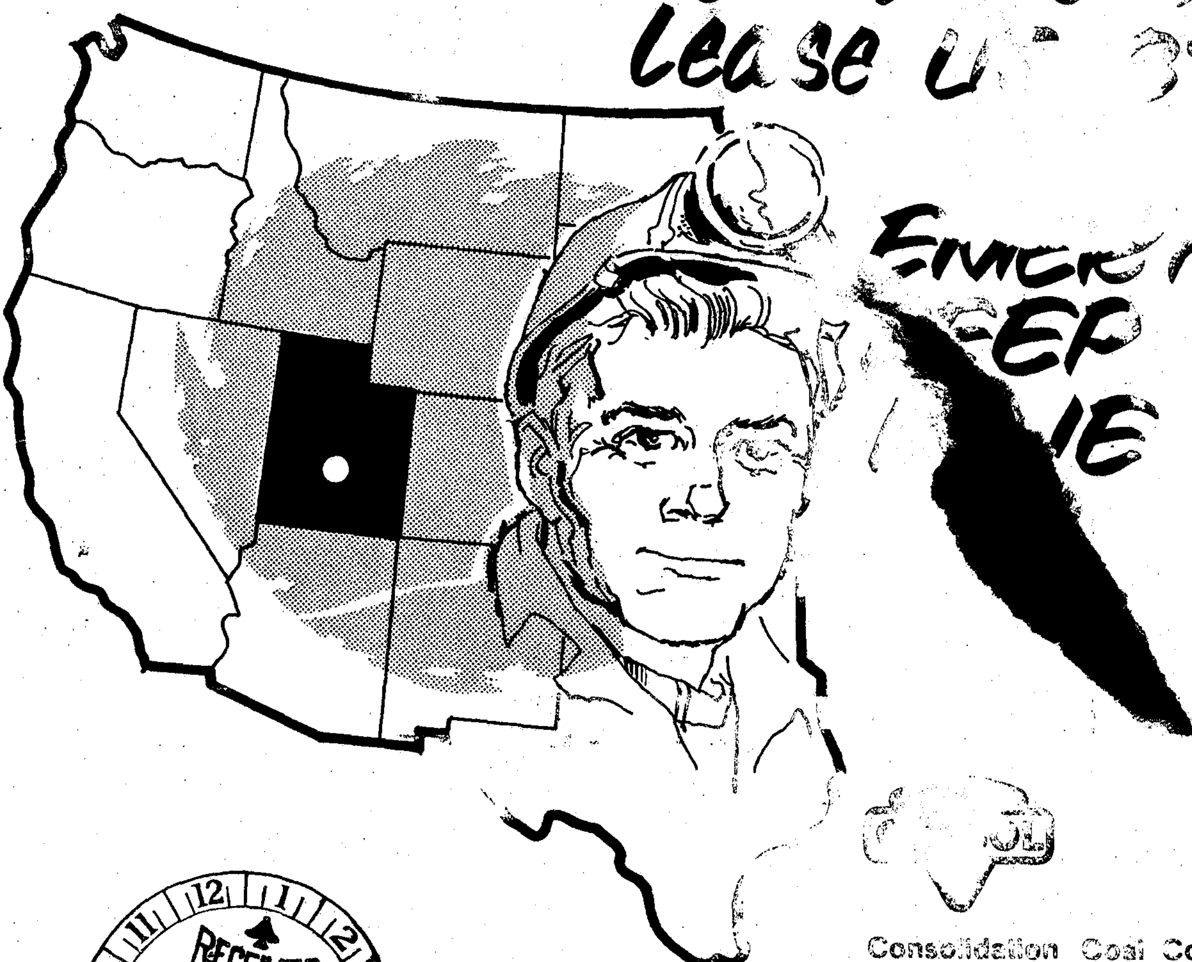
MINING & RECLAMATION PLAN for

Federal Coal Lease U-[illegible]37



Emery Deep Mine

Consolidation Coal Company
Western Region
2 Inverness Drive East
Englewood, Colorado 80110

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DIVISION OF OIL, GAS, & MINING

Ron Hughs
Engineer
286-2301

INTRODUCTION

The information contained herein is presented by Consolidation Coal Company (Consol) in accordance with the applicable regulations [1] of the United States Department of the Interior, Geological Survey, as an underground mining and reclamation plan for Federal Coal Lease U-5287 to be affected by Consol's Emery Deep Mine.

The Emery Deep Mine is an existing underground coal mining operation, located approximately four miles south of Emery, Utah. Originally, the Emery Deep Mine was known as the Browning Mine which first opened in 1881 and intermittingly produced coal until 1930. Since 1930, there has been a constant production of coal from the mine. Consol and the Kemmerer Coal Company (Kemmerer) purchased the original Browning Mine in May of 1975, and Consol, the operating partner of the joint venture between Consol and Kemmerer, has been mining coal from the Emery Deep Mine since that time.

In July of 1970, Consol and Kemmerer were jointly issued Federal Coal Lease U-5287. The lease area covers approximately 720 acres, containing parts of Sections 19, 20 and 29, T22S, R6E (Salt Lake Meridan, Utah).

(1) Title 30 - Mineral Resources
Chapter II - Geological Survey, Department of the Interior
Part 211 - Coal Mining Operating Regulations

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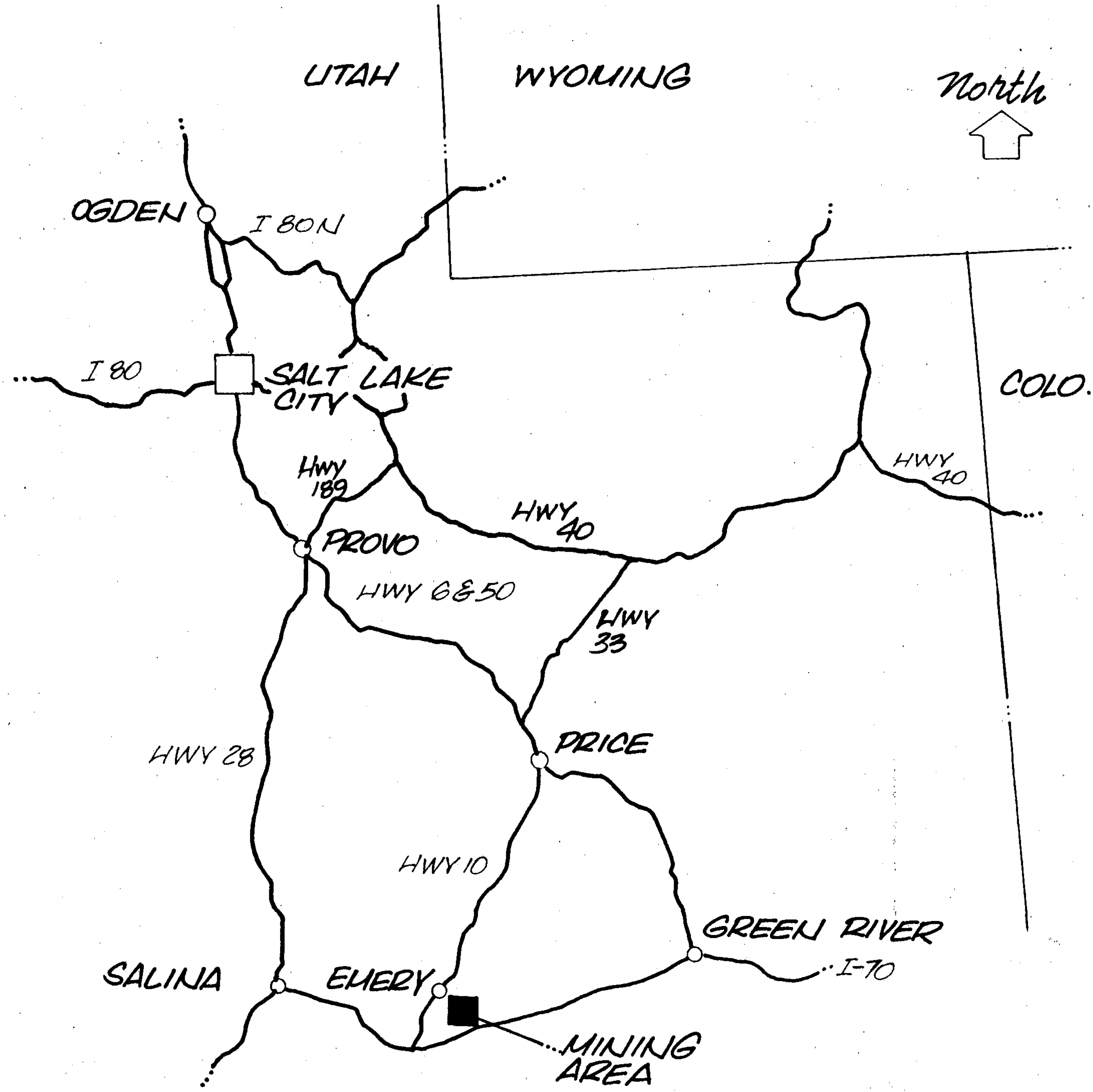


Figure 1
GENERAL AREA MAP

CONSOLIDATION COAL CO.
Western Region

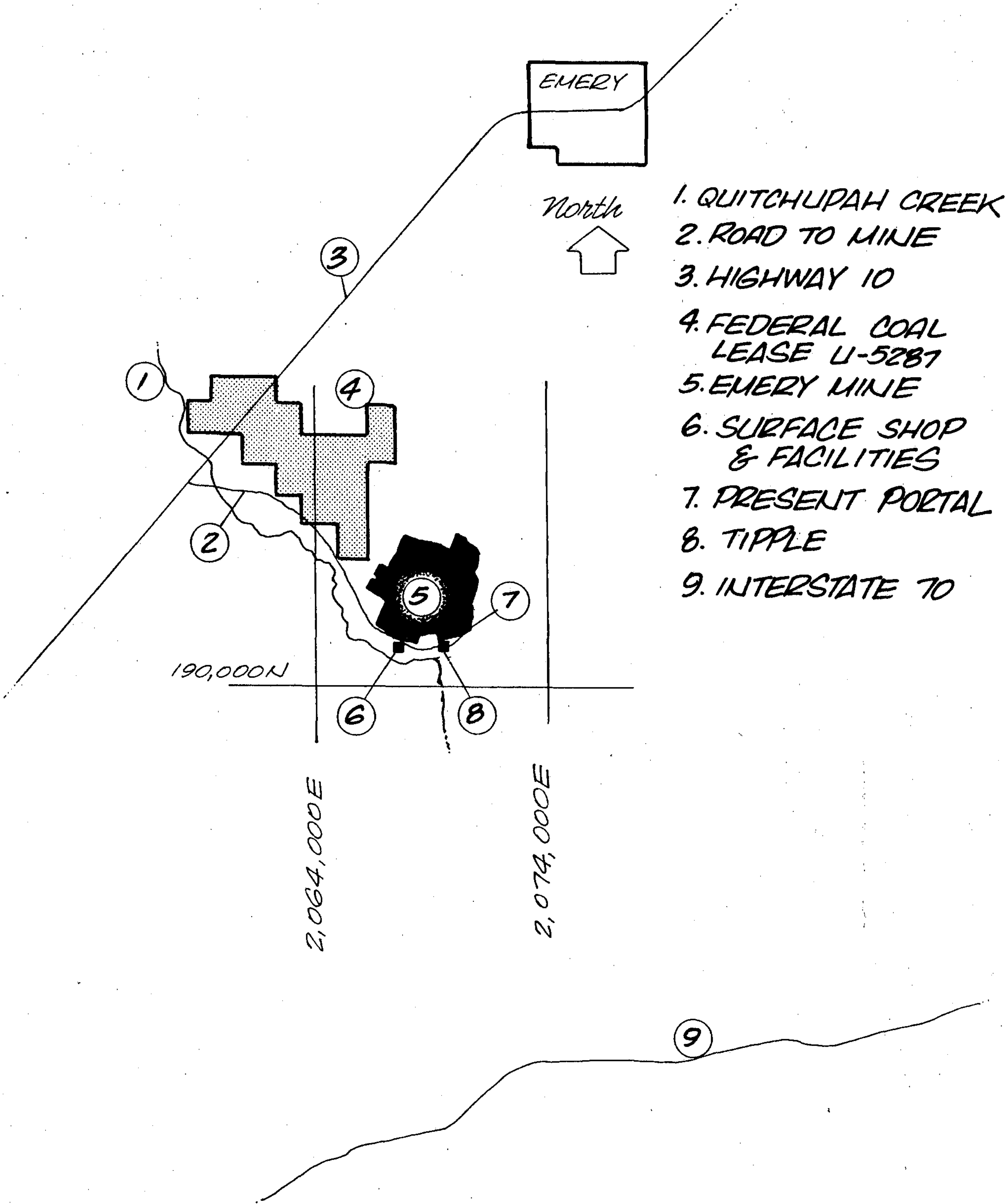


Figure 2

EMERY AREA OVERVIEW

CONSOLIDATION COAL CO.
Western Region

I. GENERAL INFORMATION

I.A. Lease Description

Consolidation Coal Company, a Delaware Corporation, and the Kemmerer Coal Company, a Wyoming Corporation, hold Federal Coal Lease U-5287 dated effective July 1, 1970. Said lease embodies the following described public lands in Emery County, Utah:

TOWNSHIP 22 SOUTH, RANGE 6 EAST, SLM (UTAH)

Section 19: NE¼ SW¼, NW¼ SE¼, E½ SE¼, S½ NE¼

Section 20: NW¼ SW¼, S½ S½, NE¼ SE¼

Section 29: NW¼ NW¼, E½ NW¼, W½ NE¼, NW¼ SE¼

(Total 720 acres more or less)

I.B. Persons Responsible for Operation

I.B.1. Consol-Western Region Headquarters

Larry C. Fuller - Vice President, Western Region Mining, #2 Inverness Drive East, Englewood, Colorado Telephone: (303)-770-1600

I.B.2. Emery Mine

George A. Harvel - Mine Superintendent, Emery Mine Emery, Utah 84522 Telephone: (801)2862301

I.C. Surface and Mineral Ownership

I.C.1. Surface Ownership

A list of the names and addresses of surface owners as well as a map of property locations may be found in Appendix A, Surface Ownership.

I.C.2. Mineral Ownership

The United States Government retains mineral ownership as well as coal in the following lands:

Salt Lake Meridian, Utah
T22S, R6E,
Sec. 19, NE¼, SW¼, SE¼, NE¼, NE¼, NE¼, SE¼;
Sec. 20, NW¼, SW¼.

These lands contain 160 acres, more or less. The rest of the lands have retained private mineral ownership.

II. DESCRIPTION OF AREA ENVIRONMENT

II.A. Regional Geological Conditions

The regional and site geological conditions have been determined by studies of geological literature, reviews of exploration borehole logs, examination of selected core samples, field observations during the drilling and coring of exploration boreholes, interpretations of regional skylab photographs and site aerial photographs, and inspections of site surficial conditions.

II.A.1. Location and Extent

Federal Lease No. U-5287 encompasses approximately 720 acres of coal reserve. The lease property is located in sections 19, 20, and 29 of township 22 south, range 6 east, three (3) miles south of the town of Emery, Utah at the southern end of Castle Valley in Emery County. The southeastern corner of the lease property is approximately 300 feet northwest of the active portion of the Emery Deep Mine as shown in Figure 2, Emery Area Overview.

II.A.2. Geomorphology

To the west of the mine and lease property is the Wasatch Plateau. The plateau is mountainous with a relief of about 1000 feet at the plateau's eastern edge. It continues to rise abruptly to elevations exceeding 10,000 feet. Near Emery, faulting has displaced the rocks at the front of the plateau cresting a rugged escarpment. The plateau itself consists of nearly flat-lying beds of shale and sandstone. The most resistance rock unit is the Flagstaff limestone which caps the summit and produces relatively flat, unbroken, high level surfaces. Deep canyons mark the emergence of Muddy and Quitchupah Creeks. The highest elevations on the plateau have been glaciated during the final stages of the Pleistocene epoch.

Castle Valley is a wide belt of relatively flat land between the Wasatch Plateau and the San Rafael Swell to the east. However, the valley narrows considerably near the town of Emery because of the western marginal influence of the swell. It is believed that the valley owes its existence to the softness of the thick Mancos Shale Formation which underlies it. The Ferron sandstone is the only resistant member noting that it forms a low ridge in the valley with a westward sloping surface. Sloping gravel-capped pediment surfaces extend eastward from the Wasatch Plateau into Castle Valley and give rise to prominent benches above the general level of the valley. Slopes range from 4 to 20 percent but decrease gradually from the mountain front into the valley; this is accompanied by a reduction in the size of the constituent gravel materials and by a thinning of the deposit as a whole. As the benches have gradually weathered back, the sandy material has moved down the slopes onto the Mancos Shale areas. There the sandy material enters into the formation of the type of fine soil that is used for cultivation farming. Unfortunately, the chemical nature of the salts within the Mancos Shale, coupled with the high evaporation rates and the extensive flood irrigation practices of the farmers, has resulted in extensive patches of "alkali swamps." Many areas which once produced abundant crops have gradually deteriorated because of the accumulation of salt; they now support only marsh grasses or brush.

