

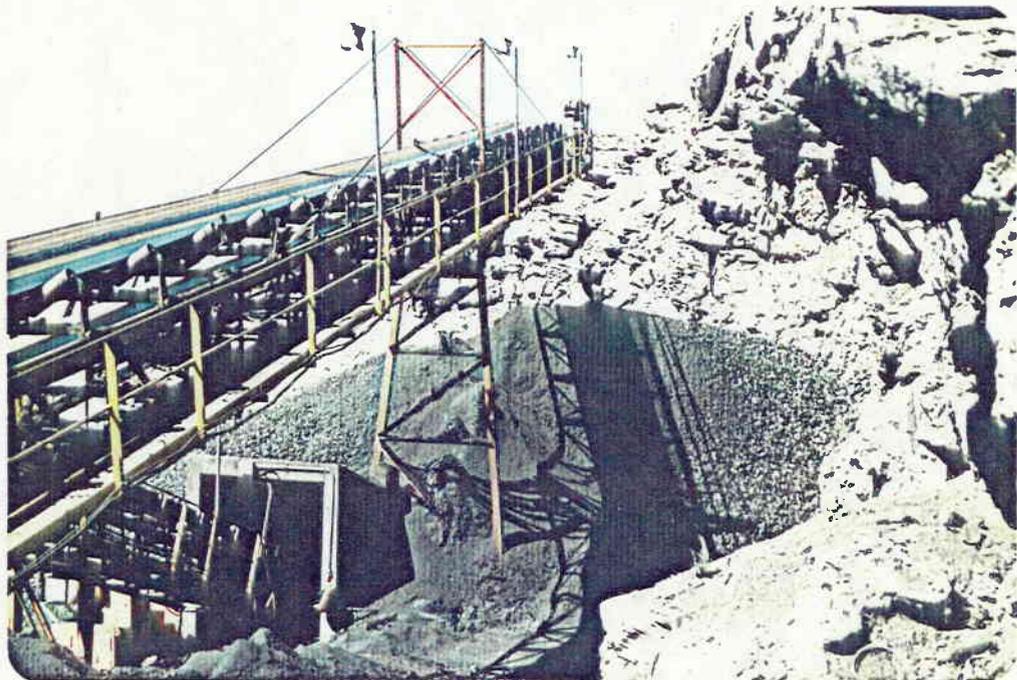
EMERY MINE
(Overview Looking East-Northeast)



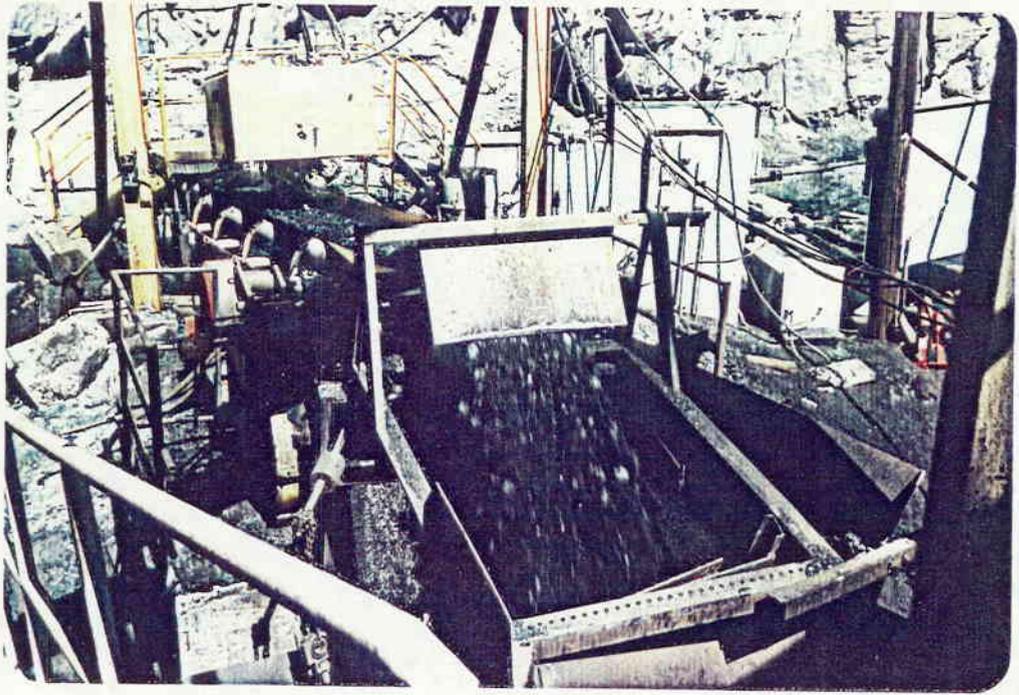
EMERY MINE
(Overview Looking Northeast)



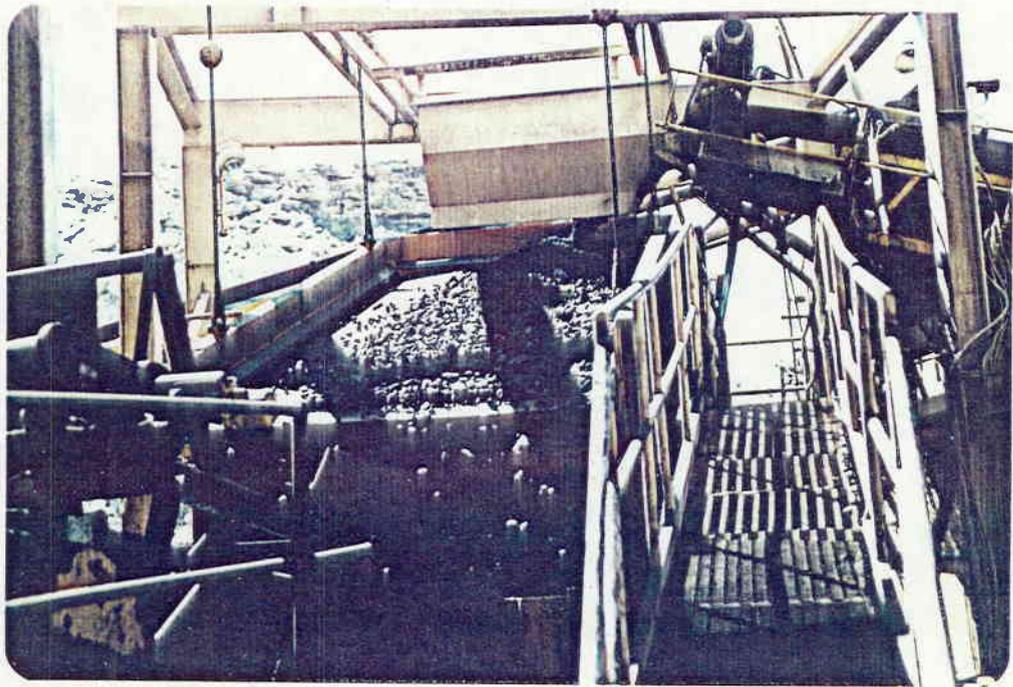
STACKER-RECLAIM SYSTEM
(Overview)
Map Code A-1



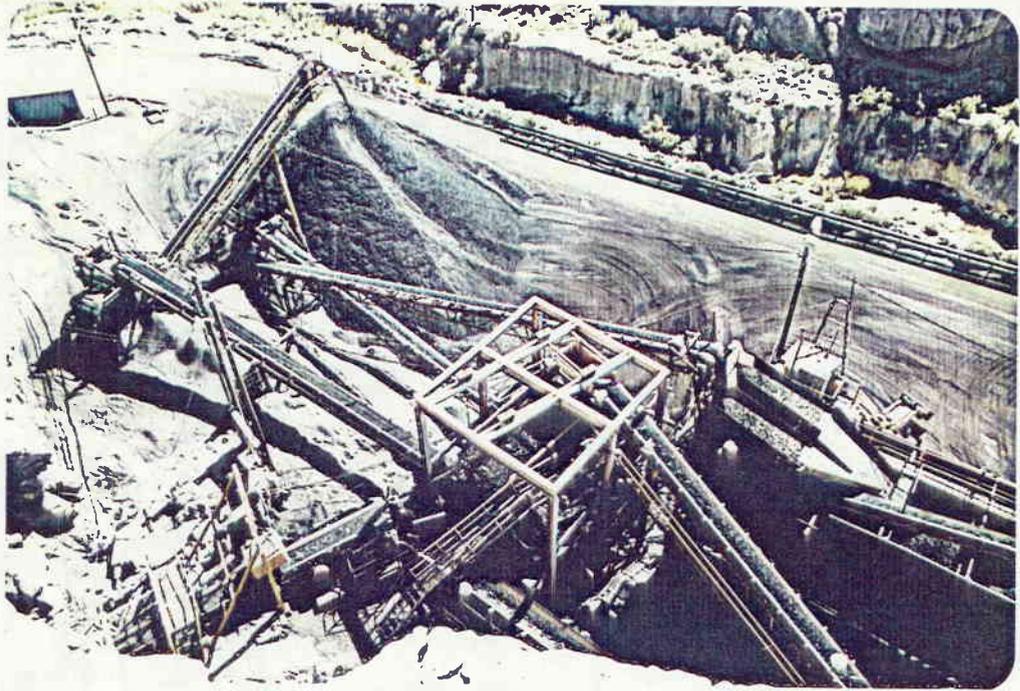
STACKER-RECLAIM SYSTEM
Map Code A-1



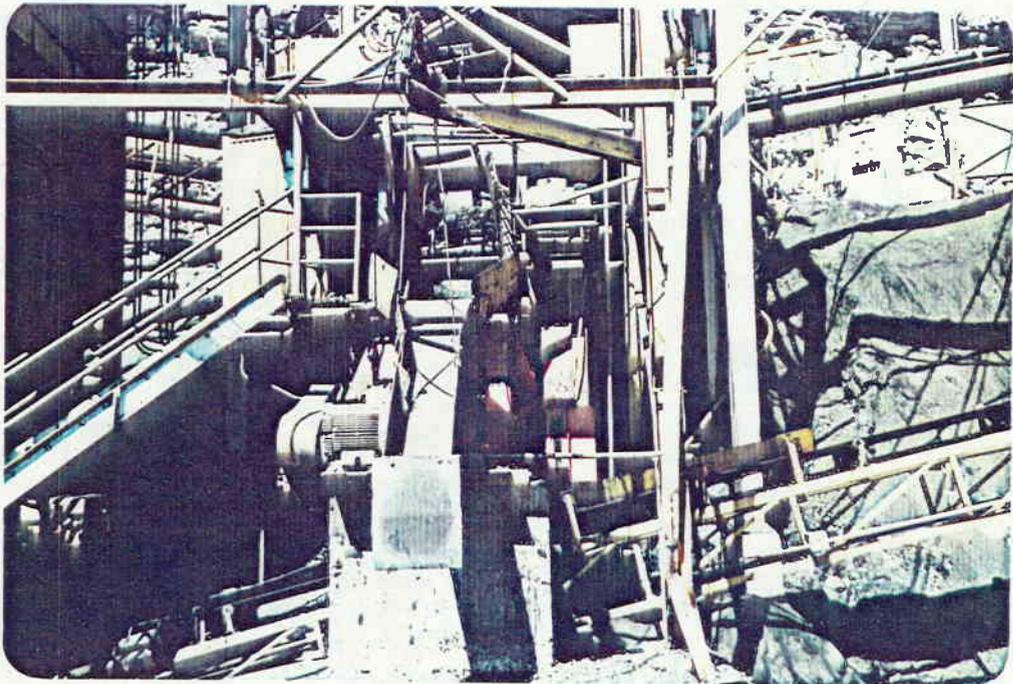
STACKER-RECLAIM SYSTEM
(Coal From Mine Entering Reclaim Feed)
Map Code 1-A



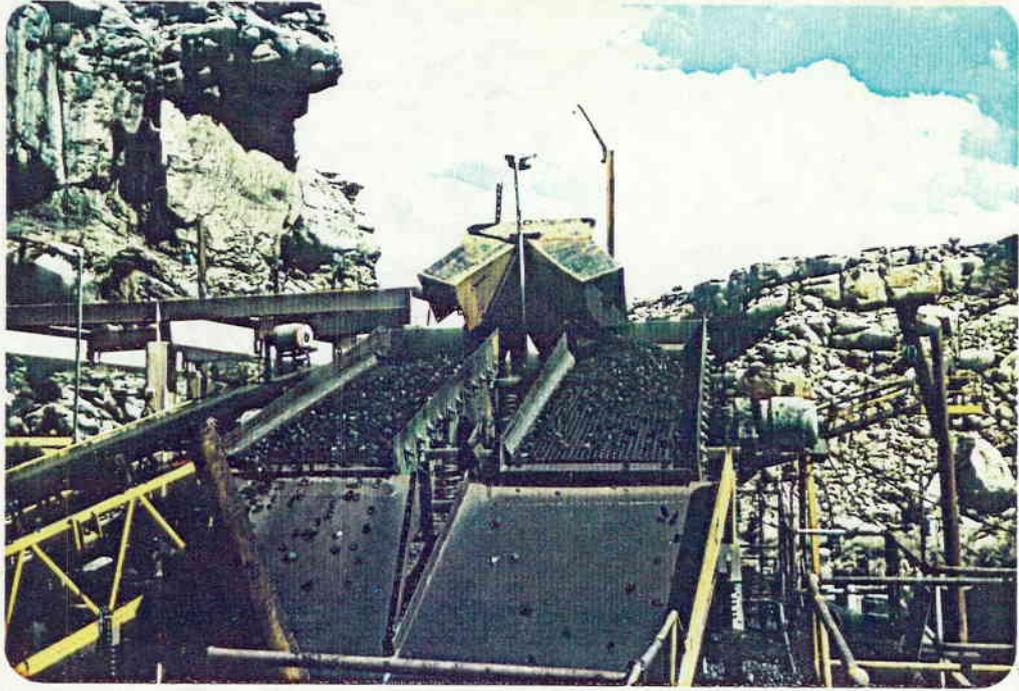
STACKER-RECLAIM SYSTEM
(Sizing of Coal Coming From Reclaim)
Map Code 1-A



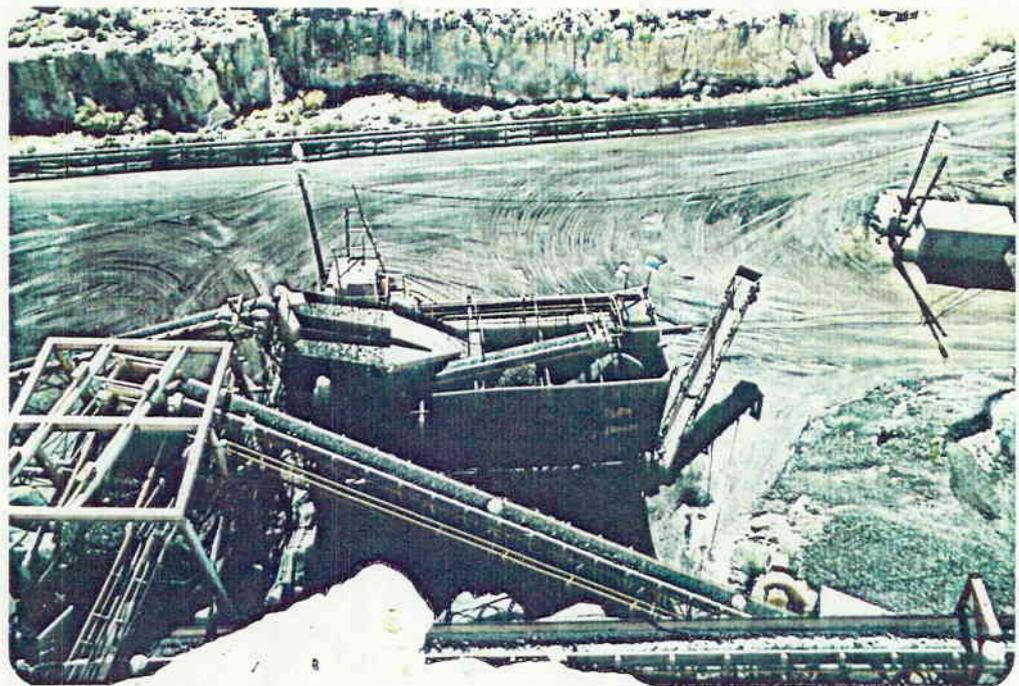
TIPPLE
(Overview)
Map Code 2-A



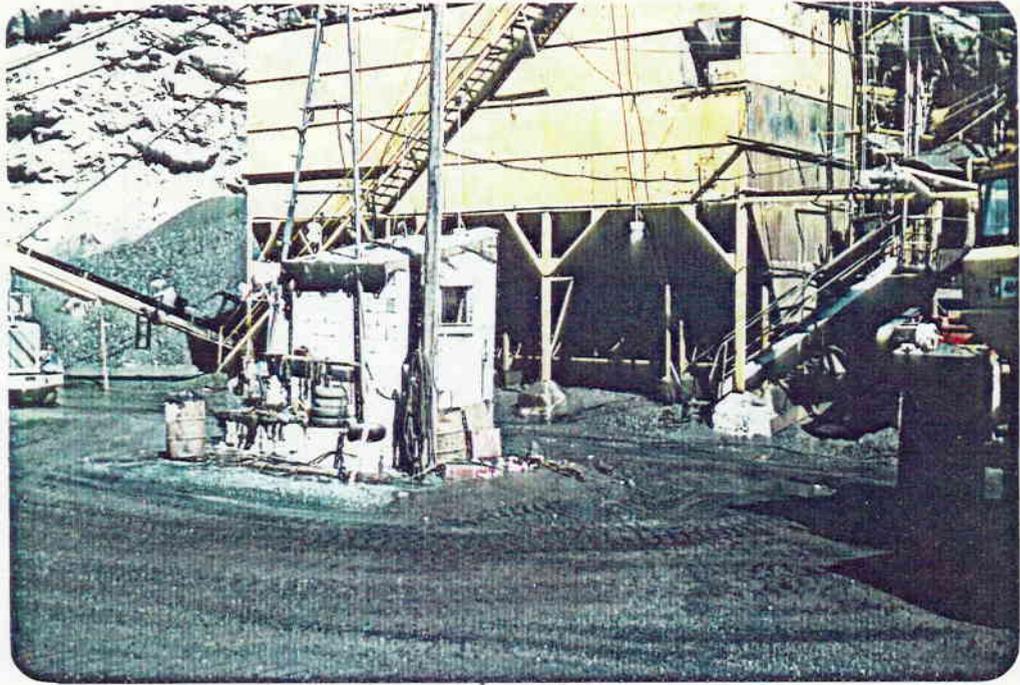
TIPPLE
(Oversize Crushing Station)
Map Code 2-A



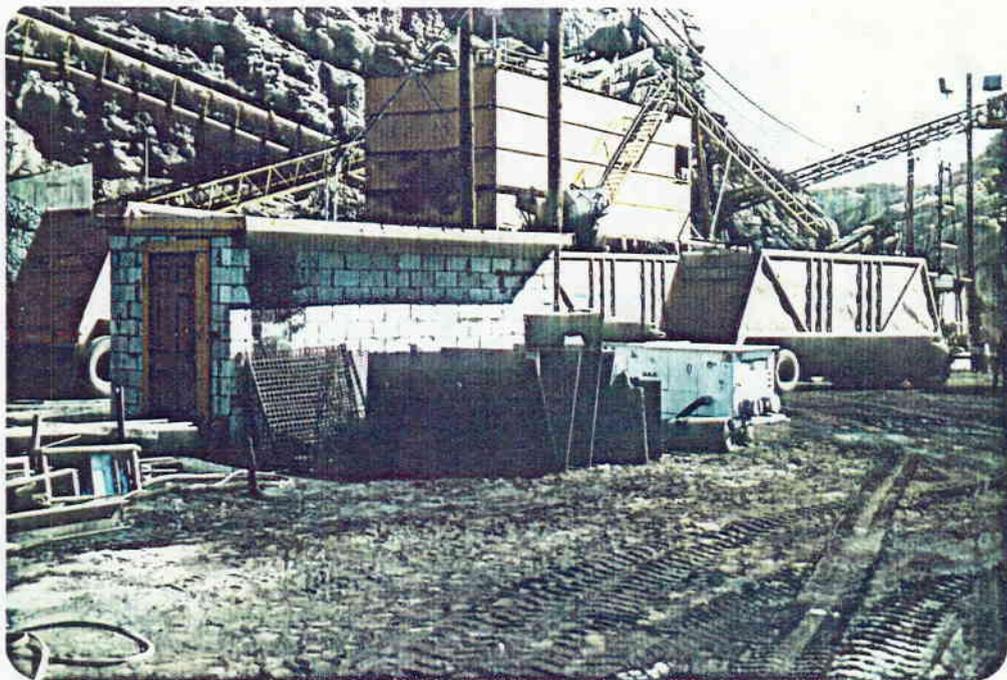
TIPPLE
(Stoker Coal Screening)
Map Code 2-A



