XP306N

PROPOSAL TO CONDUCT HYDROLOGIC AND GEOLOGIC STUDIES

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PROPOSAL TO CONDUCT HYDROLOGIC AND GEOLOGIC STUDIES

Prepared for

UTAH DIVISION OF OIL, GAS, AND MINING
Salt Lake City, Utah

Prepared by

ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.
Fort Collins, Colorado

April 1985

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April 29, 1985
Ref. XP306N

Mr. David Hooper
Utah Division of Oil, Gas, and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, UT 84180-1203

Dear Mr. Hooper:

Enclosed are three copies of Environmental Research & Technology, Inc.'s (ERT) proposal for hydrologic and geologic services pertaining to the Small Operator Assistance Program. Our proposal has been prepared in response to Request for Proposal No. 587504, dated April 3, 1985.

Since establishing our offices here in 1972, we at ERT have provided high quality, cost-effective technical services to the mining industry throughout the West. I believe we can fulfill the needs of DOGM's program in the same responsive fashion. If you have any questions or comments regarding our proposal, please call us at (303) 493-8878.

Sincerely,
ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.

James Burrell

James Burrell

JB/sc

Enc.

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1.0 INTRODUCTION

1.1 Overview

Environmental Research & Technology, Inc. (ERT) is pleased to submit this proposal to the Utah Division of Oil, Gas and Mining (DOGM) for purposes of conducting water resources and geologic investigations.

This proposal addresses baseline and assessment study tasks for surface water, groundwater, and geologic materials, to be conducted under the Small Operator's Assistance Program (SOAP) administered by DOGM. This proposal is in response to DOGM's Request for Proposal No. 587504 dated April 4, 1985, to provide contracted services to DOGM in their assistance to Summit Coal Company, Boyer Mine, Summit County, Utah.

The purpose of ERT's proposed efforts are:

- To quantify and describe existing surface and groundwater hydrology, stream morphology, water quality, and water use.
- To describe and analyze the physiochemical characteristics of the overburden/coal/underburden and the nature of their potential weathering products.
- To establish baseline networks and data for input to an integrated understanding of the surface and groundwater regime.
- To identify potential impacts to surface water and groundwater hydrology, water quality, and stream morphology as a consequence of mine construction, operation, reclamation, and abandonment activities.
- To establish baseline data with which to compare future trends in flow and water quality, and to suggest a compliance monitoring framework and other potential mitigative activities.
- To provide close coordination and a free exchange of information between ERT and DOGM.

This proposal is oriented towards fulfilling regulatory requirements set forth in Part UMC 795, the Small Operator's Assistance Program, which is a part of Chapter I, Regulations Pertaining to Surface Effects of Underground Coal Mining Activities, Coal Mining and Reclamation Permanent Program, as promulgated under Utah Code Annotated

(UCA) 40-10-1 et. seq. Specific facets of the proposal respond to data requirements set forth in the Request for Proposal and in current DOGM discipline guidelines.

1.2 Alluvial Valley Floor Considerations

ERT assumes that the valley floor of Chalk Creek and its major tributaries does constitute an alluvial valley floor as designated by USGS and/or OSM or DOGM regional assessments.

It is not ERT's intention to specifically conduct alluvial valley floor studies as part of the scope of work proposed herein. However, certain aspects of ERT's proposed scope will coincidently address portions of alluvial valley floor regulations under UMC 785.19. Should DOGM desire additional multidisciplinary studies (detailed soils, land use and irrigability, and vegetation assessments) pertinent to fulfilling UMC 785.19, ERT will be happy to discuss such additional services with DOGM. The scope of work proposed herein is specifically oriented towards assessing geological conditions and probable hydrologic consequences of mining on the surface and groundwater resources of the locale, including the Chalk Creek valley floor and associated alluvial deposits.

1.3 Program Organization

ERT proposes to conduct the scope of work in a stepwise fashion. The planning phase involves meeting with DOGM to review specific data availability in accordance with UMC 795.14(e) and (f). Laboratory procedures will be reviewed at this time. Subsequently, ERT personnel will conduct a site visit to obtain more familiarity with the watershed and cultural features. During this planning phase, existing data for the locale will be collected and reviewed from DOGM, USGS Water Resource Papers and geological documents, the National Oceanic and Atmospheric Administration (NOAA), ditch company records, county records, the Utah Geological and Mineral Survey, Utah Water Rights Division, and possible university sources.

The results of this planning phase will be a program approach better tailored to site-specific conditions and goals. At the end of the planning phase, ERT will generate a final scoping memorandum for DOGM approval. For the purposes of this proposal, however, ERT has

presented a scope of work that we feel is a reasonable level of effort at this time, and that we have used in preparing our cost estimate. The scope of work and associated costs may be increased or decreased based on the final scoping results from the planning phase.

ERT's proposal is organized as follows: Section 2.0 presents the surface water scope of work. Section 3.0 presents the groundwater scope of work, and Section 4.0 contains the proposed geologic assessment scope. Section 5.0 discusses reports and submittals. Sections 6.0, 7.0, and 8.0 present the schedule, costs, and personnel, respectively. Section 9.0 summarizes ERT's experience in Utah and the coal industry.

2.0 SURFACE WATER HYDROLOGY

2.1 Overview

The surface water study will be conducted in close coordination with groundwater, soils, vegetation, and geology tasks. The surface water investigations will involve a review of existing literature, preliminary field mapping of watershed characteristics, and design, construction, operation and maintenance of a surface hydrology monitoring network. These discipline tasks are more closely outlined below. Since groundwater and surface water hydrologic regimes are closely related, a two-way exchange of information and close coordination of the field studies will be essential to provide an assessment of the hydrologic system.

2.2 Collect and Review Existing Data

A comprehensive survey will be conducted of existing regional information on surface hydrology, including discharge, water quality, and sediment transport. Published information from federal, state, and university sources will be examined. These sources will include USGS (water resources data for Utah and other documents), the Utah water resources and water rights agencies in Salt Lake City, and any university studies as may exist. Publicly available mining permit applications in the regional watershed, if such are available at DOGM, will also be examined for pertinent information. Climatic data will be collected from the National Oceanic and Atmospheric Adminstration (NOAA). The results of these efforts will be a data compilation for average annual high, low, and mean flows for significant drainages in the proposed permit locale, the historical extremes for these drainages, and precipitation, temperature, and potential evapotranspiration data.

2.3 Watershed Investigations

ERT hydrologists will conduct site investigations of the local watershed and sub-watersheds. A combination of map interpretations and field surveying techniques will be used to determine topographic relief, stream classification, and channel length and configuration. The applicable 7.5-min USGS quadrangle does not show any water impoundments

within a 1 mile radius of the proposed permit area, but there may have been developments since the 1967 map date. ERT will also locate and describe water diversion structures within the permit area and adjacent lands. Much of this information will originate with Utah's Water Rights and Water Resources agencies. During the literature search and field reconnaissance, ERT will identify the area and capacity of any existing enclosed bodies of water and diversions. The allotted quantity, quality, and seasonality of withdrawals will be described.The results of this effort will be a 1":1,000' map and associated descriptions of water rights and water use (including wells) within a 1 mile distance of the proposed permit area.

2.4 Vegetation and Soils Information

For further input to watershed and erosion studies, ERT soils and vegetation personnel will conduct brief reconnaissance investigations of the watershed. These efforts will be preceded by a review of Soil Conservation Service (SCS) data for the area, if available (SCS work in Summit County is in progress).

The goal of soil and vegetation efforts will be to refine any available SCS information to be specific to the watershed. This will involve reconnaissance level soil surveys to describe the depth, extent and morphology of soils. Representative surface and near-surface soil samples will be retrieved for physicochemical analyses. ERT estimates that 20 soil samples will be analyzed by Intermountain Laboratories of Sheridan, Wyoming, for pH, conductivity, particle size, soluble Ca, Mg and Na, and sodium adsorption ratior. These analyses will assist in interpreting runoff water quality. These data will also be inputs to erodibility factor interpretations, and combined with vegetation data to derive soil-cover complex (CN) values for use in watershed studies.

Descriptions for each vegetation community will focus on species composition, plant cover, and productivity. A species list will be compiled for those species observed in the field. Quantitative estimates of percent ground cover will be made using the point-intercept method (Mueller-Dombois and Ellenberg 1974). Sufficient cover transects will be taken to accurately describe each community. Production level estimates will be obtained from local SCS sources utilizing

site-specific soils and vegetation information to correlate to SCS range site productivity.

Preliminary review of the status of sensitive plant species in Utah (Welsh 1979) indicates that no threatened or endangered plant species occur within the study area. Four threatened or endangered species do occur in Summit County, however, at higher elevations (10,000 and 12,000 ft). ERT proposes no further species investigations other than that described.

2.5 Develop the Surface Water Monitoring Network

Surface hydrology field studies will be designed to address existing state regulations and guidelines regarding the permitting of an underground coal mine and associated support facilities. The study approach will be based on results of the literature search, agency interaction, and watershed assessments. Selection of monitoring components for application in the study will be based on the specific characteristics of the potentially affected drainages and diversions as determined by ERT surveying efforts. Major emphasis will be placed on Chalk Creek and the intermittent and ephemeral channels. ERT's final scope of work will be designed to accommodate modification as supported by hydrologic/water quality data collected during the tasks discussed in Sections 2.2 through 2.4 above, pending DOGM approval. For the purpose of this proposal, ERT has prepared and costed the following network design. Final network design and costs will be further tailored to project needs, pending watershed assessments and DOGM authorization.

The surface water monitoring network will operate for 1 year, and include the following items:

- A number of limited gaging stations would be located on ephemeral streams and at each stream confluence with the irrigation ditch. These sites will have monthly instantaneous discharge and field water quality measurements recorded by an ERT-supervised technician from within the area. When flows are adequate, this technician will also conduct instantaneous discharge measurements at predetermined stations to correlate sudden precipitation events to significant flow changes.

- Two continuous recording gaging stations will be installed on Chalk Creek, one directly upstream and downstream of the mine site. A third would be placed on the intermittent drainage on

the eastern part of the study area. Each gaging station will consist of a 1.5-foot diameter corrugated metal shelter and an out-of-stream device to manually determine stage (to prevent destruction from freezing). An in-stream pressure transducer type sensor will be coupled with a datapod recorder housed in the shelter to continuously measure and record stream stage. The cable from the transducer to the shelter will be shielded in a metal conduit or plastic pipe. These stations will serve to collect data on minimum, maximum, and average discharge conditions which identify critical low flow, peak flow, average flow, and the respective flow volumes associated with seasonal variations.

The datapod is a miniature data logger designed to replace strip chart recorders in most applications. Rather than continually recording a trace on paper as does a strip chart recorder, this application of the datapod recorder processes sensor readings under program control of a microprocessor, and records stream stage with respect to time in a solid state memory module. Datapod technology has progressed to the point where these solid-state electronic devices are reliable and accurately measure a 10-foot range in stage with resolution to 0.01 feet. They are simpler and more economical to install than gaging stations with stilling wells and floats (no backhoe or heavy equipment required). They provide a more reliable, and higher percentage of data capture than standard mechnical recorders, and operate satisfactorily under severe weather conditions.

A tipping-bucket rain gage with an electronic event recorder will be installed at a location of representative rainfall, presumably at an average altitude, on the mine property. The time base of the event recorder will be synchronized with the time bases of the stream gages to facilitate quantitative rainfall-runoff analyses.

ERT is experienced in the use of this equipment, and has installed, operated and maintained a large datapod water monitoring network for Diamond Shamrock on the Beluga Coal Field near Anchorage. Other similar networks have successfully been designed and put into operation in California and Wyoming.

Portability of the datapod technology will allow eventual conversion of the regular permitting monitoring network to a less intensive compliance monitoring network maintainable by DOGM if so desired. Once the network is constructed, a map will be prepared at

1":1,000' showing existing and newly installed surface water gaging stations, precipitation gages, water quality sampling sites, and single-stage sediment monitoring stations. These will include all USGS and privately owned stations.

Additional monitoring network tasks are discussed below:

- Monthly current meter measurements of stream velocity will be made throughout each continuous station's cross-section. The top width of the stream will be divided into subsections with no more than 10 percent of the total discharge occurring in any subsection. At least one velocity measurement will be made in the vertical of each subsection, depending on the water depth. The depth of the stream will be sounded with a wading rod or sounding weight and cable.

- Monthly current meter measurements will be made for 1 year to determine instantaneous stream flow. Meters, such as a Marsh-McBirney, will be used for accurate and cost-effective flow measurements.

- ERT will develop stage-discharge rating curves to convert stage data into water-discharge records through instream flow analysis, channel morphology and survey data.

2.6 Channel Cross-Section Data

Gaging station locations will be surveyed with at least three cross sections per reach to determine channel geometry parameters, including gradient, depth, top width, wetted perimeter, and roughness coefficient. These variables will be used to theoretically determine probable flood depths and velocities.

The field surveyed cross-section data will be compiled on a magnetic disk file for storage, ease of access, and handling. Computer-reduced survey data will be used to generate computer plots of each channel cross-section. Each time the cross-sections are re-surveyed, the reduced data will be plotted on transparencies and included as overlays to the original plots for ease in the identification of changes in channel geometry. This information, in conjunction with instantaneous stage-discharge data, will be used to validate or modify stage-discharge rating curves.

2.7 Sediment and Water Quality Sampling

Field water quality parameters will be recorded monthly for 1 year at all continuous recording and limited stations. An instantaneous discharge measurement will always accompany each water quality sample to relate streamflow with field water quality. This will assist ERT and DOGM in recognizing monthly and seasonal variations and trends. Water quality samples will be collected on quarterly basis and sent to Standard Laboratories, Huntington, Utah, for analysis according to parameters shown in Table 2-1. Standard Laboratories certification number is E-25, as certified by the Utah State Department of Health, Section of Laboratory Improvement.

Single stage sediment samplers will be placed on intermittent and ephemeral streams to sample the rising limb of the hydrograph. These devices collect suspended sediment bottle samples at a pre-selected stage height. Stage height settings will be determined by the likely magnitude of events assessed in the watershed reconnaissance. If necessary, they will be more closely tailored to site conditions during operation of the network. Small channel events otherwise may not have been sampled due to timing and duration; samples will be collected and the station serviced immediately after the event by a trained on-site technician.

The results of this data will be used in conjunction with other field data (soils, vegetation, topography, etc.) to estimate sediment yields from both disturbed areas and undisturbed sites.

Estimates of suspended sediment transport will be made by correlating measured suspended sediment concentrations with stream discharges over an appropriate range. Various methods are available for this purpose, ranging from simple regression to involved analyses. After examination of field data, appropriate analytical procedures will be selected.

Estimates of bed sediment will be made using computer techniques based on the Meyer-Peter & Muller equation. Measured channel hydraulic parameters and sediment particle size distributions will be used to calibrate the model.

Suspended sediment will be sampled using depth-integrating and single stage samplers. Both types of samplers will be of standard design as used by the USGS.

TABLE 2-1

SURFACE WATER BASELINE WATER QUALITY PARAMETERS

Field Measurements:

- Flow
- pH
- Specific Conductivity (umhos/cm)
- Temperature (C°)
- Dissolved Oxygen (ppm)

Laboratory Measurements: (mg/l)

- Settleable Solids
- Total Suspended Solids
- Total Dissolved Solids
- Total Hardness (as $CaCo_3$)
- Aluminum (Al)
- Arsenic (As)
- Barium (Ba)
- Boron (B)
- Carbonate (CO_3^{-2})
- Bicarbonate (HCO_3^-)
- Cadmium (Cd)
- Calcium (Ca)
- Chloride (Cl-)
- Chromium (Cr)
- Copper (Cu)
- Fluoride (F-)
- Dissolved Iron (Fe)
- Lead (Pu)
- Magnesium (Mg)
- Manganese (Mn)
- Mercury (Hg)
- Molybdenum (Mo)
- Nickel (Ni)
- Nitrogen: Ammonia (NH_3)
- Nitrate (NO_3^-)
- Nitrite (NO_2)
- Potassium (K)
- Phosphate (PO_4^{-3})
- Selenium (Se)
- Sodium (Na)
- Sulfate (SO_4^{-2})
- Sulfide (S-)
- Zinc (Zn)
- Cation-Anion Balance

Pretreatment of sample bottles, sample collection, preservation, holding times, and analyses will adhere to EPA and APHA protocol (EPA, Methods for Chemical Analysis of Water and Wastes, and APHA, AWWA, WPCF, Standard Methods for the Examination of Water and Wastewater.

Sediment concentration data will be collected and related to annual discharge from disturbed and undisturbed areas to develop respective annual sediment yield estimates (in mass and volume/unit area)

2.8 Water Quality Data Reduction

Water quality data will be compiled on a magnetic disk file for storage and ease of analysis. Computer programs will be utilized to perform a quality control analysis on water quality data, including an electroneutrality program for checking cation-anion balances, and a quality control program for calculating ratios between such parameters as total dissolved solids (measured and calculated), specific conductance (field and lab), and anions and cations. These ratios will offer a quick check for recognizing potential data inconsistencies and aid in identifying seasonal trends and changes in water quality. Major physical and chemical parameters will be plotted against discharge to determine the effects of discharge and seasons on water quality.

2.9 Establishment of Hydrologic Budget

The average annual hydrologic budget for the area near the proposed activity will be estimated. The budget will approximately balance average inflows to outflows within the area under consideration. This estimate will include the following:

Inflow	Losses	Outflows
Streams	Evaporation	Streams
Springs	Transpiration	Subsurface flow
Precipitation	Infiltration	
Subsurface flow	Storage	
	Diversions	

3.0 GROUNDWATER HYDROLOGY

3.1 Overview

The purpose of the hydrogeologic investigations will be to generally characterize the regional groundwater regime, and to more closely identify the groundwater quality and flow regime within the specific mine locale itself. This objective will involve both a review of existing data and the establishment of a monitoring network as discussed below. A further objective of these studies will be to closely interact with the surface water and geologic investigations.

3.2 Collecting Existing Data

Existing literature, mine exploration data, and information from springs, seeps, and wells will be collected, reviewed, and compiled on maps and tabular form to define known baseline hydrogeologic conditions.

Primary sources of existing data include the USGS, the Utah Geological and Minerals Survey, Colorado School of Mines special publications, mine exploration data from Summit Coal Co., DOGM, exploration logs of other mine and oil companies, aerial photographs, and data from existing active or inactive water wells.

3.3 Field Reconnaissance

A qualified ERT hydrogeologist will conduct a field reconnaissance in order to gain familiarity with the site and to collect additional data not available via Section 3.2. Prior to the field visit, existing data and aerial photographs will be reviewed to identify important points of interest, conflicting data, or data gaps.

During the field reconnaissance, the locations of wells, springs, and seeps will be plotted on a topographic map. Their elevations, flows, water levels, and descriptions will be estimated or directly measured. Rock outcrops and road cuts will be examined and pertinent lithologic characteristics described and mapped to supplement exploration logs and existing geologic mapping. This effort will be coordinated with fieldwork identified in the overburden task discussion.

Particular attention will be focused upon existing or abandoned mine workings in the area. Important information to be observed includes rock outcrops, water level in or drainage from old workings, and water quality of seeps, drains, and runoff from disturbed areas.

3.4 Define Site Hydrogeology

Existing available information, along with data from the geologic field reconnaissance and aerial photograph interpretation, will be plotted on a hydrogeologic map of 1" = 1,000' scale. Locations of wells, seeps, springs, and drainage from any existing mine workings will be shown on the hydrogeologic maps. The map will extend a minimum of 1 mile radius from the mine permit area, or farther as necessary to include pertinent data.

Geologic structures such as folds, faults, subcrops, and outcrops of the coal unit and other important aquifers will also be mapped. This geologic information will be used to identify aquifer units and their hydrogeologic boundaries. Attention will focus on those aquifer units that are expected to be affected by the proposed mining activities, including the target coal seam, permeable units stratigraphyically above and below the coal, and alluvial aquifers in direct hydraulic connection with the coal.

The results of this task will be a conceptual model of groundwater flow and occurrence in the mine study area. The hydrogeologic map and scaled cross sections will be used to illustrate known site conditions and identify specific areas where more data is needed to refine hydrogeologic interpretations. This information will be the basis for design of an appropriate groundwater monitoring system in the following task.

3.5 Design the Groundwater Monitoring System

The objectives of the groundwater monitoring system are to:

- document baseline conditions;
- satisfy DOGM regulations and guidelines;
- define site groundwater hydraulics to allow for prediction of probable hydrologic consequences of mining; and

- provide monitoring points to be used during mine operation to observe actual hydrologic consequences of mining.

The monitoring system will utilize existing wells, springs, and any existing mine drainage to the maximum extent practical as groundwater monitoring stations. It is expected that these existing sites will need to be supplemented with appropriately designed monitor wells. The monitoring system includes both monitoring stations and scheduled procedures for testing, measurement, and collection of data.

There will be a substantial amount of professional judgement involved in design of the groundwater monitoring system, particularly with regard to siting of new monitoring wells. Therefore, ERT will submit specifications for monitoring system design to DOGM for approval before the system is implemented. An estimated level of effort is discussed in the next section. Specifications to be finalized will include method and frequency of measurement of flow, water level, and water quality at each station; a map of all proposed monitoring locations including both existing wells and springs and new wells; and well construction specifications, approximate depth, and proposed aquifer test methods for new wells.

3.6 Implement Groundwater Monitoring System

It is assumed for proposal costing purposes that the groundwater monitoring system will consist of three existing wells or springs and two new monitoring wells. The new wells are each assumed to be constructed of 2" diameter PVC, to a depth of 100 feet each, with 20 feet of screened interval. The actual monitoring system will probably differ from this assumption and will depend upon further definition of site conditions and approval by DOGM.

Design of a typical monitor well is shown in Figure 3-1. Two-inch diameter well casing was chosen because wells can be installed in comparatively small 4-inch boreholes drilled by air rotary equipment. In low permeability formations, evacuation of stagnant well water and replenishment with representative aquifer water would be very time consuming in a larger diameter well. Air-rotary drilling methods are preferred because water bearing zones can be readily identified during drilling and foreign mud or water is not introduced into the aquifer zones to be monitored.

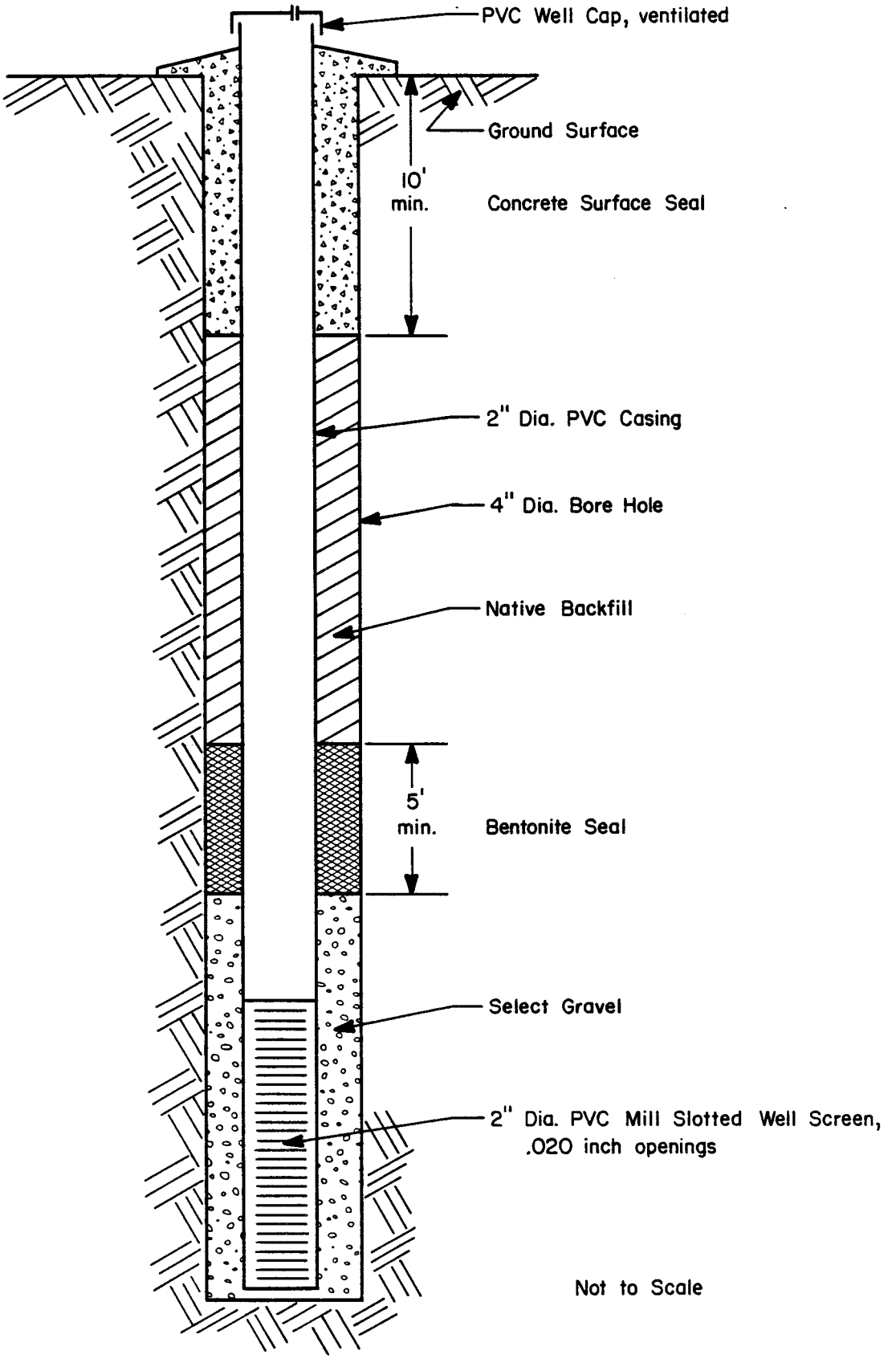

Figure 3-1 TYPICAL MONITOR WELL DESIGN

Collection of baseline data from the groundwater monitoring system will be coordinated with field visits conducted for surface water monitoring. Costs of data collection have been divided between this Section 3.6 and Surface Water Sections 2.5 and 2.7. These costs assume monthly measurement of water levels and spring flows for 1 year, with quarterly water quality sampling and laboratory analysis of parameters listed in Table 3-1 at each of five stations. Groundwater samples will be analyzed by Standard Laboratories in Huntington, Utah, as with the surface water samples.

The assumptions that two new monitor wells would be required is based upon a minimal program that could meet the objectives listed in Section 3.5. If this minimal monitoring system were implemented, one well would be installed downgradient of the proposed mine portal and completed in the coal unit aquifer near its subcrop beneath the alluvium of Chalk Creek. This well would monitor the coal aquifer zone, including immediately overlying and underlying strata in the area of hydraulic connection with the alluvial aquifer.

A second well would be installed upgradient of the mine portal. This well, in conjunction with the downgradient well, would allow measurement of hydraulic gradient in the coal zone toward Chalk Creek and provide information necessary to calculate base flow contributions of this aquifer unit. Single well aquifer tests would be conducted in each monitor well to estimate aquifer hydraulic conductivity. These tests would involve either constant discharge, repeated bailing and recovery, or slug test methods.

3.6.1 Optional Wells

If site data indicate other potentially affected permeable strata above or below the coal zone, then it may be necessary to propose additional monitoring wells or piezometer nests in these units. This option would allow performance of multiple well pumping tests. By observing water levels in upper and lower piezometers while pumping the coal well, the degree of vertical interconnection of aquifer units, or leakance, can be determined. These additional wells are not proposed at this time; however, the costs in Section 7.0 indicate the optional cost of installation and monitoring of each additional well if installed at the same time as the proposed wells.

