BRAZTAH CORPORATION

July 25, 1979

Board of Oil, Gas and Mining
Department of Natural Resources
State of Utah
1588 West North Temple
Salt Lake City, Utah 84116

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STATE OF UTAH
Division of Oil, Gas & Mining

Gentlemen:

Re: In the Matter of the Modification of Braztah Corporation Mine Plan For Braztah Mine No. 5, Carbon County, Utah

Cause No. ACT/007/004

As part of Braztah Corporation's ("Braztah") continuing effort to comply with applicable laws, rules and regulations in the conduct of its underground coal mining and reclamation operations in Carbon County, Utah, Braztah, within the next two weeks, will file its Underground Mining and Reclamation Permit Application ("Permit Application") with the Utah Division of Oil, Gas and Mining. Said Permit Application will be filed pursuant to the Cooperative Agreement by and between the State of Utah and the United States Department of Interior and the permanent regulatory program under the Utah Statute Regulating Coal Mining and Reclamation Operations (UCA (1957) §40-10-1 et seq.), the Surface Mining Control and Reclamation Act of 1977 and the regulations promulgated thereunder.

The underground mining and reclamation operations contemplated under the Permit Application are currently being conducted by Braztah, as operator, pursuant to its Mine Plan U-058184 et al, approved by the United States Geological Survey ("USGS") in April 1977.

As a part of the approved Mine Plan, Braztah contemplated, among other things, to construct an intake air shaft in Sowbelly Canyon to ventilate the existing Mine No. 5. Although the details and specific location of the air shaft were not known at the time of the original Mine Plan approval, the shaft concept was included in the Mine Plan and related drawings.

The design details and specific locations of said intake air shaft has been determined and Braztah therefore respectfully requests that the Board of Oil, Gas and Mining ("the Board") grant permission to construct the subject intake air shaft.

To assist the Board in its consideration of Braztah's request, transmitted herewith are nine (9) copies of a report outlining the proposed modifications at the Mine No. 5 Area. The report has in large part been abstracted from Braztah's aforementioned Permit Application. In addition, Braztah personnel and consultants will present testimony and respond to questions of the Board and/or staff at the hearing of the Board on Friday, July 27, 1979, at 9:00 a.m..

It is submitted that the intake air shaft in Sowbelly Canyon was contemplated when approval of the Mine Plan was granted by the USGS in April 1977. As a result, the action of the Board requested hereby is at most the approval of a minor modification to that approved Mine Plan now that design details and specific location have been determined.

The ventilation requirements of the No. 5 Mine dictate prompt construction of the intake air shaft thereby insuring the health and safety of the mine and the Braztah work force located thereat. As a result, we respectfully request your prompt consideration of our proposed shaft construction permitting the orderly and timely development of the mine while making the "coal resource" derived therefrom available to help meet our nation's "energy crisis".

Thank you for your consideration,

Respectfully submitted,

BRAZTAH CORPORATION

Howard J. Bressler

HJB/rsh

Howard J. Bressler
Vice President and
Assistant General Counsel

PROPOSED MODIFICATIONS
NO. 5 MINE AREA
BRAZTAH CORPORATION
CARBON COUNTY, UTAH

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STATE OF UTAH
Division of Oil, Gas
& Mining

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TABLE OF CONTENTS

		Page No.
1.0	Introduction	1
	1.1 General	1
	1.2 Mine Plan	1
2.0	Existing Facilities	5
	2.1 General	5
	2.2 Compliance Measures	5
3.0	Proposed Facilities	8
4.0	Geology and Hydrology	9
	4.1 Geology	9
	4.2 Hydrology	9
	4.3 Shaft Impact on the Hydrology	10
5.0	Surface Water Information	11
6.0	Climatic Data	12
	6.1 General	12
	6.2 Engineering Criteria	13
	6.2.1 Regional Hydrology	13
	6.2.2 Flow Calculations	14
	6.2.3 Channel Design	16
	6.2.4 Culvert Design	17
	6.2.5 Storm Runoff	18
7.0	Vegetation Data	19
8.0	Fish and Wildlife Resource Information	23
	8.1 General	23
	8.2 Habitat Areas	23
	8.3 Species Designation	25
	8.4 Restoration Studies	25
9.0	Soil Resources	26
	9.1 General	26
	9.2 Soils of the Wasatch Plateau Section	26
	9.3 Soils of the Book Cliffs Section	27
	9.4 Soils of the Mancos Shale Lowlands Section	27
	9.5 Specific Soils Data in the Mine Plan Area	27

1.0 INTRODUCTION

1.1 GENERAL

This document presents the details of the proposed addition of a ventilation shaft and associated surface facilities to the No. 5 mine operation, located in Sowbelly Gulch, Carbon County, Utah. Herein is also presented the measures proposed to bring the existing surface facilties of the No. 5 mine into compliance with final regulations set out by the Federal Office of Surface Mining and the Division of Oil, Gas and Mining, State of Utah.

This document details only the pertinent details applicable to the No. 5 mine operation; these have been abstracted from the overall Mine Permit Application to the Division of Oil, Gas and Mining, State of Utah, which is currently being prepared for final submission.

1.2 MINE PLAN

An intake ventilation shaft is urgently required for the No. 5 mine to maintain the present rate of production. By the end of 1979 the existing ventilation system will have been extended to its limit and, without the additional shaft, the operation of at least one and possibly two mining units will become hazardous and will have to be terminated with resulting reduction of production and loss of employment for up to 50 miners. Addition of the shaft into what is essentially the heart of the reserves to be extracted over the next 8 to 10 years will also permit an optimum level of production from the No. 5 Mine for that period. The shaft, together with the mine surface openings already serving this mine, should permit extraction of approximately 1 million tons of coal per year from the designated "B" and "D" Seam reserves.

Ultimately, the No. 5 Mine will extend into the western reserve area where two long-life vertical shafts located in Rains Canyon can provide the needed ventilation and access facilities. These shafts would permit access to and mining from the "B," "A," Sub 1, Sub 2, and Sub 3 Seam reserves.

Coal haulage would be in-seam to one of several vertical coal passes connecting with the existing No. 3 Mine belt haulage system.

Development of Mines No. 4 and No. 5 has proceeded as described in the mining and reclamation plan approved by the USGS in April 1977. The combined mine now accommodates a total of five units of continuous mining equipment. Unfortunately, the "D" Seam coal reserves have not proven to be of the uniform thickness originally anticipated, particularly in the area between No. 5 and No. 4 portals.

Since 1976 an extensive surface drilling program has been carried out across the Braztah reserves. In addition, the underground mining carried out in the period 1976 to 1979 in Mines No. 4 and No. 5 have delineated the extent of minable coal, particularly within the area of immediate mining.

The most easterly mining units, currently being serviced by man and materials access and ventilation through the No. 4 portal, have all but depleted the minable coal in this area. These units will, by the end of this year (1979), have to be accommodated in the main north area of the reserves at the extremity of the main entries of No. 5 mine.

Of the five entries driven in from the outcrop at No. 5 Mine, only one entry is currently serving as an intake airway.

This single entry is supplying in excess of 120,000 cubic feet per minute of air into the three operating sections now accommodated in this part of the mine. The pressure drop in this entry alone approximates 2 inches of water, and the velocity of the air through the entry, which is used as the main travel road for men and materials, is already excessive.

Presently, the No. 5 Mine ventilation system is being improved to accommodate the main north section from the No. 4 side of the mine to the No. 5 side of the mine by adding an additional intake airway and by grouping the parallel set of entries as returns and connecting these to the present No. 4 Mine fan.

This ventilation change will bring the existing ventilation system at the No. 4 and No. 5 Mine to its maximum capacity. This change will not permit at least one of the mining units (the 1st west section), which is presently operating on the No. 4 side of the mine, to move to the No. 5 side of the mine, which will be necessary at the end of 1979 when the No. 4 side minable reserves are mined out.

We are now proposing to add to the mine ventilation system a raise-bored intake shaft in Sowbelly Canyon, as depicted on Braztah's approved mine plan dated May 27, 1976. The detailed engineering of this shaft is presently in the final stages of completion. The addition of this shaft will improve the ventilation system to accommodate the 1st west section and a longwall mining unit which is expected to begin operation in late 1980.

Without the intake shaft, the 1st west section and its associated work force will have to be deleted from the mine by the end of 1979, which demonstrates the immediate need to start construction on the shaft so that its completion prior to the end of 1979 will eliminate a reduction in manpower and production.

The proposed shaft will be capable (in conjunction with the two intake airways) of providing the necessary volume of intake air to the five miner units and one longwall unit for 7 to 8 years at reasonable velocities and pressure drop. This will enable the depletion of the "D" Seam minable reserves assigned to this mine and the timely and orderly development of the continuous "B" Seam reserves.

In 1986-87, the "B" Seam reserves will be fully developed and will be served by a pair of conventionally constructed, long-life mine shafts located in Rains Canyon. These shafts will also serve the later development and extraction of the "A" Seam, Sub 1, Sub 2, and Sub 3 Seam reserves in the western end of the Braztah reserve.

2.0 EXISTING FACILITIES

2.1 GENERAL

The No. 5 Mine area is accessed through Sowbelly Gulch, which is a tributary to Spring Canyon and lies approximately 4 miles west-northwest of the city of Helper. Approximately 17 acres are currently or have been recently in use and are classifiable as "affected" under the terms of the Regulations. As shown on Figure 2-1, most of this area is used principally for storage and material and personnel access through Portal 5. This use will continue in the future with the possible addition of permanent workshops, a warehouse, and a bathhouse. No coal handling currently occurs at surface in the area, and none is planned in the future.

2.2 COMPLIANCE MEASURES

Proposed compliance measures for the Sowbelly Gulch area are shown conceptually on Figure 2-1. Although the details of future use may change with further planning, it is considered that the proposed concepts will still apply. As indicated on Figure 2-1, it is planned to relocate Portal 5 to eliminate a present d leg at the entrance and install a rail haulage system with spurs to a storage area and shaft at the north end of the areas. Also planned is a permanent bathhouse and associated parking area.

Because of the relative lack of coal or coal waste present on the surface of the affected areas, the major problem of compliance at Sowbelly is the control of sediments from these areas. It has been decided that the most direct method of control of sediment will be to divert stream and sheet flow from unaffected

areas and retain precipitation from affected areas by the construction of three sedimentation ponds. Location and size of these ponds are shown schematically on Figure 2-1.

The existing diversion of the main stream through the area is adequate to pass the required maximum flow and no additional work, other than revegetation, is proposed. Tentatively, we would propose that the revegetation, which would be carried out in the late fall of 1979, employ the seeding mixture currently approved by BLM for drill site reclamation on the property. This mixture is as follows.

