CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT

Coal Search Corporation
Knight Mine
ACT/041/005, Sevier County, Utah

September 8, 1987

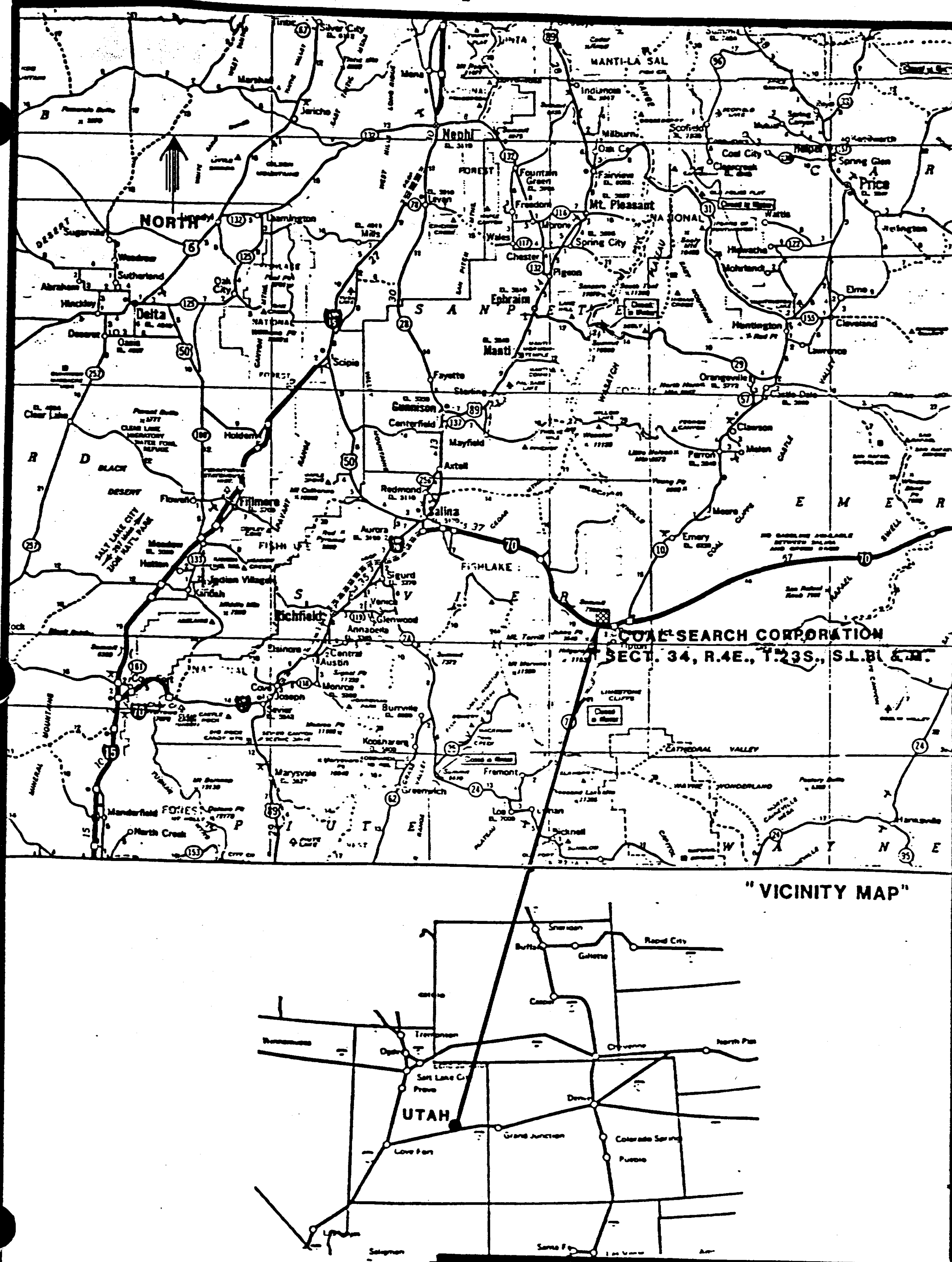
I. Introduction

This is a Cumulative Hydrologic Impact Assessment (CHIA) for Coal Search Corporation's Knight Mine located in Sevier County, Utah. This assessment analyses the probable cumulative impacts of coal mining in the general area and whether the surface reclamation activities proposed under the application have been designed to prevent damage to the hydrologic balance outside the proposed mine plan area. This report complies with federal legislation passed under the Surface Mining and Reclamation Act (SMCRA) and subsequent Utah and federal regulatory programs under UMC 786.19(c) and 30 CFR 784.14(f).