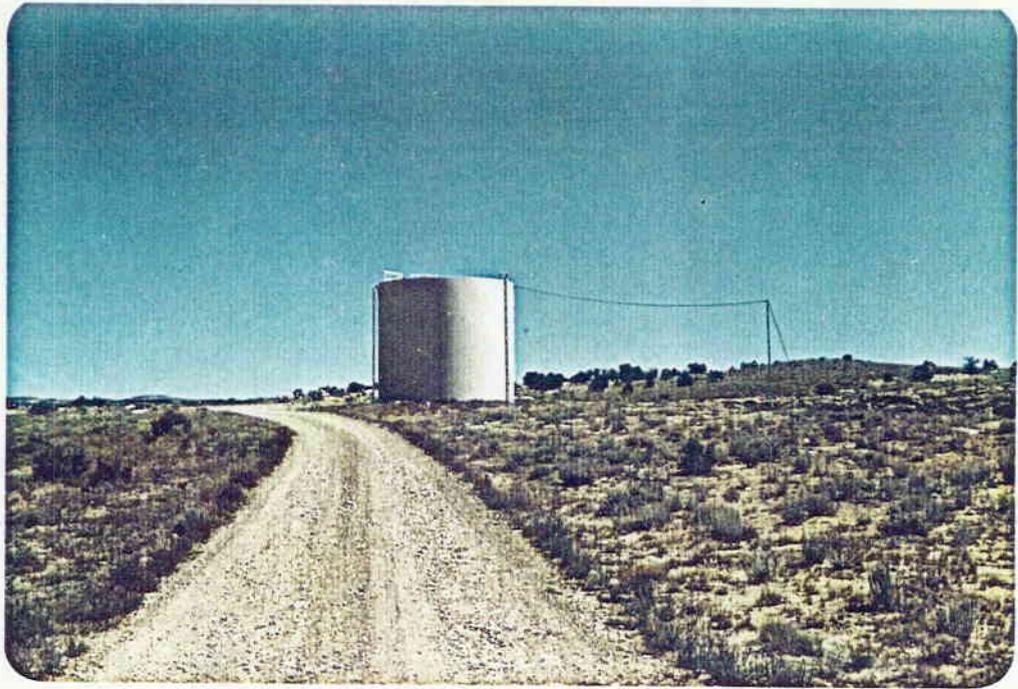
TIPPLE
(Stoker Coal Screening and Storage Bins)
Map Code 2-A



TIPPLE CONTROL STATION
Map Code 3-A



STOKER OIL HEATER
(Heater Unit Building)
Map Code 4-A



100,000 GALLON WATER TANK
Map Code 5-A



FRESH WATER TREATMENT BUILDING
(Outside)
Map Code 6-A



FRESH WATER TREATMENT BUILDING
(Reverse Osmosis Equipment)
Map Code 6-A



EVAPORATION LAGOON
(Overview)
Map Code 1-B



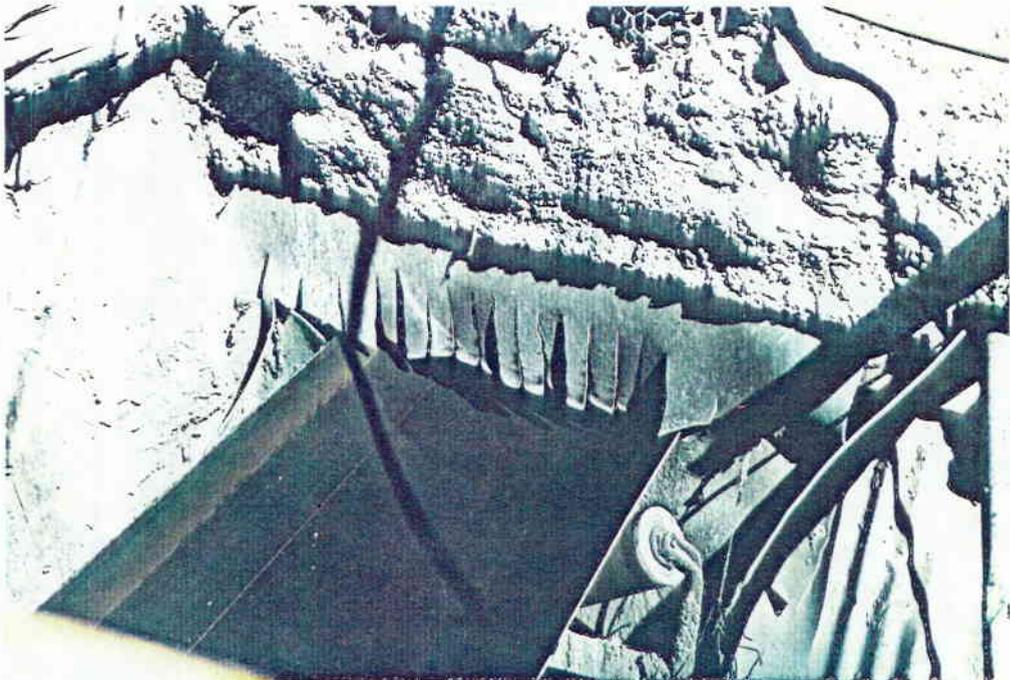
EVAPORATION LAGOON
(Plan View)
Map Code 1-B



EVAPORATION LAGOON
(Inside View)
Map Code 1-B



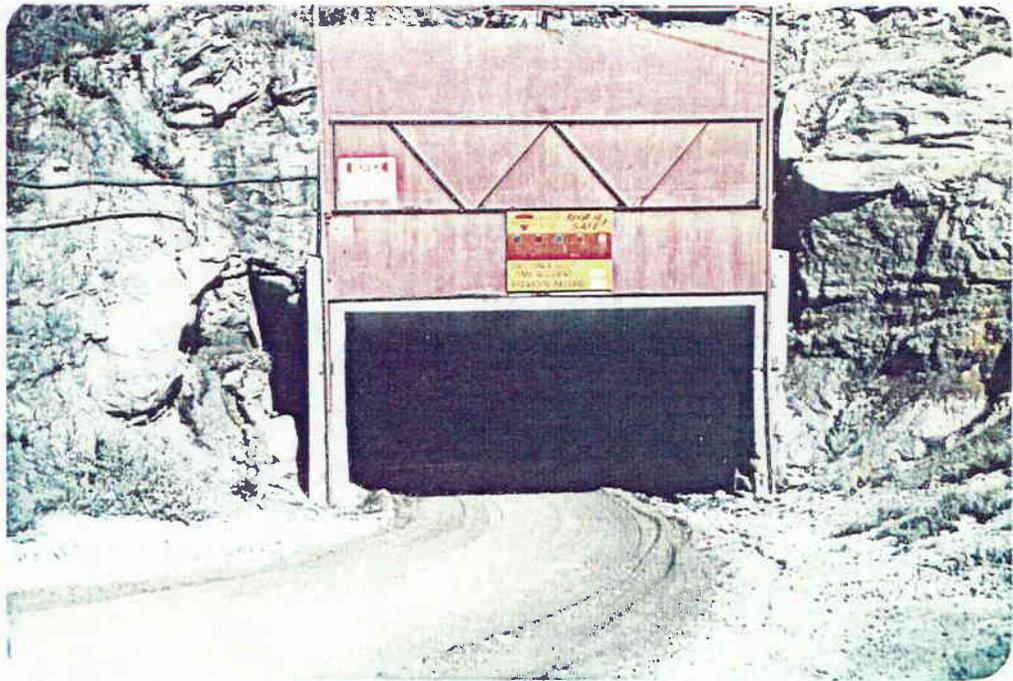
COAL HAULAGE PORTAL
Map Code 7-A



COAL HAULAGE PORTAL
Map Code 7-A



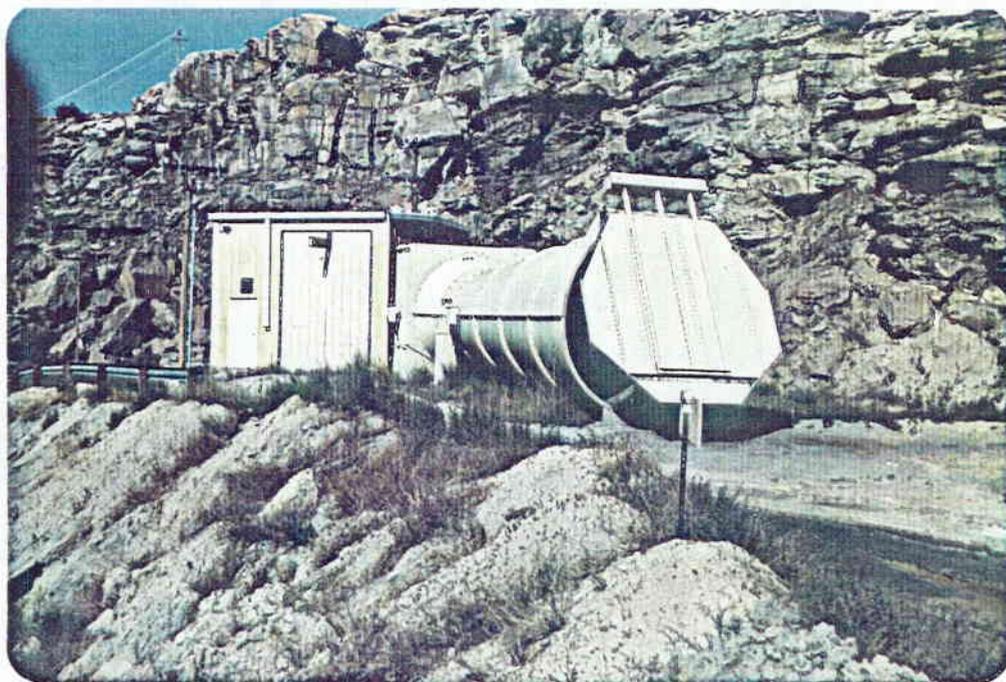
EVAPORATION LAGOON
(Inlet End)
Map Code 1-B



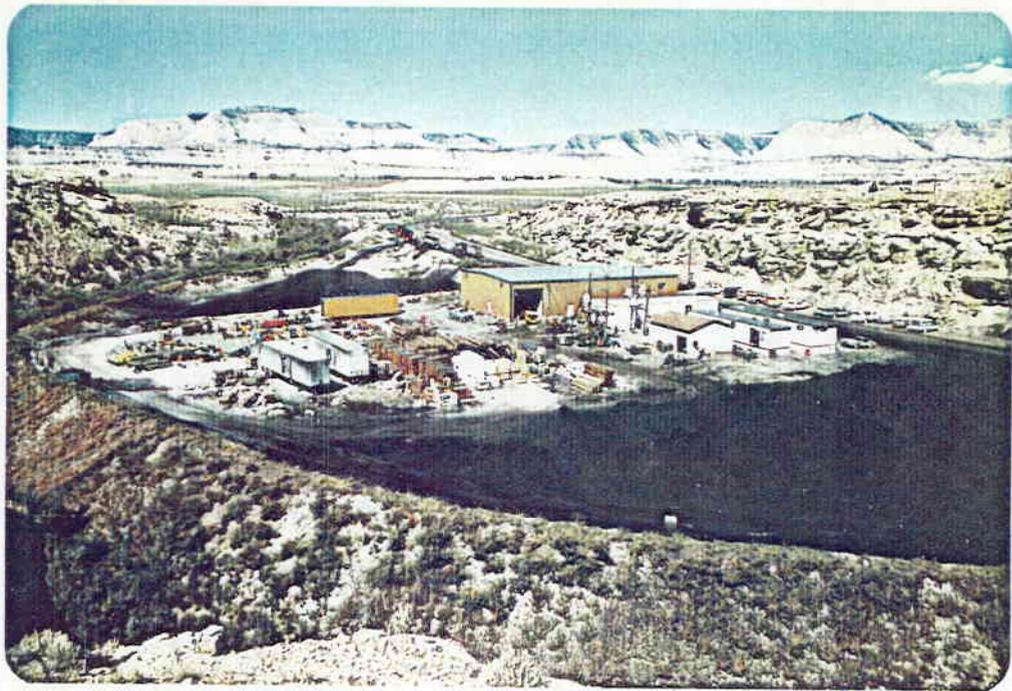
MINE ACCESS PORTAL
Map Code 8-A



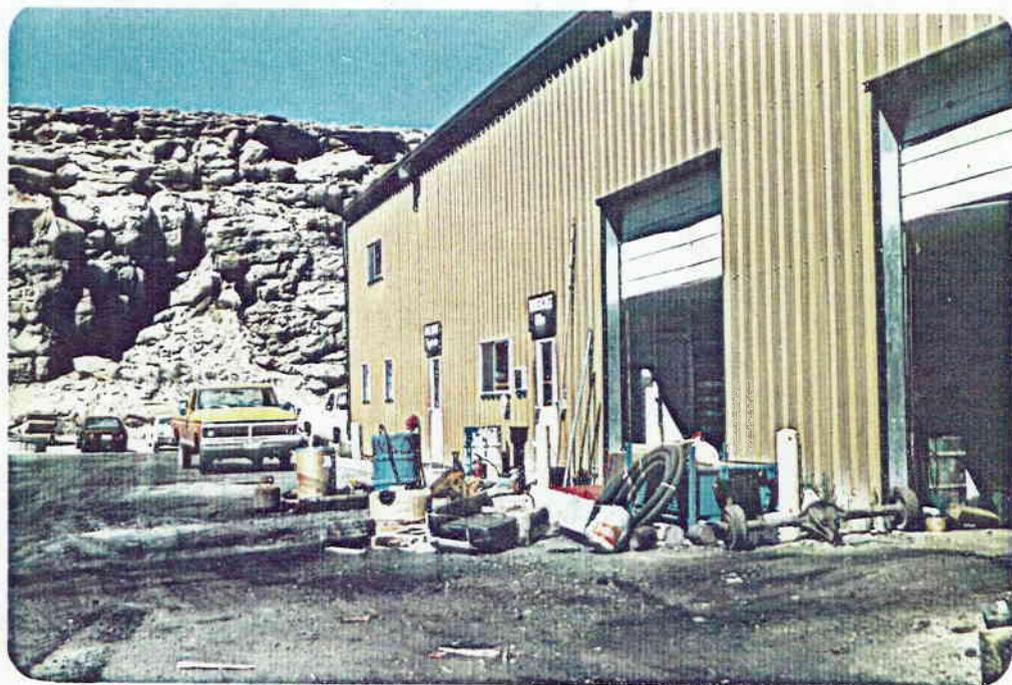
AUXILIARY INTAKE PORTAL
Map Code 9-A



RETURN AIR PORTAL, MINE FAN HOUSE
Map Code 10-A



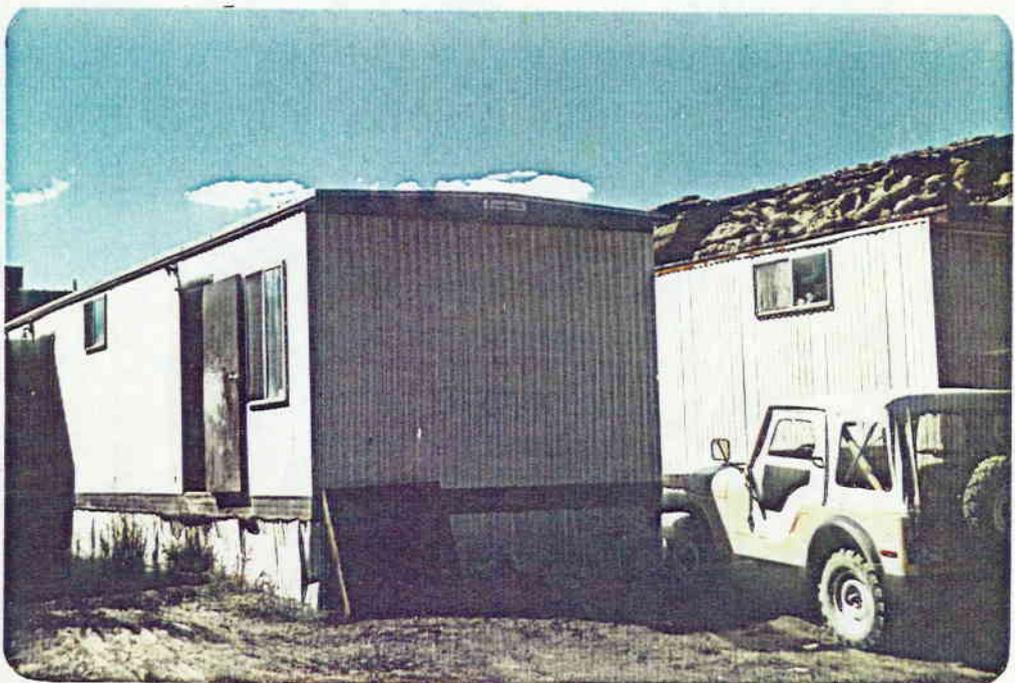
WAREHOUSE/OFFICE BUILDING AND BATHHOUSES
(Overview)
Map Code 11-A & 12-A



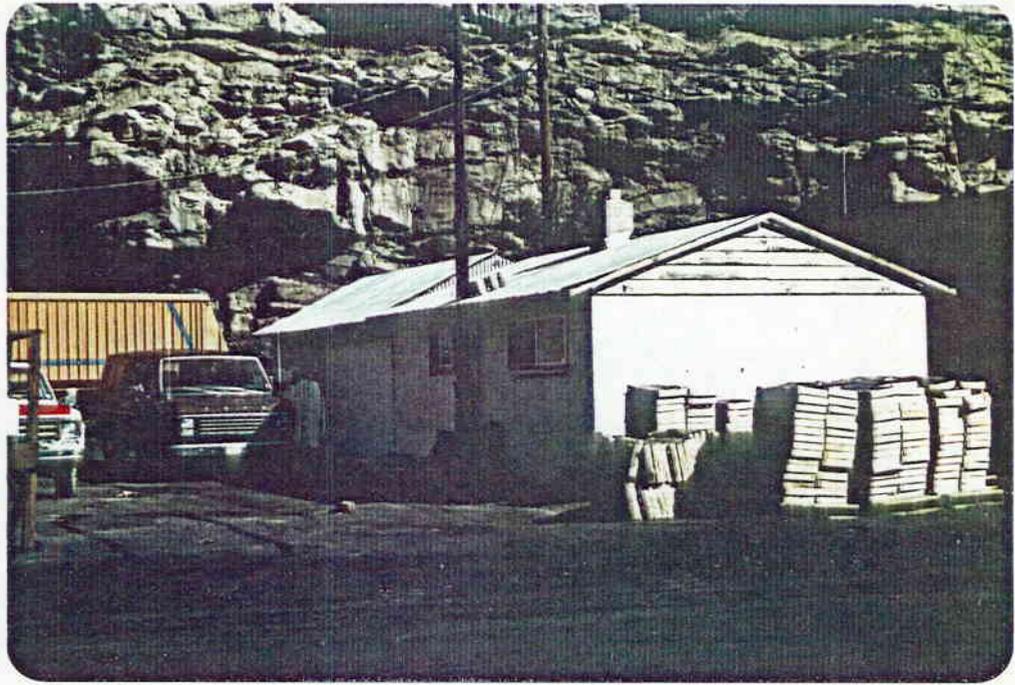
WAREHOUSE/OFFICE BUILDING
(West Side)
Map Code 11-A



