hydrology.

- Any changes in water flow and quality in perennial drainages and Boulger Reservoir of to riparian vegetation/wetlands could affect habitat for terrestrial and aquatic species, including Yellowstone Cutthroat Trout.

  Evaluation Criteria: Description of Potential Effect to Affected Habitat and Quality (Regional Aquatic Habitat Inventory).

- Subsidence of perennial streams could cause changes in stream morphology and aquatic habitat.

  Evaluation Criteria: Description of changes to ratio of habitat types (pools, riffles, runs, glides, and cascades); changes in streambed sediments (spawning habitat); changes in bank stability.

- Exploration drilling and construction of mine vent holes could temporally disrupt use of summer habitat by terrestrial species.

- Evaluation Criteria: Area and Duration of Avoidance by Affected Species.

1.8 CONTACTS MADE

A site visit was carried out by the Norwest project team to observe underground and surface conditions at the existing Skyline Mine and to observe the surface conditions over the Tract and adjacent areas.

The CFC Environmental Manager, Chris Hanson, assisted with providing data and information regarding environmental activities, data, and other relevant affairs at the Skyline Mine and the Tract.

FS and BLM personnel, along with the Utah Division of Wildlife Resources personnel, provided data and insights.

1.9 DESCRIPTION OF DATA

The following major sources of data were used in the study:

- the NorWest Geology, Mining, Subsidence and Seismicity Technical Report;
- aerial photographs flown in 1999;
- the 1998 CRF Burnout Creek Subsidence Study;
- Skyline Mine and CFC records and reports; and,
- technical papers and reports relating to studies carried out at other locations regarding relevant environmental activities.

1.10 METHODOLOGY

Geology and water resources in the study area have been described in the Geology, Mining, Subsidence and Seismicity and Water Resources Technical Reports (Norwest 2000) prepared concurrently with this Report. This Report incorporates information presented in those reports.

This Technical Report focuses on vegetative, terrestrial, and aquatic resources within the PFDS area. Specifically it will address those resources with the potential to be impacted by the proposed expansion of underground mining activity and associated surface disturbances as proposed.

Vegetative resources potentially affected include those riparian associated plant communities that are dependant on surface and groundwater recharge within the zone of impact of a reasonably foreseeable development scenario.

Wildlife and aquatic resources include fish, amphibians, and sensitive terrestrial species that might be impacted by the project, including roads, exploration drilling, ventilation shaft(s), and pipeline construction activities.

2.0 ISSUES WITH EVALUATION CRITERIA

The primary issues and respective evaluation criteria related to vegetative resources are:

- potential subsidence and other mining-caused changes (dewatering) to surface and ground water in the vicinity of the proposed action; and
- construction of a pipeline and/or roads in or across riparian areas and wetlands could destroy vegetation and related habitat and increase downstream sediment.

Evaluation criteria with which to evaluate effects on vegetation resources include:

- changes in species diversity and acres of vegetation affected by changes in surface and ground water regimes; and
- description of disturbance, area disturbed, duration of vegetative loss, and description of effects to aquatic species.

The primary issues with respect to wildlife and aquatic resources include:

- subsidence induced changes in water quality and quantity and its influence on distribution and abundance of riparian and/or wetland associated vegetation;
- topographic changes resulting from subsidence which could change stream morphology, aquatic habitat, and associated fish and wildlife habitat;
- disturbance from exploratory drilling and mine vent construction which could disrupt use of summer habitat by some terrestrial species; and
- impacts related to the point of mine water discharge which could affect aquatic and terrestrial wildlife species and habitat, including Yellowstone cutthroat trout.

Evaluation criteria with which to evaluate effects on wildlife and aquatic resources include:

- description of changes to distribution of habitat types; changes in streambed sediments (spawning habitat), and changes in bank stability;
- water quality of discharge water vs. aquatic life standards and other published sensitivity data for both acute and chronic levels;
- possible bioaccumulation of contaminants in the lake food chain;
- changes in lake turbidity (due to scouring of channel in Upper Huntington creek) and consequent changes in use of habitat in the upper portions of the reservoir and tributaries;
- area and duration of avoidance by affected species; and
- changes in sediment transport and yield in Huntington Creek below the reservoir and consequent changes in habitat, including distribution and quality of habitat features, filling of pools, stream bank erosion, and additional in-channel sediment production.

3.0 AFFECTED ENVIRONMENT

3.1 VEGETATION

Vegetation resources within the Flat Canyon Tract have been described and mapped to five general vegetative community types (USFS files). These five vegetative community types are: grasslands, meadows (includes wet meadows), sagebrush/grass, conifer/timber (includes juniper), and aspen (Figure 3.3). The approximate number of acres associated with each vegetative community within the approximately 8,800 acre area are presented in Table 3.1 (Canyon Fuel Company 1999).

Table 3.1
Acres of Vegetative Community Types In The Flat Canyon Tract, Utah As Defined By USFS

Vegetative Community	Acres
Grasslands	218
Meadows	180
Sagebrush/Grass	2081
Conifer-Timber	2412
Aspen	3868
Total	**8759**

Grassland communities in the area are dominated by slender wheatgrass (*Agropyron thachycaulum*), mountain brome (*Bromus carinatus*) and subalpine needlegrass (*Stipa lettermannii*). Forb species found in these grassland types include aster (*Aster spp.*), yarrow (*Achillea millefolium*), Indian paintbrush (*Castilleja spp.*), and fleabane (*Erigeron speciosus*) (Canyon Fuels Company 1999).

Primary species found in the dry meadow communities include Kentucky bluegrass (*Poa pratensis*), bentgrass (redtop) (*Agrostis alba*), and Ross sedge (*Carex rossii*). Wet meadow communities are composed primarily of species such as water sedge (*Carex aquatilus*), Nebraska sedge (*Carex nebraskensis*), beaked sedge (*Carex rostrata*), Baltic rush (*Juncus balticus*), bentgrass (redtop) and tufted hairgrass (*Deschampsia caespitosa*) (Canyon Fuels Company 1999).

Two species of sagebush dominate the sagebrush/grass communities. They are mountain big sage (*Artemesia tridentata var. vaseyana*) and silver sage (*Artemesia cana*). Grass species associated with the sagebrush type include slender wheatgrass, subalpine needlegrass, and sandberg bluegrass *(Poa secunda*). Other species commonly occurring within this community type include low rabbitbrush (*Chrysothamnus viscidiflorus*), Louisiana sagewort (*Artemesia ludioviciana*), aster, yarrow, Indian

paintbrush, western coneflower (*Rudbeckia occidentalis*), sweet cicely (*Osmoriza occidentalis*), and ligusticum (*Ligusticum porteri*) (Canyon Fuels Company 1999).

Conifer cover types in the area occur primarily on the upper sloping hillsides, typically on northern or eastern exposures. These sites are dominated by Englemann spruce (*Picea englemanni*) and subalpine fir (*Abies lasiocarpa*). Understory vegetation within these conifer stands varies in density and distribution, depending on canopy cover of the overstory. Representative species found in the understory includes gooseberry (*Ribes montigenum*), arnica (*Arnica cordifolia*), butterweed (*Senecio serra*), and lupine (*Lupinus alpestris*) (Canyon Fuels Company 1999).

The aspen (*Populus tremuloides*) community is the most common type within the tract and is dominated by mature aspen in the overstory. Dominant understory species found within the aspen type include snowberry (*Symphoricarpos oreophilis*), elderberry (*Sambucus racemosa),* Oregon grape (*Mahonia repens*), western coneflower, butterweed, columbia needlegrass (*Stipa columbiana*), and Kentucky bluegrass (Canyon Fuels Company 1999).

3.1.1 Riparian Communities

Riparian communities occur within all vegetative community types and are associated with stream and spring influence areas. The extent of these riparian communities varies from those areas directly adjacent to the stream channel to expanses of sub-irrigated acreage covering the entire drainage bottom. Hydrologic influence of these riparian cover types varies from direct stream influence, toeslope springs at the valley edges, springs and seeps, or as a result of a combination of surface and groundwater influences (see Water Resources Technical Report (NorWest 2000)).

Historic beaver activity in all drainages in the tract has had dramatic local influence on the extent and distribution of riparian vegetation to the extent that some residual riparian communities exist that extend the total drainage width (20-60 feet) in the middle reaches of Boulger Creek. Forested riparian cover occurs along the lower ½ mile of the south fork of Boulger Creek in Section 4, in the middle reaches of Swens Canyon and the upper reaches of Little Swens Canyon (Figure 3.4). These riparian communities are typically adjacent to the creek banks and vary in width from 2-10 feet on either side of stream channels.

Pothole type riparian communities also occur in otherwise upland cover types just below the reservoir in Boulger Canyon (Figure 3.5). These small wetland areas appear to be dependant on subsurface flows originating on the adjacent upland slopes, and comprise valuable

sagebrush/grassland associated riparian areas. The majority of acres of riparian associated communities in the area are found however within the meadow and grassland cover types in Boulger Canyon, Flat Canyon, lower Swens Canyon, and lower Little Swens Canyon drainages (Figure 3.5).

Table 3.2
Estimated Acres of Riparian Community Types found in Flat Canyon Tract, Utah

Drainage	Riparian Community Type	Estimated Acres
Boulger Canyon	Forested	2.0
	Meadow/Grassland	13.0
Flat Canyon	Forested	0
	Meadow/Grassland	9.0
Swens Canyon	Forested	0.5
	Meadow/Grassland	2.0
Little Swens Canyon	Forested	0.4
	Meadow Grassland	1.0
Total	Forested	2.9
	Meadow/Grassland	25.0

Species found in the drier fringe portions of these riparian communities include Kentucky bluegrass, red top, and Ross sedge. The wetter and interior portions of these communities contain primarily the following species; Booth willow (*Salix boothii*), geyer willow (*Salix geyeri*), cottonwood (*Populus spp.),* horsetail (*Equisetum arvense*), water sedge, Nebraska sedge, baltic rush, and tufted hairgrass.

3.1.2 Historic Disturbance

Grazing (primarily sheep) has occurred throughout the tract since at least the early 1900's and has in the past resulted in degraded streambank and riparian condition (USFS files). Since about the 1960s, reductions in grazing season length and intensity on area allotments has resulted in improved riparian condition (USFS files). Bank stabilization projects (e.g., willow plantings and organic rip rapping) have been implemented in Boulger, Swens, and Little Swens creeks with varying levels of success, though it is evident from field observation that recent bank stabilization has occurred in these drainages.

Level two riparian inventories conducted in Boulger Creek in 1991, in which data were collected on soil families, riparian vegetation, fish habitat, stream and streambank condition, and impacts of existing land use practices, summarized fish habitat and bank conditions in mainstem Boulger Creek (Raleigh Consultants 1992). Field evaluations of riparian condition and fish habitat in Boulger, Flat Canyon, Swens, and Little Swens were also conducted in 2000. Riparian condition throughout these drainages is generally considered good to excellent. Most reaches of all

area streams have fully vegetated banks which are currently stable. Vegetative cover on most streambanks appears to be vigorous, with little evidence of recent perturbances, other than localized sloughing actions. Fish habitat condition assessments are summarized below in the wildlife and Aquatics Resources section.

3.2 AQUATIC WILDLIFE RESOURCES

Upper Huntington Creek is the only disease free source of Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) in Utah (Canyon Fuels Company 1999). Boulger, Swens, and Little Swens Creeks are tributaries to Upper Huntington Creek and as such provide spawning habitat for cutthroat trout (Canyon Fuels Company 1999). Rainbow trout (*Oncorhynchus mykiss*) are also present in the system, and are stocked yearly in Boulger reservoir by the Utah Division of Wildlife Resources (UDWR). No other trout species of concern are known to inhabit the Upper Huntington Creek Watershed (Canyon Fuels Company 1999).

3.2.1 Fish Habitat Condition - Boulger Creek

Boulger Creek is located in the southern portion of the tract. It is a third order stream which flows approximately 4 miles west to east and drains into Electric Lake (Figure 3.6). Flat Canyon Creek enters Boulger Creek from the west approximately 1 mile upstream from the lake. Another tributary (South Fork) enters the channel from the south approximately 2.5 miles from the Lake (Figure 3.7). Boulger Reservoir is located between the two tributatries approximately 1 mile upstream from Electric Lake. Boulger Canyon is characterized by open grass and sagebrush meadows, an entrenched stream channel, and relatively stable banks.

The lower reaches, from Electric Lake to Boulger Reservoir, total approximately 5,000 feet in length and have an average gradient of 2-3 percent. Rosgen channel types found in these lower reaches are C3 and B3 (Rosgen 1996). The stream is 8-10 feet wide and is dominated by riffle and run habitat (approximately 90%) with some lateral scour and small plunge pools evident (10%). Stream depth varies from 6 inches to 2 feet. Substrate in the lower gradient areas (1-2% gradient) is composed of approximately 50% cobble in the 6-24 inch class, is well armored, and appears stable. Gravel (15%) and sand/silt (35%) were also present in the substrate during the 1991 survey, and appear to be distributed slightly differently at present (approximately 30% gravel and 20% sand/silt). Banks are well vegetated and stable, though evidence of previous bank instability does occur. As indicated earlier, historic bank stabilization projects (e.g., willow plantings and organic rip rapping) have been

implemented in this drainage. Cutthroat trout and sculpin (*Cottus bairdi*) were observed in these reaches.

While Raleigh Consultants (1992) reported excessive sediment in these reaches during their 1991 surveys, indications from this year's assessment are that instream sedimentation was less than excessive, though obviously, these data are difficult to compare due to variability in season of survey and yearly runoff conditions. Surveys conducted by the Utah Division of Wildlife Resources in 1986 (UDWR 1999) indicated that these reaches contained stable riparian zones, little or no erosion, 90-95% bank stability, good to excellent substrate (10-25% sand/silt), and poor bank shade (10-20%).