TABLE 3-1

GROUNDWATER BASELINE WATER QUALITY PARAMETERS

Field Measurements:

- Water Levels
- pH
- Specific Conductivity (umhos/cm)
- Temperature (C°)

Laboratory Measurements: (mg/l)

- Total Dissolved Solids
- Total Hardness (as $CaCO_3$)
- Aluminum (Al)
- Arsenic (As)
- Barium (Ba)
- Boron (B)
- Carbonate (CO_3^{-2})
- Bicarbonate (HCO_3^-)
- Cadmium (Cd)
- Calcium (Ca)
- Chloride (Cl-)
- Chromium (Cr)
- Copper (Cu)
- Fluoride (F-)
- Dissolved Iron (Fe)
- Lead (Pu)
- Magnesium (Mg)
- Manganese (Mn)
- Mercury (Hg)
- Molybdenum (Mo)
- Nickel (Ni)
- Nitrogen: Ammonia (NH_3)
- Nitrate (NO_3^-)
- Nitrite (NO_2)
- Potassium (K)
- Phosphate (PO_4^{-3})
- Selenium (Se)
- Sodium (Na)
- Sulfate (SO_4^{-2})
- Sulfide (S-)
- Zinc (Zn)
- Cation-Anion Balance

The optional costs of completing a 100 foot deep 2-inch monitor well would not substantially differ from making a multiple completion piezometer nest with two or three 1-inch piezometer tubes in a single bore hole. Also, the costs of increasing depth from 100 feet to 200 feet would result in somewhat less than a doubling of cost.

4.0 OVERBURDEN, COAL STRATA, AND UNDERBURDEN

4.1 Overview

The purpose of these investigations is to determine the extent and physicochemical nature of the geologic units likely to be affected by mining. ERT will conduct a program of existing data collection, on-site investigations of outcrops, and description and analyses of samples from boreholes. These tasks are discussed in greater detail below.

4.2 Geologic Description

ERT will generate descriptions of regional and site geology by first conducting an in-depth literature review of available sources from USGS, Utah Geological and Mineral Survey, and other federal, state, county, and university sources. Recent private geologic investigations in the area will be incorporated into this review if such information is readily available. The results of the literature review will be a description of regional geologic conditions and further familiarization with stratigraphic and lithologic units in the site locale.

Previous investigations in the area (Trexler 1966, Taff 1906) that specifically refer to the coal zone indicate the overburden to likely be a thick-bedded marine sandstone. The Wasatch coal bed itself may range on the order of 10 to 15 ft thick. It is underlain by interbedded sandstones, claystones, and carbonaceous clays. This possible stratigraphic setting will be further verified or revised during the course of ERT's study. Structurally, the strata are assumed to dip westward 15 to 18°, and to be deformed by at least one fault.

According to an additional source (Gates, et al. 1982), a considerable stratigraphic column exists above the coal bed. This corresponds with Trexler's (1966) interpretations. A considerable thickness of Upper Cretaceous to Eocene sandstones, conglomerates, and minor shales overlies the coal zone. ERT will confirm or revise the general stratigraphy and lithology in the proposed permit area and immediate locale, using field mapping of outcrops and other specific data as may be available. Ten to twenty outcrop samples will be recovered if they can be obtained readily and without incurring significant disturbance and where ERT feels they may be generally

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indicative of subsurface characteristics. This mapping and sampling task also includes unconsolidated quaternary valley deposits along Chalk Creek and its major tributaries. A subtask of this field description effort will be to create a map identifying borehole locations and the extent of the past mine workings as determined from existing records.

ERT will collect borehole logs for the four existing boreholes from DOGM. We assume that these and other information potentially available from geologic work in the area, as well as ERT's fieldwork, will be adequate to depict lithology and thickness of strata down to and including a minimum of 10 ft below the lowest coal seam to be mined. Core available through DOGM for the four boreholes will be examined by ERT to further describe the strata immediately adjacent to and including the coal seam.

4.3 Physicochemical Analyses

ERT understands that core sections representing parts of the strata of concern are available through DOGM. Four borehole locations are represented, with core available dominantly for the Wasatch seam and associated underburden. The overburden materials are represented by 30 ft of core immediately overlying the seam in one borehole, and by 10 ft of core at the 150 ft depth in another borehole. ERT does not propose additional drilling for overburden analyses at this time, since the costs for drilling and recovering geologic samples for the entire stratigraphic column is likely to be prohibitive on a project this size. ERT assumes the core has been stored properly in airtight containers. For this study task, ERT will examine the available core, write detailed geologic logs, and retrieve core splits for subsequent physicochemical analyses. Should additional stratigraphic analyses be desirable, ERT will analyze those samples as may be retained from outcrop investigations, pending DOGM authorization. Existing core will be split after coordination with DOGM, to insure that adequate materials remain for other possible analyses during the course of mine development.

Samples will be placed in clean polyethylene plastic bags, sealed, and shipped to Intermountain Laboratories, Inc. in Sheridan, Wyoming. Intermountain Laboratories is a cost-effective, experienced establishment that has conducted similar analyses for a number of

clients in various coal basins. Their qualifications statement is included at the back of this proposal.

Samples will be analyzed for the parameters shown in Table 4-1, according to methods approved by DOGM.

TABLE 4-1

SAMPLING PARAMETERS

- Saturation Percentage
- Particle Size Analysis
- Texture
- pH
- Conductivity
- Soluble Ca, Mg, and Na
- Sodium Adsorption Ratio
- Carbonates
- Nitrate-Nitrogen
- Acid Potential (by sulfur forms)
- Neutralization Potential
- Acid-Base Potential
- Arsenic
- Boron
- Mercury
- Molybdenum
- Selenium

5.0 REPORTS AND SUBMITTALS

5.1 Trip Reports and Monthly Progress Reports

ERT will submit a monthly progress report to DOGM, consisting of:

- Narrative discussions of substantial findings from all three disciplines.
- Item-by-item progress and schedule entries.
- Appendices (field and lab data, trip reports, etc.).

The progress and schedule entry portion will present the following:

- Project efforts of the past month (meetings, key correspondence, field trips made, personal contacts).
- Efforts planned for the upcoming month.
- Critical Items/Problems (if any).
- Percent task completion by discipline.

Significant findings that may affect the proposed mine development will be reported to DOGM as soon as such findings can be put into an organized, responsible communication by ERT.

5.2 Technical Report

5.2.1 Overview

A technical report will be prepared during the studies. This report will describe the tasks, methods, results, and conclusions for all three disciplines in an integrated document. The determination of probable hydrologic impacts of mining and a statement of geologic conditions will be major topics discussed in the results and conclusions sections. Potential mitigative actions, such as compliance monitoring and possible sediment pond designs, will be presented. The standards and applications discussed in UMC 817.42-.57 will be considered during the formulation of mitigative recommendations and compliance monitoring suggestions.

A draft report will be presented to DOGM at approximately the 240-day point in the contract. This draft will present the study task methods, data summaries, and preliminary interpretations as completely

as can be made at that point in the program. After DOGM critique of the draft, ERT will submit a complete draft report at about the 365th day of the contract, incorporating the remaining data and formalizing conclusions and recommendations. Following DOGM review, ERT will submit the final report to DOGM by day 415. ERT assumes that DOGM will complete their respective review cycles in the 30 day time-frame discussed in the Request for Proposal.

The technical report will address the following areas of discussion:

- Regional hydrologic and geologic conditions.
- Study area groundwater flow and water quality fluctuations.
- Study area surface water flow and water quality fluctuations, trends.
- Watershed and drainage characteristics.
- Precipitation/runoff responses.
- Flood hydrology.
- Erosion and sedimentation analyses.
- Stratigraphic and structural nature of the mine locale.
- Physicochemical characteristics of strata.

Trilinear diagrams and line graphs will depict selected properties of the surface and groundwater regimes, such as seasonal water quality fluctuations, station comparisons, or discharge/time.

5.2.2 Statement of Conditions of the Overburden

As a portion of the technical report, ERT will prepare a statement of the physicochemical characteristics of the overburden, coal, and underburden. Results of laboratory analyses, plus the results of stratigraphic fieldwork, will be used to assess the potential for acid-forming or saline/alkaline forming strata to be exposed during and after mining. Potential metals toxicity will also be included in these interpretations. ERT proposes to make semi-quantitative interpretations of the data, due to the probable lack of sufficient data points for statistical analyses.

5.2.3 Analysis of Probable Hydrologic Consequences

Surface watercourses may be affected by discharge of mine drainage, altered runoff patterns resulting from stormwater control, altered groundwater gradients, and other mine-related activities. The quantitative effects of mine development will be evaluated by relating baseline streamflow and water quality data to the mine plan. Water quality changes in streams will initially be estimated using a simple dilution model. If chemical or biological interaction is considered to be a problem, more sophisticated methods may be used to assess mine-related effects. Baseflow changes resulting from altered piezometric gradients will be evaluated using aquifer characteristics identified during the groundwater study, and by using influent/effluent reach characteristics determined from surface water monitoring. Long-term effects of altered flow regimes on channel geometry will be evaluated using computer simulations of dominant discharges before and after mine development.

Regional data suggest that the alluvial aquifers are important for limited use as domestic and stock water wells. Bedrock units are typically not developed, although a deep well north of the site reportedly has an artesian flow and may be used in the future for domestic supplies. Mining and dewatering of the coal potentially could affect water quality, availability, and hydrologic balance in these aquifers and in surface streams. The aquifer of primary concern is expected to be the alluvium of Chalk Creek.

The hydraulic effects of mine dewatering will be evaluated using a mathematical model of groundwater flow. Based upon our present understanding of aquifer geometry and hydraulic characteristics, ERT proposes the use of a two-dimensional finite difference numerical model (such as the OSM version of Prickett-Lonquist) for evaluation of groundwater hydrologic impacts. This model approach will be especially useful in simulation of complex boundary conditions, stream-aquifer interactions, and repeated model runs for various stages of mining and reclamation.

Model inputs include aquifer transmissivity, storage coefficient, hydraulic gradient, recharge, constant head and impermeable boundary conditions. These input parameters will be either measured (e.g. via

aquifer pumping tests) or reasonably estimated (e.g. boundary conditions of faults and streams) from baseline data collection and monitoring.

Water quality changes in groundwater will necessarily be evaluated qualitatively. Although numerical groundwater models can simulate solute transport, dispersion, and decay, the most significant impacts of mine drainage are subject to complex geochemical, biochemical, and oxidation reactions which cannot readily be modeled. Water quality changes during mining and after abandonment will be evaluated based upon baseline water quality, hydrologic flow regime, geochemistry of adjacent rock units, design of the mine, and reclamation. Should there be drainage from existing abandoned mine workings, the associated baseline water quality may provide one of the best indicators of potential impacts.

6.0 SCHEDULE

ERT intends to conduct the major program tasks according to the following schedule:

Task	Scheduled Completion Date
Award and Contracting (assumed date)	May 17, 1985
Collect and Review Existing Data	June 7, 1985
Field Reconnaissance and Measurement	June 7, 1985
Install Monitoring Networks	June 21, 1985
Describe, Sample, Analyze Geologic Strata	July 30, 1985
Quarterly Water Quality Sampling	June 30, 1985 September 20, 1985 December 20, 1985 March 31, 1986
Monthly Water Quality Sampling Rounds	Mid-month through April 1986
First Draft Report	January 31, 1986
DOGM Draft Review	March 3, 1986
Complete Draft Report	May 16, 1986
DOGM Draft Review	June 16, 1986
Final Report	July 11, 1986

HOPEFULLY SOONER

7.0 COSTS

Since a contract type is not specified in the Request for Proposal, ERT proposes to conduct the scope of work described herein on a Time and Materials basis for an estimated cost of $87,000. The costs for each discipline are shown below. For each discipline, these costs include literature searches, fieldwork and construction, laboratory analyses, and reports. The management discipline includes meetings and correspondence, budget tracking, progress reporting, and associated program management duties.

COST SUMMARY

SMALL OPERATOR ASSISTANCE PROGRAM

DOGM REQUEST FOR PROPOSAL 587504

Discipline	Labor	Other Direct Costs[1]	Total $
Surface Water Hydrology	4,000	29,950	33,950
Groundwater Hydrology	21,650	6,450	28,100
Geologic Studies	5,550	4,600	10,150
Soils and Vegetation	4,650	1,600	6,250
Management	8,000	550	8,550
	$43,850	$43,150	$87,000
Optional Well Construction			$ 5,200

[1]Other direct costs include all subcontracts, lodging and per diem, rentals and equipment, graphics, and report production.

8.0 PERSONNEL

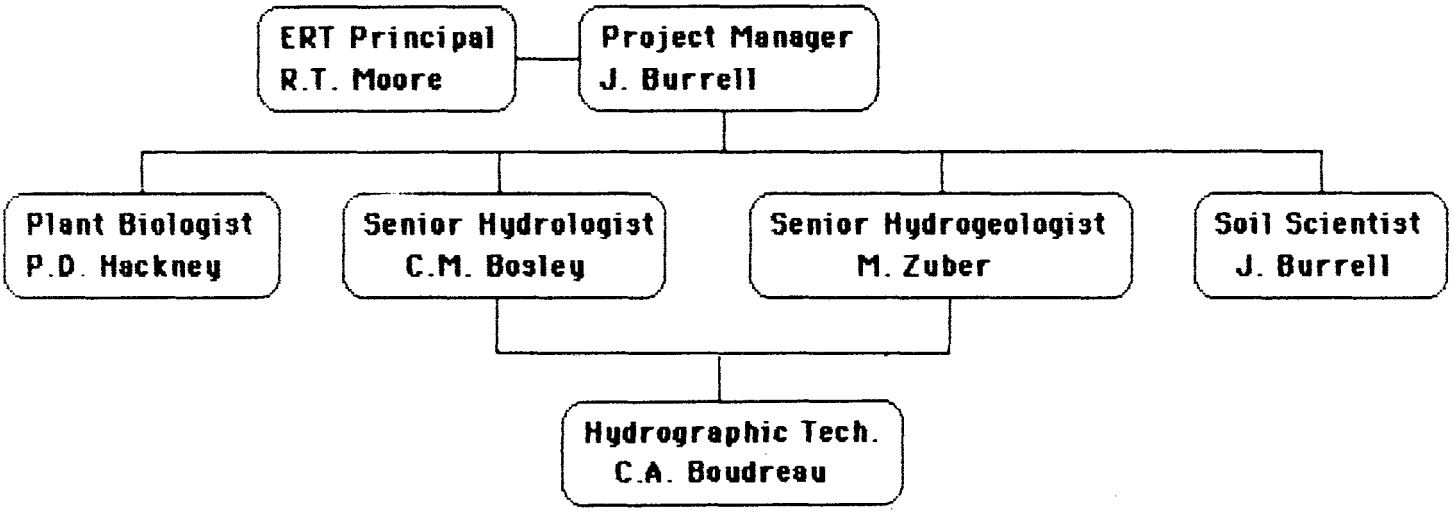
ERT proposes to conduct the scope of work with a staff consisting primarily of Mr. James Burrell, Mr. C. M. Bosley, Mr. Mark Zuber, and Dr. Russell T. Moore. Mr. Burrell will serve as overall project manager, with Dr. Moore serving as ERT Principal and project advisor. Mr. Burrell has 7 years of field and managerial experience in soils, geology and groundwater. He will be assisted by Mr. Bosley as Senior Hydrologist, and by Mr. Zuber as Senior Hydrogeologist.

Mr. Bosely is a Registered Professional Engineer with several years of experience in the design, installation, and operation of surface water monitoring networks. He has also reduced and interpreted data and generated reports for several water resources investigations in the Rocky Mountain region and Alaska. Mr. Zuber has considerable experience in designing and completing field and office tasks for groundwater monitoring and supply programs in the west.

The primary staff will be assisted by Mr. Phillip Hackney and Mr. C. A. Boudreau. Mr. Hackney will serve as Plant Biologist to assist in the watershed-related vegetation study. Mr. Boudreau will serve as a subcontracted Hydrographic Technician to ERT, primarily for purposes of data reduction. Intermountain Laboratories of Sheridan, Wyoming, will also provide subcontracted services for soils and overburden analyses. Resumes and qualifications for these individuals and for Intermountain Laboratories are included in this proposal. Standard Laboratories of Huntington, Utah, will subcontract to ERT for water quality analyses. Standard Laboratories offers cost-effective services at a location close enough to the work site to minimize transport times for the perishable water samples. They are certified laboratory number E-25 by the Utah State Department of Health.

ERT PROJECT ORGANIZATION

DOGM SMALL OPERATORS ASSISTANCE PROGRAM
SUMMIT COUNTY, UTAH



CHARLES M. BOSLEY

PROFESSIONAL HISTORY

Environmental Research & Technology, Inc., 1980 to present
Water Environment Consultants, Inc., 1978 to 1980

EDUCATION

M.S. (Hydraulics) Colorado State University
B.S. (Civil Engineering) Colorado State University

AFFILIATIONS AND CERTIFICATIONS

Registered Professional Engineer (Colorado)
Registered Professional Engineer (Alaska)

TECHNICAL SPECIALTIES

Hydrologist responsible for hydraulic/hydrologic design, computer modeling (open-channel flow simulation), water resource assessment, and installation and operation of stream gaging networks.

REPRESENTATIVE PROJECT EXPERIENCE

Mining

- Anaconda Minerals Company, Summittville Gold Project. Field supervisor for construction and operation of stream gaging and sampling network for gold mine in the Rio Grande National Forest in southern Colorado. Software author of data reduction programs. ADP supervisor for data sections of report.

- Diamond Shamrock, Diamond Chuitna Project. Direct supervision of stream gaging station construction for coal project in Alaska's Beluga coal field, utilizing state-of-the-art electronic gauging hardware. Formulation of data reduction software and theoretical rating curves. Computer simulation to determine carriage capacities of streams for mine drainage. Field supervision of survey crew for stream description/delineation for reclamation section of mine permit application. Hydrologic and hydraulic modeling of drainages and stream reaches for road culvert design.

- Houston International Minerals, Corp., Borealis Project. Discipline manager and principal author of surface water technical report to support third-party Forest Service EIS for gold mine in western Nevada. Analyses of cyanide toxicity and transport in surface and subsurface drainages; storm runoff predictions; and mine area drainage plan formulation.

EXPERIENCE (Continued)

- U.S. Forest Service/Noranda Mining, Inc., Blackbird Project. Hydrology discipline manager for third-party EIS for cobalt mine in northeastern Idaho. Computer simulation of storm runoff; hydrologic and conceptual design of reservoir and storm drainage facilities. Hydrologic evaluation of abandonment drainage scheme.

- Western Nuclear, Inc., Lakewood, Coloroado. Pumpkin Buttes in-situ uranium mine. Slope stability analysis of impoundment embankments. Flow path modeling to determine response times of leak detection system. Hydrologic design and sizing drainage system around evaporation ponds. Recommendation of embankment slope protection measures.

Oil Shale and Synfuels

- Chevron Shale Oil Company, Western Colorado Oil Shale Project. ADP supervisor for storm runoff predictions and hydrologic design of settling ponds; software author for baseline data processing and presentation; and field crew member for operations and maintenance of gaging network and surface water quality monitoring.

Engineering

- Amoco Oil Company, Texas City Refinery Land Farm Upgrade. Conceptual design of interior water management scheme for 179-acre waste disposal facility; sizing of pumps, reservoir and pipelines; and assessment of flow paths and rates.

- Burlington Northern Railroad. Designed armored roadway to isolate hazardous materials area from lakeshore.

- City of Fort Collins, Colorado, Bank Stabilization Project. Performed hydraulic analyses of unstable river reaches to determine design parameters for bank protection.

- City of Fort Collins, Colorado, Floodplain Delineation. Performed hydraulic evaluation (HEC-2 model) of inundated areas associated with recurring storms for municipal zoning.

- Gary Energy Company, Evaporation Pond Inspection. Inspection of oil refinery waste disposal system near Grand Junction, Colorado, in response to Colorado Department of Health citation. Recommended improvements in flow paths, dike system, and pond operation required to bring the refinery into compliance with conditions of permit.

Industrial Siting

- Confidential, Power Plant Feasibility Study. Discipline manager and contributing author to a series of power plant site analyses in Idaho.

EXPERIENCE (Continued)

Water Resources Evaluation/Research

- Arapahoe Water and Sanitation District, Arapahoe County, Colorado, Cherry Creek Reservoir Study. Project manager of NPDES preliminary analysis in east-central Colorado. Use of U.S. Army Corps of Engineers' WQRRS model to predict effects of nutrient loadings on eutrophic reservoir. Evaluation of stream gauging and well data in interests of client. Attendance at public review meetings on behalf of client.

- City of Cheyenne, Wyoming, Minimum Flow Analysis. Author of support document for water rights adjudication proceedings; prediction of minimum discharges in selected mountain stream reaches required to transport various sizes of spawning gravels (substrate flushing flows).

- City of Colorado Springs, Colorado, Homestake Diversion Project. Hydrology discipline manager for third-party Forest Service Environmental Impacts Report (EIR). Evaluation of alternative transmountain diversion scenarios with regard to available unappropriated water, effects on senior and junior appropriators, effects on Colorado River salinity, and effects on aquatic habitat.

- Metro Denver Sewage Disposal District No. 1. Conducted multiple-reach instream flow analysis using mass balance model to correlate measured streamflow and irrigation headgate records. Used model to predict effects of altered usage on instream flow.

- Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, Computerized Water Distribution. Author of software package for district-level water storage, allocation, distribution, and accounting. Implemented a pilot program with state administrator of the Cache la Poudre system in Northeastern Colorado.

- USDA Forest Service, Region 5, Erosion Model Calibration. Field crew supervisor for contract study of rainfall-induced erosion of logging roads in Shasto and Stanislaus National Forest. Results were used to calibrate Colorado State University's Road Sediment Model.

- U.S. Army Corps of Engineers, Yazoo River Study. Survey party leader; supervised peak discharge measurements on Yazoo River tributaries, channel cross-section surveys, and stream profile surveys near Greenwood, Mississippi. Supervised reduction of data onto computer disc files for further analysis of velocity distribution and sediment transport.

- U.S. Department of Transportation (FHWA), Highway Bridge Design Evaluation. Inspected channel reaches associated with highway bridges in western United States. Developed source data for input to design document regarding mobil boundary considerations in agrading/degrading stream reaches.

C. ANDREW BOUDREAU

PROFESSIONAL HISTORY

Independent Consultant, 1985 to present
Environmental Research & Technology, Inc., 1983 to 1985
MSM Consulting, 1983
Colorado State University, 1982 to 1983

EDUCATION

B.S. (Watershed Science) Colorado State University

AFFILIATIONS

American Water Resources Association
National Wildlife Federation

TECHNICAL SPECIALTIES

Install, operate and maintain monitoring networks for all aspects of hydrology and water quality. Analyze and reduce hydrology data (groundwater, surface water, water quality, and snow hydrology). Survey stream cross sections and longitudinal profiles for input to rating curve development and hydraulic analyses. Utilize micro and mainframe computers for data analysis and modeling. Analyze watershed characteristics and stream flow to make flood hydrology determinations, including peak flows, peak volumes, and the respective stream water levels and flow velocities.

REPRESENTATIVE PROJECT EXPERIENCE

Mining

- Anaconda Minerals Co., Thunder Basin Coal Development, Coal Creek and Black Thunder Mines. Reduced and analyzed Stevens Type A and Type F records to aid in determining stream discharges at the operating coal mines in Wyoming.

- Diamond Shamrock Corporation, Diamond Chuitna Project. Field team leader for collection of hydrologic data to support environmental baseline studies for a coal project in Alaska's Beluga coal field. Operated and maintained instrumentation to continuously record stream stages, water temperatures, precipitation, and groundwater levels. Assisted in data reduction to determine the relationships between the surface water and groundwater regimes. Assisted in drainage plan design, sized channels, and applied Thiessen method of distributing rainfall to correlate with peak discharges and flows.

- Exxon Gravel Operations, Dodge Rim and Wellfield Mines. Estimated peak flows, annual discharges and annual recharge to surface water systems. Determined watershed characteristics (area, stream length, slopes) from topographic maps. Summarized above information and prepared relevant input to aid in gaining a DEQ gravel mine permit in Wyoming.

EXPERIENCE (Continued)

Oil and Gas

- California State Lands/BLM/Santa Barbara County, Celeron/All American and Getty Pipeline Projects EIR/EIS. Assisted in estimating peak flows, annual discharges and annual recharges for groundwater and surface water systems. Determined watershed characteristics (area, stream lengths, slopes and irrigated area, etc.) over an interstate system from California to Texas. This information was derived from aerial photos, topographic maps, and soil survey maps. Summarized above information for input to an ES.

- Santa Barbara County/California State Lands/Coastal Commission, Getty Gaviota Consolidated Coastal Facility EIR. Estimated peak flows, annual discharges and annual recharge for groundwater and surface water systems. Determined watershed characteristics (area, stream lengths, slopes, irrigated areas, etc.) from aerial photos, topographic maps, and soil survey maps. Summarized above information and prepared relevant input to an EIR.

Other

- Falcon Ridge Housing Development. Designed water and sewer lines for housing development, according to state and local regulations. Designed water lines for optimal pressures and to meet fire codes. Sewer lines were designed for free flow and low energy grade drops through manholes and bends.

- Mountain Ranch Properties. Conducted reclamation of disturbed area within property boundaries; designed, installed and followed through on completions of check dams and water bars. Established revegetation and natural ground cover, and applied best management practices to other potentially affected areas.

- USDA Forest Service. Designed monitoring networks and snow courses. Used and modified state-of-the-art techniques and instrumentation for sampling and determing pH and buffering capacities. Determined foreign substance concentrations by chemical analysis using atomic absorption.

JAMES K. BURRELL

PROFESSIONAL HISTORY

Environmental Research & Technology, Inc., 1978 to present
U.S.D.A. Soil Conservation Service and Conservation District, Craig, Colorado, 1975 to 1978
Union Carbide Corporation, 1974

EDUCATION

B.S. (Forest Management) Colorado State University
Soil Mechanics and Engineering Classification Course, U.S.D.A. - Soil Conservation Service
Schlumberger Log Interpretation Seminar

AFFILIATIONS

National Water Well Association
American Society of Agronomy
Soil Science Society of America

TECHNICAL SPECIALTIES

Soil scientist responsible for designing, conducting, and managing soils investigations; hydrogeologic assistant responsible for field sampling, data interpretation, report preparation.

REPRESENTATIVE PROJECT EXPERIENCE

Hazardous Wastes

- Burlington Northern Railroad Creosote Site. Supervised a field program of monitoring well installation and exploratory borings at a creosote disposal pond near Somers, northwestern Montana. The program involved several 30-foot borings to recover undisturbed geotechnical samples, fourteen 10-foot to 100-foot continuous core retrieval borings to partially define horizontal and vertical contamination boundaries. Kept detailed logs and daily progress reports. Designed and completed monitoring wells in the upper water table aquifer and a deeper confined aquifer.

- Proposed Creosote Land Treatment Site (Confidential Client). Conducted an on-site soils investigation at this proposed location in Texas. The work involved detailed description and sample retrieval from eight shallow borings. Examined the results of physicochemical laboratory analyses and interpreted soil characteristics with regard to suitability for creosote land treatment.