The San Rafael Swell is a major anticlinal uplift. It is a large kidney shaped dome structure marked by concentric rings of cliffs and lowlands. On the western side of the swell near Emery, the structure is indefinite and poorly marked because the general dip of the swell continues into Castle Valley without a notable break.

II.A.3. Stratigraphy

Rocks outcropping locally are either Quaternary or Cretaceous in age, as shown in Figure 3, Area Geological Map. The Quaternary rocks are comprised of pediment gravels, alluvial fills, and river terrace deposits. The volume of these recent deposits is small, as they are merely thin veneers upon older rocks. Thicknesses range from zero (0) to fifty (50) feet.

The Cretaceous rock units are, in order of deposition, the Cedar Mountain Formation, Dakota Sandstone, and Mancos Shale Formation. There are four distinct members of the Mancos Shale; they are, in order of deposition, the Tununk Shale, Ferron Sandstone, Blue Gate Shale, and Emery Sandstone.

The Cedar Mountain Formation is comprised of a series of lavendar and gray nodular shales with several conglomerate lenses and beds sometimes referred to as the Buckhorn unit.

The Dakota Sandstone is a thin unit of sandstone and shale. It rests unconformably upon the Lower Cretaceous sediments. Coal and shale are only minor constituents of this formation. Its relative hardness tends to form a long dip slope and low cliffs above the Cedar Mountain Formation. Pebbles of the Dakota conglomerate are mainly quartzite, are well rounded, and are believed to be derived from the Paleozoic sections of the Great Basin. In terms of color, the Dakota Sandstone is light yellowish gray or brownish yellow. Furthermore, no unquestioned marine fossils have been found in the unit.

The Tununk shale member of the Mancos Shale Formation is blue-gray to black in color. It offers little resistance to erosion and consequently forms a lowland or slope between the harder rock units. The member ranges from 400 to 600 feet in thickness. Locally, it contains abundant amounts of carbonaceous material in the lower most 100 feet. It is generally regarded as the initial deposit of the late Cretaceous marine invasion which covered much of the interior of the continent.

The Ferron sandstone member of the Mancos Shale Formation forms many prominent cliffs in and near the mine area. The member is approximately 700 feet thick and consists of two units which can be distinguished on the basis of lithology and depositional history. The lower unit is a light gray, fine-grained, calcareous marine sandstone with siltstone and carbonaceous interbeds. It also contains two (2) very persistent calcareous concretion zones. There are two distinct cross bedding directions within the lower unit as well. The lower unit has a rather uniform thickness along a northeast-southwest outcrop and its geometry is sheet-like. The main source of the depositional materials appears to have come from the northwest and west.

The upper unit of the Ferron sandstone member differs from the lower unit in several ways. Its color is yellow-gray and brown, and weathers locally to a rust color. It does not have a sheet-like geometry like the lower unit, but occurs in lenses and pods of medium-grained sandstone and siltstone separated by interbeds of carbonaceous shale, mudstone, and/or coal. It is believed that these sediments were carried from the southwest and deposited in flood plain and swamp environments. All of the upper unit sand grains are sub-rounded to sub-angular. In addition, there are two (2) trends in grain size distribution, grains decrease in size toward the north as well as vertically within the sandstone lenses. Trough-like cross-beds are abundant in the upper unit and in some cases are nearly planar.

Coal in the Ferron sandstone member is located in the lower third portion of the upper unit. There are thirteen (13) coal beds present. Five (5) of them are regarded as the principal coal beds -- the K, IJ, G, C-D, and A. The coal bed which Consol proposes to underground mine at the present time, in Federal Lease No. U-5287 is the IJ seam. The Blue Gate shale member of the Mancos Shale Formation consists primarily of very saline, bluish-gray, mudstone and stilstone with a few thin sandstone beds. Bedding is rather nodular and irregular. The member ranges in thickness from 1500 to 2000 feet where it underlies most of the towns and farms throughout Castle Valley. Locally, the member has been either stripped completely by erosion, exposing the underlying Ferron sandstone member, or it has minimal to moderate thickness. The unit is easily recognized by the lack of vegetative cover and low rolling hills or "badlands" produced by erosion.

The Emery sandstone member of the Mancos Shale Formation is a resistant unit with a thickness of about 800 feet. It forms prominent cliffs at lower levels of the Wasatch Plateau. The member is yellow-gray in color and friable. It appears to be lenticular and does contain some coal beds. (See Figure 3, Generalized Stratigraphic Column).

II.A.4. Sedimentology

The coal bearing Ferron unit of Emery was formed in a complex setting which involved orogenic activity, subsidence and sea

ERA	PERIOD	TIME (x10⁶ yrs)	FORMATION · MEMBER	DESCRIPTION	APPROX. THICKNESS
CENOZOIC	Quaternary – Holocene	Unconformity	Alluvium	Clay, silt, sand, and gravel, flood plain and stream deposits, light brown, commonly well stratified and lenticular	0 - 60'
	Quaternary – Pleistocene		Landslide Deposits	Rubble and blocks of material from higher elevations, primarily along mesa edges	?
		Unconformity	Terrace Materials	Poorly sorted subrounded to rounded cobbles, gravel, and sand of pediment surface, thinning to the east.	0 - 50'
MESOZOIC	Cretaceous – Upper		Mancos Shale – Emery Sandstone	Sandstone tongue or tongues, yellow grey, friable, cliff former, may contain coal in some areas	200' - 500
			Mancos Shale – Blue Gate Shale	Marine mudstone and siltstone with several arenaceous beds, pale blue-grey, nodular and irregularly bedded	1500' - 2000'
			Mancos Shale – Ferron Sandstone	Alternately bedded sandstone, shale, and coal, yellow grey, brown, and grey, cliff former, with important coal beds.	300' - 800'
			Mancos Shale – Tununk Shale	Marine mudstone, blue grey to black, slope forming	500' 800'
		Unconformity	Dakota Sandstone	Sandstone, conglomerate, shale, and minor coal, yellow grey, beds lenticular and discontinuous.	185' 300'
	Cretaceous – Lower	Unconformity	Cedar Mountain Formation	Shale, lavender and grey, with conglomerate lenses or beds.	250' - 300'
	Jurassic – Upper	Unconformity	Morrison Formation	Mudstone, sandstone, and conglomerate, vari-colored, slope former.	150' - 425'
			Summerville Formation	Siltstone and sandstone, brown to reddish-brown, thinly bedded and semi-resistant.	260' - 275'
		Unconformity	Curtis Formation	Sandstone, siltstone, and occasional conglomerate, tan to greenish-grey	175' - 240'
			Entrada Sandstone	Sandstone, reddish brown, fine grained and silty, thinly bedded to massive cliff former	600' 800'
		Unconformity	Carmel Formation	Shale, sandstone, siltstone, limestone, and gypsum, vari-colored, limestone in lower half	800 ±
	Jurassic – Lower	180	Navajo Sandstone	Sandstone, orange and yellow, medium grained, massive with crossbedding	500 ±
	Triassic		Wingate Sandstone	Sandstone, brown, yellow, and red, massive with crossbedding, massive cliff former.	0 470'
			Chinle Formation	Continental shale, sandstone, limestone, conglomerate, siltstone, marl, and bentonite, vari-colored.	200' - 1350'
		Unconformity	Shinarump Conglomerate	Conglomerate, sandstone, with minor siltstone and shale, grey, brown, and yellow, cliff and bench former	200 ±
		Unconformity	Moenkopi Formation	Marine and non marine siltstone, sandstone and limestone, non-marine beds are red	2000 ±
PALEOZOIC	Permian		Kaibab Limestone	Limestone and dolomite, medium to finely crystalline with chert, light grey to light brown.	100 ±
		270	Coconino Sandstone	Sandstone, interfingered light brown aeolian and red arkosic tongues.	800' - 1000'
	Pennsylvanian	Unconformity	Hermosa Formation	Sandstone, shale and limestone, lower part predominately limestone, upper part grades into mostly sandstone and shale.	?
	Mississippian	Unconformity	Madison Red Wall Limestone	Dolomite and limestone with chert, white, pink, and grey, crystalline	1000 ±
	Devonian	Unconformity	Elbert Formation	Sandstone, shale, thinly bedded, upper portion a consistently grey dolomite	600 ±
	Middle Cambrian		Lynch Dolomite	Massive near shore dolomite deposits.	350 ±
			Maxfield Limestone	Shale and limestone interbedded.	400 ±
			Ophir Shale	Micaceous shale interbedded with quartzite.	500 ±
		Unconformity	Tintic Quartzite	Quartzite to quartzitic sandstone, light brown.	150 ±

Courtesy of:

VTN

FUGRO, INC.

Figure 3- GENERALIZED STRATIGRAPHIC COLUMN - Emery Coal Field

level fluctuations. The Ferron unit was one of several clastic sedimentary wedges deposited in or near the west edge of the Mancos Sea during the Upper Cretaceous. The Sanpete Valley was probably the western border of this sea and further west orogenic pulsations of the Sevier Orogeny had begun to cause the land to rise.

This elevated region served as a source area for the Ferron. At first the clastic material of the Ferron was supplied by Mt. Nebo, which was northwest of the Mancos Sea and later on the source area was the Fish Lake Plateau area, which was southwest of the Mancos Sea. The clastic material from these source areas was so abundant that they eventually pushed the Mancos shoreline eastward to the present-day Green River as the Mancos Sea regressed. The depositional environment of the Ferron went from an open marine area to bay, lagoon and barrier islands, and finally to deltaic plain areas.

II.A.5. Structure

An angular unconformity separates the Quaternary deposits from the Cretaceous beds. The Cretaceous beds dip approximately five degrees (or nine percent) to the west and northwest due to the marginal influence of the San Rafael Swell.

The Wasatch Plateau lies between the Colorado Plateau on the east and the Great Basin on the west. The structure on the eastern side of the plateau is simple with beds which dip gently westward from the San Rafael Swell. On the western side of the plateau beds dip steeply downward in the Wasatch monocline fold. Complex structures are also present. Generally, beds dip to the west, northwest, and southwest. A variety of smaller folds and faults are common -- some of which are located in Emery County. Monument Peak, a broad, regional, anticlinal uplift occupying most of the plateau, is the dominating structure. Its trend is parallel to the swell which is slightly east of north. Their paralleling suggests that these two structures were both created from forces of the same tectonic event, which is believed to have occurred at an early date in the Tertiary. The uplift is composed of two (2) anticlinal trends; one runs from Soldier Summit southwest through Clear Creek and the north end of the Joes Valley graben into the Joes Valley anticline, a distance of 45 miles, and the other runs northwest from Flat Canyon up through the Gorden Creek anticline, a distance of 38 miles. Two major graben fault zones, the Pleasant Valley and Joes Valley - Paradise, cut the anticlinal trend of the Monument Peak uplift. The Pleasant Valley zone extends from the north end of Pleasant Valley south to Cottonwood Creek about seven (7) miles into Emery County. Its average width is five (5) miles and its greatest displacement is 1500 feet. The faults are typically complex. The Joes Valley - Paradise graben (or fault zone) is very extensive and is located mostly in Emery County. It is 75 miles long and 2 miles wide. The vertical displacements range from 1500 to 3000 feet and are splintered by many smaller faults. Two predominant horsts, the Middle Mountain and Bald Mountain, are located within the graben. Two (2) normal fault traces of the Joes Valley - Paradise fault zone are located between the underground mine and the Wasatch Plateau. They trend northeast-southwest. The exposed rocks located between the two (2) displacement faults indicate the presence of a graben. They are further broken by paralleling minor faults.

Vertical and conjugate joint systems are present in the mine area and are easily seen in the Ferron sandstone member. See Figure 4, Area Geological Map.

II.B.Geological Hazards

Coal is contained in the Ferron sandstone member of the Mancos Shale. Cleat orientation of the coal is N25^{o}E with an 88^{o} dip of the cleats. Currently, coal is being taken from the "IJ" seam at the Emery Mine.

Consolidation Coal Company took over the Emery Mine as operator, and since that time mining has progressed in a judicious and orderly manner. No significant geologic problems have impeded our progress in mining.

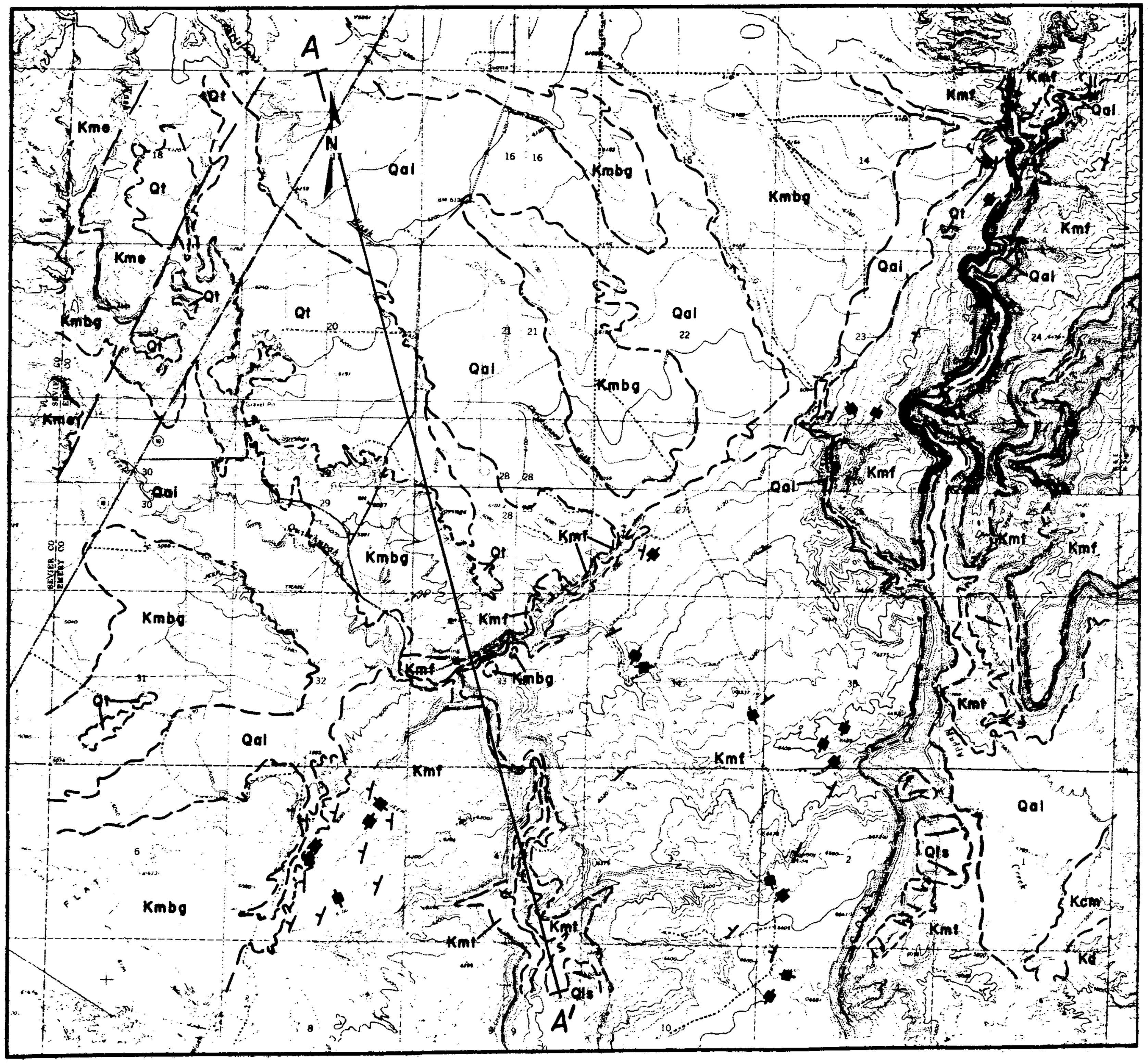
From our current mining operations, there is no evidence of any subsidence that has taken place in the mining area.

No roof bolting has been done because the roof coal has proven to be a competent support member.

II.C.Soils

Figure 5, Lease Area Soils Distribution, is a generalized soils map of the lease area. Table 1, Properties of Soil Materials, is a compilation of pertinent soils data. Figure 5 was prepared by delineating soil type areas observed during field reconnaissance, sampling, analysis of stereographic aerial photographs and review of literature. Table 1, is a compilation of data from: field reconnaissance; photo analysis; sampling; USDA Soil Survey of Carbon-Emery Area, Utah, 1970; and sample analyses by Colorado State University.

Soil materials on all of the delineated sites are primarily loams with various degrees of clay silt, sand and gravel. Type 1 soils are formed on alluvial fan and flood plain deposits in relatively level alluvial valleys and are of the Ravola-Billings-Penoyar association (underline indicates principle type(s) in area mapped). Soils formed on hills and swales composed of the Blue Gate Shale are of the Libbing-Saltair association respectively (USDA, 1972) and are mapped as Type 2. Soils developed on the old pediment gravels are mapped as unit 3 and belong to the Sanpete-Minchey association. In the lease area principle soils are of the type 2 and 3 which have residual soil depths of approximately 36 inches.