Boulger Creek above the reservoir contains four primary reaches for habitat comparison purposes. The first reach is approximately 1 mile long with an average gradient of about 1.5 percent. Riffle and run habitat dominates this reach, with pool habitat making up approximately 5 percent of its length. Stream depth is typically about 6 inches deep, though depth of some pools reaches up to two feet. The Rosgen channel type that typifies this reach is C3 with particle size in the substrate being dominated by 2-4 inch cobbles. Local sections in this stream reach contain varying amounts of cobble ranging from 6 to 12 inches in diameter. Overall stability of the channel is considered good. Undercut banks occur on approximately 90 percent of the reach and appear to provide good cover for fish observed there. Banks are predominately well vegetated with grass/sedge communities and are stable. Willow communities begin to occur along the stream approximately ½ mile up from Boulger Reservoir. Also in this area, evidence of historic bank stabilization activities, as discussed earlier, was found. Sediment was noted by the Raleigh (1992) survey, and was also evident, though not considered excessive, in slack water and pool areas during the 2000 assessment. Fish habitat surveys conducted by the Utah Division of Wildlife Resources in 1999 (UDWR 1999) indicate that from the reservoir to its headwaters, Boulger Creek contained good substrate (50-75% gravel/rubble/boulder, 25% sand/silt) and excellent cover (75-100%). Field observations in July 2000 showed an abundant population of cutthroat trout ranging from adult spawning trout to younger age classes (from field observations, R. Davies, pers. commun.).

The second reach above the reservoir begins at the creek's confluence with the southern tributary and is approximately 1,800 feet long. The gradient in this reach averages between 2 and 3 percent, though substrate composition varies considerably from 2 inch gravels to 12 inch and greater cobble/boulder material. Run and riffles make up approximately 60 percent of the habitat, with an increased representation of pools (approximately 40%) over the previous reach, apparently related to those areas with larger substrate (pool forming) material. The channel is typical

of a Rosgen B3 type (Rosgen 1996). Willow cover is prevalent in this reach as is evidence of historic and recent beaver (Castor canadensis) activity. The stream is fed in this reach by several springs and seeps adjacent to the channel in the valley toe slopes. Several cutthroat trout were observed in this reach. Sedimentation was noted by Raleigh Consultants (1992), and was attributed (potentially) to inactive beaver dams. Some sedimentation was also noted during 2000 in the pools within the reach, though no obvious sedimentation was observed in riffles or runs. Sediment sources are likely from erosion, including stream fords, gullies in existing roads, and unauthorized ATV use observed in the upper reaches.

The third reach above the reservoir is approximately 2,000 feet long and consists of a meandering C3 (Rosgen 1996) channel, approximately 10 feet wide and 6 inches deep. Riffles and runs comprise approximately 80 percent of the habitat in the reach with pools (primarily lateral scour pools at meander bends) comprising the remaining 20 percent of the reach. The substrate is made up primarily (50%) of 6-12 inch cobble, with approximately 20 percent sand and silt, and 35% gravel. Undercut banks are evident, but not dominant. Banks substrate appear stable. Sedimentation was noted as minor and appears to be related to bank sloughing at meander bends. Cutthroat trout on spawning redds were observed in this reach.

The stream channel in the fourth and final reach narrows and steepens to an average 6 percent gradient over approximately 5,000 feet. Rosgen channel types most typical of this stream segment are A2 or B2. These riffles make up nearly 90 percent of the habitat, with the remaining habitat comprised of small rock and boulder formed pools. Width is approximately 5 feet and depth ranges from 4 inches in the riffles to one foot deep in the pools. The substrate is dominated by large cobble (6 inches and greater), boulders, and bedrock. Sediment was not noted in this headwaters reach. Fish habitat appears limited due to shallow depth during most of the year, though use by fish during the early season is likely not limited.

South Fork Tributary

The lower reach of the south fork tributary is approximately 3,500 feet long. It is a Rosgen A3 channel type (Rosgen 1996) with an average width of 3-5 feet and depth of less than one foot. Substrate composition in this reach is primarily large cobble (greater than 6 inches) and boulders. There is also abundant large woody debris present in the channel from the adjacent spruce/fir community. Habitat quality for fish in this reach is poor, due to small stream size and low flow.

The upper reach of this tributary is approximately 500 feet long and originates and flows through a flat, wet, meadow. The stream in this area is approximately 1 foot wide and less than a foot deep. The substrate is composed of fine sand and silt and fish habitat is rated as poor. The Rosgen classification for this reach is C5 or E5.

Flat Canyon Creek

Flat Canyon Creek is a small tributary flowing from west to east into Boulger Creek approximately ¼ mile downstream of Boulger Reservoir (Figure 3.1). The creek originates from springs near the western edge of the Tract and flows approximately 1 1/4miles before its confluence with Boulger Creek. In its upper reach (approximately ¾ mile long) it has a gradient of less than one percent as it meanders through a flat valley bottom (Rosgen E5). Average width of the stream is about ten feet, though the wetted width of the floodplain in the upper reach is approximately 100 feet or more. Substrate is dominated by silt and sand, and fisheries habitat value is considered low due to slow moving water and siltation in the stream. Fish habitat in this reach is donimated by run features.

The lower reach of Flat Canyon Creek is a relatively incised channel (Rosgen B3) (approximately three feet wide and 1,200 feet long) that is constrained by highway 264 on its northern bank. The average gradient in this reach is three percent, and habitat is primarily riffle dominated, with occasional pools (<5%) formed as a result of rock and boulder substrate. The substrate is composed of 4-12 inch cobble and boulders and appears well armored and stable. Several cutthroat trout were observed in this reach. Vegetation associated with this reach is primarily sedge communities (*Carex nebraskensis, Carex aquatilis, Carex rostratum*), though willow clumps do occur. Banks are well vegetated and stable.

Swens Canyon

Swens Creek is a small third order tributary to Upper Huntington Creek that flows from west to east in the north central portion of the Tract. Reach one, beginning at the Highway 264 crossing, is a narrow (five feet wide) meandering channel with 75 percent undercut banks and multiple lateral scour pools at the meander bends. Habitat distribution in this stream is made up of approximately 80-90 percent runs and riffles and 10-20 percent pools. These pools range in depth from one to two feet. The reach length is approximately 4,000 feet.

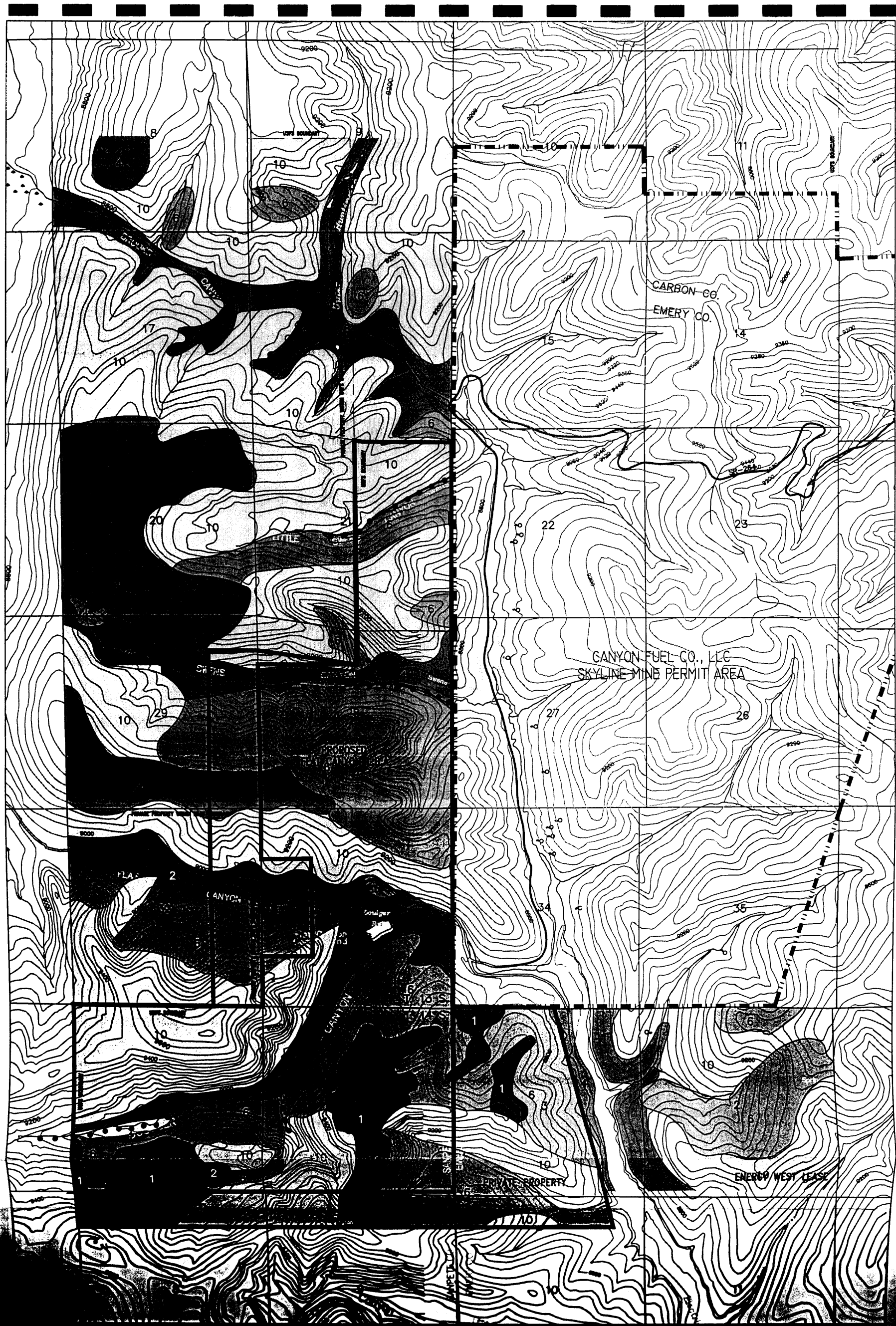


FIGURE 3.1

VEGETATIVE TYPES

DWG: VW3-1.DWG	SCALE 1" = 2000'	MAXIM TECHNOLOGIES INC.	NorWest
DATE: 10/18/2000			

The stream in this reach is incised approximately two feet below ground surface, and evidence of historic riparian degradation, perhaps due to grazing, and stream stabilization projects also occurs. The floodplain in this reach ranges up to 60 feet in width. Substrate consists of primarily 2-4 inch gravel and cobble with occasional areas of large (greater than 12 inch) boulders. The Rosgen channel type is C3 (Rosgen 1996).

A perennnial tributary enters the main drainage from the south approximately 1,000 feet from the beginning of reach one. The tributary extends approximately ½ mile to the south and west and appears to lack any suitable fish habitat value due to its small size.

Immediately upstream of its confluence with this small tributary in reach two, historic beaver activity (dams, lodges) is evident. Fish habitat in this reach is similar to that described for reach one in that meanders are still prevalent in the channel, but willow vegetation on the banks is more dominant than below in reach 1. Substrate is dominated by slightly larger cobbles in the 4-6 inch diameter range. Reach two extends for approximately 3,000 feet to its confluence with a second tributary, which enters the drainage from the north. Tributary two is a perennial A type channel (Rosgen 1996), and it appears to be too small to support quality fish habitat.

Upstream from its confluence with tributary two, the channel in reach three (approximately 1,000 feet long) narrows and willow vegetation along the channel becomes dominant. Channel dimensions in reach three are approximately six feet wide and six inches deep. Substrate is dominated by boulder and bedrock in places, which has prevented the downcutting that has been observed in other streams in the area. Beaver activity is prevalent in reach three, as are cutthroat trout.

Reach four begins at a small, willow/conifer lined, perennial stream that enters the main channel from the south and extends approximately 2,500 feet. Reach four is a low gradient (two percent), slightly meandering channel. Average depth is approximately six inches, and substrate material is predominately small (2-4 inch) cobble. One large beaver pond occurs in the middle of the reach and adult cutthroat trout were observed in the pond.

Reach five begins approximately 1 ¼ mile up the stream in the northeast portion of Section 10 (Figure 3.2). This reach is a narrow A2 channel type (Rosgen 1996) that does not appear to support fish habitat as its substrate is composed of large glacial till material (three feet diameter). The gradient is between 4 and 6 percent and bank vegetation is dominated by grasses and sedges. Several springs and seeps occur on the adjacent slopes in this reach.

Little Swens Canyon

Three reaches, approximately one mile in total length, were surveyed in Little Swens Creek. Evidence of historic beaver activity is common throughout this drainage. Reach one begins at the highway crossing and extends nearly ½ mile. It is an incised channel (two feet), B3 channel type (Rosgen 1996) with a floodplain width of approximately 30 feet. Substrate consists of 2-4 inch gravel and cobble with 12 inch boulders commonly occurring. Fish habitat consists primarily of shallow (6 inches or less) riffle habitat, though boulder associated plunge pools were also observed. Bank vegetation is dense and overhanging banks are common. Cutthroat trout are present in this reach.

Reach two narrows slightly and becomes a boulder and bedrock dominated channel (B2 channel type). Willows are prevalent and historic beavers dams appear to have influenced the channel to a large degree. This reach extends approximately 1,000 feet. A four foot high waterfall currently exists in the middle of the reach. The waterfall appears to have been formed by recent channel migration in the reach. No fish were observed above the waterfall.