EXPERIENCE (Continued)

- Briefing Documents, Trace Metals in Soils (Confidential Clients). Conducted an in-depth literature review and prepared "stand-alone" briefing documents for six trace metals. Topics included geologic and man-caused sources of the metals in soils, background concentrations in rural and urban/industrial areas, chemical forms and associations in soils, health effects, published environmental hazard levels, and references cited for each metal. This information has been used by clients in Massachusetts and New Jersey to negotiate clean-up criteria at industrial sites.

Mining

- Diamond Shamrock, Diamond Chuitna Project. Assisted in overburden and hydrogeologic investigations for Alaska coal mine project. Developed unified concept of aquifers, aquitards, and aquicludes onsite and their interrelationships. Utilized log information from cores and chip samples, down-hole electrical logs, and pump test data. Generated cross sections and plan view maps. Installed alluvial wells and rehabilitated existing wells. Monitored periodic water well levels and conducted single well drawdown and recovery tests. Conducted overburden/interburden environmental sampling and generated geologic environmental baseline report and diagrams from borehole and other exploration data.

- Various Hardrock Mining Clients. Conducted environmental soils investigations in several western hardrock areas, including Exxon Pinos Altos Copper/Zinc project in New Mexico; the Anaconda Moly Project near Tonopah, Nevada; the Inca Rich Gulch Project near Quincy, California; and the FMC Paradise Peak Project near Gabbs, Nevada.

- MONTCO, Nance Coal Mine Projects. Project manager and principal investigator for soils assessments to furnish data in conformance with the Montana Environmental Policy Act, MDSL pre-mining soils guidelines, and the Federal Surface Mine Control and Reclamation Act. Located in southern Rosebud County, Montana, this coal-related project primarily consisted of Order 1 (intensive) mapping and sampling on approximately 9,000 acres. Additional components were prime farmland and alluvial valley floor studies, soil/vegetation correlations, and surface sampling for air quality studies.

- Other Projects Include: Soil assessments for the Sun Coal Mine near Milner, Colorado; Big Sky Coal Mine near Colstrip, Montana; Green River Trona Operation for FMC in Wyoming; Copper Mountain Uranium Project near Shoshone, Wyoming; Seminoe 1, Seminoe 1-A1, and Medicine Bow Coal Mines, near Hanna, Wyoming.

EXPERIENCE (Continued)

Oil and Gas

- BLM and Forest Service/American Quasar, Exxon, Mobil, Northwest Pipeline, and Williams Exploration, Riley Ridge Natural Gas Project. Worked with Minerals Management Service on field geologic review of specific wellfield areas and a springs inventory. Identified contaminated springs in the study area and retrieved field and laboratory samples from several probable contaminated springs and probable unaffected springs. Sampling sites were chosen with regard to location of wellfield facilities and geologic formations. Read static water levels and collected field and laboratory samples from water wells. Analyzed field water quality parameters for both spring and well samples. Reviewed data and assisted in interpretations.

  Also, investigated soil resources and developed and compiled reclamation recommendations for this proposed 160,000-acre gas field in west central Wyoming. The study area included extensive acreage in both the Overthrust Belt and the Green River (Bridger) Basin. Included in this effort were approximately 50,000 acres of new soil surveys. Worked with the BLM and Forest Service to develop erosion control and rehabilitation guidelines for the wellfield, facility sites, and associated corridors.

- Northern Tier Pipeline Company, Northern Tier Pipeline Project. Developed a guideline and methodology for soil investigations to evaluate topsoil resources in advance of proposed construction along the pipeline corridor in Washington, Montana, and North Dakota segments. In addition, interpretive tables were derived by milepost within each state identifying the major characteristics of significant soils along the route, and describing their constraints or usefulness for potential revegetation efforts. Developed mechanical erosion control and stabilization recommendations for critical areas.

Other

- Chevron Shale Oil Company, Chevron Shale Oil Project. Technical and managerial responsibilities for four-person soil survey party over 18-month life of project. Located near Grand Junction, Colorado, this program involved soil surveys, sampling, and report preparation at Order 2 level on approximately 38,000 acres of the Colorado Plateau. Samples were taken for each mapping unit for laboratory analysis, in accordance with Colorado Mined Land Reclamation Board study input.

EXPERIENCE (Continued)

- U.S. Forest Service, Handbook of Revegetation Techniques, Published 1984. Prepared a comprehensive guide to reclamation practices and materials used nationwide for revegetating disturbed sites. Included in the handbook are discussions of the applicability, advantages, and limitations of methods and timing of equipment, techniques, and materials. Subjects covered include grading and topsoiling, seedbed preparation, fertilizers and other amendments, seeding and planting methods, and mulches and tackifiers. Also included were cross-references to literature sources, addresses and phone numbers of manufacturers and suppliers, associated application rates and costs, and a discussion of how to develop and implement a reclamation program.

- Various Clients, Geologic and Minerals Sections of Environmental Assessment Documents. Prepared descriptions of existing environment and potential impact sections for geologic, mineralogic, and paleontologic resources in Environmental Assessments and EISs within the Rocky Mountain region.

- WEST Management Committee, Regional Effects of Acid Precipitation. Made a general nationwide assessment of soil sensitivity to acid precipitation. Gathered laboratory data and descriptions of major soils by state, west of the Mississippi River. By review and compilation of earlier research methods and conclusions for the eastern U.S., ERT produced an overall map of the U.S. showing general zones of soil sensitivity. Nonsensitive, slightly sensitive, and sensitive zones were delineated on the basis of criteria developed from physical and chemical laboratory analyses, supplemented by soil maps and geologic, climatic, and vegetation data. A report describing acid input effects on soils, mapping criteria, and methods was also prepared.

RUSSELL T. MOORE

PROFESSIONAL HISTORY

Environmental Research & Technology, Inc., 1973 to present
California State University, San Diego, 1971 to 1973
Utah State University, 1966 to 1971

EDUCATION

Ph.D. (Ecology) Utah State University
B.S. (Range Management) University of Idaho

AFFILIATIONS

Colorado Mining Association
Denver Coal Club
Rocky Mountain Coal Mining Institute
Ecological Society of America
Society of Range Management
American Institute of Biological Sciences

TECHNICAL SPECIALTIES

Senior program manager responsible for the design and management of large multidisciplinary environmental baseline and impact assessment projects related to mining and energy development in the western U.S. Project management experience has included over 35 energy and mineral development projects throughout the western U.S. totaling over $10 million of contracts.

REPRESENTATIVE PROJECT EXPERIENCE

Mining

- Diamond Shamrock, Diamond Chuitna Project. Project manager of environmental baseline studies and permitting program for Diamond Shamrock's coal mine and port project in Alaska's Beluga Coal Field north of Cook Inlet. The proposed surface mine, designed to produce 15 million tons of coal per year, will be the largest coal mine in Alaska.

- Exxon Minerals Company, Piños Altos Project. Managed multidisciplinary environmental baseline and impact assessment studies for planned underground copper mine in southwestern New Mexico.

EXPERIENCE (Continued)

- FMC, Paradise Peak Project. Project manager of environmental baseline studies and preparation of BLM third-party Environmental Assessment for an open pit gold mine and conventional mill near Gabbs, Nevada.

- Inca Mining Corp., Rich Gulch Project. Managed environmental baseline and permitting efforts for a gold mine and mill near the Feather River in northern California.

- Mobil Oil Company, Pronghorn Coal Mine. Managed terrestrial and aquatic ecology, soils, and atmospheric studies and administered cultural resources subcontract for large surface coal mine near Gillette, Wyoming.

- Peabody Coal Company, Seneca 2-W Coal Mine: Managed environmental studies and impact assessments covering terrestrial and aquatic ecology, soils, air quality, meteorology, hydrology, socioeconomics, and cultural resources.

- Rocky Mountain Energy Company, Copper Mountain Uranium Project. Managed multidisciplinary environmental baseline and impact assessment studies for planned surface uranium mine and mill near Riverton, Wyoming.

- Texas Energy Services, Inc., Rocky Butte Project. Managed preparation of permit application to Wyoming Department of Environmental Quality for surface coal mine near Gillette, Wyoming.

Oil Shale and Synfuels

- Chevron Shale Oil Company, Clear Creek Shale Oil Project. Project manager of total environmental baseline and permitting contract for two sizable oil shale properties near Grand Junction, Colorado. This environmental program involved collection of baseline data in all environmental disciplines (ecology, soils, hydrology, meteorology, air quality, and cultural resources). The objective was to collect adequate data to enable permitting of a mine and retorting operation on either property plus permitting of transportation corridors, pipelines, upgrading facility, reservoirs, and community expansion. The multi-million dollar project extended over three years and involved over 50 personnel from four ERT offices as well as over $1 million in subcontracts.

- Great Plains Gasification Plant. Managed preparation of environmental sections of Environmental Monitoring Plan Outline for Great Plains Gasification Associates to meet requirements associated with SFC funding for the project.

- Panhandle Eastern Gasification Project. Plant ecologist and project manager of environmental baseline studies for proposed coal gasification facility and railroad proposed near Gillette, Wyoming.

MARK W. ZUBER

PROFESSIONAL HISTORY

Environmental Research & Technology, Inc., 1984 to present
Law Engineering Testing Co., 1983 to 1984
ESA Geotechnical Consultants, 1980 to 1983
Resource Consultants, (intermittently) 1980 to 1983
El Paso County, Colorado, 1977 to 1979

EDUCATION:

M.S. (Environmental Geology) Colorado State University
B.S. (Environmental Studies) University of California

PROFESSIONAL MEMBERSHIPS

National Water Well Association
Society of Mining Engineers of AIME
Colorado Groundwater Association

TECHNICAL SPECIALTIES

Hydrogeologist and environmental geologist responsible for studies including mine site hydrogeology, evaluation and monitoring of groundwater systems for RCRA compliance at industrial hazardous waste disposal sites, geologic hazards evaluation, and groundwater resource development. Experience includes management of technical subcontractors, design and construction of water supply and monitor wells, aquifer testing, quantitative analysis and modeling of groundwater hydrology and hydraulics, and principal author of over 30 technical and environmental reports.

REPRESENTATIVE PROJECT EXPERIENCE

Mining

- ARCO. Project manager for aquifer testing at Mt. Gunnison Mine, Colorado. Developed technical approach and scope of work, performed slug tests in monitoring wells, analyzed results and wrote final report to support mine permitting.

- Meridian Land and Mineral Company. Project hydrogeologist for studies of Skookum Mine, Carbonado, Washington. Duties involved characterization of hydrologic baseline conditions for existing abandoned underground coal mine, inventory of present subsidence features, review of dewatering plan, and prediction of hydrologic impacts associated with re-opening the mine.

EXPERIENCE (Continued)

- Texas Energy Services. Project hydrogeologist for quantitative analysis of probable hydrologic consequences, cumulative hydrologic impacts, and dewatering plan for surface coal mine permit application to Wyoming Department of Environmental Quality.

- U.S. Bureau of Land Management and FMC Corporation. Evaluation of geology, mineral resources, geologic hazards, paleontology, and groundwater hydrology for preparation of a third-party Environmental Assessment and mine permit applications for the Paradise Peak Project open pit precious metals mine, Nye County, Nevada. Designed conceptual groundwater monitoring plan and prepared Water Pollution Control Permit Application.

- U.S. Forest Service and Noranda Mines Ltd. Project hydrogeologist for groundwater hydrology section of an EIS addressing the re-opening of an underground cobalt mine near Cobalt, Idaho. Developed an analytical model of mine hydrology and water quality. Acid mine drainage, heavy metals loading to streams, and dewatering flow rates were evaluated for baseline conditions and alternative mine plans.

Hazardous Waste

- Confidential. Consulting hydrogeologist for interpretation of borehole logs and aquifer tests used in the development of a groundwater model of contaminant transport in glacial outwash deposits.

- Hitman Nuclear. Hydrogeologist involved in the interpretation of groundwater flow and infiltration models. The HELP model was used to evaluate alternative groundwater barrier and waste cover designs for the closure of a low-level radioactive waste disposal site located at Maxey Flats, Kentucky.

- International Paper Company. Hydrogeologist for site investigations to determine the extent of contaminated soils and groundwater for closure of hazardous waste facilities at a treated wood products site in Longview, Washington. Supervised construction of shallow monitor wells. Conducted subsurface sampling of contaminated soils and borrow investigation for waste cover material. Analysed groundwater flow and dispersion of contaminants in a tidal influenced aquifer system.

- Tosco Refineries. Project manager and hydrogeologist for two-phase projects involving design and implementation of RCRA hazardous waste groundwater monitoring programs for petroleum refineries located in Avon, California; Bakersfield, California; Duncan, Oklahoma; and El Dorado, Arkansas. Duties involved work plan formulation, site characterization, monitoring system design, and preparation of report and permit documents. At the El Dorado site, responsibilities also included planning and field supervision of monitor well installation, sampling, and aquifer testing.

EXPERIENCE (Continued)

Water Supply

- City of Woodland Park, Colorado. Project hydrogeologist responsible for installation and testing of alluvial well field. Supervised drilling, well construction, and aquifer testing, performed geologic logging, water quality sampling and analysis of aquifer tests, and analyzed long-term well field productivity.

- T.R. Ranch. Project hydrogeologist in water rights study for a ranch in northeastern Colorado. Characterized groundwater systems and hydrologic budget for development of an alluvial well field augmentation plan.

- Woodmen Water District, Colorado. Project hydrogeologist for analysis of tributary effects of deep wells in the Arapahoe formation in preparation for water rights litigation. Interpreted geophysical well logs and developed analytical model of hydrogeologic boundary conditions.

Engineering Geology

- City of Rock Springs, Wyoming. Staff geologist for subsurface investigation for evaluation of mine subsidence hazards. Responsible for geologic logs of drilling, geophysical logging, and sampling of overburden, coal, and mine voids associated with abandoned underground coal mines located beneath an urban area.

- Confidential. Staff geologist for subsurface exploration and geophysical logging in evaluating foundation stability of an existing dam. Duties involved down-hole geophysical logging, interpretation of stratigraphy, geologic logs, lab testing data, and geophysical logs for detailed characterization of dam foundation conditions.

- El Paso County, Colorado. Land use planner responsible for review of major subdivision proposals. Evaluated geologic hazards, water supply, and sewage systems. Coordinated inter-agency sponosred U.S.G.S. groundwater investigations. Also responsible for technical review of landfill, coal mine, and gravel pit applications.

Oil and Gas

- California State Lands/BLM/Santa Barbara County, Celeron/All American and Getty Pipeline Projects EIR/EIS. Groundwater discipline manager for third-party EIS. The EIS addresses an 1,800-mile crude oil pipeline and alternative routes from the Gaviota area of Santa Barbara County, California to Freeport, Texas. Key issues analyzed included: characterization of sensitive groundwater basis, evaluation of aquifer contamination by oil spills, and disposal of hydrostatic test water.

EXPERIENCE (Continued)

- City of Carpinteria/Chevron U.S.A. Inc., Carpinteria Gas Plant. Manager and technical specialist of geology and groundwater disciplines for a third-party EIR. Key issues addressed include faulting, seismic ground shaking, liquefaction, foundation stability, water supply, and potential aquifer contamination associated with proposed gas plant expansion and sour gas treatment facility.

- Santa Barbara County/California State Lands/Coastal Commission, Getty Gaviota Consolidated Coastal Facility EIR. Groundwater technical specialist for third-party EIR. The EIR addresses a consolidated oil storage, tank farm, and marine terminal facility for oil from the western Santa Barbara Channel and Santa Maria Basin. Alternative sites were also considered. Major issues addressed include: water supply, groundwater overdraft, seawater intrusion, aquifer contamination, and reduction of streamflows.

Oil Shale and Synfuels

- Geokinetics, Inc. Hydrogeologist for hydrologic permitting studies at an in-situ oil shale retort in Uintah County, Utah. Duties included logging rock core, conducting packer tests, supervision of monitor well construction, characterization of baseline groundwater conditions, and technical report preparation.

- U.S. Department of Energy and Gary Energy. Project hydrogeologist for evaluation of an oil refinery near Fruita, Colorado for hydrologic impacts associated with conversion to synfuels refining. Project involved field exploration, aquifer testing and sampling, development of a finite difference groundwater flow/contaminant transport model, and report to be included in Environmental Assessment.

iml
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Inter-Mountain Laboratories was incorporated May 8, 1979 as a Wyoming corporation, and has been providing soil, overburden, air and water quality laboratory analysis and field services to the western mining industry since that time. IML has a complete 4500 square foot office and laboratory in Sheridan, Wyoming which serves as the corporation's headquarters. Water quality analysis is also performed at our 1800 square foot laboratory in Gillette, Wyoming. IML has recently opened a 1400 square foot laboratory with full service capability in Farmington, New Mexico.

IML offers a comprehensive range of laboratory services as well as complete field soil survey and related discipline inventory including reclamation and revegetation plans for disturbed lands. IML is experienced in the preparation of environmental reports. IML has North Star and IBM Personal Computers and has phone modem capability for rapid transfer of results.

IML is equipped to provide complete topsoil and overburden analysis to satisfy environmental requirements of various state and federal regulatory agencies. IML also offers a suitability analysis on topsoil and overburden parameters according to criteria outlined in Wyoming DEQ Guideline No. 1, (January 1981). Additional soil related services include regraded spoil sampling, field soil surveys, topsoil staking, acid-base potential evaluation, leaching and weathering tests, and soil moisture determinations using nuclear probes. IML currently participates in three soil round robins: Amax Western Division, Montana Department of State Lands, and the Office of Surface Mining's Overburden Task Force of which IML President Roger Pasch is chairperson.

IML provides complete surface, ground, and safe drinking water analysis, and is currently certified in Sheridan, Wyoming by EPA for the Safe Drinking Water Act. In addition, IML provides complete air quality services including: design of air monitoring systems, full installation and maintenance capabilities, air quality/meteorology, monitoring field services, base line studies, data processing, and stack testing capabilities.

IML is proud of its professional staff, field and laboratory capabilities, close working relationships with mining industry and regulatory agency personnel, and cost competitive services. We invite you and your staff to visit our laboratories and see our capabilities.

Sincerely,

Roger N. Pasch
President

Soil Water Air

SOIL AND OVERBURDEN ANALYSIS

Inter-Mountain Laboratories, Inc. has been performing soil and overburden analysis at our 4500 square foot Sheridan laboratory since 1979. Over thirty thousand samples (including water analysis) have been analyzed since that time. Headed by soils specialist Roger Pasch, the IML soil staff is equipped to effectively satisfy all laboratory oriented environmental requirements of state and federal regulatory agencies. The following are lists of the most commonly requested parameters for soil and overburden laboratory analysis:

Overburden Analysis

pH
Electrical Conductivity
Saturation Percentage
Sodium, Calcium, and Magnesium
Sodium Adsorption Ratio
Particle Size
Texture
Selenium
Boron
Nitrate/Nitrogen
Molybdenum
Copper
Lead
Arsenic
Acid Potential
Neutralization Potential
Acid-Base Potential
Organic Carbon

Special Analytical Parameters

Batch Extraction Analysis
Complete Sieve Analysis
Exchangeable Sodium Percent
Munsell Color Chart
Moist-Dry Consistency

Topsoil Analysis

pH
Electrical Conductivity
Saturation Percentage
Sodium, Calcium, and Magnesium
Sodium Adsorption Ratio
Particle Size
Texture
Very Fine Sand
Coarse Fragments
Selenium
Boron
Organic Matter

Fertility Analysis

pH
Particle Size
Texture
Nitrate/Nitrogen
Organic Matter
Phosphorous
Potassium

Other analyses such as calcium carbonate equivalent, bicarbonate, total sulfate, chloride, 1/3 and 15 bar moisture, iron, manganese, zinc, copper, and cobalt are run upon request. In addition, IML has assisted in the design and interpretation of several types of leaching and weathering-aging tests on overburden concerning acid formation and groundwater quality. Twelve projects have been completed to date for six clients. Reference methods are available upon request. Procedures can be modified to conform with regulatory guideline revisions.

Turn-around time depends upon the number of samples received and the condition of the samples. Soils that are extremely wet will take longer to process. Normal turn-around time will be within ten working days upon receipt of samples. If a large number of samples (>75) are received, a time will be agreed upon by both parties. Approximately ten percent of all samples will be re-run at no expense, and results will be presented upon request. An average range of re-runs is calculated; the upper warning level is calculated to correspond to a 95% confidence limit of two standard deviations, and the upper control limit is calculated to the 99% confidence limit of three standard deviations. Examples of past re-runs can be furnished upon request. Instruments and equipment are properly maintained and calibrated regularly. Daily records are kept of oven, refrigerator, and incubator temperatures. Balances and deionized water are also checked daily. Spectrophotometers and pH meters are checked before use.

IML currently participates in three soil round robins: Amax Western Division, Montana Department of State Lands, and the Office of Surface Mining's Overburden Task Force round robin, of which Roger Pasch is Chairperson.

IML currently has North Star and IBM Personal computers. Raw data is entered into the computer and the computer performs all the calculations. An input data sheet is printed out and all inputs are cross-checked. Final data formatting is then completed and a hard copy is printed. IML also has a phone modem for rapid transfer of results, if desired.

IML also offers a suitability analysis on topsoil and overburden parameters according to criteria outlined in Wyoming DEQ Guidelines, January, 1981, Draft. Each sample is checked for each suitability parameter. If an unsuitable result is found, the program records lab number, drill hole, depth, the unsuitable paramcter, and the volume of the unsuitable material.

IML has performed soil and overburden analysis for over seventy-five clients. Prices for individual and volume number samples can be furnished upon request.

9.0 EXPERIENCE

RELEVANT EXPERIENCE - UTAH

ERT has performed more than 25 projects within the State of Utah for various mining clients and federal agencies. Projects have included preparation of complete environmental assessments, specialized regulatory reviews, permitting, air quality modeling, literature searches, and detailed ecological baseline and impact evaluations. Some representative projects are summarized here.

- Kaiparowits Coal Development and Transportation Study. Evaluation of corridors for the transportation of coal off the Kaiparowits Plateau in southern Utah. Transportation modes investigated included truck, rail, and coal slurry pipeline. Potential environmental impacts and mitigation measures for various levels of coal production and transportation modes were also analyzed. Study included federal, state, and local agency coordination and public presentations. Bureau of Land Management.

- Eastern Utah Mine. Intensive review and analysis of all state and local environmental regulations affecting development of surface mine in eastern Utah. Confidential client.

- Blue Lizard, Posey, and Yellow Jacket Mines. Vegetation studies and preparation of reclamation plans for several proposed uranium mines near Blanding, Utah. Energy Fuels Nuclear, Inc.

- Utah Lake - Jordan River EIS Summary. Reviewed a summary of a draft EIS for the Utah Lake - Jordan River water quality management planning study. The critique resulted in such reorganization of the first summary that a second EIS summary was produced under the auspices of the EPA in April, 1976. U.S. Environmental Protection Agency.

- Kanab Mine. Preliminary assessment of environmental constraints and installation and operation of air quality station on proposed coal mine in southcentral Utah. Utah International Inc.

- Western Energy Study. Determining air quality impacts of coal gasification and shale oil productions in Colorado, Utah, Wyoming, and North Dakota. U.S. Environmental Protection Agency.

- Uranium Mine. Environmental survey of alternative access corridors to uranium claim block in southeastern Utah. Cotter Corp.

- Ute #2 Mine. Conducted an apparent completeness review of Ute Energy's mining and reclamation plan for its proposed underground coal mine in Utah. Office of Surface Mining.

- Sage Point - Dugout Canyon Mine. Vegetation, soils, wildlife and land use baseline studies and complete reclamation planning for a proposed underground coal mine near Price, Utah; evaluation of critical mule deer winter range. Eureka Energy Co., subsidiary of Pacific Gas and Electric Co.

- Wilberg Mine. Apparent completeness review and technical critique of mining and reclamation plan submitted by Utah Power & Light Company for its Cottonwood Portal expansion of the Wilberg Mine, located west of Huntington, Utah. Office of Surface Mining.

- Alton Coal Project. Conducted air quality and visibility model for a proposed 11 MTY coal mine directly south of Bryce Canyon National Park. The air quality analysis included development of a model specifically designed for simulating mining development, the visibility analysis included examples of visual range reduction, contrast changes, and atmospheric discoloration. The results of the study were presented in testimony before the designee of the Secretary of the Interior. Utah International.

- Emery Coal Gasification Project. Complete environmental and regulatory reconnaissance for permitting a coal gasification project near Emery, Utah. Mountain Fuel Resources.

- Emery Mine Project. ERT performed a fugitive dust analysis to support a new source permit application for a coal preparation plant in Emery County, Utah. The analysis included compilation of a fugitive dust inventory and performing dispersion modeling. Consolidation Coal Company.

- Sand Wash Project. ERT performed an air quality analysis to support a PSD application for an oil shale operation in Uintah County, Utah. The analysis included dispersion modeling for gaseous pollutants and fugitive dust, compilation of a fugitive dust inventory, and reduction and analysis of meteorological and air quality data. Tosco.