EXPLANATION

CENOZOIC — QUATERNARY

Qls	LANDSLIDE DEPOSITS—Rubble and massive coherent blocks of material from higher elevations, primarily along mesa edges.
Qal	ALLUVIUM—Clay, silt, sand and gravel to boulders; flood plain and stream deposits; light brown, unconsolidated; commonly well stratified and lenticular.
Qt	TERRACE DEPOSITS—Sand to cobbles; poorly sorted, subrounded to rounded; pediment surface thins eastward.

Unconformity

MESOZOIC — CRETACEOUS

Kme	EMERY SANDSTONE MEMBER—Sandstone; yellow-gray; friable; appears to be lenticular; contains some coal beds. (MANCOS SHALE)
Kmbg	BLUE GATE SHALE MEMBER—Mudstone and siltstone with several sandy beds; pale blue-gray; marine in origin; nodular and irregularly bedded. (MANCOS SHALE)
Kmf	FERRON SANDSTONE MEMBER—Alternately bedded sandstone, shale and coal; yellow-gray, red-brown, brown and gray; contains major coal seams. (MANCOS SHALE)
Kmt	TUNUNK SHALE MEMBER—Mudstone; blue-gray to black; marine in origin. (MANCOS SHALE)
Kd	DAKOTA SANDSTONE—sandstone, conglomerate, shale and some coal; yellow-gray to light brown; beds lenticular and discontinuous.
Kcm	CEDAR MOUNTAIN FORMATION—Shale; lavender and gray; several conglomerate lenses and beds.

Scale: 1" = 4000'

- attitude of vertical joint
- strike and dip of bedding
- — — Geologic Contact—approximately located; inferred from aerial photographic interpretation, mapping and field reconnaissance
- Landslide Mass—arrows indicate direction of movement

CONSOLIDATION COAL CO.
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AREA GEOLOGIC MAP

Figure 4

December 1977

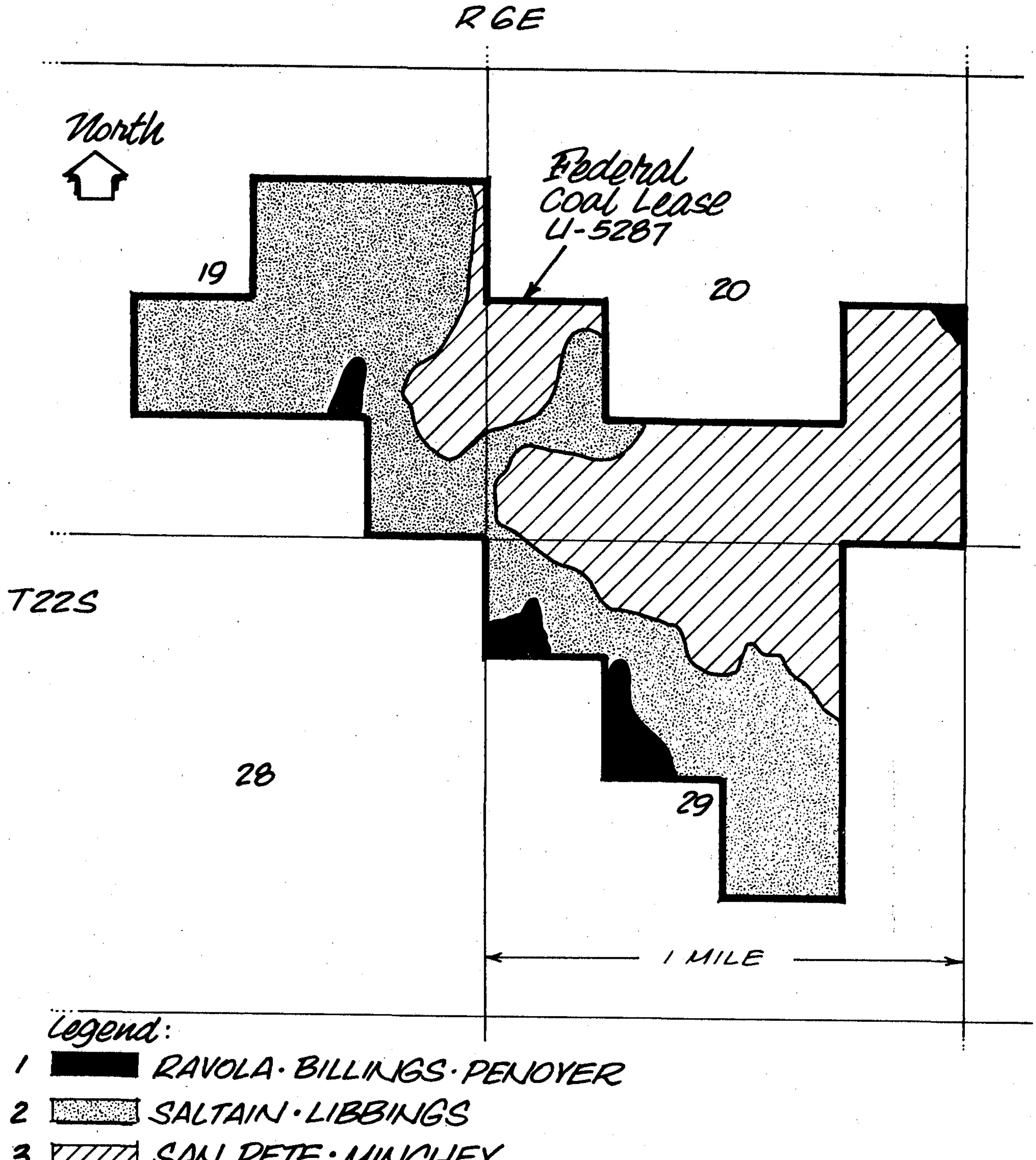


Figure 5
LEASE AREA · SOILS DISTRIBUTION

CONSOLIDATION COAL CO.
Western Region

TABLE 1
PROPERTIES OF SOIL MATERIALS

MAP CODE	USDA TEXTURE	DEPTH: (TYPICAL PROFILE)	SALINITY (RELATIVE)	SHRINK-SWELL POTENTIAL	GYPSUM CONTENT	PERMEABILITY (RELATIVE)	SOIL PROFILE DEVELOPMENT (TYPICAL)
1	Clay Loam & Sandy Clay Loam	72"	Moderate	Moderate	In sub-Surface	Slight to Moderate	3 Horizons
2	Silty Clay Loam	34" (slopes) 60"	Very High	Moderate	High	Low	1 Horizon (Slopes) 2 to 3 Horizons
3	Gravely Sandy Clay	64"	None	Low to Moderate	Low to None	High	1 to 2 Horizons

NOTE: Map Code refers to soil associations on Lease Area Soils Distribution Map (Refer to Figure 5.)

Presently, soils within the proposed mining areas primarily support native vegetation for domestic livestock grazing and wildlife foraging. A small portion of the lease area is under cultivation. It is not anticipated that underground mining here will disturb these soils.

II.D.Vegetation

The lease area and adjacent lands were surveyed by the biological Staff of VTN, Incorporated and the biological information contained in this report is the result of those investigations. Pertinent existing published materials were also used to produce a more complete understanding of the ecology of this region of Utah.

The existing vegetation for the general vicinity of the lease is represented by Figure 6, Lease Area Vegetation Map. Some of the area has been heavily disturbed by either farming or grazing. Beyond the irrigated farm fields or heavily grazed areas good examples of the native vegetation exists.

Within the map boundaries, one major vegetation association occurs: The shadscale shrub (saltbrush desert type) association. The shadscale shrub vegetation by far covers the highest percentage of the landscape on the lease area. This community is dominated by two species of saltbrush: Atriplex corrugata and Atriplex confertifolia.

The shadscale shrubs are represented by low-growing, hummock-forming plants. The plants themselves appear very evenly spaced across the desert, and rarely exceed 15 inches in height.

Aside from the major vegetation unit found in and around the lease area, there exist a variety of riparian or marsh ecosystems. Probably the most well developed of these communities is the Distichlis stricta (salt grass) meadow. These meadows are found wherever the drainage is inhibited and the presence of salt is quite high. Saltgrass is the predominant species with minor occurrences of Juncus spp. (rushes) and Carex spp. (sedges). Shrubs, with the exception of low densities of Tetradymia spinosa (horsebrush) do not occur within these meadows. Similarly, wherever running water is in fairly constant supply small marshes develop. Species of Typha (cattail), Populus (cottonwood), Salix (willow), Carex (sedges) and Juncus (rushes) are most commonly encountered with no one species being dominant. The best examples of this vegetation unit are found along Christiansen Wash, Quitchupah Creek and Muddy Creek.

No disturbances of surface soils or vegetation is anticipated to occur from the underground extraction of coal in the lease area.

II.E.Climatology and Meteorology

The climate of the lease area is typical of a semiarid steppe climate characterized by low relative humidity, generally low precipitation, and warm summer temperatures. Days are warm with cool evenings during the summer, while it is sunny and cold in the winter. The climate is mild, dry, and low in pollen count. It is comparatively uniform with continental influence typical of a high plains mid-latitude area.

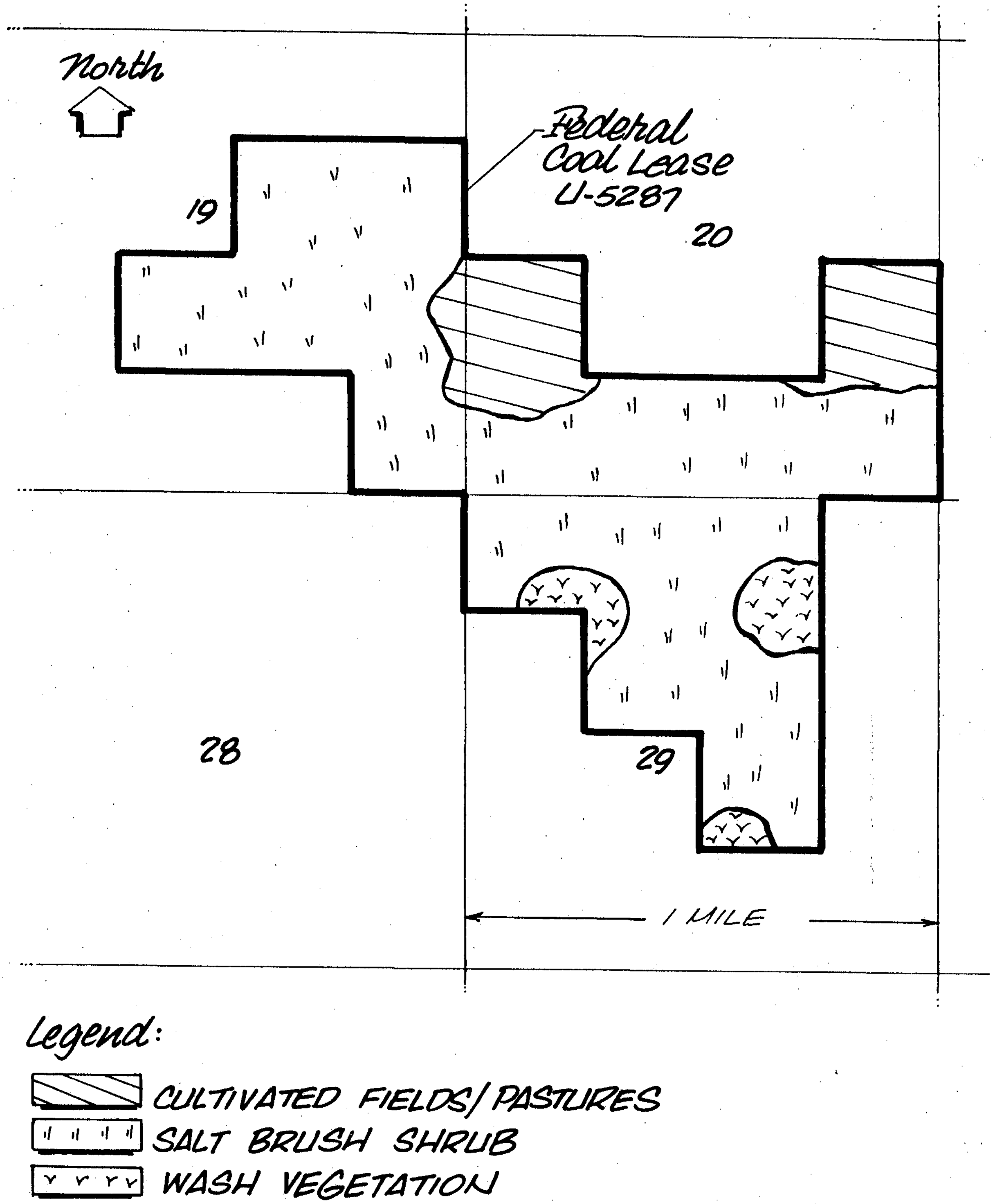


Figure 6

LEASE AREA · VEGETATION MAP

CONSOLIDATION COAL CO.
Western Region

II.E.1. Temperature

There are no existing weather stations in the mine area. Therefore, temperature ranges and other climatic elements are based on data from the nearby meteorological station located in the town of Emery. (See Table 2, Monthly Mean Climatic Conditions).

Summer highs are over ninety degrees and winter lows reach below freezing in Castle Valley. Temperatures fluctuate greatly from night to day and from winter to summer. The clear dry air permits both rapid gain and loss of heat. The maximum and minimum temperatures recorded in Castle Valley are 104^{0}F and -34^{0}F, respectively, with the mean annual temperature in Emery being 46.0^{0}F. The frost free period ranges from 110 to 140 days.

II.E.2. Precipitation

The annual rainfall in the vicinity of the mine ranges from eight to ten inches, while the mean annual precipitation recorded in Emery is 7.55 inches. Cyclonic precipitation peaks in winter with snowfall ranging from an average of 16 inches annually along the eastern portion of Castle Valley to 12 inches along the western portion. Summer flash floods are common since the conventional precipitation during this time of year is often torrential.

II.E.3. Wind

The prevailing winds over the lease area are from the southwest. The strongest winds may be expected during the months of March, April and May. Wind velocities during this period may exceed 60 miles per hour.

II.F.Topography

The topography of the area is characterized by gently westerly-sloping mesas with mesa surface gradients that range from 4 to 20 percent. Approximate elevation (datum mean sea level) range for the lease area is from 6000 to 6200 feet. (See Appendix F, Area Topography).

Streams such as Quitchupah Creek have deeply incised the gently inclined surfaces forming steep-sided mesas. Maximum relief between mesa surfaces and stream valleys is as much as 250 feet.

Principle drainage courses crossing the lease area trend perpendicular to the regional strike of the geologic units and landforms. It appears that this pattern is controlled by a system of subparallel joints in the rock units which have created zones of weakness, thus allowing more rapid erosion by streams. Incision by the streams has exposed considerable portions of the principle coal bearing unit.

II.G.Wildlife

II.G.1. Game Species

The majority of the lands in and around the lease area are not prime wildlife habitat for big game species. The pinyon-juniper

TABLE 2
MONTHLY MEAN CLIMATIC CONDITIONS

MONTH	TEMPERATURE (°F)	PRECIPITATION (inches)
January	24.3	0.47
February	29.0	0.41
March	35.7	0.45
April	44.7	0.42
May	53.5	0.62
June	61.1	0.69
July	68.3	0.71
August	66.1	1.17
September	58.7	0.79
October	48.5	0.85
November	35.4	0.40
December	27.2	0.57
Mean Annual	46.0	7.55

*Information Supplied by National Weather Service as obtained from the Emery Substation.

woodlands, which are located east and south of the lease area, are the only communities which offer enough cover and forage potential. Identification of the existing wildlife was based on tracks or scat observations and discussions with the BLM offices in Price and Richfield, Utah.

The most abundant big game species in the vicinity of the lease is the mule deer (Odocoileus hemionus). Available browse species such as sagebrush and bitterbrush are limited in the lease area. Because of their significance as winter forage to the mule deer they are probably the key to low deer numbers. The desert bighorn may occur in the vicinity of the lease, but any population that does exist is probably quite small. This species was once known from the San Rafael Swell directly to the east of the lease, but its status is undetermined at present. Small game species are numerous with the desert cottontail (Sylvilagos audubonі) probably being the most prevalent. Chukar partridge, Ringneck pheasant and Hungarian partridge are also common in the Emery area.

Since permanent water supplies are limited on the lease, except the small washes, perennial fish populations can not persist. Several small stock ponds do exist and probably attract small numbers of migrating waterfowl. It is unlikely that good waterfowl habitat exists, however, anywhere on the Consol-Kemmerer property.

II.G.2. Non-Game Species:

The primary small mammals in and around the lease area are rodents. These include the common ground squirrels (Itellus leucurus) and deer mice (Peromyscos maniculatus), chipmunks (Eutamias dorsalis), pocket gophers (Thomomys bottae) and pinyon mice (Peromyscus truci). The deer mouse is probably the most abundant mammal on the site and is found in all existing ecosystems. The chipmunks and pinyon mice are restricted to the pinyon-juniper woodlands where greater quantities of food resources exist.