Common Name	Botanical Name	Rate of Pure Live Seed (pounds/acre)
Fairway Crested Wheatgrass	*Agropyron cristatum*	1-1/2
Intermediate Wheatgrass	*Agropyron intermedium*	1-1/2
Russian Wildrye	*Elymus junceus*	1
Ladak Alfalfa	*Medicago sativa*	1
Bitterbrush*	*Purshia tridentata*	2
Stansbury Cliffrose*	*Cowania mexicana stansburiana*	1
Curleaf Mt. Mahogany*	*Cercocarpus ledifolius ledifolius*	1/2
Birchleaf Mt. Mahogany*	*Cercocarpus montanus montanus*	1/2
		9

* To be deleted from revegetation of diversions

The roadway embankment from the stream crossing down to the south substation is at a slope of 1-1/2 horizontal to 1 vertical. This is in noncompliance with the regulations, which require a slope of 2 to 1. There are no indications of instability, which is presumably the underlying reason for this regulation, but the slopes are covered with considerable coal or coal refuse which is also in noncompliance. Therefore, it is proposed that the slope

be regraded to more shallow slope, provided with 2 feet of soil cover derived from the sediment bond construction, and revegetated. (If additional volumes of soil cover are required, they will be supplied by a contractor.) It is not anticipated that any modification of the stream channel will be required.

Regulations also require a 100-foot buffer between affected surface areas and stream channels. Provision of such a buffer in the area north of Portal 5 would remove much of the usable area in this restricted valley. However, the concept of retaining all precipitation in sedimentation ponds substantially reduces the possibility of sediment from this area reaching the stream. As added protection, the proposed road upstream from Portal 5 will serve as a barrier and its surface will be graded to drain to local retention areas or ponds.

A small shaft from previous operations exists about 800 feet south of Portal 5. No future use is contemplated for this shaft, and it will be permanently sealed and the surface area reclaimed by the end of 1979.

Finally, existing rubbish and debris which has accumulated in various parts of the area will be picked up and disposed of by a private contractor. Future rubbish will be deposited in a container near Portal 5 and removed periodically, also by a contractor. Contracts for this work are currently being negotiated.

3.0 PROPOSED FACILITIES

The proposed facilities for No. 5 Mine currently include the ventilation shaft and a work area at the site of the shaft. Access to the shaft location will be via an existing road. The proposed surface facilities are shown on Figure 3-1.

The shaft will be approximately 16 feet in diameter (inside), centrally located in a work area approximately 42 feet by 80 feet. The construction will not affect the existing stream channel in the canyon, but the work area will be rip-rapped to protect against erosion. The work area will be a fill constructed from material excavated for collar construction. Topsoil removed from the work will be stockpiled in the storage area designated in Figure 3-1. The stockpile will be protected by seeding. A detail of the proposed work area is shown in Figure 3-2. Figure 3-3 shows a schematic of the proposed shaft. A cross-section of the proposed pad, the stream crossing, and other design details are shown on figures 3-4 through 3-8.

A sedimentation pond has been incorporated in the pad area to trap sediment-laden runoff from the pad area itself. Runoff from the cut and fill portions of the road is minimal, and the sediment will be separated from the runoff through the use of straw bales until vegetation is established. Cut and fill areas will be revegetated during the life of the shaft. Upon abandonment, the shaft will be sealed and the surrounding area reclaimed by return to approximate original contours.

4.0 GEOLOGY AND HYDROLOGY

4.1 GEOLOGY

Drillhole MC-205 was drilled close to the proposed shaft side to define the geologic and hydrologic conditions at the site. The log of the drillhole is shown on Figure 4-1.

The specific geology consists of colluvial materials overlying bedrock of the Blackhawk Formation. The Blackhawk consists of interbedded layers of sandstone and siltstone, with individual layer thicknesses in the range of 3 to 5 feet. The rock is massive, with essentially no fracture zones or evidence of internal displacement. Thin coal lenses are found within the Blackhawk, as is evident from the log.

4.2 HYDROLOGY

Packer permeability tests were performed in the drillhole at various intervals to determine the in situ mass permeability of the Blackhawk Formation. The results of these tests are also presented on the drill log. Generally, the mass hydraulic conductivity (permeability coefficient, k) is indicated to be low, in the order of 10^{-6} cm/sec. This is consistent with the massive, fine-grained nature of the rock observed in the core.

Upon completion of the drilling, two piezometers were installed to measure piezometric levels in the Blackhawk Formation and in the surficial colluvium. At the time of the drilling, the colluvium was dry and water levels were stabilized at the top of the Blackhawk Formation. The piezometric level in the Blackhawk was also located at the top of the formation. Water quality determinations at the time of drilling are given in Table 4-1.

1979

TABLE 4-1

WATER QUALITY DATA - BLACKHAWK FORMATION
DRILLHOLE MC-205

Parameters	Results (6/25/79)
Acidity as $CaCO_3$ mg/1	32.000
Alkalinity as $CaCO_3$ mg/1	310.000
Bicarbonate as HCO_3 mg/1	378.200
Calcium as Ca mg/1	155.200
Chloride as Cl mg/1	380.000
Iron as Fe (Dissolved) mg/1	.041
Iron as Fe (Total) mg/1	.182
Magnesium as M9 mg/1	121.440
Manganese as Mn mg/1	.063
Potassium as K mg/1	14.400
Sodium as Na mg/1	90.200
Sulfate as S04 mg/1	240.000
Total Dissolved Solids mg/1	1,195.000
Conductivity	1,700.000
pH	8.400

4.3 SHAFT IMPACT ON THE HYDROLOGY

Preliminary computations of the expected inflow to the shaft during construction, based on an average hydraulic conductivity of 10^{-6} cm/sec, indicate a total inflow of less than 10 gallons per minute during construction, although local fissures in the rock may introduce larger rates. Upon completion of the construction the shaft will be sealed into the bedrock, thereby eliminating the water inflow.

The shaft does not penetrate any aquifers which are developed as a groundwater source within the area.

Due to the raise-bore technique, the water inflow will be into the mine and no surface discharge of water will be necessary. The computed inflow is essentially negligible and should result in a minimal impact to the hydrology of the bedrock formation. However, monitoring will be carried out in the established piezometers to establish the effects of the shaft construction.

5.0 SURFACE WATER INFORMATION

The proposed additions are situated in the northwestern draw of Sowbelly Gulch, an ephemeral stream. Surface flows are minimal and occur only after large precipitation events; for the majority of the year the stream is dry. A surface water monitoring station (B-17) is located in Sowbelly Creek below the No. 5 portal facilities to monitor water quality as a result of the operations. Data from this monitor point indicate no impact to date from the Sowbelly operation. This monitoring will continue throughout the life of the facilities. Results of water quality determinations to date are given on Figure 5-1.

6.0 CLIMATIC DATA

6.1 GENERAL

The proposed mine plan area is in a mean annual precipitation belt of 13 to 25 inches (U.S. Geological Survey 1978). Precipitation generally increases to the northwest, as shown by the isopleths on Figure 6-1. Most precipitation falling on the mine plan area is received in the form of snowfall during the winter months of January, February, and March. The majority of the rainfall on the area occurs in the late summer and early fall, with the peak in August. Mean monthly rainfall data collected at monitoring stations located at the Scofield Dam (west of the plan area) and at the Price Game Farm (south and east of the plan area) are presented on Figure 6-2 (Utah Division of Water Resources 1975).

Temperatures in the area vary seasonally with the high mean monthly temperature occurring in July and the low mean monthly temperature occurring in January. The summer season is short, with maximum temperatures in the low 80's; in winter, lows are in the range of from 5 to 10 degrees in January. Data from the monitor stations at Scofield Dam and Price Game Farm are presented on Figure 6-3.

Local air patterns in the central Utah Coal Basin area tend to follow the general drainage patterns; night breezes tend to flow down-drainage, due to the inducement of denser, cool air, while daytime breezes tend to flow up-drainage due to surface heating effects. Generally, however, the winds in the study are from the west and northwest. Winds generally do not exceed 20 miles per hour (U.S. Geological Survey 1978).

6.2 ENGINEERING CRITERIA

The principal impact of the regulations on the areas of concern is received from the requirements for protection of the hydrological regime. Presented below is a discussion of the background and criteria for the design of sediment control, diversion, drainage, and other hydraulic structures.

6.2.1 Regional Hydrology

Evaporation and infiltration rates in the area vary with vegetation, soil type, and time of year. Average annual potential evaporation in central Utah is 40 inches per year (Geraghty et al. 1973). Net infiltration rates for unfrozen soil under similar conditions to those found in the Helper area are around 0.50 inches per day (Gray 1973).

Most stream channels in the watersheds considered contain no flowing water except during snow melt or heavy rains. Willow Creek and Price River, however, flow continuously. Watershed runoff during storm events carries heavy sediment load. Cloudburst floods are relatively common in the area, with most occurring in the months of July and August (Butler & Marsell 1972). Velocities in natural stream channels during 100-year floods were calculated for various representative stream channels in the study area and found to range from 15 to 25 ft/sec. Reports and observations indicate sediment load during large storms is heavy, with some evidence of transported material greater than 2-1/2 feet in diameter.

6.2.2 Flow Calculations

Peak flows on the small watersheds in the study area were estimated using the Rational Method (Gray 1973). This method is based on the criteria that for storms of uniform intensity evenly distributed over the watershed, the maximum rate of runoff occurs when the entire watershed is contributing at the outlet and that this rate of runoff, or flow, is proportional to the rainfall intensity. The equation is:

$$Q = ciA$$

where:

- c = runoff coefficient
- i = maximum rainfall intensity, in./hr, whose duration is equal to the time of concentration of the watershed
- A = area of watershed, acres
- Q = peak flow, cfs

Maximum rainfall intensities for specified return periods were calculated using precipitation data from a gaging station at Price, Utah (Table 6-1), with the duration equal to the time of concentration. No gaging stations are located closer to the Castle Gate area. However, regional precipitation data for 6-hour and 24-hour events are available and are tabulated in Table 6-1 (NOAA Rainfall Frequency Atlas for Utah 1974). Generally the precipitation at the Price station is about 94 percent of that in the Castle Gate area; thus, the Price data were considered applicable to the study area when increased by about 6 percent.

The time of concentration can be determined from Gray (1973):

$$t_c = 0.0078\ L^{0.77} . S^{-0.385}$$

where:

t_c = time of concentration, minutes
L = maximum length of travel of water, feet
S = slope, equal to H/L where H is the difference in elevation between the most remote point on the basin and the outlet (feet).

