To Mike, for review KMP

File Belina file

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CONSULTANTS / ENGINEERS
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RECEIVED
MAY 21 1979
DIVISION OF OIL, GAS, & MINING

May 18, 1979

Mr. Ron Daniels
Utah Div. of Oil, Gas, & Mining
1588 West North Temple
Salt Lake City, Utah 84116

Dear Mr. Daniels:

Enclosed are three copies each of the subsidence and hydrologic inventory and monitoring programs for Valley Camp of Utah, Inc. These programs have been developed by us following discussions with representatives of the U.S. Forest Service and the Utah Division of Oil, Gas, and Mining as well as a review of the final OSM regulations. We would appreciate it if you would review these documents as soon as possible and give us your comments.

Thank you for your cooperation.

Sincerely,

Richard B. White

Richard B. White
Hydrologist

RBW/das

RECEIVED
MAY 21 1979
DIVISION OF
GAS & MINING

VALLEY CAMP OF UTAH, INC.

HYDROLOGIC INVENTORY AND MONITORING PLAN

Prepared for

VALLEY CAMP OF UTAH, INC.

Clear Creek, Utah

By

VAUGHN HANSEN ASSOCIATES

Salt Lake City, Utah

May 1979

VALLEY CAMP OF UTAH, INC.

HYDROLOGIC INVENTORY AND MONITORING PLAN

INTRODUCTION

This document has been prepared to provide Federal and State regulatory agencies with the hydrologic inventory and monitoring plan which is being implemented by Valley Camp of Utah, Inc. for the coal mining lease area currently being developed through the Belina No. 1 mine (see Figure 1). Three objectives will be served through the implementation of this plan, in accord with appropriate governing regulations:

1. Information will be gathered which will allow the coal company and the agencies to gage and minimize the impact of mining on the hydrologic system in the lease area and adjacent areas;
2. An expanded hydrologic monitoring plan will be developed, beyond that which is currently being conducted, which is acceptable to both the U.S. Forest Service (Manti-LaSal National Forest) and the Utah Division of Oil, Gas, and Mining (acting as the regulatory authority for the USDI Office of Surface Mining Reclamation and Enforcement); and
3. Data collection will be continued at the existing hydrologic monitoring stations.

This document should be considered as final in implementing the outlined hydrologic inventory and monitoring plan unless comments are received from the regulatory agencies requesting a change.

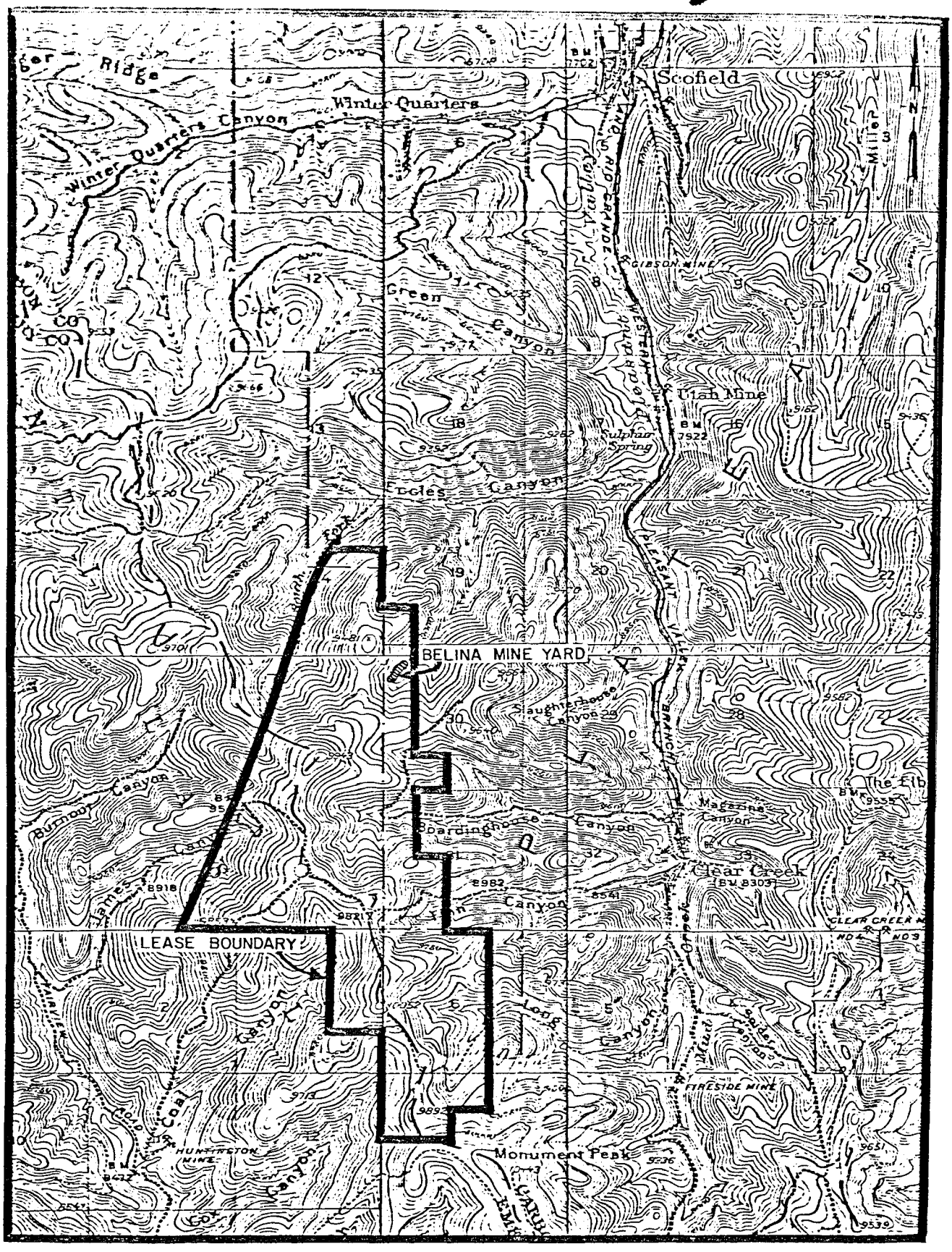

Figure 1. Location of Valley Camp of Utah, Inc. lease area near Clear Creek, Utah.