The principal mammalian predators in and around the lease area are coyote (Lanis latrans), bobcat (Lynx rufous), fox, and weasel (Mustelafrenata). These animals are quite elusive, and their presence was determined from published materials on potential inhabitants of the pertinent ecosystems and communication with knowledgeable agencies. Since the lands south of Emery are not prime wildlife habitat, it can be assumed that the population size of any one of these predators is fairly low.

The pinyon-juniper woodlands and the riparian communities in and near the lease, however, support good populations of avian wildlife. Since grasses and seed producing plants are common in these communities, such birds as the rufous-sided and green-tailed towhees, house sparrow, sage sparrow, and morning doves are numerous. Predatory birds are numerous in the area, the most common being the marsh hawk (Lireus hudsonius), red tailed hawk (Buta borealis) and sparrow hawk (Falco sparverius). The black billed magpie (Pica

pica) and turkey vulture (Lathartes avra) are common scavenging birds and occur throughout the entire lease area.

Quitchupah Creek is the only perennial stream on the lease. Amount of flow, however, is quite variable and is perhaps not sufficient to allow any permanent large fish population. Small fish such as chubs or minnows, however, are probably present.

II.G.3. Rare and Endangered Species

The only animal known to occur in the vicinity of the lease that is listed officially as an endangered species is the Prarie falcon (Falco mexicanus).

The black footed ferret (Mustela Nigripes) can be regarded as potentially occurring in the area and is generally believed to be associated with prarie dog colonies.

The Utah Prarie Dog (Cyonomys parvidus) is an endangered species in Utah and may occur in and around the lease. Prarie dog towns were found near Emery but according to the BLM Price District Office (personal communication) those found were not the threatened species.

None of the species listed as rare or endangered are anticipated to be affected by the underground mining of the lease coal.

III. DESCRIPTION OF LEASE LANDS

III.A.Land Use

III.A.1. Emery County

Emery County contains a total of 2,844,580 surface acres with 73 percent of the land managed by the Bureau of Land Management. Of the total land area, 46,295 acres are irrigated cropland. Emery County also contains 325,791 acres of range and 54,565 acres of forest land. Urbanized land in Emery accounts for very little of the land usage (12,095 acres), most of which is around the settlements of Castle Dale, Emery, Ferron and Huntington. While Carbon County is almost totally devoted to agriculture in one form or another, Emery contains much land which is considered marginal (or not suited for agricultural purposes) and, therefore, not classified as agricultural, although some of the land is used for grazing. The land acreage which is utilized for mining is not available. Small water areas account for 220 acres.

III.A.2. Lease Area

Federal lease U-5287 is partially owned and managed by the Bureau of Land Management (BLM) and partially privately owned, (See Appendix A, Surface Ownership). Currently livestock grazing is the major land use on and around the lease area.

The Emery Deep Mine surface facilities are located in Section 33, T22S, R6E, near the lease area and are situated on land owned by Consol-Kemmerer.

Some good grazing has been provided by irrigation on the lease surface. However, the total land area presently has little agricultural value other than grazing. Cattle grazing has proven to be only marginally profitable in Emery County in the past few years, and is declining in importance. (BLM, 1974).

III.A.3. Alternative Uses and Post-Mining Use

Because the coal in the lease area will be mined by underground methods, no surface disturbance is anticipated which might affect the current land use of the lease area. Although substantial subsidence is not anticipated, a monitoring system will be implemented to detect any possible disturbances which could affect current land usage, (See Appendix K, Subsidence). Due to poor soil and climatic conditions, it is doubtful that any alternate agricultural land usage is possible, aside from grazing of domestic livestock, without irrigation and fertilization.

III.B.Population Centers

The Carbon and Emery County area is dotted with many small towns of varying size. The settlement and growth of these small communities is due, for the most part, to coal mining and the railroad. Except for a small amount of agriculture, the towns still owe their livelyhood to the coal industry. Table 3, Nearby Population Centers, lists a few of the major communities near the Emery Mine.

III.C.Transportation Networks

All the major highways in the Carbon-Emery County area of Utah are subject to a considerable amount of daily automobile traffic all year round. This is due, in part, to heavy coal truck traffic and tourist traffic. However, the greatest portion of the traffic on highway 10, connecting many Castle Valley towns with Price (refer to Figure 7, Traffic Volumes), is due to the fact that this is the only major highway accessible to commuting workers.

III.D.Water Resources

III.D.1. Hydrologic Conditions

The following descriptions of surface and ground water are based on a detailed study of the geologic, surficial and topographic conditions; review of regional and local climatic conditions; review of published and unpublished literature and data; interpretations of regional Skylab photographs and site aerial photographs; inspections of site hydrologic conditions; and results of several years of surface and ground water monitoring by the U.S. Geological Survey (U.S.G.S.) and Consol. Major and minor drainages above and

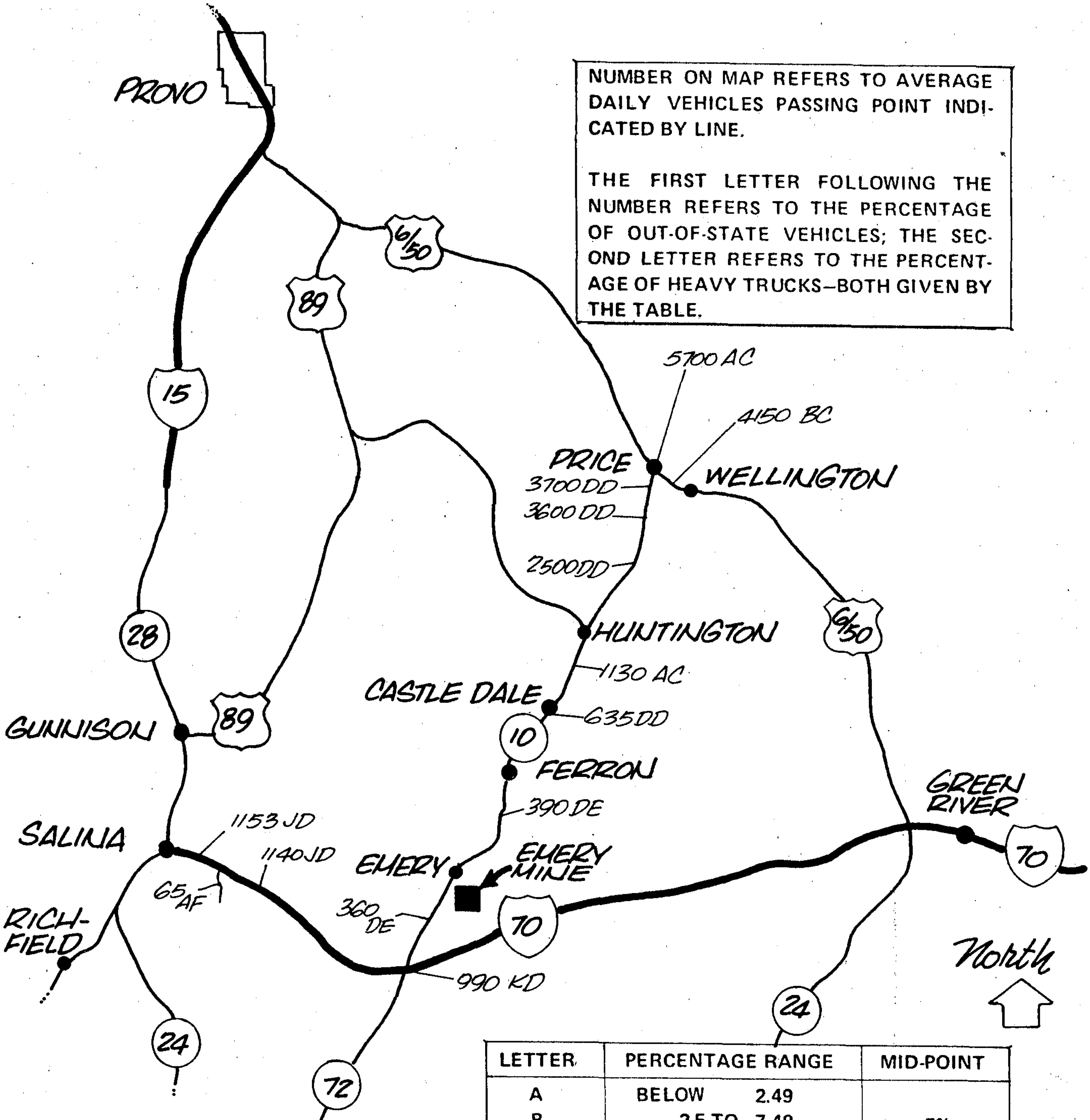
TABLE 3
NEARBY POPULATION CENTERS

TOWN	APPROX. DRIVING DISTANCE (FROM SITE)	APPROX. POPULATION (1975)
Castle Dale	31 miles	861
Cleveland	45 miles	315
Elmo	52 miles	176
Emery	4 miles	219
Ferron	20 miles	756
Green River	88 miles	969
Hiawatha	60 miles	166
Huntington	40 miles	1303
Price	59 miles	7391
Salina	50 miles	1685
Wellington	61 miles	1146

*Information supplied by the United States Department of Commerce, Bureau of the Census.

NUMBER ON MAP REFERS TO AVERAGE DAILY VEHICLES PASSING POINT INDICATED BY LINE.

THE FIRST LETTER FOLLOWING THE NUMBER REFERS TO THE PERCENTAGE OF OUT-OF-STATE VEHICLES; THE SECOND LETTER REFERS TO THE PERCENTAGE OF HEAVY TRUCKS—BOTH GIVEN BY THE TABLE.



LETTER	PERCENTAGE RANGE	MID-POINT
A	BELOW 2.49	
B	2.5 TO 7.49	5%
C	7.5 TO 12.49	10%
D	12.5 TO 17.49	15%
E	17.5 TO 22.49	20%
F	22.5 TO 27.49	25%
G	27.5 TO 32.49	30%
H	32.5 TO 37.49	35%
I	37.5 TO 42.49	40%
J	42.5 TO 47.49	45%
K	47.5 TO 52.49	50%
L	52.5 TO 57.49	55%

Figure 7
AREA TRAFFIC VOLUMES

CONSOLIDATION COAL CO.
Western Region

below the lease property and present extent of the mine were monitored for surface runoff. Monitoring wells and domestic wells set in the Ferron sandstone were used to monitor ground water. Surface and ground water were sampled to determine water quality Appendix B, Surface Monitoring Sites, shows the locations of the monitoring and domestic wells, known springs, and stream gaging and sampling sites. Figure 8, Underground Monitoring Sites, shows the locations of water sampling sites within the Emery Mine.

III.D.1.A.Surface Water

Regionally, the Emery Mine area is located at the southern end of Castle Valley within the Dirty Devil River Basin of southeastern Utah which is part of the Colorado River Basin. Locally, as shown in Figure 9, Muddy Creek Watershed, the mine and lease property are located entirely within the watershed of Quitchupah Creek north and west of the confluence with Christiansen Wash. Quitchupah Creek flows southward into Ivie Creek above Ivie Creek's confluence with Muddy Creek. Muddy Creek eventually empties into the Dirty Devil River above Hanksville, Utah.

Records from the Emery climatological station show that precipitation occurs mainly in the late summer months. The annual rainfall in the vicinity of the mine ranges from eight to ten inches, while the mean annual precipitation recorded in Emery is 7.55 inches. The annual snowfall ranges from 12 to 16 inches. Summer flash floods are common in the area because the conventional precipitation event is often of short duration and high intensity.

The Wasatch Plateau is the major source of water for Castle Valley. Precipitation, mostly in the form of snow, ranges from 20 to 30 inches annually. Streams from the plateau are typically snowfed; therefore, fluctuation of runoff rates is great. Stream flows are greatest during late spring and early summer, decreasing to a minimum flow in early autumn through mid-winter. See Appendix B, Table 1, Sampling and Analyses of Surface Water.

Field investigations have shown that the most important snowfed stream near the town of Emery is Muddy Creek because much of its water is diverted for irrigation purposes. As shown in Appendix B, Surface Monitoring Sites, an irrigation canal system directs the water onto farmland areas located on the Quaternary alluvium and river terrace deposits. Quitchupah Creek is also snowfed, only to a lesser degree. After the stream enters Castle Valley, the flow generally increases as a result of runoff from the irrigated farmland.

Like Muddy Creek and Quitchupah Creek, Christiansen Wash is a perennial stream. However, it is not normally snowfed. Instead, its flow is sustained primarily by runoff from the irrigated farmland.

III.D.1.B.Ground Water

A shallow water table exists in the northern and central portion of the lease property as well as the surrounding area to