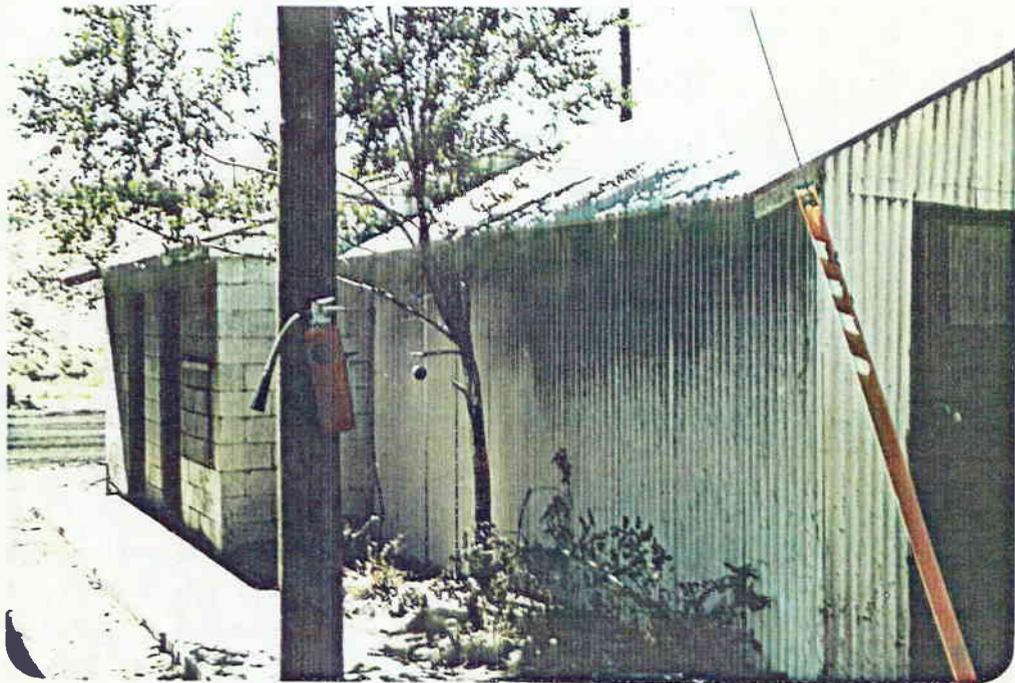
BATHHOUSES
Map Code 12-A



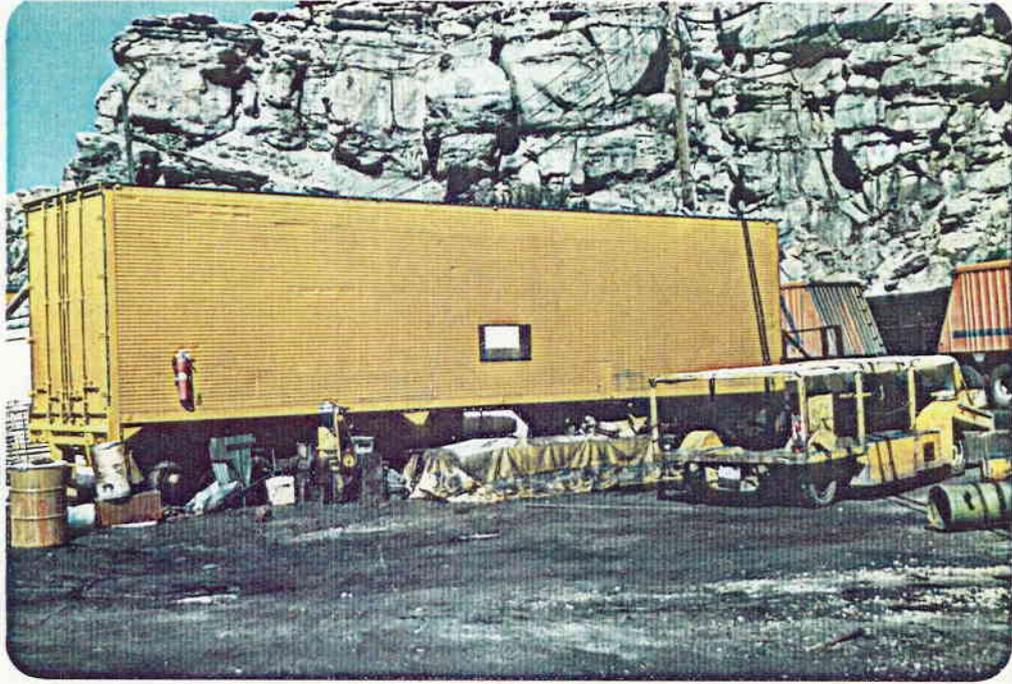
BATHHOUSES
Map Code 12-A



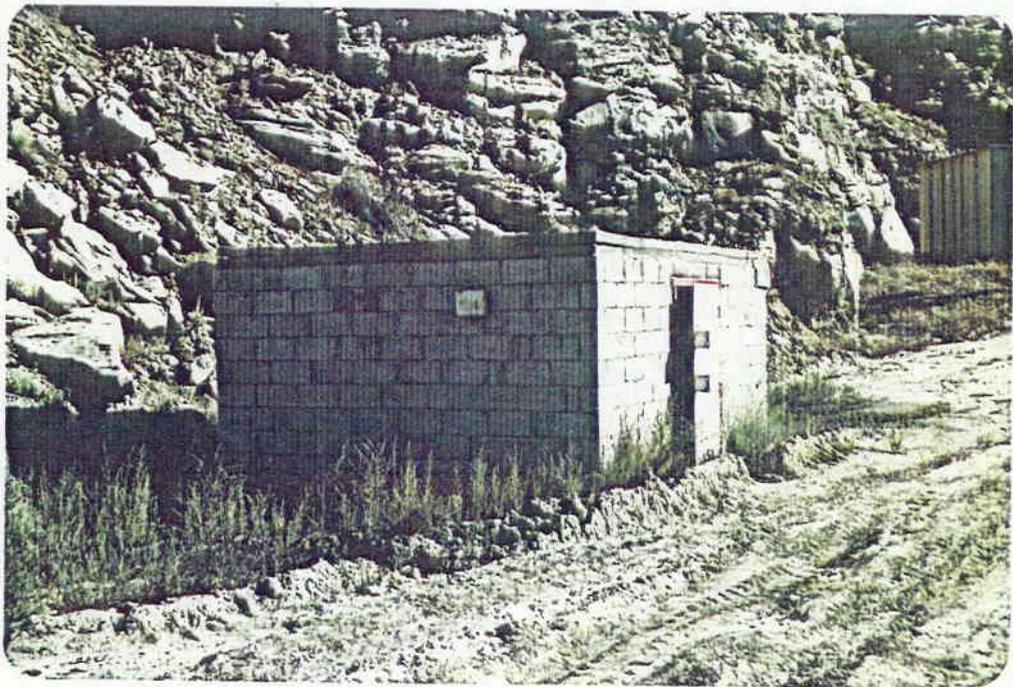
FOREMANS OFFICE BUILDING
(Looking North)
Map Code 13-A



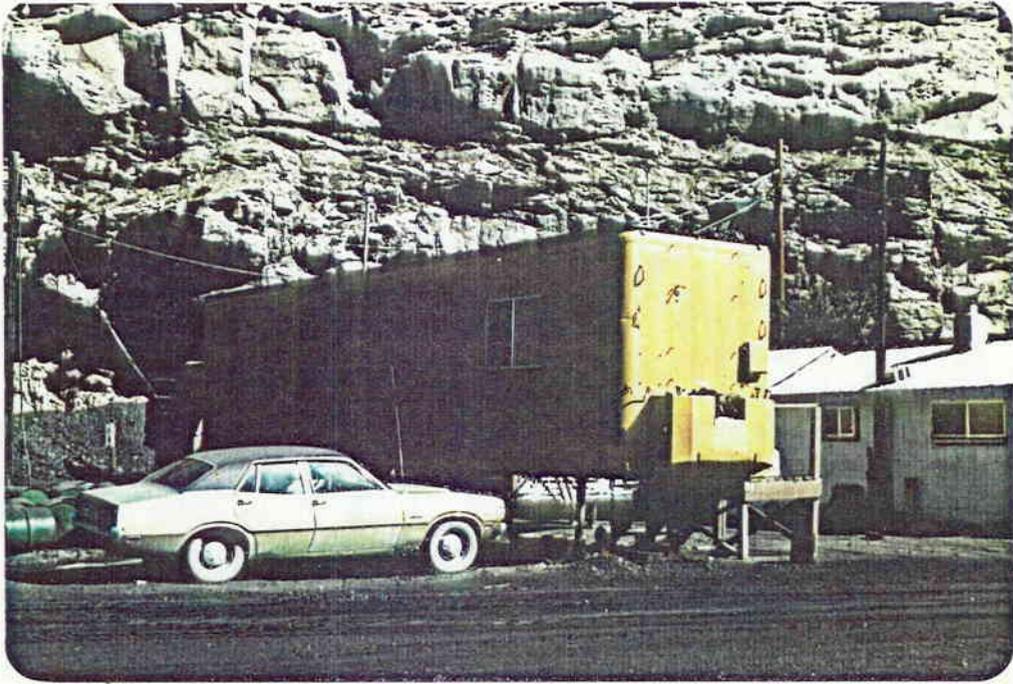
FOREMANS OFFICE BUILDING
(Looking South)
Map Code 13-A



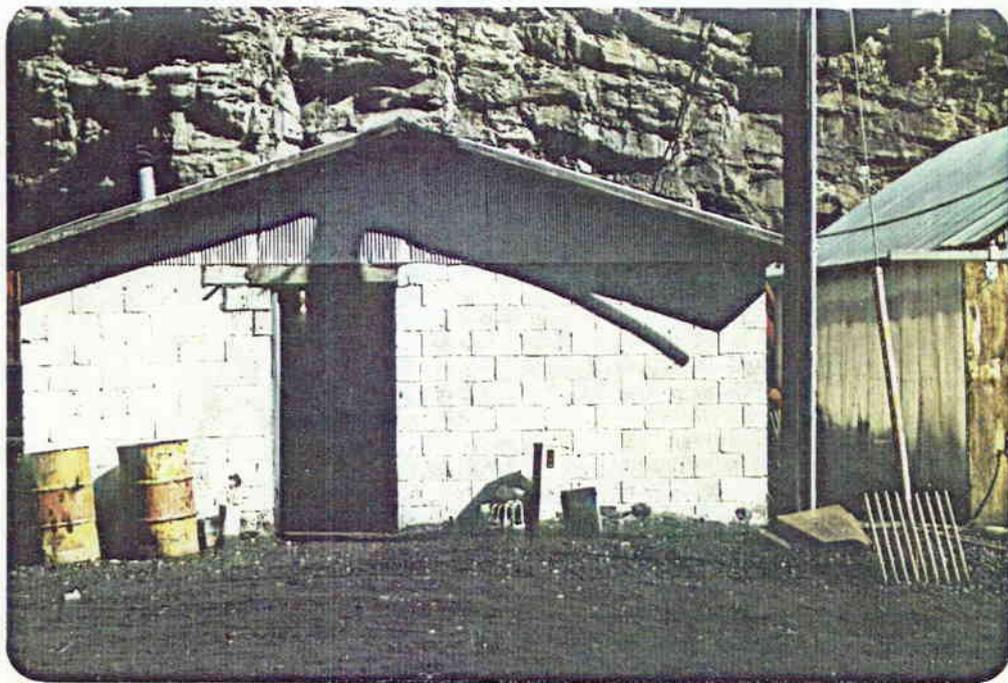
SAMPLING TRAILER
Map Code 14-A



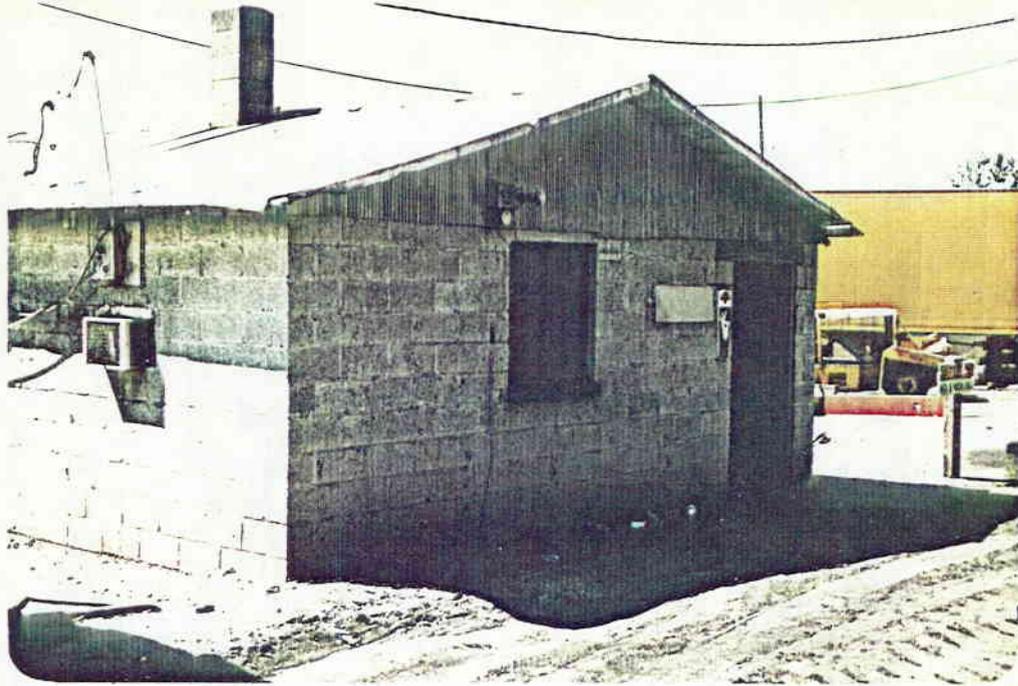
STORAGE BUILDING
Map Code 15-A



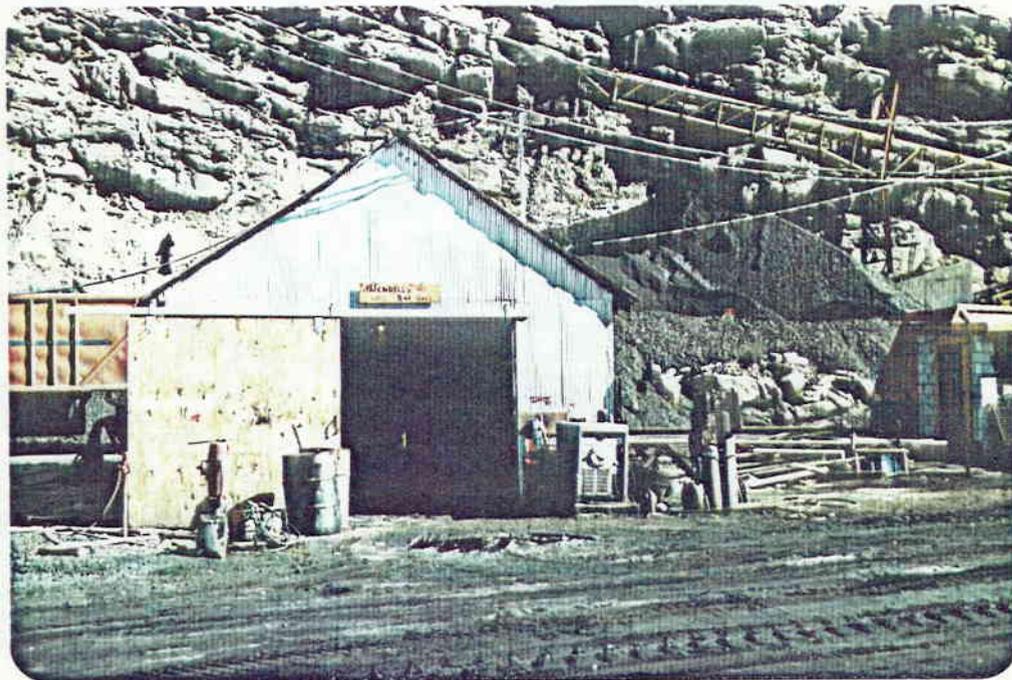
STORAGE TRAILER
Map Code 16-A



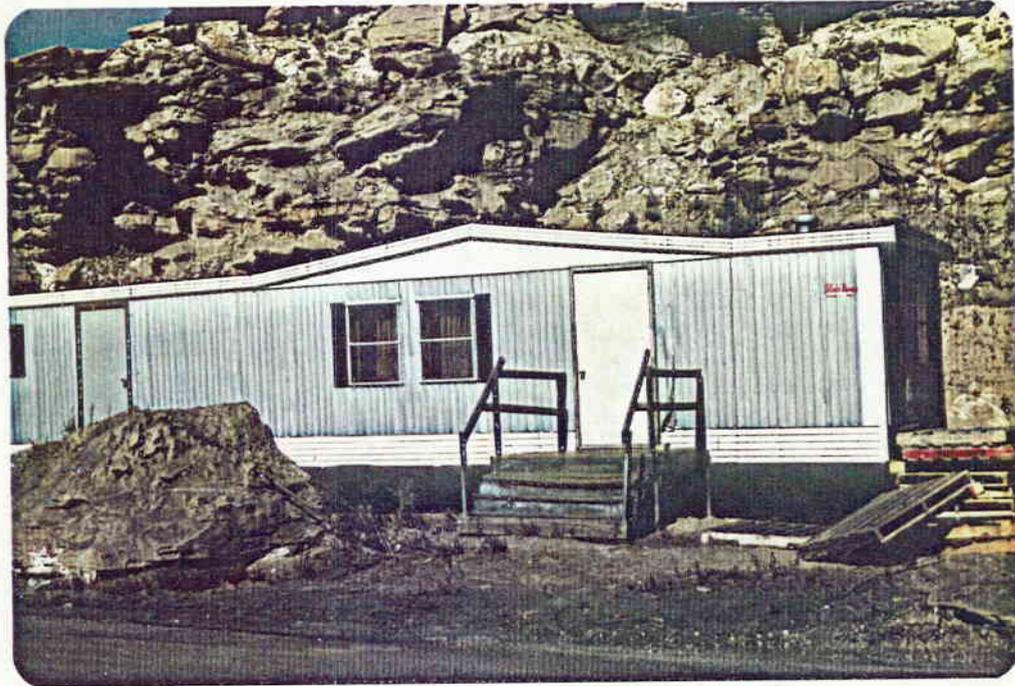
SHIFT CHANGE BUILDING
(Looking North)
Map Code 17-A



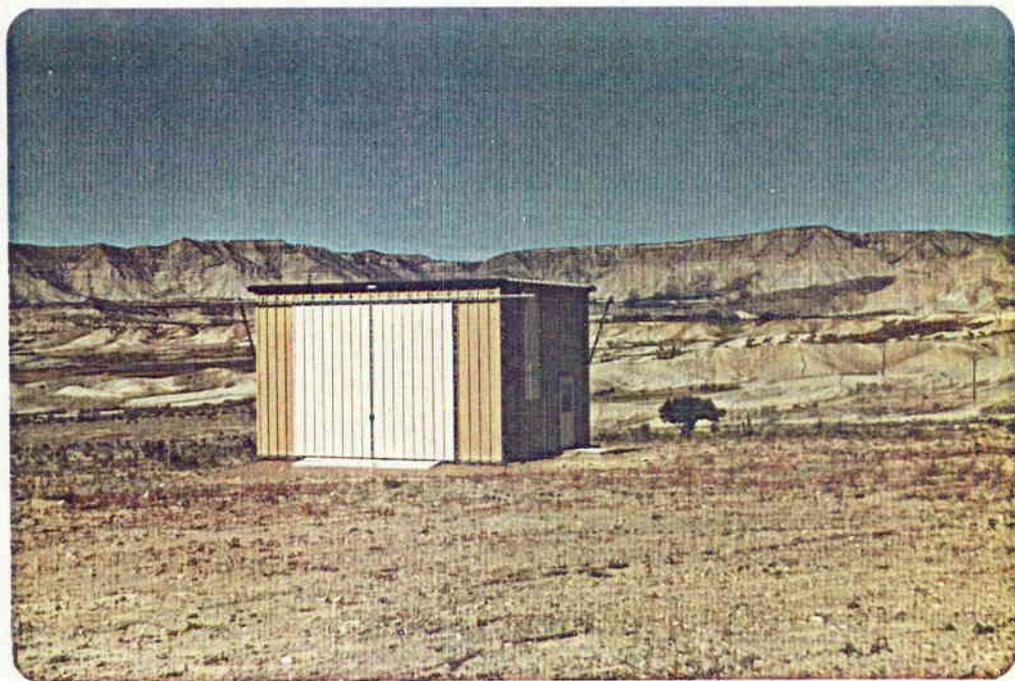
SHIFT CHANGE BUILDING
(Looking Southwest)
Map Code 17-A



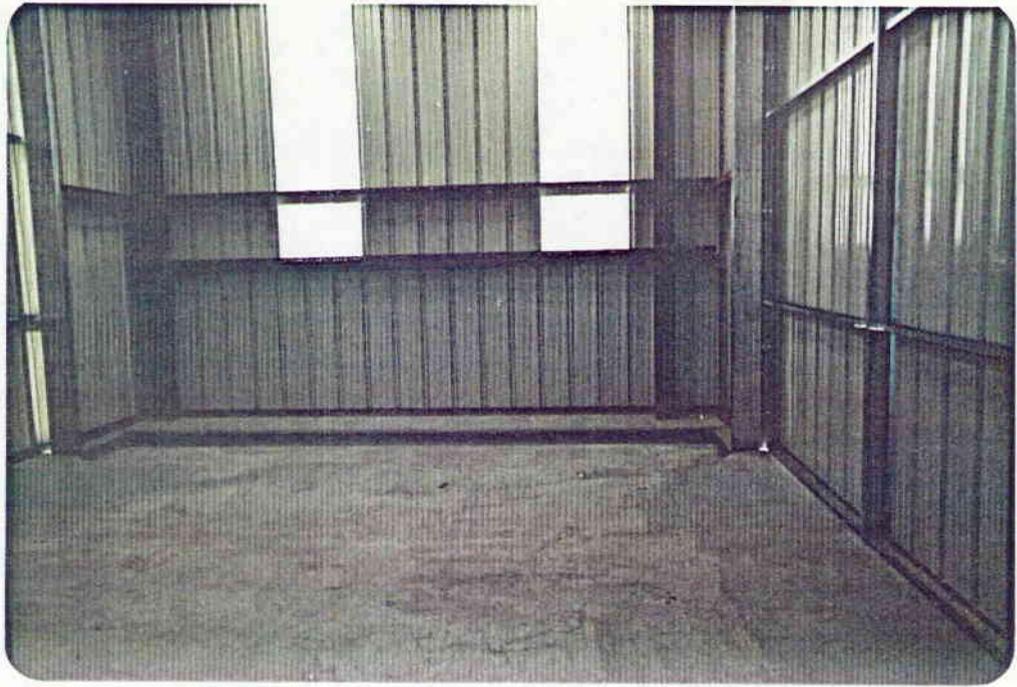
TIPPLE SHOP
(Looking North)
Map Code 18-A



