CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT

NEICO State Leases ML-21568 and ML-21569
(Genwal Coal Company)
Crandall Canyon Mine
ACT/015/032
Emery County, Utah

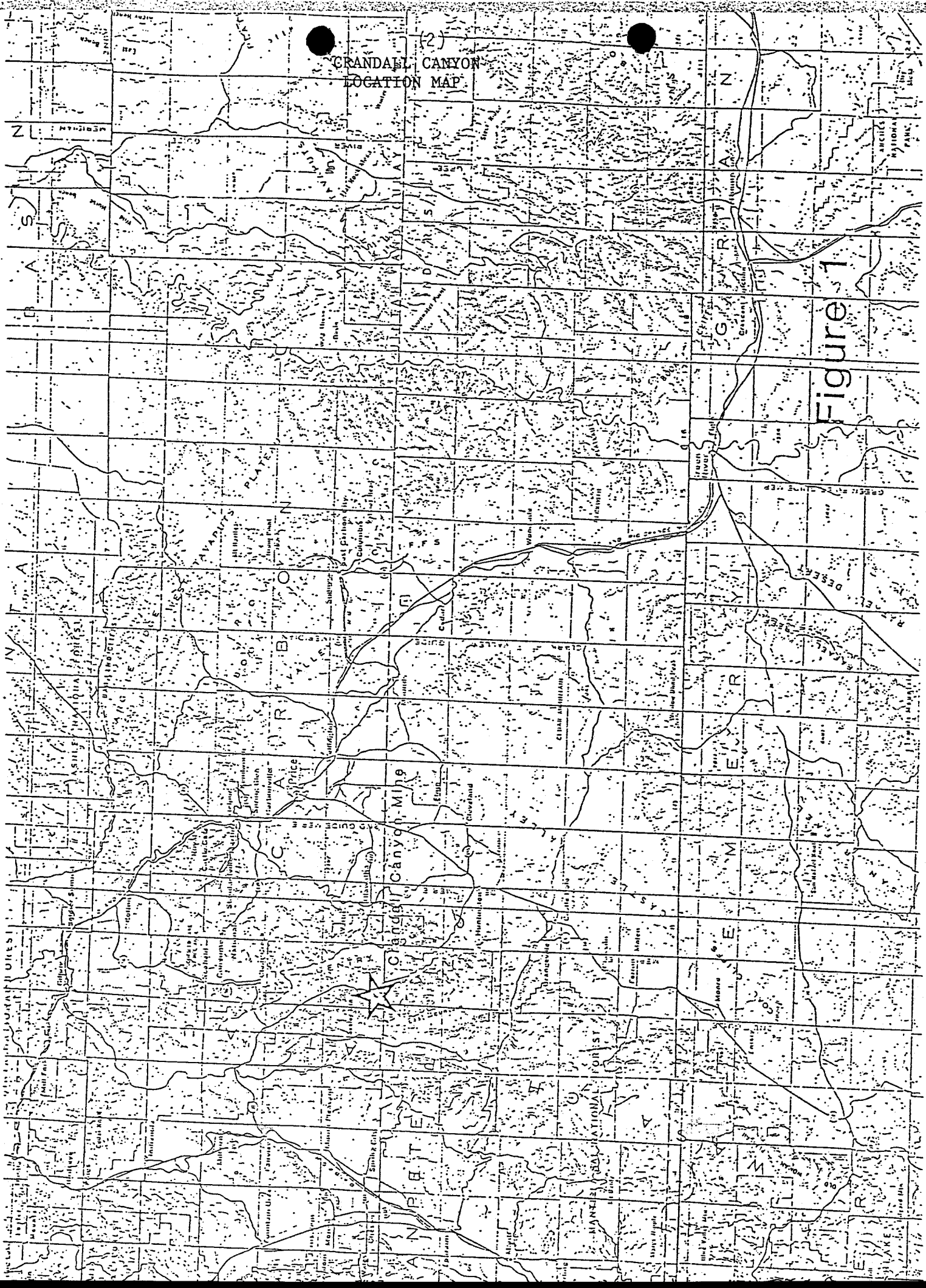
April 12, 1991

I. Introduction

This assessment defines the cumulative hydrologic impacts expected to be incurred by Genwal Coal Coal Company in the process of mining State Leases ML-21569 and ML-21568. This document updates the Cumulative Hydrologic Impact Analysis prepared for the approved mine plan on July 31, 1989. EarthFax Engineering Inc. provided the scientific consultation for NEICo on this permit. Some of their maps are used to identify sources of information. Figure numbers have been changed to conform to this document.

The cumulative impacts from mining and their effects on adjacent areas are described in a mine plan proposal submitted December 7, 1990 and this assessment. The mine plan outlines mining strategies with consideration to the rules and regulations established to maximize protection to natural resources on and adjacent to the proposed permit area. The material in this report evaluates those strategies, for anticipated coal mining, and assesses the operational procedures proposed in the application to ensure they are designed to prevent damage to the hydrologic balance outside the proposed mine permit during coal mining and reclamation operations. This report complies with federal legislation passed under the Surface Mining Control and Reclamation Act (SMCRA) and subsequent Utah and federal regulatory programs under R614-301-729 and 30 CFR 784.14(f).

Genwal Coal Company's Crandall Canyon Mine is located along the eastern margin of the Wasatch Plateau Coal Field approximately 15 miles west of Huntington, Utah (Figure 1). Access to the state leases will be accomplished underground through the existing mine via the federal leases and BLM right-of-way, see Plate 1. The lease areas consist of Section 36,


CRANDALL CANYON
LOCATION MAP
Figure 1

The eastern margin of the Wasatch Plateau forms a rugged escarpment that overlooks Castle Valley and the San Rafael Swell to the east. Elevations along the eastern escarpment of the Wasatch Plateau range from approximately 6,500 to over 9,000 feet. Outcropping rocks of the Wasatch Plateau Coal Field range from Upper Cretaceous to Quaternary in age. The rock record reflects an overall regressive sequence from marine (Mancos Shale) through littoral and lagoonal (Blackhawk Formation) to fluvial (Castlegate Sandstone, Price River Formation and North Horn Formation) and lacustrine (Flagstaff Formation) depositional environments. Oscillating depositional environments within the overall regressive trend are represented by lithologies within the Blackhawk Formation. The major coal-bearing unit within the Wasatch Plateau Coal Field is the Blackhawk Formation.

Precipitation varies from 40 inches at higher elevations to less than 10 inches at lower elevations. The Wasatch Plateau may be classified as semiarid to subhumid.

Vegetation varies from the Sagebrush/Grass community type at lower elevations to the Douglas Fir/Aspen community at higher elevations. Other vegetative communities include Mountain Brush, Pinyon-Juniper, Pinyon-Juniper/Sagebrush and Riparian. These communities are primarily used for wildlife habitat and livestock grazing.

Crandall Creek which flows past the Crandall Canyon Mine is a perennial tributary to Huntington Creek which is a tributary to the San Rafael River. The upper drainage of Huntington Creek encompasses about 200 square miles of mountainous country in the Wasatch Plateau. About 90 percent of the area is higher than 8,000 feet. The average channel gradient along Huntington Creek is about 100 feet per mile. The lower reaches of the tributaries to Huntington Creek typically have surface relief between the stream channels and tops of adjacent canyon walls of 2,000 feet or more.