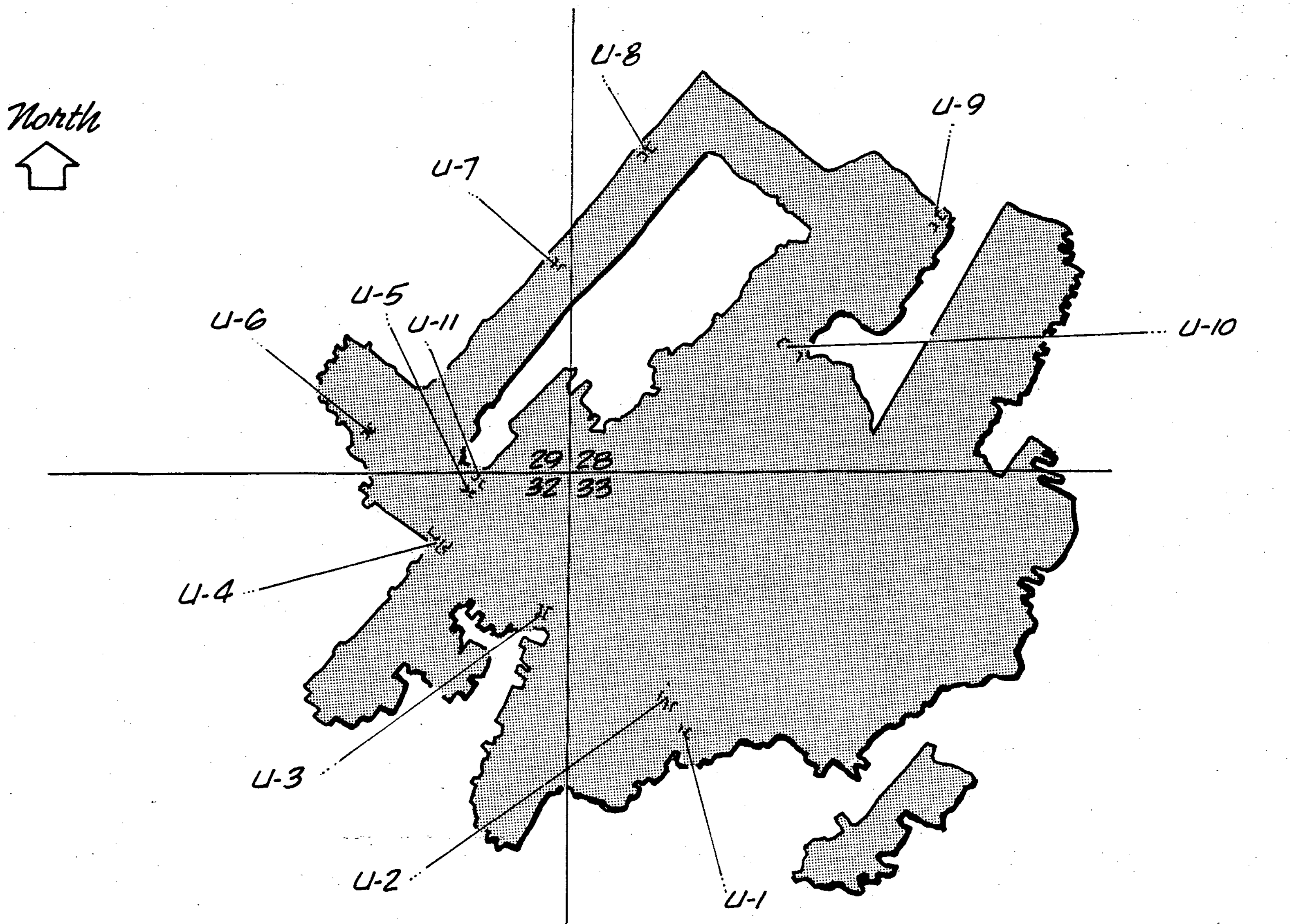


Figure 8
UNDERGROUND MONITORING SITES

CONSOLIDATION COAL CO.
Western Region

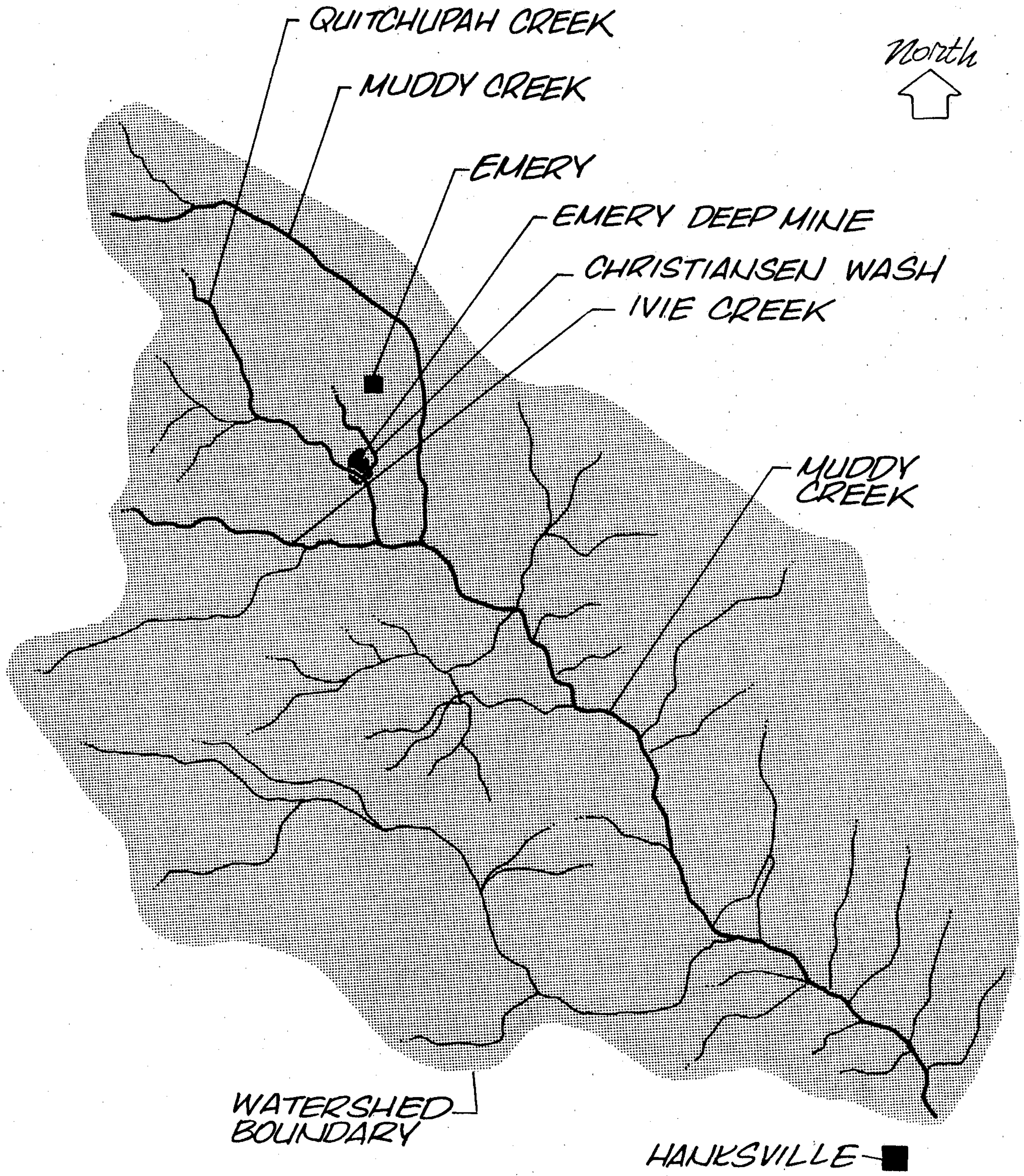


Figure 9
MUDDY CREEK WATERSHED

CONSOLIDATION COAL CO.
Western Region

the north and east. This ground water is contained in a minor aquifer formed by the Quaternary alluvium and river terrace deposits which cap the Blue Gate shale and Ferron sandstone members. Ground water of principal significance to the mine and the town of Emery is contained in a confined aquifer formed by the Ferron sandstone member. Aquifers which may exist in deeper rock units will not be affected by the mining operation.

III.D.1.B.1.Unconfined Aquifer

The boundaries of the minor unconfined aquifer are clearly defined by the limits of the Quaternary deposits. Recharge to this aquifer is sustained by the almost constant irrigation activity practices by the local farmers.

Numerous springs can be seen flowing continuously from the contact of the Quaternary deposits and the Blue Gate shale and Ferron sandstone members. They are identified in Appendix B, Surface Monitoring Sites. Because of the rolling topography of the Blue Gate shale, water flowing from some of these springs becomes trapped in swales creating "alkali swamps." Other spring waters can be seen entering Quitchupah Creek, Christiansen Wash, Muddy Creek, and Miller Canyon. The location of these springs indicates that the general direction of ground water flow is to the south and east.

The ground water in the unconfined aquifer is not used for consumptive purposes because of its relative saline quality. Cattle, on the other hand, do drink from the springs. A discussion of water quality is presented in a following section.

III.D.1.B.2.Ferron Aquifer

Ground water in the Ferron sandstone (or aquifer) is confined above by the Blue Gate shale. It is believed to be confined below by the Tununk shale.

Ground water levels measured in the Emery municipal well, Kemmerer Coal Company well, and monitoring wells (See Appendix B, Table 2, Sampling and Analyses of Ground Water) show that the potentiometric surface is above the land surface within the lease property as well as north and west of the mine in general. The drilling records of several boreholes located in and around the lease property also clearly indicate an artesian (i.e., flowing) condition in this area. Where the Ferron sandstone outcrops, water table conditions are encountered (See Figure 10, Aquifers and Potentiometric Surfaces).

Static water levels remained nearly constant during the monitoring period. Figure 11, Flow Net of the Ferron Aquifer, was constructed from the static water level data. In Figure 11, the flow lines, which have been drawn perpendicular to the potentiometric surface lines (or equipotential lines) indicate that some ground water is draining into the mine. Elsewhere, the ground water is

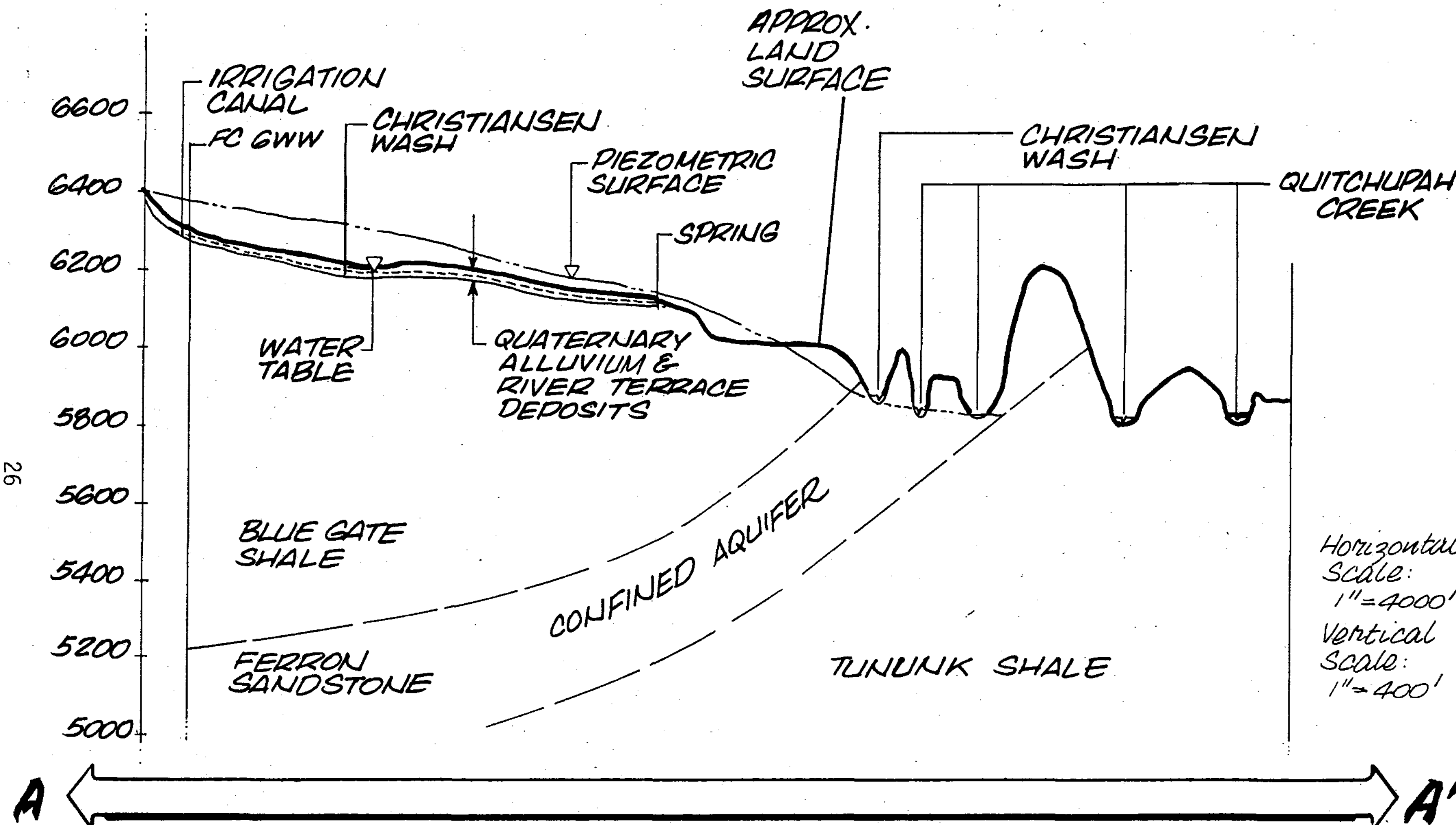


Figure 10
AQUIFERS & POTENTIOMETRIC SURFACES

CONSOLIDATION COAL CO.
Western Region

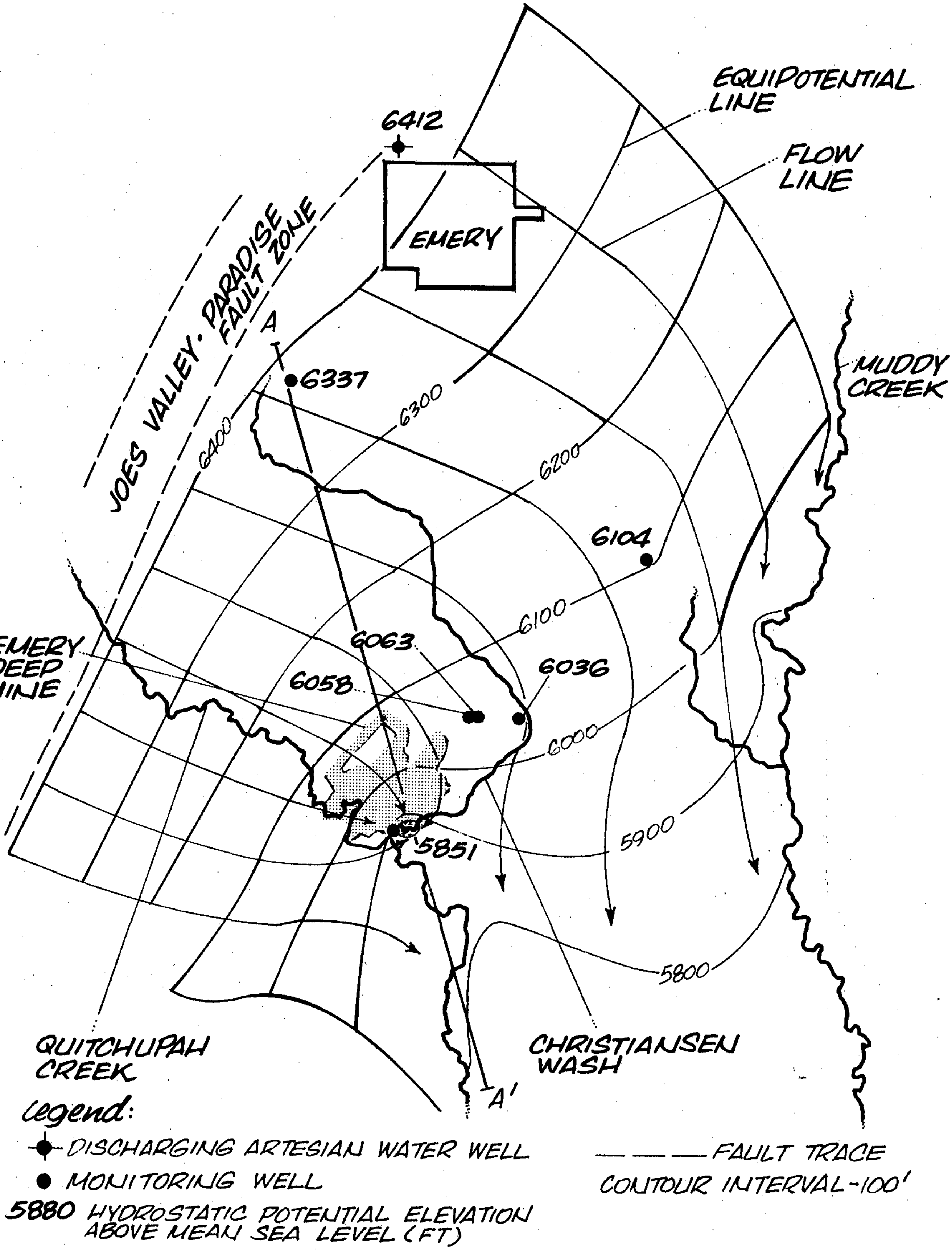


Figure 11- FLOW NET OF FERRON AQUIFER

CONSOLIDATION COAL CO.
Western Region

draining into Christiansen Wash and Quitchupah Creek (where the Ferron sandstone outcrops) and into Muddy Creek. The flow net also shows that the ground water in the aquifer flows up-dip and perpendicular to the Joes Valley-Paradise fault zone from the west-northwest.

What is known about the structural geology and amount of precipitation on the Wasatch plateau and the direction of ground water flow in the aquifer strongly suggests that recharge to the aquifer occurs continuously on the plateau through outcrops of permeable beds and major fractures. A geologic and hydrologic interpretation of Figure 12, Regional Skylab Color Photograph, and Figure 13, Regional Skylab Color Infrared Photograph, lends further credibility to this theory.

The results of recent field investigations by Consol, Continental Oil Company, and the Utah Division of Oil, Gas, and Mining to the underground mine have shown that ground water enters the mine primarily through cleats and joints in the roof. This information, together with the knowledge that vertical and conjugate joints systems are present in the Ferron sandstone, suggests that these structural features probably determine the intrinsic permeability of the aquifer. Some ground water may be entering the mine through the working faces as well. However, very recently a small amount of water was reported to be flowing from a newly created spring in a fracture in the coal floor near the center of the mine. Otherwise, no sand boils or quick conditions on the coal floor were observed or ever reported to have occurred. A four to five foot layer of relatively impermeable clay and shale located immediately below the coal floor apparently retards any significant vertical flow of ground water into the mine. Thus, the resultant flow pattern into the mine appears to be essentially horizontal through about twenty (20) feet of coal, of which the lower portion is being mined, and about eighty (80) feet of upper Ferron sandstone in the overburden. This ground water flow pattern is expected to persist as the mine expands into the federal lease coal.

The average hydraulic conductivity (K) of the coal and upper sandstone producing zone of the aquifer has been estimated to be 1.743 ft./day. This value is typical of a medium-grained sandstone. In order to estimate the hydraulic conductivity, the following assumptions were made:

1. The producing zone is isotrophic; that is, all significant properties are independent of direction. Although no aquifers are isotrophic in detail, models based upon the assumption of isotrophy have been shown to be valuable tools for predicting the approximate relationship between discharge and potential in many aquifers.