SPARE OFFICE TRAILER
Map Code 19-A



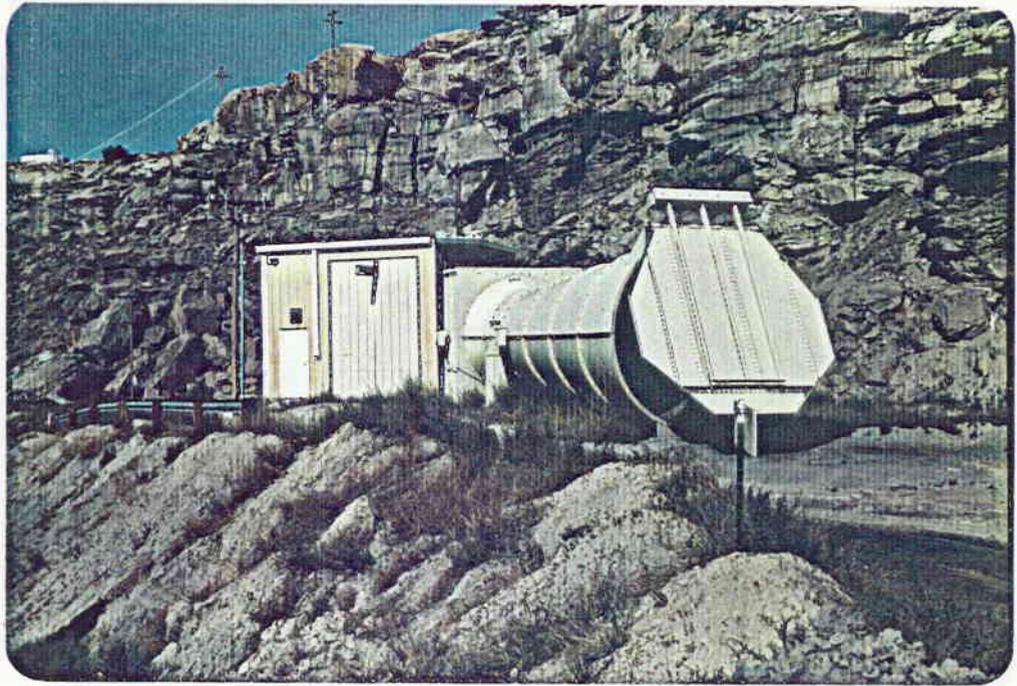
PCB STORAGE BUILDING
Map Code 2-B



PCB STORAGE BUILDING
(Inside)
Map Code 2-B



PCB STORAGE BUILDING
(Inside)
Map Code 2-B



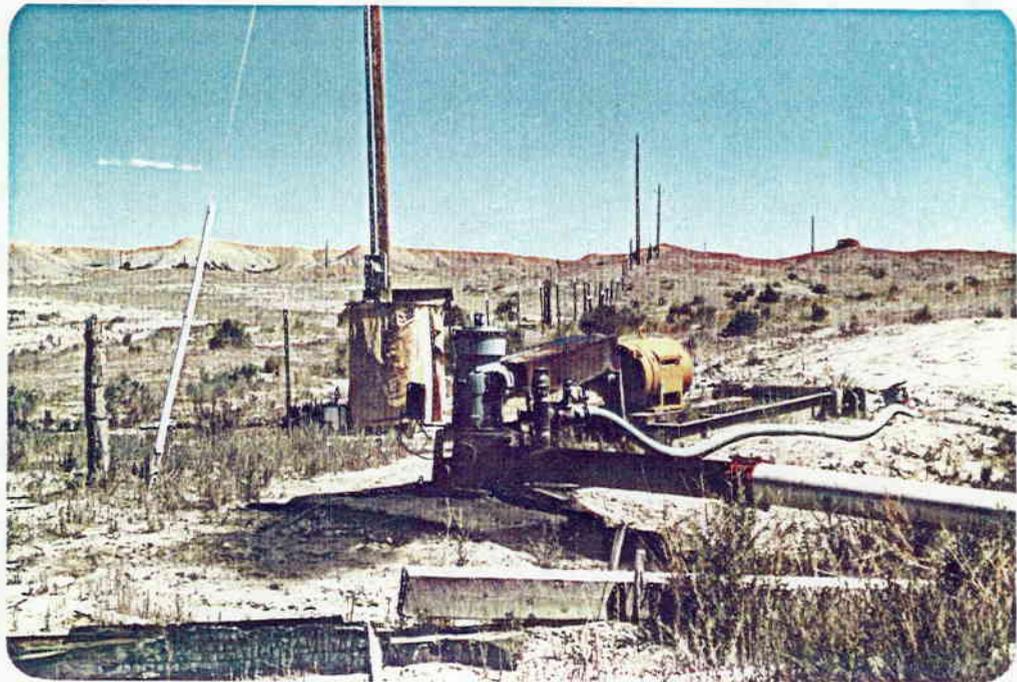
MINE FAN BUILDING
Map Code 20-A



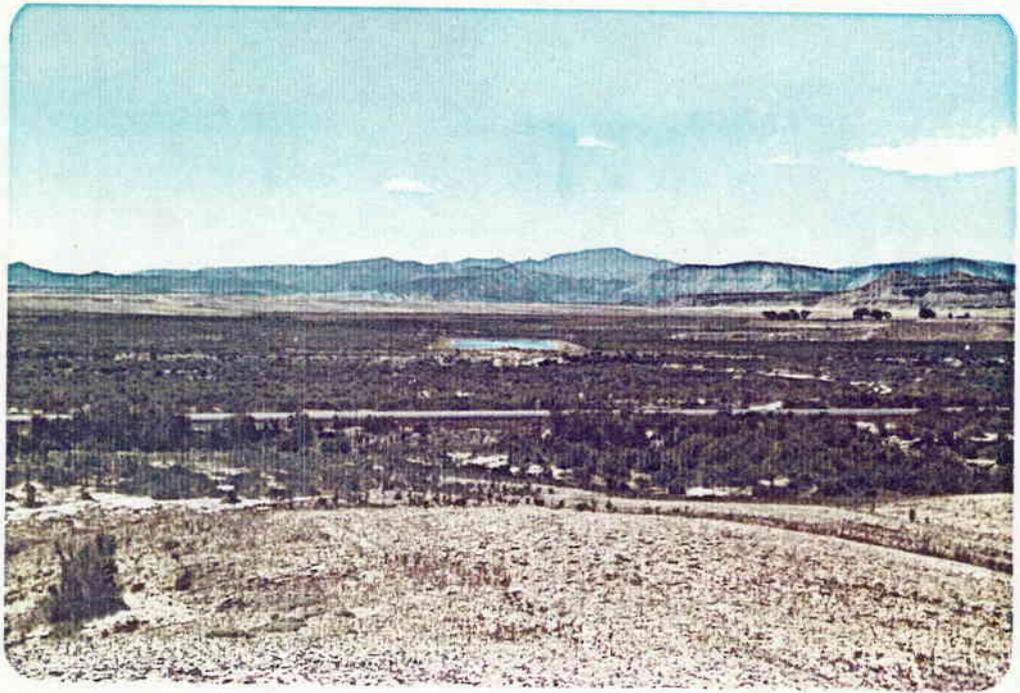
MINE SUBSTATION
Map Code 3-B



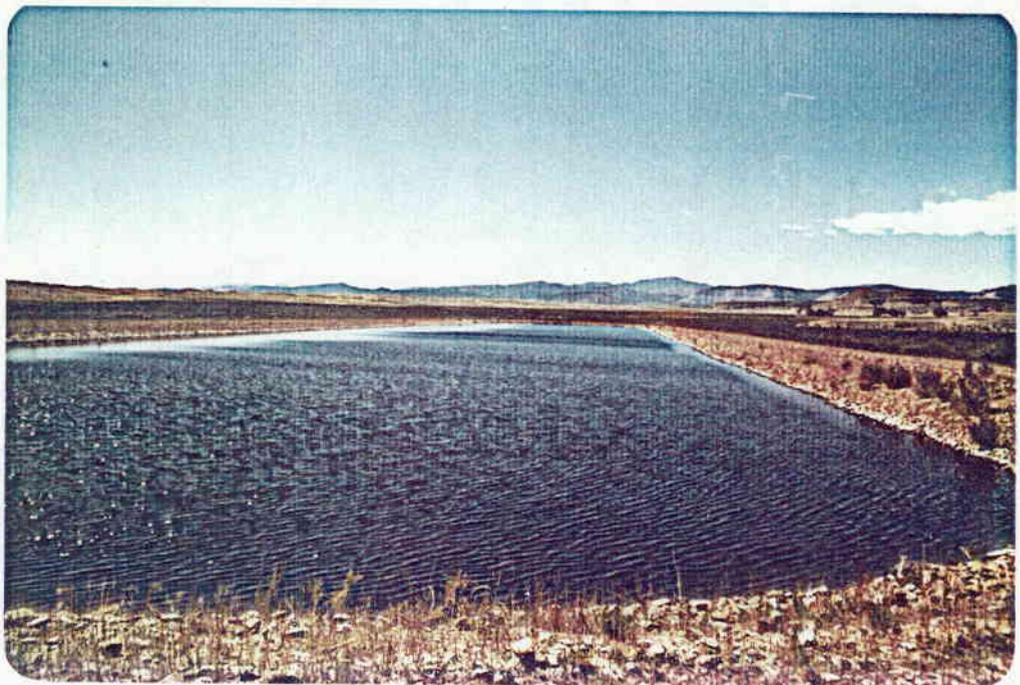
BOREHOLE PUMP FACILITY
(Overview)
Map Code 4-B



BOREHOLE PUMP FACILITY
Map Code 4-B



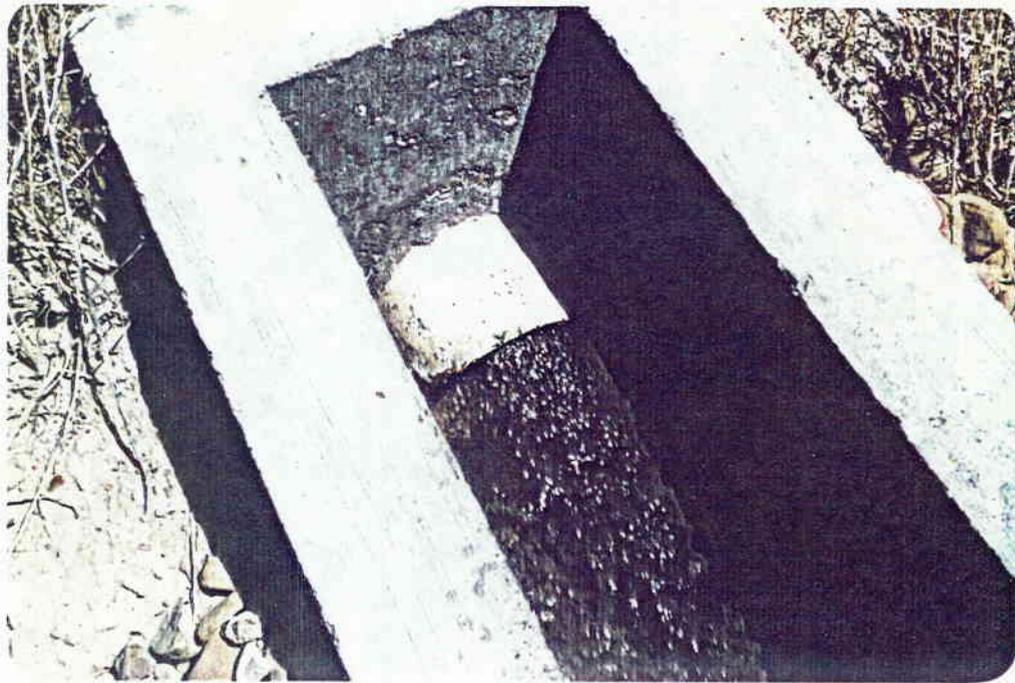
MINE DISCHARGE SEDIMENTATION POND
(Overview)
Map Code 5-B



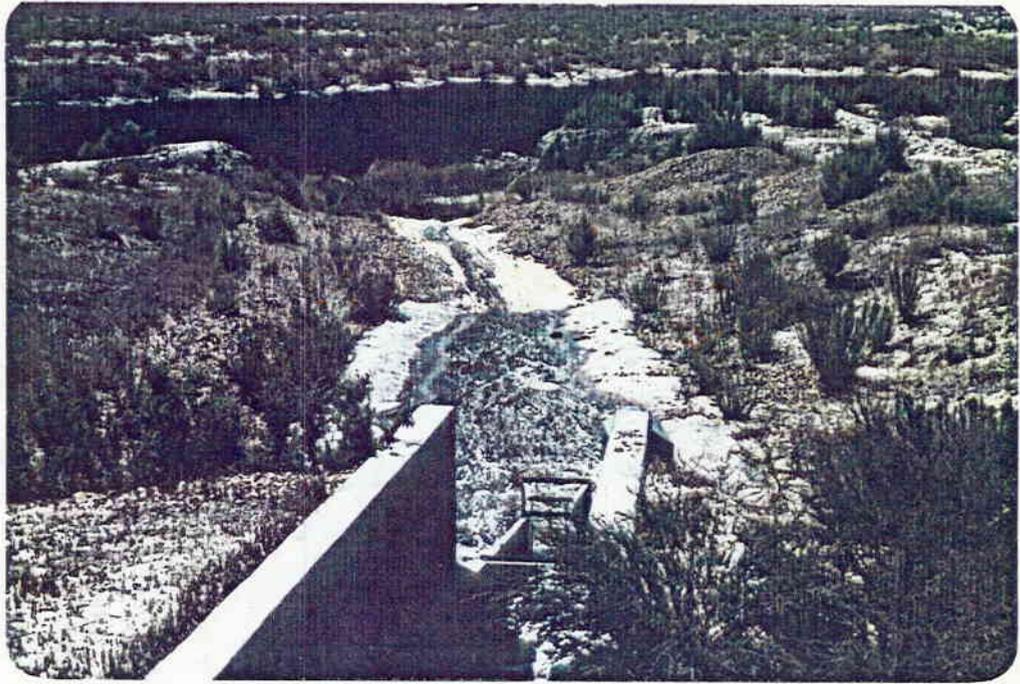
MINE DISCHARGE SEDIMENTATION POND
Map Code 5-B



MINE DISCHARGE SEDIMENTATION POND
(Inlet)
Map Code 5-B



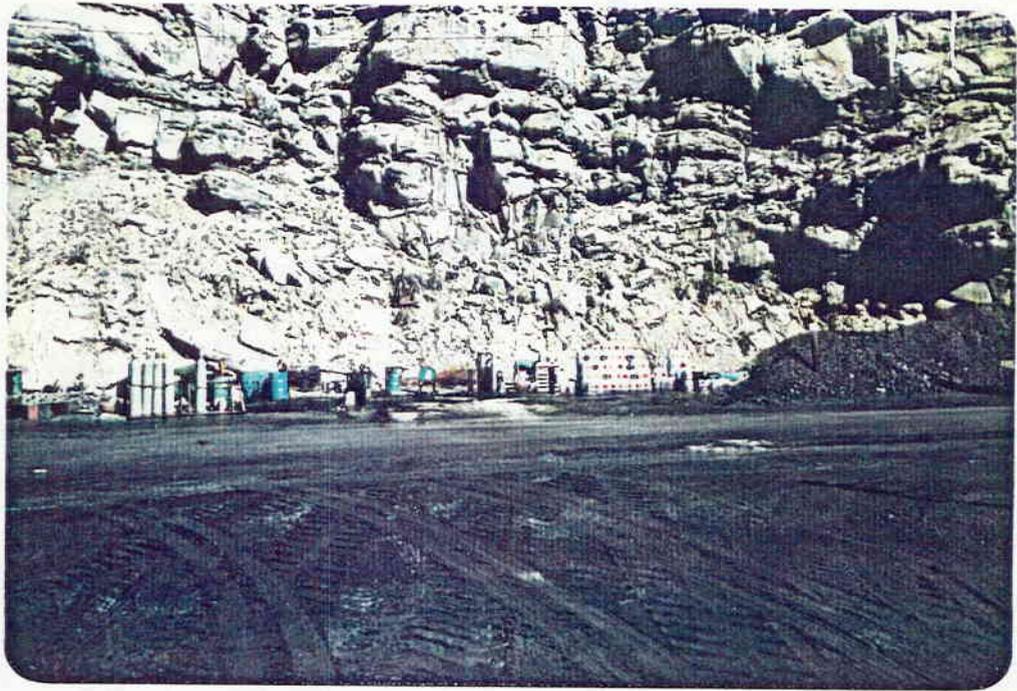
MINE DISCHARGE SEDIMENTATION POND
(Inlet Closeup)



MINE DISCHARGE SEDIMENTATION POND
(Outlet)



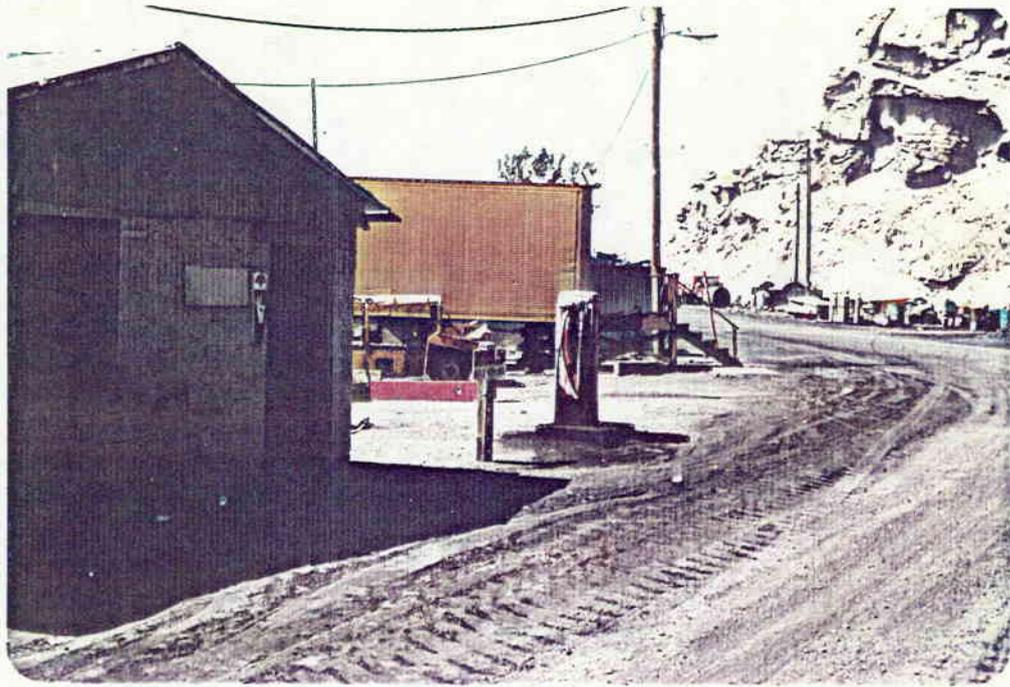
MINE DISCHARGE SEDIMENTATION POND
(Outlet)