Coal Search Corporation's Knight Mine is located within the Wasatch Plateau Coal Field of central Utah. The field is oriented in a north-south direction through parts of Carbon, Emery, Sanpete and Sevier Counties. Southern Utah Fuels Company's Convulsion Canyon Mine is the nearest active coal mine located approximately eight miles away to the north. The confluence of Quitchupah Creek and Ivie Creek, the receiving streams for the Convulsion Canyon Mine and the Knight Mine respectively, is located ten miles to the southeast of the minesite. The Emery Deep Mine is located approximately 12 miles to the northeast in Emery County.

No oil or gas wells are located within the existing mining area or adjacent areas.

Outcropping rocks of the Wasatch Plateau Field range in age from Late Cretaceous to Tertiary. The rock record reflects oscillating transgressive and regressive sequences that include, in ascending order, the Mancos Shale, the Star Point Sandstone, the Blackhawk Formation, the Castlegate Sandstone, the Price River Formation and the North Horn Formation. Unconformably overlying Cretaceous sedimentary rocks are Tertiary lucustrian deposits, volcanics and Quaternary deposits.



COAL SEARCH CORPORATION
SECT. 34, R.4E., T.23S., S.L.B. & M.
"VICINITY MAP"
NORTH
MANTI-LA SAL
Nephi
Mt. Pleasant
Price
Helper
Scofield
Delta
Fillmore
Salina
Richfield
Ephraim
Manti
Gunnison
Castle Dale
Huntington
Orangeville
Ferron
Emery
Cleveland
Fairview
Spring City
Moroni
Mayfield
Centerfield
Axtell
Redmond
Aurora
Sigurd
Glenwood
Annabella
Elsinore
Monroe
Joseph
Sevier
Marysvale
Koosharem
Fremont
Loa
Bicknell
Hanksville
Cove Fort
Kanosh
Holden
Scipio
Leamington
Lynndyl
Sugarville
Hinckley
Oasis
Deseret
Clear Lake
Flowell
Meadow
Hatton
Levan
Mills
Fayette
Sterling
Wales
Chester
Fountain Green
Fairview
Clawson
Molen
Elmo
Lawrence
Wattis
Hiawatha
Kenilworth
Spring Glen
Jericho
Eureka
Silver City
Mona
Greenwich
Manderfield
North Creek
Burrville
Venice
Central
Austin
Sutherland
Woodrow
Abraham
Indianola
Milburn
Clear Creek
Emery
Cathedral Valley
FISHLAKE
UTAH
Grand Junction
Salt Lake City
Provo
Ogden
Cheyenne
Denver
Colorado Springs
Pueblo
Rapid City
Casper
Gillette
Sheridan
North Platte

FIGURE 1

Coal Mine Creek and Ivie Creek are part of the Muddy Creek drainage system which drains to Lake Powell within the Colorado River system. The major streams in the region (Price River, San Rafael and Muddy Creek) all have been dry in their lower reaches sometime during the period of record. Drainage basins in the CIA are ephemeral and flow only in direct response to snowmelt or precipitation. Stream flow is the greatest during late spring and early summer steadily decreasing to a minimum flow in early autumn through mid-winter. Intense rainfall causes heavy flooding in localized areas with runoff dissipating quickly due to the small areas affected by the storms.

There are two major vegetation types present in the area. Pinyon-juniper woodland occupies the upland areas and benches and the lower areas support the desert shrub vegetation type.

The are no alluvial valley floors in or adjacent to the permit area.

II. Cumulative Impact Area (CIA)

Figure 2 delineates the CIA for the Knight Mine. The CIA includes portions of Sections 21, 22, 26, 27, 28, 34, and 35 of Township 23 South, Range 4 East and Sections 2 and 3 of Township 24 South, Range 4 East. The CIA encompasses 2,435 acres.