2. The producing zone is homogeneous (or uniform). An aquifer is homogeneous if its hydrologic properties are identical everywhere. Although no aquifers are homogeneous in detail, models based upon the assumption of homogeneity have been shown empirically

Figure 12, Regional Skylab Color Photography

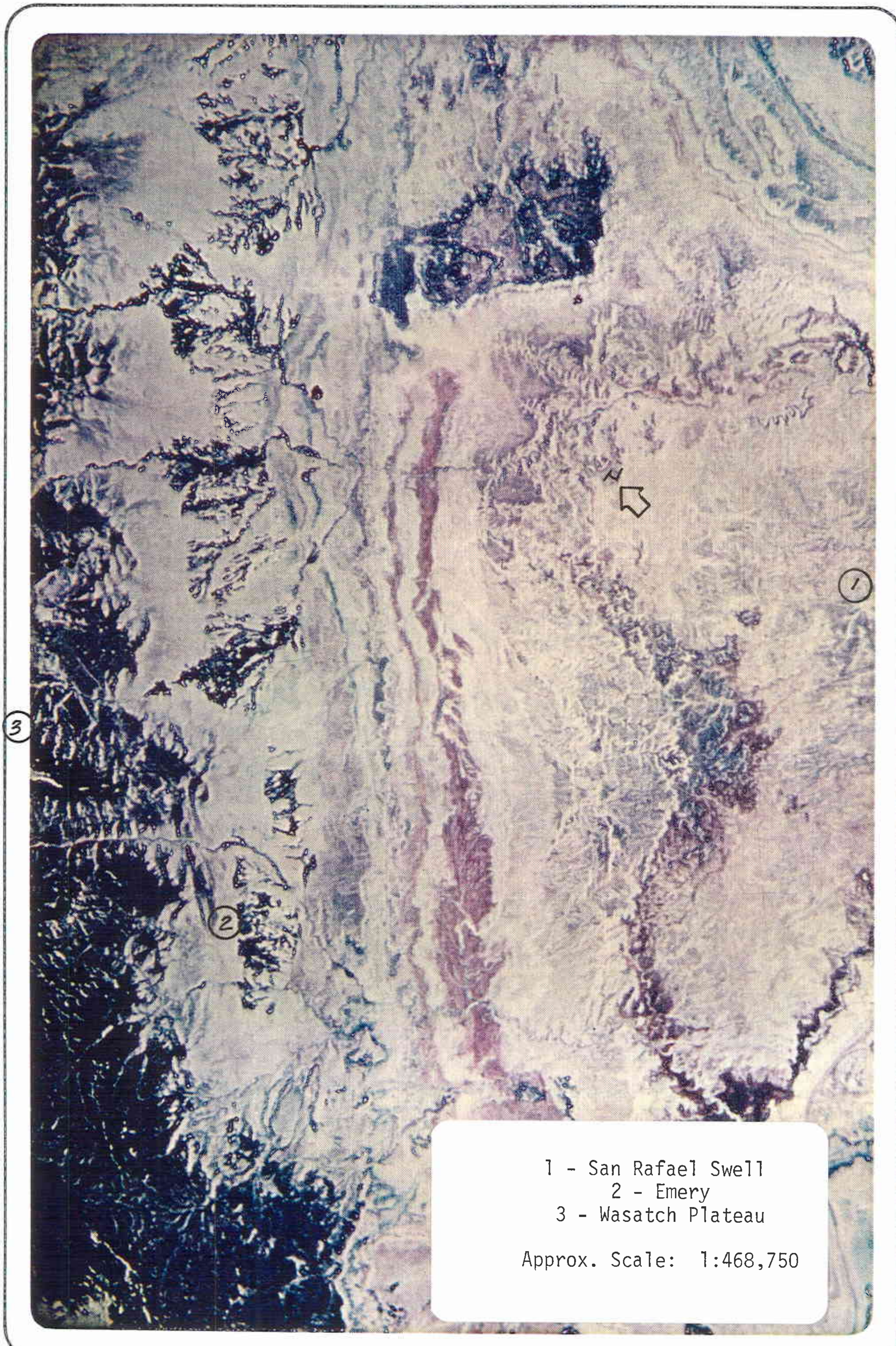


Figure 13, Regional Skylab Color Infrared Photograph to be valuable tools for predicting the approximate relationship between discharge and potential in many aquifers.

The average hydraulic conductivity of the producing zone was estimated by analyzing the flow net in Figure 11 and employing the following flow net equation:

$$K = \frac{Q\, n_d}{h\, m\, n_f}$$

Where K = approx. average hydraulic conductivity in ft/day,

Q = average ground water flow into the underground mine, 69,733.3 ft^3/day,

h = total potential drop, 880 ft.*

m = saturated thickness of the producing zone (20 ft of coal plus 80 ft of upper sandstone), 100 ft,

n_d = number of potential drops, 8.8*, and

n_f = number of flow channels, 4.

$$K = \frac{69{,}733.3\ ft^3/day \times 8.8}{880\ ft \times 100\ ft \times 4}$$

$$K = 1.743\ ft/day$$

The approximate transmissivity (T) of the producing zone was then estimated to be 174 ft^2/day by multiplying the estimated average hydraulic conductivity by the saturated thickness of the producing zone. The storage coefficient of the producing zone is unknown; however, because the producing zone is confined, the storage coefficient probably has an order of magnitude of 10^{-5}.

A general ground water availability map published by the U.S.G.S. shows that well yields from the Ferron aquifer will be less than ten (10) gallons per minute (GPM). However, wells which intersect major fractures, particularly near the Joes Valley-Paradise fault zone, may yield as much as a few hundred gallons per minute. The Emery municipal well and the Kemmerer Coal Company well, which are both artesian, are two good examples. On September 10, 1975, the U.S. Geological Survey Water Resources Division measured a flow of 375 gpm from the Emery municipal well without pumping; and, on May 3, 1973, Layne Western Company measured a flow of 343 while pumping from the Kemmerer Coal Company well.

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*In order to keep the flow net from becoming unwieldy, the scale of the drawing was fixed at 1 inch equals 4,000 feet. Unfortunately, only 520 feet of the potential drop can be shown. Likewise, only 5.2 potential drops can be counted. The total potential drop of 880 feet and the 8.8 potential drops are both inferred from the dip of the coal seam and the present location of the lowermost portion of the underground mine.

Ground water which drains into the Emery mine is discharged into an unnamed tributary of Quitchupah Creek via an over-designed sedimentation pond shown in Appendix B, Surface Monitoring Sites.

All of the water in the Emery underground mine is discharged to the surface by two (2) pumps. One is a centrifugal pump and the other is a deepwell turbine pump. The flow of groundwater into the mine was determined by calculating the amount of water discharged by these two pumps.

The amount of groundwater flowing into the underground mine has been calculated at 69,733.3 ft^3/day (See Appendix B, Ground Water Flow into the Emery Mine).

The static water levels in the monitoring wells, which are located adjacent to the mine, remained essentially constant at near-artesian levels during a two-year ground water monitoring period from March 8, 1975 to March 23, 1977 (see Table 2, Sampling and Analyses of Ground Water). This indicates that the mine has not adversely affected the potentiometric surface in the aquifer. It also indicates that the rate of ground water flow into the mine did not increase significantly during the monitoring period.

III.D.1.C.Water Quality

An assessment was made of the surface and ground water quality in and around the mine and lease property to establish baseline data for evaluating existing site conditions. The data was also used to assess potential changes in ground water chemistry resulting from the mining operation and potential impacts of discharged mine water on the surface environment.

Surface water samples for chemical analysis were collected from Muddy Creek, Quitchupah Creek, Christiansen Wash, and other streams in the surrounding area. The sampling locations are shown in Appendix B, Surface Monitoring Sites. To assess any adverse effects the mine discharge does have and will have on the quality of water in Quitchupah Creek, Ivie Creek, and Muddy Creek, several sampling sites below the discharge including the discharge itself were selected for use. Other sampling sites on Quitchupah Creek above the discharge were selected for use as control sites unaffected by the discharge.

Ground water samples, representative of water contained in the Quaternary deposits, were taken at selected spring locations. Samples representative of water in the Ferron aquifer were taken from the two water wells, three of the monitoring wells, and from ground water seepages in the mine. To assess how the mining operation impacts on the quality of water (i.e., total dissolved solids) entering the mine, water samples were collected from various locations within the mine (See Figure 8, Underground Monitoring Sites) and analyzed for chemical quality. In addition, simple leach tests were performed on samples of coal dust and rock dust to help identify the source of the dissolved solids problem.

Some field measurements by the U. S. Geological Survey were made for temperature, pH, and conductivity. Otherwise, water samples were collected and submitted to a laboratory for the determination of silica, calcium, magnesium, sodium, potassium, bicarbonate,

carbonate, sulfate, chloride, nitrogen, suspended solids, dissolved solids, specific conductance, alkalinity, acidity hardness, sodium absorption ratio, pH, boron, iron, manganese, and aluminum.

All of the water quality data are presented in Appendix B in Table 1, Sampling and Analyses of Surface Water, and Table 2, Sampling and Analyses of Ground Water.

III.D.1.C.1.Surface Water Quality

Results of analyses of water samples collected from Muddy Creek at sampling site S-1 show that Muddy Creek has long been a good source of fresh water for irrigation purposes. The highest dissolved solids concentration and specific conductance measurement recorded were 250 milligrams per liter (mg/l) and 520 micro-mhos (m-mhos) respectively. However, as Muddy Creek makes its way into Castle Valley, it begins to pick up dissolved solids (mostly in the form of sulfate). The results of analyses of samples collected from Muddy Creek at sampling site S-2 reflect this increase. Dissolved solids concentrations ranged from 1230 mg/l to 2230 mg/l. Even greater concentrations were recorded from the analyses of samples collected at sampling site S-10.

Downstream from sampling site S-1 near the base of the Wasatch Plateau, some of the watter in Muddy Creek is diverted into the irrigation canal system. The results of analyses of samples collected from sampling sites S-3, S-4, and S-5 located on the canals show that the diverted water remains fresh before it is distributed onto the farmlands.

As stated previously, the runoff from the irrigated farmland is primarily responsible for the perennial flow in Christiansen Wash. That runoff water normally has a high concentration of dissolved solids (mostly in the form of sulfate and sodium). Results of analyses of water samples collected from Christiansen Wash and from springs which drain from the unconfined aquifer into the Christiansen Wash (sampling sites S-5, S-7, S-11, S-12, S-13, S-14, S-15, S-16, S-17, S-18, S-19, S-20, S-21, S-22, and S-23) show that the water in Christiansen Wash generally increases in salinity as it flows through and past the irrigated farmland. Dissolved solids concentrations ranged from 207 mg/l at the head waters to more than 5000 mg/l near the mouth of Christiansen Wash.

The water quality environment of Quitchupah Creek is very similar to the water quality environment of Christiansen Wash. The results of analyses of samples collected along Quitchupah Creek (at sampling sites S-8, S-31, S-30, S-27, S-26, and S-25) show that the stream generally increases in salinity as it flows through and past the irrigated farmland. Dissolved solids concentrations ranged from 370 mg/l at Highway 10 to more than 5000 mg/l near the mine. These samples were not collected while the mine was discharging its water.

Like Christiansen Wash, Quitchupah Creek, and the lower reaches of Muddy Creek, Ivie Creek is a slightly saline stream. The sampling sites along Ivie Creek and its western tributaries are identified as S-34, S-35, S-36, S-37, S-38, and S-40. For those samples collected, dissolved solids concentrations ranged from 494 mg/l to 6000 mg/l.

Numerous powder deposits of white alkali material are present along the banks of each of these streams. Many such deposits have been found in small depressions on the Quaternary alluvium and river terrace deposits as well. Although the white alkali material has not been analyzed chemically, its appearance indicates that it contains gypsum. This observation plus the fact that the surface water samples contained high concentrations of dissolved solids (especially calcium, magnesium, sodium, sulfate, and chloride) suggests that the saline chemistry of the surface waters is caused by the leaching or chemical dissociation of soluble minerals present in the soft Quaternary deposits and Blue Gate shale. Those minerals may include the following:

- glauberite $Na_2Ca(SO_4)_2$
- halite $NaCl$
- polyhalite $K_2 Ca_2 Mg (SO_4)_4 \cdot 2H_2 O$
- gypsum $Ca SO_4 \cdot 2H_2 O$
- epsomite $Mg SO_4 \cdot 7H_2 O$

III.D.1.C.2.Ground Water Quality

A general chemical quality map published by the U. S. Geological Survey shows that the dissolved solids concentration of the water in the Ferron aquifer ranges from 250 to 1000 milligrams per liter. Analyses of ground water samples collected from the Emery municipal well, Kemmerer Coal Company well, two Consol monitoring wells* (FC 346 WW and FC 363 WW), and from seepages in three roof fall areas in the mine (U-6, U-7, and U-8) support this fact (See Appendix B, Table 2, Sampling and Analyses of Ground Water).

The initial water samples collected from monitoring wells FC 343 WW and FC 346 WW contained abnormally high concentrations of dissolved solids (especially calcium, magnesium, sodium, and sulfate) because the wells were not properly completed. Contamination occurred as a result of the saline chemistry of the drilling medium left in the holes. However, the data revealed a significant

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* A messenger operated vertical sampling tool was used to collect the water samples from the monitoring wells. Water samples were collected from the other wells by inducing positive displacementof ground water.

improvement in the quality of the water in these wells in a very short time. This occurred because the movement of water in the aquifer removed existing water from the wells and replaced it with fresh recharge water.

The results of chemical analyses of water samples collected from Quitchupah Creek and Christiansen Wash show a measurable decrease in total dissolved solids concentration where the streams flow through the Ferron sandstone outcrop. This occurs because fresh water in the Ferron aquifer drains into these streams from the west-northwest. This strongly suggests that the mine does not adversely impact the quality of water in the Ferron aquifer.

Figure 8, Underground Monitoring Sites, shows the location of water sampling sites within the mine. The results of analyses of water samples collected at these various locations indicates that after the "fresh" ground water enters the mine, the water picks up dissolved solids. The additional dissolved solids are mostly calcium, magnesium, sodium, sulfate, and chloride. Iron aluminun, manganese concentrations, as well as pH and alkalinity did not increase.

To help identify the source of the dissolved solids problem, simple leach tests were performed on samples of coal dust and rock dust. One hundred grams of each dust sample were mixed with 100 milliliters of distilled water and were periodically agitated for one week. The results of these tests, presented in Table 4, Leach Test Results, show that both the coal dust and rock dust released appreciable amounts of calcium, magnesium, sodium, sulfate, and chloride to solution. This strongly suggests that the saline chemistry of the mine water is caused by the chemical dissociation of soluble minerals present in the coal dust and rock dust. Those minerals may include the following:

- glauberite $Na_2\ Ca\ (SO_4)_4 \cdot 2H_2O$
- halite $Na\ Cl$
- polyhalite $K_2\ Ca_2\ Mg\ (SO_4)_4 \cdot 2H_2O$
- gypsum $Ca\ SO_4 \cdot 2H_2O$
- epsomite $Mg\ SO_4 \cdot 7H_2O$

The analyses of numerous surface water samples collected from Christiansen Wash, Quitchupah Creek, Ivie Creek, and Muddy Creek at locations unaffected by the pond discharge (See Table 1, Sampling and Analyses of Surface Water) that these streams normally carry waters which have total dissolved solids concentrations commensurate with concentrations measured in the pond discharge. In other words, the pond discharge has not adversely impacted upon the quality of water in these streams. Furthermore, there is no indication from the data that the total dissolved solids concentration in the effluent will increase as a result of mining the lease coal.

III.D.2. Probable Impacts of the Proposed Action of the Area Hydrology

The proposed extension of the Emery Mine into the federal lease coal will temporarily affect surface and ground water flow in the same manner that the mine presently affects surface and ground water flow. The principal long-term impact will be the permanent alteration of the upper portion of the Ferron aquifer from where the coal will be removed; but, this impact will be mostly desirable. The proposed extension of the mining operation is not expected to create adverse long-term effects on the quality of surface or ground water.

III.D.2.A. Surface Water

The mine-related surface facilities (roads, buildings, coal crusher, and storage areas) have been located, constructed, and maintained in a manner such that they have not (and most likely will not) measurably increase runoff or contribute to flooding.

The amount of water that will be discharged into Quitchupah Creek as a result of mining the lease coal is not precisely known. Any additional discharge of water into Quitchupah Creek would temporarily raise the stream level. However, even if the discharge were to double, it would not likely raise the stream level sufficiently to change the erosional and depositional pattern of the flow.

III.D.2.B. Ground Water

The static water levels in the monitoring wells, which are located adjacent to the mine, remained esentially constant at near-artesian levels during a two-year ground water monitoring period from March 8, 1975 to March 23, 1977. This indicates that the mine has not adversely affected the potentiometric surface in the aquifer. It also indicates that the rate of ground water flow into the mine may be approaching a peak. That is, the flow of ground water into mine may be at or near a steady-state condition. A steady-state of flow is reached if, in the monitoring wells, the changes in drawdown with time have become negligible, or that the hydraulic gradient has become constant.

As stated previously, the amount of ground water encountered while mining the lease coal and eventually discharged into Quitchupah Creek cannot be precisely quantified, but the loss of this water will be unavoidable. Ground water that is intercepted during the mining operation and used for bathing and dust control on the surface or lost by evaporation will be unavailable for other uses.

Because of very definitive hydrogeologic boundary conditions, the mining operation has not (and very probably will not) affect the flow of ground water in the shallow unconfined aquifer.

Expansion of the mining operation into the lease coal will affect the flow of ground water in the confined Ferron aquifer. The major effect will be a continuation of the temporary lowering of the potentiometric surface during mining. However, this is not

TABLE 4

LEACH TEST RESULTS - MARCH 30, 1977

Sample	Sulfate mg/l	Calcium mg/l	Magnesium mg/l	Potassium mg/l	Sodium mg/l	Chloride mg/l
Coal Dust	57	13	38	0.7	46	22
Rock Dust	36	15	11	5.6	8.2	34

Note: 100 grams of each dust sample was leached with 100 milliliters of distilled water.

expected to adversely affect the yield of water from the Emery municipal well because the well is located three miles north-northeast of the lease property and the direction of ground water flow is to the east-southeast. This belief is further supported by the fact that the static water levels in the monitoring wells, which are located adjacent to the mine, had remained essentially constant at near-artesian levels during the two year ground water monitoring period. Following the completion of the mining, the potentiometric surface should recover to its approximate original configuration.