OIL STORAGE AREA
Map Code 21-A



GASOLINE FUEL STORAGE
Map Code 22-A



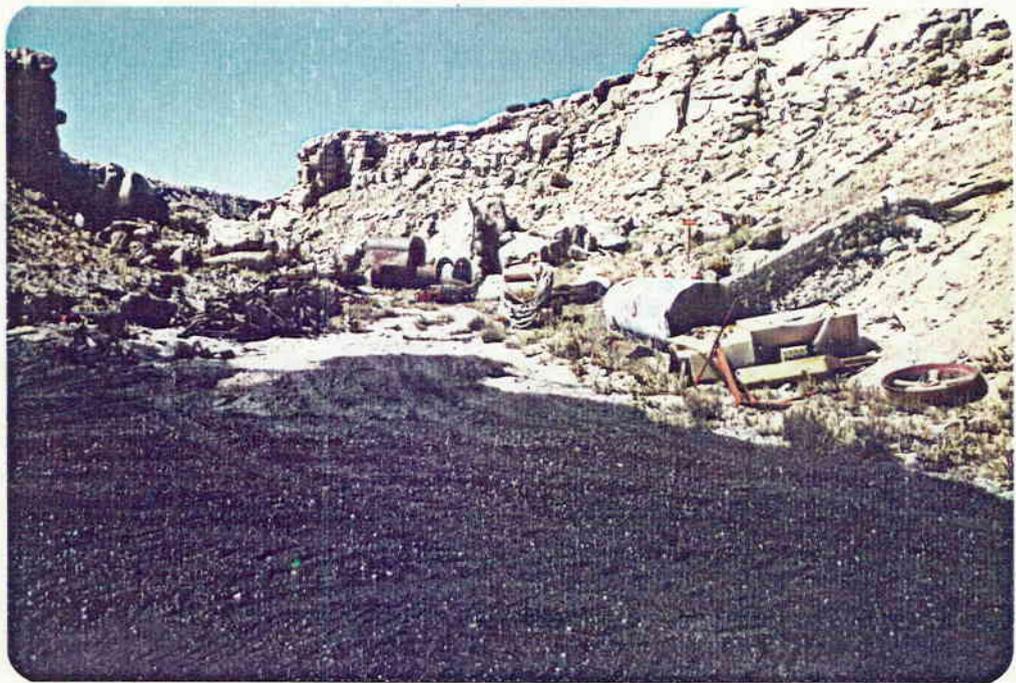
DIESEL FUEL STORAGE
Map Code 23-A



GENERATOR FUEL STORAGE
(Against Fan House)
Map Code 25-A



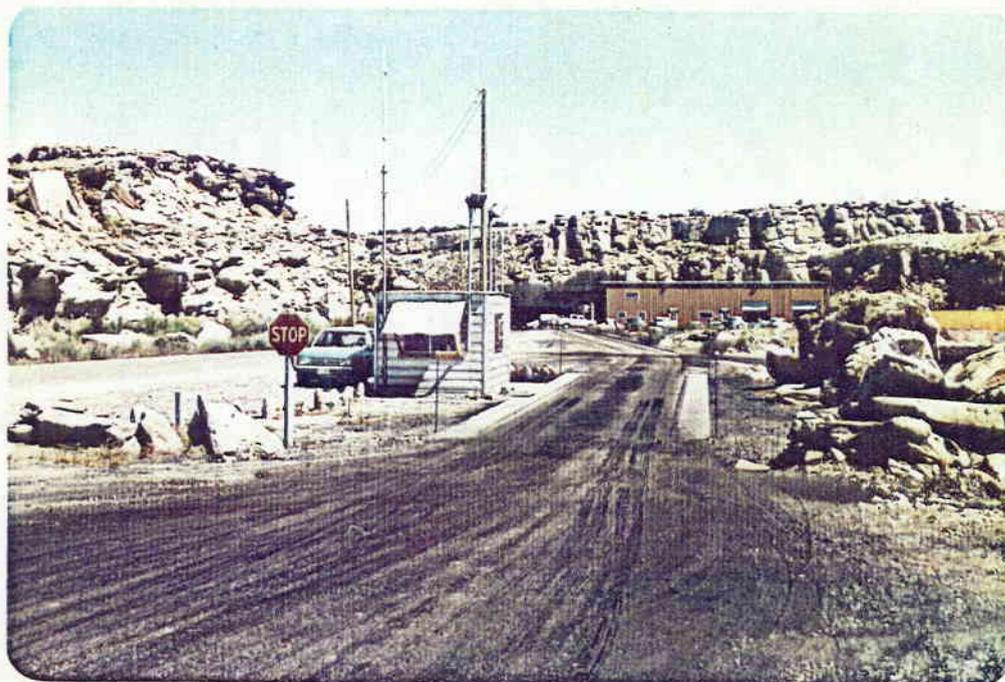
SCRAP YARD
(Overview)
Map Code 26-A



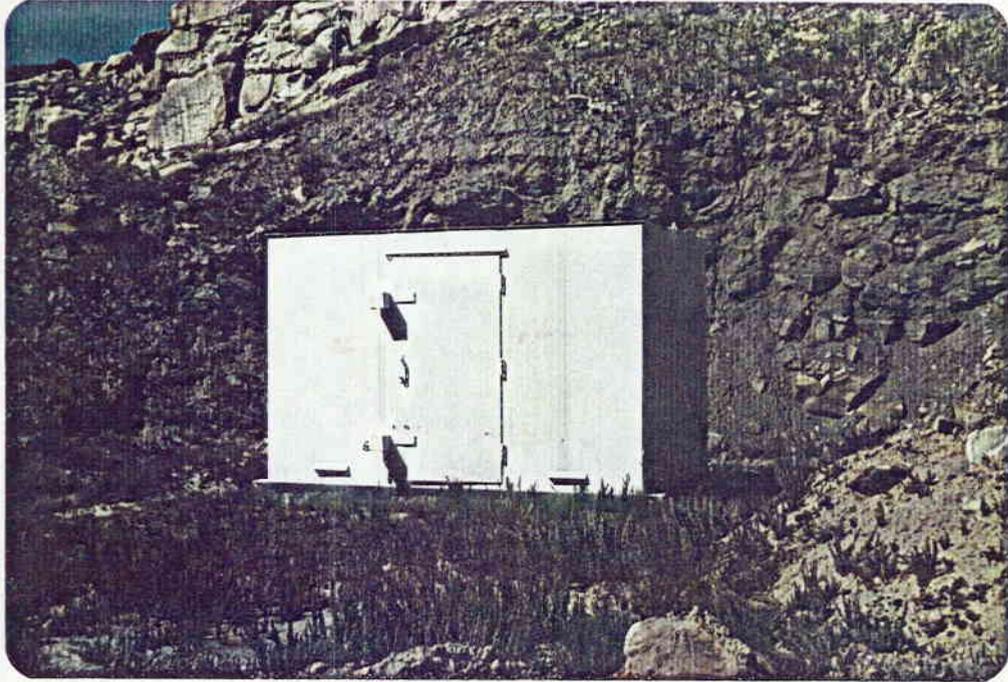
SCRAP YARD
Map Code 26-A



SUPPLY YARD
Map Code 27-A



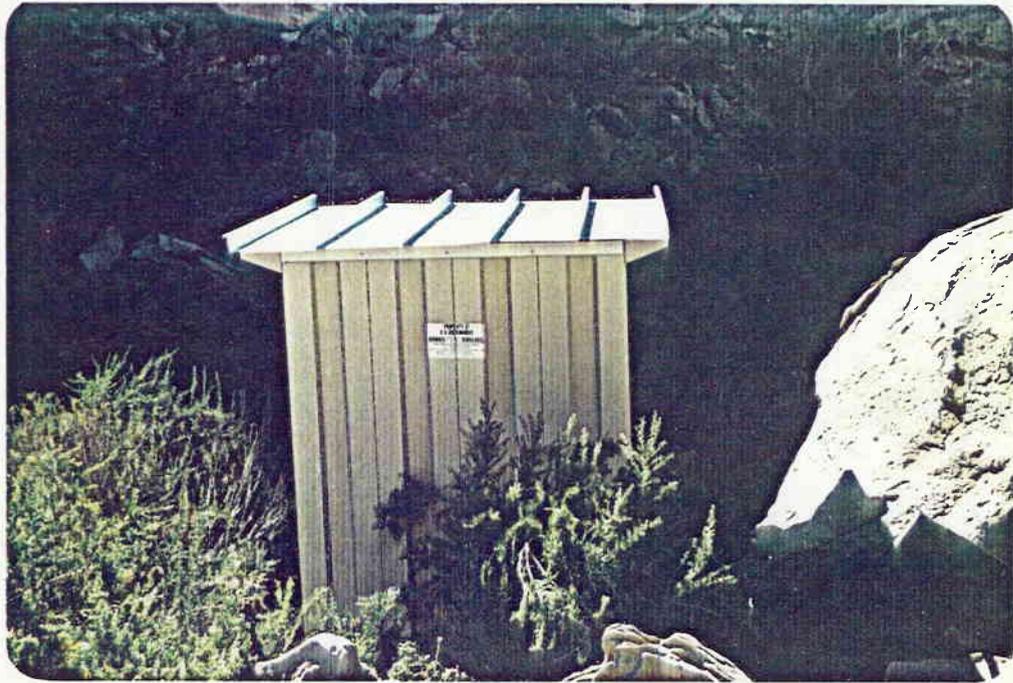
TRUCK SCALES
Map Code 28-A



EXPLOSIVES STORAGE
Map Code 29-A



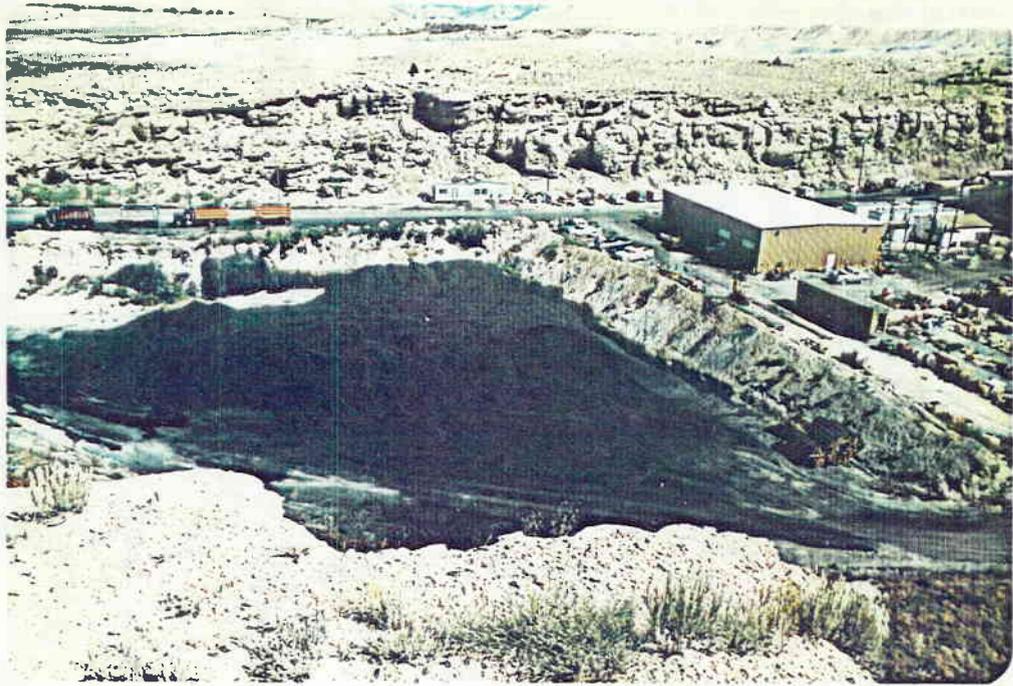
GAGING STATION
Map Code 30-A



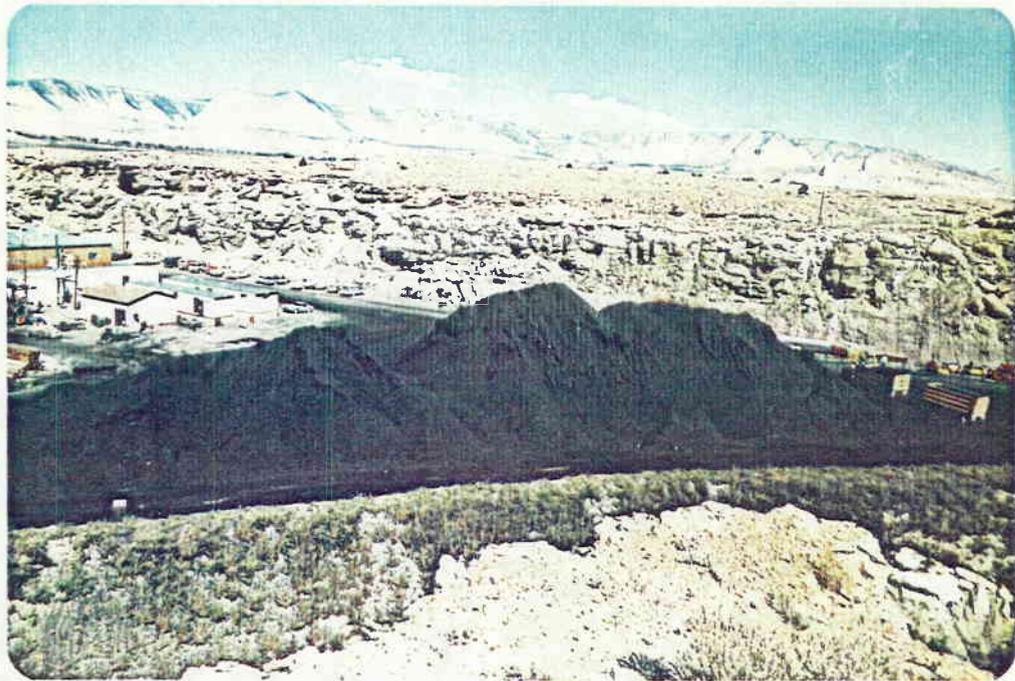
GAGING STATION
Map Code 11-B



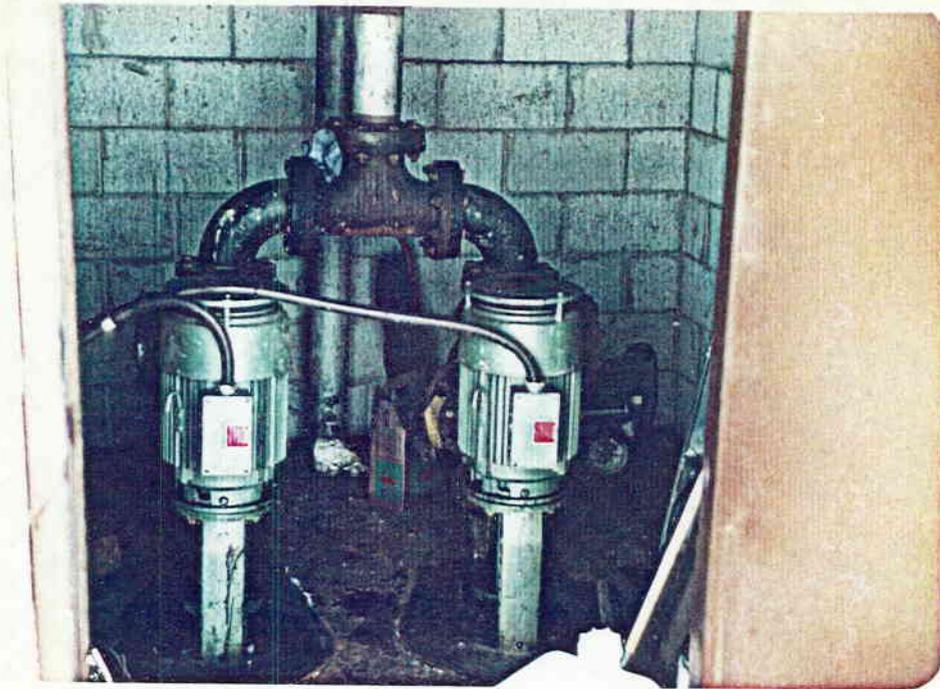
COAL STOCKPILE AREAS
(Lower Area)
Map Code 31-A



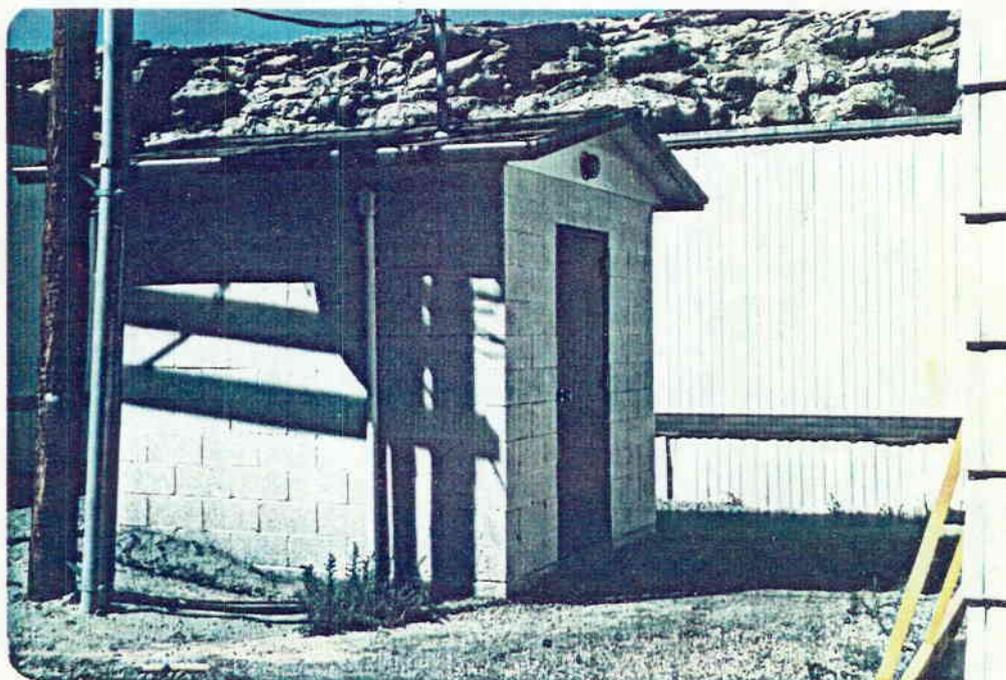
COAL STOCKPILE AREAS
(Stoker Yard)
Map Code 31-A



COAL STOCKPILE AREA
(Upper Area)
Map Code 31-A



SEWAGE TREATMENT SYSTEM
(Sewage Pumphouse Inside)



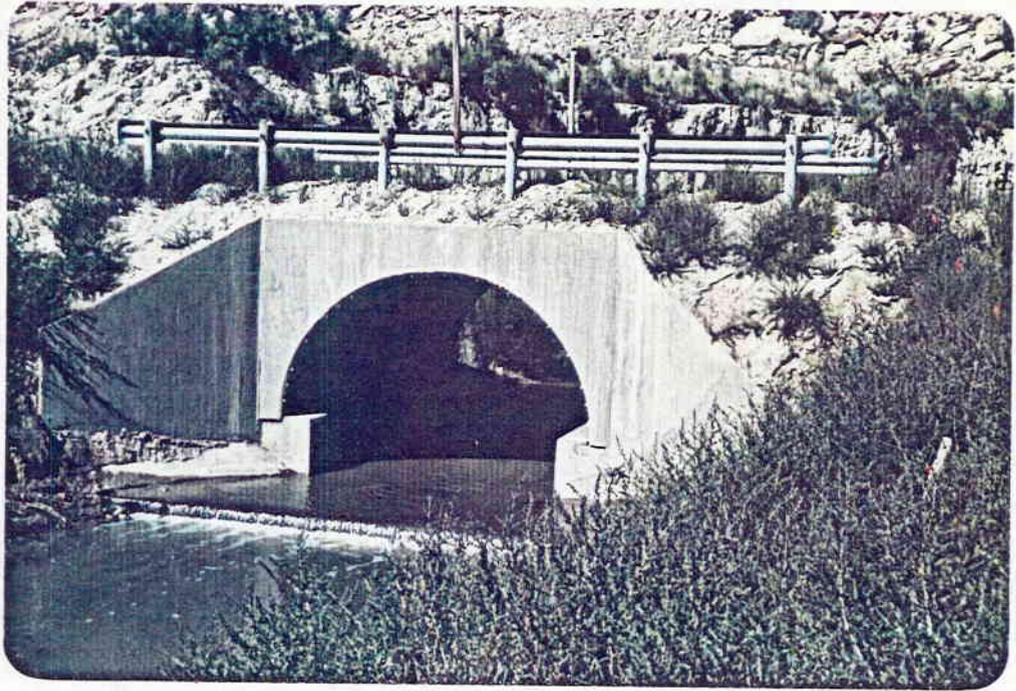
SEWAGE TREATMENT SYSTEM
(Outside of Pumphouse)



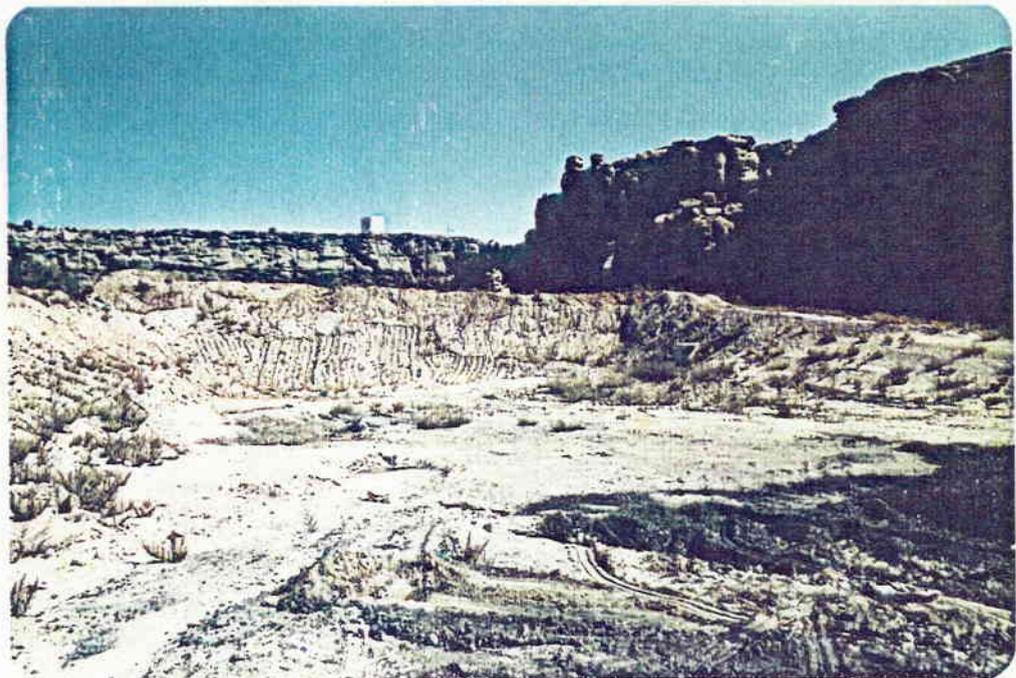
SEWAGE TREATMENT SYSTEM
(Leach Field Looking South)



