0081

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Mine Number: C/007/007

File Name: Incoming

To: DOGM

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Company N/A

Date Sent: N/A

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SUMMARY OF AVAILABLE AND PROPOSED GEOLOGIC AND HYDROLOGIC DATA. SUNNYSIDE NO. 5 MINE PAP.

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SUMMARY OF AVAILABLE AND PROPOSED GEOLOGIC AND HYDROLOGIC DATA SUNNYSIDE NO. 5 MINE PAP

Prepared for

KAISER COAL CORPORATION

Prepared by

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1.0 GEOLOGIC DATA

The local and regional geology for the Sunnyside No. 5 permit area will be described using both published and non-published geologic data. Published data sources will be:

Economic Geology of the Castlegate, Wellington, and Sunnyside quadrangles, Carbon County, Utah (Clark, 1928)

Geology of Central Utah Coal Fields; Book Cliffs (Doelling, 1972)

Observations on the Sunnyside Coal Zone (Doelling, 1981)

Preliminary Lithologic and Structural Map of Sunnyside No. 1 Mine Area, Carbon County, Utah (Osterwald, 1962)

Bedrock, Surficial and Economic Geology of the Sunnyside Coal-Mining District, Carbon and Emery Counties, Utah (Osterwald, et. al., 1981)

Geology of the Single-Entry Project at Sunnyside Coal Mines 1 and 2, Sunnyside, Utah (Scheibner, 1979)

Coal Resource Occcurence and Coal Development Potential Maps of the Sunnyside Quadrangle, Carbon County, Utah (U.S.G.S. Open File Report 79-491)

Coal Resource Occurence and Coal Development Potential Maps of the Patmos Head Quadrangle, Carbon County, Utah (U.S.G.S. Open File Report 79-492)

Final Environmental Impact Statement, Development of Coal Resources in Central Utah (U.S. Geological Survey, 1979)

Stratigraphy of Coal-Bearing Rocks of Book Cliffs, Utah, Colorado (Young, 1966)

Unpublished data and various government agency submittals from Kaiser Coal Corporation

Stratigraphy and structural geology will be described in both a regional and local context.

1.1 Geologic Mapping.

Surface geologic maps for the area are available in Osterwald (1981) and Doelling (1972). The outcrop patterns of exposed geologic units and a number of faults with unknown displacement are shown on the maps.

These existing geologic maps will be enlarged and traced onto 7 1/2' topographic bases (1:24,000 scale). Osterwld's map will be used to prepare a geologic map of the permit area, using Doellings map as needed to help in placing contacts and faults. Placement of stratigraphic contacts on the larger scale map will be verified by study of color aerial photo graphs. A series of reconnaissance level geologic mapping traverses will be made across the Sunnyside No. 5 area as necessary to confirm the interpretation of surficial geology made by enlarging Osterwald's map and examining the available photography. In addition, the stratigraphic nomenclature used by Osterwald (1981) will be applied, to the extent possible, to the interpretation of logs from available drill holes in the new permit area (see Section 1.2). Where possible, surface contacts in areas between mapping traverses will be verified by projecting stratigraphic contacts identified in drill holes to the surface. Lines of geologic cross sections and drill hole locations will also be shown on this map.

The mapping traverse locations will be selected based upon the following criteria:

outcrop exposure

accesibility to foot travel

existence of data gaps

the need to confirm stratigraphic occurences of seeps and springs

1.2 Stratigraphic Data

Lithologic logs and locations for nine exploratory holes drilled in A, B, C, and Bear Canyons and an unnamed canyon north of Bear Canyon are available from the records of Kaiser Coal Corporation and the Utah Geological and Mineral Survey (U.G.M.S.). In addition, logs from nine other holes drilled in Whitmore Canyon are available from these same sources. It is also likely that additional drill hole data from Rock Canyon and its side canyons, which comprise the north end of the proposed permit area, may exist in U.G.M.S., Kaiser Coal, or U.S. BLM records, but this has not yet been verified.