As stated previously, the principal long-term impact on ground water will be the permanent alteration of the upper portion of the Ferron aquifer from where the lease coal will be extracted. This has already occurred southeast of the lease property where the mine has been operating for several years. However, the hydrogeologic boundary conditions will be essentially unchanged. Therefore, hydrostatic pressures in the Ferron aquifer will be basically the same after mining as before, and Christiansen Wash, Quitchupah Creek, and Muddy Creek will continue to act as drains for the aquifer. The void created by the removal of the coal will be desirable because it will provide substantial storage for ground water.

III.D.2.C.Water Quality

Suspended solids in the mine discharge have been and will continue to be effectively controlled by pumping the water into an overdesigned sedimentation pond before release into Quitchupah Creek.

In terms of total dissolved solids, the water which flows from the pond into Quitchupah Creek has been and will likely continue to be slightly saline (greater than 1,000 milligrams per liter concentration). However, the analyses of numerous surface water samples collected from Christiansen Wash, Quitchupah Creek, Ivie Creek, and Muddy Creek at locations unaffected by the pond discharge (See Appendix B, Table 1, Sampling and Analyses of Surface Water) show that these streams normally carry waters which have total dissolved solids concentrations commensurate with concentrations measured in the pond discharge. In other words, the pond discharge has not adversely impacted upon the quality of water in these streams. Furthermore, there is no indication from the data that the total dissolved solids concentration in the effluent will increase as a result of mining the lease coal.

The ground water quality data (See Appendix B, Table 2, Sampling and Analyses of Ground Water) have shown that while the mine discharge has been slightly saline, the ground water entering the mine has been and will continue to be fresh (less than 1,000 milligrams per liter total dissolved solids concentration). The increase in total dissolved solids concentration in the mine water appears to have been caused by the dissociation of soluble sulfate, calcium, magnesium, potassium, sodium, and chloride bearing minerals present in the coal dust and rock dust. Once hydrostatic pressures in the Ferron aquifer are restored after mining, the dissociation process will terminate.

The movement of water through the aquifer will remove existing water from the vacated mine into Christiansen Wash, Quitchupah Creek, and Muddy Creek and replace it with fresh recharge water. This natural flushing action should eventually improve the quality of water in the mine to a level commensurate with the quality of water found throughout the aquifer.

III.D.3. Mitigating Measures

Consol has a National Pollutant Discharge Elimination System (NPDES) permit to discharge water from the Emery Mine into Quitchupah Creek. However, before the water is discharged into Quitchupah Creek it is pumped into a large sedimentation pond to reduce the suspended solids concentration in the effluent. With this treatment system Consol has been complying with the conditions of the NPDES permit, the Coal Mining Effluent Guidelines and Standards (40 CFR 434) promulgated by the Environmental Protection Agency, and the effluent limitations of the Surface Mining Reclamation and Enforcement Provisions (30 CFR 717.17(a)) recently promulgated by the Office of Surface Mining Reclamation and Enforcement.

During the short-term, as the mine expands into the lease coal, more ground water may flow into the mine from the upper portion of the Ferron aquifer. If this occurs, the additional water will be pumped into the sedimentation pond. In so doing Consol will maintain its present efficient operation of the pond. And if necessary, Consol will design, construct and maintain additional sediment control facilities to prevent additional contributions of sediment to streamflow in compliance with all applicable state and federal effluent requirements.

Regardless of the volume, the discharge from the sedimentation pond into Quitchupah Creek will be controlled, where necessary, using energy dissipators, surge ponds, and other devises to reduce erosion and prevent deepening or enlargement of the stream channel and to minimize disturbances to the hydrologic balance in compliance with paragraph f of 30 CFR 717.17.

The existing surface facilities will be maintained and reclaimed to prevent additional contributions of suspended solids to streamflow, to the extent possible using the best technology currently available and to control other diminution or degradation of water quality and quantity. In no event will contributions be in excess of requirements set by applicable state or federal law.

Surface and ground water will not be discharged or diverted into the underground mine workings. Some ground water will, of course, be used with mine machinery to facilitate dust control in the mine.

It is not anticipated that the static water level in the Emery municipal artesian well may be lowered during the mining of the lease coal. However, if this occurs, the drop would be only temporary and the level should recover to its approximate original elevation after mining. If the static water level in the well is lowered during mining to a point such that the well yield is adversely affected (although not considered likely), the well could again be made productive by reaming the well and installing a pump or by drilling a new larger diameter well into the Ferron aquifer and installing a pump. Even though the mine has not impacted on the well, the people of Emery have already considered various schemes to obtain more water over the well's present yield.

A surface and ground water monitoring program as outlined in Appendix B will be implemented to provide data for measuring the progress of anticipated impacts and for detecting any unanticipated environmental impacts which could magnify the short-term effects or which could lead to long-term effects. Additional mitigating procedures would be undertaken if unanticipated impacts are identified.

To prevent contamination of the ground water in the Ferron aquifer, the mine portals will be properly sealed and all boreholes will be plugged permanently, unless intended for use in monitoring, in accordance with 30 CFR 717.17(g).

III.E. Archaeological Resources

A preliminary archaeological field survey of the Emery area has been performed. The survey was conducted by Lamar Lindsay, BLM Archaeologist and C. B. Caliendo, VTN Antiquities coordinator in cooperation with Consol (1974). In addition, BLM recreation specialists, Edward McTaggert and Paul Boos accompanied the survey party. Five archaeological sites were located at a considerable distance from the lease area during this survey as shown on Figure 14, Archaeological and Paleontological Sites. These have been characterized as chipping stations and habitation sites. At present no cultural affiliation or age has been assigned to these finds.

Dr. Jesse D. Jennings of the University of Utah has directed archaeological surveys and excavation to the north and south of the Emery area. Archaeological sites with components of the Desert Archaic and Fremont culture have been located. In late prehistoric and contact times, Ute Indians were known to have lived in the area.

No known archaeological resources will be disturbed by planned mining activities.

III.F. Paleontological Resources

A Paleontological Resources assessment was conducted by C. B. Caliendo, VTN Antiquities Coordinator, in conjunction with the archaeological assessment, from July 1 to July 3, 1974. Fossil bearing strata are known to exist in the Emery area. They contain plant, shellfish and

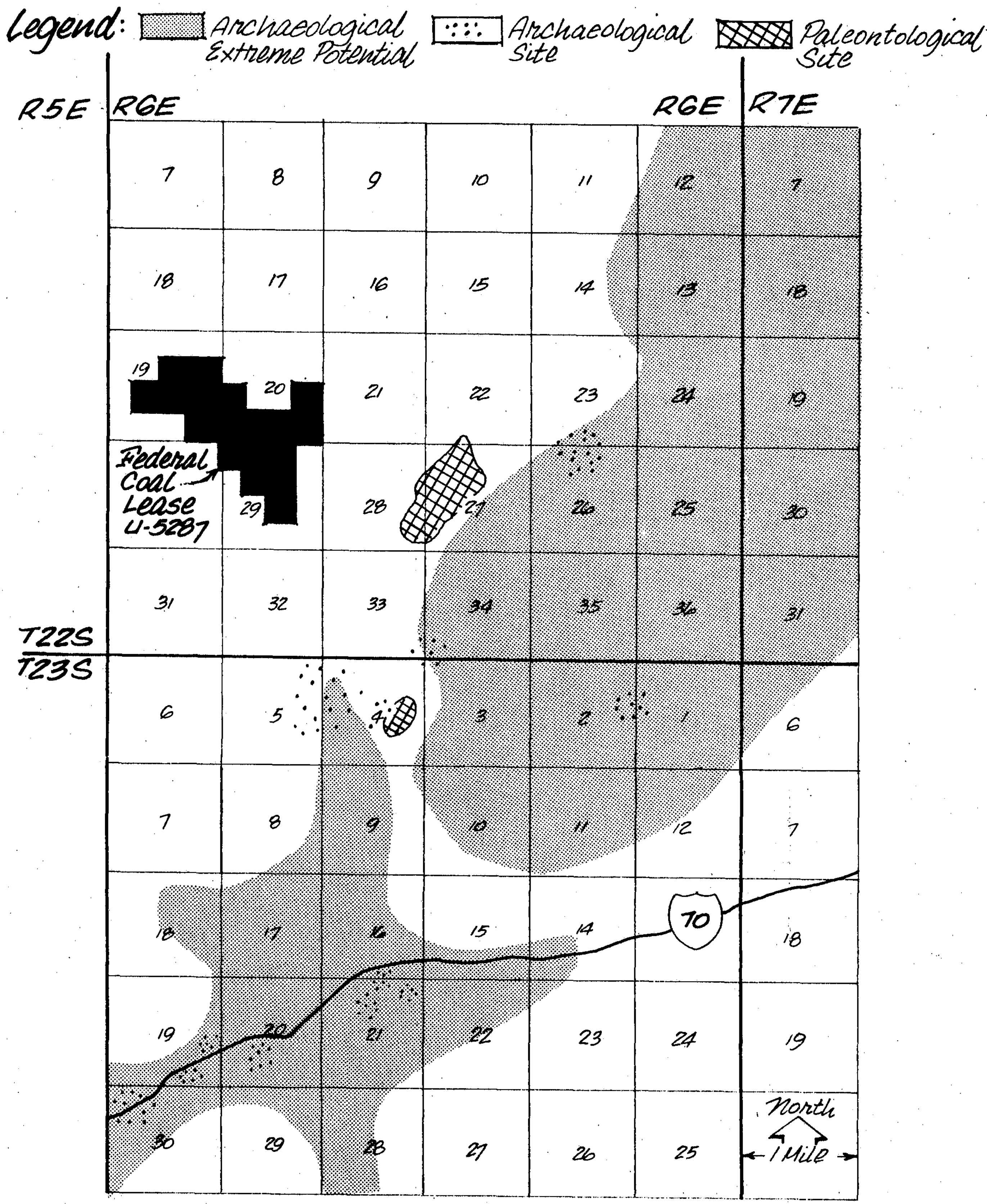

Figure 14 ARCHAEOLOGICAL & PALEONTOLOGICAL SITES

CONSOLIDATION COAL CO.
Western Region

vertebrate fossils associated with a variety of prehistoric inland sea environments. They occur in both the coal bearing strata as well as in the overlying strata. Marine shellfish fossils were found in the Tununk shale member on a ridge east of Quitchupah Creek by the assessment party (See Figure 14).

No paleontological resources are anticipated to be disturbed by underground mining of the lease coal.

III.G.Historical Resources

The history of the Emery and Carbon County region has had a varied and colorful past, highlighted by Mormon pioneers and the exploits of Butch Cassidy. However, it is doubtful that any artifacts of historical interest exist in or around the lease area.

IV. DESCRIPTION OF PROPOSED OPERATIONS

IV.A.Nature and Extent of Coal Deposit

The Ferron sandstone is the main coal bearing unit encountered in the lease area. Coal in the Ferron sandstone member is located in the lower third portion of the upper unit. There are thirteen (13) coal beds present. Four (4) of them are regarded as the principal coal beds identifiable within the lease. They are the K, IJ, G, & CD. The coal bed which Consol proposes to underground mine at this time under Federal Lease No. U-5287 is the IJ seam. The Blue Gate shale member of the Mancos Shale Formation consists primarily of very saline, bluish-gray, mudstone and stilstone with a few thin sandstone beds. Bedding is rather nodular and irregular. The member ranges in thickness from 1500 to 2000 feet where it underlies most of the towns and farms throughout Castle Valley. Locally, the member has been either stripped completely by erosion, exposing the underlying Ferron sandstone member, or it has minimal to moderate thickness. The unit is easily recognized by the lack of vegetative cover and low rolling hills on "badlands" produced by erosion.

The Emery sandstone member of the Mancos Shale Formation is a resistant unit with a thickness of about 800 feet. It forms prominent cliffs at lower levels of the Wasatch Plateau. The member is yellow-gray in color and friable. It appears to be lenticular and does contain some coal beds.

Total reserves for the "IJ" seam have been calculated on a minimum recoverable coal thickness of four feet and are addressed in Table 5. The present plan calls for the continued development of the "IJ" seam. When mining technology and marketability present themselves, recovery of the remaining seams within the lease can be addressed.

Coal quality ranges and averages have been calculated from the available drilling data, and can be found in Table 5. These values are for raw coal only, and where the coal seam is split badly dilution of the quality will occur. A complete set of all raw quality data is available in Appendix H.

IV.B.Overburden Description and Analysis

Overburden in the lease area ranges from 400 to 900 feet in thickness, increasing in depth to the northwest, the main geologic units being the Bluegate Shale and the Ferron sandstone, both of which are highly competent.

A more detailed discussion of the lease area overburden may be found in Section II.A., Regional Geologic Conditions, and the detailed drill logs in Appendix C.

Because pillars will not be extracted during the underground mining in the lease area, no major caving is expected. Therefore, it is not anticipated that the overburden will be altered to any great degree.

TABLE 5

LEASE RESERVES AND QUALITY FOR "IJ" SEAM

Coal Acres	Total Tons In Place	Aug Coal Thickness	Recoverable* Tons
720	17,300,000	13.8	5,010,000

	Moisture %	Ash %	Volatile Matter %	Fixed Carbon %	Sulfur %	BTU/lb
Ranges	2.7-4.3	8.6-10.6	34.0-41.0	43.0-51.7	0.37-1.76	12164-12676
Average	3.8	9.3	39.0	47.9	.96	12498

* Recoverable tons have been calculated on a 50% recovery rate, except "IJ" seam where practical mining thickness due to partings was used. The practical mining thickness inplace reserves are 12,300,000 tons.

IV.C. Method of Mining

The Emery mine will continue to use an Entry and Room method of mining, similar to that which has been successful in the prior development of the mine.

A seven entry, Main Entry Development System is used to maintain adequate ventilation openings through the life of the mine. (See Figure 15, Typical 7 Main Entry System).

Panel entries will be driven to the NE and SW, off these Main Entries. Panels to the North of the Mains are planned for advance mining, utilizing a North Bleeder System to assure proper ventilation of both the active workings and old workings. Panels to the South of the Mains are planned for retreat mining, utilizing a South Bleeder System and the mined out North Panels for proper ventilation of both areas.

In the production panels, four entries will be driven with rooms taken on the advance. (See Figure 16, Typical Panel Mining System). These panels will be driven at 79-80 degrees off the Main Entries. This allows for positive water drainage from each panel such that the operator may effectively control water in the mine.

In addition this angle, through experience in the existing mine, has proven beneficial in maintaining good roof conditions.

IV.C.1. Mining Sequence

The Emery mine will be producing coal from three (3) production units a conventional unit and two (2) continuous miner units. The conventional mining unit will be advancing the development of the Main Entries, while the continuous miners work in the panels mining entries and rooms. The actual mining area for each of the first five years is designated on the map in Appendix I, Detailed Five Year Forecast.

IV.C.2. Production Rate

The projected production rates of Federal and fee coal for the Emery Mine are contained in Table 6, Projected Production Rates.

IV.D. Surface Reclamation Measures

It should be emphasized that only underground mining methods will be used to extract coal in the lease area. Surface subsidence due to convergence of mining openings is anticipated to be minimal, for the following reasons:

1. Projected plans do not allow for the extraction of standing pillars in panel entries, or rooms.

2. The nature and depth of the overburden (400 - 900 feet of sandstone and sandy shale) is such that any convergence of the mine openings will probably not propagate to the surface.