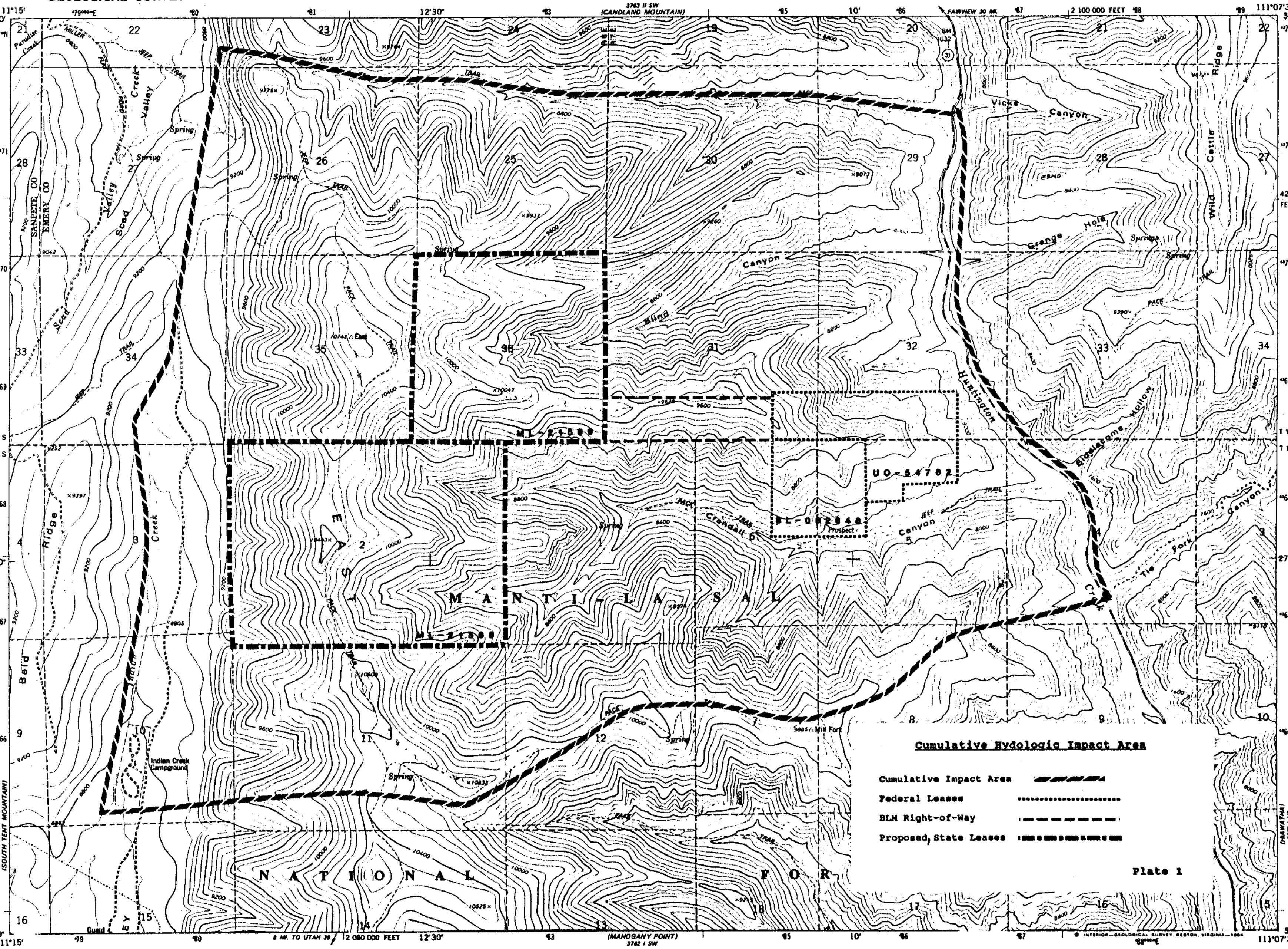
II. Cumulative Impact Area (CIA)

Plate 1 delineates the current federal leases (SL-062648 and U54762), the BLM right-of-way and the state lease tracts for the Crandall Canyon Mine operations as well as the CIA. The CIA incorporates Indian Creek on the west side of the permit area to Hunting Creek on the east, and the ridge seperating Rilda Canyon and Crandall Canyon on the south to Horse Canyon on the north. Horse, Blind and Crandall Canyons all drain into Huntington Creek. The CIA incorporates mining affects to Huntington Creek down to Tie Fork Canyon. Several small drainages flow west toward Indian Creek, the hydrologic connection between them and Indian Creek is thought to be surface only. The CIA encompasses approximately 8,320 acres.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF UTAH
UTAH GEOLOGICAL AND MINERAL SURVEY

RILDA CANYON QUADRANGLE
UTAH
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 HIAWATHA 15' QUADRANGLE



Mapped, edited, and published by the Geological Survey

Control by USGS, NOS/NOAA, and U.S. Forest Service

Topography by photogrammetric methods from aerial photographs taken 1970. Field checked 1974. Map edited 1979

Projection and 10,000-foot grid ticks: Utah coordinate system, central zone (Lambert conformal conic) 1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue. 1927 North American datum

Fine red dash-ed lines indicate selected fence lines

There may be private inholdings within the boundaries of the National or State reservations shown on this map

To place on the predicted North American Datum 1983 move the projection lines 8 meters north and 64 meters east as shown by dashed corner ticks

(JOES VALLEY RESERVOIR) 3762 IV SE

0°07' 2 MILS

12° 267 MILS

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

UTAH
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U S Route
State Route

(RED POINT) 3762 I SE

RILDA CANYON, UTAH
NW/4 HIAWATHA 15' QUADRANGLE
N3922.5—W11107.5/7.5

1979

DMA 3762 I NW—SERIES V897

III. Scope of Mining

Historically, mining was conducted near this site from November of 1939 to September of 1955. Mining in Tract 1 by Genwal Coal Company began in 1983. Genwal Coal Company currently controls approximately 526.4 acres in Huntington Canyon in Emery County, Utah. Lease SL-062648 was mined in sequence as Tracts 1 (southern half, 80 acres) and 2 (northern half, 75.2 acres). Lease U-54762 (256.5 acres) was added to the permit and accessed by extending the existing North Main entries. The BLM right-of-way (111.5 acres) allows access the contiguous state and federal coal leases. The same surface facilities are established for the previous leases will be used in mining the State Leases.

The current method of room and pillar mining in use for Lease SL-062648, U-54762 and the BLM right-of-way will be continued in the State leases. Overall, an advance-retreat mining system is projected for the mine.

The current permit area is comprised of coal lands leased by Genwal Coal Company from the United States Bureau of Land Management, under leases SL-062648 and U-54762. The BLM right-or-way was granted to Genwal Coal Company on August 8, 1990 to access the their State lease holdings. Other than the two State leases the adjacent surface lands are controlled by the United States Forest Service, Manti-LaSal National Forest and Beaver Creek Coal Company.

The reserves within the permit area are proposed for mining through 2000, however, access will be maintained through this permit area until all future reserves to the northwest and west are mined. Presently, Genwal Coal Company holds no further leases. Genwal has indicated an interest for coal reserves both north and south west of the State lease sections. The CIA (Plate 1) was designed to incorporate mine expansion and potential environmental diminution.

IV. Study Area

A. Geology

The formations exposed in the Wasatch Plateau are Tertiary and Cretaceous-aged sedimentary units. These formations are of both continental and marine origin and are comprised principally of shale and sandstone. Siltstone, mudstone and limestone occur in lesser amounts. The formations in the Wasatch Plateau area generally dip one to three degrees westward off the west flank of the San Rafael Swell. Regional dips are interrupted by principally east trending fold axes, and principally north trending fault axes.

Stratigraphic units outcropping within the study area include, from oldest to youngest, the Masuk Shale Member of the Mancos Shale, Starpoint Sandstone, Blackhawk Formation, Castlegate Sandstone, Price River Formation, North Horn Formation and Quaternary deposits. Lithologic descriptions and unit thicknesses are shown in Figure 2 and 2a.

The Hiawatha Coal Seam is the only coal seam to be mined in the new lease area. It occurs at the base of the Blackhawk Formation. Maximum overburden is approximately 2100 feet in the middle of Section 36, and the minimum overburden lies in the stream channels of Blind Canyon and Crandall Canyon where the thickness is 600 feet and 900 feet (Figure 3). The entire permit area is underlain by the Starpoint Sandstone.

B. Topography and Precipitation

Topography in the area is generally very steep and rugged with elevations ranging from approximately 7,200 feet to over 10,000 feet above sea level. Slopes vary from vertical cliffs to less than 2 percent.

Precipitation in the Wasatch Plateau ranges from 10 inches to 40 inches annually. Average annual precipitation in the CIA is approximately 20 inches (Simons 1984).