Reach three is a very narrow A2 channel type that is dominated by large 6-24 inch boulders in the substrate, though bedrock substrate was also found in local areas within the reach. The average gradient is nearly 6 percent. Evidence of historic beaver dams also occurs in this reach. No fish were observed.

3.3 THREATENED, ENDANGERED, PROPOSED, AND SENSITIVE PLANTS

There are no known threatened, endangered, proposed, or sensitive plant species on the delineated tract (personal communication with Bob Thompson, Range Conservationist, Manti-LaSal National Forest, Price, Utah).

3.4 TERRESTRIAL WILDLIFE RESOURCES

The tract contains habitat for numerous wildlife species common to southeastern Utah, including amphibians, big game, furbearers, and raptors. Species of particular concern relative to land management in the area are the goshawk (*Accipiter gentilis*), flammulated owl (*Otus flammeolus*), and three-toed woodpecker (*Picoides tridactylus*), which have been designated as sensitive by the USFS, and for which habitat occurs in the area (USFS files).

An evaluation of U.S. Fish and Wildlife Service information indicates that the bald eagle (wintering populations only) is the only federally listed species with the potential to occur in the Upper Huntington drainage.

3.4.1 Goshawk

Goshawks breed in coniferous and mixed deciduous forests throughout much of North America (Reynolds et al. 1991) and have been documented as nesting in the area. Preferred habitat during the spring and summer breeding season is mature forests where the birds can maneuver in and below the canopy while foraging, and where large trees are available in which to build nests. In the Rocky Mountains, goshawks frequently nest in dense stands of mature lodgepole pine (*Pinus contorta*) or aspen trees in stands of mixed coniferous species (Jones 1979). Potential goshawk habitat occurs throughout the tract along upper slopes in all drainages. Of particular concern for this sensitive species is the avoidance of human disturbance (e.g., road building, mine vent construction) during the nesting and early post fledging periods (May through August), which could potentially cause nest failure.

3.4.2 Flammulated Owl

This small migratory forest owl is associated primarily with old growth an/or mature open growth stands of ponderosa pine (*Pinus ponderosa*), Douglas-fir (Pseudotsuga *menziesii*), true fir (*Abies spp.)*, or aspen. They are somewhat dependant for foraging habitat on a shrubby understory as they feed almost exclusively on small invertebrates (e.g, moths, beetles and grasshoppers) (DeGraaff et al. 1991). Nests are usually located in abandoned flicker or other woodpecker cavities in aspens, oaks, or pines.

Though no flammulated owls have been documented in the area suitable habitat is present and they are suspected to occur in upper slope aspen and mixed forest habitats.

3.4.3 Three-toed Woodpecker

Three-toed woodpeckers primarily inhabit coniferous forests of the west, where they rely on wood boring and bark beetles associated with beetle and fire related ecology. They occur throughout the Rocky Mountains in mixed conifer stands, including engelmann spruce (*Picea engelmanii*)/sub alpine fir (*Abies lasiocarpa*) and lodgepole pines, similar to those found on north and east slopes in the area. In Colorado, this species consumes spruce beetles (*Dendroctonus rufipennis*) for 65 percent of its annual diet and 99 percent of its winter diet (DeGraaff et al. 1991). Though not documented for the area, this species is suspected to occur there.

3.5 AMPHIBIANS

Though no sensitive amphibians are suspected to occur in the area of influence, known populations of boreal toads (*Bufo boreas*) occur in lower Boulger Canyon, and likely as well in some riparian habitats in the other area drainages (USFS files). Because of these species dependence on water and riparian associated habitats, any activities with the potential to influence the abundance or distribution of water in the area could indirectly impact amphibians. (See vegetation and riparian discussions above).

followup surveys showed potential habitat but no boreal toads. Spring 2001 USFS.

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5.0 DESCRIPTIO1N OF POTENTIAL EFFECTS

This technical assessment addresses the potential effects to vegetation, wildlife, and aquatic resources by alternative for the Reasonably Foreseeable Development Scenario for the Flat Canyon Tract Development. Issues specific to these resources as well as evaluation criteria by which this evaluation of potential impacts to these resources is found in Section 2.0 above. Potential impacts are derived primarily from information presented in the Water Resources and Geology and Subsidence Technical Reports prepared concurrent with this assessment (NorWest 2000).

5.1 VEGETATION

A discussion of anticipated changes in surface water quantity and quality in Eccles Creek and Electric Lake related to mine water discharge under all mining alternatives is discussed in Section 5.1 of the Surface and Groundwater Technical Report. The impacts to riparian vegetation associated with discharge related flow could include local increases in amount of streamside (riparian) vegetation due to increased subsurface water influence. The extent and duration of these impacts are, however, difficult to predict, due to the likelihood that mine water would only be pumped on an intermittent basis.

Alternative 2

Potential impacts to vegetation relate to changes in surface water distribution due to dewatering and subsidence. Under this alternative subsidence of perennial drainages, Boulger Dam, and Boulger Reservoir would not occur and morphological changes to streams and any corresponding water related impacts to vegetation (local pool formation) resulting from stream subsidence would not be expected.

Undermining and subsidence related impacts to springs and seeps throughout the tract would occur under this alternative, and the potential for reductions or other changes in surface recharge to wetlands and seeps would exist. It is estimated (see Water Resources Technical Report (NorWest 2000)) that there is a very low probability of perceptibly or quantifiably dewatering near surface groundwater systems as a result of mining-related subsidence and fracturing. Therefore, drawdown related impacts to riparian and wetland associated plant communities throughout the tract, are expected to be minor in nature under Alternative 2. There is however, the possibility that subsidence may cause some local alterations in groundwater flow direction, which may cause spring discharge

locations to shift. The actual locations of springs and/or seeps which may be impacted is however, not known.

Construction of the ventilation shaft, access road, and pipeline in the lower reach of Swens Canyon and along the highway in Upper Huntington Creek would temporarily disturb approximately 8 acres of native grass and shrub vegetation along the road and pipeline right-of-way. These ground disturbing activities could also increase the potential for noxious weed infestation in the Swens Canyon and upper Huntington drainages. Mitigation activities including revegetation of disturbed areas and weed management planning in the area would reduce the potential for erosion and weed related impacts resulting from road and pipeline construction.

Alternative 3

Potential impacts to vegetation under this alternative are:

- changes in stream and spring morphology related to subsidence; and
- impacts to vegetation associated with access roads, pipeline, and facility (ventilation shaft) construction.

Subsidence induced changes are described in the Geology and Subsidence Technical Report and include sequential lowering of surface features by up to 14 feet in affected drainages. These surface changes would likely influence instream morphology to some extent though actual water volume is not expected to change. Although changes to surface features are difficult to predict (see Geology and Subsidence Technical Report), stepwise subsidence within stream channels would likely result in local increases in pool and cascade habitat features. The amount of riffle habitat would be expected to decrease proportionally.

Ventilation shaft, access road, and pipeline construction in the lower reach of Swens Canyon and along the highway in Upper Huntington Creek would temporarily disturb approximately 8 acres of native grass and shrub vegetation along the road and in the pipeline right-of-way. An additional 7-8 acres of disturbance is expected due to exploratory drilling on the Tract. These ground disturbing activities could also increase the potential for noxious weed infestation in the Swens Canyon and upper Huntington drainages. Mitigation activities including revegetation of disturbed areas and weed management planning in the area would reduce the potential for erosion and weed related impacts resulting from road, pipeline, and facility construction.

5.2 AQUATIC RESOURCES

A discussion of anticipated changes in surface water quantity and quality in Eccles Creek and Electric Lake related to mine water discharge under all mining alternatives is discussed in Section 5.1 of the Surface and Groundwater Technical Report. The impacts to aquatic wildlife associated with discharge related flows could include local increases in aquatic habitat (based on higher flow and longer duration of flow), though the possibility that increased flow could influence sedimentation and erosion in some stream reaches also exists, as discussed in the Surface and Groundwater Technical Report. The extent and duration of these impacts are however difficult to predict, due to the likelihood that mine water would only be pumped on an intermittent basis.

Alternative 2

Potential impacts to wildlife and aquatic resources under this alternative are related to changes in water distribution and/or abundance due to mine dewatering activities. Under this alternative, subsidence of perennial drainages, Boulger Dam, and Boulger Reservoir would not occur, and morphological changes to instream habitat parameters (changes in distribution of pools, riffles, glides, and runs) and any corresponding water related impacts to bank vegetation resulting from stream subsidence would not be expected to occur.

Undermining and subsidence related impacts to springs and seeps throughout the tract would however, be expected under this alternative, and the potential for reductions or other changes in surface recharge to wetlands and seeps would exist. Drawdown related impacts to riparian and wetland associated plant communities throughout the tract are also expected, though as discussed above, drawdown related impacts, including alterations in groundwater flow direction and thus spring discharge points, are expected to be limited (NorWest 2000).

Exploratory drilling would disturb an estimated 7-8 acres within the Tract. Construction of the ventilation shaft, access road, and pipeline in the lower reach of Swens Canyon and along the highway in Upper Huntington Creek, would remove approximately 8 acres of native grass and shrub vegetation in the road and pipeline corridor, and temporarily disturb terrestrial wildlife using the lower Swens and Little Swens drainages during the six month duration of the construction. Sedimentation due to pipeline and road construction across Swens Creek would potentially enter Swens and Upper Huntington Creeks. Mitigation measures as described in the Mitigation and Monitoring section would reduce or eliminate the potential for adverse impacts due to sedimentation in these streams. These impacts would occur with both action alternatives.

Alternative 3

As described in the Water Resources section (NorWest 2000), it is expected that there is a very low probability that dewatering associated with implementing alternative 3 would perceptibly impact surface water flows in the Tract. The impact would likely not influence riparian and wetland vegetation associated with springs and seeps in the drainages. Subsidence induced changes as described in the Geology and Subsidence Technical Report (NorWest 2000) include lowering of surface features, (including streams) by up to 14 feet in all drainages. These surface changes would likely influence instream morphology (by increasing locally the extent of pool habitat), though actual water flow (as discussed above) is not expected to change. It is estimated that subsidence of the streams would result in an increase in the relative abundance of pool related habitat in affected streams, which, if flow continues and fish migration barriers are not formed, is not expected to negatively influence the overall fish habitat quality in the area. A discussion relative to the potential for more severe morphological changes (e.g that could serve as barriers to fish migration) is found in Section 5.2.2 of the Surface and Groundwater Technical Report. This report disclosed "Thus it is believed that although differential subsidence of perennial drainages above longwall-mined areas would occur under Alternative 3, these changes would generally be minor. If a major impact to stream morphology were to occur, the impacts would likely be short-lived".

Exploratory drilling would disturb an estimated 7-8 acres within the Tract. Construction of the ventilation shaft, access road, and pipeline in the lower reach of Swens Canyon and along the highway in Upper Huntington Creek, would disturb approximately 8 acres of native grass and shrub vegetation in the road and pipeline corridor and temporarily disturb terrestrial wildlife using the lower Swens and Little Swens drainages during the 6 month duration duration of the construction. These temporary impacts would occur with both action alternatives.

5.3 TERRESTRIAL RESOURCES

5.3.1 Goshawk

Potential impacts to goshawks, flammulated owls, and three-toed woodpeckers are similar for each of the action alternatives. These impacts would relate to the disturbance associated with the construction and maintenance of the ventilation shaft(s), the associated road(s), and the pipeline from Swens Canyon to Electric Lake. Because disturbance to these species during the early nesting season can cause reproductive failure, any construction that occurred between late April and late August would likely impact individual birds if any were nesting in the lower Swens and Little Swens drainages.

6.0 MITIGATION AND MONITORING

The following mitigation and monitoring measures are suggested as needed to reduce potential impacts to vegetation, aquatic, and/or terrestrial resources as described above and detect changes or damages to resources. They are not meant to substitute for Forest Plan standards and guidelines where they are less restrictive. They should be implemented where they are more restrictive than those measures found in the Forest Plan.

1) Long term monitoring program of springs and seeps should be implemented to evaluate short and long term impacts to springs and seeps from undermining, dewatering, and subsiding.

2) Revegetation of disturbed areas due to road, ventilation shaft(s), and pipeline construction. Requirements to be included are the use of native vegetation or sterile annual species. Include a weed management and monitoring plan for the road and pipeline corridors.

3) Apply Best Management Practices (e.g. silt fencing, straw bales, armored stream crossings) during construction of ventilation shaft access roads and pipeline construction activities to reduce potential for sediment input to perennial streams.

4) A long term program of fish habitat and water flow monitoring (pool/riffle ratios, substrate sampling) should be implemented to assess and define impacts related to undermining and subsiding the drainages.

5) Long term monitoring of stream flow with continuous record in Boulger Creek just above the reservoir in addition to continuous monitoring of an appropriate control stream should be implemented to assess subsidence related impacts on stream flow in Boulger Creek.

6) Seasonally restrict construction activities if monitoring indicates sensitive species use/nesting of the immediate area, and their response to disturbances. Monitor for 5 years if operations and maintenance activities are expected to be a major or continuous source of noise in the future. Implementing avoidance practices and seasonal construction requirements based on site specific surveys to locate nesting pairs of these species, would likely eliminate or reduce to minor, the potential impacts from the project.