TABLE 8-1

ERT - COAL MINING EXPERIENCE

Client	Project		Location	Terrestrial Ecology	Aquatic Ecology	Water Quality	Hydrology	Soils & Reclamation	Meteorology	Air Quality	Socioeconomics	Cultural Resources	Permitting	EA/EIS	Audits
Aluminum Company of America	Sandow Surface Mine	S	near Rockdale, Milan County, TX	x				x							
Amax Coal Company	Catlin Mine								x	x					
Amax Tennessee, Inc.	Tennessee No. 1 Surface Mine	S	Tennessee		x					x					
Arch Mineral Corp.	Hanna South Mine	S	near Hanna, Carbon County, WY					x					x		
	Medicine Bow Mine	S	''					x					x		
	Seminoe I(A-1) Mine	S	''					x					x		
	Seminoe II Mine	S	''					x							
	Seminoe No. 1 Mine	S	''					x					x		
Atlantic Richfield Company	Black Thunder Mine	S	North of Douglas, WY			x	x		x	x					
	Coal Creek Mine	S	Campbell County, Wyoming			x	x	x	x	x					
	Mt. Gunnison Mine	U	near Somerset and Gunnison, CO	x	x	x		x					x		
Black Butte Coal Company	Black Butte Mine	S	Eastern Wyoming							x			x		
Bureau of Land Management	Air Qual. Impacts of Energy Development in NE Montana	S	Northeast MT							x					
	Kaiparowits Coal Devel. & Transp. Study	S	Kaiparowits Plateau, UT	x	x	x	x	x		x	x	x		x	
	NW Colorado Regional & Site-Specific EIS	S	Northwest CO							x				x	
	S. Central WY Coal Dev. Transportation Studies	S	Southcentral WY							x					
Burlington Northern	Circle West Project	S	near Circle, MT	x	x	x		x	x	x	x				
Coastal States Energy Co.	McCoy Alma/Caney Branch Coal Mine		near Phelps, Kentucky												x
Consolidation Coal Company	Glenharold Mine	S	near Stanton, North Dakota	x				x	x						
	Pronghorn Mine	S	Campbell County, WY					x		x			x		
The Coteau Properties Co.	Coteau Mine		near Beulah, Mercer County, ND	x	x	x	x	x							
Mobil Coal	Consol-Mobil Surface Mine	S	near Gillette, WY	x	x	x		x	x	x				x	
Decker Mining Company	Decker Mine	S	near Decker, southern Montana	x											
Department of Energy	Alt. Approaches for Est. of Particulate Conc. from Coal Mining, NE WY	S	Northwest WY							x					
Diamond Shamrock	Diamond Chuitna Project	S	Beluga Coal Field, AK	x	x	x	x								
Empire Energy			Craig, CO		x										
Energy Development Company	Surface Coal Mines	S	near Hanna, Carbon County, WY						x	x			x		
	Surface Mine near Hanna	S	near Hanna, Carbon County, WY	x	x			x		x			x		
Energy Fuels Corp.	Eckman Park Mine Expansion		near Steamboat Springs, CO	x	x										
	Mapco Permit Area	S	near Milner, CO	x				x							
	Sudduth Property Permit Area		near Walden, CO	x	x										
	Sugarloaf Mine		near Lay, CO	x										x	
Eureka Energy Company	Sage Point-Dugout Canyon Underground Coal Mine	U	near Price, Utah					x					x		
Falkirk Mining Company	Falkirk Mine	S	near Underwood, McLean County, ND	x	x	x	x	x							
Gulf Mineral Resources Co.	Wildcat Mine		Powder River Basin, WY						x	x					
Hunt Oil Minerals Div.	Mine Audits	S/U	W. VA												x

TABLE 8-1 (CONTINUED)

Client	Project		Location	Terrestrial Ecology	Aquatic Ecology	Water Quality	Hydrology	Soils & Reclamation	Meteorology	Air Quality	Socioeconomics	Cultural Resources	Permitting	EA/EIS	Audits
Kemmerer Coal Company	Elkol/Sorensen Mine	S	near Kemmerer, WY	x				x							
	Surface Mine near Kemmerer	S	near Kemmerer, WY	x				x					x		
Kerr-McGee Coal Corp.	Jacobs Ranch Mine	S	Eastern Wyoming	x		x	x			x					
	Choctaw Mine	U	Eastern Oklahoma							x			x		
Mead Corp.	Coal Mine Discharge Study		Village & Short Creeks, AL	x	x	x									
	Mulga Mine	U	near Birmingham, AL					x						x	
Montco	Proposed "Nance" Mine	S	Rosebud County, MT		x			x		x	x		x		
Peabody Coal Company	Seneca and Seneca 2W	S	Hayden, CO	x	x	x	x	x	x		x	x	x		
	Big Sky Mine	S	Rosebud County, MT		x	x		x							
	North Antelope Creek Mine	S	near Douglas, WY	x	x	x		x	x	x			x		
	Rochelle/North Antelope Mines	S	near Douglas, WY, Campbell & Converse Counties	x	x	x		x	x	x			x		
Peabody Coal Co., Cherokee & Pittsburg Coal Co.	Star Lake/LaRue Mines	S	Star Lake, New Mexico	x				x							
Public Service Co of OK	Ash Creek Mine	S	North of Sheridan, WY	x	x								x		
	Little Young's Creek Mine	S	Sheridan County, WY	x	x	x		x	x						
Rocky Mountain Energy Company	Carbon County Mine	S	near Hanna, WY							x					
	Hanna Mine	S	near Hanna, WY							x					
	South Haystack Mine	S	Uintah County, near Evanston, WY	x	x	x	x	x	x	x	x		x		
Rosebud Coal Sales Company	Rosebud Mine	S	near Hanna, WY	x	x										
Shell Oil Company	Buckskin Mine	S	near Gillette, Campbell County, WY			x				x	x		x	x	
		S	north of Gillette, WY							x					
Sun Coal Company, Inc.	Sun Coal Properties		near Hayden, CO	x	x			x							
Sunedco Coal Co. (now Cordero Mining Co.)	Cordero (Belle Fourche) Mine	S	South of Gillette, Campbell Co., WY	x	x	x		x		x			x		
Texas Energy Services, Inc.	Rocky Butte Coal Mine	S	near Gillette, WY	x		x	x	x			x		x		
Tower Resources, Inc.	Coalmont Mine	S	near Hebron, CO	x	x									x	
Utah International, Inc.	Alton Coal		near Alton, UT							x					
	Kanab Mine	S	Southcentral Utah	x	x	x	x		x	x					
	Navajo Mine	S	Northwestern New Mexico					x							
	Trapper Mine	S	near Craig, CO	x	x	x	x	x	x	x		x	x	x	
W.R. Grace and Company	Colowyo Mine	S	Craig-Meeker area Colorado						x	x					

[1]S = Surface Mine
U = Underground Mine

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PROPOSAL TO PROVIDE SMALL OPERATOR ASSISTANCE PROGRAM SERVICES FOR THE BOYER MINE, SUMMIT COAL COMPANY

Submitted to

UTAH DIVISION OF PURCHASING
Salt Lake City, Utah

Submitted by

EARTHFAX ENGINEERING, INC.
Salt Lake City, Utah

April 30, 1985

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PROPOSAL TO PROVIDE SMALL OPERATOR ASSISTANCE PROGRAM SERVICES FOR THE BOYER MINE, SUMMIT COAL COMPANY

1.0 INTRODUCTION

Summit Coal Company has proposed to develop an underground coal mining operation (the Boyer Mine) on a small tract of land located in Summit County, Utah approximately one mile east of the town of Upton. To aid in the collection of the hydrologic and overburden data necessary to obtain a permit to mine coal, Summit Coal Company applied to the Utah Division of Oil, Gas, and Mining (DOGM) under the Small Operator Assistance Program (SOAP) for aid and technical assistance.

EarthFax Engineering, Inc. is pleased to submit this proposal to the Utah Division of Purchasing to provide the necessary services to complete the Summit Coal Company SOAP project. The services to be provided by EarthFax will include installation of hydrologic monitoring stations, review of literature and other data sources, collection of field hydrologic and geologic data, and preparation of a report describing local hydrologic and geologic conditions as required in the Request for Proposal dated April 3, 1985. The objectives of this project are to meet the needs of regulations promulgated by DOGM with respect to a determination of the probable hydrologic consequences of mining and reclamation (UMC 795.16[b][1]) and a statement of the physical and chemical nature of the overburden, coal, and underburden (UMC 795.16[b][2]).

This proposal is divided into five sections, including this introduction. Section 2.0 presents the technical approach for the project, followed by a discussion of related experience in Section 3.0. Qualifications of key personnel to be involved in the project are provided in Section 4.0. Section 5.0 presents cost information for the project.

2.0 TECHNICAL APPROACH

The Summit Coal Company SOAP project is designed to gather the necessary data to assess the potential hydrologic and geologic impacts of proposed coal mining activities at the Boyer Mine. A general discussion of local hydrogeologic conditions is presented here to aid in understanding the technical approach to the project presented subsequently in this section.

The project area lies between the Wasatch Mountains to the west and the Uinta Mountains to the east. The area has been structurally affected by the large orogenic activities which created both ranges of mountains. Numerous folds, faults, anticlines, and synclines are evident and have been mapped throughout the area. Of particular note is the Dry Canyon Anticline whose north-south axis lies within a few hundred feet of the eastern edge of the permit boundary (Trexler, 1966).

The permit area is located on the west dipping limb of the Dry Canyon Anticline where a small window of the Frontier Formation has been exposed by uplift and subsequent erosion. This west dipping limb (15^{o} west) which joins the Dry Canyon Anticline with the Clark Canyon syncline to the west has been fractured and faulted. An unnamed, high-angle fault appears to cross through the permit area (Trexler, 1966). If the fault is present within the permit boundary, and creates an offset within the Chalk Creek Member of the Frontier Formation, it could have a direct effect on the groundwater quality and movement into or away from the permit area.

Precipitation at the site averages about 20 inches, approximately 60 percent of which occurs during the period of October through April (Thompson, 1983). Temporally, streamflow in the area is subject to wide variations, with peak runoff normally occurring between the middle of April and the middle of June (Gates et al., 1984). Drainage from the site is to Chalk Creek, a perennial tributary of the Weber River.

2.1 Hydrologic Investigation

2.1.1 Literature and Data Search. Immediately following contract award, an information search will be conducted by EarthFax personnel to identify published and unpublished sources of data and literature describing hydrologic conditions in the permit and adjacent areas. This search will include a detailed review of plans and analyses that have been previously submitted to DOGM by Summit Coal Company for the Boyer Mine.

A library search will be conducted to obtain available published data and supplement the inhouse library maintained by EarthFax regarding hydrologic conditions in the region. In addition, selected agencies will be contacted to obtain unpublished data and reports. These agencies will include the U.S. Geological Survey, U.S. Bureau of Reclamation, U.S. Soil Conservation Service, Utah Division of Water Rights, Utah Division of Water Resources, Utah Water Research Laboratory, Utah Geological and Mineral Survey, and the Summit County Planning Office.

Maps will be obtained to identify drainage-basin characteristics in the permit and adjacent areas (area, slope, elevation range, etc.) and to locate surface-water bodies (streams, diversions, lakes, reservoirs, etc.) within one mile of the permit boundary. Water bodies will be identified by name (if available) and classified based on a field investigation according to their general hydrologic regime (i.e., perennial, intermittent, or ephemeral).

Water-quantity and -quality data previously collected in the region will be assembled. Monthly means and extremes will be determined from the available records. These data will aid in defining baseline surface-water conditions and in interpreting data collected during the site-specific field investigation. Empirical models of runoff and sediment yield will also be reviewed to determine their applicability for the permit area.

Previously collected climatological data will be assembled from representative stations near the proposed mine. Data to be reviewed will include normal annual and monthly temperature, precipitation, and evaporation, if available.

Records of water wells and water rights (surface and groundwater) will be obtained from the Utah Division of Water Rights for the area within one mile of the permit boundary. Data to be collected for water wells identified during this inventory will include construction details (casing depth and type, location of screened or open interval, date drilled, etc.), yield, static water level, owner, water-quality data, and results of any pumping tests. Water rights information to be gathered will include source type (well, spring, stream, etc.), point of use, quantity of use, period of use, and owner. Information will also be obtained on oil well drilling operations in the area. Permission will be sought from the owners of local water wells to obtain data during the course of the project.

The information obtained from the literature and data search will be used to supplement the site-specific data and establish baseline hydrologic conditions in the vicinity of the permit area. This information will also allow better interpretation of data collected during the site-specific field investigation.

2.1.2 Field Investigation. As soon as possible after contract award, a field trip will be made to the site to begin data collection. Timing of this field trip is important in order to allow collection of surface-water data during the spring runoff season.

During this initial field trip, a recording rain gage will be installed to determine local precipitation depths, durations, and timing. The gage operates with a 31-day chart that will be changed during each subsequent monthly field trip. The gage is an 8-inch standard gage and will be installed according to accepted practices (Brakensiek et al., 1979) in a location that will be reasonably protected from vandalism and local surface activities.

Stream gaging stations will be established during the initial field trip, with locations chosen in consultation with representatives of DOGM. Stations on three ephemeral channels will each consist of a crest-stage gage (Buchanan and Somers, 1968) and three single-stage sediment samplers (Guy and Norman, 1970). These devices will allow the inexpensive collection of streamflow and water-quality data during periods not coinciding with field trips. The precipitation gage will provide information regarding the timing and depth of the precipitation event that caused runoff, the crest-stage gage will indicate the peak flow depth of the runoff event (which will be converted to a peak rate using slope-area methods), and the single-stage samplers will collect sediment and water-quality samples during the event. This type of surface-water monitoring system has been used successfully by EarthFax at other mine sites.

Two stations (one upstream and one downstream from the permit area) will be installed on the intermittent channel that crosses the southeast corner of the site. The upstream station on this channel will consist of a crest-stage gage and three single-stage sediment samplers as indicated for the ephemeral channels. The downstream station will consist of a water-level recorder installed in a stilling well with intake tubes that lead to the channel bottom. Installation of the stilling well and intakes will be in accordance with accepted standards (Buchanan and Somers, 1968). A 31-day automatic recorder will be used to collect water-level data.

Two stations will also be established on Chalk Creek (one upstream and one downstream from the permit area). The upstream station will consist of a sampling and measuring location only, with no instrumentation being installed. A recording gaging station will be installed at the downstream location in a manner similar to that installed on the intermittent channel.

Channel cross sections will be surveyed at each of the monitoring stations and channel hydraulic conditions will be estimated to aid in interpreting the crest-stage data (i.e.,

conversion of peak depths to peak flows using slope-area methods). Additional cross sections will be surveyed on Chalk Creek and the intermittent channel (for a total of three cross sections each within the permit and adjacent areas on each channel) to better define channel morphologic conditions.

Stream gradient profiles will be determined from topographic maps. The area and capacity of existing reservoirs, lakes, and impoundments within one mile of the permit area will also be determined from field measurements.

A general examination of channel stability, morphology, and sediment deposition will be made. Samples of the channel bank and bed materials will be collected at three locations along the intermittent channel and Chalk Creek for size-fraction analyses to aid in quantifying local conditions. A general description of riparian vegetation will also be prepared based on field observations.

During the initial field trip, an inventory will be conducted to locate all seeps and springs within one mile of the permit boundary. Field water-quality data will be collected from each seep or spring (pH, specific conductance, and temperature) and the flow rate will be determined. In addition, geologic controls of spring discharge will be examined. The seep and spring inventory will be repeated during the October field trip to determine temporal variations at the site.

If deemed necessary by DOGM, a monitoring well will be constructed in the western portion of the permit area to better characterize local groundwater conditions. Drilling for water supplies in support of oil field operations in the vicinity of the site has indicated that yields in excess of 200 gallons per minute are not uncommon for 1000-foot wells in the region. Hence, at the depths anticipated for a monitoring well at the site (assumed to be 750 feet), a casing diameter of at least 7 inches will be required to accomodate a pump with sufficient capacity to conduct a meaningful pumping test.

If required, a monitoring well at the site will be rotary drilled to an assumed depth of 750 feet at a diameter of 11 inches. During drilling, cuttings from the hole will be logged to indicate rock type, texture, cementing agents, presence of voids and fractures, staining, lithofacies changes, thickness, presence of water-bearing zones, etc.

Because of the assumed depth, the hole will be cased with 7-inch diameter steel casing and screen. It is assumed that three intervals in the well will be screened (one corresponding to the overburden, one adjacent to the coal, and one within the underburden). Wire-wound, continuous-slot screen (80 slot) will be utilized to ensure that the well has good hydraulic

characteristics. The annulus between the borehole wall and the screens will be backfilled with 4- to 8-mesh rounded gravel, with a bentonite seal above and below each screened section. Run-of-pit gravel will be used to fill the annulus between screened sections and above the upper screen to a depth 20 feet from the surface.

- The upper 20 feet of the annulus will be sealed with a neat-cement grout to prevent future washout around the casing. A cap will be placed on the portion of the casing extending above the ground surface to protect the well. Following construction, the monitoring well will be developed by pumping or surging to correct any damage to or clogging of the water-bearing formations that may occur as a side effect of drilling.

Monthly field trips (initial and 11 subsequent) will be made to the site to collect streamflow measurements, change charts on the rain gage and water-level recorders, and measure groundwater levels in local wells. General site conditions will be observed and repairs will be made as necessary to instrumentation during these field visits.

During the first, fourth, seventh, and tenth monthly field trips (i.e., on a quarterly basis during the project duration), water-quality samples will be collected from the two Chalk Creek stations and the local wells that are included in the investigation. To the extent possible, the samples from Chalk Creek will be collected at times that reflect approximate high- and low-flow periods. The intermittent and ephemeral channels will be sampled as flow occurs (either in the form of grab samples or by the single-stage sediment samplers). All samples will be analyzed in the field for pH, specific conductance, dissolved oxygen (surface water), and temperature. Each sample will be preserved in accordance with guidelines established by the U.S. Geological Survey (1977). Samples will then be delivered to a Utah-certified laboratory for analyses according to the list contained in Table 2-1.

Aquifer tests will be conducted in existing wells in the vicinity of the mine to determine local groundwater hydraulic conditions. It is currently anticipated that pumping tests (step-drawdown and constant rate) will be conducted in one existing well, with slug-discharge tests being conducted in two additional wells in the area. Selection of the wells for specific tests will be made in consultation with representatives of DOGM.

A step-drawdown test will be conducted in the candidate well to determine the pumping rate for the constant-rate test. The test will be conducted at three increasing pumping rates, with the specific rates depending on the selected well. Each pumping rate will be held constant for a period of approximately 90 minutes, during which drawdown data will be collected at

Table 2-1. Laboratory analyses for water samples.

Settleable solids[a]	Magnesium
Total suspended solids[a]	Manganese
Total dissolved solids	Mercury
Total hardness (as $CaCO_3$)	Molybdenum
Aluminum	Nickel
Arsenic	Ammonia-nitrogen
Barium	Nitrate-nitrogen
Boron	Nitrite-nitrogen
Carbonate	Potassium
Bicarbonate	Phosphate
Cadmium	Selenium
Calcium	Sodium
Chloride	Sulfate
Chromium	Sulfide
Copper	Zinc
Fluoride	Oil and grease[a]
Iron, dissolved	Cation-anion balance
Lead	

standardly accepted intervals (see U.S. Bureau of Reclamation, 1977). Discharge measurements will be collected volumetrically or with an orifice gage. Water-level data will be collected with an electric water-level indicator.

The step-drawdown data will be plotted as drawdown versus time and a stabilized drawdown will be determined for each pumping rate. This stabilized drawdown will then be plotted against discharge rate to determine the pumping rate at which the constant-rate test can be conducted (based on the depth of the well, the static water level, and the maximum available drawdown).

The constant-rate drawdown test will be conducted after allowing the water level to stabilize from the step-drawdown test. During the constant-rate test, water-level and discharge measurements will be collected at standardly accepted intervals (U.S. Bureau of Reclamation, 1977) using methods outlined for the step-drawdown test.

It is anticipated that the constant-rate test will proceed for a period of 8 hours to allow the system to be adequately stressed during testing. At the end of the drawdown test, the pump will be shut down and water-level recovery measurements will be collected at the same frequency as drawdown measurements were collected. Recovery measurements will continue until the recovery curve is predictable over at least one log cycle of time.

In addition to the pumping tests, slug-discharge tests will be conducted in two additional wells selected in consultation with DOGM. These tests will be conducted by withdrawing a known volume of water from the wells and rapidly measuring the water-level recovery until the water-level stabilizes. These data will allow variations in the hydraulic properties of the tested aquifers to be estimated.

If the decision is made to construct an onsite monitoring well, pumping tests (step-drawdown and constant-rate) will also be conducted in this well. To conserve time, the step-drawdown test will be conducted on the well as a whole rather than on the individual zones. From this information and the driller's log, discharge rates from the separate zones will be established. These zones will then be isolated with a packer system and a constant-rate test will be conducted in each zone with the pump intake being located between the packers. The constant-rate tests will be conducted as outlined above for the existing well in the area.

2.1.3 Data Analyses and Impact Assessment. All data collected during the literature/data search and field investigations will be compiled and displayed as appropriate in figures, tables, and maps. Information to be compiled will include locations

of surface-water bodies, water-rights data, cross sections and longitudinal profiles of the major stream channels of concern, and the results of all field and laboratory analyses. Maps will be prepared at the scales identified in the Request for Proposal. All raw data (water-quality data, pumping-test results, etc.) will be included either in the main body of the final report or in an appendix.

Climatologic data will be tabulated for the adjacent weather stations and the rain gage installed at the site. Based on these data, a water budget will be prepared for the permit and adjacent areas using a water-balance methodology such as that developed by Thornthwaite and Mather (1957).

Data collected from the streamflow monitoring network at the site will be analyzed to determine seasonal variations in surface-water quality and quantity. Instantaneous flow measurements collected at the upstream and downstream Chalk Creek stations will be analyzed to determine if a statistically significant difference exists in flows between the two stations. If the difference is significant, the relation between the two stations will be determined by regression analysis. This relation will be used to define flow conditions that occurred at the upstream station during the investigation.

Average annual sediment yields from the site will be estimated using the Universal Soil Loss Equation (Barfield et al., 1981) and the PSIAC method (Shown, 1970). Both baseline and disturbed conditions will be examined. Using these data, possible sediment-pond locations will be delineated and shown on a map.

Stage-discharge relations for important channels in the permit and adjacent areas will be determined from the channel cross sections and channel hydraulic conditions. The 10- and 100-year return period flows will be determined for Chalk Creek and the intermittent channel using a rainfall-runoff model or empirical methods (such as developed by Fields, 1975). The depth of flow during these runoff events will be shown graphically on the appropriate channel cross sections.

Based on available well logs and new drilling activities (if required), the locations of aquifers and aquitards relative to a generalized stratigraphic cross section will be delineated. Water-level data collected during the field investigation will be analyzed to determine seasonal fluctuations (in comparison with rainfall and runoff data). The direction of groundwater movement will be estimated by developing a potentiometric-surface map is sufficient data are available.

Surface and groundwater quality data collected from the permit and adjacent areas will be examined to determine baseline chemical conditions. Comparisons will be made with Federal and State water quality standards to determine applicable future

uses of the water. Seasonal fluctuations in water quality will also be displayed graphically. Based on the data, long-term compliance monitoring station locations will be recommended.

Field groundwater hydraulic data collected during the slug or pumping tests will be analyzed using methods appropriate to local conditions and the particular test (Cooper et al., 1967 for slug tests in confined aquifers; Bouwer and Rice, 1976 for slug tests in unconfined aquifers; Walton, 1970 or others for pumping tests).

An assessment of possible drawdown effects and diminuation of downgradient water supplies due to seepage of groundwater into the underground mine workings will be made using the field groundwater-hydraulics data. If adequate pumping tests or slug tests cannot be conducted at the site, regional information (such as that found in Gates et al., 1984 or from local well logs) will be used to estimate local hydraulic conditions. Potential inflows to the mine workings and drawdown effects will be calculated analytically using models provided by Freeze and Cherry (1979) and others for inflow to tunnels.

2.2 Geologic Investigation

2.2.1 Literature and Data Search. EarthFax will conduct a detailed literature search to obtain existing geologic data pertaining to the permit and adjacent areas immediately following contract award. A previous review of information on file with DOGM in Salt Lake City and discussions with local drillers, indicates that a significant amount of applicable data are available.

Stratigraphic and lithologic data exist and will be obtained (when available) from both Summit Coal Company, local drilling companies, the Utah Geological and Mineral Survey, the Utah Division of Water Rights, the U.S. Geological Survey, and DOGM. These data are available in the form of well logs, analyses of core samples, published geologic reports, open-file reports, geologic maps, cross-sections and profiles, mine permit applications, and Environmental Impact Statements.

Data obtained from the previously mentioned sources will be compiled into baseline maps, cross-sections, profiles, and tables to gain an understanding of the physical and chemical characteristics of the overburden, coal, and underburden. These data will include the stratigraphic and structural features of the bedrock as well as the spatial extent, thickness, and depth of the geologic units within the permit area. These preliminary compilations will be made prior to field studies and sampling to aid in the geologic evaluation of the area.

2.2.2 Field Investigation. An EarthFax engineering geologist will complete a detailed geologic map (1:6000 scale) of the permit area. Exposed bedrock outcrops will be delineated on a map and and described. The description will include:

- o Typical rock name
- o Texture
- o Weathering
- o Color (Munsell)
- o Rock hardness
- o Mineralogy
- o Cementing material
- o Bedding/depositional features
- o Voids and fractures
- o Staining
- o Lithofacies changes
- o Thickness
- o Strike and dip

In addition, the geomorphic features, faults, structure, locations and dimensions of previously mined areas, subcrop and outcrop lines, existing borehole locations, and any geologic hazards at the site will be identified in the field and delineated on a geologic map of the site. All available core from the site will be logged and described as defined above. A geologic report describing the geology of the permit area and general regional geologic characteristics of the area will be prepared.

2.2.3 Sampling and Laboratory Analyses. The existing core which was obtained and stored from previous geologic investigations at the site will be sampled and described. Based on data obtained from DOGM, it appears that representative samples can be obtained from the stored core for laboratory analyses. It is our understanding that sufficient core is available from at least three drillholes to allow sampling of the core for both the coal seam and eight feet of underburden in each of the holes. However, only one of the drillholes has a sufficient length of overburden core available to allow sampling. In the absence of additional overburden core, fresh samples will be collected in the field. To accomplish this task, either backhoe test pits or fresh cutslopes from facilities construction activities will be used to access the bedrock. Surface samples will be collected as two separate, 20-foot long channel samples from fresh, unweathered bedrock.

All samples will be submitted to a Utah-certified laboratory for analyses. Overburden and underburden samples will be analyzed for the parameters contained in Table 2-2. Analyses of the coal strata will be limited to pyritic sulfur, acid-base potential, and clay content.

The purpose of laboratory analyses of the overburden, coal, and underburden will be to identify acid-forming or toxic-forming horizons that may cause future concerns. All sample collection

Table 2-2. Parameters for which overburden and underburden samples will be analyzed.

Parameter	Reported as
pH	Hydrogen ion activity
Conductivity	mmhos/cm at 25°C
Saturation	Percent
Particle size analysis	Percent clay, silt, sand, and very fine sand (Hydrometer)
Texture	USDA textural class
Soluble Ca, Mg, and Na	meq/l
Sodium absorption ratio	Calculated from soluble Na, Mg, and Ca conc.
Carbonates	Percent
Selenium	ppm to a lower detection limit of .01
Boron	ppm
Nitrate-Nitrogen	ppm
Molybdenum	ppm to a lower detection limit of 0.1
Mercury	ppm
Acid Potential	meq H/100g or percent S
Neutralization Potential	percent $CaCO_3$ or tons $CaCO_3$/1,000 tons material
Acid-base potential	tons $CaCO_3$/1,000 tons material
Arsenic	ppm

and analyses will be conducted utilizing approved methods as developed by the U.S. Environmental Protection Agency, American Society for Testing and Materials, American Society of Agronomy, and other approved methods if so requested by DOGM.

2.2.4 Data Analyses and Impact Assessment. All data gathered from the literature search, field investigations, and laboratory analyses will be analyzed to determine local geologic conditions and potential impacts associated with mining in the permit area. The geologic data will be assembled and analyzed to differentiate the strata (overburden, coal, and underburden) that contain acid-forming or toxic materials and those that act as aquifers. The physical and chemical characteristics of the overburden, coal, and underburden will be evaluated to determine the impacts from mining wastes or spoils which could cause negative environmental impacts. The analyses will address how these parameters affect the vegetation, reclamation, surface water, and groundwater.

A final detailed site-specific surface geology map will be prepared. The site map will use existing baseline maps corrected to depict site-specific conditions. The map will delineate the surface geology, strike and dip of bedrock units, subcrop and outcrop lines, locations and dimensions of previous mines, faults, and other structural features. This map will be prepared at a scale of 1:6000.

2.3 Coordination and Deliverables

2.3.1 Briefing Session and Site Visit. Immediately following contract award, EarthFax personnel will meet with DOGM in Salt Lake City to review the requirements of the project, obtain data and information from DOGM files concerning the Boyer Mine, and to discuss additional data sources. Following this session, a site visit will be conducted with DOGM personnel. To conserve time at the beginning of the project (with the need to obtain field data quickly during the spring runoff season) it is proposed that this site visit coincide with the initial field trip.

2.3.2 Monthly Progress Reports. Monthly progress reports will be submitted to the DOGM Lead Reviewer by the 15th of each following month. These letter reports will outline tasks accomplished since the last report, present copies of field and laboratory data, discuss problems encountered in the field, and provide an estimate of cumulative expenditures to that date. Significant findings that may influence the development of the mine plan will be reported to DOGM as soon as possible. At no time during the course of the contract will EarthFax personnel contact the mine operator or the U.S. Office of Surface Mining directly concerning the project without prior approval of DOGM.