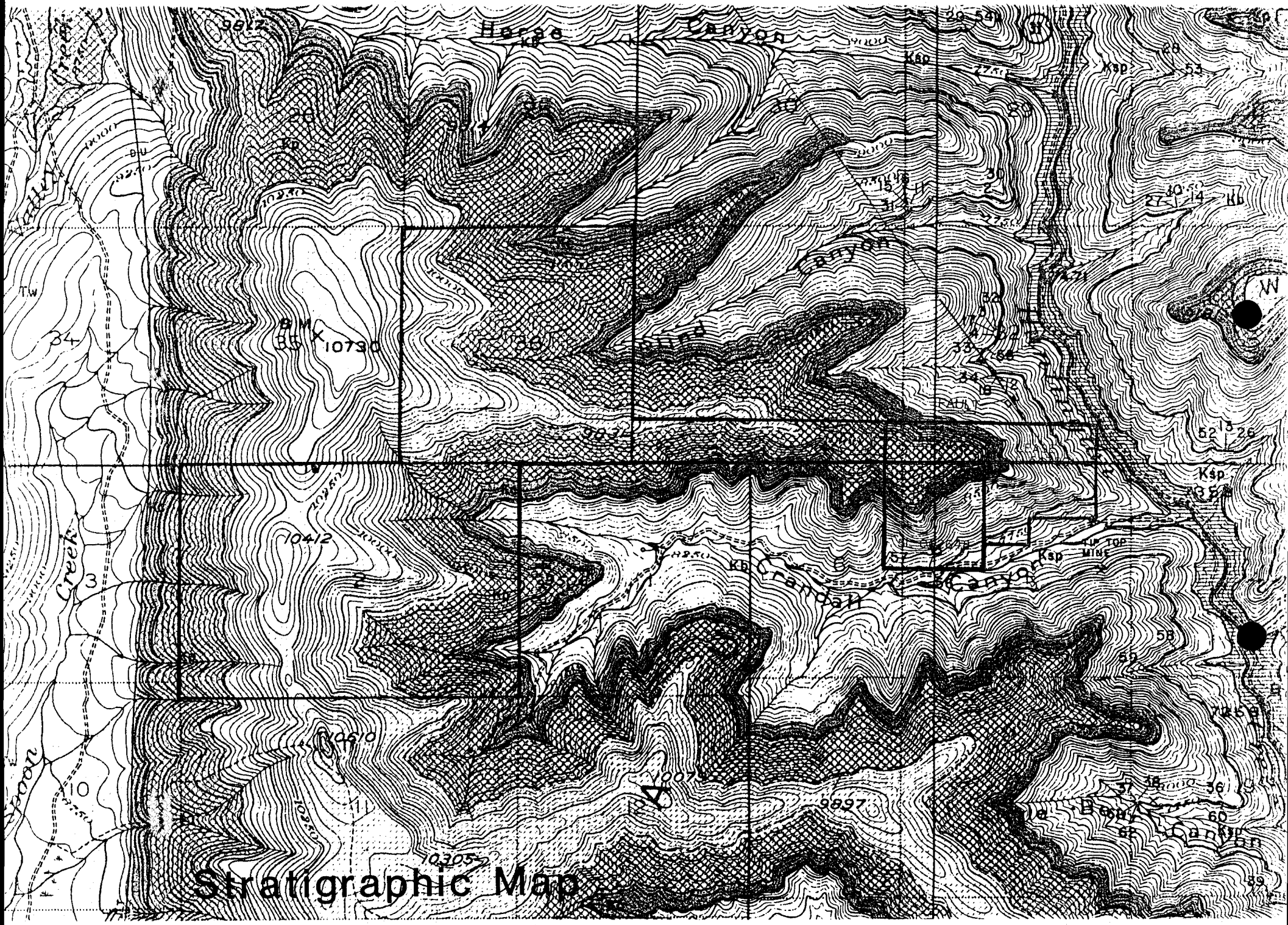
C. Vegetation

There are five vegetative communities in the CIA including Sagebrush, Mountain Shrub/Grassland, Mixed Mountain Shrub, Conifer/Aspen and Spruce/Fir. Aspen are found on the north facing south slopes and higher up on the north slopes, on ridge tops. Spruce/Fir is also found on the north slopes and appears to be tied to both a moister site as well as areas with less sunlight. Mixed Mountain Shrub and Mountain Shrub/Grassland appear to be transitional and are predominant on the open exposed ridges at approximately mid-slope. The Sagebrush community follows primarily along the ridges and is more than likely climax in nature to the shrub grass associations.

V. Hydrologic Resources

A. Groundwater

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



Stratigraphic Map

EXPLANATION (continued)

QUATERNARY

Qal — Alluvium
Stratified clay, silt, sand, gravel and some unsorted flood deposits.

Ql — Landslide Deposits
Mixed rubble and blocks of material slumped from formations at higher elevations.

Qg — Gravel Deposits
Partly consolidated poorly sorted and stratified deposits of rock fragments of local origin, pediments or terrace, up to 75 feet thick.

TERTIARY

Tv — Volcanic Flows
Bullion Canyon Series, volcanic flows.

Tg — Green River Formation
Chiefly greenish lacustrine shale and siltstone.

Tc — Colton Formation
Varicolored shale with sandstone and limestone lenses, thickest to the north. 300-1,500 feet.

Tf — Flagstaff Formation
Dark yellow-gray to cream limestone, evenly bedded with minor amounts of sandstone, shale and volcanic ash, ledge former. 200-1,500 feet.

TERTIARY
CRETACEOUS

Tw — North Horn Formation
Variegated shales with subordinate sandstone, conglomerate and freshwater limestone, thickens to north, slope former. 500-2,500 feet.

Kp — Price River Formation
Gray to white gritty sandstone interbedded with subordinate shale and conglomerate, ledge and slope former. 200-1,000 feet.

Kc — Castlegate Sandstone
White to gray, coarse-grained often conglomeratic sandstone, cliff former, weathers to shades of brown. 150-500 feet.

-Unconformity-

Kb — Blackhawk Formation
Yellow to gray, fine- to medium-grained sandstone, interbedded with subordinate gray and carbonaceous shale, several thick coal *seams. 600-1,500 feet.*

Ksp — Star Point Sandstone
Yellow-gray massive cliff-forming sandstone, often in several tongues separated by Masuk Shale, thickens westward. 90-1,000 feet.

Km — Masuk Shale
Yellow to blue-gray sandy shale, slope former, thick in north and central plateau area thins southward. 300-1,300 feet.

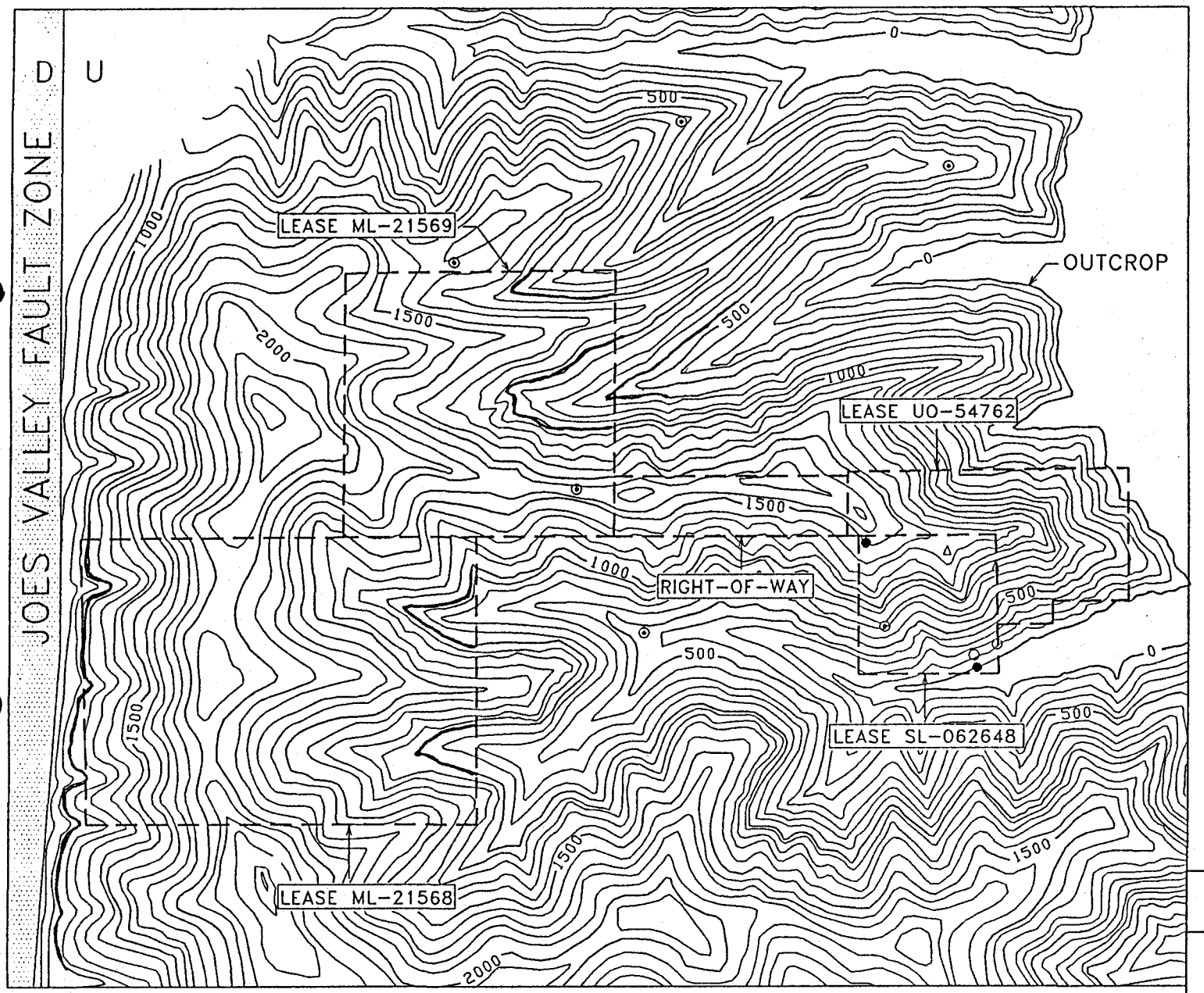
Ke — Emery Sandstone
Yellow-gray friable sandstone tongue or tongues, cliff former, may contain coal *(?) in south part of plateau if mapping is correct, thickens to west and south.* Coal *may be present in subsurface to west. 50-800 feet.*

Kbg — Blue Gate Shale
Pale blue-gray, nodular and irregularly bedded marine mudstone and siltstone with several arenaceous beds, weathers into low rolling hills and badlands, thickens northerly. 1,500-2,800 feet.