PLAN METHODOLOGY

Initial Survey

In keeping with the previously mentioned plan objectives, historical water quantity and quality data from the area will be compiled from various sources. In addition to the data which has been previously collected by Vaughn Hansen Associates for Valley Camp as part of their ongoing monitoring progam and for the Southeastern Utah Association of Governments 208 Water Quality Study (see Figure 2), some data have been collected in the area by the Utah Division of Health and the U.S. Geological Survey. This historical data consists almost entirely of surface water information.

When conditions permit, a further field inventory will be made of water sources in the area to better determine areal hydrologic conditions. Seeps, springs, streams, and ponds in the area will be located in the field and noted on a map. Conductivity, flow, and temperature data will be collected from each stream, spring, and seep of significant flow to establish areal variations. Samples from selected sources will also be analyzed for the major ions (generally bicarbonate, calcium, chloride, magnesium, potassium, sodium, and sulfate) as well as total dissolved solids in order to further document the degree of variation. Using this data, representative sources will be chosen for future monitoring and analysis according to Table 1. This list will be abbreviated after it is found that certain parameters exist only in insignificant concentrations.

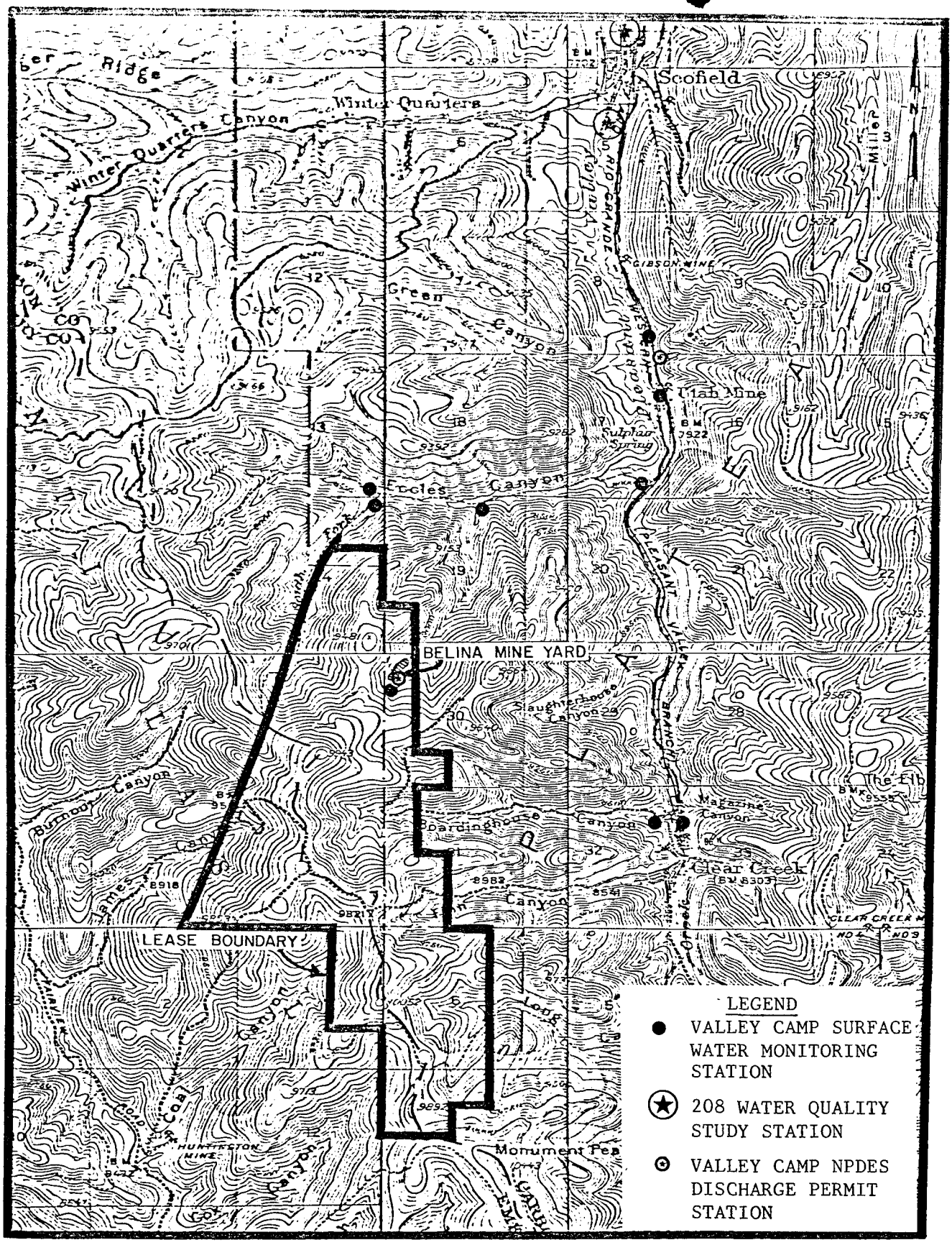

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Figure 2. Hydrologic monitoring stations with historic data.