III. Scope of Mining

The minesite lies within the Wasatch Plateau Coal Field approximately 22 miles east of Salina, Utah. Elevations range about 7200 to 8000 feet on the permit area. The Knight Mine is an underground coal mine that has been in existence since approximately 1923. The mine has a sporadic history at best and probably has been reopened and closed several times through the decades. The mine had not been reclaimed prior to this episode of mining. Interest began in the Knight Mine in 1974 when exploration activities were conducted.

Mining operations began at the Knight Mine in November of 1977 when it was decided to enter the coal seam through the abandoned workings of the original Jesse Knight Mine. Two additional portals were driven next to the existing portals. The entries advanced 600 feet using conventional mining methods by May, 1987 when the portals had to be abandoned due to thinning of the coal seam, and the mine started to take on water. Three new portals were driven northeast of the existing portals where drilling indicated the coal seam to be thicker. By mid 1978, excavation had been completed and mining began at the new portals. The old portals were permanently sealed and backfilled in December, 1979.

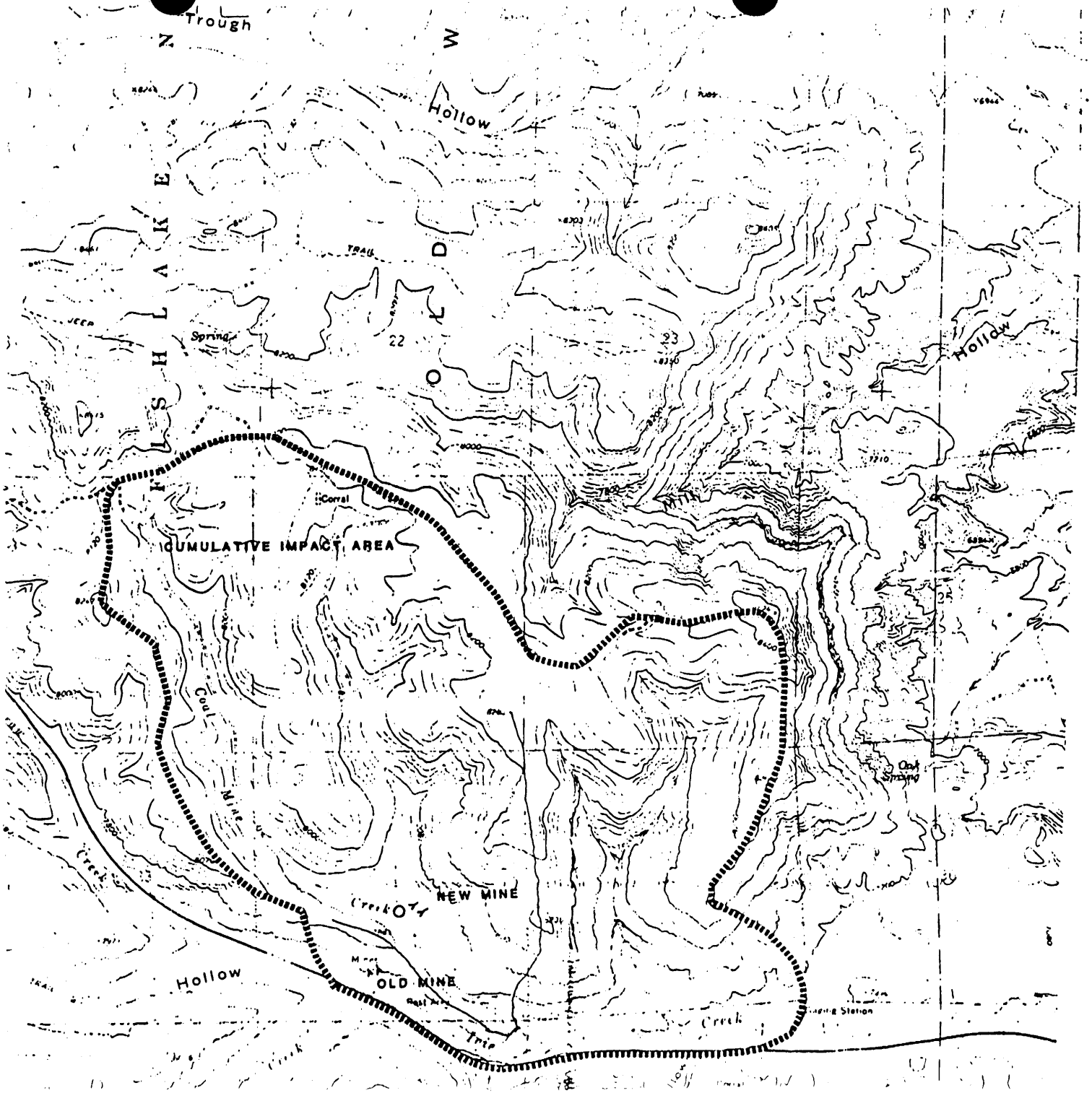


Figure 2.