Kf — Ferron Sandstone
Alternating yellow-gray sandstone, sandy shale and gray shale with important coal *beds of Emery coal field, resistant cliff former, thickens to the south. 50-950 feet.*

Kt — Tununk Shale
Blue-gray to black sandy marine slope forming mudstone. 400-650 feet.

Figure 2a



LEGEND

- OVERBURDEN ISOPACH
- LEASE BOUNDARY
- SURFACE DRILL HOLE
- IN-MINE DRILL HOLE
- MINE SURVEY
- STRATIGRAPHIC CROSS SECTION

N

SCALE

0' 3000'

CONTOUR INTERVAL 100'

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ISOPACH MAP OF
HIAWATHA COAL SEAM
OVERBURDEN.

Figure 3

Snowmelt at higher elevations provides most of the groundwater recharge, particularly where permeable lithologies or faults/ fractures are exposed at the surface. Vertical migration of ground water occurs through permeable rock units and/or along zones of faulting and fracturing. Lateral migration initiates when groundwater encounters impermeable rocks and continues until either the land surface is intersected (and spring discharge occurs) or other permeable lithologies or zones are encountered that allow further vertical flow.

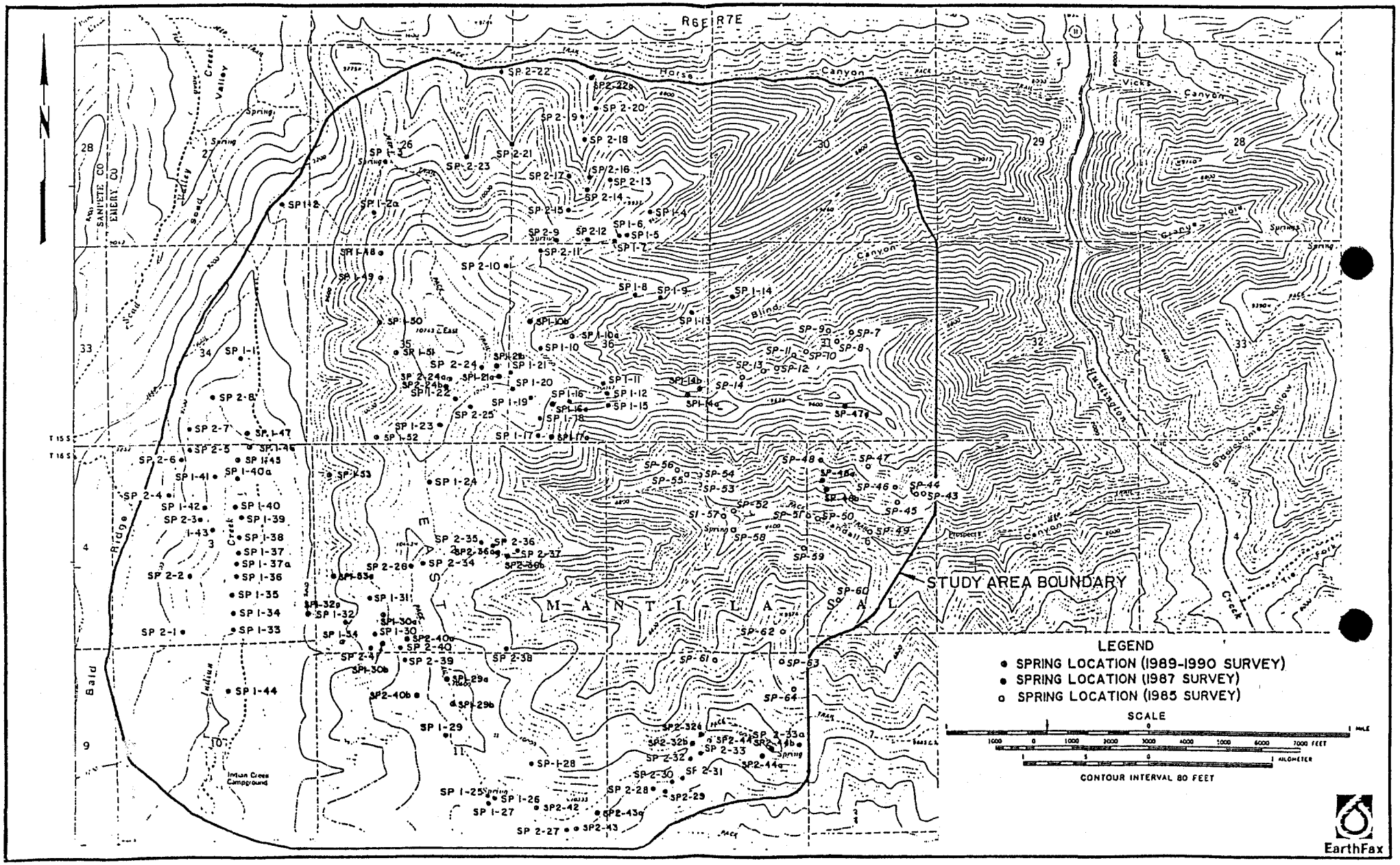
A seep and spring survey was conducted by Earthfax Engineering in June and October of 1985, 1987 and 1989 (Figure 4) provided locations of springs and seeps in the area, geologic conditions including lithologic and structural controls and the geologic formation from which the seepage issued. Flow rates, use and field characteristics were analyzed. Water samples were collected where sufficient flows were present.

Regional groundwater conditions were determined from a review of available literature and by studies conducted by the operator. Three drill monitoring wells were developed to monitor the potentiometric water levels in the Star Point aquifer. Data is collected on these sites, however on of the wells was destroyed when a mining section was abandon. Two more underground monitoring wells will be developed prior to June 1991.

Six formations outcrop in and adjacent to the mine area. According to Doelling (1972), the Masuk Shale Member of the Mancos Shale is a light gray to blue-gray marine sandy shale in the mine vicinity. This unit is exposed at the mouth of Crandall Canyon and in adjacent areas along Huntington Creek. The Masuk Shale Member yields water locally to seeps and springs but does not serve as a regionally important aquifer (Danielson et al., 1981).

The Star Point Sandstone is predominantly a light gray massive sandstone with minor interbedded layers of shale and siltstone near its base (Doelling, 1972). In the vicinity of the mine, the Star Point Sandstone is approximately 300 feet thick. The Star Point serves as an important regional aquifer (Danielson et al., 1981), yielding water to several minor and some major springs where fractured and jointed.

The Blackhawk Formation is the principal coal-bearing unit in the region (Doelling, 1972). This formation consists of interbedded layers of sandstone, siltstone, shale, and coal, all of marine origin. The Blackhawk is approximately 700 feet thick in the mine area, with the principal coal seam (the Hiawatha seam) occurring near the bottom of the formation. The formation yields water to springs and coal mines when fractured. Where it is locally interbedded with the Star Point Sandstone, the lower portion of the Blackhawk Formation is considered an aquifer



SEEP AND SPRING LOCATIONS IN NEICO STATE LEASES ML-21568 AND ML-21569 AND SURROUNDING AREAS.

Figure 4

(Danielson et al., 1981).

The Castlegate Sandstone overlies the Blackhawk Formation and consists of tan to brown cliff-forming sandstones of fluvial origin. The sandstones are massive and medium- to coarse-grained. In the area of the mine, the Castlegate yields water locally to seeps and springs but does not serve as an important regional aquifer because it is commonly drained within short distances from its recharge area due to deeply incised canyons (Danielson et al., 1981).