TABLE 6-1

ESTIMATED RETURN PERIODS FOR SHORT DURATION PRECIPITATION (INCHES) - PRICE, UTAH*

Return Period (yrs)	Duration 5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.08	.13	.17	.23	.29	.37	.44	.62	.78	.95
2	.12	.18	.23	.32	.40	.49	.58	.80	1.00	1.20
5	.16	.25	.32	.44	.56	.68	.79	1.07	1.32	1.58
10	.20	.31	.39	.54	.68	.81	.94	1.25	1.53	1.82
25	.24	.37	.47	.65	.82	.98	1.13	1.50	1.83	2.18
50	.28	.43	.54	.75	.95	1.12	1.29	1.71	2.18	2.47
100	.31	.49	.62	.85	1.08	1.27	1.45	1.91	2.32	2.74

* Ref: Utah State University, 1971, Department of Soils and Biometeorology, Bulletin No. 1.

TABLE 6-2

PRECIPITATION FOR CASTLE GATE AREA**

Storm	Precip (in)	Storm	Precip (in)
2 yr-6 hr	.92	2 yr-24 hr	1.30
5 yr-6 hr	1.20	5 yr-24 hr	1.65
10 yr-6 hr	1.32	10 yr-24 hr	1.90
25 yr-6 hr	1.65	25 yr-24 hr	2.30
50 yr-6 hr	1.85	50 yr-24 hr	2.70
100 yr-6 hr	2.05	100 yr-24 hr	2.90

** Ref: National Oceanic and Atmospheric Administration, 1974, NOAA Atlas 2, Vol. VI, Rainfall Frequency Maps of Utah.

For very small watersheds, the Rational Method can result in unrealistically high intensities. Therefore, when the 100-year storm intensity was greater than half of the probable maximum thunderstorm, the 1/2 PMTS value was used (i = 3.25 hr./inches per hour; from USBR, "Design of Small Dams," Figure 20).

The runoff coefficient in the Rational Method is dependent on the topography, soil type, and vegetation of the watershed. Values for runoff coefficients can be found in Gray (1973), Table VIII.2. A conservative value of 0.80 was used for all flow calculations.

6.2.3 Channel Design

Diversion channels were conceptually designed using the Chezy-Manning equation:

$$Q = \frac{1.49}{n} A R_h^{2/3} S^{1/2}$$

where:

Q = flow, cfs
n = Manning roughness coefficient
A = cross-section area
R_h = hydraulic radius equal to A/P
P = wetted perimeter
S = slope

The roughness coefficient ranges between 0.035 for channels with earth and rubble sides and 0.050 for channels with jagged rock sides (Gray 1973). A coefficient of 0.050 is used.

Channels were designed, where possible, to cause no increase in the sediment contribution to the hydrologic system over that of natural channels. This was accomplished by keeping the velocity below 15 feet per second through the use of wide, shallow channels. Where it was not possible to reduce velocities sufficiently, riprap will be provided to prevent erosion.

6.2.4 Culvert Design

A culvert is needed at the major road/stream intersection at the foot of the pad area. It is designed to accommodate at least the 10-year storm, as required by the regulations. The culverts are to be corrugated metal pipe with headwall entrances and are to be buried to a depth of one-half their diameter or 1 foot, whichever is greater. Culvert dimensions were determined using nomographs for inlet controlled culverts provided in the U.S. Soil Conservation Service National Engineering Handbook, Section 4, Hydrology, 1969.

6.2.5 Storm Runoff

Runoff of the 10-year/24-hour storm from disturbed areas is required by the regulations to be retained or treated to reduce sediment. Rainfall from this storm is 1.93 inches (Table I). The U.S. Soil Conservation Service Handbook contains relationships between runoff volumes and precipitation amounts based on soil and vegetative conditions of the watershed. A curve number of 93 yields a runoff volume of 1.25 acre in./acre.

The volume of runoff from snowmelt can be determined. Twelve inches of accumulated snow at 10 percent water content yields a runoff volume of 0.12 acre in./acre, which is much less than the 10-year/24-hour storm runoff. Therefore, structures for returning runoff were designed for a volume of 1.25 acre in./acre.

Based on data developed by the USGS, a sediment load factor of 0.05 acre-ft/acre has been incorporated into the required retention volumes to take care of sediment accumulation.

7.0 VEGETATION DATA

Within the Mine Plan Area, three distinct plant associations are apparent. The locational occurrence of these associations is directly dependent on site elevation, slope, and aspect. A fairly wide transitional zone exists between these associations as a result of micro-environmental factors associated with a specific site. The three vegetative associations are as follows.

1. Mixed conifer association, found on the higher north-facing slopes in the Mine Plan Area. Principal tree species include Douglas-fir, subalpine fir, and white fir with ponderosa pine, quaking aspen, red maple, and willow occurring in lesser numbers and on those sites which provide the silvical necessities particular for the species. Shrub species present in this association include true mountain mahogany, serviceberry, chokeberry, and snowberry.

Presently, these stands are unmanaged and overstocked. Most of the canopy is comprised of the stagnated, codominant class. Merchantable timber over most of the area is limited to pulp and small pole-size stems. Saw timber within the Mine Plan Area is limited to small clusters of ponderosa pine and Douglas fir, which are too widely distributed to be economically significant given access considerations.

From the standpoint of wildlife habitat, this association provides moderate amounts of food, water, and shelter and serves as a summer range for deer and elk. The fir thickets also provide the required dense habitat for the blue grouse.

Since the activities described in the Mine Plan will be carried out at elevations below those required for this plant

association, little impact on this association as a result of mining is anticipated.

2. Mountain Brush Association is found on south-facing slopes of higher elevations and on slopes of all aspects at the intermediate elevations. The only commercial tree species within this association is quaking aspen, and its occurrence is restricted primarily to the banks of the various intermittent and ephemeral streams and washes which dissect the area. The remainder of this association is comprised of a mixture of scrub trees and bush which includes gamble oak, true mountain mahogany, cliff-rose, curleaf mahogany, and Rocky Mountain maple. To a lesser extent, sagebrush, rabbit brush, bitterbush, and Mormon tea are also present.

The limited rainfall associated with this geographic area of the country in combination with the slope and aspect of the topography and sandy-stony nature of the soils create a xeric environment for all members of this species association.

Consequently, stand densities of the population are, and will remain, low.

From a wildlife standpoint, the area provides limited browse to deer and elk and additionally provides habitat for a moderate population of small game and non-game rodents. These latter animals serve as the primary food source for the higher order carnivores and raptors which inhabit the higher elevations.

Surface activities proposed in the Mine Plan will result in limited surface disturbance to this vegetative association. This disturbance will, however, be of negligible impact due to the very limited size of the areas affected. Deer and elk are commonly observed in and around the mine site, especially during the

winter when the cleared roads provide easier mobility. Rodent populations in and around the mine site are likewise expected to increase, partly as a result of increased cover due to construction disturbance and storage areas and partly as a result of preferential predator avoidance of the small mine site area.

3. Pinyon-Juniper Association is found on the lower elevations within the Mine Plan Area. At elevations above 550 feet it generally becomes mixed with, and as elevation increases, gives way to The Mountain Brush Association. The principal species in the Pinyon-Juniper Association includes Pinyon Pine, Utah juniper, Rocky Mountain juniper, sagebrush, mountain mahogany, serviceberry, and rabbit brush. The only species of commercial importance within this association is Pinyon Pine. The seeds or pinyon nuts are of limited commercial importance, being harvested in the fall and either used by the individual or sold.

As in the case of the Mountain Brush Association, stand densities are low due to adverse site conditions and xeric soil moisture regime. Ground cover densities within the association are generally 30 percent or less.

In terms of wildlife resources, the area offers year-round habitat to small rodents and provides limited winter range for deer and elk. For reasons cited in the discussion of the Mountain Brush Association, the wildlife impact resultant from development of the limited surfaces areas addressed in the Mine Plan will be minimal.

As a result of an inquiry in 1978, the Bureau of Land Management indicated that there were no proposed or listed, threatened, or endangered species which were known to exist on the Mine Plan Area.

Revegetation of surface areas disturbed during the life of the Mine Plan will be accomplished by application of necessary soil amendments (lime, fertilizer, etc.) as indicated by a soil test, planting affected areas with recommended seed mixtures during the mid- to late fall, and mulching the area. The seeding mixture recommended for this property by The Bureau of Land Management (Moab District, Price River Resource Area) is presented in Section 2.1. Alternative seeding mixtures will be used if required by the regulatory authorities or recommended by resource conservation agencies as a result of further research.

8.0 FISH AND WILDLIFE RESOURCE INFORMATION

8.1 GENERAL

The Mine Plan Area for Braztah encompasses portions of the West Tavaputs and Wasatch plateaus in Carbon County, Utah. The State of Utah Division of Wildlife Resources Publication No. 78-16, "Species List of Vertebrate Wildlife that Inhabit Southeastern Utah," adequately identifies occurrence, status, population trend, and habitat use areas for wildlife species that inhabit the Wasatch and West Tavaputs plateaus. Generally speaking, the Mine Plan Area is inhabited on occasion and during different seasons of the year by about 368 species of vertebrate wildlife (7 fish species, 6 amphibian species, 19 reptile species, 249 bird species, and 87 mammal species), some of which are considered to be high interest species for the habitats and local area represented. High interest wildlife are defined as all game species; any economically important species; and any species of special aesthetic, scientific, or educational significance. This definition would include all federally listed, threatened, and endangered species of wildlife.

8.2 HABITAT AREAS

The attached map (Figure 8-1) displays mapable, high value habitats for high interest wildlife (mule deer, elk, sage grouse, and golden and bald eagles) on and adjacent to the Mine Plan Area. Mule deer and elk normally utilize the crucial-critical and high-priority winter ranges between November 1 and May 15 each year. The year-long sage grouse use area has been ranked as being crucial-critical to the birds' survival.

In the instance of the eagles, it is important to note that golden eagles are common, year-around residents of the Mine Plan

Area and extremely sensitive to disturbance within 1/4 mile of an active nest site between April 15 and June 15. Bald eagles are winter residents between November 15 and March 15 each year. To date, no roost trees have been identified on or adjacent to the Mine Plan Area. No bald eagles are currently known to nest in Utah.