2.3.3 Draft Report. A draft report will be submitted to the DOGM lead reviewer within 240 days of the effective date of the contract. This report will outline the general regional conditions, methodologies, data collected to that date, and the results of analyses that are completed to that date. It is anticipated that much of the geologic section of the final report will be finalized by the date of the draft report. However, results and conclusions concerning the hydrologic investigation will not be complete due to ongoing field work. Comments received by DOGM will be incorporated and the draft will be resubmitted within 30 days of receipt of comments.

2.3.4 Final Report. A draft of the complete report will be submitted within 365 days of the effective date of the contract. This draft will contain all data, results of analyses, references, and conclusions pertaining to the project. Following receipt of comments from DOGM, eight copies of the final report will be submitted to DOGM by day 415 of the contract.

2.4 Project Schedule

The proposed schedule for the Summit Coal Company SOAP project is provided in Figure 2-1. This schedule assumes that weather and site-access conditions will be conducive to field work and that review periods will proceed in a timely manner. Should significant changes occur over which EarthFax has no control, accompanying changes in the schedule may be necessary.

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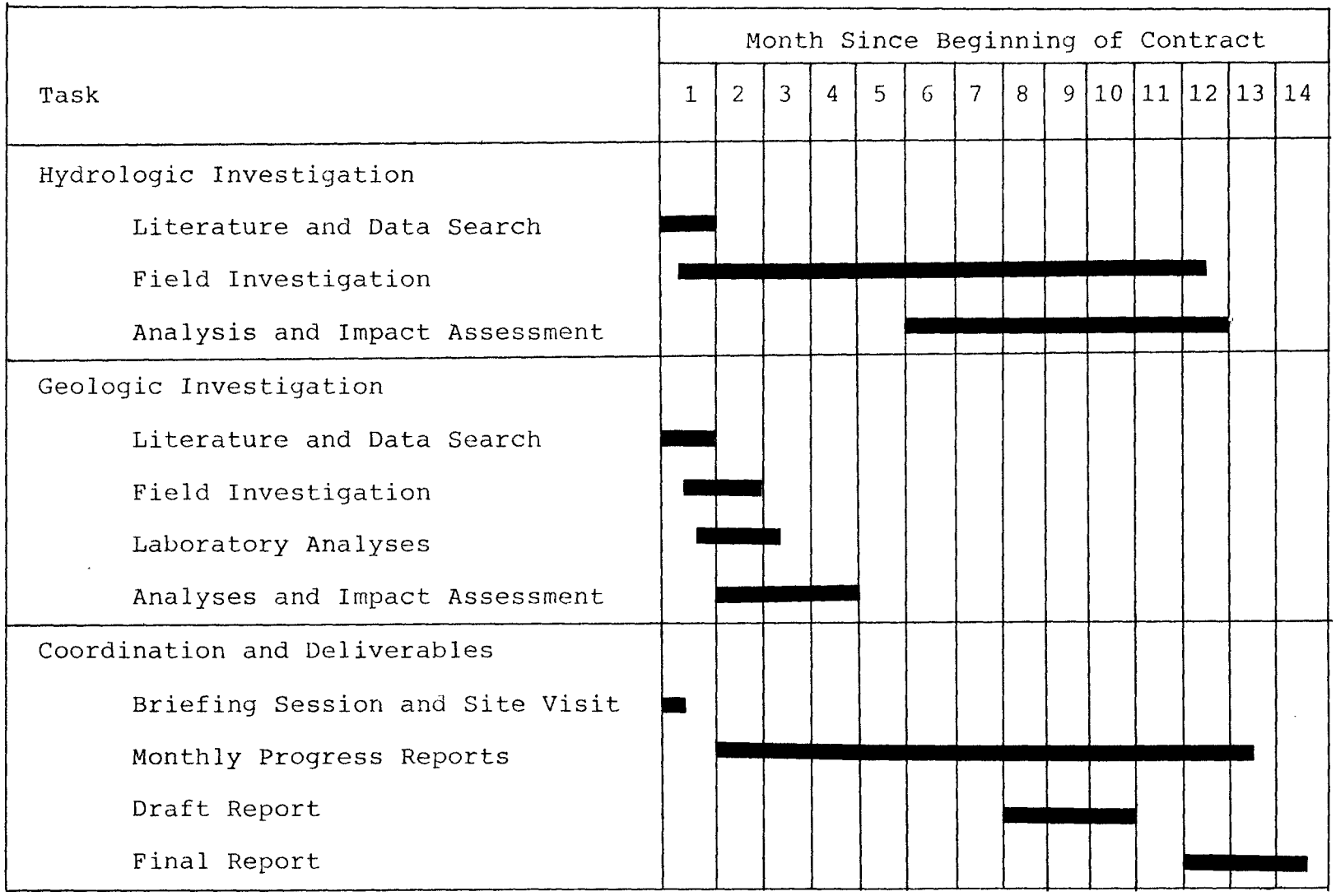
Figure 2-1. Proposed project schedule.



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3.0 RELATED EXPERIENCE

EarthFax personnel have had significant experience analyzing the hydrologic, soil, and geologic aspects of coal mining and other operations. The experience of the company with Utah coal mining permit baseline studies in general and SOAP investigations in particular will be a valuable asset to the Summit Coal Company SOAP project.

As indicated by the scope of the projects listed below, EarthFax meets the criteria specified in UMC 795.17 for qualified SOAP investigators. Representative projects include:

Hydrologic Characterization of Four Coal Mines. Existing hydrologic conditions have been determined at four coal mines in the interior western United States. Included in the separate projects were two surface mines in Wyoming (one existing and one proposed), one proposed underground mine in Colorado, and one proposed underground mine in Utah. Several monitoring wells and stream-gaging stations were installed for the collection of water-quantity and -quality data. Field trips were made to each site at least monthly for data collection. Utilizing the site-specific and regional data, existing conditions were established and future hydrologic consequences of mining were projected. Reports were prepared for submission to State and Federal regulatory agencies to satisfy permitting requirements.

Hydrologic and Geologic Characterization of a Coal Mine in Washington. EarthFax conducted a hydrologic investigation at the site of an existing surface coal mine in western Washington under the Small Operator Assistance Program (SOAP) of the U.S. Office of Surface Mining. Monitoring wells, stream-gaging stations, and a rain gage were installed for the collection of site-specific data. Data were also collected from private wells in the area to aid in determining potential impacts from mining. Existing runoff- and sediment-control plans were reviewed for adequacy in light of Federal coal mining regulations. Test pits, drill holes, cut slopes, and rock outcrops were utilized to obtain detailed geologic and geochemical data for the area. Samples were collected from significant lithologic units and submitted for laboratory analyses. Data obtained from the test results were utilized to determine the presence of toxic or hazardous materials, the stability of spoil piles, and required reclamation measures. A comprehensive report was prepared describing existing hydrologic and geologic conditions at the site and the potential impacts from continued mining. This project was completed by the currently existing staff of EarthFax.

Surface-Runoff and Sediment-Control Facility Design. Numerous surface-runoff and sediment-control facilities have been designed for surface and underground coal mines in Utah, Wyoming, Colorado, and Washington. Facilities have included sedimentation ponds, diversion channels, riprapped channels, check dams, and culverts. State-of-the-art models such as DEPOSITS and SEDIMOT II have been used to aid in design. Design considerations have included subcritical versus supercritical flow, avoidance of maximum permissible velocities, cost-effective erosion control, water-surface profile analyses, and selection of the appropriate design storm.

Hydrologic Investigations at UMTRAP Sites. Detailed surface and groundwater investigations were conducted at nine inactive sites associated with the Uranium Mill Tailings Remedial Action Program (UMTRAP) of the U.S. Department of Energy. The project involved the construction of nearly 40 monitoring wells, collection of water-level data, performance of pumping and slug-discharge tests to determine groundwater hydraulics, performance of surface geophysical surveys to determine stratigraphic changes within alluvium and bedrock anomalies below alluvium, and the collection of several soil and water samples for analyses to determine physical, chemical, and radiologic parameters. All data were analyzed to provide a characterization of existing surface and groundwater conditions (quantity and quality) and an estimation of the impacts of proposed remedial actions. Detailed reports were prepared for each individual site.

Hydrologic Investigations at an Active Uranium Mill. Groundwater conditions were investigated by EarthFax at an existing uranium mill in southeastern Utah to aid in the development of a remedial-action program to control groundwater contamination at the site. Fracture systems were identified using very-low-frequency electromagnetic geophysical methods. Long-term pumping tests were conducted to define the anisotropic nature of the contaminated aquifer. Seepage rates from the tailings ponds were determined and the fractured aquifer was modeled to determine the rate and direction of groundwater movement at the site. Flood-control plans were also developed to comply with regulations promulgated by the U.S. Nuclear Regulatory Commission for both the operational and abandonement periods. Design flows were determined based on the probable maximum precipitation event, flows were routed through existing ponds, and diversions were designed to bypass the mill site and tailings ponds.

Coal Refuse Quality Investigation. Field investigations were conducted at an active coal mine in Utah to determine the quantity and quality of potentially toxic materials in coal refuse. Representative samples were collected and tested in a Utah-certified laboratory and the test results were assessed. Remedial-action plans were developed which provided for the safe disposal of the coal waste. These plans were accepted by both State and Federal regulatory agencies in the permit approval process.

1st Order Soil Survey of a Waste Rock Disposal Area. A 1st order soil survey for a 30 acre waste-rock disposal area was completed for a coal mine in central Utah. The soil survey delineated soil mapping units to the phase level of a soil series, a soil description was prepared for each unit, and the present and potential productivity was determined. A soil map was prepared which listed all of the mapping units. Suitable topsoil for reclamation was identified. Soil isopach maps were prepared for the removal of the topsoil, as well as plans for the removal, storage, protection, post-use surface preparation, and topsoil redistribution. In addition, the current nutrient level of the soil was determined and the need for, plus the types and application rates of, soil nutrients and amendments were determined. The established vegetation and chemical analyses of the soils were utilized to ensure that hazardous and toxic concentrations of potentially deleterious elements were not present.

Substitute Topsoil for Reclamation Use. A 1st Order soil survey was conducted in central Utah for an existing coal mine. The soil survey entailed defining the volumes and locations of the existing, disturbed soil resources at the mine site, plus determining their physical and chemical properties and the current level of contamination, if any. In addition, the survey required delineating over 300,000 cubic yards of substitute topsoil for use in reclamation. Potential borrow areas were delineated, investigated, sampled, described, and mapped. The requirements for nutrients and amendments were determined and the required types and amounts of additives were calculated.

Land Use Inventory for a Proposed Coal Mine. The historical and current land use for the site and region associated with a proposed coal mine in central Utah were determined. A map and supporting narrative were prepared which described the land use, the soils, geomorphic stability, foundation characteristics, topography, vegetation, and hydrology of the area. In addition, any previous mining or minerals production and all existing mineral resources were defined.

Alluvial Valley Floor Determination. Studies were conducted in central Utah to determine if an alluvial valley floor existed on or contiguous to proposed and existing mining operations. An inventory was made of the vegetative cover, historical irrigation activities, sub-irrigation, land use (both historic and current), soils, geologic and geomorphic features, and hydrologic regime. Both the quantity and quality of the preceding parameters were defined and a map and report were prepared which detailed the final determination.

Coal Mine Permitting. Major portions of permit documents have been prepared by EarthFax personnel for several coal mines in Colorado, Utah, and Wyoming. Baseline inventories of hydrology, soils, geology, and alluvial valley floors have been prepared

and submitted to regulatory agencies for approval. Impacts of mining activities on these resources have also been predicted and mitigation measures have been designed. In addition, reclamation plans have been developed, including programs for identifying, handling, storing, and redistributing topsoil. EarthFax professionals have also managed multi-disciplinary teams to prepare entire permit documents for coal mines.

4.0 PERSONNEL QUALIFICATIONS

4.1 EarthFax Personnel

EarthFax personnel to be involved in the Summit Coal Company SOAP project are listed below. Expanded resumes of these individuals are provided in Appendix A. Additional support personnel will be utilized as necessary.

Randolph B. Gainer - Project Manager, Principal Engineering Geologist. Mr. Gainer has had over 11 years of experience conducting geologic investigations for coal mines (including a SOAP investigation in Washington) and other major construction operations. He has conducted numerous sampling programs to determine rock and soil properties (physical and chemical) related to the presence of hazardous materials, slope stability, topsoil suitability, and borrow suitability. He will provide overall management of the SOAP project, serving as the primary contact for coordination of activities between DOGM and EarthFax. He will also be responsible for all field and office evaluations regarding geolgic conditions at the site.

Richard B. White - Principal Hydrologist. Mr. White has been involved in numerous hydrologic baseline and impact evaluations for surface and underground coal mining operations in Utah, Wyoming, Colorado, and Washington (under SOAP). He has supervised the construction of several wells, has performed field and laboratory analyses of water samples, has conducted field tests of surface and groundwater systems, and has modeled hydrologic systems to determine impacts resulting from land-use changes. He has designed several runoff- and sediment-control facilities for coal mining operations. Mr. White is a Registered Professional Engineer (Utah No. 7102), Registered Professional Hydrologist (AIH No. 328), and a Certified Professional Soil Erosion and Sediment Control Specialist (ARCPACS No. 117). He will be responsible for all field and office hydrologic investigations and analyses.

4.2 Subcontractors

Subcontractors will be utilized primarily for laboratory analyses and for drilling (if required). Major subcontractors include Chemical and Mineralogical Services, Inc. of Salt Lake City (a Utah-certified laboratory that will provide analyses of rock and water samples) and Dave's Drilling of Heber City (providing drilling services and pumping equipment for the pumping tests).

5.0 PROPOSED COST

The proposed cost to provide the services described in this proposal is outlined in Table 5-1. Costs in this table are broken out by major task. The cost provided in this table can be considered a fixed price.

The cost contained in Table 5-1 assumes that the project will be completed during the 12-month period outline in the Request for Proposal, with a starting date in the immediate future. It is also assumed that conditions beyond the control of EarthFax will not alter the scope or schedule of the project. Should such changes occur, accompanying changes in the cost may be necessary.

At the request of DOGM, a cost estimate is also provided for the optional moitoring well that may be drilled at the site as part of this project. This cost estimate is provided in Table 5-2. Also included in Table 5-2 are costs associated with the testing of this well if it is constructed. Assumptions associated with this monitoring well are outlined in Section 2.1.2 of this proposal.

It is currently anticipated that monthly invoices will be sent to the Utah Division of Purchasing for work completed during the course of the project. However, other arrangements can be made if desired.

Table 5.1. Proposed cost for the Summit Coal Company SOAP project.

Labor:	
Field work, monthly reports	$10,200
Analyses, draft and final report	14,400
Expenses:	
Mileage, per diem	870
Report costs (printing, graphics, miscellaneous)	1,900
Field equipment (purchase and rental)	1,600
Laboratory analyses	
Water	6,580
Rock, coal, soil	1,410
Total:	$36,960

Table 5-2. Proposed cost for monitoring well if required onsite.

Drilling:	
Drilling and casing	$17,640
Screen (GALVANIZED)	1,200
Gravel pack, bentonite seals, cement surface seal	1,180
Supervision (EarthFax)	1,800
Pumping Tests:	
Pumping equipment	5,640
Engineering (data collection and analyses)	3,000
Total:	$30,460

APPENDIX A

Resumes

RANDOLPH B. GAINER

Education: BS, Geology, 1973
West Virginia University

Memberships: Association of Engineering Geologists
Sigma Gamma Epsilon

Experience:

EarthFax Engineering, Inc.
Salt Lake City, Utah
Principal Engineering Geologist, 1983-Present

Responsible for engineering geology, field geology, soils, land-use, and reclamation investigations. Responsibilities include the design of earthen structures, delineation of borrow sources, foundation investigations, slope-stability analyses, reclamation suitability of soils, remedial action and reclamation plans, and geophysical investigations.

Reviewed the environmental assessment for the proposed Davis Canyon high-level nuclear-waste repository under contract with the State of Utah. This review centered on the adequacy of plans for storage and disposal of salt to be encountered during development of the repository. Provided comments to the State for submission to the U.S. Department of Energy.

Conducted field investigations to delineate soil types in areas of existing and proposed disturbance at three coal mines in central Utah. Developed recommendations for the application of soil nutrients and amendements. Developed reclamation plans for topsoil borrow areas, potentially hazardous and/or toxic waste materials, mine facilities, and alluvial valley floors.

Conducted a geologic and soil baseline study at an active surface coal mine in western Washington. The project involved sampling, stratigraphic mapping, and delineation of joint and fracture patterns.

Conducted resistivity and very-low-frequency electromagnetic surveys at the site of an active uranium mill in Utah. Analyzed the geophysical and existing drillhole data to determine lithologic boundaries, geologic structures, and bedrock fracturing. Prepared geologic cross sections, structural contour maps, and remedial-action plans to control groundwater contamination for submission to the U.S. Nuclear Regulatory Commission.

Analyzed an oil and gas field in Texas to determine potential natural-gas reserves. Evaluated geophysical

borehole logs of the well field (gamma, spontaneous potential, conductivity, resistivity, caliper, and micro-inverse) and examined engineering geology aspects of a potential distribution pipeline through several soils types and varying landforms.

Ford, Bacon & Davis, Inc.
Salt Lake City, Utah
Engineering Geologist, 1982-1983

Prepared permit-application documents relating to soils and land-use for a proposed underground coal mine in Utah. Developed descriptions of soil series, taxonomic units, quantities and qualities in order to develop reclamation plans for the mine. Determined soil depths, distribution plans, and protection measures for the reclamation plan.

Maintained lead responsibility for obtaining geotechnical, and pedogenic data at the sites of 17 inactive uranium-mill tailings piles in the southern and western United States. Developed remedial action plans for disposal or containment of the tailings. Identified available cover materials for use in stabilizing the tailings and reclaiming the sites.

Conducted surface geophysical investigations at the sites of potential coal developments and inactive uranium-mill tailings piles to determine foundation conditions and delineate faulting. Methods included seismic refraction, electrical resistivity, and very-low frequency electromagnetic surveys.

Completed all lead work necessary for obtaining water rights, dam construction, stream alteration, and right-of-way permits for a proposed insitu oil-shale operation in Utah.

U.S. Soil Conservation Service
Clinton, Tennessee
District Conservationist, 1981-1982

Directed and supervised a district office and staff to provide technical assistance to land owners on soil and water conservation problems. Developed land-use plans, engineering designs, layouts, and directed the installation of reclamation plans and conservation practices (dams, grassed waterways, slope stabilization, diversions, terraces, revegetation, etc.). Inspected, planned, and supervised installation of reclamation measures on abandoned mine lands.

Supervised data gathering and planning for the establishment of a demonstration project at an abandoned surface coal mine. Overburden materials were examined to locate suitable topsoils and supplemental plant growth media for revegetation. Delineated suitable backfill materials to eliminate the existing highwall. Developed runoff- and sediment-control plans to minimize erosion and the production of acid mine drainage. Examined hydrologic, geologic, and pedogenic factors affecting slope stability.

U.S. Soil Conservation Service
Salt Lake City, Utah
State Geologist, 1977-1981

Directed engineering geology programs associated with the construction and maintenance of large earthfill dams. Supervised and conducted foundation investigations, seismic-hazard studies, and geotechnical testing. Directed grouting operations, piezometer installations, and data collection. Conducted safety inspections and studies on existing and proposed dams. Chaired a deficiency study team which investigated dam failures.

U.S. Soil Conservation Service
Morgantown, West Virginia
Watershed Planning Geologist, 1974-1977

Directed engineering geology and sedimentation studies in selected watersheds to evaluate site conditions for proposed earthfill flood-control dams. Developed major portions of work plans and environmental impact studies. Delineated the extent, value, and quantity of mineral deposits underlying proposed dam and reservoir areas. Identified the quantity and quality of groundwater, including identification of recharge zones. Conducted stream bedload movement studies and detailed foundation investigations of potential and proposed dams sites.

West Virginia Department of Natural Resources
Elkins, West Virginia
Geologist, 1974

Conducted safety, engineering geology, and hydrologic studies and analyzed supporting documentation on existing and proposed coal refuse piles and earthfill dams. Performed field inspections, approved plans, and enforced State and Federal regulations regarding coal refuse disposal and dam safety. Planned revegetation and stabilization measures for hazardous coal refuse banks and dams.

RICHARD B. WHITE

Education: MS, Civil and Environmental Engineering, 1977
Utah State University

BS, Watershed Science, 1976
Utah State University

Memberships: American Institute of Hydrology
National Water Well Association
Association of Engineering Geologists
ASCE Task Committee on Quantifying the Hydrologic Effects of Land-Use Changes

Experience:

EarthFax Engineering, Inc.
Salt Lake City, Utah
Principal Hydrologist, 1983-present

Responsible for investigations and designs involving both surface and groundwater systems, with expertise in the areas of water quality, surface and groundwater hydraulics, groundwater contamination, rainfall-runoff phenomena, hydrologic impacts of land development, water supply development, and hydraulic engineering.

Reviewed the environmental assessment for the proposed Davis Canyon high-level nuclear-waste repository under contract with the State of Utah for adequacy in addressing the surface-water impacts of repository activities. Provided comments to the State for submission to the U.S. Department of Energy.

Investigated groundwater conditions at the site of an existing underground coal mine in Utah. Determined potential impacts of subsidence on local hydrologic conditions. Designed surface-runoff and sediment-control facilities for the site.

Examined groundwater contamination at an active uranium-mill tailings disposal site in Utah. Conducted surface geophysical surveys to delineate the extent of contamination in unmonitored areas and to locate major water-bearing fractures. Supervised pumping tests and analyzed the data to determine anisotropic groundwater hydraulics. Modeled the site to determine the rate and extent of contaminant migration. Designed a remedial-action plan to provide off-site control of contaminant migration.

Designed a water-supply and -distribution system for a proposed 300-lot summer-home development in Utah. Conducted surface geophysical surveys to delineate water-bearing fractures in the area. Supervised drill-

ing activities and performed pumping tests to determine the long-term yield of a water-supply well.

Conducted a hydrologic inventory of an existing surface coal mine in Washington. Established surface and groundwater monitoring stations, collected field data, performed pumping tests, and analyzed all data to determine potential hydrologic impacts due to mining at the site.

Currently conducting a groundwater-contamination investigation at the site of a hazardous-waste generator in Utah. Waste products include explosives and miscellaneous organic and inorganic chemicals.

Ford, Bacon, and Davis, Inc.
Salt Lake City, Utah
Senior Hydrologist, 1979-1983

Supervised data collection and analyses to evaluate the migration of chemical and radioactive contaminants from several inactive uranium-mill tailings piles in the Western United States to the hydrologic environment. Supervised drilling and monitoring-well construction. Collected soil and water samples for analyses. Performed pumping and other field tests to determine groundwater hydraulics. Analyzed all data to determine existing conditions and probable impacts of implementing proposed remedial actions. Prepared a detailed report for each individual site.

Developed cost estimates for restoration of groundwater quality at a uranium solution mine in Texas. Responsible for hydrologic and water-quality analyses to determine the time required for restoration to be complete.

Conducted hydrologic evaluations at several sites in the eastern and western United States to assess the effects of past processing and storage of radioactive materials on the quality of surface and groundwater.

Designed an instrumentation network to monitor moisture and contaminant migration in the unsaturated zone at the site of a proposed low-level high specific-activity radioactive waste disposal facility at the Nevada Test Site in southern Nevada.

Developed a conceptual design of a wellfield capable of producing several thousand gallons-per-minute of brine in Nevada for the production of industrial salts.

Conducted a hydrologic baseline and impact investigation of an existing surface coal mine in Wyoming. Designed runoff- and sediment-control facilities for a proposed underground coal mine in Colorado. Designed and supervised construction and of a wellfield to supply over 300 gallons-per-minute of water at the mine.

Vaughn Hansen Associates, Inc.
Salt Lake City, Utah
Hydrologist, 1977-1979

Performed in-depth hydrologic investigations of areas to be affected by several existing and proposed surface and underground coal mines in Colorado, Utah, and Wyoming. Assessments were made of existing hydrologic conditions (surface and groundwater quantity and quality), probable hydrologic impacts resulting from mining, and mitigating measures to minimize impacts. Results of the investigations were submitted to State and Federal agencies for permit approval.

Developed runoff- and sediment-control plans for surface facilities associated with several coal mines in Colorado, Utah, and Wyoming. Designed the necessary improvements (e.g., sedimentation ponds, diversions, riprapped channels, culverts, etc.). Designs were submitted to State and Federal agencies for approval.

Conducted hydrologic analyses to determine the adequacy of existing and proposed water supplies for use at coal-fired power plants in Utah. Examined alternative surface and groundwater sources to supplement existing supplies.

Evaluated the impact of water use at power plants on the quantity and quality of water available for downstream agricultural and other uses. Suggested mitigating measures where appropriate.

Certifications, Registration:

Certified Professional Soil Erosion and Sediment Control Specialist (ARCPACS No. 117)
Registered Professional Hydrologist (AIH No. 328)
Registered Professional Engineer (Utah)

CEP/043/002
#3 of 5

SUMMIT COAL COMPANY

EXPLORATION PLAN

FEBRUARY 1984

SUMMIT COAL COMPANY

Exploration Plan
To Mine More Than 250 Tons of Coal
Boyer Mine Project
Coalville Coal Field
Summit County, Utah

February 1984

Signed by Leonard Maki

2-29-84
Date

Prepared by: Melvin A. Coonrod
Environmental
Consultant

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PROJECT PROPOSAL

Summit Coal Company proposes to extract approximately 50,000 tons raw coal over a 12 month period to determine the feasibility to proceed in the re-establishment of the Boyer Mine. The necessity for an exploration permit in excess of 250 tons are as follows:

The site was previously worked, the records of the Old Boyer Mine as well as the actual location and extent of workings are not known in sufficient detail to determine the:

A. Amount of coal removed
B. The stability and condition of the old workings
C. The actual direction and extent of the old works
D. The degree of faulting which may have led to abandonment

An exploration mine, parallel to the approximate old works will allow a safe method of intersecting the old works at predetermined points. In this manner the actual extent of the mine can be determined in a safe and controlled manner. The exploration mine will determine conclusively, the actual conditions encountered relative to roof and floor as well as an extensive testing of mining conditions and coal quality and to some degree quantity relative to seam variation and faulting.

Faulting is also a prime concern. It is known to be extensive in a substantial portion of the coal field and the potential for a major fault which would make further development not feasible could be substantiated to a large degree.

The exploration of the old works through a controlled underground entry could have a major impact on the methodologies proposed in the present operation plan. If the old works can be made safe and utilized as ventilation or access portals to the reserves, considerable savings in both costs and potential disturbance could be avoided.

Also, a number of important variables relative to methane accumulation around water and potential subsidence could be evaluated.

The balance of this application deals in a cursory manner with those concerns relative to mining and associated environmental impacts. A detailed and much more specific information on the existing environment and potential impacts as well as mitigation is contained in the January 1984 submittal of Summit Coal Company's MRP.

1.1 PROJECT LOCATION

The mine is located on 15 acres of Fee land located in the NE quarter of Section 36, Township 3 North, Range 6 East, SLM. The property, which lies about 10 miles east of the town of Coalville, Utah, is accessed by a county paved road that extends past the property on the south side. "Unimproved" dirt roads extend on the property for access to the existing mine.

Coalville is located off of Interstate Highway 15 and has access to UP Railroad in the town of Coalville, Utah.

The project mine area lies within the Coalville Coal Field. There have been at least 1 small coal operation on the property. The Boyer Mine opened up in the early 1900's through 1956 and produced a small amount of coal. There is another mine located within 1 mile of the proposed location but is not presently producing coal.

See following Figures, 1-1, and 1-2.