Table 1. Water quality analytical schedule for Valley Camp of Utah, Inc.

Field Measurements	Laboratory Measurements
pH	Acidity
Water Temperature	Alkalinity
Air Temperature	Bicarbonate
Specific Conductance	Calcium
Discharge or Water Level	Chloride
Dissolved Oxygen	Fluoride
	Magnesium
	Potassium
	Sodium
	Sulfate
	Arsenic
	Barium
	Boron
	Cadmium
	Chromium
	Copper
	Iron (Total and Dissolved)
	Lead
	Manganese
	Mercury
	Selenium
	Silver
	Zinc
	Total Suspended Solids
	Total Dissolved Solids
	Nitrate
	Ortho-phosphate
	Phenol
	Oil and Grease

Geologic information is being gathered from various sources and compiled to better understand the hydrologic system. A map will be prepared which shows faults, formations, igneous dikes, landslides, etc. The geologic information will be confirmed on the ground during the initial field survey.

Special Surface Water Information

The flow characteristics of the lease area streams are being determined, paying particular attention to the high and low flow characteristics and seasonal variations in stream flow. This information is being derived using published methodologies, comparisons with nearby streams, and the data which have been collected from the area in the past. Low flow streamflow measurements will also be made on most perennial streams in the area as an aid in determining areal streamflow variations.

Natural sediment yields of the lease area will be estimated using standard procedures (The Universal Soil Loss Equation, methods developed by the Pacific Southwest Inter-Agency Committee, etc.). This information, the historic data, and the data collected during the remainder of the 1979 field season will be used to determine seasonal variations in water quality, background concentrations, and naturally occurring phenomena.

Special Ground Water Information

The subsurface geologic setting of the area has been and will continue to be investigated in order to better understand the ground water system. Such things as aquifer thickness and lithologic

characteristics will be determined from the available geologic information (published and unpublished reports, drill hole logs, etc.).

A hydrologic budget of the area will be derived in order to estimate the ground water flow conditions of the area (including recharge, storage, and discharge). If future exploration holes are drilled, selected holes may be cased to provide information on the depth to and quality of ground water in the area. Aquifer characteristics may be determined in selected exploratory holes using a recovery rate test prior to the installation of casing or sealing.

Water quality data will be collected from the representative springs and observation holes periodically during the 1979 field season in order to determine the existing ground water condition. Areal and seasonal variations will be determined and displayed.

Expanded Monitoring Program

Valley Camp has been conducting a surface water monitoring program for the past three years in conjunction with the Belina No. 1 mine. Samples have been analyzed for most of the parameters listed in Table 1 at various sites near the mine. However, as mentioned previously, one of the primary purposes of implementing this plan is to enlarge the existing hydrologic monitoring plan to accomodate expanding mining activities. Thus, as a result of the hydrologic inventory previously described, additional representative surface and ground water sources will be chosen for inclusion in the existing monitoring program.

As mining progresses, data collection will begin at a surface water monitoring station in sufficient time to allow for the collection of one complete year of data before the area is impacted from below or on the ground. Additional surface water stations have been tentatively chosen on the streams as shown in Figure 3, pending the results of the hydrologic inventory. Once data collection at a station begins, data will be collected according to the schedule outlined in Table 1 (or an abbreviated schedule) every two months during the mining and reclamation operation unless an alternate frequency is determined to be adequate or necessary as a result of the hydrologic inventory.

Ground water monitoring will consist of water quality and flow and/or water level data collection from the representative springs and observation holes in the early summer and mid-autumn of each year. Access problems created by heavy snowfall will probably preclude more frequent sampling at the ground water monitoring stations. No locations can be given for these stations until the initial field survey has been completed. However, it is anticipated that approximately one ground water source per square mile will be chosen for future monitoring. As was the case with the surface water program, future ground water monitoring will preceed underground or above ground disturbances by one year.

Mine water discharges are currently being monitored at the Belina No. 1 mine in harmony with an NPDES permit (see Table 2). In addition to the parameters listed in Table 2, total manganese has been added to the list to satisfy OSM regulations. This sample will