It should be noted that in addition to the mapable areas of high value habitat that have been ranked as being either crucial-critical or of high-priority to some wildlife, the entire lease area provides high-priority yearlong habitat for cougar and black bear. Mountain cottontail (above 7,000 feet elevation), desert cottontail (below 7,000 feet elevation), mourning doves, ruffed and blue grouse also inhabit the Mine Plan Area. The entire lease area provides high-priority, yearlong habitat for cottontail rabbits. Mourning doves inhabit the Mine Plan Area between May 1 and September 15 each year; they nest throughout most of this period. Ruffed grouse, for the most part, are dependent upon wildlands vegetated by aspen and coniferous vegetation that are located within 1/4 mile of stream courses. These areas are crucial-critical, yearlong use areas for ruffed grouse. Blue grouse utilize the mountain brush and coniferous areas of wildlands and are not dependent upon stream courses. The mountain brush zones provide crucial-critical breeding territories for blue grouse between March 15 and June 15 each year. The high elevation, mature stands of Douglas fir are crucial-critical winter range for blue grouse during December, January, and February each year.

It should be noted that the high elevation mountain habitats provide summer range for a substantial number of mule deer and some elk between May 16 and October 31 each year. Fawning/calving and rearing processes take place on the summer range.

8.3 SPECIES DESIGNATION

Since Utah's Division of Oil, Gas and Mining and the U.S. Fish and Wildlife Service have been provided with a copy of the publication, "Vertebrate Wildlife That Inhabit Southeastern Utah," there is no apparent reason why all of the species that occur on the mine plan area should be listed. Additionally, it is not believed that detailed population studies of wildlife specific to the Mine Plan Area should be required.

8.4 RESTORATION STUDIES

The primary effort will be placed on identifying species of vegetation in each vegetative association for the purposes of reclamation. If satisfactory reclamation is achieved and man's disturbance does not continue or become a factor, then most species of wildlife will return. Without doubt, the key to success for enhancing or restoring wildlands will be development of habitats so that the post-mining condition will have similar species, frequency, and distribution of permanent plants in each vegetative type that will allow for natural plant succession.

9.0 SOIL RESOURCES

9.1 GENERAL

The state of Utah is divided into 57 soil survey units. Not all of these units have been surveyed in detail: Figure 9-1 presents the units and the status of survey data for each unit. As is evident, regional, detailed soil survey data are not available in the vicinity of the Mine Plan Area. This is primarily due to the low demand for soil data in this area; land use is minimal due to the badlands-type topography. Therefore, the data presented in the following discussion has been collected from several sources in order to summarize conditions within the Mine Plan Area.

The Mine Plan Area is at the juncture of three major physiographic sections of east-central Utah known as the Wasatch Plateau, the Book Cliffs, and the Mancos Shale Lowland (Figure 9-2). The soils of the area have been formed primarily by sedimentary bedrock weathering, but vary in response to such host environments as geology, topography, climate and, vegetation (U.S. Geological Survey 1978). The general soil types characteristic of the physiographic sections are described below.

9.2 SOILS OF THE WASATCH PLATEAU SECTION

The Mine Plan Area lies along the eastern front of the Wasatch Plateau. This portion of the plateau is steep, with high escarpment conditions. The area is mountainous and is characterized by steep cliffs and deeply incised drainages. The soils are rocky, generally found at the base of the cliffs, and support little vegetation. Generally, the soils of this area are identified as high mountain types and are easily erodable if uncovered or disturbed.

TABLE 9-1 SOIL TYPES AND DESCRIPTIONS

Map Symbol	Taxinomic Classification	Soil Depth	Drainage class	Surface Soil texture	Subsoil texture	Soil reaction	Per-meability	Major limiting factors	Dominant Species in Climax Vegetation (in descending order of yield)
	Argic Cryoborolls	Deep to moderately deep (20-36"+)	Moderately well to somewhat excessively drained	Silt loam to clay loam	Cobbly loam to clay loam	Slightly alkaline to strongly acid	Slow to rapid	Steep slopes. Some areas with unstable soils, high elevations, some rocky areas.	Douglas fir, subalpine fir, Englemann spruce, Lodgepole pine
	Pachic Cryoborolls								blue wildrye, mountain brome, edible valerian, bearded wheat grass, quaking aspen
	Cryic Paleborolls								quaking aspen, blue wildrye, bearded wheatgrass, slender wheatgrass, mallow ninebark
									slender wheatgrass, basin wildrye, Gambel oak, mountain brome, bitterbrush
									bigtooth maple, blue wildrye, Gambel oak, mallow ninebark, chokecherry
	Typic Argiborolls	Shallow to deep (10-36"+)	Well drained	Gravelly loam to silty clay loam	Cobbly loam to cobbly clay loam	Neutral to moderately alkaline	Slow to moderate	Steep slopes, shallow soils, some areas with unstable soils, somewhat limited precipitation 14-20".	mountain brome, Nevada bluegrass, antelope bitterbrush, Gambel oak, muttongrass
	Lithic Argiborolls								Gambel oak, Nevada bluegrass, slender wheatgrass, antelope bitterbrush, birch leaf mountain mahogany
	Typic Haploborolls								pinyon pine, Utah juniper, Indian ricegrass, muttongrass, serviceberry
									blue bunch wheatgrass, galleta, muttongrass, neddleandthread, prickly pear
									needleandthread, Nevada bluegrass, big sagebrush, western wheatgrass, black sagebrush
									no data
	Badland-Rockland	This is a miscellaneous landtype. This area is mainly barren shale and sandstone. The relief is steep to very steep dissected mountains, plateaus, escarpments, and breaks along canyons.							

(Ref: USGS, 1978.)

9.3 SOILS OF THE BOOK CLIFFS SECTION

The soils of the Book Cliffs are derived from weathering of the steep, deeply dissected cliffs of the area. The soils have formed from sandstone and shales. They commonly have a silt loam to loam surface, with a loam to clay loam subsoil. Erosion potential is moderate. Climate generally rules out vegetation in these soils within the Mine Plan Area.

9.4 SOILS OF THE MANCOS SHALE LOWLANDS SECTION

The Mancos Shale Lowland lies to the south of the junction between the Wasatch Plateau and the Book Cliffs, on the Mancos Shale Formation. The soils tend to be high in soluble salts and are generally a silty clay. Fertility is low. Due to the high clay content, they have a relatively high shrink-swell potential upon moisture content change. The soils in general are highly erodable.

9.5 SPECIFIC SOILS DATA IN THE MINE PLAN AREA

A general soil map of the Mine Plan Area is shown on Figure 9-3. The corresponding soil type description is found in Table 9-1 (data taken from Wilson et al. 1975 and U.S. Geological Survey 1978). Due to the general rocky nature of the terrain, the soils are quite variable, with drainage, texture, reaction, and land-use generally site-specific as a result of weathering and the parent rock materials.

The Argic Cryoborolls-Pac~~i~~hic Cryoborolls-Cryic Paleborolls Association, found to the west of the Price River on the Wasatch Plateau, is characteristic of the high mountain landform, with steep slopes, moderate to deep soil depths, and highly variable

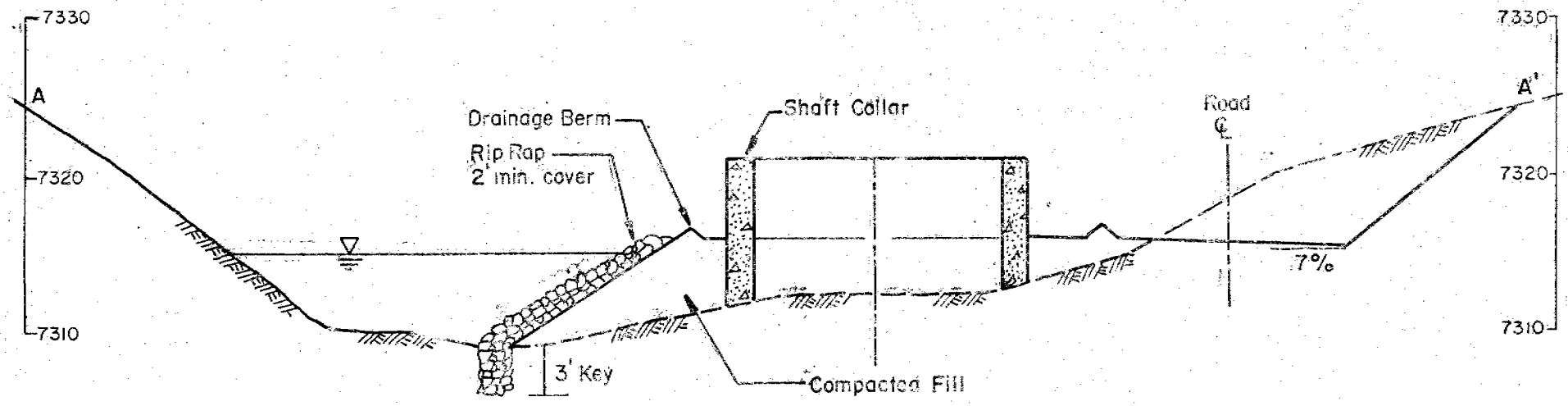
permeabilities. The association consists generally of 25 percent Argic Cryoborolls, 25 percent Pachic Cryoborolls, and 25 percent Cryic Paleborolls, with the remaining 25 percent consisting of varying amounts of Typic Cryoborolls, Cryic Pachic Paleborolls, Lithic Cryoborolls, Mollic Cryoboralls, and rock outcrop.

The majority of the area to the east of the Price River is covered by the Typic Argiborolls-Lithic Argiborolls-Typic Haploborolls Association. This association is characterized by steep slopes, shallow to deep soil cover (10 inches to 36 inches), and reasonably well-drained soils. The association generally is composed of 35 percent Typic Argiborolls, 20 percent Lithic Argiborolls, and 20 percent Tpic Haploborolls. The remaining 25 percent consists of Pachic Argiborolls, Argic Cryoborolls, and rock outcrop.

Badland-rockland topography is found in the northeastern section of the mine plan area. This area consists primarily of barren sandstones and shales, with steep relief.

A detailed soil resources study for the overall mine plan area will be presented in the application for the mining permit.