The Price River Formation consists predominantly of friable limey sandstone interbedded with pebbly conglomerates and shales. It forms steep receding slopes and reaches a maximum thickness of about 500 feet in the mine area (Doelling, 1972). This formation yields water locally to seeps and springs (Danielson et al., 1981). However, like the Castlegate Sandstone, deeply incised canyons in the area prevent the Price River Formation from being an important regional aquifer.

The uppermost formation that outcrops within the area adjacent to the mine plan area is the North Horn Formation. This formation consists of interbedded limestones, sandstones, and shales (Doelling, 1972). Due to high topographic presence, the North Horn Formation in the CIA serves primarily as a recharge unit to underlying formations rather than as an important source of water itself.

Investigations by Danielson et al. (1981) indicated that most, if not all, groundwater in the region is derived from snowmelt. Recharge tends to be limited in areas underlain by the Price River Formation and older rocks (relative to recharge in areas underlain by younger rocks) due to slope steepness and relative imperviousness (both of which promote runoff rather than infiltration of snowmelt).

Detailed potentiometric surface data are not available for the CIA, however, the operator installed a groundwater monitoring well in March 1987. The well was drilled using air rotary methods to a total depth of 375 feet and encountered the Star Point Sandstone through the entire depth.

The driller indicated that the formation was relatively homogeneous except in the zone from 290 to 335 feet, where the sandstone became courser. It is from this zone that the well is producing water, with water first being encountered at a depth of about 315 feet. The static water level approximately one week after completion of the well was at a depth of 186.1 feet below ground surface.

Slug tests were performed on the completed well to determine hydraulic characteristics of the aquifer. The slug test data were analyzed using a method developed by Bouwer and Rice (1976). Transmissivities were calculated to be approximately 4.5 square feet per day assuming that the 45 foot producing zone accounts for the entire thickness of the aquifer at the site of MW-1.

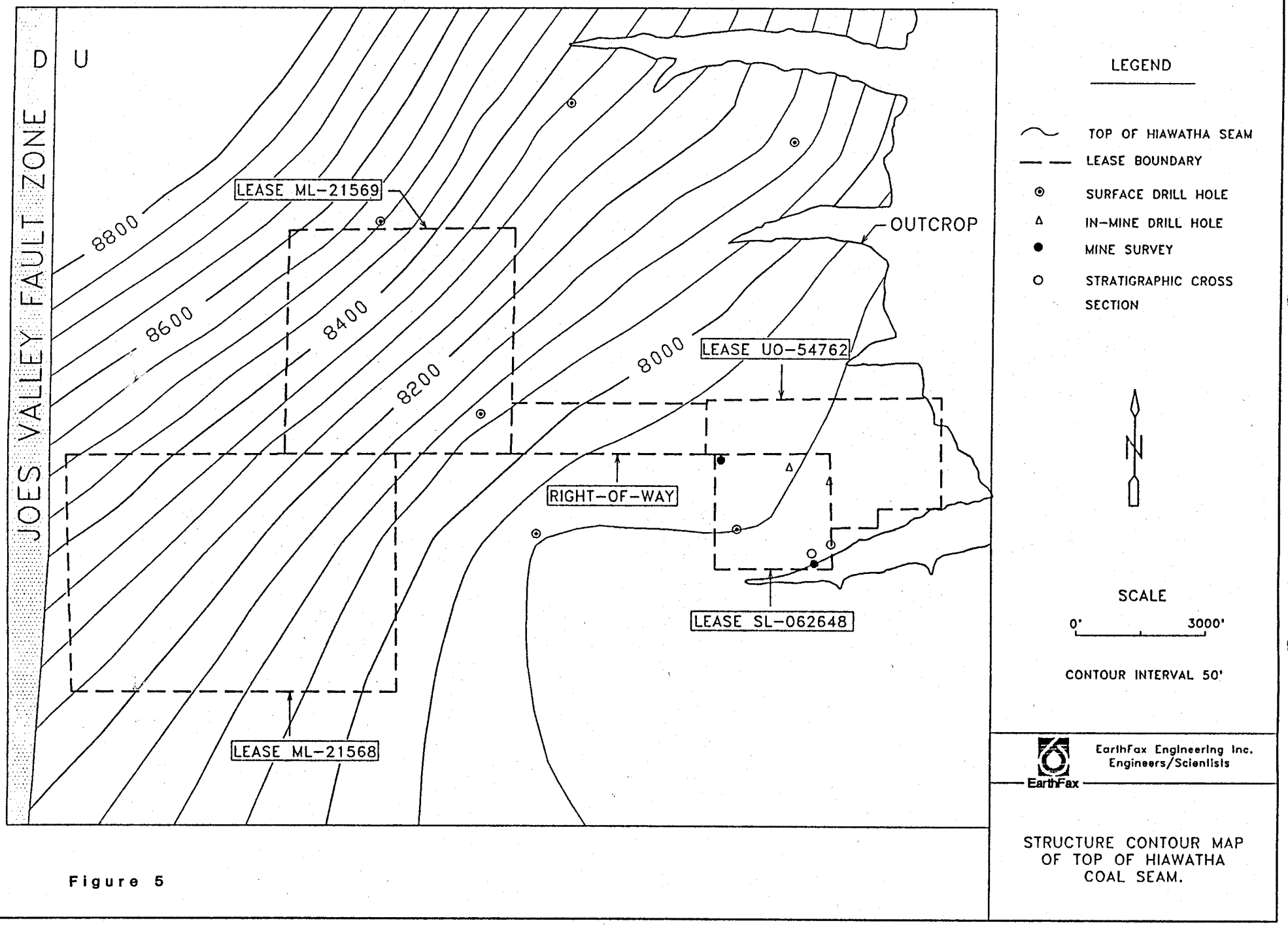
Groundwater inflow to the existing underground workings amounts to approximately 100 gallons per minute. The inflow is currently being used in the mining process. Mine inflow rates in the State Leases are estimated using Figures 5 and 6. The figure uses hydraulic conductivities of 0.01 and 0.02 foot per day for the Blackhawk and Star Point Formations. To predict groundwater inflow into the leases, a comparrison was conducted between the predicted flow and the measured flow in the existing leases. The values agreed closely, and a predictive inflow of 0.33 cfs (148 gpm) is expected. A modification of the UPDES permit has been obtained for inflow that exceeds the requirements for underground use and discharges from the mine occur.

At least two in-mine wells will be developed to collect groundwater information on the Blackhawk/Star Point aquifer.

The predominant chemical constituents in most springs in the region are calcium and bicarbonate (Danielson et al., 1981). Dissolved solids concentrations generally range from about 50 to 750 milligrams per liter. Regionally, the concentrations of major dissolved constituents in water from individual geologic units is highly variable, due to the complex lithologic nature of the area (Danielson et al., 1981).

Over 50 percent of the seeps and springs discovered during the June, 1985 inventory issued from the Blackhawk Formation. However, flow rates at these points were normally minimal (less than one gallon per minute), with seepage issuing predominantly at the interface between sandstone lenses above and less permeable shale layers below. Most of these seeps and springs had dried up prior to the October survey. Useage at these points of seepage is minimal, due to the low flow rate and inaccessibility of the seeps.

The low seepage rates measured in most of the seeps and springs issuing from Blackhawk Formation are due to the low hydraulic conductivity of the formation in its unfractured state. Laboratory permeability data provided by Lines (1985) from a core sample collected in Section 27, T. 17 S., R. 6 E. (approximately 10 miles south of the mine permit area) indicate that sandstone units within the Blackhawk Formation have an average horizontal hydraulic conductivity of 1.3×10^{-2} feet per day and an average vertical hydraulic conductivity of 3.8×10^{-3} feet per day. Shales and siltstones within the Blackhawk Formation were found to have