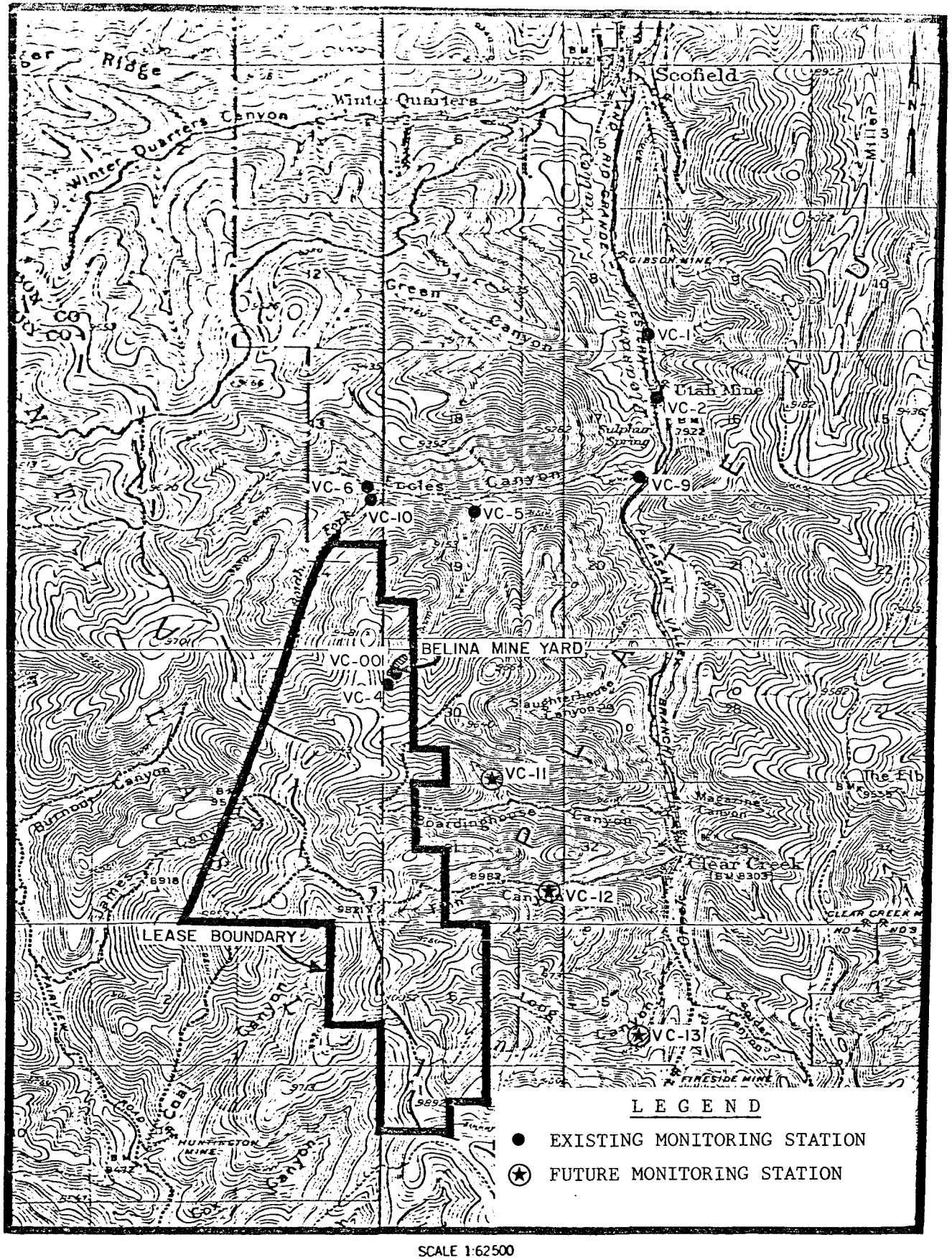

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Figure 3. Anticipated surface hydrologic monitoring stations.

Table 2. Water quality monitoring schedule for the Belina mine discharge.

Parameter	Monitoring Requirements	
	Measurement Frequency	Sample Type
Flow	Two per month	Measured
Total Suspended Solids	Two per month	Composite
Total Iron	Two per month	Composite
Alkalinity	Two per month	Grab
Acidity	Two per month	Grab
Total Dissolved Solids	Two per month	Composite
Oil & Grease	Two per month	Grab
Total Selenium	Monthly	Grab
B.O.D.	Quarterly	Grab
Total Coliform	Quarterly	Grab
Fecal Coliform	Quarterly	Grab
pH	Two per month	Grab

be collected twice each month from the composite sample. A totalizing flow meter has also been installed at the discharge point from the mine. As requested by the USFS, regular measurements are also made of the coal moisture content. Significant changes in the source of water in the mine will be moted during the period of operation.

The USFS has requested that a precipitation gage be installed at the mine site. It is anticipated that a simple storage gage will be installed and monitored each working day.

Hydrologic Impact of Mining

The work done to date under this plan and special studies by Vaughn Hansen Associates for other coal companies with leases in the general area have led to basic conclusions regarding the hydrologic impact of mining in the area. These conclusions will be updated or fortified as a result of the Valley Camp hydrologic inventory and monitoring plan but appear to be valid at this time.

The Valley Camp lease area surface is covered essentially entirely by the Blackhawk Formation (see Figure 4). This formation consists of interbedded layers of shale and sandstone separated by various mineable and non-mineable coal seams (see Figure 5). The sandstone beds are generally massive while the shale layers are bentonitic, tending to swell when wet and decompose into an impervious clay (see the Central Utah Coal EIS). The thickness of the lenticular sandstone and shale beds both vary from about 1 to 60 feet.