These data will be used to compile a statigraphic column and geologic cross sections in the Sunnyside No. 5 permit area. Also, where applicable, detailed lithologic and stratigraphic data available in measured outcrop sections on file with the U.G.M.S. will be used to supplement the drill hole data during geologic interpretation. Cross sections and lithologic descriptions will be as detailed as the available data allow. The cross sections will be used in support of both the geologic and hydrologic chapters of the PAP.

To provide rock strength information on the overburden strata, hand samples of the major sandstone units will be obtained from the outcrops and tested for uniaxial strength via the point-load method.

1.3 Coal Reserves

Coal reserve calculations for the Sunnyside No. 5 Mine that have been prepared by the Kaiser Coal Corporation will be used to present coal reserves in the PAP.

1.4 Coal Quality Data

Coal quality data from the existing Sunnyside Mine as well as that obtained from cores.

This data will be supplemented by coal quality data that is available in the files of the U.G.M.S.

1.5 Overburden Thickness and Lithology

An overburden isopach map for the Sunnyside No. 5 area will be prepared using the previously mentioned outcrop and drill hole data. The lithologies comprising the overburden will be described through narrative and geological cross sections.

1.6 Roof and Floor Characteristics

Roof and floor analyses from the Sunnyside Mine will be used to describe the clay contents and pyritic sulfur contents of the roof and floor in the adjacent Sunnyside No. 5 permit

area.

1.7 Adequacy of Available Data

The geologic data available for the proposed Sunnyside No. 5 Mine, augmented as necessary by air photo analysis and geologic mapping traverses, is considered adequate for the purposes of preparation of the "Geology" chapter of the B Canyon PAP. Requirements for additional geohydrologic data are described below.

1.8 References

Clark, F.R., 1928, Economic geology of Castlegate, Wellington and Sunnyside quadrangles, Carbon County, Utah: U.S. Geological Survey Bull. 793.

Doelling, H.H., 1972, Central Utah Coal Fields: Book Cliffs, Monograph No. 3, Utah Geological and Mineral Survey, Salt Lake City, Utah.

Doelling, H.H., et. al., 1979, Observations on the Sunnyside Coal Zone, Coal Studies, Special Studies 49, Utah Geological and Mineral Survey, Salt Lake City.

Osterwald, F.W., 1962, Preliminary lithologic and structural map of Sunnyside No. 1 area, Carbon County, Utah, showing coal outcrops: U.S. Geological Survey Coal Investigations Map C-50.

Osterwald, F.W., Mayberry, J.O., and Dunrud, C.R., 1981, Bedrock, Surficial, and Economic Geology of the Sunnyside Coal Mining District, Carbon and Emery Counties, Utah, U.S. Geological Survey Professional Paper 1166, Washington, D.C.

Scheibner, Barbee J., 1979, Geology of the Single-Entry Project at Sunnyside Coal Mines 1 and 2, Sunnyside, Utah, R.I.-8402, Bureau od Mines Report of Investigations, ashington, D.C.

U.S. Geological Survey, 1979, Coal Resource Occurence and Coal Development Potential Maps of the Sunnyside Quadrangle, Carbon County, Utah, U.S. Geological Survey Open File Report 79-491, Washington, D.C.

U.S. Geological Survey, 1979, Coal Resource Occurence and Coal Development Potential Maps of the Patmos Head Quadrangle, Carbon County, Utah, U.S. Geological Survey

Open File Report 79-492, Washington, D.C.

U.S. Geological Survey, 1979, Final Environmental Impact Statement, Development of Coal Resources in Central Utah, U.S. Geological Survey, Washington, D.C.

Young, R.G., 1966, Stratigraphy of Coal-Bearing Rocks of Book Cliffs, Utah, Colorado, in Central Utah Coals, Utah Geological and Mineral Survey Bulletin 80, Salt Lake City, Utah.

2.Ø HYDROLOGIC DATA

Regional surface water and groundwater conditions will be described from the following and published and non-published sources:

Kaiser Coal Corporation's Sunnyside Mine and B Canyon PAP submittals.