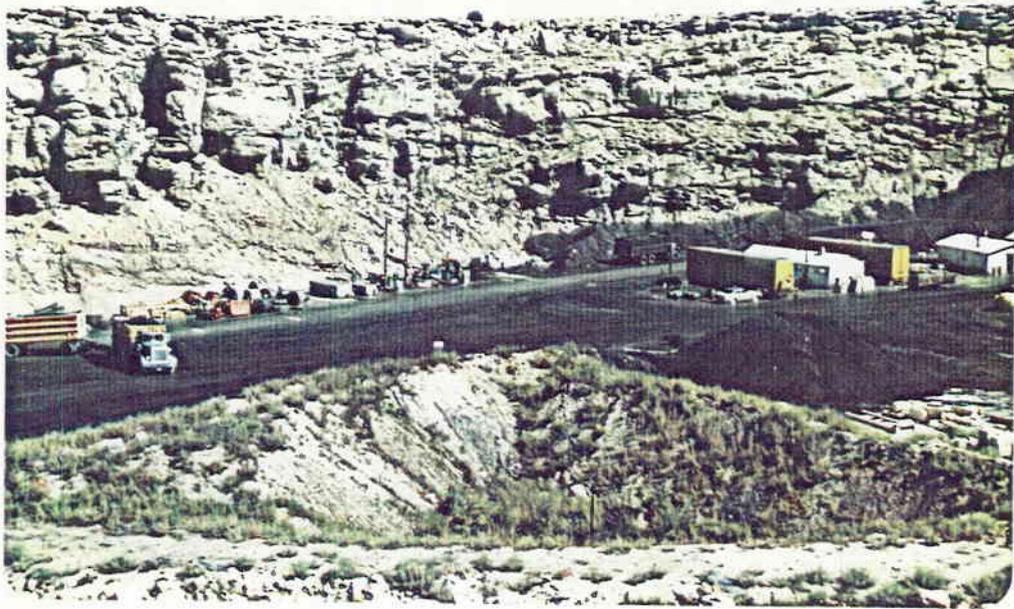
SEWAGE TREATMENT SYSTEM
(Leach Field Looking North)



BRIDGE ON QUITCHUPAH CREEK
Map Code 33-A



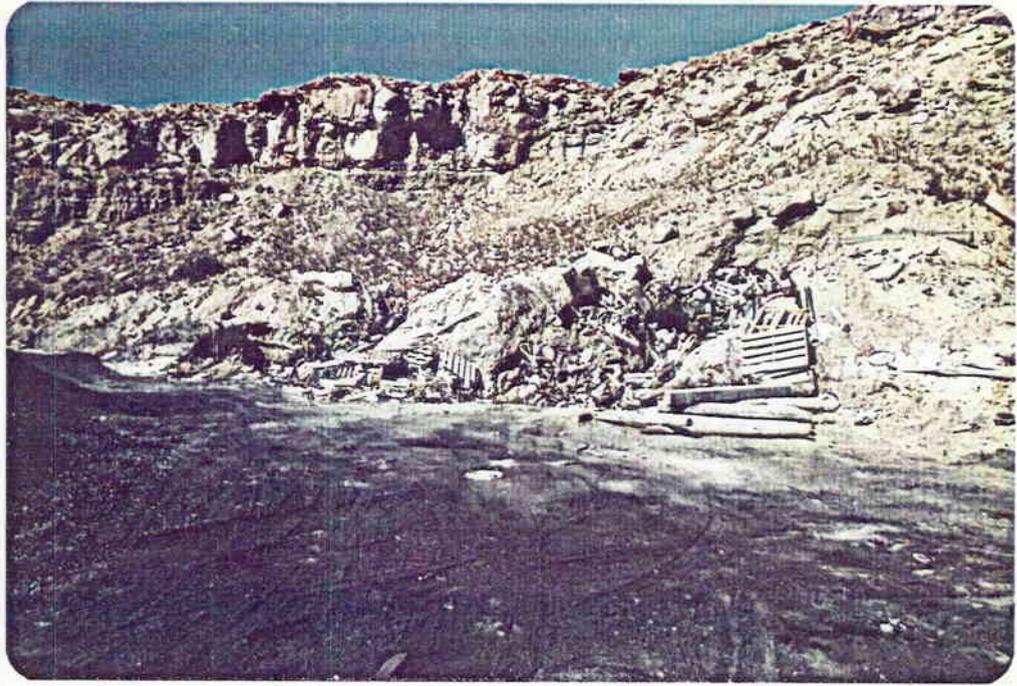
SURFACE DRAINAGE CONTROL SYSTEM
(Lower Sedimentation Pond)



SURFACE DRAINAGE CONTROL SYSTEM
(Main Sedimentation Pond)



SURFACE DRAINAGE CONTROL SYSTEM
(Main Sedimentation Pond)



NON-COAL WASTE STORAGE AREA
Map Code 34-A

CHAPTER 4.0
LAND STATUS, LAND USE, AND POST-MINING LAND USE

EMERY MINE
CONSOLIDATION COAL COMPANY
MARCH 23, 1981

TABLE OF CONTENTS

	<u>Page</u>
4.1 Scope	4-1
4.2 Methodology	4-1
4.3 Land Status	4-1
4.3.1 Surface Land Ownership Within and Adajcent to the Permit Area	4-1
4.3.1.1 Surface Managing Authorities	4-6
4.3.1.2 Utility Corridors and Other Rights- of-Way	4-6
4.3.2 Coal Ownership Within and Adjacent to the Permit Area	4-6
4.3.2.1 Permit Area Coal Leases	4-10
4.4 Land Use	4-10
4.4.1 Regional Land Use	4-10
4.4.2 Land Use in the Permit Area	4-10
4.4.3 Land Use During Mining	4-13
4.4.3.1 Affects of Mining on Land Use	4-13
4.4.3.2 Mitigation of Effects of Operation	4-13
4.5 Post-Mining Land Use	4-13
4.6 Socioeconomic Characteristics	4-13
References	4-14

FIGURES

	<u>Page</u>
4-1 Land Use in Emery Mine Region	4-11

TABLES

4-1 Permit Area Land Use	4-12
--------------------------	------

PLATES

4-1 Permit Area Surface Ownership (1" = 1000')	
4-2 Permit Area Coal Ownership (1" = 1000')	
4-3 Permit Area Surface and Coal Ownership (1" = 500')	
4-4 Permit Area Road and Utility Corridors	
4-5 Project Area Mines and Prospects	

4.0 LAND STATUS, LAND USE, AND POST-MINING LAND USE

4.1 Scope

Chapter 4.0 describes the status of lands in and adjacent to the permit area. Consol's right to mine is based on ownership or lease rights to the coal. Land use is discussed for the region and for the mine plan area. As discussed in Section 4.5, the post-mining land use will be the same as the premining use.

4.2 Methodology

The section discussing land status was developed by reviewing Consol's land ownership information and right to mine documents. In most cases, legal title opinions were prepared for Consol which explained the status of coal and surface ownership. The discussion of land use is based on the present use of the soils in the area and a previous land use study prepared by the BLM.

4.3 Land Status

4.3.1 Surface Land Ownership Within and Adjacent to the Permit Area

The following information describes the surface land ownership within and adjacent to the permit area. Plate 4-1 shows surface land ownership in and adjacent to the permit area.

Section 19 T22S, R6E

Earl Olsen
123 2nd Ave. #1101
Salt Lake City, Utah 84103
(801) 363-8199

James Olsen
647 N. Main
Spanish Fork, Utah 84660
(801) 798-3322

United States of America (BLM)
Lease No. U-5287

D. Horne (Cedar Ridge Land & Livestock)
2496 Southwest Temple
Salt Lake City, Utah 84115
(801) 364-3339

Utah Power and Light
P.O. Box 899
Salt Lake City, Utah 84522
(801) 748-2570

Section 20 T22S, R6E

A. Petty c/o Gary Petty
Emery, Utah 84522
(801) 286-2395

Glen R. Anderson
1462 W. 6235 S.
Murray, Utah 84107
(801) 266-4324

Bevan Wilson
Huntington, Utah 84528
(801) 687-2566

Utah Power and Light
P.O. Box 899
Salt Lake City, Utah 84110
(801) 748-2570

L. Mangum
Emery, Utah 84522

Cedar Ridge Land & Livestock Co.
Emery, Utah 84522
(801) 364-3339

Merlin Christiansen
Box 35
Emery, Utah 84522
(801) 286-2348

Earl Bryant
Emery, Utah 84522
(801) 286-2227

Robert Anderson
Emery, Utah 84522
(801) 286-2369

Lyle Anderson
Box 523
Emery, Utah 84522
(801) 286-2295

Wayne Staley
Emery, Utah 84522
(801) 286-2213

Dewey Jensen
Emery, Utah 84522
(801) 286-2355

Lloyd Jensen
Emery, Utah 84522
(801) 286-2207

Earl Jensen
Box 111
Emery, Utah 84522
(801) 286-2398

Section 21 T22S, R6E

Morgan Jensen
1163 Wildflower Drive
Cedar City, Utah 84728
(801) 586-6432

Section 22 T22S, R6E

Kemmerer Coal Company
Frontier, Wyoming 83121
(307) 877-4452

J. & L. Kingston
1998 South 9th East
Salt Lake City, Utah 84103
Phone Unknown

Dewey Jensen
Emery, Utah
(801) 286-2355

Section 27 T22S, R6E

Kemmerer Coal Company
Frontier, Wyoming 83121
(307) 877-4452

Section 28 T22S, R6E

Cedar Ridge Land & Livestock Company
Emery, Utah 84522
(801) 364-3339

Wayne Staley
Emery, Utah 84522
(801) 286-2213

John Lewis
1163 E. 25th St.
Idaho Falls, Idaho 83401
(208) 522-3646

Morgan Jensen
1163 Wildflower Dr.
Dedar City, Utah 84728
(801) 586-6432

Jens C. Jensen
8760 Cranbrook Dr.
Boise, Idaho 83704
(208) 376-1917

Section 29 T22S, R6E

R. Anderson et al.
Emery, Utah 84522
(801) 286-2369

John Lewis
1163 E. 25th St.
Idaho Falls, Idaho 83401
(208) 522-3646

Cedar Ridge Land & Livestock Company
Emery, Utah 84522
(801) 364-3339

Earl Bryant
Emery, Utah 84522
(801) 286-2227

L. Mangum
Emery, Utah 84522

Section 30 T22S, R6E

Earl Olsen
123 2nd Ave. #1101
Salt Lake City, Utah 84103
(801) 363-8199

A. Petty c/o Gary Petty
Emery, Utah 84522
(801) 286-2395

Robert Lewis
Emery, Utah 84522
(801) 286-2424

George Lewis
75 East 3rd South
Salt Lake City, Utah 84103
Phone Unknown

James Olsen
647 N. Main
Spanish Fork, Utah 84660
(801) 798-3322

John Lewis
1163 E. 25th St.
Idaho Falls, Idaho 83401
(208) 522-3646

D. Horne
2496 Southwest Temple
Salt Lake City, Utah 84115
(801) 364-3339

Section 31 T22S, R6E

Kemmerer Coal Company
Frontier, Wyoming 83121
(307) 877-4452

Robert Lewis
Emery, Utah 84522
(801) 286-2424

Earl Bryant
Emery, Utah 84522
(801) 286-2227

	John Lewis 1163 E. 25th St. Idaho Falls, Idaho 83401 (208) 522-3646
Section 32 T22S, R6E	Earl Bryant Emery, Utah 84522 (801) 286-2227
	Kemmerer Coal Company Frontier, Wyoming 83121 (307) 877-4452
Section 33 T22S, R6E	Kemmerer Coal Company Frontier, Wyoming 83121 (307) 877-4452
Section 34 T22S, R6E	Kemmerer Coal Company Frontier, Wyoming 83121 (307) 877-4452
	United States of America
Section 25 T22S, R5E	Rex Addley Emery, Utah 84522 (801) 286-2250
Section 36 T22S, R5E	Robert Lewis Emery, Utah 84522 (801) 286-2424
Section 6 T23S, R6E	Kemmerer Coal Company Frontier, Wyoming 83121 (307) 877-4452
	Earl Bryant Emery, Utah 84522 (801) 286-2227
Section 5 T23S, R6E	Earl Bryant Emery, Utah 84522 (801) 286-2227
	United States of America (BLM) Lease No. U-073039
Section 4 T23S, R6E	United States of America (BLM) Lease No. U073039
	United States of America (BLM) Not leased

4.3.1.1 Surface Managing Authorities

The following identifies the apparent surface managing agencies in and adjacent to the permit area.

Public Lands:	U.S. Department of Interior Bureau of Land Management Price, Utah 84501
State Lands:	Division of State Lands 231 E. 400 South Room 440 Salt Lake City, Utah 84111
Zoning:	Emery County Zoning Commission Castledale, Utah 84513
Irrigation:	Muddy Creek Irrigation District Clyde Mortenson, President Emery, Utah 84522

4.3.1.2 Utility Corridors and Other Rights-of-way

Plate 4-4 shows the location of powerlines and road rights-of-way crossing the permit area.

4.3.2 Coal Ownership Within and Adjacent to the Permit Area

All the holdings described below that are shown as controlled by Kemmerer or Consol are subject to a 50/50 lease agreement between Consol and Kemmerer dated August 23, 1966 as amended 9/1/72 and 2/27/75, unless otherwise specified. The documents and lands listed pertain only to coal ownership. Plate 4-2 shows coal ownership in the permit area. Plate 4-5 shows other mines and prospects in the area.

Township 22 South, Range 6 East (SLM)

Section 19	NE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$ E $\frac{1}{2}$ SE $\frac{1}{4}$ S $\frac{1}{2}$ NE $\frac{1}{4}$	Lease from USA (BLM) to Kemmerer and Consol dated 7/1/70 (#U-5287)*
	SE $\frac{1}{4}$ SW $\frac{1}{4}$	Deed from Emery County to Kemmerer Coal Co. dated 5/14/68
	SW $\frac{1}{4}$ SE $\frac{1}{4}$	Deed from L. M. and S.M. Pratt to Kemmerer Coal Co. dated 6/22/49
	N $\frac{1}{2}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$	U.S.A., not leased

	W $\frac{1}{2}$ S $\frac{1}{2}$ W $\frac{1}{4}$	Emery County
Section 20	NW $\frac{1}{4}$ SW $\frac{1}{4}$ S $\frac{1}{2}$ S $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$	Lease from U.S.A. (BLM) to Kemmerer and Conso dated 7/1/70 (#U-5287)
	NE $\frac{1}{4}$ E $\frac{1}{2}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58
	W $\frac{1}{2}$ NW $\frac{1}{4}$	U.S.A., not leased
Section 21	W $\frac{1}{2}$ SE $\frac{1}{4}$ W $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58
	SE $\frac{1}{4}$ NE $\frac{1}{4}$	Deed from L.M. and S.M. Pratt to Kemmerer Coal Co.
Section 22	NW $\frac{1}{4}$ NW $\frac{1}{4}$	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/158
	SW $\frac{1}{4}$ SW $\frac{1}{4}$	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58
	SW $\frac{1}{4}$ NW $\frac{1}{4}$ N $\frac{1}{2}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$	U.S.A., not leased
Section 27	S $\frac{1}{2}$ NW $\frac{1}{4}$	Deed from San Rafael Coal Co. to Kemmerer Coal Co. dated 10/1/58
	N $\frac{1}{2}$ NE $\frac{1}{4}$	Deed from L.M. and S.M. Pratt to Kemmerer Coal Co. dated 6/22/49
	S $\frac{1}{2}$ NE $\frac{1}{4}$	Private ownership, L. Hunter
Section 28	NW $\frac{1}{4}$	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58
	NE $\frac{1}{4}$	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58
	S $\frac{1}{2}$	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58
Section 29	NW $\frac{1}{4}$ NW $\frac{1}{4}$ E $\frac{1}{2}$ NW $\frac{1}{4}$ W $\frac{1}{2}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$	Lease from U.S.A. (BLM) to Kemmerer and Conso dated 7/1/70 (#U-5287)

Beginning 20 rods South of the NW corner of the SW Quarter of Section 29, thence South 60 rods, thence East 80 rods, thence North 20 rods, thence Northwesterly to the place of beginning.

Lease from John and Carolyn Lewis to Conso1 and Kemmerer dated 11/12/80

SW $\frac{1}{2}$ NW $\frac{1}{4}$, beginning at the NW corner of the SW $\frac{1}{4}$, thence E 80 rods, thence S 76 rods thence Northwesterly to the place of beginning.

Lease from G.Q. Olsen to Consolidation Coal Co. dated 12/17/80

SE $\frac{1}{2}$ NE $\frac{1}{4}$

Lease from R.D. Jensen and D.R. Close to Consolidation Coal Co. dated 12/17/80

NE $\frac{1}{4}$ NE $\frac{1}{4}$
E $\frac{1}{2}$ SE $\frac{1}{4}$
SW $\frac{1}{4}$ SE $\frac{1}{4}$
NE $\frac{1}{4}$ SW $\frac{1}{4}$

Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58

S $\frac{1}{2}$ SW $\frac{1}{4}$

Lease from State of Utah to Kemmerer Coal Co. dated 1/23/68 (#25005)

Section 30

S $\frac{1}{2}$ NE $\frac{1}{4}$
E $\frac{1}{2}$ NW $\frac{1}{4}$
NW $\frac{1}{4}$ SE $\frac{1}{4}$
SW $\frac{1}{4}$ SE $\frac{1}{4}$
SE $\frac{1}{4}$ SW $\frac{1}{4}$

Deed from Emery County to Kemmerer Coal Co. dated 5/14/68

N $\frac{1}{2}$ NE $\frac{1}{4}$
SW $\frac{1}{4}$ NW $\frac{1}{4}$
NE $\frac{1}{4}$ SW $\frac{1}{4}$

Deed from L.M. and S.M. Pratt to Kemmerer Coal Co. dated 6/22/49

NW $\frac{1}{4}$ NW $\frac{1}{4}$

Private ownership, R. Lewis

W $\frac{1}{2}$ SW $\frac{1}{4}$

U.S.A. not leased

NE $\frac{1}{4}$ SE $\frac{1}{4}$

Lease from John and Carolyn Lewis to Consolidation Coal Co. dated 11/12/80

SE $\frac{1}{4}$ SE $\frac{1}{4}$

Lease from State of Utah to Kemmerer Coal Co. dated 1/23/68 (#25005)

Section 31

W $\frac{1}{2}$ NE $\frac{1}{4}$
E $\frac{1}{2}$ NW $\frac{1}{4}$
NW $\frac{1}{4}$ NW $\frac{1}{4}$

Deed from Emery County to Kemmerer Coal Co. dated 5/14/68

SW $\frac{1}{4}$ NW $\frac{1}{4}$
W $\frac{1}{2}$ SW $\frac{1}{4}$
SW $\frac{1}{4}$ SE $\frac{1}{4}$

See Note A.

	E $\frac{1}{2}$ NE $\frac{1}{4}$	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58
	NW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$	Lease from State of Utah to Kemmerer Coal Co. dated 11/19/62 (#19797)
	E $\frac{1}{2}$ SE $\frac{1}{4}$	Deed from L.M. and S.M. Pratt to Kemmerer Coal Co. dated 6/22/49
Section 32	NW $\frac{1}{4}$ E $\frac{1}{2}$	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58
	SW $\frac{1}{4}$	Deed from L.M. and S.M. Pratt to Kemmerer Coal Co. dated 6/22/49
Section 33	All	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58
Section 34	N $\frac{1}{2}$	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. dated 10/1/58
	S $\frac{1}{2}$	U.S.A. not leased
<u>Township 22 South Range 5 East (SLM)</u>		
Section 25	E $\frac{1}{2}$ E $\frac{1}{2}$	U.S.A., not leased
Section 36	All	Utah State, not leased
<u>Township 23 South Range 5 East (SLM)</u>		
Section 1	All	U.S.A., not leased
<u>Township 23 South 6 East (SLM)</u>		
Section 6	N $\frac{1}{2}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$	See Note A.
	NE $\frac{1}{4}$ NE $\frac{1}{4}$	Deed from L.M. and S.M. Pratt to Kemmerer Coal Co. dated 6/22/49
Section 5	NW $\frac{1}{4}$ NW $\frac{1}{4}$	Deed from L.M. and S.M. Pratt to Kemmerer Coal Co. dated 6/22/49
	E $\frac{1}{2}$ E $\frac{1}{2}$ W $\frac{1}{2}$ W $\frac{1}{2}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$	Lease from U.S.A. (BLM) to Consol and Kemmerer dated 6/1/62

Section 4	W $\frac{1}{2}$	Lease from U.S.A. (BLM) to Consol and Kemmerer dated 6/1/62
	E $\frac{1}{2}$	U.S.A., not leased

**NOTE A: The Kemmerer Coal Company has been paying taxes on these lands for a number of years. However, during the title investigations, the deed from Ira Browning to Kemmerer was found to be missing, but these lands are not included in the Browning estate. Therefore, it is Consol-Kemmerer's contention that these coal lands do indeed belong to Consol-Kemmerer, although judicial action will probably be necessary to clear them. The legal proceedings for these properties will be initiated in the near future.

4.3.2.1 Permit Area Coal Leases

Coal leases within the permit area are shown on Plates 4-2 and 4-3. They are discussed in Section 4.3.2.

4.4 Land Use

4.4.1 Regional Land Use

Regionally, land use in the vicinity of the Emery Mine includes five types. These are forestland, agriculture, pinyon-juniper rangeland, open rangeland, and urban areas. Figure 4-1 shows these land uses as they occur near the Emery Mine. The closest town is Emery which has a population of approximately 220 people, most of whom are involved in ranching, limited agriculture, or employed at the Emery Mine (BLM, 1979).

Present day agriculture consists of alfalfa and improved pastureland. The adjacent open and fenced rangeland is used for livestock grazing. There is limited recreational use because of the open land (BLM, 1979).

4.4.2 Land Use in the Permit Area

Permit area land use is divided in several categories, including pastureland, irrigated farmland and pasture, wildlife habitat, rangeland, built-up, and lands disturbed by mining and gravel pits.

These land uses occur in several combinations throughout the area. Table 4-1 lists the acreage distribution for land use in the permit area (also see Section 3.4.1).