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Engineers/Scientists

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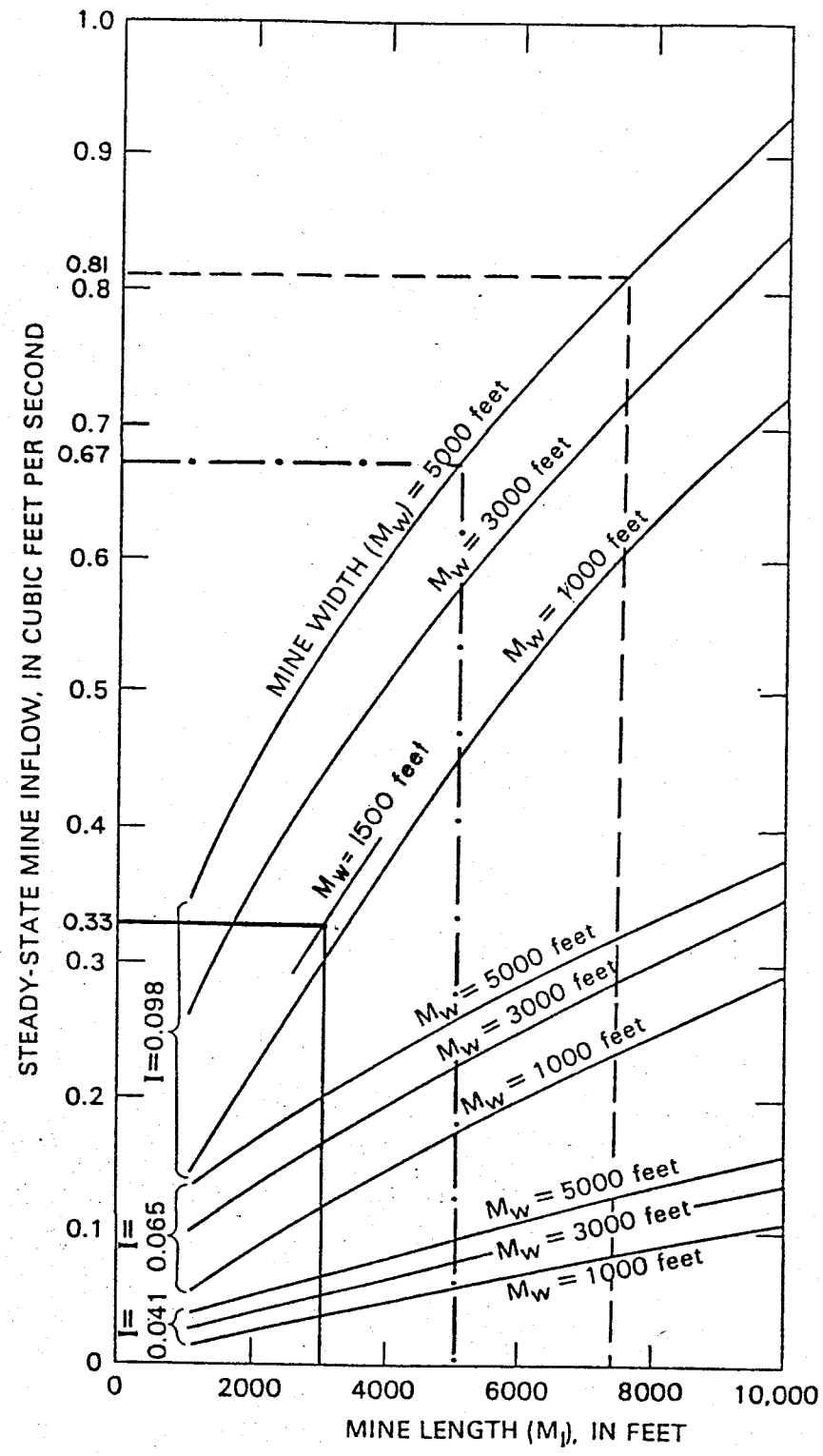
STRUCTURE CONTOUR MAP
OF TOP OF HIAWATHA
COAL SEAM.

Figure 5



SOURCE: LINES (1985)

——— PRESENT MINE AREA

— — LEASE ML-21568

—·— LEASE ML-21569

Figure 6

PROJECTED GROUNDWATER INFLOW INTO THE NEICO STATE LEASES ML-21568 AND ML-21569 PROPOSED MINE WORKINGS.

EarthFax

maximum horizontal and vertical hydraulic conductivities of 1.0 X 10^{-7} and 1.2 X 10^{-6} feet per day, respectively.

The relatively large hydraulic conductivity of the sandstones of the Blackhawk Formation compared with the siltstone and shales indicates that the fine grained sediments of the formation serve as barriers to the downward movement of water. In simple terms, as water recharges the Blackhawk Formation (either through snowmelt, rainfall, or subsurface seepage from an adjacent formation), it is permitted to percolate downward within the sandstone beds.

However, upon reaching a less permeable siltstone or shale layer, the water is forced to flow horizontally to the surface, issuing at the interface between the two units.

Notable exceptions to the above generality concerning the Blackhawk Formation occur at a few springs that issue from fractured sandstone within the formation. Examples of this phenomenon were found in the western portion of the survey area, where flow rates of up to 15 gallons per minute were encountered during both the June and October inventories. Travertine deposits are common at these springs, suggesting that the recharge area for these springs is dominated by limestone (probably the North Horn Formation on the ridges to the north and west). The Blackhawk Formation apparently serves more as a conveyance body rather than a significant source of water to these springs.

Several seeps and springs issue at the site from colluvium overlying sandstone of the Blackhawk Formation and the Castlegate Sandstone. These seeps normally occur in drainage bottoms where shallow subsurface water collects at topographic lows. Nearly all flows from seeps of this type were insignificant in both June and October, suggesting (together with the topographic position) that these seeps are intermittent in nature.

Most seeps and springs issuing within the survey area from the Castlegate and Star Point Sandstones flow from bedding planes within these formations. Flows issuing in this manner were generally low during the June inventory (less than one gallon per minute) and nonexistent during the October inventory.

As noted, flow rates measured during the October survey were generally significantly less than those found during the June survey. In June, a total of 80 seeps or springs were found, 34 of which had sufficient flow to sample (the remaining 46 were seeps that could not be sampled). In October, 55 of the sources originally discovered were dry. An additional 7 sources existed only as seeps, with only 18 of the original sources containing sufficient flow to sample.

The results of the seep and spring inventory tend to support the conclusion of Danielson et al. (1981) that groundwater occurs in most geologic formations at the site (all but the Masuk Shale Member of the Mancos Shale), but none of the units are saturated everywhere. No continuous zones of saturation appear to be present at the site, indicating that potentiometric surface maps would be difficult to prepare.

Based on the conclusions of Danielson et al. (1981), it is assumed that groundwater within the permit and adjacent areas flows toward the main canyons (Crandall, Blind, and Huntington) and then along Huntington Canyon to the valley bottom.

The data indicates that the specific conductance of water issuing from springs in June generally increased with increasing stratigraphic depth. This is in agreement with findings of Danielson et al. (1981). Springs issuing from the Price River Formation typically had a specific conductance during the June survey that varied from 150 to 450 umhos/cm at 25°C while those issuing from the Blackhawk Formation and Star Point Sandstone had a specific conductance varying from 500 to 1000 umhos/cm at 25°C. This increase in specific conductance is indicative of leaching of minerals by the groundwater as it flows through increasing distances of bedrock to the lower stratigraphic positions.

The pH of water issuing from springs in the survey area showed no trends within or between formations. Values varied from 6.80 to 8.57, averaging 7.74. Hence, spring water in the study area is slightly alkaline.

In those springs with sufficient water to sample, pH generally increased slightly between June and October. Increases normally amounted to 0.1 to 0.5 pH unit. Specific conductance showed no consistent pattern between the June and October data, with approximately as many increases as decreases between June and October.

A list of surface water rights was obtained from the files of the Utah Division of Water Rights in September 1987. All surface water rights are held by the U. S. Forest Service for stock watering purposes. Although the rights exist, usage of these rights are apparently curtailed.

B. Surface Water

Crandall Canyon is an east-flowing tributary of Huntington Creek, one of the major tributaries of the San Rafael River.

Huntington Creek had annual flows near Huntington ranging from 25,000 to 150,000 acre-feet during the period of October 1931 through September 1973, averaging 65,000 acre-feet per year (Waddell et al., 1981). Variations in the annual flow of Huntington Creek near Huntington are portrayed graphically in Figure 4.

Approximately 50 to 70 percent of streamflow in the mountain streams of the region occurs during May through July (Waddell et al., 1981). Streamflow during this late spring/early summer period is the result of snowmelt runoff. Such seasonal variations are common for streams in the area (Waddell et al., 1981).

The quality of water in Huntington Creek and other similar streams in the area varies significantly with distance downstream. Waddell et al. (1981) found that concentrations of dissolved solids varied from 125 to 375 milligrams per liter in reaches above major diversions to 1600 to 4025 milligrams per liter in reaches below major irrigation diversions and population centers. The major ions at the upper sites were found to be calcium, magnesium, and bicarbonate, whereas sodium and sulfate became more dominant at the lower sites. They attributed these changes to (1) diversion of water containing low dissolved solids concentrations, (2) subsequent irrigation and return drainage from moderate to highly saline soils, (3) groundwater seepage, and (4) inflow of sewage and pollutants from population centers.

Average annual sediment yields within the Huntington Creek drainage basin range from approximately 0.1 acre-feet per square mile in the headwaters area to about 3.0 acre-feet per square mile near the confluence with the San Rafael River (Waddell et al., 1981). Increases in sediment yield with increasing distance downstream is generally the result of increasing amounts of shale and sandstone in the downstream direction (Waddell et al., 1981).