Cumulative Impact Area ▪▪▪▪▪▪▪

Mine ⅄

Well ○

IV. Study Area

A. Geology

The Knight Mine is located in the southern part of the Wasatch Coal Field of central Utah. The field is oriented in a north-south direction through parts of Carbon, Emery, Sanpete, and Sevier Counties.

The Knight Mine is developed in the Hiawatha (Ivie) coal seam which is located in the upper part of the lower member of the Blackhawk Formation of the Mesa Verde Group. Underlying the Blackhawk Formation is the Star Point Sandstone, a massive cliff-forming sandstone that is approximately 300 feet thick. The top of the Star Point Sandstone is generally 100 feet below the Hiawatha coal seam of the Knight Mine workings. Overlying the Hiawatha seam is 55 to 75 feet of Blackhawk Formation.

Stratigraphic units, Figure 3, outcropping within the study area include, from oldest to youngest, the Star Point Sandstone, the Blackhawk Formation, the Castlegate Sandstone and Quaternary deposits. Lithologic descriptions and unit thicknesses are given in Figure 3.

The mineable coal seams of the Southern Wasatch Plateau are found in the lower part of the Blackhawk Formation. Two beds contain the bulk of the area's reserves. The Hiawatha (formerly called the Ivie) and the Upper Hiawatha are widespread in occurrence but show great variation in quality and thickness due to rapid lateral changes in their depositional setting.

The Hiawatha coal seam increases in elevation and thickness progressing eastward across the mine lease area. A comparison of lithologic logs show that the west side of the seam is 3 feet thick at 7630 feet and the east side of the seam is 9.5 feet thick at 7678 feet. The coal bearing strata dip 5 degrees or less to the west or north-west.

Two major fault systems affect the Southern Wasatch Plateau. In the area surrounding the Coal Search properties, many small faults are present. These faults are often in obvious association with the major north-south zones.

The most important structural feature of the Knight Mine area is the well defined pattern of orthogonal systematic joints. The joints trend northeast-southwest and are accompanied by a secondary set of fractures in a northwest-southeast direction.

Folding is limited to drag folds associated with major faulting.

System	Series	Stratigraphic Unit		Thickness (feet)	Description
TERTIARY	Eocene	Green River Formation		—	Chiefly greenish lacustrine shale and siltstone.
		Wasatch Group	Colton Formation	300-1,500	Varicolored shale with sandstone and limestone lenses, thickest to the north.
	Paleocene		Flagstaff Limestone	200-1,500	Dark yellow-gray to cream limestone, evenly bedded with minor amounts of sandstone, shale and volcanic ash, ledge former.
			North Horn Formation (Lower Wasatch)	500-2,500	Variegated shales with subordinate sandstone, conglomerate and freshwater limestone, thickens to north, slope former.
CRETACEOUS	?				
	Maestrichthian	Mesaverde Group	Price River Formation	600-1,000	Gray to white gritty sandstone interbedded with subordinate shale and conglomerate, ledge and slope former.
	Campanian		Castlegate Sandstone	150- 500	White to gray, coarse-grained often conglomeratic sandstone, cliff former, weathers to shades of brown.
			Blackhawk Formation *MAJOR COAL SEAMS*	700-1,000	Yellow to gray, fine- to medium-grained sandstone, interbedded with subordinate gray and carbonaceous shale, several thick *coal* seams.
			Star Point Sandstone	90-1,000	Yellow-gray massive cliff-forming sandstone, often in several tongues separated by Masuk Shale, thickens westward.
	Santonian	Mancos Shale	Masuk Shale	300-1,300	Yellow to blue-gray sandy shale, slope former, thick in north and central plateau area, thins southward.
			Emery Sandstone *COAL (?)*	50- 800	Yellow-gray friable sandstone tongue or tongues, cliff former, may contain *coal* (?) in south part of plateau if mapping is correct, thickens to west and south. *Coal* may be present in subsurface to west.
	Coniacian		Blue Gate Member	1,500-2,400	Pale blue-gray, nodular and irregularly bedded marine mudstone and siltstone with several arenaceous beds, weathers into low rolling hills and badlands, thickens northerly.
	Turonian		Ferron Sandstone Member *MAJOR COAL SEAMS*	50- 950	Alternating yellow-gray sandstone, sandy shale and gray shale with important *coal* beds of Emery coal field, resistant cliff former, thickens to the south.
	Cenomanian		Tununk Shale Member	400- 650	Blue-gray to black sandy marine slope forming mudstone.
	Albian	Dakota Sandstone *MINOR COAL*		0- 60	Variable assemblages of yellow-gray sandstone, conglomerate shale and *coal*. Beds lenticular and discontinuous.