Land use in the permit area was determined according by soil use, which is discussed in Chapter 8. Plate 8-3 shows the uses within the permit area.

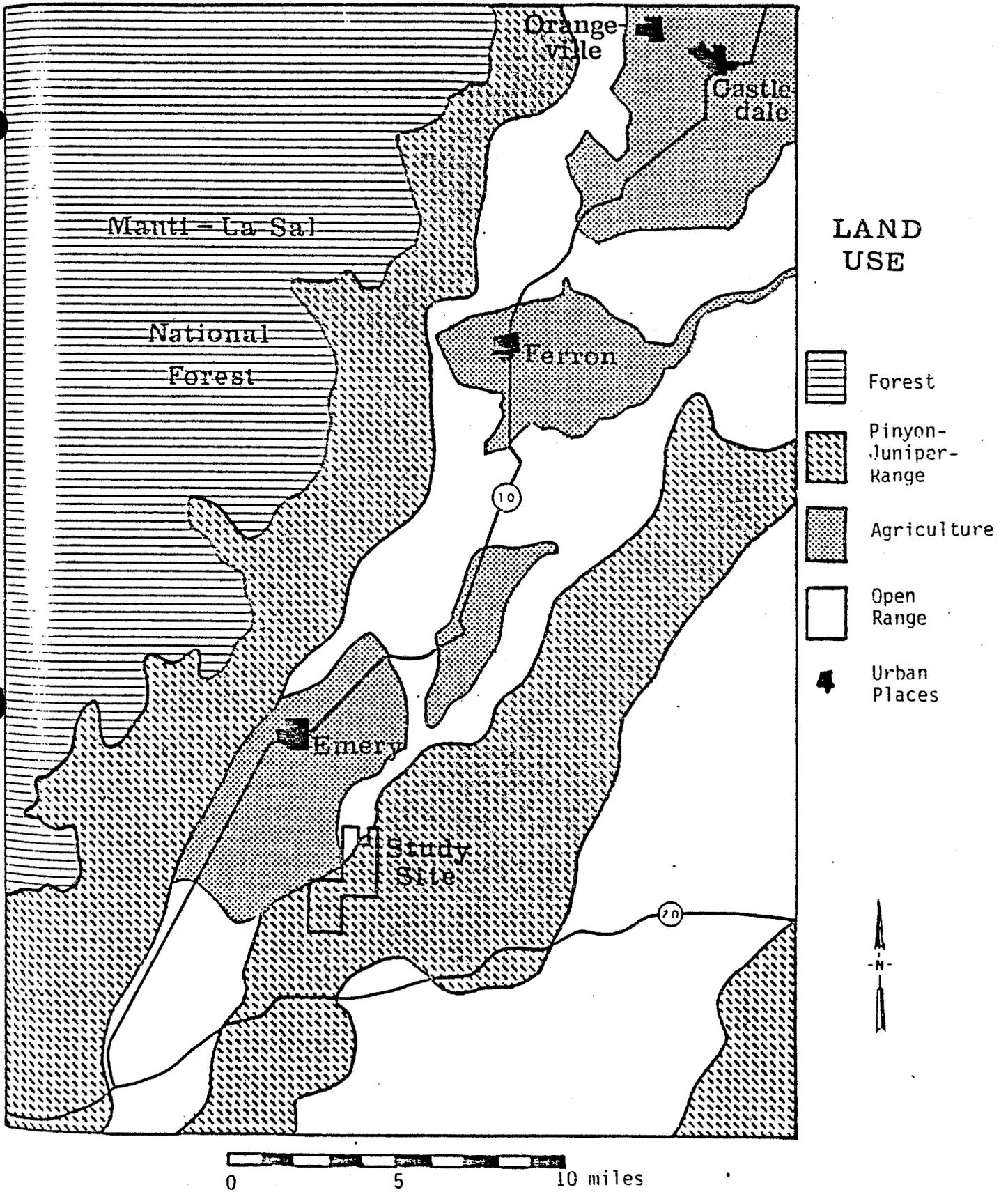


FIGURE 4-1
Land Use in Emery Mine Region

(Source: BLM, 1979)

TABLE 4-1

Permit Area Land Use		
Category	Acres	% of Area
Disturbed Lands (Mining disturbance, gravel pits)	42	1
Farmland	1,321	25
Irrigated Cropland	311	6
Pasture/Irrigated Pasture	115	2
Rangeland/Wildlife Habitat/Forest	103	2
Rangeland/Wildlife Habitat	1,871	37
Rangeland	1,370	26
Wildlife Habitat	47	1
	5,180	100

4.4.3 Land Use During Mining

The land use in the permit area during mining operations will not vary significantly from the premining uses. At present, only the land uses in the vicinity of the surface facilities have been affected. These impacts will be only temporary, since the land will eventually be reclaimed to its premining use. Since subsidence from underground mining is not expected to occur, land uses in other parts of the permit area will not be affected.

4.4.3.1 Affects of Mining on Land Use

The effects of mining on land use will be only temporary. Since subsidence is not expected to occur, only surface facility disturbances will affect land use. As seen on Plate 8-3, the land use in the vicinity of the Emery Mine surface facilities was originally grazing land (rangeland), wildlife habitat, and forestland. The reclamation plan (Section 3.5) has been designed to replace these uses.

There has been an underground mine at this location for more than 80 years. The continuation of mining under the proposed 5-year mine plan is not expected to cause any further degradation of land use or land use potential.

4.4.3.2 Mitigation of Effects of Operation

The reclamation plan discussed in Section 3.5 was developed to replace the same land uses that existed prior to mining. The replacement of these uses will make the land productive for wildlife and grazing livestock.

Certain environmental protection measures will be taken during mining to ensure that impacts will be minimized. These measures include: (1) sedimentation control; (2) protection of suitable soil resources; (3) minimizing surface disturbance; and (4) subsidence control.

4.5 Post-mining Land Use

The surface affected areas will be reclaimed to the same land uses that existed prior to mining. These uses are rangeland and wildlife habitat and will be compatible with surrounding land uses and regional land use policies.

4.6 Socioeconomic Characteristics

Continued mining at the Emery Mine is not expected to change the sociological or economic characteristics of the surrounding area. Considering the length of time the Emery Mine has been in production and based on the proposed 5-year mine plan, there do not seem to be any factors that could significantly change the socioeconomic status quo.

References

Bureau of Land Management. 1979. EMRIA Report No. 16: Reclaimability Analysis of the Emery Coal Field, Emery County, Utah. Prepared by Playa Del Rey, CA: Geoscientific Systems and Consulting for the BLM.

CHAPTER 5.0
ARCHEOLOGICAL EVALUATIONS
IN THE
EMERY MINE PERMIT AREA
IN
EMERY COUNTY, UTAH

Mine Plan Applicant: Consolidation Coal Company
of the Emery Mine Project

F. R. Hauck, Ph.D., Principal Investigator



Report Prepared by:
F. R. Hauck and D. G. Weder
ARCHEOLOGICAL-ENVIRONMENTAL
RESEARCH CORPORATION

PAPER NO. 24

October, 1980

Salt Lake City, Utah

TABLE OF CONTENTS

	<u>Page</u>
5.1 Scope	5-1
5.2 Methodology	5-5
5.2.1 Field Research	5-5
5.2.2 Laboratory Research	5-8
5.2.3 Artifact Inventory and Analysis	5-9
5.3 Environment and Locality	5-13
5.4 Prehistory and History of the Region	5-16
5.4.1 The Prehistoric Period	5-16
5.4.1.1 Paleo Indian Period	5-16
5.4.1.2 Archaic Phase	5-18
5.4.1.3 Fremont Period	5-21
5.4.1.4 Shoshonean Phase	5-24
5.4.2 The Protohistoric Period	5-25
5.4.2.1 Precontact	5-26
5.4.2.2 Early Contact	5-26
5.4.2.3 Late Contact	5-28
5.4.3 The Historic Period	5-31
5.5 Previous Investigations in the Region	5-39
5.6 Research Design	5-43
5.7 Cultural Resource Descriptions	5-45
5.7.1 Site Analyses	5-45
5.7.2 Comparative Resource Analyses	5-48
5.8 Evaluations and Recommendations	5-49
5.8.1 Resource Significance Evaluations	5-49
5.8.2 National Register Criteria for Eligibility	5-52
5.8.3 Discussion of Impact Potential on Cultural Resource Sites	5-53
5.8.4 Recommendations	5-56
5.9 Bibliography for Cultural Resources	5-60
5.10 Paleontology	5-71

App 5-1 Additional Arch. Investigations
5-2 Arch. Survey of Borehole Amendment
88d

List of Figures

	Page
5-1. General Project Area.	5-3
5-2. Emery Mine Intensive Survey Area and Sample Units.	5-4
5-3. Cultural Resources in the General Locality.	5-7
5-4. Diagnostic Lithic Artifact Sketches	5-11
5-5. Vertebrate and Plant Fossil-Bearing Areas in Central Utah Coal Region	5-72

List of Tables

	<u>Page</u>
5-1. Survey Unit Locations (Ownership and Acreage).	5-6
5-2. Site-Artifact Descriptions	5-10
5-3. Cultural Resource Site Summary	5-47
5-4. Cultural Resource Site Significance	5-51
5-5. Cultural Resource Impact Potential	5-54

ABSTRACT

In the summer of 1980, the Archeological-Environmental Research Corporation (AERC) conducted an intensive surface evaluation of 460 acres in the Emery Mine Project area for Consolidation Coal Company (CONSOL). The purpose of the field research was to assess the existence of cultural resources in the previously unevaluated segments of the mine permit area. Seven cultural resource sites were found within the Emery Mine Project disturbance zone, another six sites were located in the mine permit area, and three sites were located outside the mine permit area and the potential disturbance zone. None of these sites are considered to be eligible for nomination to the National Register of Historic Places, although the eight most significant sites are potential candidates for nomination.

Three sites, 42Em1314, 42Em611, and the Browning Mine (488N/10), all of lesser significance, have a high potential for disruption during mine development. Two sites, 42Em1317 and 42Em1319 (with the latter site having potential for nomination to the National Register), have a high potential for being destroyed by vandalism and erosion, and a moderate potential for adverse affect from mine development. Some seven sites (42Em625, 626, 627, 1312, 1313, 1316, and 1318) have a moderate potential for disruption from mining development, vandalism, or erosion. The remaining four sites (42Em1311, 1315, 1321, and 488N/11) have a low to moderate potential for disturbance, with three of these sites being outside the permit and disturbance zone.

5.0 HISTORICAL AND CULTURAL RESOURCES

5.1 Scope

In July and August of 1980, the Archeological-Environmental Research Corporation (AERC) of Salt Lake City was contracted by Consolidation Coal Company (CONSOL) to conduct an intensive surface archeological survey in the existing Emery Mine Project area. CONSOL, desirous of preparing a mine plan application for submission to federal and state authorities, requested that cultural resource evaluations be conducted which would comply with pertinent governmental legislation, i.e., Executive Order 11593 "Protection and Enhancement of the Cultural Environment" (Federal Register, Vol. 36, No. 95, May 15, 1971), and "The Archeological and Historical Data Conservation Act of 1974," which is an amendment of "The Reservoir Salvage Act of 1960" (Stat. 220). For additional information on this development, please refer to the mine plan application prepared by CONSOL.

AERC's field evaluations for CONSOL in the general central Utah region began in 1976 with an intensive evaluation of proposed well locations and access roads in the Dog Valley locality which is situated six miles south of the Emery Mine Project (see Hauck 1976). During the 1977, 1978, 1979, and 1980 field seasons, AERC personnel conducted numerous cultural resource surveys in the general area for CONSOL's coal exploration unit. In 1980, three separate consulting projects were initiated by AERC for CONSOL in this general locality. Two of these projects (CCC-80-2 and 80-3) were conducted within the Emery Mine Project area with the latter being the intensive survey related to the permitting of the Emery Mine. AERC has recorded nine cultural resource

sites within the Emery Mine Project area. These include the Browning Mine site, 42Em1312, 1313, 1314, 1316, 1317, 1318, 1319, and 1321 (AERC 488N/2-4, 488N/6-10, and 488N/12). Three other sites lie outside the permit area and include the Spanish Trail (488N/11), and sites 42Em1311 and 42Em1315. All sites recorded in this report are situated on private land.

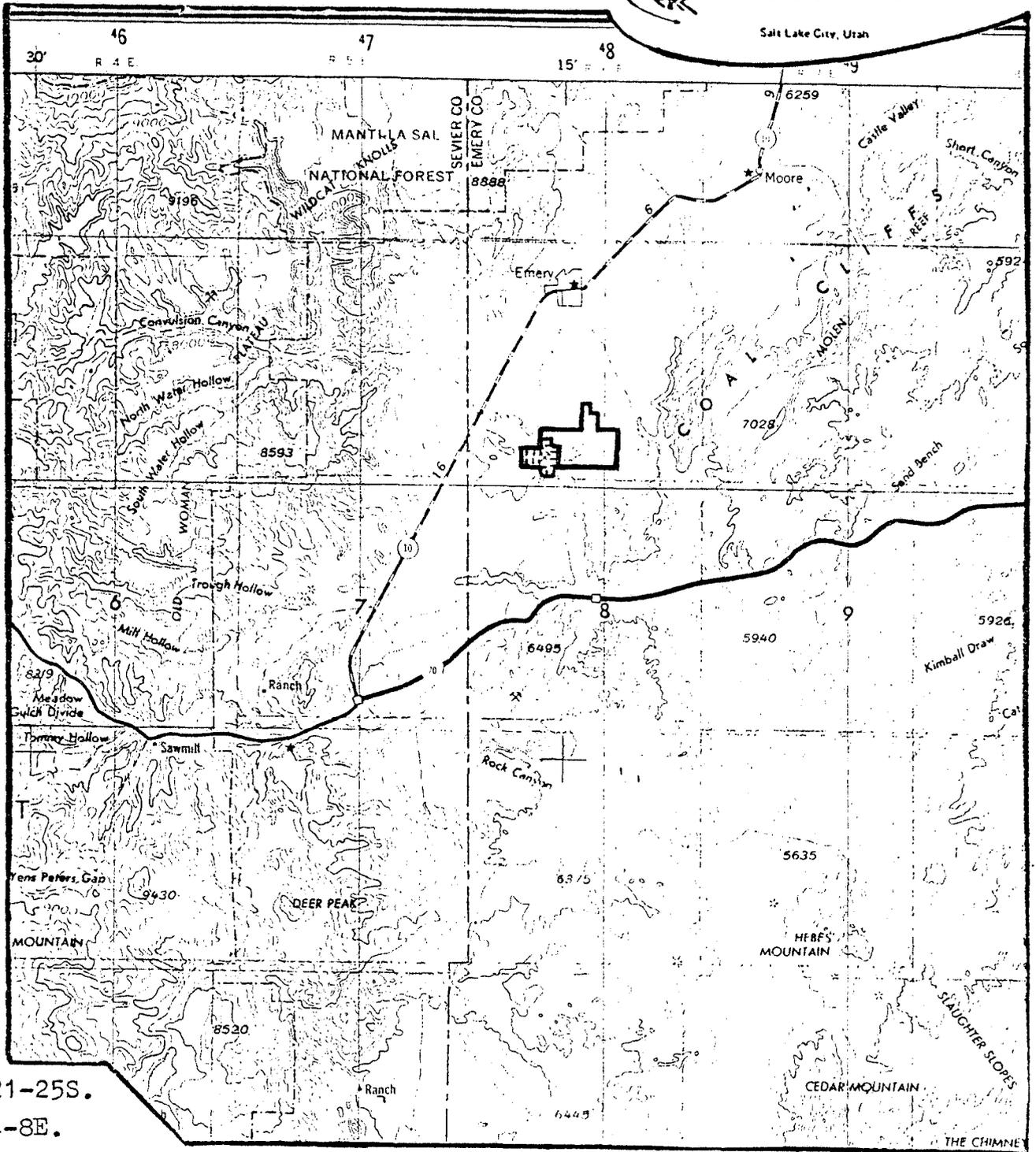
Archeologists attached to the Antiquities Division of the Utah State Historic Preservation Office (SHPO) and to the Bureau of Land Management have also conducted investigations in the Emery Mine Project area in 1974 and 1975. Their evaluations resulted in the recording of four sites, 42Em611, 625, 626, and 627, which are all along Christiansen Wash. Thus, a total of 16 known prehistoric and historic cultural resource sites is situated within, or near, the Emery Mine Project area as defined on Figure 1 (also see Plate 5-1).

AERC initiated the 1980 field work under U.S. Department of Interior Antiquities Permit No. 80-Ut-069 (expires 5-8-81). Work on the Emery Mine permit area extended from September 9 to October 6, 1980.

The resource inventory included one large land parcel of about 410 acres situated in Sections 32 and 33 of Township 22 South, Range 6 East (see Figure 2). Three sample survey units situated in Sections 33 and 34 were also intensively evaluated. These three units involve about 50 acres and are located outside that segment of the Emery Mine permit area which was intensively evaluated by Michael Berry of SHPO in 1975. Because an intensive survey in parts of Sections 27 and 28 had been previously completed by Berry, sample survey units on those same parcels were not re-inventoried, but AERC's sample survey was confined to the northern half of Section 34 and the southern half of the northeast quarter of Section 33. These three sample survey units total about 50 acres, or 11 percent, of the total 440 acres situated within the sampling universe.



Salt Lake City, Utah



T. 21-25S.

R. 4-8E.

Meridian: Salt Lake B. & M.

Quad:

Project: CCC-80-3
Series: Central Utah
Date: 10-9-80

Figure 5-1
General Project Area

Salina, Utah
1:250,000

Legend:
Permit Area
Boundary



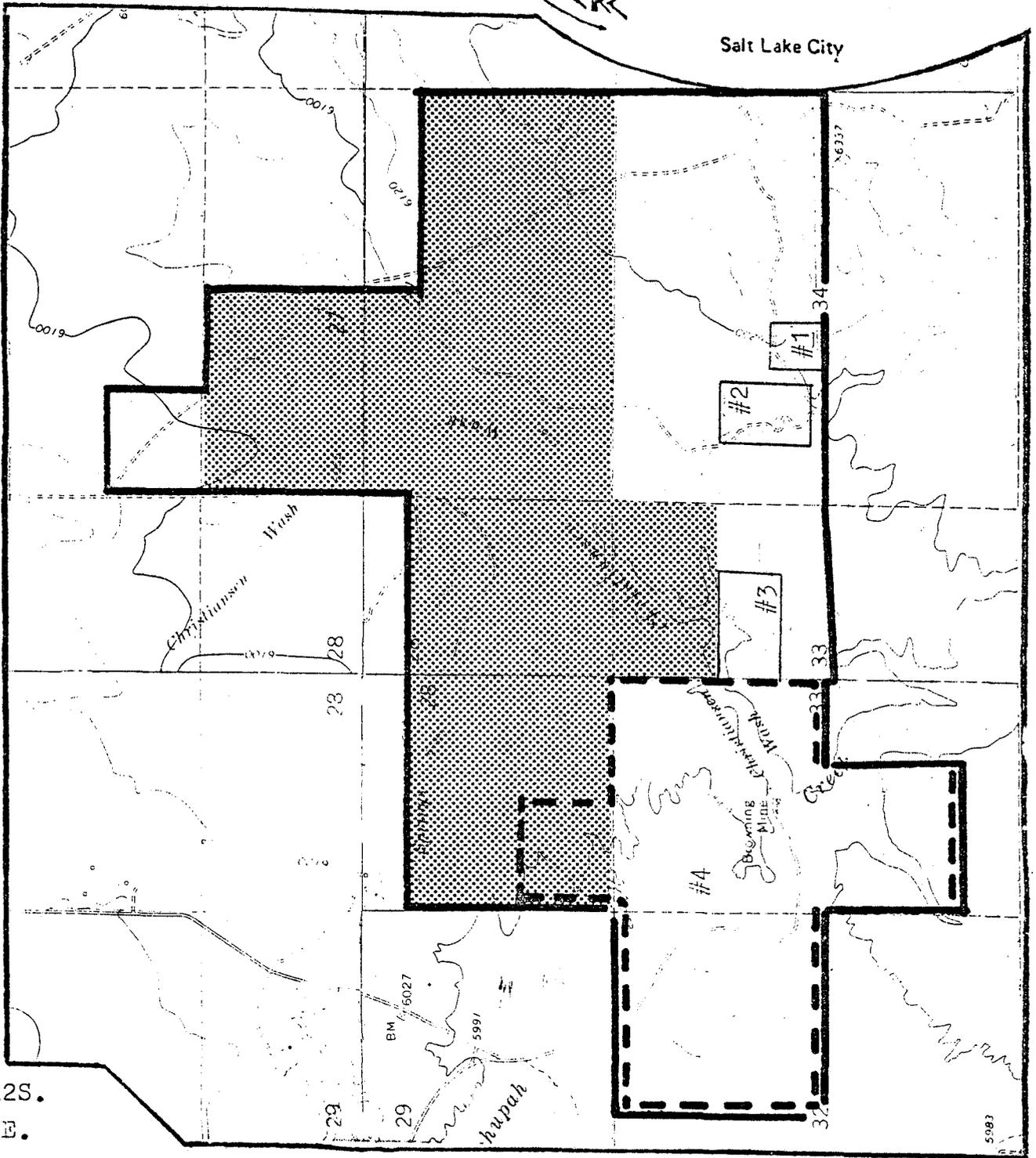
Potential Mine
Disturbance Zone

1" = 4 miles

Scale 5-3

AEPC

Salt Lake City



T. 22S.

R. 6E.

Meridian: Salt Lake B. & M.