APPENDIX A

EIS SUMMARY

EIS SUMMARY

Affected Environment

VEGETATION

This summary provides a description of the vegetative resources in the vicinity of the Flat Canyon Tract with the potential to be impacted by the Proposed Action and alternatives as described above. Vegetative resources potentially affected include those riparian associated plant communities that are dependent on surface flow and groundwater recharge within the zone of impact of a reasonably foreseeable development scenario. For a more detailed description of vegetative resources and a listing of scientific names of plant species in the area please see Technical Report for Vegetation and Wildlife (Norwest 2000)

Vegetation resources within the Flat Canyon Tract have been described and mapped to five general vegetative community types (USFS files, Norwest 2000)). The approximate number of acres associated with each vegetative community within the approximately 8,800-acre area are presented in Table 3.1.

Table 3.1
Acres of Vegetative Community Types In The Flat Canyon Tract, Utah As Defined By USFS

Vegetative Community	Acres
Grasslands	218
Meadows	180
Sagebrush/Grass	2081
Conifer-Timber	2412
Aspen	3868
Total	**8759**

Grassland communities in the area are dominated by slender wheatgrass, mountain brome, and subalpine needlegrass. Several forb species also occur in the grassland community type.

Primary species found in the dry meadow communities include Kentucky bluegrass, bentgrass (redtop), and Ross sedge. Wet meadow communities are composed primarily of species such as water sedge, Nebraska sedge, beaked sedge, and tufted hairgrass.

The sagebrush/grass communities are dominated by mountain big sage and silver sage. Grass species associated with the sagebrush type include slender wheatgrass, subalpine needlegrass, and sandberg bluegrass.

Conifer cover types in the area occur primarily on the upper sloping hillsides, typically on northern or eastern exposures. These sites are dominated by Englemann spruce and subalpine fir. Understory vegetation within these conifer

stands varies in density and distribution, depending on canopy cover of the overstory. Representative understory species include gooseberry, arnica, butterweed, and lupine.

The aspen community is the most common forested type within the tract and is dominated by mature aspen in the overstory with snowberry, elderberry, Oregon grape, and butterweed making up the primary species in the understory.

RIPARIAN COMMUNITIES

Riparian communities occur within all vegetative types and are associated with stream and spring influence areas. The extent of these riparian communities varies from those areas adjacent to the stream channel to expanses of sub-irrigated acreage covering an entire drainage bottom. Hydrologic influence of these riparian cover types varies from direct stream influence, toeslope springs at the valley edges, springs and seeps, or as a result of a combination of surface and groundwater influences (see Water Resources Technical Report (NorWest 2000)).

Historic beaver activity in all drainages in the tract has had dramatic local influence on the extent and distribution of riparian vegetation to the extent that some residual riparian communities exist that extend the total drainage width (20-60 feet) in the middle reaches of Boulger Creek. Forested riparian cover occurs along the lower ½ mile of the south fork of Boulger Creek in Section 4, in the middle reaches of Swens Canyon and the upper reaches of Little Swens Canyon. These riparian communities are typically adjacent to the creek banks and vary in width from 2-10 feet on either side of stream channels.

Pothole type riparian communities also occur in otherwise upland cover types below the reservoir in Boulger Canyon. These small wetland areas appear to be dependent on subsurface flows originating on the adjacent upland slopes, and comprise valuable sagebrush/grassland associated riparian areas. The majority of acres of riparian associated communities in the area are found however within the meadow and grassland cover types in Boulger Canyon, Flat Canyon, lower Swens Canyon, and lower Little Swens Canyon drainages. Table 1 displays estimated acres of riparian community types within the Flat Canyon Tract.

Table 1. Estimated Acres of Riparian Community Types found in Flat Canyon Tract, Utah

Drainage	Riparian Community Type	Estimated Acres
Boulger Canyon	Forested	2.0
	Meadow/Grassland	13.0
Flat Canyon	Forested	0
	Meadow/Grassland	9.0
Swens Canyon	Forested	0.5
	Meadow/Grassland	2.0
Little Swens Canyon	Forested	0.4
	Meadow Grassland	1.0
Total	Forested	2.9
	Meadow/Grassland	25.0

Historic Disturbance

To a large extent, current distribution of vegetation has been influenced by historic (natural and human related) disturbance. Grazing (primarily sheep) has occurred throughout the tract since at least the early 1900's and has in the past resulted in degraded streambank and riparian condition (USFS files). Since about the 1960s, reductions in grazing season length and intensity on area allotments has resulted in improved riparian condition (USFS files). Bank stabilization projects (e.g., willow plantings and organic rip rapping) have been implemented in Boulger, Swens, and Little Swens creeks with varying levels of success, though it is evident from field observation that recent bank stabilization has occurred in these drainages.

Level two riparian inventories conducted in Boulger Creek in 1991, summarized fish habitat and bank conditions in mainstem Boulger Creek (Raleigh Consultants 1992). Field evaluations of riparian condition and fish habitat in Boulger, Flat Canyon, Swens, and Little Swens were also conducted in 2000. Current riparian condition throughout these drainages is generally considered good to excellent. Most reaches of all area streams have fully vegetated banks which are currently stable. Vegetative cover on most streambanks appears to be vigorous, with little evidence of recent perturbances, other than localized sloughing actions. Fish habitat condition assessments are summarized below in the Wildlife and Aquatics Resources sections.

AQUATIC RESOURCES

Upper Huntington Creek is the only disease free source of Yellowstone cutthroat trout in Utah (Canyon Fuels Company 1999). Boulger, Swens, and Little Swens Creeks are tributaries to Upper Huntington Creek and as such provide spawning habitat for cutthroat trout (Canyon Fuels Company 1999). Rainbow trout are also present in the system, and are stocked yearly in Boulger reservoir by the Utah Division of Wildlife Resources (UDWR). No other trout species of concern are

known to inhabit the Upper Huntington Creek Watershed (Canyon Fuels Company 1999).

Fish Habitat Condition

Boulger Creek

Boulger Canyon is characterized by open grass and sagebrush meadows, a moderately entrenched stream channel, and relatively stable banks. Boulger Creek is a third order stream which flows approximately 4 miles west to east and drains into Electric Lake. Flat Canyon Creek enters Boulger Creek from the west approximately 1 mile upstream from the lake. Another tributary (South Fork) enters the channel from the south approximately 2.5 miles from the Lake. Boulger Reservoir is located between the two tributaries approximately 1 mile upstream from Electric Lake.

The lower reaches, from Electric Lake to Boulger Reservoir, total approximately 5,000 feet in length and have an average gradient of 2-3 percent. Rosgen channel types found in these lower reaches are C3 and B3 (Rosgen 1996). The stream is 8-10 feet wide and is dominated by riffle and run habitat (approximately 90%) with some lateral scour and small plunge pools evident (10%). Stream depth varies from 6 inches to 2 feet. Substrate in the lower gradient areas (1-2% gradient) is composed of approximately 50% cobble in the 6-24 inch class, is well armored, and appears stable. Gravel (15%) and sand/silt (35%) were also present in the substrate during the 1991 survey, and appear to be distributed slightly differently at present (approximately 30% gravel and 20% sand/silt). Banks are well vegetated and stable, though evidence of previous bank instability does occur. As indicated earlier, historic bank stabilization projects (e.g., willow plantings and organic rip rapping) have been implemented in this drainage. Cutthroat trout and sculpin were observed in these reaches.

While Raleigh Consultants (1992) reported excessive sediment in these reaches during their 1991 surveys, indications from this year's assessment are that instream sedimentation was light to moderate, though obviously, these data are difficult to compare due to variability in season of survey and yearly runoff conditions. Surveys conducted by the Utah Division of Wildlife Resources in 1986 (UDWR 1999) indicated that these reaches contained stable riparian zones, little or no erosion, 90-95% bank stability, good to excellent substrate (10-25% sand/silt), and poor bank shade (10-20%).

Boulger Creek above the reservoir contains four primary reaches for habitat comparison purposes. The first reach is approximately 1 mile long with an average gradient of about 1.5 percent. Riffle and run habitat dominates this reach, with pool habitat making up approximately 5 percent of its length. Stream depth is typically about 6 inches deep, though depth of some pools reaches up to two feet. The Rosgen channel type that typifies this reach is C3 with particle size

in the substrate being dominated by 2-4 inch cobbles. Local sections in this stream reach contain varying amounts of cobble ranging from 6 to 12 inches in diameter. Overall stability of the channel is considered good. Undercut banks occur on approximately 90 percent of the reach and appear to provide good cover for fish observed there. Banks are predominately well vegetated with grass/sedge communities and are stable. Willow communities begin to occur along the stream approximately ½ mile up from Boulger Reservoir. Also in this area, evidence of historic bank stabilization activities, as discussed earlier, was found. Sediment was noted by the Raleigh (1992) survey, and was also evident, though not considered excessive, in slack water and pool areas during the 2000 assessment. Fish habitat surveys conducted by the Utah Division of Wildlife Resources in 1999 (UDWR 1999) indicate that from the reservoir to its headwaters, Boulger Creek contained good substrate (50-75% gravel/rubble/boulder, 25% sand/silt) and excellent cover (75-100%). Field observations in July 2000 showed an abundant population of cutthroat trout ranging from adult spawning trout to younger age classes (from field observations, R. Davies, pers. commun.).

The second reach above the reservoir begins at the creek's confluence with the southern tributary and is approximately 1,800 feet long. The gradient in this reach averages between 2 and 3 percent, though substrate composition varies considerably from 2 inch gravels to 12 inch and greater cobble/boulder material. Run and riffles make up approximately 60 percent of the habitat, with an increased representation of pools (approximately 40%) over the previous reach, apparently related to those areas with larger substrate (pool forming) material. The channel is typical of a Rosgen B3 type (Rosgen 1996). Willow cover is prevalent in this reach as is evidence of historic and recent beaver activity. The stream is fed in this reach by several springs and seeps adjacent to the channel in the valley toe slopes. Several cutthroat trout were observed in this reach. Sedimentation was noted by Raleigh Consultants (1992), and was attributed (potentially) to inactive beaver dams. Moderate sedimentation was also noted during 2000 in the pools within the reach, though no obvious sedimentation was observed in riffles or runs. Sediment sources are likely from erosion, including stream fords, gullies in existing roads, and unauthorized ATV use observed in the upper reaches.

The third reach above the reservoir is approximately 2,000 feet long and consists of a meandering C3 (Rosgen 1996) channel, approximately 10 feet wide and 6 inches deep. Riffles and runs comprise approximately 80 percent of the habitat in the reach with pools (primarily lateral scour pools at meander bends) comprising the remaining 20 percent of the reach. The substrate is made up primarily (50%) of 6-12 inch cobble, with approximately 20 percent sand and silt, and 35% gravel. Undercut banks are evident, but not dominant. Banks and substrate appear stable. Sedimentation was noted as minor and appears to be related to bank sloughing at meander bends. Cutthroat trout on spawning redds were observed in this reach.

The stream channel in the fourth and final reach narrows and steepens to an average 6 percent gradient over approximately 5,000 feet. Rosgen channel types most typical of this stream segment are A2 or B2. These riffles make up nearly 90 percent of the habitat, with the remaining habitat comprised of small rock and boulder formed pools. Width is approximately 5 feet and depth ranges from 4 inches in the riffles to one foot deep in the pools. The substrate is dominated by large cobble (6 inches and greater), boulders, and bedrock. Sediment was not noted in this headwaters reach. Fish habitat appears limited due to shallow depth during most of the year, though use by fish during the early season is likely not limited.

South Fork Tributary

The lower reach of the south fork tributary is approximately 3,500 feet long. It is a Rosgen A3 channel type (Rosgen 1996) with an average width of 3-5 feet and depth of less than one foot. Substrate composition in this reach is primarily large cobble (greater than 6 inches) and boulders. There is also abundant large woody debris present in the channel from the adjacent spruce/fir community. Habitat quality for fish in this reach is poor, due to small stream size and low flow.

The upper reach of this tributary is approximately 500 feet long and originates and flows through a flat, wet, meadow. The stream in this area is approximately 1 foot wide and less than a foot deep. The substrate is composed of fine sand and silt and fish habitat is rated as poor. The Rosgen classification for this reach is C5 or E5.

Flat Canyon Creek

Flat Canyon Creek is a small tributary flowing from west to east into Boulger Creek approximately ¼ mile downstream of Boulger Reservoir (Figure 3.1). The creek originates from springs near the western edge of the Tract and flows approximately 1 1/4miles before its confluence with Boulger Creek. In its upper reach (approximately ¾ mile long) it has a gradient of less than one percent as it meanders through a flat valley bottom (Rosgen E5). Average width of the stream is about ten feet, though the wetted width of the floodplain in the upper reach is approximately 100 feet or more. Substrate is dominated by silt and sand, and fisheries habitat value is considered low due to slow moving water and siltation in the stream. Fish habitat in this reach is dominated by run features.

The lower reach of Flat Canyon Creek is a relatively incised channel (Rosgen B3) (approximately three feet wide and 1,200 feet long) that is constrained by highway 264 on its northern bank. The average gradient in this reach is three percent, and habitat is primarily riffle dominated, with occasional pools (<5%) formed as a result of rock and boulder substrate. The substrate is composed of

4-12 inch cobble and boulders and appears well armored and stable. Several cutthroat trout were observed in this reach. Vegetation associated with this reach is primarily sedge communities, though willow clumps do occur. Banks are well vegetated and stable.

Swens Canyon

Swens Creek is a small third order tributary to Upper Huntington Creek that flows from west to east in the north central portion of the Tract. Reach one, beginning at the Highway 264 crossing, is a narrow (five feet wide) meandering channel with 75 percent undercut banks and multiple lateral scour pools at the meander bends. Habitat distribution in this stream is made up of approximately 80-90 percent runs and riffles and 10-20 percent pools. These pools range in depth from one to two feet. The reach length is approximately 4,000 feet.