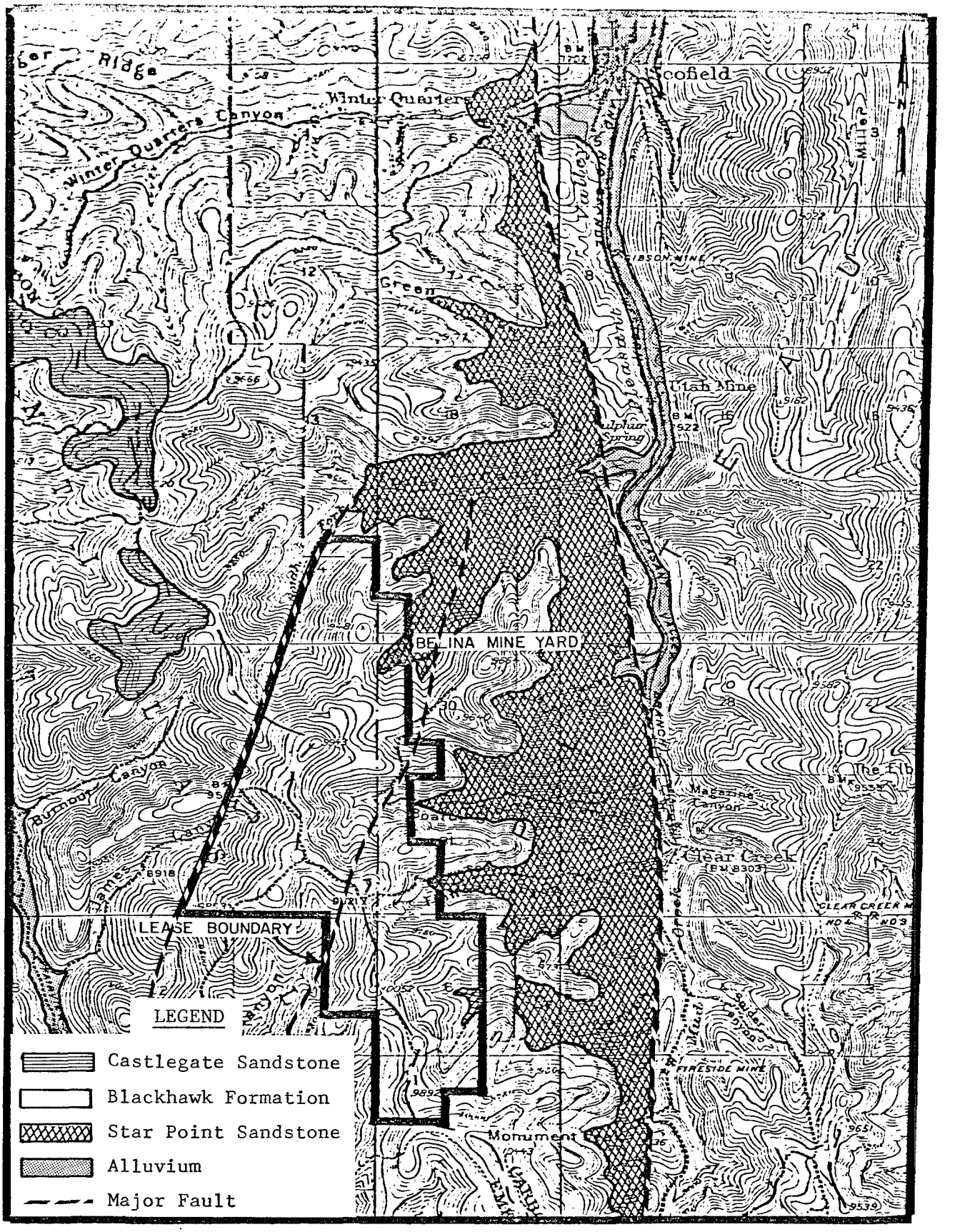

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Figure 4. General geologic map of the Valley Camp of Utah, Inc. lease area and adjacent areas.