Project No. 78253A Reviewed CL Date 7-79



E. 2,160,500

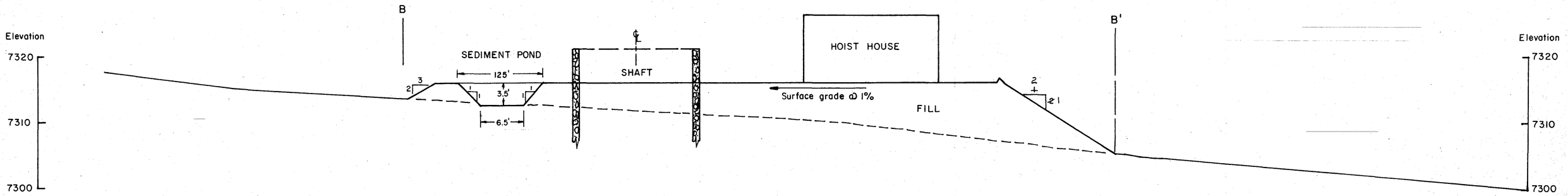
N 508,650

CROSS SECTION THROUGH SHAFT PAD (A-A')

Figure 3-4

CROSS - SECTION THROUGH SHAFT PAD (B - B')

Figure 3-5



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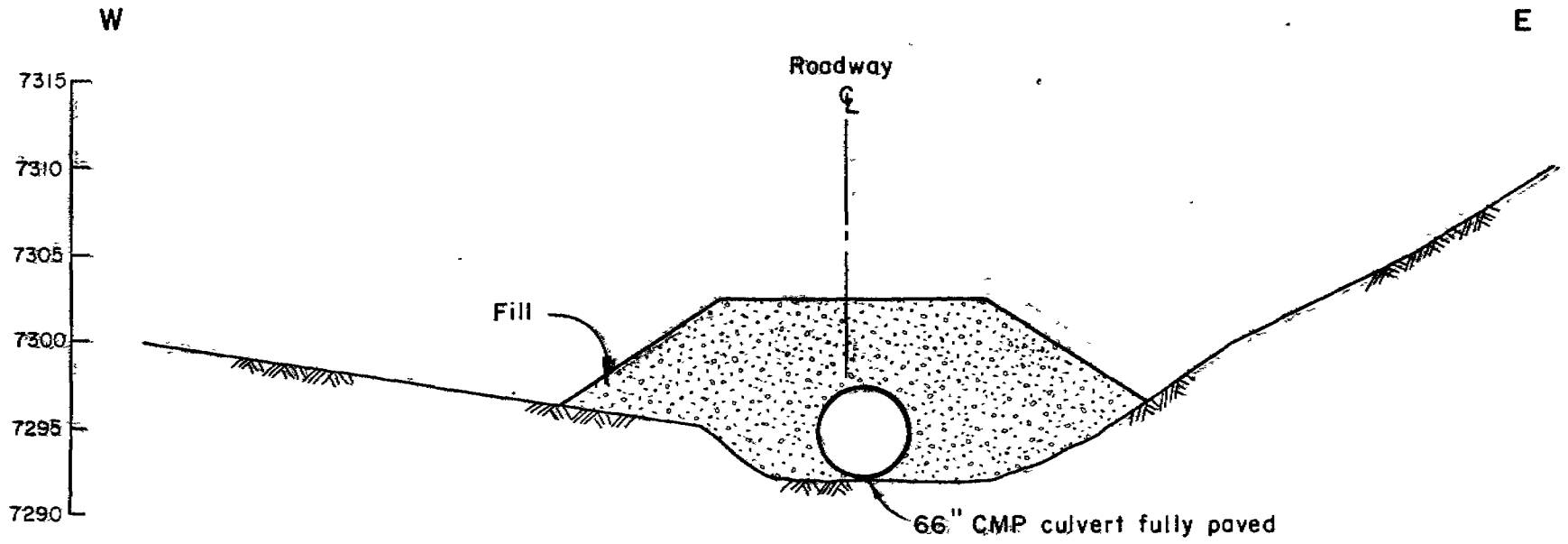
Project No 78253 A Reviewed CL Date 7/79



Scale: 1" = 10'

CULVERT DETAIL

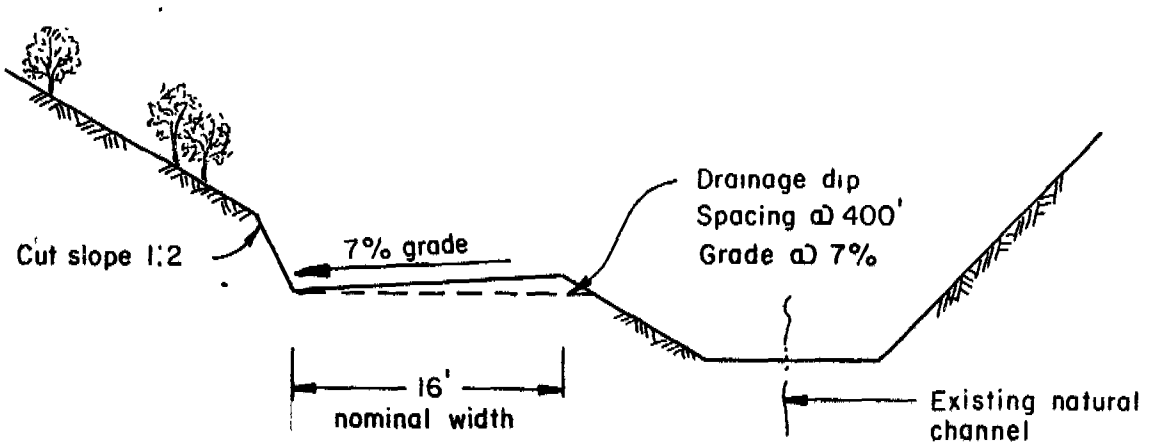
Figure 3.6

Golder Associates

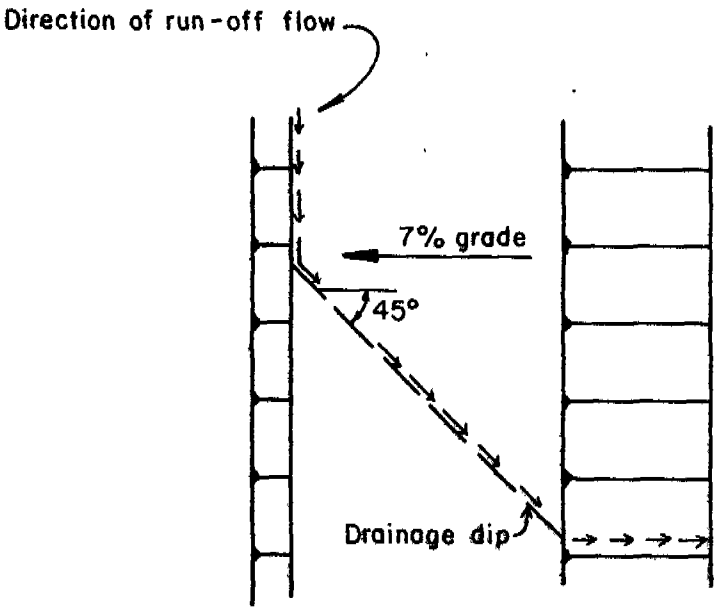
TYPICAL ROAD DETAIL

Figure 3-7

SECTION



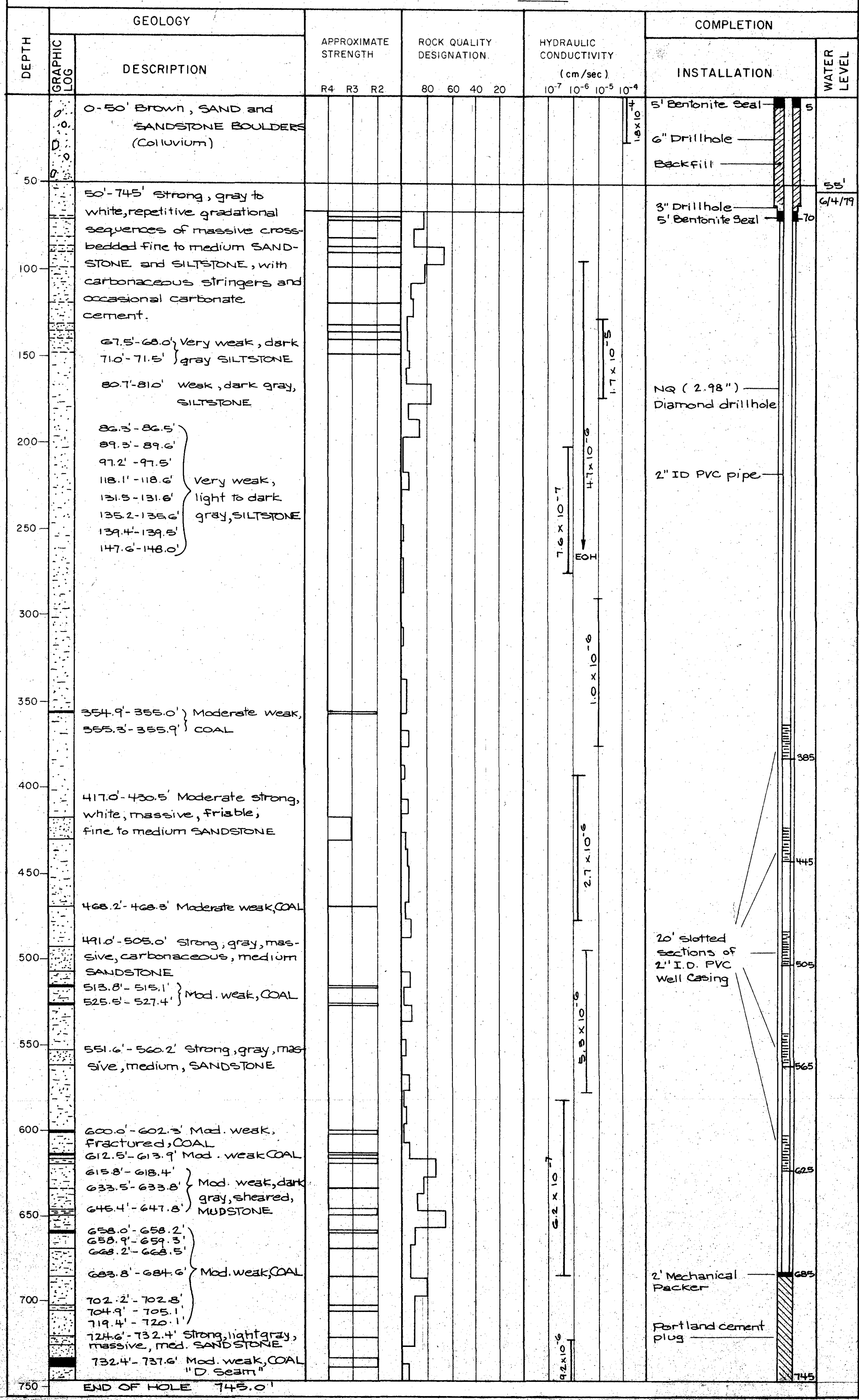
PLAN



Scale: 1" = 10'