The stream in this reach is incised approximately two feet below ground surface, and evidence of historic riparian degradation, perhaps due to grazing, and stream stabilization projects also occurs. The floodplain in this reach ranges up to 60 feet in width. Substrate consists of primarily 2-4 inch gravel and cobble with occasional areas of large (greater than 12 inch) boulders. The Rosgen channel type is C3 (Rosgen 1996).

A perennial tributary enters the main drainage from the south approximately 1,000 feet from the beginning of reach one. The tributary extends approximately ½ mile to the south and west and appears to lack any suitable fish habitat value due to its small size.

Immediately upstream of its confluence with this small tributary in reach two, historic beaver activity (dams, lodges) is evident. Fish habitat in this reach is similar to that described for reach one in that meanders are still prevalent in the channel, but willow vegetation on the banks is more dominant than below in reach 1. Substrate is dominated by slightly larger cobbles in the 4-6 inch diameter range. Reach two extends for approximately 3,000 feet to its confluence with a second tributary, which enters the drainage from the north. Tributary two is a perennial A type channel (Rosgen 1996), and it appears to be too small to support quality fish habitat.

Upstream from its confluence with tributary two, the channel in reach three (approximately 1,000 feet long) narrows and willow vegetation along the channel becomes dominant. Channel dimensions in reach three are approximately six feet wide and six inches deep. Substrate is dominated by boulder and bedrock in places, which has prevented the downcutting that has been observed in other streams in the area. Beaver activity is prevalent in reach three, as are cutthroat trout.

Reach four begins at a small, willow/conifer lined, perennial stream that enters the main channel from the south and extends approximately 2,500 feet. Reach four is a low gradient (two percent), slightly meandering channel. Average depth is approximately six inches, and substrate material is predominately small (2-4 inch) cobble. One large beaver pond occurs in the middle of the reach and adult cutthroat trout were observed in the pond.

Reach five begins approximately 1 ¼ mile up the stream in the northeast portion of Section 10 (Figure 3.2). This reach is a narrow A2 channel type (Rosgen 1996) that does not appear to support fish habitat as its substrate is composed of large glacial till material (three feet diameter). The gradient is between 4 and 6 percent and bank vegetation is dominated by grasses and sedges. Several springs and seeps occur on the adjacent slopes in this reach.

Little Swens Canyon

Three reaches, approximately one mile in total length, were surveyed in Little Swens Creek. Evidence of historic beaver activity is common throughout this drainage. Reach one begins at the highway crossing and extends nearly ½ mile. It is a moderately incised channel (two feet), B3 channel type (Rosgen 1996) with a floodplain width of approximately 30 feet. Substrate consists of 2-4 inch gravel and cobble with 12 inch boulders commonly occurring. Fish habitat consists primarily of shallow (6 inches or less) riffle habitat, though boulder associated plunge pools were also observed. Bank vegetation is dense and overhanging banks are common. Cutthroat trout are present in this reach.

Reach two narrows slightly and becomes a boulder and bedrock dominated channel (B2 channel type). Willows are prevalent and historic beavers dams appear to have influenced the channel to a large degree. This reach extends approximately 1,000 feet. A four-foot high waterfall currently exists in the middle of the reach. The waterfall appears to have been formed by recent channel migration in the reach. No fish were observed above the waterfall.

Reach three is a very narrow A2 channel type that is dominated by large 6-24 inch boulders in the substrate, though bedrock substrate was also found in local areas within the reach. The average gradient is nearly 6 percent. Evidence of historic beaver dams also occurs in this reach. No fish were observed.

THREATENED, ENDANGERED, PROPOSED, AND SENSITIVE PLANTS

There are no known threatened, endangered, proposed, or sensitive plant species on the delineated tract (personal communication with Bob Thompson, Range Conservationist, Manti-LaSal National Forest, Price, Utah).

TERRESTRIAL WILDLIFE RESOURCES

The tract contains habitat for numerous wildlife species common to southeastern Utah, including amphibians, big game, furbearers, and raptors. Species of particular concern relative to land management in the area are the goshawk, flammulated owl, and three-toed woodpecker, which have been designated as sensitive by the USFS, and for which habitat occurs in the area (USFS files).

An evaluation of U.S. Fish and Wildlife Service information indicates that the bald eagle (wintering populations only) is the only federally listed species with the potential to occur in the Upper Huntington drainage.

Goshawk

Goshawks breed in coniferous and mixed deciduous forests throughout much of North America (Reynolds et al. 1991) and have been documented as nesting in the area. Preferred habitat during the spring and summer breeding season is mature forests where the birds can maneuver in and below the canopy while foraging, and where large trees are available in which to build nests. In the Rocky Mountains, goshawks frequently nest in dense stands of mature lodgepole pine or aspen trees in stands of mixed coniferous species (Jones 1979). Potential goshawk habitat occurs throughout the tract along upper slopes in all drainages. Of particular concern for this sensitive species is the avoidance of human disturbance (e.g., road building, mine vent construction) during the nesting and early post fledging periods (May through August), which could potentially cause nest failure.

Flammulated Owl

This small migratory forest owl is associated primarily with old growth an/or mature open growth stands of ponderosa pine, Douglas-fir, true fir, or aspen. They are somewhat dependant for foraging habitat on a shrubby understory as they feed almost exclusively on small invertebrates (e.g, moths, beetles and grasshoppers) (DeGraaff et al. 1991). Nests are usually located in abandoned flicker or other woodpecker cavities in aspens, oaks, or pines.

Though no flammulated owls have been documented in the area suitable habitat is present and they are suspected to occur in upper slope aspen and mixed forest habitats.

Three-toed Woodpecker

Three-toed woodpeckers primarily inhabit coniferous forests of the west, where they rely on wood boring and bark beetles associated with beetle and fire related ecology. They occur throughout the Rocky Mountains in mixed conifer stands, including engelmann spruce/sub alpine fir and lodgepole pines, similar to those

found on north and east slopes in the area. In Colorado, this species consumes spruce beetles for 65 percent of its annual diet and 99 percent of its winter diet (DeGraaff et al. 1991). Though not documented for the area, this species is suspected to occur there.

AMPHIBIANS

Though no sensitive amphibians are suspected to occur in the area of influence, known populations of boreal toads occur in lower Boulger Canyon, and likely as well in some riparian habitats in the other area drainages (USFS files). Because of these species dependence on water and riparian associated habitats, any activities with the potential to influence the abundance or distribution of water in the area could indirectly impact amphibians. (See vegetation and riparian discussions above).

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ENVIRONMENTAL CONSEQUENCES

DESCRIPTION OF POTENTIAL EFFECTS

This section describes the potential effects to vegetation, wildlife, and aquatic resources by each alternative for the Reasonably Foreseeable Development Scenario for the Flat Canyon Tract. Issues specific to these resources and evaluation criteria by which potential impacts are derived are also discussed. Potential impacts are derived primarily from information presented in the Water Resources and Geology and Subsidence Technical Reports prepared concurrent with this assessment (NorWest 2000).

ISSUES WITH EVALUATION CRITERIA

The primary issues and respective evaluation criteria related to vegetative resources are:

- potential subsidence and other mining-caused changes (dewatering) to surface and ground water in the vicinity of the proposed action; and
- construction of a pipeline and/or roads in or across riparian areas and wetlands could destroy vegetation and related habitat and increase downstream sediment.

Evaluation criteria with which the evaluation of effects was conducted include;

- changes in species diversity and acres of vegetation affected by changes in surface and ground water regimes; and
- description of disturbance, area disturbed, duration of vegetative loss, and description of effects to aquatic species.

The primary issues with respect to wildlife and aquatic resources include;

- subsidence induced changes in water quality and quantity and its influence on distribution and abundance of riparian and/or wetland associated vegetation;
- topographic changes resulting from subsidence which could change stream morphology, aquatic habitat, and associated fish and wildlife habitat;
- disturbance from exploratory drilling and mine vent construction which could disrupt use of summer habitat by some terrestrial species; and
- impacts related to the point of mine water discharge which could affect aquatic and terrestrial wildlife species and habitat, including Yellowstone cutthroat trout.

Evaluation criteria with which the evaluation of effects on wildlife and aquatic resources was conducted include;

- description of changes to distribution of habitat types; changes in streambed sediments (spawning habitat), and changes in bank stability;
- water quality of discharge water vs. aquatic life standards and other published sensitivity data for both acute and chronic levels;
- possible bioaccumulation of contaminants in the lake food chain;
- changes in lake turbidity (due to scouring of channel in Upper Huntington creek) and consequent changes in use of habitat in the upper portions of the reservoir and tributaries;
- area and duration of avoidance by affected species; and
- changes in sediment transport and yield in Huntington Creek below the reservoir and consequent changes in habitat, including distribution and quality of habitat features, filling of pools, stream bank erosion, and additional in-channel sediment production.

VEGETATION

A discussion of anticipated changes in surface water quantity and quality in Eccles Creek and Electric Lake related to mine water discharge under all mining alternatives is discussed in Section 5.1 of the Surface and Groundwater Technical Report. The impacts to riparian vegetation associated with discharge related flow could include local increases in amount of streamside (riparian) vegetation due to increased subsurface water influence. The extent and duration of these impacts are however difficult to predict, due to the likelihood that mine water would only be pumped on an intermittent basis.

No Action

Under the No Action alternative, no underground coal mining or associated facilities construction would occur in the Flat Canyon Tract. Mining related impacts to vegetative resources in the area would not occur.

Alternative 2

Potential impacts to vegetation relate to changes in surface water distribution due to dewatering and subsidence and impacts to vegetation associated with access roads, pipeline, and facility (ventilation shaft) construction. Under this alternative subsidence of perennial drainages, Boulger Dam, and Boulger Reservoir would not occur and morphological changes to streams and any corresponding water related impacts to vegetation (local pool formation) resulting from stream subsidence would not be expected.

Direct and Indirect Effects

Undermining and subsidence related impacts to springs and seeps throughout the tract would occur however, and the potential for reductions or other changes in surface recharge to wetlands and seeps would exist. It is estimated (see Water Resources Technical Report (NorWest 2000)) that there is a very low probability of perceptibly or quantifiably dewatering near surface groundwater systems as a result of mining-related subsidence and fracturing. Therefore, drawdown related impacts to riparian and wetland associated plant communities throughout the tract, are expected to be minor in nature under Alternative 2. There is however, the possibility that subsidence may cause some local alterations in groundwater flow direction, which may cause spring discharge locations to shift. The actual locations of springs and/or seeps which may be impacted is however, not known.

Construction of the ventilation shaft, access road, and pipeline in the lower reach of Swens Canyon and along the highway in Upper Huntington Creek would temporarily disturb approximately 8 acres of native grass and shrub vegetation along the road and pipeline right-of-way. An additional 7-8 acres of disturbance is expected due to exploratory drilling on the Tract. These ground disturbing activities could also increase the potential for noxious weed infestation in the Swens Canyon and upper Huntington drainages. Mitigation activities including revegetation of disturbed areas and weed management planning in the area would reduce the potential for erosion and weed related impacts resulting from road and pipeline construction.

Cumulative Effects

Cumulative effects to vegetation resources associated with Alternative 2 would include impacts associated with historic and existing activities in the area. The primary activity which has and could potentially impact vegetation in the area is grazing by domestic sheep. As discussed in the Affected Environment, historic livestock grazing has influenced vegetation by reducing vegetative cover (primarily riparian). Current grazing management has reduced the potential for grazing related impacts, and it is not anticipated that the additional mining related impacts would result in significant cumulative impacts to the area's vegetation.

Alternative 3

Potential impacts to vegetation under this alternative include changes in stream and spring morphology related to subsidence and impacts to vegetation associated with access roads, pipeline, and facility (ventilation shaft) construction.

Direct and Indirect Effects

Subsidence induced changes are described in the Geology and Subsidence Technical Report and include sequential lowering of surface features by up to 14 feet in affected drainages. These surface changes would likely influence instream morphology to some extent though actual water volume is not expected to change. Although changes to surface features are difficult to predict (see Geology and Subsidence Technical Report), stepwise subsidence within stream channels would likely result in local increases in pool and cascade habitat features. The amount of riffle habitat would be expected to decrease proportionally.

Exploratory drilling would disturb an estimated 7-8 acres within the Tract. Ventilation shaft, access road, and pipeline construction in the lower reach of Swens Canyon and along the highway in Upper Huntington Creek would temporarily disturb approximately 8 acres of native grass and shrub vegetation along the northwest facing slope and along the east facing slope adjacent to Upper Huntington Creek within the right-of-way of Highway 264.

Cumulative Effects

As discussed in the Affected Environment, historic livestock grazing has influenced vegetation by reducing vegetative cover (primarily riparian). Current grazing management has reduced the potential for grazing related impacts, and it is not anticipated that the additional mining related impacts as described above would result in significant cumulative impacts to the area's vegetation.

AQUATIC RESOURCES

A discussion of anticipated changes in surface water quantity and quality in Eccles Creek and Electric Lake related to mine water discharge under all mining alternatives is discussed in Section 5.1 of the Surface and Groundwater Technical Report. The impacts to aquatic wildlife associated with discharge related flows could include local increases in aquatic habitat (based on higher flow and longer duration of flow), though the possibility that increased flow could influence sedimentation and erosion in some stream reaches also exists, as discussed in the Surface and Groundwater Technical Report. The extent and duration of these impacts are however difficult to predict, due to the likelihood that mine water would only be pumped on an intermittent basis.

No Action

Under the No Action alternative, no underground coal mining or associated facilities construction would occur in the Flat Canyon Tract. Mining related impacts to aquatic resources in the area would not occur.