Figure 3

GENERALIZED STRATIGRAPHIC SECTION

Wasatch Plateau Coal Field

(from Doelling, 1972)

B. Topography and Precipitation

The general area of the Knight Mine is arid, mountainous terrain with slopes ranging from 5 to 70 percent. Vegetation native to the area is pinion pine, juniper, oakbrush, big sagebrush, bitterbrush, indian ricegrass and scattered ponderosa pine. Principle uses are range and wildlife habitat. Topography ranges from less than 7400 feet to over 8200 feet in the CIA.

The study area is characterized by a southerly and easterly system of small ephemeral drainages.

Average annual precipitation is 18 inches. Annual snowfall contributes to this value with the area generally snow covered from early November to mid-April. The CIA may be classified as semiarid.

Soils in the area are deep to moderately deep, neutral to medium acid soils with hard bedrock at shallow depths under the surface. The surface layers are brown to grayish-brown silt loams and clay loams. The subsoils are brown, fine, fine-loamy, loamy-skeletal, and clayey-skeletal. Soils in the area are well to moderately excessively drained. Permeability is slow to moderately rapid. Runoff is medium, and sediment production is low. The surface mineral soil layers are brown to dark brown cobbly loams (section UMC 783.16, MRP).

V. Hydrologic Resources

A. Ground Water

The ground-water regime within the CIA is dependent upon climatic and geologic parameters that establish systems of recharge, movement and discharge.

Complete information regarding regional and local groundwater gradients and flow is incomplete. Information garnered fro observation within and near the mine suggests a ground water regime that recharges along the escarpment east of the mine. The ground water then migrates to the west and northwest beneath the site with discharge along the outcrops of the local canyons that lie west of the mine area. These discharge areas primarily are associated with the Star Point Sandstone that outcrops along Clear, Ivie, Red and Meadow Creeks.

Springs do not occur within the CIA. The closest spring exists at the head of Mill Hollow north of the CIA. Exploration drilling within the permit area did not encounter significant amounts of subsurface water. Moreover, mining development did not intercept sufficient ground water to warrant discharge.

The Star Point Sandstone is the geologic formation that yields water locally and would be referred to as the "local aquifer". This sandstone is the geologic unit in which the Knight Mine well is completed. The Knight Mine well has a collar elevation of 7700 feet. The bottom of the well is at an elevation of 7050 feet. The main aquifer is at an approximate depth of 270 feet (elev. 7340 feet). The main aquifer is 200 feet lower than the lowest side of the coal seam. The Knight Mine well is the only known well completed to the local aquifer or any other aquifer within a two mine radius of the permit area.

Overburden in the Knight Mine area consists predominantly of sandstones, shales and siltstones of the Blackhawk Formation. A few thin coals of small extent are present above the Hiawatha seam. There are no significant aquifers above the coal.

B. Surface Water

The Knight Mine site and CIA drain to the Coal Mine Creek which in turn drains to Ivie Creek in the Muddy Creek drainage. The Coal Mine Creek Drainage area is approximately 1600 acres. The watersheds within the CIA are ephemeral in nature responding only to major precipitation events and snowmelt. The chemical quality of surface water in this area is relatively good but deteriorates downstream due to a gradual increase in total dissolved solids (TDS) concentration as the flow continues downstream. Suspended sediment levels during major storm events are significant based on the erosive nature of the soils in the region. The concentration of dissolved solids in streams is usually inversely proportional to the flow. The chemical quality of water is usually best during high flow and worst during low flow.