Hydrologic Reconnaissance of the Wasatch Plateau - Book Cliffs Coal Field Area, Utah (U.S. Geological Survey)

Final Environmental Impact Statement, Development of Coal Resources in Central Utah (U.S. Geological Survey)

Hydrologic Reconnaissance of the Southern Uintah Basin (Utah Dept. of Natural Res.)

Kaiser records relating to mine water inflows, shaft construction, and surface water monitoring.

2.1 Groundwater

Data currently available as well as additional data requirements for describing existing groundwater conditions in the Sunnyside No.5 permit area are presented below.

2.1.1 Available Data. Data describing current groundwater conditions is available from the following sources:

A seep and spring inventory conducted in October, 1985 by JBR that covered most of the proposed mine plan area;

Water quality and quantity monitoring data from two springs, including 3 samples taken at one month intervals during summer of 1985 by Kaiser;

Reports of the first appearance of groundwater in old exploration drill holes are available in driller's logs.

Sunnyside mine water inflow records.

Groundwater data from the Sunnyside mine will be useful in projecting groundwater conditions in the Sunnyside No. 5 permit area. Mine discharge rates and in-mine groundwater quality and quantity monitoring data soon to be collected by Kaiser from 13 permanent monitoring stations in the Sunnyside mine comprise this data base. These data will be used to help determine

the geohydrologic controls on the mine water inflow.

2.1.2 Additional Data Sources. The following additonal data are intended to be collected to complete the data base of existing groundwater conditions:

Extension of the 1985 seep and spring survey area to the north to cover the entire proposed mine permit area plus a one-mile periphery. This will be done for the Spring 1986 seep and spring survey.

Extension of the seep and spring survey to the south to cover the northwest slopes of Whitmore Canyon above the existing Sunnyside Mine workings. This will be done to determine what mining impacts, if any, can be expected on the seeps and springs in the No. 5 Mine area by comparing the relative occurrence of groundwater discharges between the two areas. Observations of the surface evidences of subsidence will also be recorded during this field work.

Completion of a Spring 1986 seep and spring survey over the balance of the permit area in conjunction with the above-mentioned additional sampling;

Investigation of the occurrence of groundwater inflow to the present service shaft. This will be done by conducting a detailed survey of the water production zones exposed on the shaft walls and gauging the inflow to the shaft sump. The construction records for this and the other shafts on the property will also be reviewed to extract any pertinent information on geology and groundwater.

An in-mine groundwater inflow study to augment, as needed, current mine records. This study would map and describe the geologic and hydrologic characteristics of all points of groundwater inflow in the existing Sunnyside mine workings. The objective of this work will be to determine the geohydrologic controls on inflow and relate these to the local hydrologic setting.

2.1.3 Groundwater Development and Mine De-watering. An assessment of the impact upon groundwater by development and dewatering of the Sunnyside No. 5 Mine will be made by analogy with data from the existing Sunnyside operations.

2.1.4 Mitigation and Control Plans. Mitigation and control plans for the Sunnyside No. 5 mine will be developed using all available geologic and hydrologic data plus information on the position of the coal seam, Sunnyside No. 5 mine plans and water inflow and discharge rates from the Sunnyside mine. The mitigation and control plans for the PAP will be adjusted as necessary by the end of the year using data gathered from the 1986 field season work.

2.1.5 Groundwater Monitoring Plan. Water samples from 11 springs in the Sunnyside No. 5 permit area were taken in early November, 1985. These samples were analyzed for all required water quality parameters (see Table 1). Data from these sites and from potential additional sites in the expanded survey area will be discussed with the Division following the Spring 1986 seep and spring inventory. Following mutual selection of any additional monitoring points, these additional points will also be monitored for water quality and discharge rates. These monitoring stations will serve as both initial and operational monitoring points for the Sunnyside No. 5 mine. These stations will be monitored four times at one month intervals during the 1986 field season and at this same interval annually during operational monitoring. It is assumed that operational monitoring of selected springs and seeps will only occur when the underground mine workings are close enough to the springs to have a potential affect.