Project No. 782334 Reviewed CL Date 7-79

DIAMOND DRILL HOLE Mc-205



DIAMOND DRILL HOLE Mc-205

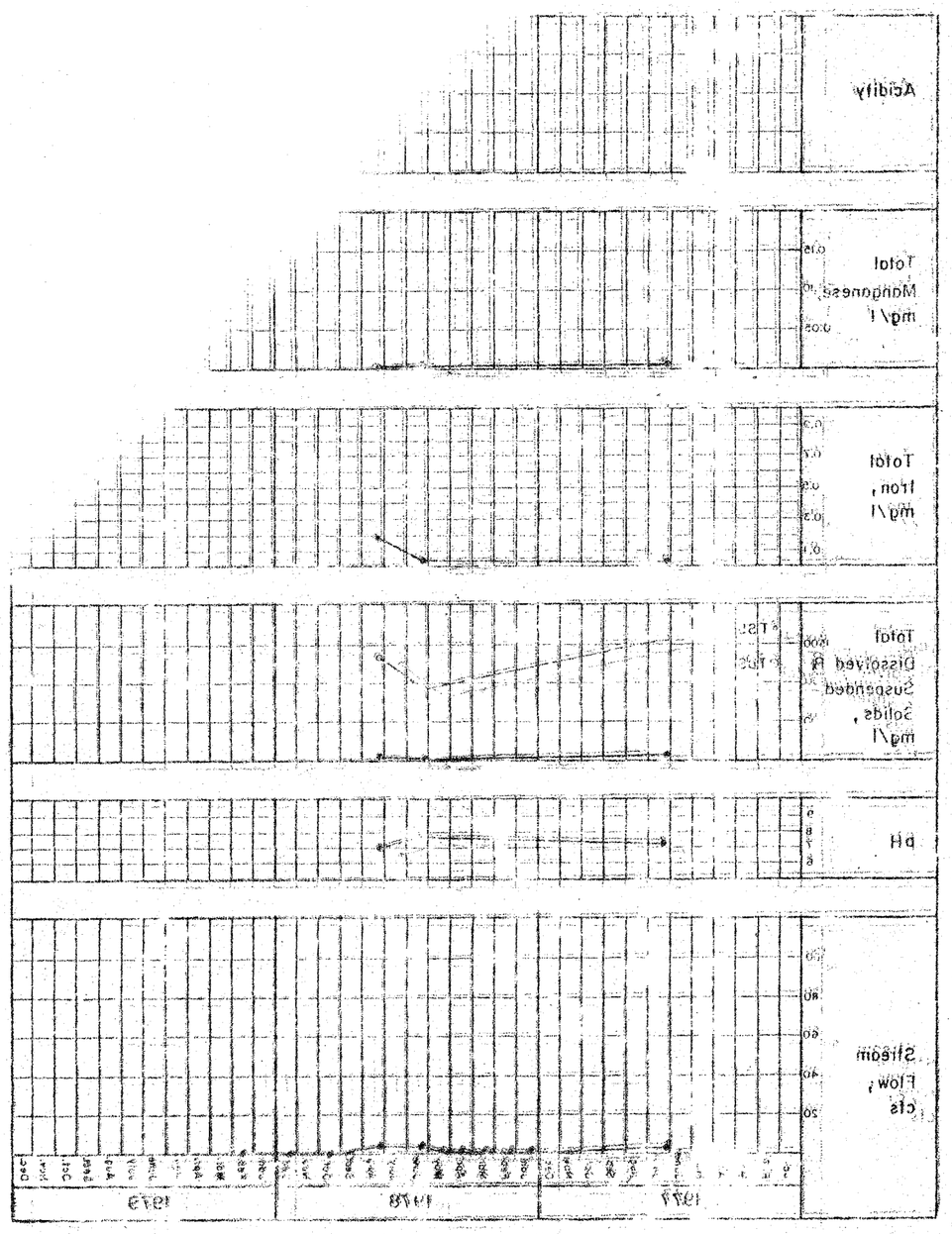
(Water Quality Monitoring Station B-41)

LOCATION: SOWBELLY CANYON
COLLAR ELEVATION:

DATE: Apr. 30 - May 17 '79
CORE SIZE: NQ

78253-A

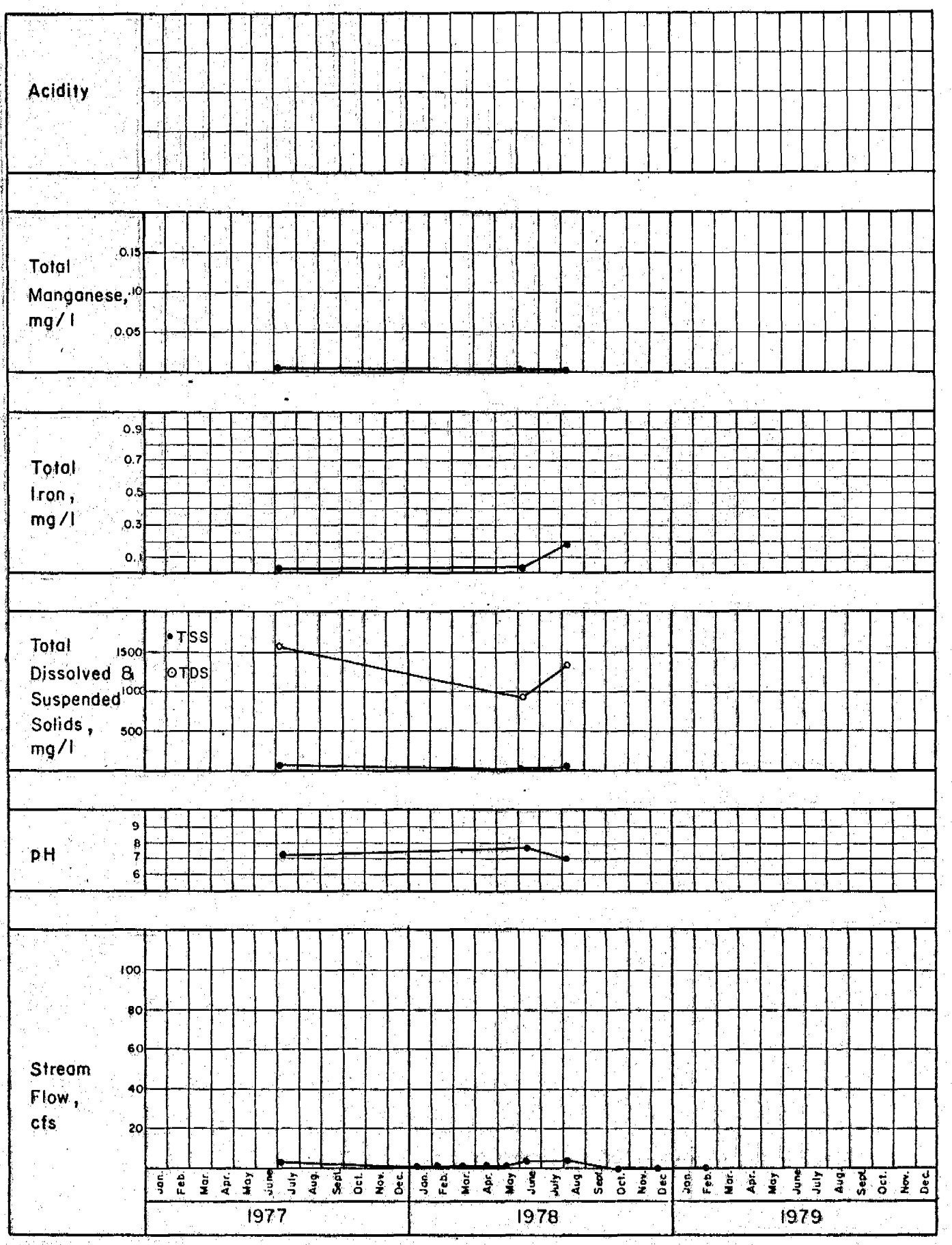
FIGURE 4-1


Acidity
Total Manganese, mg/l
Total Iron, mg/l
Total Dissolved R, Suspended Solids, mg/l
pH
Stream Flow, cfs
1979
1978
1977