ENTRIES —— 80' CENTERS
CROSSCUTS —— 100' CENTERS
ENTRY WIDTHS —— 16-18'
CROSSCUT WIDTHS —— 16-18'
MINING HEIGHT —— 8'

Legend:
|| VENTILATION STOPPINGS
→ INTAKE AIRWAYS
→→ RETURN AIRWAYS

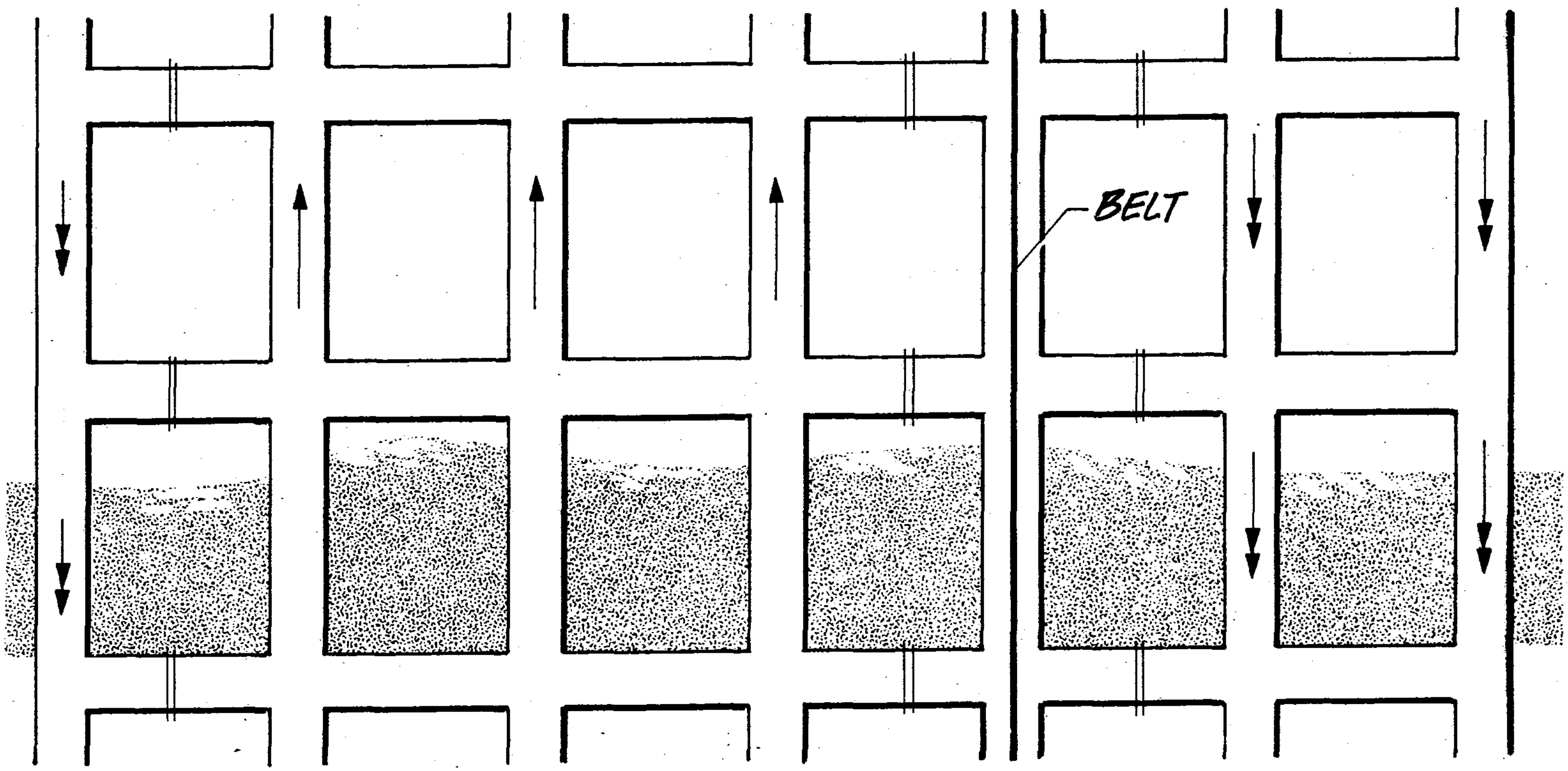

Figure 15
TYPICAL 7 MAIN ENTRY SYSTEM

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ENTRIES — 80' CENTERS
ENTRY CROSSCUTS — 80' CENTERS
ROOMS — 40' CENTERS
ROOM CROSSCUTS — 50' CENTERS

MINING WIDTHS — 16-18'
MINING HT., Panel Entries — 8.5-9'
MINING HT., Room — 9-10'

Legend:
|| VENTILATION STOPPINGS
→ INTAKE AIRWAY
→→ RETURN AIRWAY

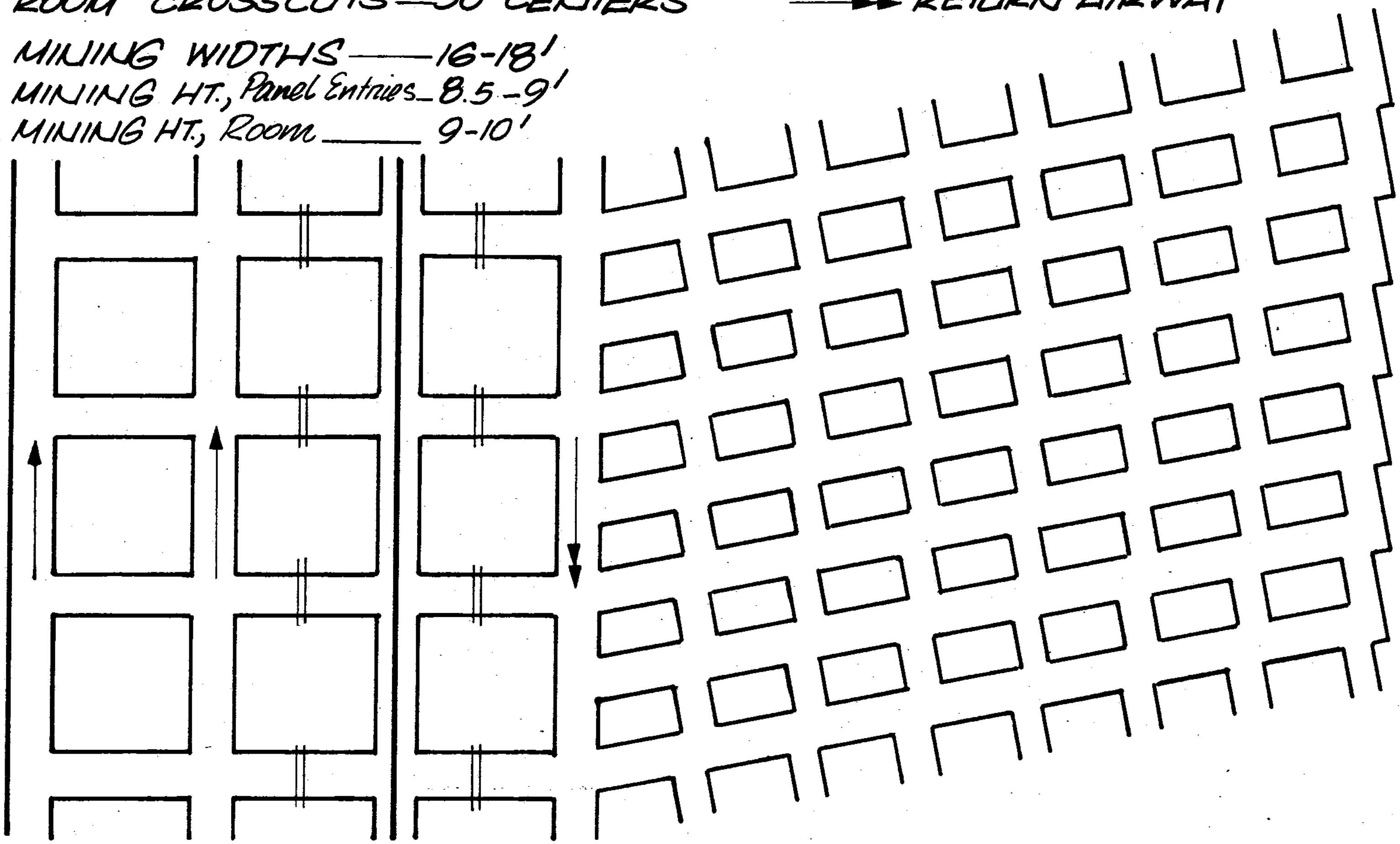

Figure 16
TYPICAL PANEL MINING SYSTEM

CONSOLIDATION COAL CO.
Western Region

TABLE 6
PROJECTED PRODUCTION RATES

YEAR	FEDERAL COAL (TONS)	FEE COAL (TONS)	FEDERAL ACRES* AFFECTED
1 (1978)	90,000	437,000	20
2	312,000	295,000	54
3	171,000	426,000	43
4	477,000	120,000	73
5	589,000	8,000	85
6-14	808,000	4,565,000	147

* 298 Acres of Federal coal will be mined by other operations for a total of 720 acres.

Since all required surface facilities are already located on land owned by Consol-Kemmerer Coal, there will be no future road or building construction in the lease area.

If subsidence is detected in the lease area which might detrimentally affect current land usage, (See Appendix K, Subsidence), reclamation and/or necessary corrective measures will be taken as approved by the USGS or other applicable governmental agencies.

IV.D.1. Reclamation of Surface Facilities

The surface facilities area (located on private property) will be reclaimed in accordance with Section IV.L., Method of Abandonment.

IV.E. Engineering Techniques

IV.E.1. Design and Construction of Roads, Dams, Ditches, and Settling Ponds

No new access roads, ditches, or dams are planned in the lease area. Current access to the surface facilities is provided by an unpaved county road from Highway 10. This road is maintained by Emery County as necessary.

Surface facilities and settling ponds for the mine are presently existing, and located on land owned by Consol-Kemmerer Coal. All roads, ditches, and settling ponds were designed and installed as required by applicable State, Federal, and local regulations.

IV.E.2. Control of Water Drainage and Accumulation

Since little surface disturbance in the lease is anticipated, all natural drainage and water accumulation areas should remain unchanged. In the area of the surface facilities, however, positive drainage to Christiansen Wash or Quitchupah Creek will be established after abandonment. (Refer to Section IV.L., Method of Abandonment).

Currently, water pumped from the underground mine is retained in the settling pond and then discharged into Quitchupah Creek in compliance with Federal and State regulations. (See Appendix J, Location of Surface Facilities).

IV.F. Major Mining Equipment

A list of all the major equipment used at the Emery Mine is contained in Table 7, Major Mining Equipment.

IV.G. Cost of Reclamation

Because minimal subsidence and no new surface construction is anticipated in the lease area, reclamation work will be that necessary to correct any subsidence affects. Also, Consol-Kemmerer is accruing funds adequate for all required restoration work throughout the mine area.

TABLE 7
MAJOR MINING EQUIPMENT

Underground: Equipment Type	Number of Units
Joy 12CM6 Continuous Miner	2
Joy 10SC Shuttle Cars	7
Joy 14BU Loading Machine	2
Joy 15RU Cutting Machine	2
Joy CD71 Coal Drill	1
Feeder Breakers	3
Belt Conveyors	8

Surface: Equipment Type	Number of Units
48" Triple Roll Crusher	1
Mack Truck (End Dump)	1
Hough Front End Loader	2
Various screens, conveyors, and coal storage bins associated with tipple.	

IV.H. Anticipated Starting and Termination Dates of Each Operation Phase

The operator anticipates production of coal, from the "IJ" seam in Federal Lease U-5287, beginning in 1978 and ending in 1991. In addition to the lease coal to be mined from the Emery Deep Mine, approximately 298 acres of this lease will be mined by future Consol underground operations, not discussed within this submittal.

The location of each phase of mining is found in Appendix I, Detailed Five Year Forecast, and the affected underground acreages appear on Table 6, Projected Production Rates.

IV.I. Water and Air Quality Compliance

IV.I.1. Water Quality

It is anticipated that there will be no impact on the surface water drainage or the present quality of surface water in the lease area because of underground mining.

Ground water pumped from the existing mine is passed through a settling pond and then discharged into Quitchupah Creek. The ground water which is found during the mining of coal from the lease will be pumped to the existing settling pond.

IV.I.2. Air Quality

There will be no disturbance of the existing air quality in and around the lease area because the coal will be mined by underground techniques.

IV.J. Measures to Ensure Maximum Practical Recovery

Mining heights of 8 feet in Main Entries, 8.5 to 9 feet in Panel Entries, and 9 to 10 feet in the Rooms have proven, in the existing Emery Deep operation to be the optimum heights for maximizing recovery and maintaining safe operating conditions with stable roof and ribs.

Mining technology has yet to present a viable method of mining slightly dipping western coal seams of 20-25 feet in thickness.

The practical mining thickness was determined by a combination of the coal seam which did not have a 0.6 foot or greater parting material involved. (See Appendix G, Practical Mining Thickness Isopach).

The Emery Mine presently mines coal in the combined "IJ" seam, which varies from 6 to 24 feet in thickness. However, due to major splitting of the coal seam in the lease area, the practical mining thickness is substantially different. As evidenced by cross sections through the lease area, and drill hole listings, (reference to Appendices C, D, and E), only 51 acres of Federal Lease U-5287 contain a coal seam of 19 to 21 feet in thickness. In the remainder of the lease area portions of the seam pinch out or are split by as many as 5 partings varying from .2 to 16.7 feet in thickness.

Consol has initiated substantial research in the area of maximizing recovery from the thick coal seam in the Emery Deep Mine. Pillar recovery plans have been designed, and a preliminary study on a multi-lift longwall system has been completed in cooperation with the U. S. Bureau of Mines. Many questions still remain unanswered in both these plans; however, until such time that these questions can be satisfactorily answered, alternative recovery plans can not be implemented for the following reasons:

1. The top coal left in the existing mine is a substantial support member. Additional recovery of top coal could produce hazardous mining conditions and unusual caving patterns, due to the highly-jointed sandstone above the coal seam.

2. The Ferron Sandstone Formation is an aquifer in the area. The effects of major caving, caused by additional recovery, on the aquifer horizons, are unclear.

3. The Emery coal is highly prone to spontaneous combustion and further planning and engineering design on the control and monitoring of spontaneous combustion must be completed.

If advanced technology becomes available to increase the recovery while maintaining high safety standards, Consol will modify the mining plan accordingly.

IV.K.Surface Facilities

The surface facilities for the Emery Mine are located on private surface controlled by Consol-Kemmerer. The location of these facilities is in the NE¼, Section 32, and NW¼, Section 33, T22S, R6E, SLM (Utah). The existing Emery Deep Mine will not require surface facilities to be built upon the lease area.

Post mining reclamation of the facilities area has been addressed in Section IV.L., Method of Abandonment.

A list of the surface facilities at the Emery Mine appears on Table 8, Emery Deep Mine Surface Facilities. (Also see Appendix J, Location of Surface Facilities).

IV.L.Method of Abandonment

It should be emphasized that the abandonment of the Emery Deep Mine will have no effect on the surface of the lease. The abandonment plan below is the current commitment by Consol to restore the surface facility area to approximately the premining condition.

At the conclusion of all underground mining activity, existing haulage, belt, and fan portals will be sealed using concrete block walls, backfilled with dirt, recontoured and seeded.

TABLE 8
EMERY DEEP MINE SURFACE FACILITIES

STRUCTURE	NUMBER
Main Office Building	1
Support Office Building	3
Warehouse Building	4
Shop	1
Bathhouse	3
Reverse Osmosis Water Treatment Building	1
Truck Scales	1
Mine Substation	1
100,000 Gallon Water Tank	1
Mine Dewatering Pump	1
Settling Pond	1
Coal Crushing, Screening & Loadout Facilities	1

All buildings, power facilities, and ventilation systems will be removed from the mine site, (not located on U-5287 lease surface) and their component parts moved to other locations for sale, salvage, or reuse. Once this is accomplished, surface grading will be performed as necessary.

IV.L.1. Grading and Regrading

No topographic changes are anticipated on lease, fee, or other property surfaces, to result from the Emery Underground Mine or related surface facilities.

No new facilities construction is planned at this time. However, if new construction is required, a study will be made to determine suitable soils and their thicknesses. From the results obtained from this study, the approximate thickness of the final surfacing material will be determined.

Necessary soil treatment will be based on results of soil tests.

All areas graded after abandonment will have positive drainage to Quitchupah Creek or Christiansen Wash. Also, graded slopes will not exceed 3:1.

IV.L.2. Testing

Soils which are intended to support vegetation will be tested by standard methods to determine nutrient deficiencies prior to the revegetation effort. Any additional soil treatment employed as an aid to revegetation will be based on the results of soil testing. As an area is prepared for revegetation the surface will be graded, disced, mulched and seeded as necessary.

IV.L.3. Revegetation

The revegetation objective at the Emery Mine is the establishment of a diverse permanent ground cover meeting the needs of the proposed land use by utilizing as many species native to the area as possible. Based on the above revegetation objective, the seed mixture will include both introduced and native species. Based on greenhouse studies conducted on soils located near the Emery Mine, practical experience in revegetation areas under semi-arid conditions, and recommendations of the USDA Soil Conservation Service, District Conservationists for Emery County, Utah, the following grasses and shrubs are being considered for inclusion in the seed mixture:

1. Streambank Wheatgrass
2. Crested Wheatgrass
3. Russian Wildrye
4. Indian Ricegrass
5. Alkali Sacaton
6. Fourwing Saltbrush
7. Siberian Wheatgrass
8. Nuttal Saltbrush
9. Mat Saltbrush
10. Scarlet Globemallow
11. Shadscale
12. Galleta

After seeding, straw or hay (approximately 1500-2000 lbs/acre) mulch will be added, when necessary, to promote moisture retention and minimize the erosion of loose surface materials.

Due to the high slopes around Christiansen Wash, and the rocky nature of the land, grazing prior to vegetation establishment should not be a problem.

Vegetation establishment and growth will be monitored and corrective actions taken if necessary.

IV.M.Oil, Gas and Water Well Protection

No water, gas or oil wells exist within the lease or the immediate area surrounding the lease. However, should there be any installed, a barrier pillar will be left to ensure the integrity of such wells.

IV.N.Justification For Not Recovering Any Coal Deposits That May Be Detrimentally Affected in Terms of Recovery by Future Operations:

The proposed mining plan prohibits the entire recovery of the "IJ" coal seam at this time. However, the recovery rate is consistent with the current underground mining technology of thick Western coal seams. If advanced technology is developed, additional recovery of this seam may be attempted because major caving of the seam is not anticipated. (Refer to Section IV.J., Measures to Ensure Maximum Practical Recovery).

Mining of the "IJ" seam is not expected to have any adverse effects on the recovery of other coal seams within the lease by future operations.

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