Alternative 2

Potential impacts to aquatic resources under this alternative are related to changes in water distribution and/or abundance due to mine dewatering activities.

Direct and Indirect Effects

Under this alternative, subsidence of perennial drainages, Boulger Dam, and Boulger Reservoir would not occur, and morphological changes to instream habitat parameters (changes in distribution of pools, riffles, glides, and runs) and any corresponding water related impacts to bank vegetation resulting from stream subsidence would not be expected to occur.

Undermining and subsidence related impacts to springs and seeps throughout the tract would however, be expected under this alternative, and the potential for reductions or other changes in surface recharge to wetlands and seeps would exist. Drawdown related impacts to riparian and wetland associated plant communities throughout the tract are also expected, though as discussed above, drawdown related impacts, including alterations in groundwater flow direction and thus spring discharge points, are expected to be limited (NorWest 2000).

Construction of the ventilation shaft, access road, and pipeline in the lower reach of Swens Canyon and along the highway in Upper Huntington Creek, would remove approximately 8 acres of native grass and shrub vegetation in the road and pipeline corridor during the six month duration of the construction. Sedimentation due to pipeline and road construction across Swens Creek would potentially enter Swens and Upper Huntington Creeks. Mitigation measures as described in the Mitigation and Monitoring section would reduce or eliminate the potential for adverse impacts due to sedimentation in these streams. These impacts would occur with both action alternatives.

Cumulative Effects

As discussed in the Affected Environment, historic livestock grazing has influenced local streambank stability by reducing vegetative cover along some portions of the streams. Current grazing management has reduced the potential for grazing related impacts however, and it is not anticipated that the additional mining related impacts as described above would result in significant cumulative impacts to the area's aquatic resources.

Alternative 3

As described in the Water Resources section (NorWest 2000), it is expected that there is a very low probability that dewatering associated with implementing alternative 3 would perceptibly impact surface water flows in the Tract. The impact would likely not influence riparian and wetland vegetation associated with springs and seeps in the drainages. Subsidence induced changes as described in the Geology and Subsidence Technical Report (NorWest 2000) include lowering of surface features, (including streams) by up to 14 feet in all drainages. These surface changes would likely influence instream morphology (by increasing locally the extent of pool habitat), though actual water flow (as discussed above) is not expected to change. It is estimated that subsidence of the streams would result in an increase in the relative abundance of pool related habitat in affected streams, which, if flow continues and fish migration barriers are not formed, is not expected to negatively influence the overall fish habitat quality in the area.

Exploratory drilling would disturb an estimated 7-8 acres within the Tract. Construction of the ventilation shaft, access road, and pipeline in the lower reach of Swens Canyon and along the highway in Upper Huntington Creek, would disturb approximately 8 acres of native grass and shrub vegetation in the road and pipeline corridor and potentially cause sediment to enter adjacent streams, either during construction or due to post-construction erosion. These temporary impacts would occur with both action alternatives. Mitigation measures as described in the Mitigation and Monitoring section would reduce or eliminate the potential for adverse impacts due to short and long-term sedimentation into these streams.

TERRESTRIAL WILDLIFE RESOURCES

Potential impacts to goshawks, flammulated owls, and three-toed woodpeckers are similar for each of the action alternatives. These impacts would relate to the disturbance associated with exploratory drilling activities the construction and maintenance of the ventilation shaft(s), the associated road(s), and the pipeline from Swens Canyon to Electric Lake. Because disturbance to these species during the early nesting season could cause territory abandonment and/or reproductive failure, any road construction or drilling activities that occurred between late April and early August would likely impact individual birds if any were nesting in the vicinity of the disturbance. Mitigation specific to these species includes site specific surveys following USFS protocols to locate breeding or juvenile birds and avoidance of occupied breeding territories during the breeding season.

No impacts to wintering or migrating bald eagles are anticipated under either alternative.

MITIGATION AND MONITORING

The following mitigation and monitoring measures are suggested as needed to reduce potential impacts to vegetation, aquatic, and/or terrestrial resources as described above and detect changes or damages to resources. They are not meant to substitute for Forest Plan standards and guidelines where they are less restrictive. They should be implemented where they are more restrictive than those measures found in the Forest Plan.

1) Long term monitoring program of springs and seeps should be implemented to evaluate short and long term impacts to springs and seeps from undermining, dewatering, and subsiding.

2) Revegetation of disturbed areas due to road, ventilation shaft(s), and pipeline construction. Requirements to be included are the use of native vegetation or sterile annual species. Include a weed management and monitoring plan for the road and pipeline corridors.

3) Application of Best Management Practices (e.g. silt fencing, straw bales, armored stream crossings) during construction of ventilation shaft access roads and pipeline construction activities to reduce potential for sediment input to perennial streams.

4) A long term program of fish habitat and water flow monitoring (pool/riffle ratios, substrate sampling) should be implemented to assess and define impacts related to undermining and subsiding the drainages.

5) Long term monitoring of stream flow with continuous record in Boulger Creek just above the reservoir in addition to continuous monitoring of an appropriate control stream should be implemented to assess subsidence related impacts on stream flow in Boulger Creek.

6) Seasonally restrict construction activities if monitoring indicates sensitive species use/nesting of the immediate area, and their response to disturbances. Monitor for 5 years if operations and maintenance activities are expected to be a major or continuous source of noise in the future. Implementing avoidance practices and seasonal construction requirements based on site specific surveys to locate nesting pairs of these species, would likely eliminate or reduce to minor, the potential impacts from the project.

Resource Element/Issue	Alternative		
	No Action	Alternative 2	Alternative 3
Vegetation	No Effect	Minor impacts related to drawdown but some local alterations in direction of groundwater flow could occur which could cause spring and seep discharge locations to shift. Local indirect impacts to spring and seep associated vegetation could occur. Approximately 16 acres of temporary surface disturbance associated with exploration roads, ventilation shaft, and pipeline construction. Revegetation of disturbed areas would reduce the extent and duration of the impact.	Minor impacts related to drawdown but some local alterations in direction of groundwater flow could cause spring and seep discharge locations to shift. Local indirect impact to spring and seep associated vegetation could occur. Local impact to streamside vegetation (wetting or drying) due to subsidence induced morphological changes could occur. Approximately 16 acres of temporary surface disturbance associated with exploration roads, ventilation shaft, and pipeline construction. Revegetation of disturbed areas would reduce the extent and duration of the impact
Aquatic Resources	No Effect	Undermining and subsidence related impacts to springs and seeps throughout the tract could include reductions or other changes to surface recharge to wetlands and seeps and changes in points of spring and seep discharge. Amphibian species associated with impacted springs could also be affected and would have to relocate. Approximately 16 acres of temporary surface disturbance associated with exploration, facilities, and pipeline construction could result in increased	Subsidence induced alteration to local stream morphology would likely occur by increasing the extent and or occurrence of pool habitat and reducing riffle habitat. If flow continues and fish migration barriers do not form, these are expected to be minor impacts. Amphibian species associated with impacted springs could also be affected and would have to relocate. Undermining and subsidence related impacts to springs and seeps throughout the tract could include reductions or

		sedimentation to adjacent streams. Mitigation measures would be required (including revegetation) to reduce sedimentation impacts to these streams.	other changes to surface recharge to wetlands and seeps and changes in points of spring and seep discharge. Approximately 16 acres of surface disturbance associated with exploration, facilities, and pipeline construction could result in increased sedimentation to adjacent streams. Mitigation measures would be required (including revegetation) to reduce sedimentation impacts to these streams.
Terrestrial Resources	No Effect	Short-term (6 months) disturbance impacts associated with exploratory drilling, facility, and pipeline construction. Mitigation to avoid occupied goshawk or other special status species territories during the breeding season would need to be implemented, including yearly surveys to document presence or absence of breeding pairs.	Short-term (6 months) disturbance impacts associated with exploratory drilling, facility, and pipeline construction. Mitigation to avoid occupied goshawk or other special status species territories during the breeding season would need to be implemented, including yearly surveys to document presence or absence of breeding pairs.

APPENDIX B

TABLE OF RESOURCE ELEMENT EVALUATION

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Resource Element/ Issue	Alternative		
	No Action	Alternative 2	Alternative 3
Vegetation	No Effect	Minor impacts related to drawdown but some local alterations in direction of groundwater flow could occur which could cause spring and seep discharge locations to shift. Local indirect impacts to spring and seep associated vegetation could occur. Approximately 16 acres of temporary surface disturbance associated with exploration roads, ventilation shaft, and pipeline construction. Revegetation of disturbed areas would reduce the extent and duration of the impact.	Minor impacts related to drawdown but some local alterations in direction of groundwater flow could cause spring and seep discharge locations to shift. Local indirect impact to spring and seep associated vegetation could occur. Local impact to streamside vegetation (wetting or drying) due to subsidence induced morphological changes could occur. Approximately 16 acres of temporary surface disturbance associated with exploration roads, ventilation shaft, and pipeline construction. Revegetation of disturbed areas would reduce the extent and duration of the impact.
Aquatic Resources	No Effect	Undermining and subsidence related impacts to springs and seeps throughout the tract could include reductions or other changes to surface recharge to wetlands and seeps and changes in points of spring and seep discharge. Amphibian species associated with impacted springs could also be affected and would have to relocate. Approximately 16 acres of temporary surface disturbance associated with exploration, facilities, and pipeline construction could result in increased sedimentation to adjacent streams. Mitigation measures would be required (including revegetation) to reduce sedimentation impacts to these streams.	Subsidence induced alteration to local stream morphology would likely occur by increasing the extent and or occurrence of pool habitat and reducing riffle habitat. If flow continues and fish migration barriers do not form, these are expected to be minor impacts. Amphibian species associated with impacted springs could also be affected and would have to relocate. Undermining and subsidence related impacts to springs and seeps throughout the tract could include reductions or other changes to surface recharge to wetlands and seeps and changes in points of spring and seep discharge. Approximately 16 acres of surface disturbance associated with exploration, facilities, and pipeline construction could result in increased sedimentation to adjacent streams. Mitigation measures would be required (including revegetation) to reduce sedimentation impacts to these streams.
Terrestrial Resources	No Effect	Short-term (6 months) disturbance impacts associated with exploratory drilling, facility, and pipeline construction. Mitigation to avoid occupied goshawk or other special status species territories during the breeding season would need to be implemented, including yearly surveys to document presence or absence of breeding pairs.	Short-term (6 months) disturbance impacts associated with exploratory drilling, facility, and pipeline construction. Mitigation to avoid occupied goshawk or other special status species territories during the breeding season would need to be implemented, including yearly surveys to document presence or absence of breeding pairs.

APPENDIX C

RESUMES

NAME	James D. Alto, P. E.
TITLE	Manager, Environmental Services
SUMMARY OF EXPERIENCE	Over 17 years experience in a variety of engineering roles in the mining and environmental fields. Licensed professional engineer and registered environmental manager with more than seven years management experience in environmental and engineering consulting. Extensive background in environmental compliance auditing, preparation of Plans and Operations, site reclamation design and bond calculations, financial analysis, project feasibility justification, project management, proposal development, NEPA, RCRA, and CERCLA. Proven leadership abilities with commitment toward the quality process and team management principles.
ACADEMIC AND PROFESSIONAL QUALIFICATIONS	B.S., Mining Engineering, University of Utah Licensed Engineer, State of Utah Registered Environmental Manager Certified Environmental Auditor Member Elect - Mining and Metallurgical Society of America (MMSA) Past Chair - Utah Section, Society of Mining Engineers (SME of AIME)
PROFESSIONAL HISTORY	1997-Present **NorWest Mine Services, Inc., Salt Lake City, UT** MANAGER, ENVIRONMENTAL SERVICES: Responsible for project management and engineering for a wide variety of mining and environmental projects. 1990 - 1997 **JBR Environmental Consultants, Salt Lake City, Utah** MANAGER, ENGINEERING & INVESTIGATION TEAM LEADER: Senior level management responsibility for all contracted environmental engineering projects including: tailings impoundment and heap each design, permitting and project management; ancillary facilities design and construction management; and design, installation and operation of environmental remediation systems. Directed engineering marketing efforts and long-range and short-range strategic planning. Staff totaled nine full time engineers, geologists, designers and drafters with annual revenues of over $900,000.

- Manager of Engineering for multi-phased tailings impoundment retrofit project resulting in client savings of more than $6 million in capital expenditures.
- Co-author of Utah's Division of Water Quality's Guidelines for Design, Construction and Operation of Heap Leach Facilities.
- Project Manager for renewal of three discharge permits for a major gold mine in central Nevada. Permit renewals submitted to and approved by Nevada's DEP.

1990 - 1991

Plexus Resources Corporation, Salt Lake City, Utah

MANAGER, PERMITTING AND ENVIRONMENTAL AFFAIRS:
Directed evaluations of environmental and regulatory requirements for properties and projects presented to company for purposes of joint ventures and acquisition consideration. Responsible for coordination of company's efforts for acquisition of permits for underground polymetallic mine which included cooperative involvement with federal (USFS) state and county agencies. Responsible for environmental compliance auditing of 110,000 ounce/yr gold operation in western Nevada.

1988 - 1990

Plexus Resources Corporation, Salt Lake City, Utah

MINING ENGINEER: Responsible for all ore reserve calculations,, mine planning, metallurgical evaluation, capital and operating expense cost estimation, and feasibility analysis for preparation of recommendations for future of properties and projects. Responsible for review, analysis and reporting of findings of mine plan efficiencies and operating performance of 110,000 ounce/yr gold mine in western Nevada.