What distance? 1-2, 1000' ?

An in-mine monitoring plan similar to that now being established in the existing Sunnyside mines will be designed in concept for the Sunnyside No. 5 area PAP.

Table 1. Water Monitoring Parameters.

Field Parameters:

Dissolved Oxygen (a)
Flow
pH
Specific Conductance
Temperature

Laboratory Analyses:

Aluminum
Ammonia (NN_3)
Arsenic
Barium
Bicarbonate (HCO_3^-)
Boron
Cadmium
Calcium
Carbonate (CO_3^{-2})
Chloride

Chromium
Copper
Fluoride
Iron (dissolved)
Lead
Magnesium
Total Manganese
Mercury
Molybdenum
Nickel

Nitrate (NO_3)
Nitrite (NO_2)
Oil and Grease
Phosphate (PO_4)
Potassium
Selenium
Sodium
Sulfate
Sulfide
TDS

Total Hardness ($CaCO_3$)
Total Settleable Solids (a)
Total Suspended Solids (a)
Zinc

(a) Surface water only

2.2 Surface Water Hydrology

2.2.1 Existing Surface Water Conditions. Local surface water conditions will be described using monitoring data available from Kaiser Coal Corporation for the stream in Whitmore Canyon. Surface water conditions are adequately understood in Whitmore Canyon as the result of this monitoring which is associated with the existing Sunnyside mine. Mining in the Sunnyside No. 5 permit area will not affect the stream in Whitmore Canyon since the planned subsidence boundary is west of the stream channel. During the 1986 field program, sampling stations at one or two locations along the creek upstream from Grassy Trail Resevoir will be established to augment the present understanding of the surface hydrology of this stream.

Three intermittent to perennial streams are known in canyons along the Book Cliffs in the Sunnyside No. 5 permit area. One occurs in the upper reaches of the right fork of C Canyon, which is the canyon located immediately north of B Canyon. The stream in Bear Canyon exhibited flow in one or more channel segments during the November, 1986 water quality sampling program. Flow was observed coming from the right fork of Rock Canyon in January, 1986. U.S.G.S. topographic maps indicate that the streams in Rock and Bear Canyons flow for more than 1/2 of the year, therefore they could be considered perennial (subject to verification from on-site observations). A survey of the stream flow conditions in these channels will be conducted in conjuction with the seep and spring survey planned for the Spring of 1986. This work will include recording the length of the channels involved in the flow, locating and describing potential quantity and quality monitoring stations in the most appropriate locations, and obtaining water samples from these points. Water flow measurements will be conducted with a current meter or by other measurement of flow cross-section and velocity. Prior to establishing the monitoring stations, the initial inventory data will be reviewed with the Division of Oil, Gas and Mining

see our definition of intermittent

These data will be used to characterize the surface water conditions in the Book Cliffs side of the Sunnyside No. 5 permit area.

2.2.2 Surface Water Development and Control, Effects of Mining on Surface Water, Mitigation and Control Plans, and Surface Water Monitoring Plan. Sufficient data for preparation of these plans will be generated from the available and yet to be collected data that has been discussed above as well as from the mine plan that will be prepared as part of the PAP.

2.3 References

Kaiser Steel Corporation, 1984, Application for an Underground Coal Mine Permit, Kaiser Steel Corporation, Sunnyside Mines, Carbon County, Utah.

U.S. Geological Survey, 1979, Final Environmental Impact Statement, Development of Coal Resources in Central Utah, U.S. Geological Survey, Washington, D.C.

U.S. Geological Survey, 1981, Hydrologic Reconaissance of the Wasatch Plateau - Book Cliffs Coal Field Area, Utah, U.S. Geological Survey Water Supply Paper 2068, Washington, D.C.

Utah Dept. of Natural Resources, 1975, Hydrologic Reconnaissance of the Southern Uintah Basin, Utah and Colorado, Technical Publication No. 49.