The U. S. Geological Survey established a gaging station at the mouth of Crandall Creek in 1978. Flow data collected at the gaging station are not complete for the winter in most years, due presumably to data acquisition problems. However, the limited data indicate that most of the flow of Crandall Creek occurs in the period of May through July, in keeping with the conclusions of Waddell et al. (1981). Assuming an average of 30 acre-feet per month for the period of missing record, the average annual flow for the six year period of data was 2740 acre-feet.

Surface water quality data collected from Crandall Creek by Genwal for the Tract 1 Lease from 1985 indicate that the dominant ions in Crandall Creek are calcium and bicarbonate. Total dissolved solids concentrations in the stream have varied from 180 to 286 milligrams per liter, with lower concentrations normally occurring during the high flow season. Total suspended solids

concentrations in Crandall Creek have varied during the period of record from 0.5 to 208.0 milligrams per liter. As expected, the highest suspended solids concentrations generally occur during periods of highest flow.

VI. Potential Hydrologic Impacts

A. Groundwater

Dewatering and subsidence related to mining have the greatest potential for impacting groundwater resources in the CIA.

Dewatering

Inflow into the existing underground workings amounts to approximately 100 gallons per minute and an increase is expected from the State Leases by at least 148 gallons per minute. Continued interception of mine inflow may potentially dewater certain localized aquifers not only during the first five year permit term, but also throughout the life-of-mine as the workings are further developed. Studies will be conducted during the mining process to establish a better understanding of the groundwater regime and the influences of mining. Adverse impacts will require expedient mitigation either by restricting mining or reestablishing the hydrologic balance.

Subsidence

Subsidence impacts are largely related to extension and expansion of the existing fracture system and upward propagation of new fractures. Potential area of impacts are shown on Figure 5. Inasmuch as vertical and lateral migration of water appears to be largely controlled by fracture conduits, readjustment or realignment in the conduit system may potentially produce changes in the configuration of ground-water flow. Potential changes include increased flow rates along fractures that have "opened" and diverting flow along new fractures or permeable lithologies. Subsurface flow diversions may cause the depletion of water in certain localized aquifers, whereas increased flow rates along fractures would reduce ground-water residence time and potentially improve water quality.

Therefore, mining may dewater certain localized aquifers and affect flow rates along existing or new subsidence related fractures. However, these impacts will be localized near the mine permit area. Stream channels will be protected by preventing disruption to the surface through support controlled mining. No other groundwater disturbances exist within the CIA and cumulative hydrologic impacts are not expected.

B. Surface Water

The main concern in terms of impact to surface water is water quality deterioration downstream from the minesite, primarily in the form of suspended sediments. Typically the suspended sediment concentration in Crandall Canyon Creek since 1983 varied from approximately 205 mg/l to 0.5 mg/l. The low suspended sediment values are associated with natural climatic and geologic processes although a proportion may be attributed to surface disturbances from roads and the mine pad area. Sediment controls do exist for the disturbed surface areas. Therefore, the impact associated with mining in Crandall Canyon is minimized by surface controls (i.e., sediment pond, diversions, etc.). No other surface disturbances due to mining occur within the CIA and therefore cumulative hydrologic impacts are not expected.

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

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TECHNICAL ANALYSIS

Genwal Coal Company, Inc.
Crandall Canyon Mine
New Lease
ACT/015/032
Emery County, Utah

March 20, 1991

This document evaluates the adequacy of Genwal Coal Company's mine proposal for State Leases ML-21568 and ML-21569 submitted as Chapter 14 on December 7, 1990. This analysis is to ensure that the applicant meets the performance standards of Utah's Coal Mining regulations and the rules established under 30 CFR 784.14.

R614-301-525 Subsidence Control - DWD

Existing Environment and Applicant's Proposal

The applicant presents a subsidence control plan which begins on page 14-27 in Chapter 14. The subsidence plan identifies the planned underground mine design on Plate 14-1. The mine is planned for room and pillar type mining. Pillars will be developed 80 feet by 140 feet long, with entry ways 20 feet wide.

Methods used to evaluate safty factors of the pillar design are established in Sections 12.3.1 and 12.3.2, as well as in Appendix 12-1. Safty factors for the leases range from 1.47 to 4.37. Map 14-8 identifies the overburden isopachs of the Hiawatha Coal seam, the only seam of economic value on the permit area. Overburden thicknesses range from a low of 600 feet where Blind Canyon intersects the eastern edge of Lease ML-21569 to a high of 2350 feet in lease ML-21568.

Maximum subsidence limits have been projected on a map (Figure 14-9) for the leases. The maximum amount of subsidence indicates that 3.5 feet could occur in Lease ML-21568. and approximately 1 foot at the outer edges of both lease areas. In order to delineate the maximum limit of subsidence in the vicinity of the leases an angle-of-draw of 30 degrees (vertical) was used.

Figure 14-10 identifies the springs and seeps that lie within the maximum limit of potential subsidence. All springs within the subsidence zone except springs SP-13 and SP-14 appear to exist above 1000 feet of overburden. The springs eminate from the North Horn Formation and Price River Formation.

There are not any structures, utilities, right-or-ways or other resources other than spring that are currently being utilized or will be impacted from mining.

Genwal will extend its current subsidence monitoring program to encompass the state lease areas. Designs have been submitted to establish control monuments and monitoring sites for a aerial photogrametric survey. Baseline information for the lease areas was flown and collected in October 1989. Surveys will be conducted annually. Every fifth year a color infrared survey will be conducted to monitor vegetation variation (page 12-13).

The applicant commits to notifying the appropriate agencies if subsidence effects springs by 50 percent or negative impacts are noticed. If impacts to grazing the applicant commits to restoring or compensating the appropriate party after the grazing loss is proven to have resulted from surface subsidence.

Compliance

Except as stated in the following comment the applicant has complied with the requirements of this regulation.

The U.S. Forest Service determined that subsidence projections have the potential to encroach on Forest Service lands which lie outside the lease areas. Due to the sensitive nature of resource values and managment objectives for the area an Environmental Assessment will have to be developed if this scenerio proceeds. Until such time as the EA can be completed to identify adverse impacts the applicant can not sponsor a mine plan that has the potential or promoting surface effects on Forest Service lands.

Stipulation R614-301-525 DWD

The applicant will not be allowed to conduct mining operations which will influence or project disturbance of landuse or surface features on U.S. Forest Service lands. The applicant will be restricted to conduct no subsidence mining operations within an angle-of-draw established at 30 degrees, horizontal, from the boundaries of State Leases ML-21568 and 21569 until the Regulatory Authiority either receives a letter from the

Manti-Lasal National Forest granting permission to encroach on their boundaries or by receiving geotechnical data from Genwal that will allow mining at a lesser angle-of-draw.

1. The applicant will be required to develop a mine map that reflects a no mining area within a 30 degree angle-of-draw, horizontal, other than developing main entries with no second or retreat mining, along the boundaries between the State Leases and Forest Service lands. The applicant will be required to submit the map within 60 days of permit approval which identifies the no mining area.

The applicant has not identified measures to protect the stream channel in Blind Canyon, and Crandall Canyon from subsidence. The Forest Service have established water rights along the stream channel which should be protected. The appicant will be required to maintain surface configuration by retaining support pillers along the stream channel buffer zone. The buffer zone will be establish at a 30 degree angle-of draw and no secondary mining will take place in the buffer zone, until the applicant submits sufficient information to show that subsidence of those areas will not occur.

2. The applicant must submit a map and plans to protect those portions of Blind Canyon and Crandall Canyon stream channels which lie within the state leases. The applicant will be required to submit the map within 60 days of permit approval.

R614-301-535.100 Operational Plans for the Disposal of Excess Spoil - PB

Applicant's Proposal:

In section 14.3.2.2 of this submittal (Waste Disposal Plans) the reader is refered to sec 3.3.9 of the MRP. Genwal Coal Co submitted a modified section 3.3.9 of the MRP on February 10, 1991. This waste disposal plan describes the gobbing of spoil underground and the disposal of excess spoil at a landfill.

Compliance:

Storage of underground development waste underground is in compliance with the regulations. However, the practice of removing coal mining waste from the permit area is not in compliance with this regulation. Section 14.3.2.2 can not be approved.

Stipulation R614-301-535.100 PB:

1. Within 30 days of permit approval, Genwal Coal Co. must develop a plan for the disposal of excess spoil within a permitted area. For further details see stipulation below under R614-301-536.