1981 - 1988

Arentz Mining Engineers, Salt Lake City, Utah

MINING ENGINEER: Directed development and on-site implementation of gold tailings retreatment heap leaching project in Sonora, Mexico. Performed ore reserve calculations, mine planning and feasibility analysis on numerous national and international consulting assignments.

1980

Ranchers Exploration & Development Corp., Escalante Silver Mine

JUNIOR MINING ENGINEER

1979

Black Butte Coal Company, Black Butte Mine

JUNIOR MINING ENGINEER

NAME	Dr. C.B. (Conrad) Houser
TITLE	Vice President
SUMMARY OF EXPERIENCE	Internationally experienced mining engineer and manager with broad engineering, environmental, legal, marketing, planning, and financial experience as well as focussed skills in surface and underground mining of coal, oil shale and trona.
ACADEMIC AND PROFESSIONAL QUALIFICATIONS	M.S. (civil engineering - Rice University, Houston, Texas, 1969 B.S., U.S. Air Force Academy, Colorado Springs, Colorado, 1967 MBA course work, University of Utah, Salt Lake City, Utah, 1977 J.D. (Cum Laude), J. Reuben Clark Law School at BYU, Provo, Utah, 1975 Member of Utah State Bar U.S. Patent License Registered Professional Engineer in Colorado and Wyoming Certificated in Total Quality Management, Financial Analysis of Investments, Project Management, International Finance, Industrial Relations, Safety Supervision, Negotiation Techniques
PROFESSIONAL HISTORY	**1996 - Present** **NorWest Mine Services, Inc., Salt Lake City, Utah** VICE PRESIDENT: Provides mining, financial services, and project management. Recent assignments include preparing final EPC and contract mining documents for an Indian coal project; due diligences studies and appraisals; and project manager on Brazilian underground mining project. **1995 - 1996** **Rocky Mountain Leadership Institute, Casper, Wyoming** PRESIDENT: Consulting and training for businesses and governmental entities. Acquisition analysis and due diligence. Asset maximization. Marketing realignment. Strategic planning. **1993 - 1995** **Wold Trona Company, Inc., Casper, Wyoming** VICE PRESIDENT, CHIEF OPERATING OFFICER: Overall responsibility for integration of $200 million new mineral process technology development, design, financing, permitting, marketing, administration, and legal affairs.

MARKETING: Pre-sold 80% of initial 10 year's production via letters of intent: established strategy, introduced new project to market, initiated revision of industry specifications, established customer relations all leading to project revenue base loading.

ADMINISTRATION: Organized all office functions from ground zero to produce synergistic MIS, planning, accounting, budgeting, and associated functions.

PERMITTING: Orchestrated all aspects of permit preparation, review, and approval at minimal cost and record speed to clear the way for project construction.

ENGINEERING: Participated in process development, capital and operating cost reduction, process and mine design and engineering, construction of demonstration plant, preparation of bid packages, leading to success ful posturing of Engineering Procurement - Construction contract.

LEGAL: Developed in-house and through outside counsel partnership agreements (Limited Liability companies and Limited Partnerships) sales, contracts, Interior Board of Land Appeals defence, patent applications, engineering contracts, and the project financial prospectus.

1992
Drummond, Gillette, Wyoming
ENGINEERING & ENVIRONMENTAL MANAGER: After purchase of Mobil operations by Drummond, responsibilities included development of plans and permits to transition the Caballo Rojo Mine from truck and shovel to dragline operations.

1977 - 1991
Mobil Corporation
VICE PRESIDENT - ENGINEERING MANAGER, DENVER, COLORADO (1988 - 1991): Operations in Wyoming's Powder River Basin and Indonesia. Complete engineering, environmental, strategic planning and financial responsibility. Key participant in Booz, Allen, Hamilton strategic posturing project in New York City to determine whether Mobil should remain in the coal business. Recommended Mobil discontinue its coal focus unless it was willing to become a major player. Played a major role in the solicitation of buyers and the sale of Mobil's coal interests, netting $80 million in asset recovery. Quarterbacked lawsuit defending Mobil's integrity against claims of tortuous contract interference by a competitor.

ENGINEERING & ENVIRONMENTAL MANAGER, GILLETTE, WYOMING (1985 - 1987): Created $3 million unanticipated profit enhancement by changing mining location to better optimize returns from the operation - requires complete revision of both short and long term mining plans as well as major permit revision in record time. Made major operating changes to match coal quality to customer needs - necessitated changing both vertical and horizontal mining orientations. Development drilling techniques were significantly enhanced. Developed special software for selection of coal to yield increased profits though proper shipment scheduling. Truck and shovel operations were optimized.

Negotiated a win-win agreement out of deadlocked conflict saving over $1.3 million. Actively participated in marketing of coal. Led an environmental team to the only perfect record (zero notices of violation) in U.S. fossil fuelled mining history (over 280 inspections). Revitalized and empowered a stagnant engineering and environmental staff.

1982 - 1985

Mobil Synfuels, Denver, Colorado

VENTURE SERVICES ADVISOR: Led matrix organization including all reserve definition and underground mine planning supporting $6 billion project. Complete infrastructure alignment with mining and processing operations.

1980 - 1981

Mobil Corporation, Ndola, Zambia

MANAGING DIRECTOR/GENERAL MANAGER: Originated program for converting wasted flare-gas into replacement fuel for transportation with national hard currency savings estimated at $4 million per year. Pioneered transfer of wholesale metered distribution system into developing country, saving over $180,000 in annual operating cost. Coordinated legal, financial, and engineering activities for EPC blending and packaging plant in Zambia with revenue contribution projected at $8 million per year.

1977 - 1980

Australia Marketing Operations; Manager, Queensland, Brisbane

TERMINAL MANAGER: Dramatically improved customer and marketing support services and responsiveness. Resolved hot union conflicts and sustained peaceful and productive relationships, avoiding work stoppages and their attendant loss of revenue and market share. Reorganized production practices to dramatically reduce losses and costs.

1975 - 1977
Spafford, Nixon & Houser; Salt Lake City, Utah
LAW FIRM PARTNER

1971 - 1973
Nelson, Haley, Patterson & Quirk; Greeley, Colorado
ENGINEERING COORDINATOR

1968 - 1971
Captain, US Air Force; Tokyo, Japan
Headquarters Fifth Air Force
BASE ENGINEER

NAME	Kelly L. Payne
TITLE	Hydrogeologist
EDUCATION	M.S. Hydrogeology, Expected Graduation Date December 2000 Brigham Young University, Provo, Utah, Usa Thesis Title: *Occurrence and Geochemical Evolution of Shallow Groundwater in the Northern Altiplano, Bolivia: Implications for Groundwater Resource Development* B.S. Geology, 1994 Brigham Young University, Provo, Utah, USA
WORK EXPERIENCE	NorWest Mine Services, Inc, Salt Lake City, Utah, June 2000 to present. Mayo and Associates, LC, Lindon, Utah, April 1994 to June 2000, hydrogeologist, project manager, office manager
PROJECT EXPERIENCE	**Coal Mine Permitting** Supervised the preparation of Chapter 6 (Geology) and Chapter 7 (Hydrology) of the Mining and Reclamation Plan (MRP) for the new West Ridge Mine. Work was performed for WEST RIDGE Resources, Price, Utah. Supervised the investigation of groundwater systems, preparation of a statement of Probable Hydrologic Consequences (PHC), and a surface water and groundwater monitoring plan for existing coal leases and new properties acquired by the C.W. Mining Company, Huntington, Utah. Made a presentation at an Informal Conference before the director of UDOGM when the permit was protested. Characterized groundwater systems and evaluated the impacts of underground coal mining on surface water and groundwater at a number of mines in the Wasatch Plateau and Book Cliffs Coal Fields. Prepared a statement of the Probable Hydrologic Consequences (PHC) and a surface water and groundwater monitoring program, as required for a Mining and Reclamation Permit (MRP) by the Utah Division of Oil, Gas and Mining. These mines include:

Soldier Canyon Mine, Soldier Creek Coal Company, Wellington, Utah.
Skyline Mines, Canyon Fuel Company, Scofield, Utah
SUFCO Mine, Canyon Fuel Company, Salina, Utah
PacifiCorp Mines (Deer Creek, Cottonwood, and Trail Mountains), Huntington, Utah
Crandall Canyon Mine, GENWAL Resources, Inc, Huntington, Utah
Willow Creek Mine, Plateau Mining Corp., Helper, Utah

Supervised the investigation of potential impacts of longwall mining at the SUFCO Mine to the hydrologic balance of Box Canyon Creek, a perennial stream. Prepared a report summarizing impacts to cultural resources, riparian ecosystems, and hydrologic balance. The purpose of the investigation was to gain U.S. Forest Service consent to use longwall extraction to undermine the perennial stream. Evaluation performed for Canyon Fuel Company, Salina, Utah.

Investigated the source of large volume groundwater in-flows from faults in the West Elk Mine in order to predict future encounters and assess the hydrologic impacts of intercepting fault waters. This investigation was undertaken for Mountain Coal Company, Somerset, Colorado.

NEPA
Managed the preparation of technical reports and groundwater resource sections of Environmental Impact Statements for both The Pines and the Cottonwood Coal Lease Tracts. Work was performed for the Manti-La Sal National Forest as a third-party NEPA contractor.

Water Supply, Water Resources, and Water Rights
Performed a preliminary evaluation of the shallow groundwater resources and assessed the potential for contamination of shallow water wells in the northern Altiplano, Bolivia for the Benson Institute, a non-governmental organization based in Provo, Utah.

Managed the evaluation of background water quality and infiltration potential for a new sewage treatment facility in Cedar Valley, Utah. The project included the installation and sampling of monitoring wells and soil borings and in situ permeability tests.
Prepared Delineation Reports for the Drinking Water Source Protection Plan, required by the State of Utah for all public culinary water supplies. Work was completed for Skyline Mines and SUFCO Mine.

Preparing the Delineation Report and Drinking Water Source Protection Plan for Alpine Cove Water Company's culinary wells.

Characterized groundwater conditions in the New Harmony, Utah Area in order to help defend water rights held by the LDS Church. Gave oral testimony in deposition and at trial.

Hazardous Materials Investigations

Conducted geophysical investigations at several UST sites in Provo, Utah. The research evaluated the response of electrical resistivity (ER), very low frequency electromagnetic (VLF), and ground-penetrating radar (GPR) geophysical methods to shallow gasoline contamination.

Performed a characterization of groundwater flow regimes and the fate of hydrocarbon contamination in the Big Piney Oil and Natural Gas Field, Wyoming for Mobil Exploration and Producing, U.S.

Characterized the hydrogeology and extent of natural gas condensate contamination and prepared a groundwater monitoring plan for a natural gas production well site near Big Piney, Wyoming. Work was completed for Mobil Exploration and Producing, U.S. and Williams Field Services.

Provided technical and logistical support to the investigation of heavy metal contamination caused by irrigation with raw sewage in the Mezquital Valley north of Mexico City. This investigation was conducted by Brigham Young University and the University of Hidalgo in Pachuca, Hidalgo, Mexico. Performed initial project reconnaissance and provided verbal translation for BYU faculty.

Prepared a site characterization and groundwater monitoring plan for a hydrocarbon contaminated site at a natural gas compressor station in Wyoming. The project included the installation of monitoring wells, water quality sampling, and the review and analysis of historical data.

Managed the hydrogeologic characterization and hydrocarbon contamination evaluation at the Foundation Creek Natural Gas Compressor Station, Rangely, Colorado. This project involved the installation of monitoring wells and soil borings, chemical sampling, and preparation of final report. Work was completed for Williams Field Services.

Forensic Hydrogeology and Litigation

Participated in the hydrogeologic characterization and evaluation of the extent of Cr^{6+} contamination of an alluvial aquifer at Hinkley, California. The work was performed in support of the lawsuit Anderson v. PG&E and Aguyo v. PG&E. Complied a database from more than 80,000 pages of documents produced by the defendant. Produced maps, graphs, and interpretations that were used in the presentation of expert testimony.

Currently participating in the hydrologeologic characterization of evaluation of the extent of TCE and perchlorate contamination of aquifers supplying domestic water to the City of Redlands, California. Work is being performed in support of a class-action and direct-action lawsuit brought against Lockheed-Martin Corporation.

PUBLICATIONS

Benson, A.K., Payne, K.L., and Stubben, M.A., 1995, Detecting organic groundwater contamination using electrical resistivity and VLF surveys *in* Hinchee, R.E., Douglas, G.S., and Ong, S.K., eds., Monitoring and verification of bioremediation: Battelle Press, Columbus, p. 105-113.

Benson, A.K., Payne, K.L., and Stubben, M.A., 1997, Mapping groundwater contamination using dc resistivity and VLF geophysical methods—A case study: Geophysics, v. 62, n. 1, p. 80-86.

Mayo, A.L., Morris, T.H., Petersen, E.C., and Payne, K.L., 1997, Groundwater flow systems in the Utah Coal District: Proceedings Rocky Mountain Ground Water Conference, Boise, Idaho.

Natural Resource Specialist
Helena, Montana

EDUCATION

B.S. Biology, University of Oregon, 1982
M.A., Zoology/Wildlife Biology, University of Montana, 1985

CONTINUING EDUCATION

Range Vegetation Identification and Analysis, 1994
Sensitive Plant Identification, U.S. Forest Service (USFS), Northern and Rocky Mountain Regions, 1992
Threatened and Endangered Species Management, USFS, Northern Region, 1992
Procedures for Conducting Stand Examinations, USFS, Northern Region, 1988
Statistical Methods in Wildlife Research, 1986

QUALIFICATIONS SUMMARY

Mr. Mullen has over 15 years of professional experience in the areas of wildlife, fisheries, threatened and endangered animals and plants, range management, grazing systems, land management planning, fire planning, National Environmental Policy Act (NEPA) analysis, and monitoring. He is currently a project scientist responsible for environmental assessments (EAs), environmental baseline surveys and mine reclamation projects. Mr. Mullen has been a program manager for range and wildlife for USFS ranger districts, served on forest planning interdisciplinary teams, served as team leader for fire management planning projects, and large-scale ecosystem restoration planning projects. Mr. Mullen has also been the operations manager for a landscaping design and construction company.