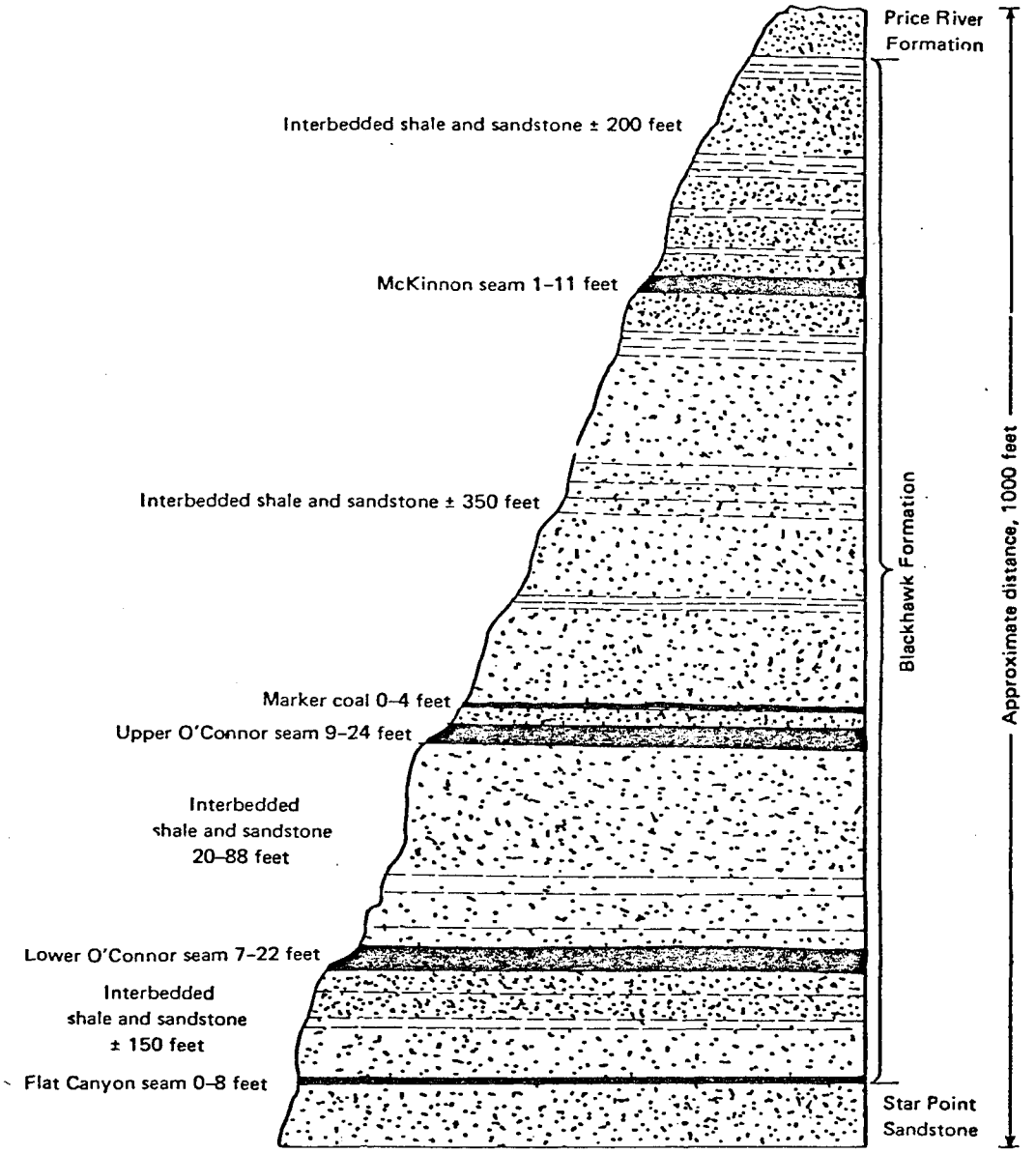

Figure 5. Generalized stratigraphic column at the O'Conner mine, Sec. 31, T. 13 S., R. 7 E. (from the Central Utah Coal EIS).

Studies to date indicate that the sandstone layers may readily conduct water but the underlying layers of relatively impervious shale prevent significant downward movement of the percolating water. Thus, springs generally occur below small basins which accumulate the infiltrated percipitation and snowmelt, issuing near a sandstone-shale contact.

Additional confirmation exists along the numerous faults and fractures over the area. Very few springs are found along the extensive faults in the Wasatch Plateau between the towns of Scofield on the north and Emery on the south. Apparently, fractures seal readily because of the ability of the interbedded shales to swell and decompose to form an impervious clay, preventing significant downward percolation, collection, or conveyance of water along faults in the Blackhawk formation.

The fact that natural gas fields can be found in the Scofield-Clear Creek area also suggests that the overlying formations and the fractures that connect them are impermeable. If the formations and fractures were pervious enough to allow significant downward percolation of water, the gas would not remain trapped.

Where the Star Point Sandstone which underlies the Blackhawk formation (see Figure 5) is exposed, an entirely different ground water regime exists. Infiltrating precipitation and snowmelt readily enters the Star Point Sandstone and few springs exist except at lower elevations, generally in the bottom of a canyon, often adjacent to traverse faults where contact is again made with less permeable Blackhawk formation (see Figure 2).

These observations indicate the the impact of mining (and particularly subsidence) on the quantity of water in the lease area will be minimal. Should subsidence occur, the subsidence cracks will likely rapidly seal, preventing the deep percolation of water and subsequent loss of springs and other water sources. Thus, springs will continue to be available for use by wildlife, domestic animals, etc.

The impact of mining by Valley Camp on the quality of water in the area is also considered to be minimal. This conclusion is based on comparisons of mean values using Student's t test made between historic water quality data from the Belina No. 1 mine water discharge (station VC-001) and monitoring station VC-6 and VC-10 (see Figure 3). The only samples included in the analysis were those which were collected on the same date in the streams and at the discharge point. The results of this test are contianed in Table 3. Mean values are not statistically considered to be significantly different unless the level of significance is greater than 90 percent. Thus, it appears that the only significant difference between the mine water discharge and the undisturbed streams is a lower dissolved oxygen concentration and a higher total dissolved solids concentration in the mine water discharge. The dissolved oxygen concentration can be expected to increase as the water enters a stream channel and is subject to aeration through turbulence. In both cases, however, the mean parameter concentration of the mine water discharge is well within regulatory agency standards for all beneficial uses of the water.

Table 3. Results of Student's t test of water quality data from VC-001 versus VC-6 and VC-10.

Comparison Station	Parameter	Number of Samples	Mean Value of Discharge Parameter	Mean Value of Stream Parameter	Student's t	Significance Level (%)
VC-6	Water Temp (^{o}C)	5	10.0	8.1	1.559	82
VC-6	pH	5	7.56	7.78	1.169	70
VC-6	DO(mg/l)	5	7.20	9.20	7.906	>99.5
VC-6	TSS(mg/l)	5	55.0	29.6	1.822	86
VC-6	TDS(mg/l)	5	273.4	222.2	2.019	89
VC-6	Total Iron (mg/l)	5	0.054	0.062	0.227	<50
VC-10	Water Temp (^{o}C)	4	10.8	9.4	0.776	51
VC-10	pH	4	7.58	7.75	0.683	<50
VC-10	DO(mg/l)	4	7.10	8.95	4.311	98
VC-10	TSS(mg/l)	4	28.2	25.8	0.131	<50
VC-10	TDS(mg/l)	4	281.8	193.8	3.384	96
VC-10	Total Iron (mg/l)	4	0.041	0.176	1.124	68

In summary, it can be concluded that Valley Camp mining operations in the lease area have had and will continue to have little (if any) impact on the areal hydrologic system. The hydrologic inventory and monitoring plan which has been implemented will result in the collection of data which will allow these conclusions to be updated or fortified. Particular attention will be paid in the future to the identification and quantification of legitimate uses of water in the area. If it is determined that mining in the lease area will significantly impact these uses by diminuation, contamination, or interruption, alternative sources of water will be identified for replacement.

SUBSIDENCE MONITORING PLAN FOR VALLEY CAMP OF UTAH, INC.

Prepared for

VALLEY CAMP OF UTAH, INC.

Clear Creek, Utah

By

VAUGHN HANSEN ASSOCIATES

Salt Lake City, Utah

May 1979

SUBSIDENCE MONITORING PLAN FOR VALLEY CAMP OF UTAH, INC.