WATER QUALITY MONITORING STATION B-17

SOWBELLY CREEK ABOVE SPRING CANYON CREEK

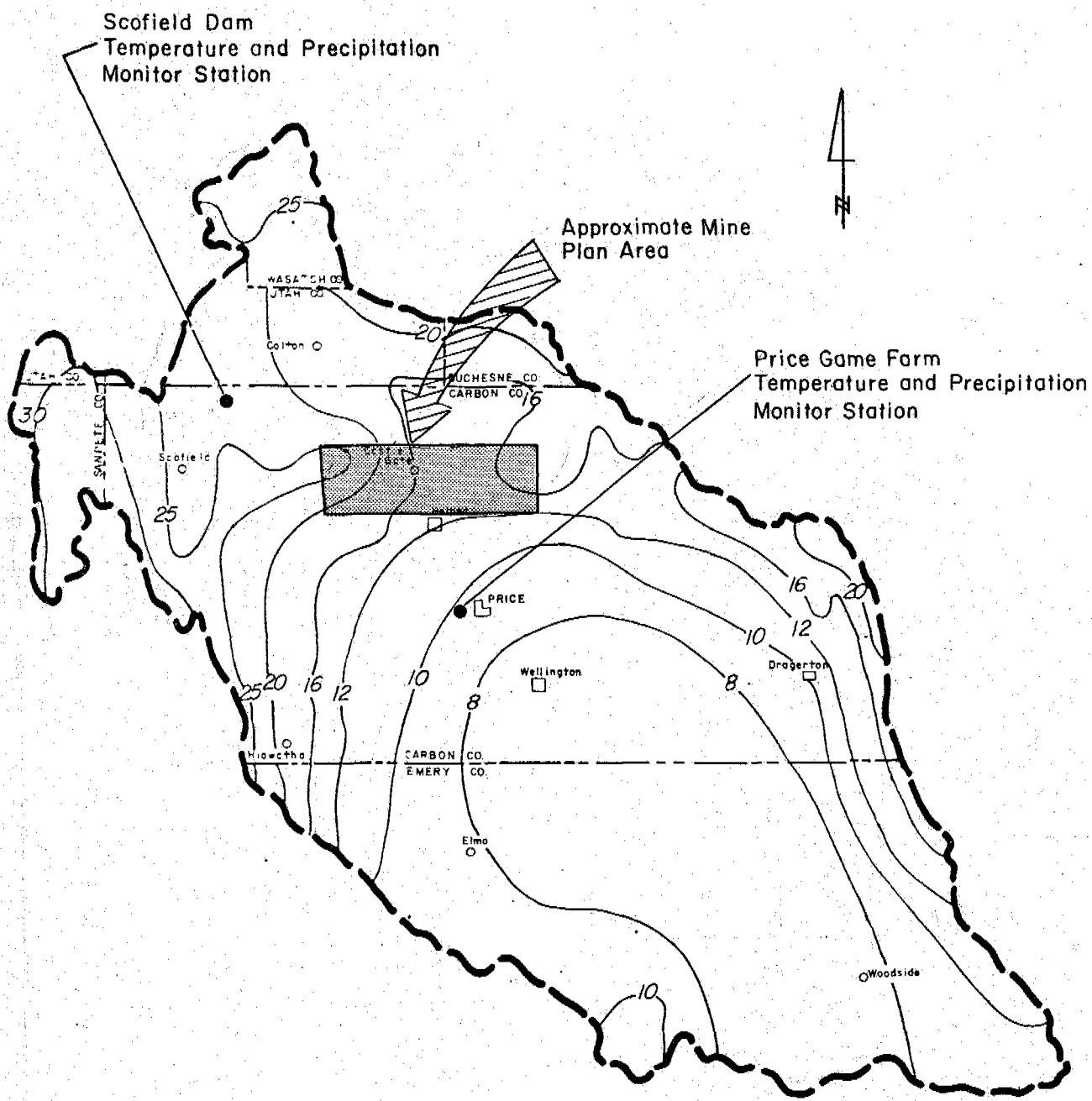
Figure 5-1



Project No. 78253 A Reviewed CL Date 5-79

ANNUAL PRECIPITATION
PRICE RIVER DRAINAGE

Figure 6-1



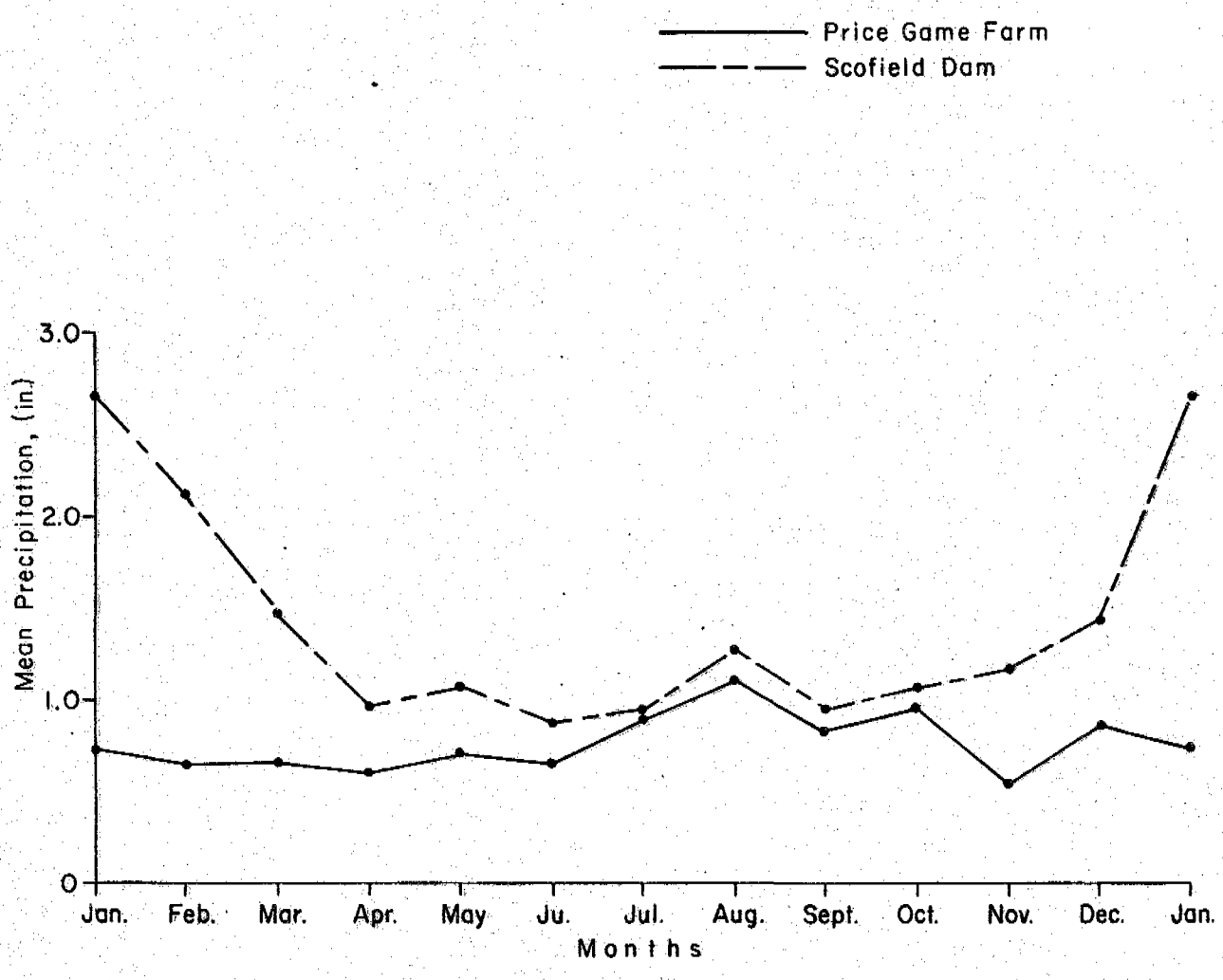
Scale 1: 500,000

Project No. 78 2531 Reviewed C.L. Date 5-79

MEAN MONTHLY PRECIPITATION
PRICE RIVER DRAINAGE

Figure 6 - 2

(from Utah Division of Water Resources, 1975)

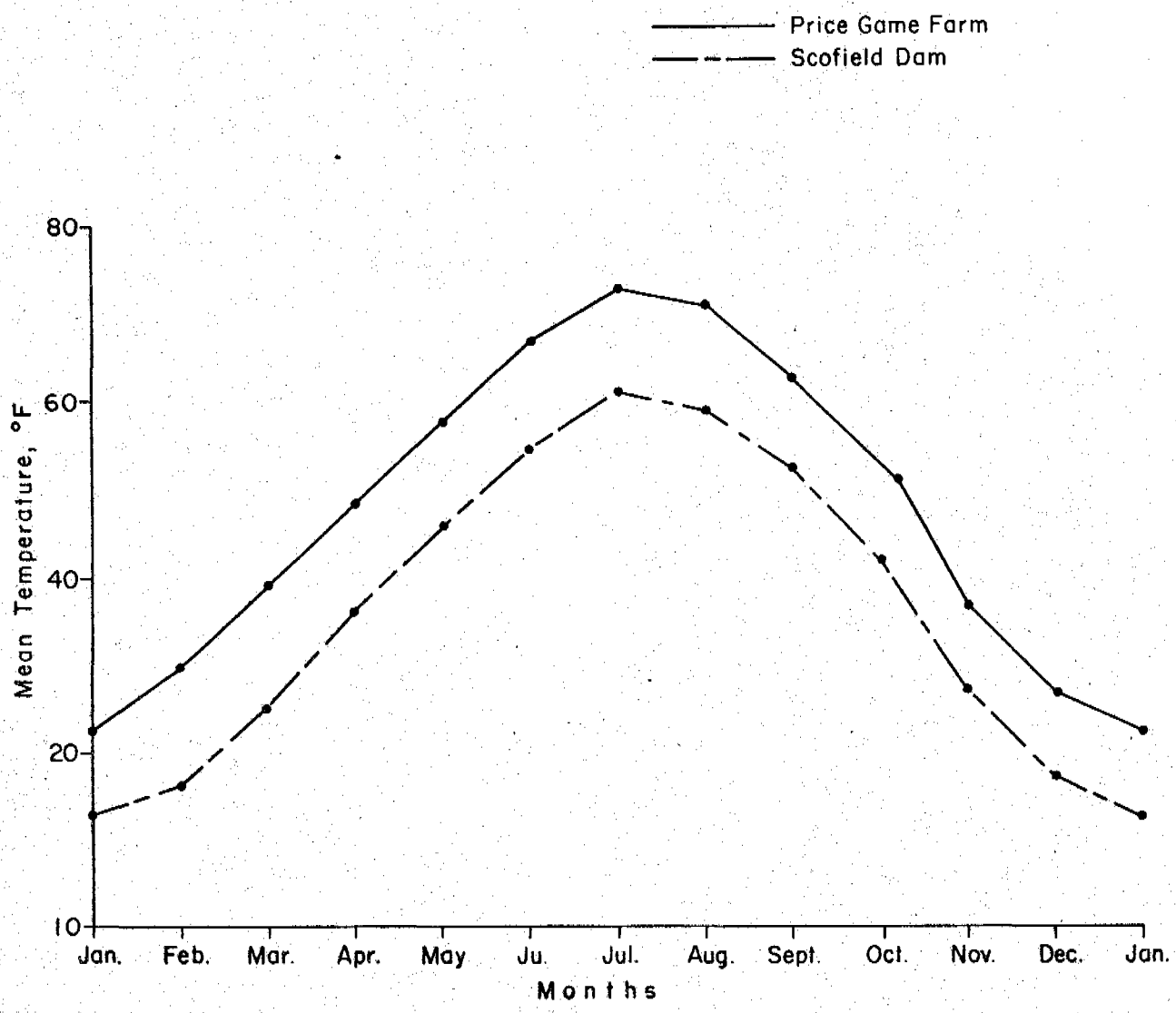


Project No. 782531 Reviewed CL Date 5-79

MEAN MONTHLY TEMPERATURE
PRICE RIVER DRAINAGE

Figure 6-3

(from Utah Division of Water Resources, 1975)