PROFESSIONAL EXPERIENCE

Vegetation Studies/Management

- Lead biologist for environmental baseline surveys for the Dry Prairie Rural Water Project. Responsible for characterization of land use and vegetation resources within a four county area. Project involved compiling existing information and performing field reconnaissance to quantify and describe resources potentially impacted by project development. Unique features encountered included: prairie potholes, native grasslands, and sand dunes.

- Performing long-term revegetation monitoring on reclaimed mine disturbance in the New World Mining District Response and Restoration Project in southern Montana. Performing area-wide monitoring to identify barren areas and erosion features and conducted cover monitoring to quantify revegetation performance. Reclamation activities treated acid mine waste in high elevation environments. Results of monitoring include recommendations for response and restoration where past reclamation has failed. Revegetation monitoring will be performed over the 8-year life of the project.

- Designed and conducted field inventories for numerous species of plants as a USFS biologist or technician since 1988. Baseline survey results were used to determine habitat associations, aid in forest management project design, and determine potential impacts to the various species from forest and range management projects, including timber sales, prescribed burning projects, and recreation and ski area development. Work performed in conjunction with environmental assessments as well as programmatic forest management and forest management plan monitoring.

- Conducted rangeland vegetation surveys and analysis in northwestern Colorado for the USFS. These inventories involved collecting data on species cover/frequency for development of management plans on individual grazing allotments. Data results were used to assess vegetation condition, seral stage, and grazing capacity on the allotments totaling about 200,000 acres.

- As a USFS range management specialist, participated in yearly utilization monitoring on grazing lands utilized by sheep and cattle in northwestern Colorado. Measurements were taken on permanent transects for quantifying biomass and forage utilization on about 5,000 acres of montane grasslands each year.

- Designed, planned, and implemented range improvement projects, including off-channel stock water pits, drift fencing, noxious weed control. Projects were planned based on analysis and monitoring data as part of duties as Rangeland Management Specialist on the Routt National Forest.

- Revegetation coordinator for ski area, road rehabilitation, and grazing-related revegetation projects. Included species selection, fertilizer selection and soil augmentation needs analysis. Work performed as part of duties as Rangeland Management Specialist on the Routt National Forest.

- Crew leader for stand exams performed on the Idaho Panhandle National Forest for use in forest management and forest management plan monitoring. Responsible for field data collection preparation, supervision of field crews and QA/QC. Involved collection of ECODATA plot data. Project spanned two field seasons.

- Responsible for design, implementation, and monitoring of several restoration-related projects associated with the Hayden Gulch Mine, county highway development, and numerous construction and development activities in northwest Colorado. Projects involved soil preparation, seeding, shrub planting, mulching, and yearly monitoring on project sites that ranged from one to several hundred acres.

Fisheries Studies/Management

- Lead biologist for environmental baseline surveys for the Dry Prairie Rural Water Project. Responsible for characterization of fisheries resources within a four county area. Project involved compiling existing information and performing field reconnaissance to quantify and describe resources potentially impacted by project development. Unique features encountered included pallid sturgeon, a special status species.

- Designed and conducted field inventories for numerous species of fish as a USFS biologist or technician since 1988. Survey results were used to determine habitat associations, aid in forest management project design, and determine potential impacts to the various species from forest and range management projects, including timber sales, prescribed burning projects, and recreation and ski area development.

- Served as contracting officer's representative and technical reviewer for a contract in which approximately 1,500 miles of stream survey and fisheries habitat inventory were conducted in the St. Joe and Little Clearwater drainages in north Idaho. Involved R1/R4 fisheries habitat assessments, snorkel surveys, hydrologic characterizations, and channel stability analyses. Responsible for validation data collection, inspection, and QA/QC of contractor's work product.

- Performed fish population surveys as part of baseline data collection and monitoring in conjunction with FERC projects on the lower Flathead River. Involved sampling using electrofishing gear to document composition of native and non-natives species in assessing potential impacts on bull trout from pike.

- As a member of the Lake County Conservation District Board of Supervisors for two years, responsible for field review of several streambank modifications projects for compliance with the Montana Natural Streambed and Land Preservation Action (310 permits). The reviews and on-site inspections of the projects formed the basis by which they were either approved, modified, or denied.

- Project manager for streambank reconstruction project on the Lower Fish Hook Creek and Quartz Creeks on the St. Joe National Forest. Work performed as part of forest-wide habitat improvement initiative and involved instream construction of channel, structures, anchored logs, drop structures, and sediment traps to develop cover and pool habitat.

Wildlife Studies/Management

- Lead biologist for environmental baseline surveys for the Dry Prairie Rural Water Project. Responsible for characterization of wildlife resources within a four county area. Project involved compiling existing information and performing field reconnaissance to quantify and describe resources potentially impacted by project development. Unique features encountered included: prairie potholes, native grasslands, sand dunes, waterfowl production and special status species (pallid sturgeon, piping plover, mountain plover and interior least tern).

- Completed wildlife resource surveys in association with a proposed federal land exchange on the Gallatin National Forest in south central Montana. Review of wildlife survey data, review of biological assessments and field reconnaissance was conducted to characterize wildlife resource values in the upper Paradise valley. Species of concern included elk, grizzly bear, gray wolf, wolverine, and lynx.

- Designed and conducted field inventories for numerous species of wildlife as a USFS biologist or technician since 1988. Survey results were used to determine habitat associations, aid in forest management project design, and determine potential impacts to the various species from forest management projects, including timber sales, prescribed burning projects, and recreation and ski area development.

- Designed and conducted research on ospreys, bald eagles, and boreal owls in western Montana. The bald eagle and osprey research focused on the ecology of these species as it related to water level fluctuations and prey availability for a Federal Energy Regulatory Commission (FERC) re-licensing action. The boreal owl research involved data collection on distribution and habitat selection on Beaverhead and Bitterroot National Forests in Montana.

- Performed NFMA big game surveys tracking elk habitat use and migration in portions of the Pintler Wilderness Area. Project involved transect surveys and mapping on over 100,000 acres of elk winter range, summer range, and general use areas.

- Responsible for tape playback surveys for gray wolf, goshawk, pileated woodpecker, blackbacked woodpecker, boreal owl, and flamulated owl as part of baseline surveys for timber-related management. Surveys were conducted over a 170,000 acre area in support of watershed analyses.

- Conducted summer and winter wolf and pine martin surveys as part of forest plan monitoring on the St. Joe and Routt National Forests. Snow tracking surveys were performed using snowmobiles covering about 100 transect miles per week. Baited trip cameras were maintained to document summer use.

- Performed weekly aerial surveys of big horn sheep, goat, bald eagle, and elk as part of winter habitat use surveys on the St. Joe National Forest and Flathead Indian Reservation. Process involved developing statistically-based population estimates from transect survey data.

Wetland Management/Studies

- Performed wetlands mapping and inventory as part of an environmental site assessment for the Deadrock Ranch in south central Montana. Involved characterization of a variety of slope and riparian wetlands as well as those associated with man-made impoundments. Project resulted in recommendations for project development and permitting.

- Lead biologist for wetland delineation and 401(b) permitting in association with proposed reroute of the NARCo Pipeline. Work performed in the glaciated wetlands region of northeast Montana. Responsible for all permit preparation and served as a liaison between the client and the U.S. Army Corps of Engineers.

- Biological sciences coordinator responsible for preparation of 401(b) permits for mine disturbance at the Luzenac Mine site in south central Montana. Project included functions and values assessments and will require development of mitigation plans and water quality certification.

- Responsible for preparation of 404 permits in conjunction with range improvement projects on the Routt National Forest. Involved wetland delineation and necessary analysis to satisfy forest plan requirements and U.S. Army Corps of Engineer regulations.

Resource Management Planning

- As team leader, implemented and coordinated a large-scale ecosystem restoration project on 20,000 acres for the Routt National Forest in northwestern Colorado. Coordination involved bringing together multi-agency, public, and private parties to begin data collection and project design for soil and vegetative restoration of the area. The area contained five grazing allotments and multiple state and federal wildlife, fish, and plant species of concern. Collated information from the various disciplines involved, and produced a project charter and grant proposal for long-term implementation and monitoring of the project.

- Served as an ad hoc member of the Routt National Forest planning team during the 1998 revision of the forest plan. Primary role was to collaborate with planning team members on issues relating to sensitive and management indicator species during the formation of the plan. Also participated in identification of suitable and available lands for timber harvest that were mapped for the forest.

- Team member on the Medicine Bow National Forest plan revision team. Responsible for issues related to wildlife and threatened and endangered species, particularly regarding analysis pertaining to population viability for these animals. Included habitat and population modeling to assess fragmentation and distribution resulting from alternative management scenarios.

- Assistant project manager responsible for performing watershed analysis on 170,000 acres of checkerboard ownership in several drainages of the St. Joe and Clearwater Rivers. Performed data compilation, field data collection, and analysis to characterize watersheds, describe current and reference conditions, and to develop management recommendations to guide forest management activities and watershed restoration. All analyses were performed according to the Federal Guidelines.

- Interdisciplinary team leader and planning specialist for development of a wildland fire use plan and the associated environmental assessment for the Routt National Forest. Responsible for directing analysis and production according to the Federal Wildland Fire Management Policy.

Environmental Impact Statements/Environmental Assessments

- Biological sciences coordinator for an environmental impact statement addressing proposed mine expansion at the Santa Rita and Cobre Mine in central New Mexico. These mines represent the largest copper developments in North America. Project involves addressing vegetation, wildlife, and wetlands including locally sensitive bats, amphibians, and plants.

- Lead natural resource specialist performing an EA of fire management plans for the Yakama Reservation in south central Washington. Address potential risks and benefits of fire use to commercial timber, cultural resources, ethnobotanial resources, and traditional fisheries. Involves addressing values at risk and potential fire behavior resulting from suppression, prescribed fire, and wildland fire use.

- NEPA specialist for wildlife, fish, rare plants for numerous environmental analyses pertaining to timber management, range management and recreation development for nine years. Representative projects included:

    - Tourist Creek Helicopter Timber Sale, Idaho Panhandle National Forest;
    - Beetle Juice Helicopter Timber Sale, Idaho Panhandle National Forest;
    - Rocket Run Timber Sale, Idaho Panhandle National Forest;
    - Municipal Reservoir Expansion, City of Streamboat Springs and Routt National Forest;
    - Lake Catamount Ski Area, Routt National Forest;
    - Steamboat Ski Area Expansion, Routt National Forest;
    - Numerous Grazing Allotment Management Plans, Routt National Forest; and
    - Idaho Panhandle Douglas-fir Bark Beetle Project; Idaho Panhandle National Forest.

PROFESSIONAL EMPLOYMENT HISTORY

1999 - Present	Project Scientist, Maxim Technologies, Inc.
1998 - 1999	Wildlife Biologist, Ecosystem Planning Specialist, USFS
1997 - 1998	Range Program Manager, USFS
1996 - 1998	Operations Manager, Routt County Landscaping, Steamboat Springs, Colorado
1993 - 1996	Wildlife Biologist/Range Management Specialist, USFS
1990 - 1993	Wildlife Biologist, USFS
1988 - 1990	Forestry Technician, USFS
1985 - 1988	Research Biologist, Bureau of Indian Affairs, Pablo, Montana

NorWest
Mine Services, Inc.

OCT 2 0 2000

October 18, 2000

Carter Reed
Forest Geologist
USDA Forest Service
599 West Price River Drive
Price, UT 84501

Dear Carter:

Enclosed are four copies of the Final Technical Report on Vegetation and Wildlife. The other copy will be delivered to BLM.

The Subsidence and Hydrology Reports will follow tomorrow or later this week.

Our responses to each of your comments is attached to this letter.

We will look forward to your final approval of this report. Copies of references will provided before the end of the month..

Please contact me if you have any questions.

Yours truly
NorWest Mine Services, Inc.

Conrad B. Houser
Vice President

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Calgary · Pittsburgh · Calcutta

USFS Comments
Flat Canyon Tract Technical Reports
Final Draft Review

9/28/2000

II. Vegetation and Wildlife

1. The potential effects to riparian vegetation and aquatic wildlife from increased mine water discharge to Eccles Creek or from shifting discharge from Eccles Creek to Upper Huntington Creek/Electric Lake have not been evaluated and need to be added.

NorWest response: A discussion of these effects was added to Sections 5.1 and 5.2 as well as the EIS Summary.

2. The potential for differential subsidence in streams to cause fish barriers is mentioned. The potential for this to occur, the effects, duration of effects need to be addressed.

NorWest response: A discussion of barriers was added to Section 5.2, Alternative 3.

3. See the above comments regarding the use of terms such as "moderate effects". These need to be used consistently throughout the Technical Reports and Summaries and must be defined.

NorWest response: The word moderate has been deleted from the Report.

4. The map identified as Figure 3.1 is excellent. A legible black and white version of this map is needed for the EIS summary that can be easily copied and incorporated into the EIS. The vegetation information on the map must be extended to south to completely cover the RFDS area.

NorWest response: The map area has been extended. A legible black and white version has been provided for your reproduction needs.