Applicant's Proposal:

Present plans described in sections 3.3.9.2 and 3.3.9.3 (submitted on February 10, 1991) call for sediment pond sludge and oil contaminated soils to be taken to a landfill outside the permit area.

The removal of dry sediment pond sludge to Sinbad Landfill was approved on 7/16/86 by Lowell Braxton, to "facilitate compliance/ construction schedules at the Genwal Mine." This approval was granted for a singular pond cleaning. Correspondence records show that on 8/5/86 a stipulation was written in the mid-term permit review. This stipulation reads as follows:

> Within 30 days from the date of the approval of the mid-term review, the Operator shall submit to the Division a detailed set of plans for the location, installation, operation and reclamation of a non-coal waste disposal facility to be included within the mine permit area and disturbed area boundaries....No permanent disposal of non-coal waste material, sediment pond waste, coal spoils, or coal processing waste shall be made by the Operator until such time as the above modifications are approved. The Operator shall store all such material within the temporary waste storage facilities as shown on Plate 3-1 of the MRP.

On August 20, 1986, Andrew C. King of Genwal Coal Co. responded to the mid-term permit review stipulations in a letter to Lowell Braxton. The letter simply states:

> Genwal Coal accepts the stipulations for the surface construction approval as stated in your letter dated August 5, 1986.

Compliance:

The practice of removing coal mining waste from the permit area can not be approved. Coal mine waste includes sediment pond sludge, underground development waste, coal processing waste, and oil contaminated soil.

Genwal Coal Co. is referred to the 11-26-90 memo from Lowell Braxton to all Title V Staff (RE: Sediment Pond Waste Disposal). A copy of this memo was sent to Genwal Coal Co. on March 11, 1991.

Stipulation R614-301-536 - PB:

Within 30 days, Genwal Coal Co. must develop a plan for the disposal of coal mine waste within a permitted area. The operator shall submit to the Division a detailed set of plans for the location, installation, operation and reclamation of a coal mining waste disposal facility. This submittal will follow the review and public notice requirements for an amendment to the Mining and Reclamation Plan.

No temporary or permanent disposal of coal mining waste material shall be made by the Operator, until the above modifications are approved and finalized, with the exception of the underground storage of underground development waste.

R614-301-600 Geology DWD

Applicants Proposal

The regional and local geologic framework has been depicted in Chapter 6 of the February 1988 mine plan. A geologic map (Plate 6-1) identifies the structure and stratigraphy over the lease area.

A drill log for drill hole DH-7 was submitted to identify the lithologic facies of Section 2. This information will be held confidential. Exploration logs drilled in adjancent to the leases
will be submitted as soon as they are desyphered from the geophysical logs. The applicant has allowed the DOGM to view and evaluate the exploration cores.

Compliance

The applicant has submitted sufficient information to define the geology of the lease areas and adjacent areas.

Stipulations

None

R614-301-700 Ground Water Hydrology DWD

Existing Environment and Applicant's Proposal

No material damage or diminution of value of foreseeable use of renewable resource lands is expected to occur. The applicant plans to minimize changes to the prevailing hydrologic balance by monitoring springs and mine water production for discharge and quality. The applicant describes the methodologies to be used to analyze and maintain the ground water conditions at and adjacent to the minesite in Section 14.5 and Chapters 3, 7 and 12 of the Mining and Reclamation Plan (MRP).

The geologic characteristics in the vicinity of the mine area are described in Chapters 6 and 7 of the February 1988 mine plan submittal.

Ground water hydrology is also addressed in Chapter 7 of the February 1988 mine plan submittal. The applicant conducted seep and spring surveys during June and October of 1985. Spring locations and monitoring sites are illustrated on Figures 7-2 and 7-3. Table 7-1 provides the baseline data obtained from 1985 surveys.

In March of 1987 the applicant developed a ground water monitoring well (MW-1, see Figure 7-4 for location). The well monitors the water level in the Star Point Sandstone at a level approximately 186 feet below the surface. During the first quarter of 1989 the operator will construct two wells (MW-2 and MW-3, see Figure 7-4) in the mine, which will be used to monitor the levels and quality of the Star Point Sandstone.

Water level measurements and water quality samples will be collected from the wells on a quarterly basis following completion. Water quality samples will be analyzed according to the list provided in Table 7-4.

Compliance

The applicant proposes to increase the area of underground mining but will not change the existing surface facilities and related surface hydrology. Therefore, any changes in surface flow or surface water quality would be a result of intercepting groundwater flow in the mining process and/or capture by subsidence. The addition of lease ML-21569 (T. 15 S., R. 6 E., Section 36), underlies the headwaters of Blind Canyon and the south tributary to Horse Canyon, both are intermittent streams within the lease area. The addition of lease ML-21568(T. 16 S., R. 6 E., Section 2), underlies a portion of the head waters of

Crandall Canyon, a perennial stream draining west, and includes the main tributary. The remainder of the area (< 50%) drains east of the divide towards Indian Creek also a perennial stream.

The applicant uses the hydro-geologic description of the Trail Mountain area to describe the proposed mining area. The applicant also submitted additional information to address mining the State Leases. This information was submitted to the division in the fourth quarter hydrologic report. The information submitted includes a complete seep and spring inventory of the state lease and adjacent lands. It also includes information on geologic conditions of the area.

Stipulations R614-301-700 sf

The Applicant has not sufficiently demonstrated hydro-geologic connection between the Trail Mountain area and the proposed site. Although the applicant has submitted additional hydrologic and geologic information it is not provided in the application package.

The applicant shall submit information showing that the hydro-geology of the lease area is the same as that described. The applicant shall submit the seep and spring inventory as part of the Mining and Reclamation Plan.

R614-301-724.200 Surface Water Information

The applicant has included a commitment to include baseline and operational monitoring of the hydrologic regime and water quality of Blind Creek. Monitoring commenced on 11-21-90. The applicants analysis of geologic conditions indicated that the lease area does not have a significant affect on the ground water hydrology east of Joes Valley Fault and will not need to conduct monitoring in that area.

Compliance

The applicant needs additional information to comply fully with a demonstration of surface-water quantity and quality for the south tributary of Horse Creek. The applicant has not provided sufficient information to determine if the main tributary to Crandall Canyon is perennial or intermittent within the lease boundary. The applicant did not submit sufficient information to demonstrate that Joes Valley Fault is not hydrologically connected with the lease area (see Ground Water Information).

Stipulation 724.200-SF

1. The applicant shall include a monitoring regime for Horse Creek tributary, and information characterizing seasonal regime of upper Crandall Canyon

R614-301-727 Alternative Water Source Information

The applicant has committed to contact the Utah Division of Wildlife resources to install a guzzler on a case by case due to diminution of ground water resources. The applicant has also committed to mitigation of water resources where flow is reduced by 50 % due to subsidence.

Compliance

The applicant has not addressed the water availability and alternative water sources for all existing pre-mining uses that may be affected by mining.

Stipulation R614-301-727-SK

The applicant will amend the permit to include measures to be taken to protect or replace all potentially affected pre-mining water uses.

731.100 Hydrologic Balance Protection

Surface water protection for surface facilities is contained in the currently approved plan. For additional mine water inflow the applicant has committed to treatment through a new sump and pump facility, and routing excess water to the existing sump as a secondary treatment, then finally routing discharge to the sedimentation pond. The permittee has committed to Utah Pollution Discharge Elimination System monitoring for their discharge sites.

Compliance

The permittee is in compliance with this section but, must not rout the mine water to the sedimentation pond unless the pond is re-sized to demonstrate detention storage and treatment of the design storm (10yr-6Hr) event including maximum mine-water discharge.

Stipulation

The applicant must remove the reference to routing mine water through the sedimentation pond or demonstrate adequate sedimentation design.

Surface Water

The proposed new lease areas are primarily located in the Crandall Canyon drainage basin and to a limited extent in an unnamed tributary to Huntington Creek. The lease area is comprised of surface lands that are primarily located in headwater areas (elevation approximately 9200 ft.) with no perennial or intermittent streams existing. Some very insignificant, mildly developed ephemeral drainages occur on the lease area. These areas are located in a relatively remote and inaccessible area. The applicant proposes no additional surface water monitoring sites for this area.

UMC 817.53 Transfer of Wells - DWD

Existing Environment and Applicant's Proposal

The applicant has addressed this issue in Volume 1, Chapter 3, pages 3-29 and 3-30 (submittal dated 2-10-88) in the MRP.

No transfer of wells will occur. The applicant intends to seal all wells at cessation of mining operations. Plans incorporating permanent sealing methods will be submitted to the Regulatory Authority at that time. The plans will include approved sealing methods.

Compliance

The information submitted by the applicant is sufficient to address this section.

Stipulation

None