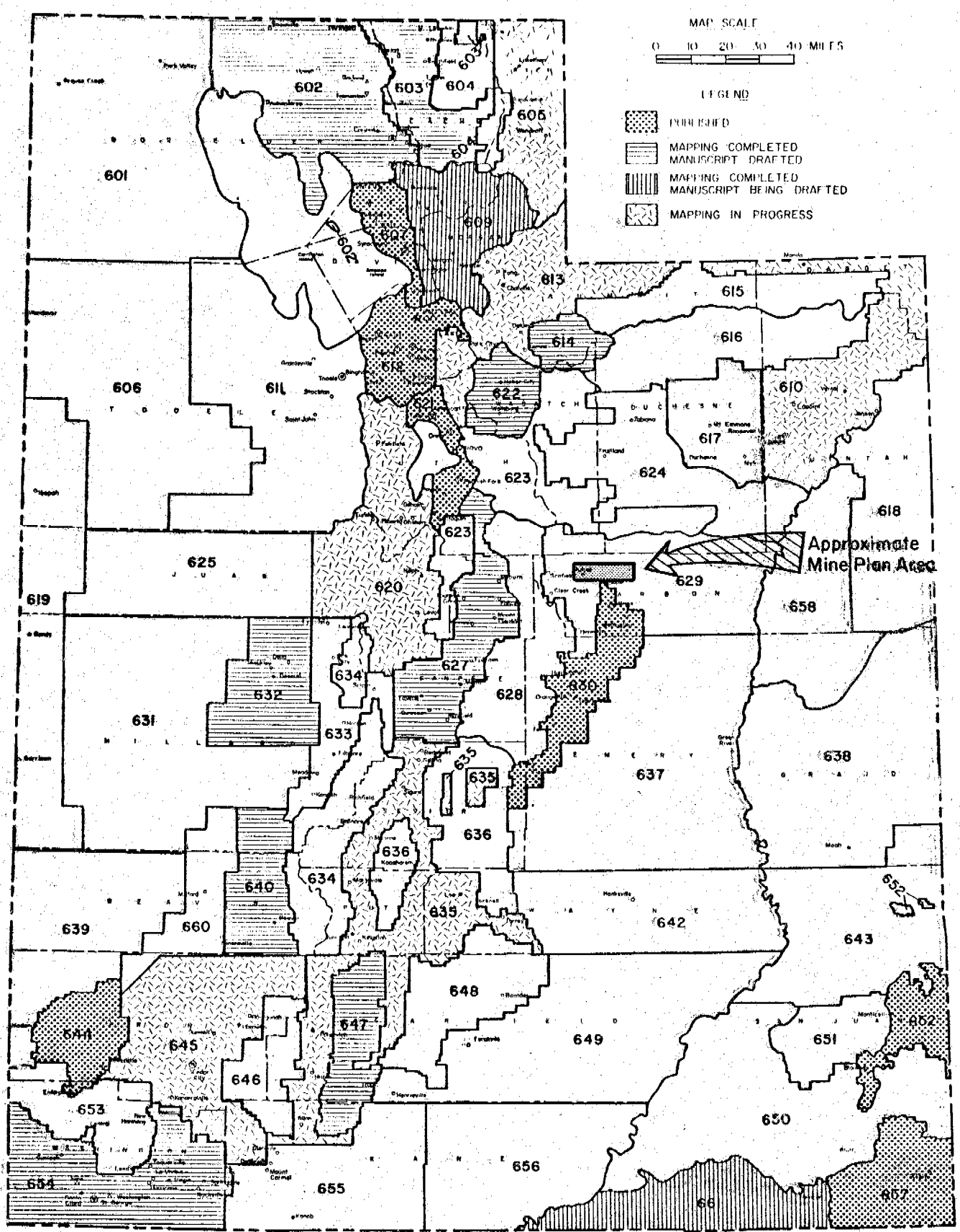


Project No. 78253A Reviewed C.L. Date 5-79

SOIL SURVEY DATA
UTAH

Figure 9-1

(Taken from Wilson et al, 1975)

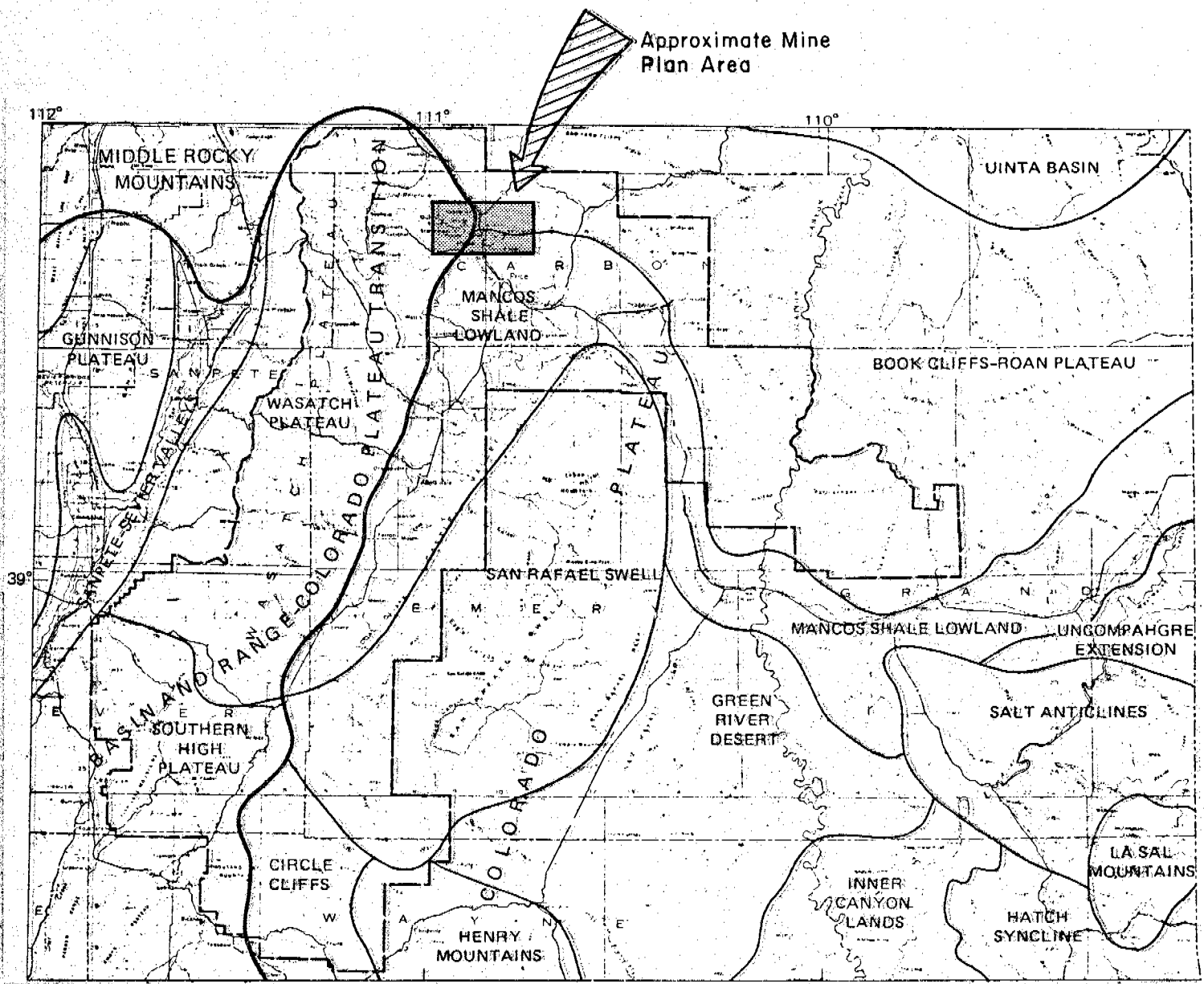


Project No. 78253 A Reviewed C.L. Date 6-79

MAJOR PHYSIOGRAPHIC UNITS
CENTRAL UTAH

Figure 9-2

(Taken from USGS, 1978)



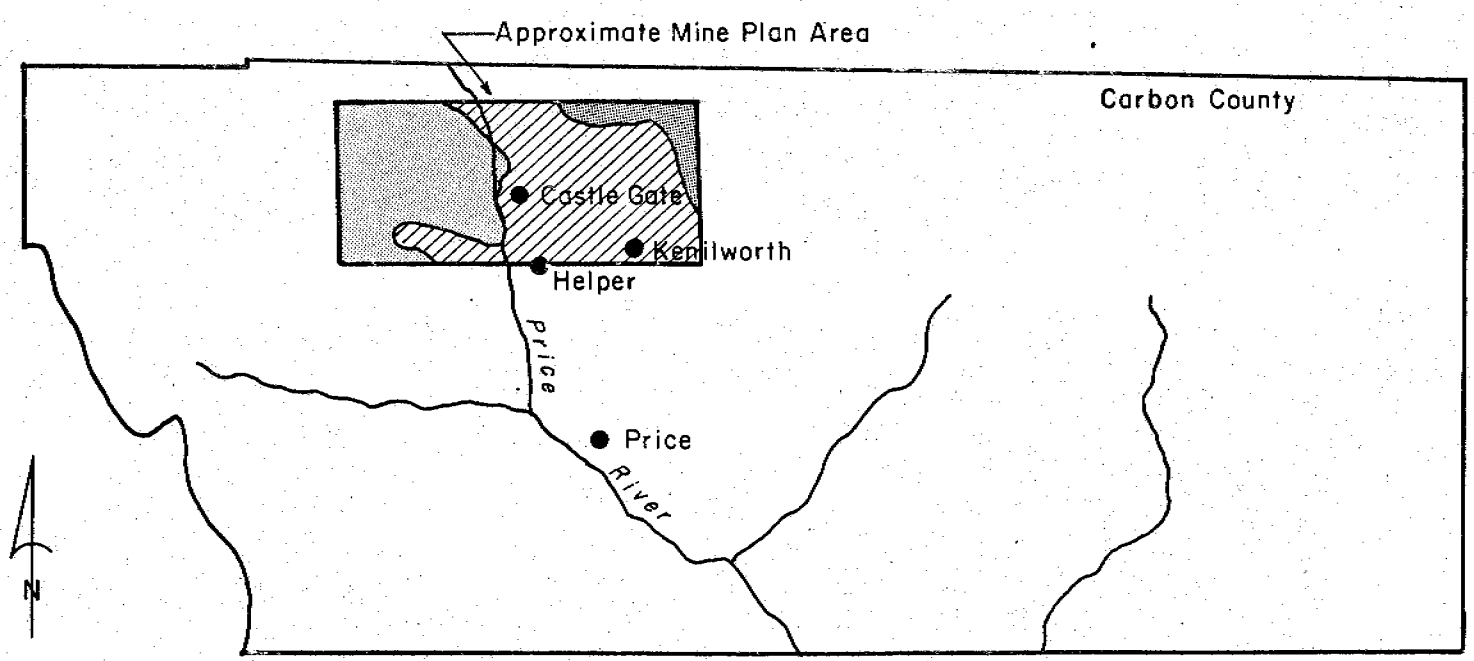
SCALE

0 10 20 30 40 50 Miles

Project No. 7253A Reviewed CL Date 5/79

Project No. 78253A Reviewed CL Date 7/79

DETAILED SOILS MAP



Argic Cryoborolls-Pachic Cryoborolls-Cryic Paleborolls Association

Typic Argiborolls-Lithic Argiborolls-Typic Haploborolls Association

Badland-Rockland Association

(Not to scale)

Figure 9-3