The USGS gaging station closest to the mine is station 3315 on Ivie Creek located 1.25 miles downstream from the confluence of Coal Creek. Data from this station are available from August 1950 to September 1960, October 1960 and September 1961, and 1960 to 1974. Records from that station indicate that the largest annual maximum discharge during this period occurred on 7-11-73 at 310 cfs.

Water quality data collected at a station located on Coal Creek leaving the site during the period 6-82 through 6-86 indicates the mean TDS levels were 1315 mg/l (std. dev. of 81.09, n=24). Total suspended solids (TSS) averaged 333 mg/l (std. dev. of 661.2, n=24).

Conversely, data collected at a station located on Coal Creek upstream from the mine indicates a TDS average of 1337 mg/l (std. dev. of 92.3, n=24) and a TSS average of 418 mg/l (std. dev. of 723.3, n=24).

A test of the TDS and TSS variances for the Coal Mine Creek upstream and downstream data sets indicates that the variances are not significantly different at the 0.01 level. Using a pooled variance estimate, a test of the hypothesis that the TDS and TSS means for the upstream and downstream data sets are not significantly different was conclusive at the 0.01 level.

VI. Potential Hydrologic Impacts

A. Ground Water

The only identifiable ground-water resource within the CIA is the aquifer located approximately 200 feet below the Hiawatha coal seam. Inasmuch as mining did not intercept sufficient water to warrant discharge, and exploration drilling did not encounter significant amounts of subsurface water, a natural system of recharge from the surface above the workings to the aquifer below is not thought to be existent. Accordingly, a mining-induced dewatering impact is determined to have a low probability.

The new Knight Mine was a dry mine. No water has been encountered to date. Of the seven exploration holes drilled in 1980 six holes showed no water encountered. Drill hole 80-7 produced 2 gallons per minute at a depth of 585 feet. The site of this drill hole was never mined.

Subsidence related to mining has the greatest potential for impacting ground-water resources in the CIA. Subsidence impacts are largely related to extension and expansion of the existing fracture system and upward propagation of new fractures. Surface infiltration and vertical migration may increase if surface tension fractures propagate to the surface.

Subsidence monitoring above the abandoned workings has not identified zones of mining-induced tension fractures. All mining at the Knight Mine was developmental. The workings in the new mine extend north about 2400 feet. No pillars have been extracted and no panels were developed. Impacts from subsidence are not expected. The post mining land use of cattle grazing and wildlife habitat is expected to remain intact.

The semiarid climate within the CIA will serve to limit temporary impacts to the ground-water regime, which are hereby determined to be minimal.

B. Surface Water

The area influenced by surface disturbance is of limited areal extent (40 acres, p. 783-1 MRP). Surface sediment controls currently are in place and will continue to be in place during reclamation. Two sedimentation ponds will remain at the site until the water quality criteria of UMC 817.46 (u) are met. Sediment pond #1 treats drainage from the majority of the reclamation area. The pond is conservatively designed as it will sufficiently contain the 100-yr, 24-hr precipitation event.

Sediment pond #2 is relatively small and will treat the area of reclamation defined as the old portal area. Pond #2 is sufficiently designed to treat the runoff from this area for a 10-yr, 24-hr event. The water quality impacts associated with reclamation will be minimal or nonexistent due to the fact that all drainage from the disturbed area will be routed through these sediment controls and treated prior to any discharge. Site-specific erosion control practices, such as riprap, silt fences, surface pitting, and energy dissipators will be used to control erosion of small areas within the disturbed area.

The operational design proposed for reclamation of the Knight Mine is herein determined to be consistent with preventing damage to the hydrologic balance outside the mine plan area.

REFERENCES

Coal Search Corporation, Consolidated Mining and Reclamation Plan, April 15, 1986, Knight Mine, Sevier County, Utah

Doelling, H. H. 1972. Central Utah coal fields: Sevier-Sanpete, Wasatch Plateau, Book Cliffs and Emery: Utah Geol. and Mineral Surv., Monograph Ser. No. 3.