INTRODUCTION

The purpose of this document is to outline the subsidence monitoring program to be implemented by Valley Camp of Utah, Inc. in the coal lease area currently being developed through the Belina No. 1 mine (see Figure 1). Because the Office of Surface Mining Reclamation and Enforcement no longer requires that a subsidence monitoring program be established, the program presented herein is based primarily on the requirements of the U.S. Forest Service, Manti-LaSal National Forest. Prior to the development of this program, meetings were held with representatives of the Manti-LaSal National Forest and their draft guidelines were reviewed. This document should be considered as final in implementing a subsidence monitoring plan unless comments to the contrary are received from the U.S. Forest Service.

BASELINE DATA COLLECTION

A field survey will be made by a consultant as soon as the area is reasonably accessible in order to locate surface and subsurface structures which might be materially damaged or altered by possible subsidence. The area to be studied will include the lease area plus the area covered by a 45 degree angle of draw from the lowest coal seam to be mined. Existing structures will be examined for their existing condition and photographs will be taken to provide a permanent record. Particular attention will be paid to gas pipelines,

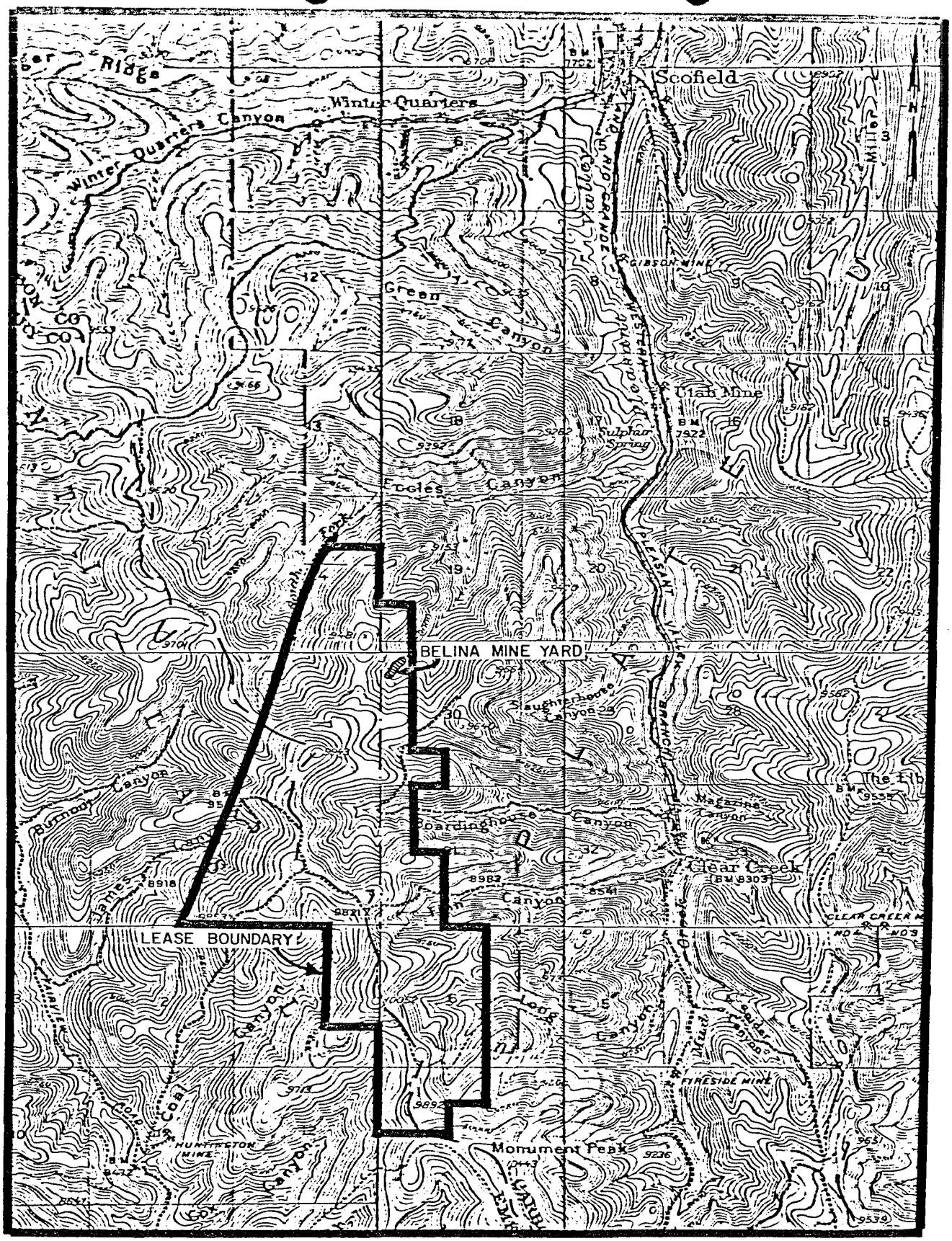

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Figure 1. Location of Valley Camp of Utah, Inc. lease area near Clear Creek, Utah.

roads, fences, section corners, electronic equipment and instrumentation, etc. The condition of the ground surface in the study area will also be examined and noted.

In cooperation with the Manti-LaSal National Forest, monuments have been selected in and adjacent to the lease area for the purpose of monitoring subsidence through the use of aerial photography (see Figure 2). When the area is accessible, those monuments which have not yet been will be flagged. If time permits, the monuments will also be surveyed at this time by representatives of Valley Camp to establish control. If this is not possible, the monuments will be surveyed later.