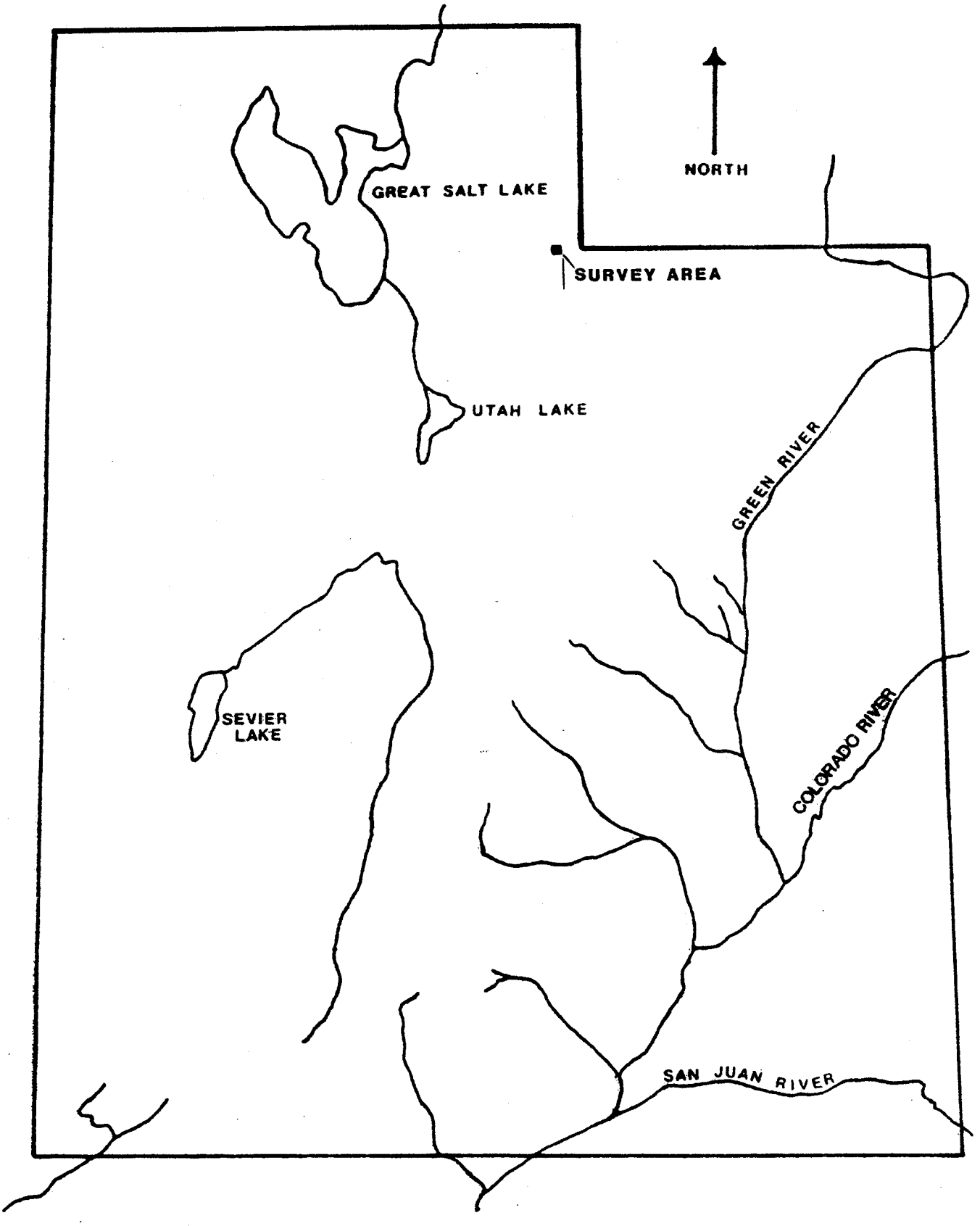
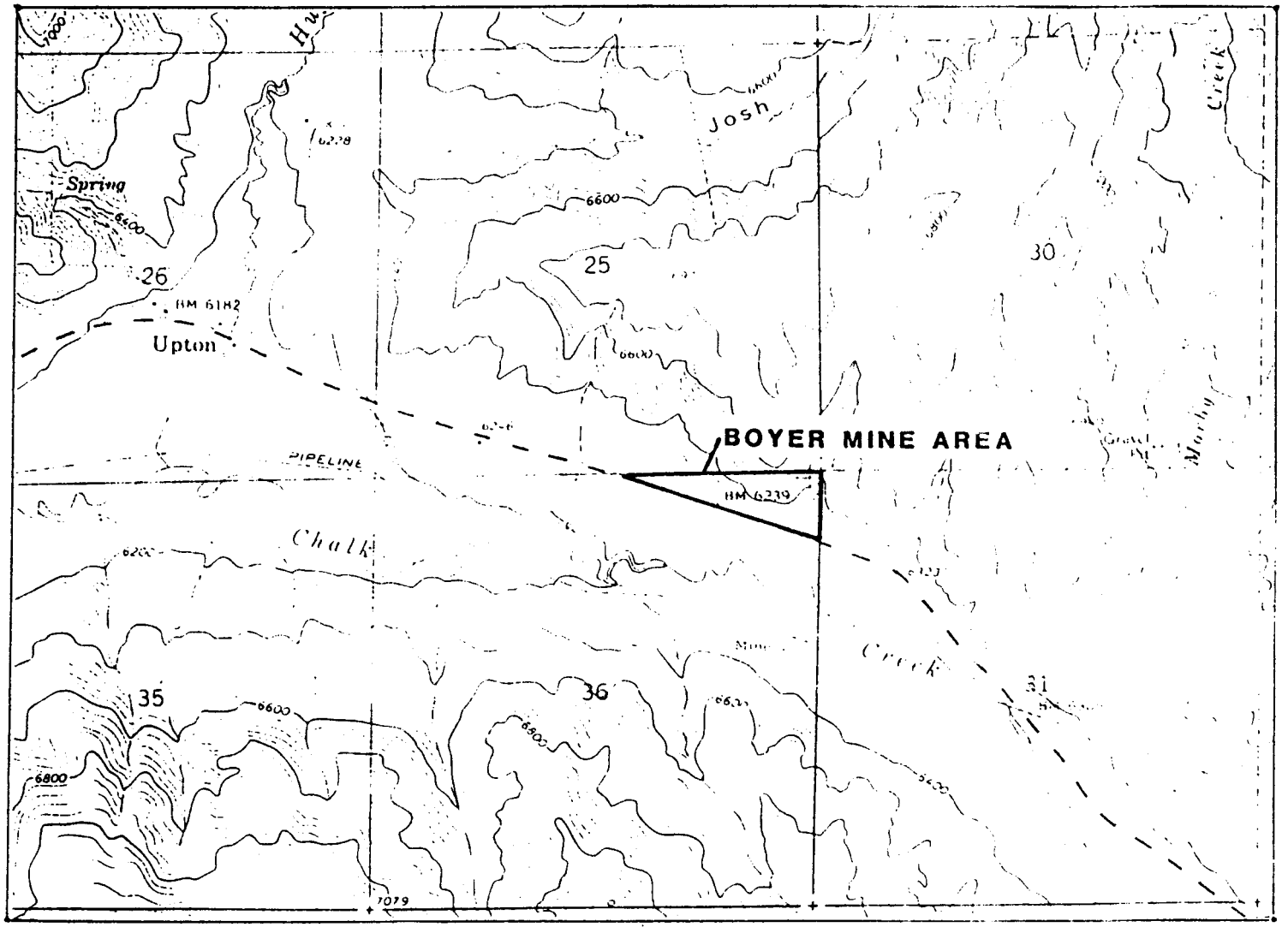


Figure1-1

General Survey Location



SCALE 1:24000

1000 0 1000 2000 3000 4000

N

PROJECT: Boyer Mine Development

COUNTY: Summit

LEGEND: Project Area, Mine Location

T. 3 N

R. 6 E

QUAD: Upton, Utah 7.5 min.

Figure J-2

8-8-83

LAND AND MINERAL STATUS
AND RIGHT TO MINE COAL

2.1 SCOPE

This chapter provides all relevant and required information about the ownership and control of persons involved in the operation of the proposed Boyer Mine, ownership and control of lands in the exploration area.

2.2 IDENTIFICATION OF INTERESTS [UMC 782.13]

Applicant:

Summit Coal Company, Inc.
P.O. Drawer 7
Coalville, Utah 84017

2.2.1 Owners of Record of Surface Area

Tom and Vern Boyer - Land and Livestock
Coalville, Utah 84017

Plate 2-1 shows the property within and contiguous to the exploration area. Table 2-1 lists the fee owners of the mineral property rights.

TABLE 2-1

COAL RIGHTS OWNERS

Jesse W. Fox, Jr.
H. S. Young

Albert E. Boyer
John R. Boyer
Elizabeth Arnold
Annie Perry
Rosa Rogers
Dena Boyer
Lester Boyer
Wlwood Boyer
Elwood Boyer
Maggie Boyer
Marie Boyer
Rosa Boyer
Joseph LaVern Boyer
Lyle E. Boyer
William Leo Boyer
Mary Leah B. Neilson
Ella M. Pace
Linda B. Bennett
Blaine E. Boyer
Kathy Violet Wilde
Charlotte Ann Boyer
Fern J. Boyer
Dee F. Boyer
Gerald G. Boyer
Gregory J. Boyer
Stephen W. Boyer
Brent W. Boyer

Owners of Mineral, Oil, and Gas Rights

TABLE 2-1A
(Continuation)

1. $S\frac{1}{2}$ $S\frac{1}{2}$, Sec. 25, T3N, R6E; and that portion of Sec. 36, T3N, R7E, that is north of the county highway and a strip of land between the county highway and Chalk Creek running about 800 feet west fromthe east side of Sec. 36.

Surface rights belong to:

LaVern Boyer	RFD, Coalville, Utah 84017

Mineral Rights belong to:

William L and Lorene Boyer	Coalville, Utah 84017
Lyle and Helen, Boyer	Coalville, Utah 84017
Joseph LaVern and Marcey Boyer	Coalville, Utah 84017
Angus and Ella M. Pace	Coalville, Utah 84017
Blaine and Dorothy Boyer	Coalville, Utah 84017
Kathy and Kevin Wilde	Coalville, Utah 84017
Linda and Norman Shipley	Coalville, Utah 84017
Charlotte Boyer	Coalville, Utah 84017
Woodrow and Leah B Nielson	Coalville, Utah 84017
Fern J., Gregory J., Gerald G., Stephen W., Brent W., and Dee F., Boyer	5050 Ben Lomond Ave. Ogden, Utah 84404

2. A strip of land between the county highway and Chalk Creek about 1,300 feet long in the $NE\frac{1}{4}$ of Sec 36 containing about 15 acres.

Surface rights belong to William L and Lorene B. Boyer, RFD Coalville, Utah 84017
Mineral rights same as Item 1.

3. $W\frac{1}{2}$, Sec. 30 T3N, R7E:

   Surface rights: Bow Valley Coal Resources Inc.

   Mineral rights: Utah Land Board

4. $NW\frac{1}{4}$ Sec. 31, T3N, R7E, except items 5. and 6.

   Surface rights: Wayne Jones RFD Coalville, Utah 84017

   Mineral rights: Champlin Petroleum Co.

5. A strip of land about 200 feet wide on the west side of the $NW\frac{1}{4}$ of Sec 31, T3N, R7E extending from the county highway to Chalk Creek

   Surface rights: Merrill and Freda Orgill RFD Coalville, Utah

   Mineral rights: Champlin Petroleum Co.

6. Not adjacent to the proposed coal mine area. Approximately 10 acres in the $NW\frac{1}{4}$, Sec 31, T3N, R7E

   Surface rights:

Ward Dean and Wilma Morby	Coalville, Utah 84017
Melvin and Valene Shaw	Coalville, Utah 84017
Gail and Lorene Billings	Coalville, Utah 84017
Fern J. Boyer	5050 Ben Lomond Ave.
	Ogden, Utah 84404

   Mineral rights: Champlin Petroleum Co.

2.2.2 Owners of Record of Surface and Subsurface Areas Contiguous to the Proposed Permit Area

Plate 2-1 displays the parcels of land contiguous to the permit boundaries. The parcels are designated with lower case letters.

Owners	Address
J. S. Wilde	Salt Lake City, Utah
A. & E. Pace	Coalville, Utah
L. E. Boyer	Coalville, Utah
F. J. Boyer	Ogden, Utah
W. L. Boyer	Coalville, Utah
J. L. Boyer	Coalville, Utah
W. Jones	Coalville, Utah
Bow Valley	Denver, Colorado

2.3 RIGHT OF ENTRY AND OPERATION INFORMATION [UMC 782.15]

The applicant's right to enter the lands and to conduct operations in the permit area is based on the documents listed in Appendix 2-2.

2.4 MAP SHOWING LEGAL BOUNDARIES

Legal boudaries of the permit area and contiguous area are shown on Plate 2-1.

2.4.1 Unsuitability Criteria

No portion of the area to be disturbed is within an area designated as unsuitable for mining under the provision of 30 CFR 764 and 765. To the best of the applicant's knowledge, no portion of the area to be disturbed is under study

for designation as unsuitable for mining in an administrative proceeding under 30 CFR 764 and 765.

In addition, the exploration area includes no cemeteries, no national trails, no wild and scenic rivers, no wilderness or wilderness study areas, and no significant harvestable forest cover.

2.5 WAIVER OF OWNERS OF NEARBY OCCUPIED DWELLINGS

Applicant does not propose to conduct or locate facilities within 300 feet of an occupied dwelling.

2.6 PERMIT TERM INFORMATION - ANTICIPATED FOR EACH PHASE

2.6.1 Starting Date

Starting dates anticipated for each phase of exploration are dependent on permit approvals, however, it is hoped that work could commence by early spring 1984 and the exploration could theoretically be completed within 12 calendar months from approval.

2.6.2 Termination Dates

Termination dates anticipated for each phase of exploration are nebulous at this time although a detailed time table of each phase of exploration will be supplied to the Division prior to any work commencing with a "not to exceed" timetable of 1 year.

The final termination date for the exploration operation is expected to be mid summer 1985.

2.6.3 Numbers of Surface Acres Affected

The anticipated disturbance by the exploration area totals less than 10 acres.

2.6.4 Horizontal and Vertical Extent of Underground Working for Each Phase

Plate 2-3 shows the anticipated phases of the underground exploration activities.

2.7 PERSONAL INJURY AND PROPERTY DAMAGE INFORMATION

Summit Coal Company will carry public liability and property damage insurance in due force. The policy will also bear a rider requiring the insurer to notify DOGM if the policy is cancelled. A copy of the certificate of insurance and rider will be supplied to the Utah Division of Oil, Gas, and Mining.

2.8 PROPOSED PERFORMANCE BOND

The applicant will, upon approval of this application, file copies of a Performance Bond. Reclamation costs relevant to this bond are detailed in Section 93.

2.9 OTHER LICENSES AND PERMITS

The other permits and licenses dealing with land use, air and water quality, water rights, and health and safety laws and regulations are presently being applied for and will be submitted to the Division upon approval. (See Appendix 2-1 Supporting Correspondance).

2.10 LOCATION OF PUBLIC OFFICE FOR FILING APPLICATION

The applicant has simultaneously filed complete copies of this application with the following agencies:

State of Utah
Division of Oil, Gas, and Mining
1588 West North Temple
Salt Lake City, Utah — 5 copies

Summit County Clerk
Summit County Courthouse
Coalville, Utah — 1 copy

2.11 NEWSPAPER ADVERTISEMENT/PROOF OF PUBLICATION

On the date of the filing of this application with Division of Oil, Gas, and Mining, the applicant will also file an advertisement with the Salt Lake Tribune, The Ogden Standard Examiner, and the Summit County Bee, local newspapers with circulation in Summit, Salt Lake, Davis, and Weber counties sufficient to cover the locality of the applicant's operations. This advertisement follows the format required under 30 CFR 786.11[a] and UMC 786.11[a]. Proof of publication will be submitted when available.

APPENDIX 2-1

SUPPORTING CORRESPONDANCE

APPENDIX 2-1

Coalville, Utah
June 17, 1983

Mr. Jim Smith
State of Utah
Division of Oil, Gas and Mining
Box 4241
State Office Building
Salt Lake City, Utah

Dear Mr. Smith;

In regard to the peoposed coal mine in the Chalk Creek area of Summit County, In the N½ N½ Sec. 36 and S½ S½ Sec. 25 T3N R6E, we as property and mineral right owners in that area desire to have this mine developed.

We feel that as mineral right owners we have the right of access to the coal we own. We now have an opportunity to have our coal mined and if this opportunity is lost another may not be forthcoming in the forseeable future, if ever.

Development of the proposed mine would not have any adverse effect upon property values or the general ecological status of the area. The area of the surface development of the proposed mine is small-less than 20 acres-. It would have no more effect upon wildlife habitat etc. then would the development of homes. Also there has been a coal mine in operation on this site, as well as the existing coal mine across the canyon, so coal mining is not new or unheard of at this site.

Some of us own land adjacent to the proposed mine and do not feel that our property values would be depreciated by the development of this mine.

Sincerely

William L. Boyer

Lorene B. Boyer

Lyle E. Boyer

Helen W. Boyer

Woodrow Nielson

Leah B. Nielson

Summit County
State of Utah

P.O. Box 128
COALVILLE, UTAH
84017

June 7, 1983

Dr. G. A. Shirazi, Director
Division of Oil, Gas & Mining
Utah State Department of Natural Resources
4241 State Office Building
Salt Lake City, UT 84114

Dear Dr. Shirazi:

For some months there has been a proposal for a new coal mine to be developed in the Chalk Creek area, east of Coalville, Summit County. You may be aware that the Chalk Creek Basin is part of the Overthrust Belt, rich in natural gas and oil reserves.

This is to state the position of the County with respect to the proposed mine. The Commission does not oppose the project and is especially interested in the prospects of employment and economic stimulation which could come to the Coalville area if the mine were to be able to open and operate successfully.

The operator is aware of the County permitting requirements and the project will be reviewed as appropriate by county officials. We hope that your office will give full consideration to this project. If you have any questions concerning this project or its relationship in the County please feel free to contact Stan Strebel, Director, Summit County Planning Office (336-2334).

Sincerely,

Summit County Board of Commissioners

Gerald Young, Chairman

CC/jr

COALVILLE CITY

(Best Little City by a Dam Site)

P. O. Box 188 -- Coalville, Utah 8401

Telephone 336-5981

MERLYN W JOHNSON

May 3, 1983

DEPARTMENT OF OIL, GAS AND MINING
State Office Building
Salt Lake City, Utah 84114
Attention: Mr. Jim Smith

RE: Proposed Coal Mine
East of Coalville

Dear Mr. Smith:

As Mayor of Coalville City, I am writing to encourage your department to give speedy and favorable consideration to the request for a new coal mine East of Coalville. I understand Mr. William Blonquist and Associates have filed for permission to open a mine.

With the depressed oil situation in our area, many people have had to move on. A coal mine would help to give us some stable jobs for our people.

Thank you for whatever help you can give.

Sincerely,

COALVILLE CITY MUNICIPAL CORPORATION

Merlyn W Johnson
Coalville City Mayor

MWJ:vdr

Summit County
State of Utah

P.O. Box 128
COALVILLE, UTAH
84017

COMMISSIONERS
GERALD E. YOUNG
CLIFTON BLONQUIST
RON PERRY

REED D. PACE, COUNTY CLERK
ROBERT H. WILLIAMS, TREASURER
ALAN SPRIGGS, RECORD
ROBERT ADKINS, ATTORNEY
FRED ELEY, SHERIFF
LEO O. FRAZIER, ASSESSOR

November 9, 1983

Summit Coal Company
William C. Blonquist
P.O. Box 294
Coalville, UT 84017

Dear Mr. Blonquist:

This is to confirm action taken by the Summit County Planning Commission at their regular meeting held November 8, 1983, with respect to your request for a conditional use permit for an underground coal mine and the associated support facilities located in Sections 25, 36 T3N, R6E SLB&M.

It was the decision of the Planning Commission to approve this request, subject to your obtaining the necessary access permit onto the county road (Chalk Creek Road) from the County Road Superintendent, Bruce Rowser.

Should you have any questions concerning this matter, please contact the Summit County Planning Office at 336-2334.

Sincerely,

Jerry Smith

Jerry Smith, Assistant Director
Summit County Planning Office

JS/jr

cc: Leonard Maki
Bruce Rowser

APPENDIX 2-2

COAL MINING SURFACE LEASE AGREEMENT

COAL MINING SURFACE LEASE AGREEMENT

THIS LEASE AGREEMENT is made and entered into by and between SUMMIT COAL COMPANY, INC., of Coalville, Summit County, Utah, herein referred to as "Lessee", and Tom + Vera Boyer Land and Livestock, of Coalville, Summit County, Utah, herein referred to as "Lessor".

RECITALS

A. Lessee has entered into a written coal mining agreement to prospect for and develop certain coal which is believed to be located under the surface of Lessor's property.

B. Lessor desires to enter into a lease agreement with Lessee to permit Lessee to explore for and to develop the subsurface coal underlying Lessor's real property.

NOW THEREFORE, in consideration of the covenants herein contained the parties agree as follows:

1. Premises. Lessor hereby leases to Lessee and Lessee hereby leases from Lessor the following described real property for the purposes and uses herein defined, located in Summit County, Utah, and more particularly described as follows:

> The South ½ of the South ½ of Section 25; and the North ½ of the North ½ of Section 36; said sections located in Township 3 North, Range 6 East, Salt Lake Base and Meridian.

2. Term. The term of this lease shall be for a period of three years, and for successive periods as hereinafter defined.

3. Covenant to Explore and Mine. Lessee shall have the right to enter upon the premises for the purpose of exploring for and mining coal. Lessee shall have the right to excavate and construct roads and other access as Lessee deems necessary for exploration and mining. Lessee shall have the right to fence up to twenty (20) acres, fifteen (15) acres of which shall be contiguous, the location of which is described in Exhibit "A" attached hereto and incorporated herein by this reference, which fifteen (15) acres have been marked on the ground by the parties by stakes and shall be identified more particularly with a legal description and survey at the time of fencing the same. Such legal description shall be added to exhibit A. The remaining five (5) acres shall be identified by lessee as the same becomes necessary

Balance of Lease Agreement available upon written request.

3. NATURAL ENVIRONMENT

The descriptions of the natural environment as contained here have been developed using the information from several sources: A complete compilation of all source material and detailed analysis are contained in "Summit Coal Company, Boyer Mine, Reclamation Plan" submitted to DOGM January 1984.

3.1 EXISTING ENVIRONMENT

The climate of the Boyer Mine area is typical of subalpine areas in the Northern region of Utah. In general, the summer season is short with maximum temperature reading (F) in the 80's and minimum readings in the 40's. Fall and spring seasons are erratic in nature with snow precipitation occurring as early as September and as late as the first part of June. Winters in this subalpine area are often severe, with recorded temperatures of -30 F or below at times. Major snowfalls occur in the months of December, January, and February. Snow frequently remains on the ground from November until April in depths varying up to 6 ft. Winds are generally light to moderate with an estimated maxium average speed below 20 m.p.h. The prevailing wind direction within the general area of the mine site is from the Northeast. Winds are generally parallel to the canyons except during storm periods. Wind speed varies from canyon to canyon.

Estimated annual average background total suspended particulate (TSP) in rural, Northern Utah is approximately 30 to 35 ug/m^3 (AeroVironment, 1977). Because of the proximity to the existing mine, background TSP could be higher than the average background total for typical rural areas.

3.2 SOILS

The exploration area had a soil survey conducted May 1981 by the Soil Conservation Service. The soil that could be potentially impacted are described herein. More detailed information is available in the Soil Conservation Office.

3.2.1 Soil Information

SOIL LEGEND

Soil Symbol	Soil Mapping Unit Name
1E	Bezzant gravelly loam, 25 to 40 percent slopes
2B	Moweba gravelly loam, 2 to 5 percent slopes
3G	Richville gravelly loam, 40 to 70 percent slopes

Description of the Soils

1E Bezzant gravelly loam, 25 to 40 percent slopes

3.2.2 Soils Description

This Bezzant soil is deep and well drained. It occurs on mountainsides at elevations of 6,400 to 6,800 feet. This soil formed in colluvium and alluvium from sandstone and quartzite.

The average annual precipitation is 16 to 25 inches. Mean annual air temperature is 42 to 45 F. and the freeze-free season is 60 to 80 days.

Slopes are 25 to 40 percent, south and east facing. They are short in length and convex in shape.

Vegetation is big sagebrush, bluebunch wheatgrass, cheatgrass, rabbitbrush, scattered juniper, and mountain mahogany.

Included in mapping are small areas of rock outcrop.

In a typical profile the surface layer is grayish brown gravelly loam about 7 inches thick. The upper subsoil is brown very gravelly loam about 9 inches thick. The lower subsoil is brown very gravelly sandy loam about 20 inches thick. The substratum is pale brown extremely cobbly sandy loam about 12 inches thick.

Permeability is moderately rapid. Available water capacity is 3.5 inches to a depth of 48 inches. Organic matter content in the surface layer is 2 to 4 percent. Effective rooting depth is 48 inches. Surface runoff is slow and erosion hazard is slight under potential native vegetation and rapid if vegetation is removed and the soil is left bare. Erodibility is moderate. This soil is used for range and wildlife habitat.

Taxonomic classification of this soil is loamy-sheletal, mixed frigid Typic Calcixerolls.

A typical pedon on Bezzant gravelly loam 25 to 40 percent slopes, was described about 400 feet west and 500 feet south of NE corner, Section 36, T3N, R6E.

A -- 0 to 7 inches; grayish brown (10 YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak fine and medium granular structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine roots; few very fine tubular pores; estimated 25 percent gravel, 5 percent cobbles; neutral reaction (PH 6.6); abrupt smooth boundary.

B1 -- 7 to 16 inches; brown (10 YR 5/3) very gravelly loam, dark brown (10YR 3/3) when moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; few very fine tubular pores; estimated 30 percent gravel, 10 percent cobbles; neutral reaction (PH 6.8); clear smooth boundary.

B2 -- 16 to 36 inches; brown (10 YR 5/3) very gravelly sandy loam, dark brown (10 YR 4/3) when moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; common very fine and fine roots; few very fine tubular pores; estimated 30 percent gravel, 10 percent cobbles; neutral reaction (PH 6.8) clear smooth boundary.

CK -- 36 to 48 inches; pale brown (10 YR 6/3) extremely cobbly sandy loam, dark brown (10 YR 4/3) when moist; massive; slightly hard, very friable, nonsticky, nonplastic; few very fine roots; estimated 40 percent cobbles, 20 percent gravel; slightly calcareores, carbonates are desseminated; mildly alkaline reaction (PH 7.6); clear smooth boundary.

1B Moweba gravelly loam, 2 to 5 percent slopes

This moweba soil is deep and well drained. It occurs on alluvial fans at the foot of mountain slopes at elevations of 6200 to 6300 feet. This soil is formed in alluvium derived mainly from sandstone and quartzite.

The average annual precipitation is 18 to 25 inches. Mean annual air temperature is 42 to 45° F. and the freeze-free season is 60 to 70 days.

Slopes are 2 to 5 percent, south and east facing. They are short in length and concave-convex in shape.

Vegetation is big sagebrush, rabbitbrush, cheatgrass, bluebunch wheatgrass, and few scattered juniper.