An initial flight will be made by the U.S. Forest Service as soon as the monuments have been flagged to provide aerial photography of the entire lease area and angle of draw. Although mining has already begun in the area, subsidence has not yet taken place, thus making the initial aerial photography representative of pre-mining conditions. It is assumed that flights will be made in accordance with the draft guidelines; namely, a 30 percent overlap of flight lines and 65 percent overlap in photographs will result, producing photographs having a scale of 1:4800 and a quality that will produce elevations accurate to within one foot. It is further assumed that the photographs will not be digitized unless future subsidence is discovered. At that point, only that area over which subsidence has occurred will be studied to produce contour intervals, thus saving the expense of topographic reduction until necessary.

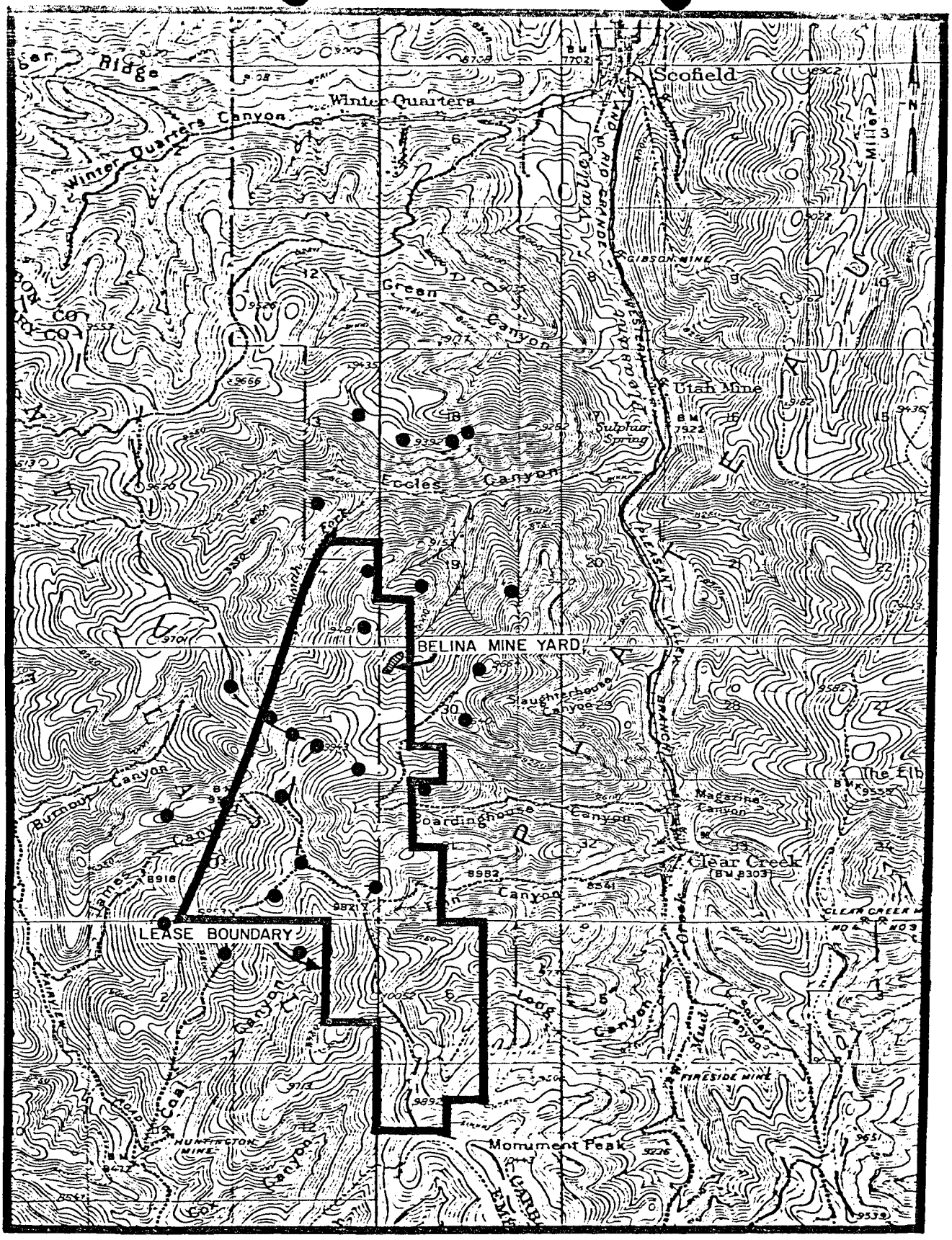

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Figure 2. Location of existing and proposed subsidence monuments.

MONITORING PROGRAM

An ongoing subsidence monitoring program will be conducted which will consist of annual field surveys and overflights. An on-ground visual inspection will be made by a consultant each year following the initial survey. This inspection, to be made normally in mid-summer after the ground has dried, will deal with the condition of the ground surface and existing structures above all underground workings and their angle of draw. Attempts will be made to identify and document the presence of tension cracks, fissures, landslides, structural offsets, structural damage, etc. Photographs will be taken of the noted changes to assess impacts. Changes in the hydrologic condition of the area will be assessed through an on-going hydrologic monitoring program.

Annual overflights will be made of the area overlying underground workings plus the angle of draw. Monuments will be inspected each year prior to the flight to insure proper flagging. Flights will produce photographs at a scale of 1:4800 and follow the overlap guidelines outlined in the previous section. It is again assumed that the photographs will not be topographically reduced unless subsidence is discovered, thus saving on the cost of the monitoring program. Only those areas where subsidence has occurred will be studied in further detail as an aid in establishing the magnitude of subsidence.