In a typical profile the surface layer is brown loam about 6 inches thick. The next layer is brown very stony clay loam about 14 inches thick. The subsoil is pale brown gravelly loam and very gravelly clay loam about 20 inches thick. The substratum is pale brown extremely cobbly loam about 20 inches thick.

Permeability is moderate. Available water capacity is 6.5 inches to a depth of 60 inches. Organic matter content in the surface layer is 3 to 5 percent. Effective rooting depth is 40 to 60 inches. Surface runoff is very slow and erosion hazard is slight under potential native vegetation and slight if vegetation is removed and the soil is left bare. Erodibility is moderate. This soil is used for range and wildlife habitat.

Taxonomic classification of this soil is loamy-sheletal, mixed frigid, Pachic Ultic Haploxerolls.

A typical pedon of Moweba gravelly loam, 2 to 5 percent slopes, was described about 100 feet west and 650 feet south of NE corner of Section 36.

A1 -- 0 to 6 inches; brown (10 YR 5/3) gravelly loam, very dark brown (10 YR 2/2) when moist; moderate fine and very fine granular that parts to weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine, common fine and few coarse roots; common very fine tubular pores; estimated 15 percent gravel and 5 percent cobbles; neutral reaction (PH 7.0); clear smooth boundary.

A2 -- 6 to 20 inches; brown (10 YR 5/3) very strong clay loam, very dark grayish brown (10 YR 3/2) when moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; common very fine tubular pores; estimated 15 percent stones, 15 percent cobbles, 25 percent gravel; neutral reaction (PH 7.0); clear smooth boundary.

Bwl -- 20 to 30 inches; pale brown (10 YR 6/3) gravelly clay loam, dark brown (10 YR 4/3) when moist; strong medium subangular blocky structure; slightly hard, friable, sticky, plastic; few very fine and fine roots; few very fine tubular pores; estimated 25 percent gravel; neutral reaction (PH 7.0); clear smooth boundary.

BC -- 30 to 40 inches; pale brown (10 YR 6/3) very gravelly clay loam, dark brown (10 YR 4/3) when moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; estimated 35 percent gravel, 5 percent cobbles; neutral reaction (PH 7.2); clear smooth boundary.

C -- 40 to 60 inches; pale brown (10 YR 6/3) extremely cobbly loam, brown (10 YR 5/3) when moist; massive; slightly hard, friable, slightly sticky, slightly plastic; estimated 50 percent cobbles, 20 percent gravel; mildly alkaline reaction (PH 7.4).

2G Richville loam, 40 to 70 percent slopes

This Richville soil is deep and will drained. It occurs on mountainsides at elevations of 6400 to 6800 feet. This soil formed in colluvium from shale, sandstone and quartzite.

The average annual precipitation is 16 to 25 inches. Mean annual air temperature is 42 to 45° F. and the freeze-free season is 60 to 80 days.

Slopes are 40 to 70 percent mainly northeast and southeast facing. They are short to medium in length and convex in shape.

Vegetation is big sagebrush, gambel oak, serviceberry, bluebunch wheatgrass, cheatgrass, basin wildrye, mountain mahogany and few scattered juniper.

Included in mapping are small areas of rock outcrop and soils that are less than 20 inches over bedrock.

In a typical profile the surface layer is pale brown loam about 4 inches thich. The upper subsoil is pale brown gravelly clay loam about 20 inches thick. The lower subsoil is very pale brown very sandy clay loam about 17 inches thick. The substratum is very pale brown soft fractured shale and sandstone 20 inches or more thick.

Permeability is moderate. Available water capacity is 6.25 inches to a depth of 60 inches. Organic matter content in the surface layer is 1 to 3 percent. Effective rooting depth is 40 to 60 inches. Surfce runoff is rapid and erosion hazard is high under potential native vegetation and very rapid if vegetation is removed and the soil is left bare. Erodibility is moderate. This soil is used for range and wildlife habitat.

Taxonomic classification of this soil is fine-loamy, mixed, frigid, Calcixerollic Xerochrepts.

A typical pedon of Richville loam, 40 to 70 percent slopes was described about 300 feet west, 150 soouth of NE corner, Section 36, T3N, R6E.

A -- 0 to 4 inches; pale brown (10 YR 6/3) loam, dark brown (10 YR 3/3) when moist; weak fine granular that parts to weak fine subangular blocky structure; soft, very friable, sticky, slightly plastic; many very fine and fine, common medium and few coarse roots; common very fine tubular pores; estimated 10 percent gravel; neutral reaction (PH 6.6); clear smooth boundary.

B1 -- 4 to 10 inches; pale brown (10 YR 6/3) gravelly clay loam, dark grayish brown (10 YR 4/2) when moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky, plastic; many very fine and fine, and common medium and few coarse roots; common very fine and fine tubular pores; estimated 25 percent gravel; neutral reaction (PH 6.8); gradual smooth boundary.

B2 __ 10 to 24 inches; pale brown (10 YR 6/3) gravelly clay loam, dark grayish brown (10 YR 4/2) when moist; weak fine and medium subangular blocky structure; hard, friable, sticky, plastic; common very fine and fine and few medium roots; common very fine and fine tubular pores; estimated 15 percent gravel; neutral reaction (PH 6.8); clear smooth boundary.

BCK -- 24 to 41 inches; very pale brown (10 YR 7/3) very cobbly sandy clay loam, brown (10 YR 5/3) when moist; weak fine and medium subangular blocky structure; hard, friable, sticky, slightly plastic; common very fine and fine and few medium roots; few very fine tubular pores; estimated 25 percent cobbles, 15 percent gravel and 5 percent stones; carbonates are disseminated; mildly alkaline

reaction (Ph 7.6); abrupt irregular boundary.

Cr -- 41 to 60 inches; weathered sandstone and shale that breaks down to sandy clay loam, very pale brown (10YR 8/3) pale brown (10 YR 6/3) when moist; carbonates are disseminated; mildly alkaline (Ph 7.8).

3.2.3 Prime Farmland Determination

The entire exploration area is deamed unsuitable for prime farmland based on:

1. There is no available water rights of an agricultural nature in conjumction with and of the land within the permit area.

2. The vast majority of the permit area is excessively steep to farm.

3. The nature of the soils (excessive rock) prohibit farming activities.

Based on all of the above, the only conclusion possible is; there are no Prime Farmlands within the exploration area. (See Appendix 3.1 Negative Declaration SCS).

APPENDIX 3.1

PRIME FARMLAND DETERMINATION - UMC 783.27)

CORRESPONDANCE

[Prime Farmland Determination - UMC 783.27]

United States Department of Agriculture
Soil Conservation Service
P. O. Box 11350
Salt Lake City, UT 84147

April 13, 1983

William C. Blonquist
President
Summit Coal Co.
P. O. Box 294
Coalville, Utah 84017

Dear Mr. Blonquist:

Your request concerning the extent of prime farmland in the NW 1/4, NW 1/4, NW 1/4 of sec. 36, T. 3 N., R 6 E. Summit County, Utah has been forwarded to this office with the field report. According to the field report and our data, there are no soils in the area concerned that qualify as prime farmland. The soils are too steep, gravelly and stony to qualify for prime farmland. Also, irrigation water is not available to the location described.

We are retaining the associated maps and data in this office for future reference. If we can be of service in the future, please call on us.

Sincerely,

FERRIS P. ALLGOOD
State Soil Scientist

4.0 SURFACE WATER

The exploration area is located at the bottom of a hill next to the confluence of a gully with Chalk Creek's north bank. No known stream gauging stations are located near or upstream from the mine on either stream. Chalk Creek is a perennial stream, primarily fed by snowmelt while the gully is most likely ephemeral. Since no stream flow quantity or quality data is available near the mine, an accurate quantification of these values was not possible in this preliminary study. In general, it is known that the quality of water in Chalk Creek is quite good in the upstream reaches and deteriorates as it progresses downstream. It is anticipated that water samples be collected from both Chalk Creek and the gully and submitted to a qualified laboratory for analysis, for baseline information prior to beginning mining operations.

5.0 GROUND WATER

The mine is located in T3N and R63, near the town of Upton in Summit County, Utah, at an altitude of 6,239 feet, adjacent to Chalk Creek. Westward flowing Chalk Creek is the trunk stream into which all drainage from north and south empties. The alluvium of Chalk Creek constitutes the principal domain for ground water supply. Some water is also known to exist in the other geologic formations (Knight, Wanship, Wasatch and Frontier) in the area. Stark (1953), presents a description of the areal geology of the Upton area and Yates, it al. (1982) present some data on ground water resources in the Chalk Creek Drainage west of the mine. The use of ground water in the area does not appear to be significant at present. Small to moderate amounts (3-560gpm) of fresh to slightly saline water are yielded by the rocks in the area. The alluvium is quite permeable and can yield up to 2,000 gpm at some locations.

In general, data from only a few wells is available on the quantity

and quality of ground water in the region. Only one spring has been mapped by the USGS in a two-mile radius around the mine.

A hydrology map is included indicating the clear water and disturbed are drainages. (Plate 7-1), also a diagram of the proposed sediment retention pond. (Appendix 5).

6.0 WILDLIFE

The purpose of this is to inventory the wildlife resources in the Summit exploration area. The study includes birds, amphibians, reptiles, and mammals. Analysis entailed a review of the applicable literature, consultation with the relevant agencies, field analysis, and impact evaluation. The existing species that may located within the permit area are attached. (Table 6.1-6.4).

In sum, this study uncovers a minimum impact on wildlife from the proposed exploration operation of the mine. Since the Boyer Mine has been worked intermittantly since the early 1900's, the ecosystem has already stabilized to some degree with mining.

All water within the permit area is ephemeral (Class 6). Runoff from the permit area flows into the Chalk Creek drainage. This is the only drainage which could potentially be affected by the exploration activities and the potential impact is expected to be insignificant. Chalk Creek may receive some groundwater from the area, as well as runoff from the disturbed areas. Surveys have been conducted on this stream, and the potential for impact is considered to be minimal. There are no threatened or endangered species within the area. See (Appendix 6A relates to correspondance from UDWR).

Species* List and Classification of Mammals Whose Published Ranges Overlap the Expansion Area of Summit Coal Company

Mammal	Range					
	Pinyon Juniper	Desert Shrub	Sagebrush	Conifer Aspen	Mixed [illegible]	High-interest Species
Masked Shrew					UR	
Mirrium Shrew	UR	UR	UR		UR	
Dusky Shrew					UR	
Little Brown Myotis	CS	CS	CS		CS	
Fringed Myotis	US	US	US			
California Myotis	US	US	US			
Small-footed Myotis		US	US			
Silver-haired Bat					US	
Big Brown Bat					US	
Hoary Bat					US	
Townsend's Bib-eared Bat	US	US			US	
Brasilian Free-tailed Bat	US	US	US		US	
Nuttall's Cottontail				UR	UR	X
Desert Cottontail	CR	CR	CR			X
Snowshoe Hare				CR	CR	X
White-tailed Jackrabbit		UR	UR		UR	X
Black-tailed Jackrabbit	CR	CR	CR			X
Least Chipmunk	AR	AR	AR	CR	CR	
Cliff Chipmunk	CR	CR			CR	
Uinta Chipmunk	AR	AR	AR	CR	CR	
Yellow-bellied Marmot				CR	CR	

* Scientific names of species are listed in Appendix 10A

TABLE 6-1

TABLE 6-1 (cont.)

Mammal	Range					
	Pinyon Juniper	Desert Shrub	Sagebrush	Conifer Aspen	Mixed Shrubs Grasses	High-Interest Species
Ermine				UR		X
Long-tailed Weasel	CR	CR	CR	CR	CR	X
Badger	CR	CR	CR	CR	CR	X
Striped Skunk	CR	CR	CR	CR	CR	X
Mountain Lion (Cougar)	UR	UR	UR	UR	UR	X
Bobcat	CR	CR	CR	CR	CR	X
Wapiti or Elk					CW	X
Mule Deer	CR	CR	CR	CR	CR	X
Moose					CR	X

A = Abundant
C = Common
U = Uncommon
Ca= Casual or Rare
R = Permanent Resident
S = Summer Only
W = Winter Only

TABLE 16-2

Birds of the Mine Site and Haul Road of the Expansion Area

Summit County, Utah

Name	Season of Occupancy	Status
Turkey vulture	spring, summer, fall	uncommon
Red-tailed hawk	all year	common
Swainson's hawk	spring, summer, fall	uncommon
Ferruginous hawk	spring, summer, fall	uncommon
Golden eagle	all year	uncommon
Bald eagle	winter	rare
Marsh hawk	all year	uncommon
Prairie falcon	all year	common
Peregrine falcon	all year	rare
Sparrow hawk	all year	common
Chukar	all year	unknown
Mourning dove	spring, summer	common
Great-horned owl	all year	uncommon
Poor-will	spring, summer	common
Common night hawk	spring, summer	common
Black-chinned hummingbird	spring, summer	common
Broad-tailed hummingbird	spring, summer	common
Common flicker	all year	common
Hairy woodpecker	all year	uncommon
Downy woodpecker	all year	uncommon
Western kingbird	spring, summer	common
Ash-throated flycatcher	spring, summer	common
Say's phoebe	spring, summer	common
Gray flycatcher	spring, summer	uncommon
Violet-green swallow	spring, summer	common
Horned lark	all year	common
Black-billed magpie	all year	common
Raven	all year	common
Crow	spring, fall, winter	common
Pinon jay	all year	common
Mountain chickadee	all year	common
Plain titmouse	all year	uncommon
Bushtit	all year	uncommon
Bewick's wren	spring, summer	uncommon
Robin	all year	common
Mountain bluebird	spring, summer, fall	uncommon
Blue-gray gnatcatcher	spring, summer	uncommon
Cedar waxwing	all year	uncommon
Loggerhead shrike	spring, summer	uncommon
Starling	spring, summer, fall	uncommon
Gray vireo	spring, summer	uncommon
Solitary vireo	spring, summer	uncommon
House finch	all year	common
Pine siskin	all year	common
Lark sparrow	spring, summer	common
Chipping sparrow	spring, summer	common
Sage grouse	all year	uncommon
Pigmy owl	all year	uncommon
Long-eared owl	all year	uncommon
Saw-whet owl	all year	uncommon
White-throated swift	spring, summer	uncommon
Cassin's kingbird	spring, summer	uncommon
Western flycatcher	spring, summer	uncommon
Scrub jay	all year	uncommon
White breasted nuthatch	all year	uncommon
Western bluebird	all year	uncommon
Townsend's solitaire	all year	uncommon
Black-throated gray warbler	spring, summer	common
Scott's oriole	spring, summer	uncommon
Rufous-sided towhee	all year	uncommon
Brewer's sparrow	spring, summer, fall	uncommon
Black-chinned sparrow	spring, summer	uncommon

Species* List and Classification of Reptiles Whose Published Ranges Overlap the Expansion Area of Summit Coal Company

Reptiles	Range					
	[illegible]	Desert [illegible]	Sagebrush [illegible]	Conifer [illegible]	Mixed [illegible]	[illegible]
Fence Lizard	US				US	
Sagebrush Lizard	CS	CS	CS		CS	
Mountain Short-horned Lizard	CS	CS	CS	U	CS	
Utah Rubber Boa				US		
Wandering Garter Snake	US	US	US	US	US	
Western of Yellow-bellied Racer	US	US	US		US	
Striped Whipsnake	US	US	US			
Gopher Snake	CS	CS	CS		CS	
Milk Snake	US	US	US			
Utah Mountain Kingsnake	US				US	
Night Snake		US	US			
Western Basin Rattlesnake	CS	CS	CS		CS	

* Scientific names of species listed in Appendix 10-A

C = Common
U = Uncommon
S = Summer Only

TABLE 6-3

Species* List and Classification of Amphibians Whose Published Ranges Overlap the Expansion Area of Summit Coal Company

Amphibian	Range					
	Pinyon Juniper	Desert Shrub	Sagebrush	Conifer Aspen	Mixed Sagebrush	High-Elevation Streams
Great Basin Spadefoot Toad		CS	CS			
Woodhouse's Toad		US	US			
Northern Leopard Frog		CS	CS			

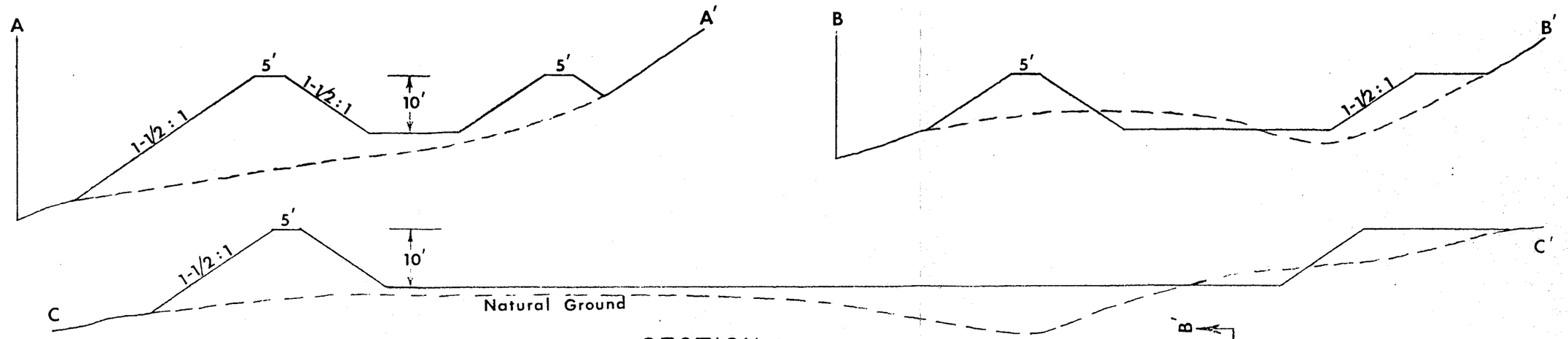
TABLE 6-4

* Scientific names of species are listed in Appendix 10A

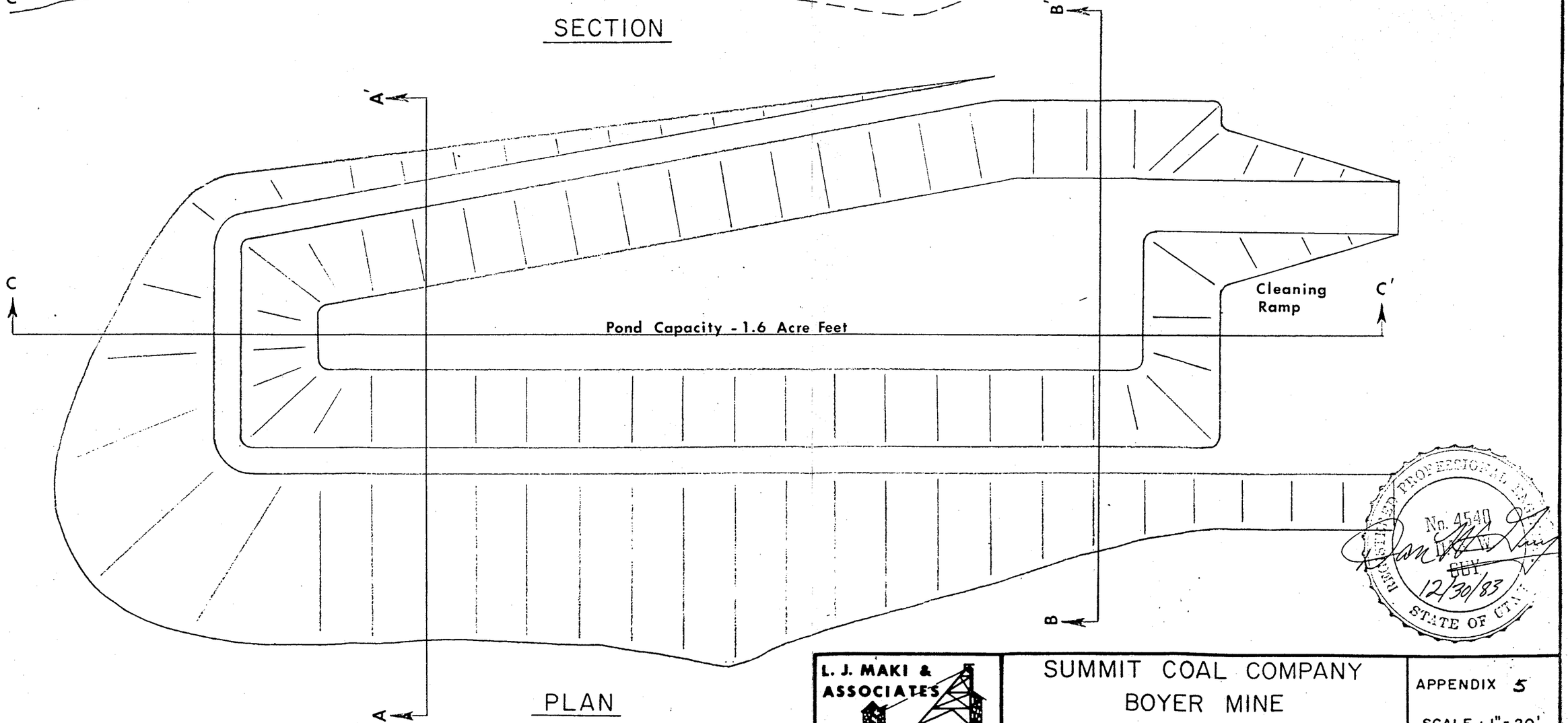
C = Common
U = Uncommon
S = Summer Only

APPENDIX 5

WATER TREATMENT FACILITY



SECTION



PLAN

L. J. MAKI & ASSOCIATES
SANDY, UTAH

SUMMIT COAL COMPANY
BOYER MINE
WATER TREATMENT FACILITY

APPENDIX 5

SCALE : 1" = 20'

PROFESSIONAL ENGINEER
No. 4540
STATE OF UTAH
12/30/83

APPENDIX 6A

UDWR CORRESPONDANCE

DIVISION OF WILDLIFE RESOURCES

DOUGLAS F. DAY
Director

1596 West North Temple/Salt Lake City, Utah 84116/801 533-9333

Reply To NORTHERN REGIONAL OFFICE
515 East 5300 South / Ogden, Utah 84403

March 7, 1983

Mr. Lynn M. Kunzler
Reclamation Biologist
Division of Oil, Gas and Mining
4241 State Office Building
Salt Lake City, Utah 84114

Dear Mr. Kunzler:

We have reviewed the Summit County coal mine site (T.2N, R.6E, portions of sections 25,36) proposed by Mr. Bill Bloomquist, Coalville, Utah and provide the following concerns and considerations to incorporate into the mining and mitigation plan.

The proposal presented will have an impact on resident wildlife; however, the magnitude and nature of impact will be minimal for many species. Since the project site is primarily big game winter range, the direct loss of browse and grass species from road construction, excavation and associated disturbance from mining activities will reduce available forage for big game. Although moose and elk occur within the general area, project impacts will affect primarily deer. This loss could be minimized and partially mitigated by (1) reclaiming disturbed sites with browse seedlings; (2) removing fall livestock grazing within a 20-30 acre fenced portion of the site to increase browse forage available; or (3) planting additional browse on other south or south-westerly slopes adjacent to the project.

We do not anticipate impacts to wintering bald eagles along Chalk Creek. No other threatened or endangered plant or animal species are known to occur within or adjacent to the project site.

Erosion control and on-site detention of run-off and mining wastes are needed to avoid discharge to Chalk Creek. Chalk Creek is a Class III fishery and tributary to Echo Reservoir (municipal-industrial water source).

The intermittant drainage east of the mining portal should be used to divert run-off away from the haul road and portal area. Sediment detention basins are needed to detain sediment before discharge to Chalk Creek.

Overall, the impacts of the proposal, as presented (size, extent of excavation, etc) will not significantly affect resident wildlife species or existing management activities or goals; however, a significant change in the magnitude of the project would require a re-evaluation of our position.

If I can provide additional information or suggestions, please contact George Wilson, Regional Resource Analyst, (801-479-5143).

Sincerely,

Jack A. Rensel
Regional Supervisor

JAR/GWW/jm

7.0 GEOLOGY OF THE PROJECT VICINITY

The Boyer Deposit is located at the east end of the Coalville Coal Field approximately eleven miles east of the town of Coalville, Utah. This deposit is situated on the north side of Chalk Creek, about one mile upstream from Upton, in Sections 25 and 36, Township 3 North, Range 6 East.

The Boyer Deposit is a bed of sub-bituminous coal dipping to the northwest at about 11 to 13 degrees. This bed is known as the Wasatch Bed (Coalville) and is six to seven feet thick in this area. Two parallel normal faults seem to bound this deposit on the east and west and form a block about two-thirds of a mile wide between them. The eastern fault has a reported displacement of more than 1,000 feet and the displacement of the Western fault is unknown and may be only minor. The northern extent of this block is not known but seems to extend at least as far north as Josh Hollow. Southward this block extends across Chalk Creek, where it has been recently mined by another company and probably extends all the way through the ridge into the South of Chalk Creek. Near the northeast corner of Section 36, this bed surfaces under a cover of talus, but is noticeable by the outcrop of the sandstone cap rock just above the coal bed. In this area, this bed was mined, about the turn of the century, by the Boyer Family. The full extent of these workings are not known. This is one of the reasons why it is important to proceed with an exploratory entry adjacent to the old works. On the south side of Chalk Creek this bed has been mined more extensively and has proved to be successful and produce a good quality coal.

7.1 STRATIGRAPHY

Cretaceous and Tertiary rocks made up of at least 18,000 feet of strata crop out in the Coalville area. Five or six formations are of Creataceous age, two of which are coal bearing. The two thick coal-bearing members have been subdivided into 3 coal zones:

(1) Dry Hollow coal about 900 feet above the base of the Wanship Formation; (2) Wasatch coal about 1,100 feet below the top of the Frontier; and (3) the Spring Canyon zone, about 100 feet above the base of the Frontier Formation. A generalized section of the rock formation in the Coalville Coal Field is shown on Figure 6.3.1.

7.2 STRUCTURE

The beds of the Coalville Field have been folded into an overturned anticline which has a general northeast-southwest trend. This anticline dips from 15° to 30° on the northwest flank, then flattens to form a broad crest, and turns abruptly to an overturned nearly vertical southeast flank. The southeast flank then turns abruptly again to form a parallel syncline with the same trend as the anticline The southeast flank of the syncline dips from 10° to 25° to the northwest. The coal beds were included in this folding. Most of this folding preceded the deposition of a thick cover of Eocene deposits which since have been eroded away in many places to expose the Cretaceous sediments.

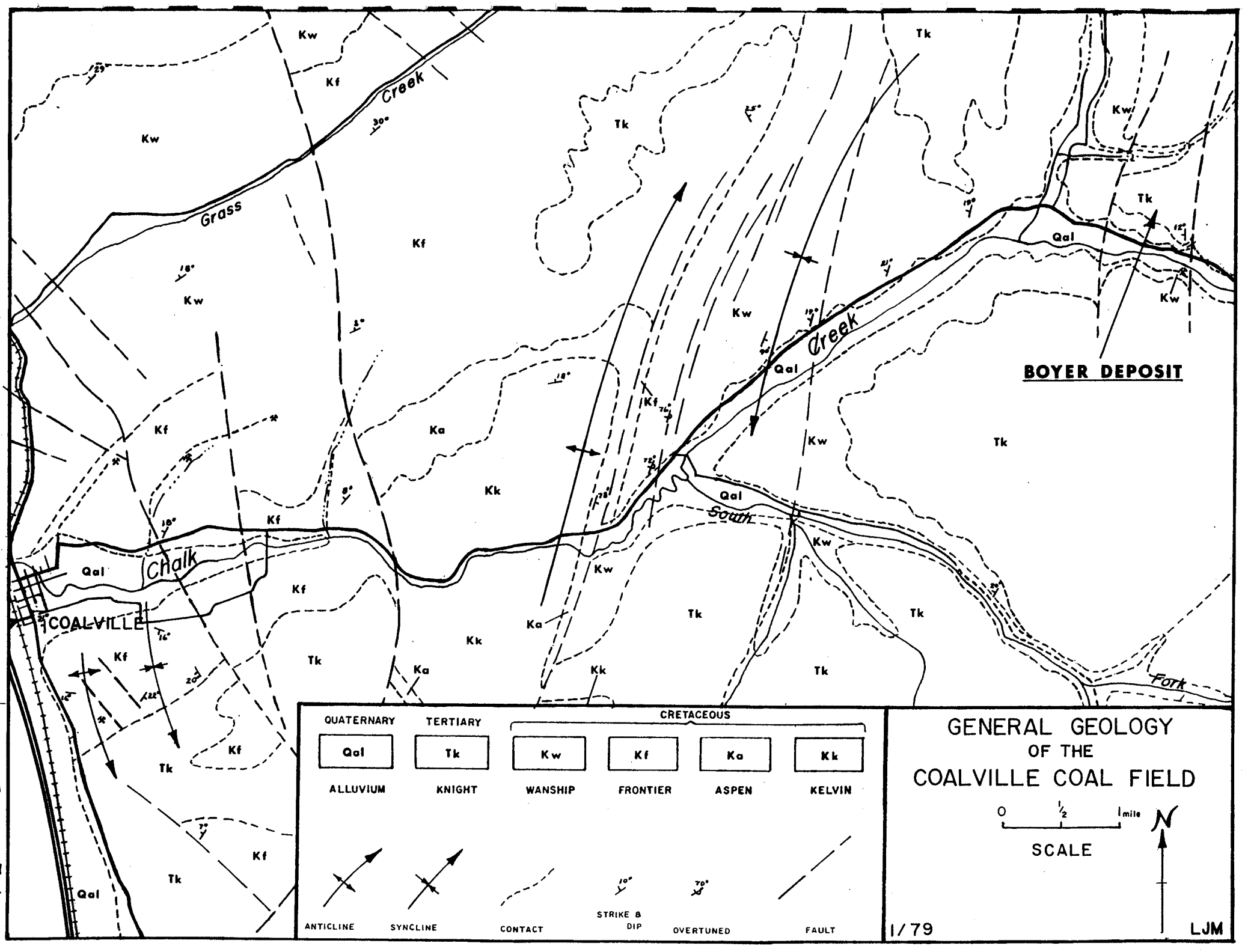
A number of faults cut the Coalville Field, most of which trend across the anticline near Coalville and complicate the structure by breaking beds into blocks. The abandonment of the old works may have been directly influenced by these faults. The exploratory mine will to some degree delineate the extent of the nearest fault and aid in determining feasibility of an active mine. (See attached figure).

8.0 LAND USE AND CULTURAL RESOURCES

The principal land use of the 10 acres of private land to be covered by this exploration plan is that of grazing livestock by the owner of the surface. There is a limited use of the land by hunters during the deer season. The roads and pads for previous coal mines have done most of the disturbance of the property that will be needed in order to set up the planned mining of coal for testing purposes.

Figure 6.3.1

System	Series	Stratigraphic Unit		Thickness (feet)	Description
TERTIARY	Eocene	Knight Formation		2,000+	Red to variegated clays, sands and conglomerates.
					Unconformity
CRETACEOUS	Maestrichtian	Echo Canyon Conglomerate		3,000±	Gray, red weathering boulder and pebble conglomerate interbedded with gray and red shale and gray sandstone.
	Campanian				
	Santonian				
					Unconformity
	Coniacian	Wanship Formation	Henefer Member	2,450-2,500	Light brown to light yellowish gray, fine- to medium-grained sandstone and red, brown, yellow and tan claystone.
			Upton Sandstone	450	Light yellow to blue-gray, fine-grained, calcareous, well bedded sandstone.
			Judd Shale	350- 760	Gray marine shale, thickens eastward.
			Gram Creek Member	875-1,025	Tan thin-bedded sandstone, alternating with gray shale in upper third with lenticular coarse-grained sandstone and red clay shale in lower part, thickens westward.
			Dry Hollow Member *COAL*	1,000-1,220	Upper white sandstone hogback, Dry Hollow coal zone, and lower part divided into an upper shale and conglomerate, middle nonmarine shale and basal conglomerate.
					Unconformity
	Turonian	Frontier Formation	Oyster Ridge Sandstone	200- 28	Light yellow, orange to gray, massive, ridge-forming very fine-grained calcareous sandstone.
			Allan Hollow Shale	780	Gray marine calcareous shale.
			Coalville Member *COAL*	175- 223	Dark gray conglomeratic sandstone overlies Wasatch coal zone, yellow-gray ridge-forming fine-grained calcareous sandstone at base, thickens westward.
	Cenomanian		Chalk Creek Member	3,150	Nonmarine redbeds; pink to red claystone, coarse sandstone and conglomerate sandstone.
			Spring Canyon Member *COAL*	350+	Dark shales, carbonaceous shales, sandstone and thin coal beds.
	Albian		Longwall Sandstone	70- 100	Light gray ridge-forming, massive, fine-grained sandstone, thickens eastward.
		Aspen Shale		210	Dark gray shale and tan sandstone with interbedded light gray shale containing teleost fish scales.
		Kelvin Formation		2,500+	Nonmarine redbeds, shale and sandstone with lenses of conglomerate.
	?				
	Aptian				
	?				
	Neocomian				


Kw
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LJM

FIGURE 7-1

A paleo-arceological inventory was done on the entire area of potential disturbance and no site were observed. The balance of this report is available upon request.

Due to the fact that most of the surface roads and needed pad area has already been constructed, there would be little cultural significance.

9.0 PROPOSED EXPLORATION PLAN

The proposed exploration plan of the applicant on the Boyer Mine Project will require approximately 9 to 12 months of mining of the Wasatch Seam and opening up and mining the lower middle portion of this seam of coal. The portals of these proposed workings are shown on Plate 2-1. The total coal needed for exploration of these coal seams and to determine the degree of faulting and the extent of the old work is 50,000 tons of coal. The time to mine this amount of tonnage depends on permit approval, and the degree of difficultly in assessing the extent of the old works.

Timetable

March 1, 1984	Submit exploration plan to Utah Department of Oil, Gas, and Mining, U.S. B.L.M., Dept. of Health, and MSHA.
April 1, 1984	Approval by Utah Dept DOGM, Start earth moving operation, construction of sediment pond, and clear water diversion
May 1, 1984	Start pad and portal construction. Begin shaft for underground coal mine. Submit partial plan when available.
March 1, 1985	MRP approval or withdrawal and the onset of reclamation.

Equipment

Surface Equipment

1 3.5 yd. Frontend Loader
1 36" Ridgid Frame Conveyor
1 $2\frac{1}{2}$ ton Service Truck
1 1-ton Pickup Truck
2 Ventilation Fans

Underground Equipment

2 3.5 yd. LHD (Diesel SCH 31)
1 Face Drill (Diesel SCH 31)
1 Roof Bolt Drill (Diesel SCH 31)
1 Coal Saw (Electric)
36" Cable Frame Conveyor

Normal surface equipment: end loaders, shop building, change house, water storage tank with capacity of 50,000 gallons.

There will be no coal washing facility on the premises.

Access

There is presently a couty road that extends through the south edge of the property. The road accessing the mine is existing but must be improved. A few modifications to the road system such as settling ponds for runoff water will be constructed.

The Summit County Commission was informed of the proposed mine, and a copy of their endorsement as well as a letter indicating access and road use is included as Appendix 9-2.

Archeological Survey

A survey was completed in the Fall of 1983 and there are no known archeological sites identified on the property.

Noise

The noise levels will be kept within the guidelines of the Federal re-ulatory agencies as pertain to coal mining.

Safety Features

People

Standard safety precautions will be followed to prevent accidents or injury to personnel.

Livestock and Wildlife

Precautions will be taken to keep hazardous material and conditions in a way so that they will not be injurious to either livestock or wildlife. Any opening or portal not needed will be sealed up to keep wildlife out of the mine.

Fire Protection

Standard procedures as required in and around coal mines will be adhered to.

General Health

Hazards to public health are not expected during operation or abandonment because of the isolation of this project from any residential, industrial or recreation activity centers. All rules and regulations as established by the State and Federal governmental agencies will be followed.

APPENDIX 9-2

ACCESS CORRESPONDANCE

Summit County
State of Utah

COMMISSIONERS
GERALD E. YOUNG
CLIFTON BLONQUIST
RON PERRY

P.O. Box 128
COALVILLE, UTAH
84017

REED D. PACE, COUNTY CLERK
ROBERT H. WILLIAMS, TREASURER
ALAN SPRIGGS, RECORDER
ROBERT ADKINS, ATTORNEY
FRED ELEY, SHERIFF
LEO O. FRAZIER, ASSESSOR

TO: Bill Blonquist

FROM: Bruce Rowser, Summiy County Road Superintendent

DATE: February 14, 1984

RE: Access onto County Road

Dear Bill,

This letter is to verify that you will be able to access onto the County Road for your coal mining operation above Upton under the provisions that we talked about earlier. This being, proper signing, proper culverts, and approach to County Road under our inspection and final approval.

Sincerely,

Bruce Rowser, Superintendent
Summit County Road Department

cc: Road Dept.
Jerry Smith, Planning

APPENDIX 9-3

RECLAMATION COSTS

ESTIMATE OF RECLAMATION COSTS

All costs are based on known costs - contract amount on work either in progress or completed in the preceding 12 months.

TYPE OF ACTIVITY	COST PER ACRE
Hydromulching and Seeding:	
Application of seed and tackifyer; equipment and labor only	$ 175.00/acre
Application of mulch, fertilizer and tac; equipment and labor only	275.00/acre
Mobilization [Utah Area]	Job 500.00
Mulch	380.00/acre
Tac @ $1.60/# 140#/acre	224.00/acre
Fertilizer @ $23.00/100#	23.00/acre
Drill Seeding	240.00/acre
JD 450 Crawler @ $45.00/hour estimating 8 hours/acre	360.00/acre
Case 580 Backhoe @ $35.00/hour estimating 24 hours/acre	840.00/acre
Seed	
Variable - current quote	165.00/acre
Planting and Site Preparation	93.00/acre
Nursery Stock	.50/each

ESTIMATE OF TOTAL COST ON RECLAMATION

Approximately 2 Acres

5 Acres Hydroseeding	$ [illegible]
2 Acres Hydromulching and Fertilizing	1,[illegible].00
Mobilization in Utah	[illegible].00
Drill Seeding	360.00
Crawler Tractor	720.00
Backhoe 560 Case	1,680.00
Seed [current bid - Maple Leaf supply]	330.00
Planting and Site Preparation	180.00
Nursery Stock $1,500/acre	3,000.00
TOTAL	$ 8,667.50/2acres

Cost per acre = $4,334.00 x 10 acres = $43,340.00

Cost comparables received from:

U.S.F.S. Fishlake National Forest
Plateau Mining Company - Test Plot Data
Kaiser Mining Company - Slaughter Canyon Road
Getty Coal CV Ridge Reclamation
B&R Reclamation Company - Kenilworth, Utah

1. Soldier Creek Sewage Pond
2. Trail Mountain Reclamation
3. Plateau - Wildlife Enhancement Area
4. Mountain Resources - Drill Site Reclamation

Coal Analysis

Selected coal samples will be analyzed for:

Btu
Sulfur
Proximate Analysis (moisture, volatiles, ash, carbon)
Ultimate Analysis
Hardgrove Grindability
Major Ash Analysis (ten major elements)

Phosphorus	Calcium	Silica
Magnesium	Iron	Sulfur
Aluminum	Potassium	Titanium
Sodium		

10.0 EXPLORATION MINE PLAN

The exploration plan for the mine is comprised of a systematic development from outcrop of a conventional room and pillar mine. A detailed outline of this plan is in the following sections.

10.1 Mining Plans

The overall mining plan for this mine consists of a system of main entries, sub-entries, and panels. Development of the mine is designed to maximize coal recovery with safety and efficiency, while at the same time determine:

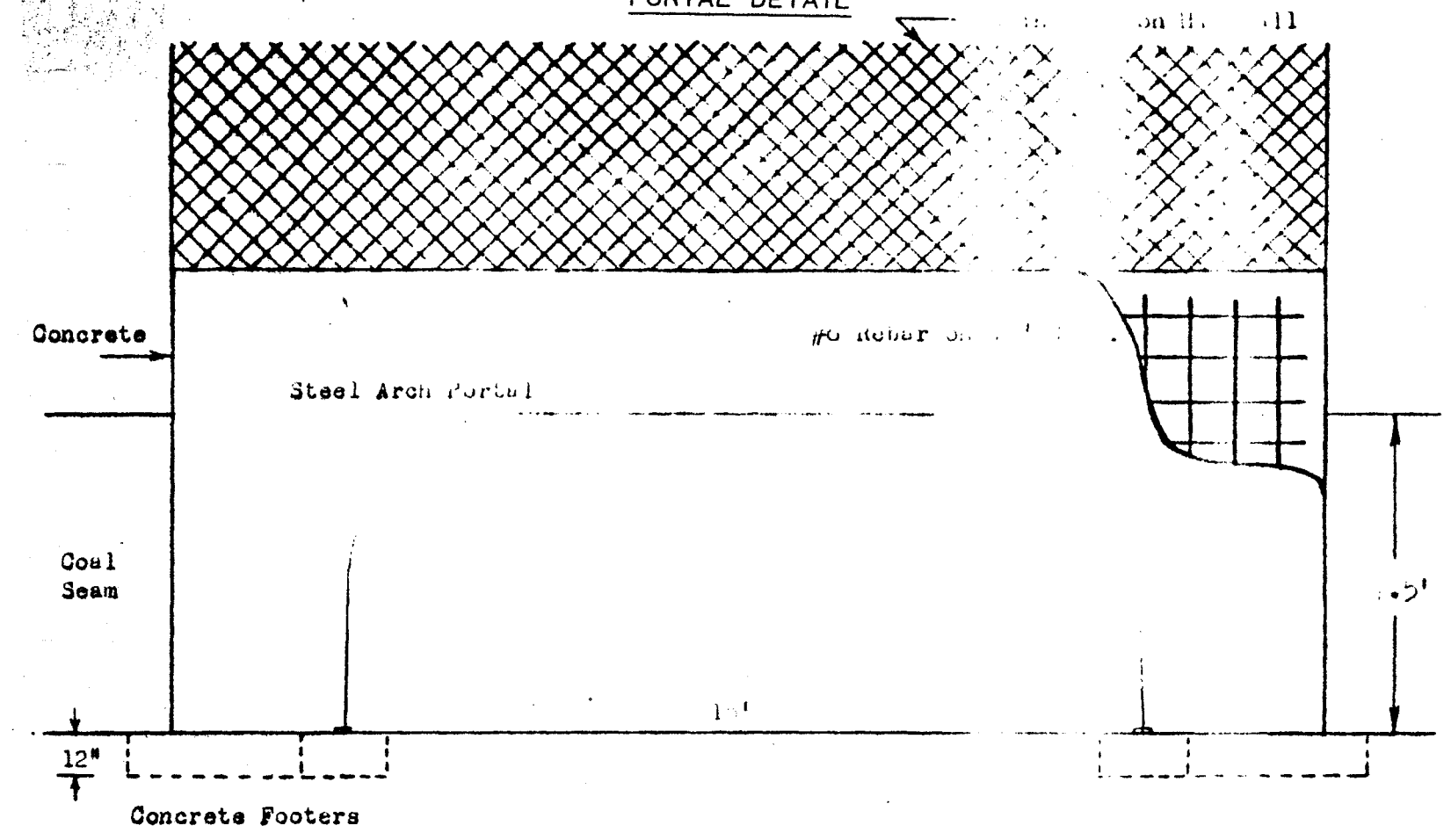
1. The extent of the old works.
2. The degree of faulting as well as roof and floor conditions.
3. To ascertain the feasibility of developing the old Boyer Mine as a working producing mine supplying the Wasatch Front.

10.2 PORTALS, SHAFTS, AND SLOPES

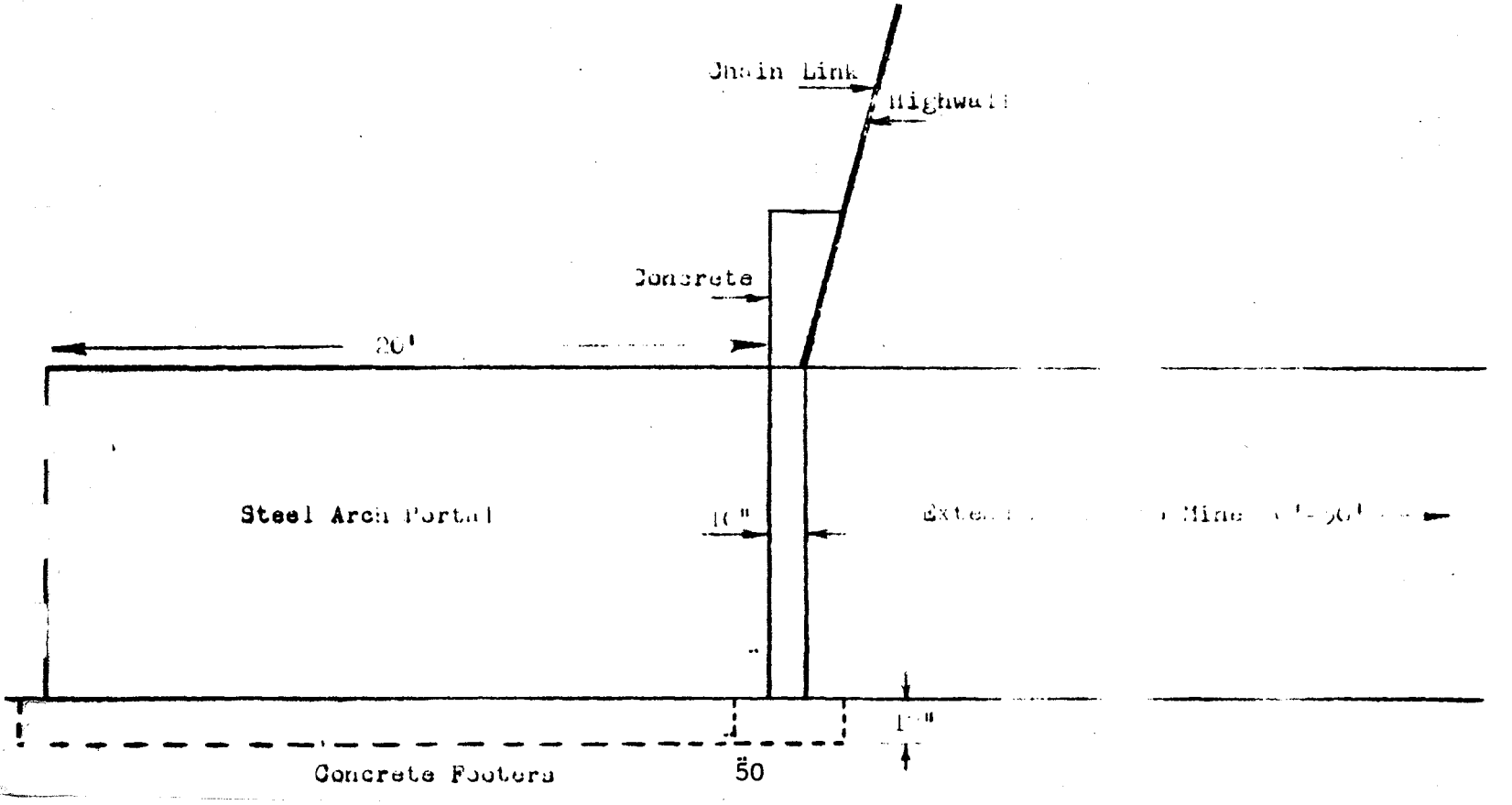
Entry to the mine will be made through three portals; details as shown on Figure 10-1. These portals will be connected to the main entries of the mine which will be excavated in an approximate N 45° W direction. This will develope the mine on a bias to the

Figure10-1

PORTAL DETAIL



FRONT VIEW



slope on the entries of about 10 percent. The three entries will be developed into the mine a distance of approximately 150 to 200 feet and then will be expanded to five entries for safety and ventilation efficiency. Each entry will be excavated eighteen feet wide on 80 foot centers with interconnects between the entries each 160 feet, thus maintaining larger pillars on the main entries. All mine openings will be excavated at right angles to each other entry, forming a checker board pattern. Through this method the exact extent of the old works can be ascertained in a safe and productive manner.

10.3 MINING METHODS

The new Boyer Exploratory Mine is planned to utilize a conventional room and pillar advance retreat mining method. This plan is designed around the use of as much diesel equipment as possible in the mine. The basic mining cycle involves undercutting, drilling, blasting, scaling, loading out, and roof bolting. This cycle will vary somewhat according to the mining conditions. Conveyors are planned as the primary haulage out of the mine. The mining area will be divided into panels as shown on Plate 3-2, and each panel will be treated as an individual section of the mine. Mining in each panel is planned to use advance room and pillar method until the limits of the panel are reached. Then, the pillars will be mined by the retreat method.

10.4 PROJECTED MINE DEVELOPMENT

The project mine development is as shown on Plate 3-2. This is the proposed mine development for the exploration term.

10.5 ROOF CONTROL

Roof control is planned primarily around the use of roof bolts. Basically the mine roofs will be bolted on 5 foot centers with either split set, expansion shield or resin grouted bolts not less than 48 inches

long. Roof bolt plates and, if necessary, wooden head boards will be used. Wooden posts and head boards may also be installed if needed. This methodology will be upgraded or modified as the roof condition dictates in order to insure safe mining conditions.

Floor strata, based on a literature search, appear to be adequate and should create few problems. Some minor floor heaving may occur in the thin clay seam at the base of the coal bed. This seam is generally only a few inches thick.

10.6 VENTILATION

Fans with a combined capacity of 50,000 CFM supply air to the underground mining units.

Intake air is carried in the entries on one side of a set, while return air is carried through the entries on the other side. Air is directed through the mine by stoppings, doors, overcasts, regulators and brattice cloth. After sweeping the working faces of each section the air is directed into the return air courses and out of the mine. Historically, little or no methane gas is generated in the Wasatch seam.

10.7 DEWATERING, WATER SYSTEMS AND DUST SUPPRESSION

Water generated in the mine is collected in sumps and used at the mine for sprays on the machines at the working faces, on the coal at belt heads and transfer points. Water expected to be generated will be used or contained at the mine; there will be no discharge to surface waters. However, a National Pollution Discharge Elimination System (NPDES) permit will be obtained in case increased volumes are encountered.

10.8 ELECTRICAL

Electric power will be purchased from a public utility and distributed over the surface of the property through company-owned overhead and buried transmission lines. At the mine portals, a company sub-station will convert the power for underground distribution and for use on the surface.

Underground distribution voltages are transformed to 440/220/120 V at a power center for use by the machines. All circuits are isolated by switches and protected by adequate circuit breakers and overload devices as required by law.

10.9 BARRIER PILLARS

Pillars of coal generally are left underground to protect a surface or underground feature which must be maintained and protected for the life of the mine (main entries) or permanently (oil or gas wells). The size of some is specified by law; others are designed by the operator to provide the protection needed. Those along the outside property boundary will be 100 feet wide.

There are no active or abandoned oil or gas wells within the permit boundary.

11.0 ABANDONMENT AND REHABILITATION PROCEDURES

The area of surface disturbance that is done during this exploration project that will not be needed at a later date on the development of the privately owned property will be reclaimed and reseeded. (See Appendix 11-1 Letter from land owner).

Roads and Road Repairs

The road belonging to the county will be left in shape that is acceptable to the Summit County Road Department. The roads on the private property will be left so as not to create any runoff problem that might cause excessive erosion.

Revegetation

The disturbed area that has no further use to any future coal mining activity will be revegetated using the following methods:

Seed bed Preparation

The surface of the ground to be re-seeded will be prepared for planting by either harrowing or raking the area by hand to pulverize the surface dirt and clays.

Seeding

The seed will either be drilled where flat and a large enough area to warrant or to use a mechanical broadcast seeder such as a cyclone seeder or hydroseeder, then oversprayed with 1500 to 2000 lbs. of wood fiber mulch.

Seeding Dates

Late Fall seeding between October 1st and December 31st is planned.

Seed Mixture and Rate

A total of 11 species have been selected for reclamation of the disturbed areas. The mixture was selected by E.I.S.

personnel that are specialized in this field. The species recommended follow: (See Appendix 11-2).

12.0 SUMMARY

The Summit Coal Company leases the mineral rights under the $NW\frac{1}{4}$, $NW\frac{1}{4}$,$NW\frac{1}{4}$, Sec. 36, T3N, R6E Summit County, Utah. There have been coal mines operating in the Coalville area in the past and one small coal operation on the property.

Most all of the roads, pads, and other activities that would disturb the surface have historically been done. No major disturbance of the surface that has not been historically disturbed, is planned at this time.

The tonnage requested in this exploration plan will be necessary to remove in order to determine: (1) the extent of the old Boyer Mine, (2) the degree and amount of faulting, and (3) actual mine conditions, such as roof, floor, ground water, and the potential existence of gas or foul air.

The opening up the seam would check out the continuity and the physical qualities of coal. Summit Coal is committed to opening a mine at this location as represented by the MRP which was submitted to the Division on January, 1984. However, the actual decision to invest the large amounts of capital necessary to bring this mine on line, will depend largely on the outcome of this exploration endeavor.

APPENDIX 11-1

CORRESPONDANCE FROM LAND OWNER

February 13, 1984

To Whom It May Concern:

I, Thomas V Boyer, do hereby authorize Summit Coal to make a general clean up around properties used for mining purposes at the conclusion of their operations. They are, however, to leave all major excavation work and access to mine entrance as they were during operation. The area is to be posted, thereby holding all parties free from any liability.

Thomas V Boyer

APPENDIX 11-2

RECOMMENDED SEED MIX

Appendix 11-2

RECOMMENDED SEED MIX
INTERIM AND PERMANENT RECLAMATION

SPECIES	RATE* PER ACRE
GRASSES	
Agropyron unilaterale Bearded wheatgrass	3
A. spicatum Bluebunch wheatgrass	8
Elymus cinereus Basin wildrye	1.5
Oryzopsis hymenoides Indian ricegrass	3
Poa secunda Sandberg bluegrass	1
FORBS	
Achillea millifolium Western yarrow	.15
Aster chilensis Pacific aster	.15
Hedysarum boreale Northern sweetvetch	9
Lupinus sericeus Silky sweetvetch	.5
Penstemon palmeri Palmer penstemon or P. strictus Rocky Mountain penstemon	.5
	26.8

* Rate is pure live seed to be broadcast and lightly covered.

ADDITION FOR PERMANENT RECLAMATION MIX

SHRUBS

Amelanchier utahensis Utah serviceberry	"
Artemisia tridentata ssp. vaseyana Big sagebrush	.15
Cercocarpus montanus Birchleaf mountain mahogany	"
Purshia tridentata Antelope britterbrush	.5
Symphoricarpos albus Common snowberry	.8

For hydroseeding	38.25 #/acre
$\frac{1}{2}$ application for drill seeded areas	19.13 #/acre