Quad:

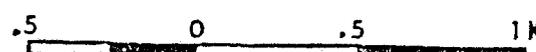
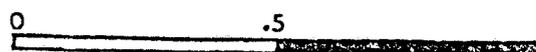
Project: CCC-80-3
Series: Central Utah
Date: 10-9-80

Figure 5-2
Emery Mine
Intensive Survey Areas
and
Sample Units

Walker Flat, Utah
Composite Map
7.5 Minute - USGS

Legend:

Project Boundary 
Potential
Disturbance Zone 
Sample Survey Unit 



Scale 5-4

M. Berry's 1975
Project 



5.2 Methodology

5.2.1 Field Research

Between September 9 and 17, 1980, a cultural resource inventory of surface areas was conducted by AERC personnel for CONSOL in the Emery Mine Project area in the Quitchupah Creek locality of Emery County, Utah.

The AERC personnel involved in the field work included V. G. Norman, Michael Sloan, Bunny Melendez, and Mark Melendez. V. G. Norman was in charge of the field crew with F. R. Hauck as the principal investigator.

The cultural resource inventory included an intensive evaluation of four separate survey units (see Table 1). Units 1, 2, and 3 involve sample units selected to provide a ten percent coverage of the 440 acres in the Emery Mine Project area which were not previously examined by Michael Berry in 1975. The 50 acres within these three sample units comprise an 11 percent coverage of the 440 acre total situated in the southwestern quarter of Section 22, the southern half of the northeast quarter of Section 33, and in the northern half of Section 34.

Survey area 4 (see Figure 2) involved an intensive examination of the 410 acres which surround the Emery Mine. All of the surfaces evaluated in units 1 through 4 lie on privately owned lands.

The purpose of the sample survey of units 1, 2, and 3 was to assess the probability of cultural resource presence in the previously unevaluated segments of the mine permit area, specifically on the south bank of Christiansen Wash (unit 3) and along the course of a primary tributary of Christiansen Wash (units 1 and 2). Christiansen Wash and its tributaries were selected for intensive evaluation because of their high potential for containing important cultural resources as contrasted to the marginal potential presented by the barren

clay hills to the north. The purpose of the intensive survey of area 4 was to determine the presence or absence of any surface cultural remains within the actual disturbance zone of the Emery Mine.

All examined surfaces were evaluated by personnel walking a series of parallel transects with individual spacing ranging between 15 and 25 meters. When evidences of cultural resource presence were observed, the team members altered their survey pattern and positions to better determine the spatial extent of the potential site. Cultural resource sites were evaluated, recorded, sketched, photographed, and the locations plotted on a standard USGS topographic map. Isolated diagnostic artifacts were recovered with the location shown on the field map.

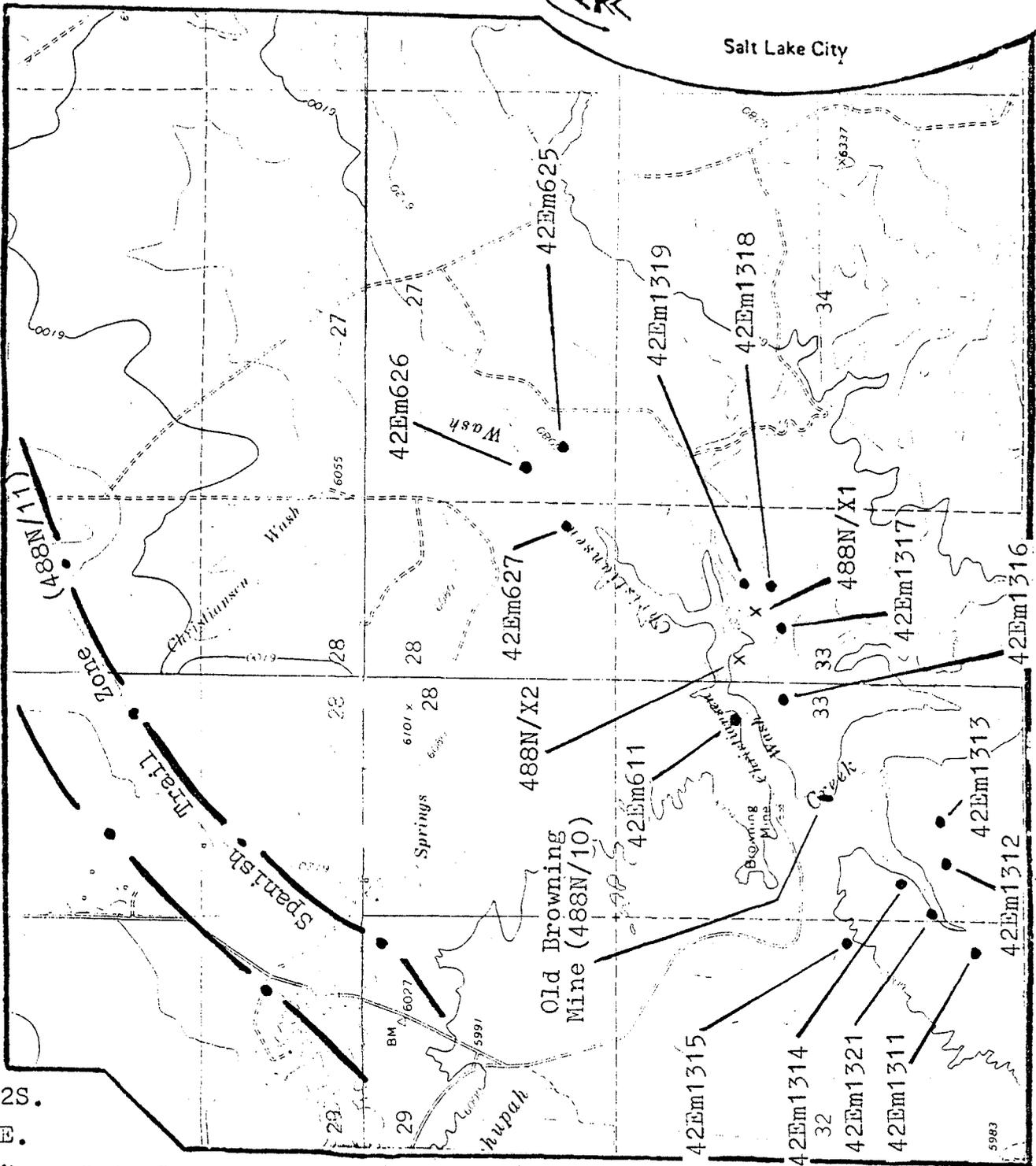
A total of eight prehistoric cultural resource sites was recorded within, or adjacent to, units 3 and 4 (see Figure 3). One previously recorded site, 42Em611, is also situated in unit 4. In addition, the Browning Mine, which was first opened in the 1920s, lies within the project area and therefore constitutes a historic site. Thus, seven cultural resource sites are situated in the Emery Mine Project disturbance zone with another six sites being located in the mine permit area while three sites, 42Em1311, 42Em1315, and a segment of the Spanish Trail, are located outside the potential disturbance zone (see Plate 5-1).

Table 5-1

<u>Survey Unit</u>	<u>Acreage</u>	<u>Location</u>	<u>Ownership</u>
1	10	T22S., R6E., Sec. 34	Private
2	20	T22S., R6E., Sec. 34	"
3	20	T22S., R6E., Sec. 33	"
4	410	T22S., R6E., Sec. 32, 33	"



Salt Lake City

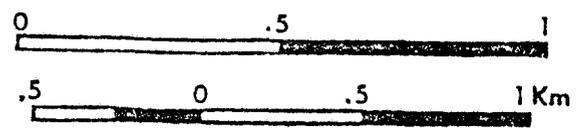


T. 22S.
R. 6E.

Meridian: Salt Lake B. & M.

Quad:

<p>Project: CCC-80-3 Series: Central Utah Date: 10-9-80</p>	<p>Figure 5-3 Cultural Resources in the General Locality</p>	<p>Walker Flat, Utah Composite Map 7.5 Minute - USGS</p> 
		<p>Legend: Archeological Site ● Isolated Artifact x</p>



Scale 5-7

5.2.2 Laboratory Research

The analyses performed in the laboratory for this project concerned the evaluation of projectile points, miscellaneous lithics and ceramic fragments.

Projectile point analyses includes identification of manufacturing techniques, e.g., heat treatment, blank and preform preparation, edge grinding, edge reworking and use wear analyses. Arrow and atlatl points were catalogued according to type.

The evaluation of miscellaneous lithics involves obsidian trace element analysis and the identification of various tool styles and manufacturing techniques.

Ceramics collected during the performance of the field survey were examined to determine manufacturing technique, paste and temper composition, and surface preparation. Sherds were later catalogued according to type and variety.

5.2.3 Artifact Inventory and Analysis

Chronological evaluations of prehistoric sites were accomplished through artifact correlation with established types and varieties. The various projectile point types collected from the field were generally identifiable with similar Great Basin, Eastern Great Basin, Colorado Plateau and Western Plains types. Ceramics were evaluated for type and, thus, correlated with the types and varieties of local Utah wares.

Table 2 contains a list of sites inventoried by AERC and a description of artifacts collected in the field. A total of 20 artifacts was collected including nine ceramic and 11 lithic fragments. Sketches of the diagnostic lithic artifacts are provided in Figure 4.

Table 5-2

<u>AERC No.</u>	<u>Permanent Site No.</u>	<u>Artifact</u>
488N/1	42Em1311	3 sherds-Snake Valley Gray
488N/2	42Em1312	Not collected
488N/3	42Em1313	" "
488N/4	42Em1314	" "
488N/5	42Em1315	" "
488N/6	42Em1316	1 primary flake
488N/7	42Em1317	Not collected
488N/8	42Em1318	1 sherd-Snake Valley Gray 1 sherd-Ivie Creek B/w 1 secondary flake 1 biface blade base 1 side-notch knife 1 Pinto point
488N/9	42Em1319	2 sherds-Emery Gray 2 sherds-Snake Valley Gray 1 biface blade base 1 serrated Gypsum point 1 corner-notch point
488N/10	Browning Mine	Not collected
488N/11	Spanish Trail	" "
488N/12	42Em1321	" "
488N/X1	Isolated artifact	Northern side-notch point
488N/X2	" "	Pinto sloping shoulder point
488N/X3	" "	Fragmented projectile point

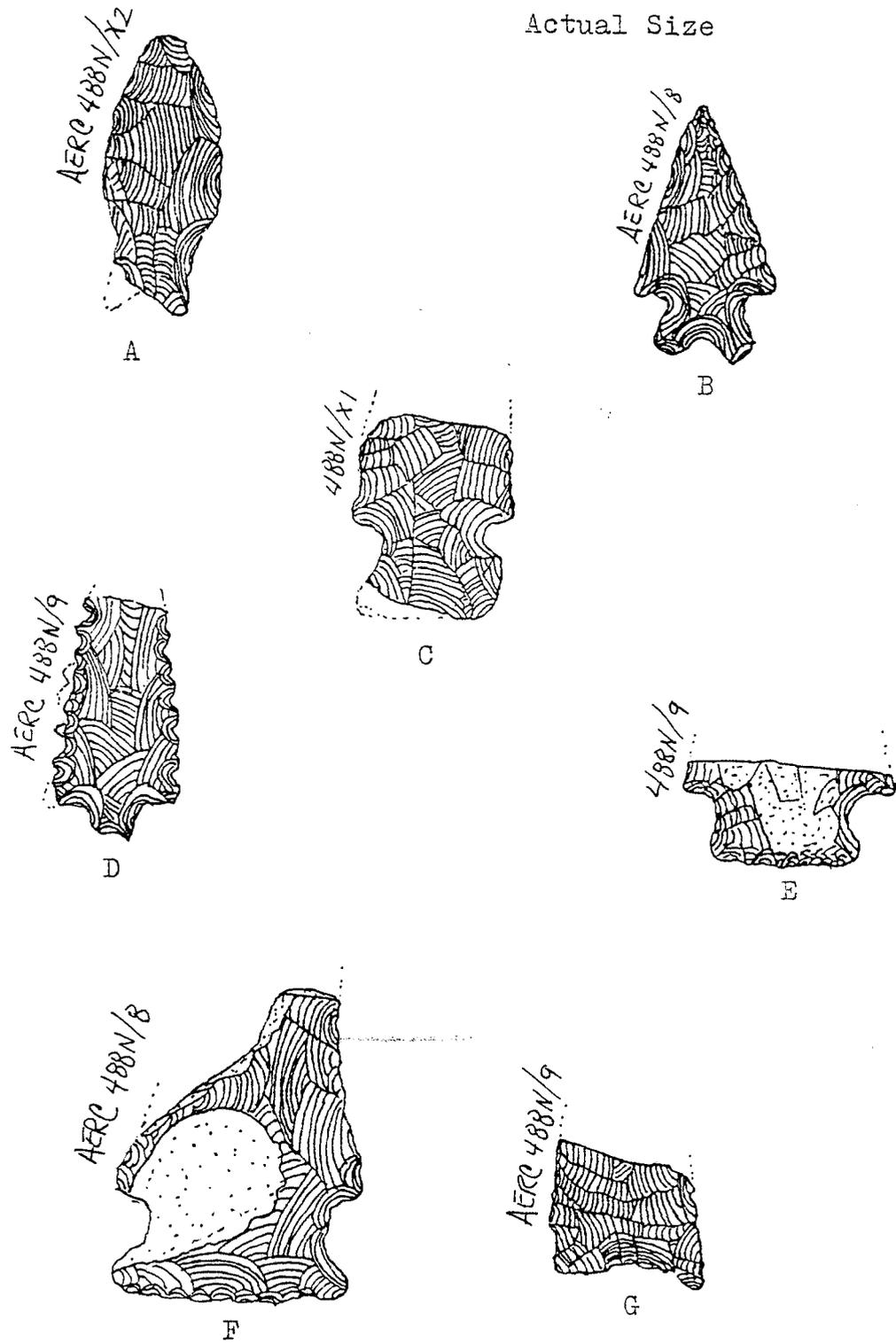


Figure 5-4

The project area is situated some four miles south of Emery, Utah. U.S.G.S. 7.5 minute topographic quads of the project area include Emery East, Walker Flat and Mesa Butte, Utah.

Surfaces within the Emery Mine Project area are primarily privately owned; however, federal land administered by the Bureau of Land Management is located in the southwest quarter of Section 33 and lies outside, but adjacent to, the project boundary in Sections 26, 34 and 35.

All field notes and site data are on file at AERC headquarters in Bountiful, Utah. Site reports are being submitted to the SHPO and to all relevant government agencies as an appendix to this final report. Artifacts collected by AERC during the survey are being curated at the Museum of Archaeology and Ethnology at Brigham Young University.

5.3 Environment and Locality

The Emery Mine Project area is located in the northern portion of the Walker Flats segment of Castle Valley. Quitchupah Creek and its tributary, Christiansen Wash, are the primary drainages within the project area. These flats are flanked on the west and east, respectively, by the high Wasatch Plateau piedmonts and the lower elevation Coal Cliffs. The elevations within the mine project area range from 5880 feet to 6100 feet ASL.

The general locality is situated in the Desert Shrub and Pinyon-Juniper ecozones with sparse juniper communities and greasewood communities extending along drainages within the Desert Shrub zone. The vegetation is the Desert Shrub ecozone and consists primarily of scattered pockets of sagebrush Artemisia tridentata, Plains prickly pear Opuntia polyacantha, fishhook cactus Sclerocactus whipplei, rabbitbrush Chrysothamnus nauseosus, and shadscale Atriplex canescens.

The lower elevations of the Pinyon-Juniper ecozone extend into the project area and are primarily associated with the Ferron Sandstone outcrops with their attendant stony soils and drainages. Here Juniperus is the most apparent vegetation with sagebrush, rabbitbrush, and shadscale communities interspersed among the junipers.

Stream channels along the Quitchupah primarily support greasewood Sarcobatus vermiculatus and Tamarix ramosissima communities, while the junipers form the more abrupt and rocky tributaries which have a northern or western aspect.

The surface geology of the Emery Mine Project area is predominantly composed of Quaternary period alluvial deposits which originated in the Wasatch Plateau piedmonts to the northwest. Two Cretaceous period members of the Mancos Shale Formation are also found in the vicinity of the Quitchupah channel. These include the gray clay flats which make up the Blue Gate Shale Member and the Ferron Sandstone Member.

Precipitation rates within the mine permit area include eight inches of rainfall or snow per annum with four inches occurring between the months of May and September. The freeze-free season for the year is relatively long averaging from 120 to 140 days per annum, which is sufficient for horticultural demands.

Prior to the beginning of the Holocene Epoch (ca. 10,000 years B.P.), the pluvial conditions of the Pleistocene in the eastern Great Basin and in the Wasatch Range began to decrease. The gradual heating and drying trend of the Anathermal (ca. 10,000 to 7500 B.P.) was accelerated until ca. 4000 B.P., although this occurrence varied in different localities throughout the West relative to local conditions. The ecosystems of the project area were, undoubtedly, influenced by these climatic changes from cool and wet through a period of increasing desiccation. After ca. 4000 B.P., the climate in the Intermountain West became cooler and wetter than at the present with a subsequent remigration of floral and faunal species from the upper elevations back into the lower basins. These fluctuations in climate affected prehistoric human occupation patterns in the west as shall be noted in a later section.

Land-use techniques employed in the project area have ranged from hunting-gathering activities, which began during the Pleistocene, to primitive farming technology practiced along the river bottoms by the Fremont peoples as early as 1500 B.P. With the introduction of the Euro-American settlers in the 19th Century, modern farming technology, including horticulture and livestock production, became established in the Castle Valley area. During the Historic period until the present, the general project area has been primarily utilized as rangeland for livestock grazing. Some horticulture related to the livestock industry has

developed along the alluvial creek bottoms that extend between the Wasatch Cliffs and the Coal Cliffs. In addition to agriculture, some coal mining has occurred during the 20th Century at the junction of Quitchupah Creek and Christiansen Wash at the site of the Browning Mine.

5.4 Prehistory and History of the Region

The variety of human cultures which have inhabited the project region can be examined from several perspectives. The temporal continuum extending over a range of 12,000 years involves such diverse groups as the early prehistoric big game hunters, the archaic hunter-gatherers, the semi-horticultural Fremont, the Shoshonean bands, the early historic explorers and fur trappers, the Mormon colonists, the coal and cattle barons, the final influx of farmers, small town settlers, and merchants. Man's social and technological variations mirror the complexity of his changing ecological system.

5.4.1 The Prehistoric Period

The Prehistoric period within the project region can be subdivided into four main temporal phases: Paleo Indian, Archaic, Fremont and Shoshonean.

5.4.1.1 Paleo Indian Phase

The Paleo Indian phase began at approximately 12,000 B.P. and terminated by about 7000 B.P., and is generally divided into three subphases which are known as the Llano, Folsom and Plano cultures (Jennings 1974:81).

The Llano culture was characterized by the hunting of mammoth during a time period between 12,000 B.P. and 10,000 B.P. Since the Llano culture has been defined primarily from the excavation of mammoth kill sites, very little is known about the overall subsistence activities of this culture.

Evidence of the Llano culture has been found over a widespread area in the Intermountain West and Southwest. The Clovis point, a large, lanceolate, fluted spear point is the only artifact which can be used confidently to infer the presence of the Llano hunters. Clovis points, in association with mammoth remains, have been found in New Mexico, Oklahoma, Colorado, Arizona and Wyoming.

Based on these sites, which are characterized by mammoth-Clovis point association, the core area of the Llano culture is limited to eastern Colorado, most of New Mexico, and eastern Arizona. However, the Clovis point by itself has a much larger distribution. Clovis points, or very similar fluted points, have been found throughout the entire United States.

Within the project region of Utah, no characteristic Llano sites have been found, although several isolated Clovis points and one fluted point site have been reported. An isolated Clovis point was reported from Sevier County, Utah (Tripp 1966). Gunnerson (1956) performed a test excavation on a small rockshelter in Emery County (42Em8) from which a local collector had obtained a Clovis point. The test excavation did not, however, recover any additional Clovis points. An unusual fluted point very closely resembling the Cumberland fluted points commonly found east of the Mississippi River was found by an amateur collector in the San Rafael Swell and reported by Hauck 1979 (see 42Em677).

The Folsom culture (ca. 11,000 B.P. to 9000 B.P.) immediately followed the Llano culture, but several differences in subsistence and artifacts allow a clear distinction to be drawn. Although the primary evidence of the Folsom culture is also from kill sites, the fauna hunted and the projectile points used are different from the Llano culture. The Folsom point is a lanceolate, fluted and usually eared projectile point generally smaller and thinner than the Clovis point. In addition, the Folsom point is associated at kill sites with the extinct Bison antiquus.

Folsom kill sites occur predominantly within the same region as the Llano core area but isolated Folsom points are not as widely distributed as Clovis points. Isolated Folsom points are almost entirely limited to the High Plains immediately east of the Rocky Mountain. A total of 11 Folsom points has been found in Utah but only one of these, found by an amateur

collector somewhere in the San Rafael Swell, is known from the project region (Tripp 1967).

The Plano subphase of the Paleo Indian phase extends from ca. 9000 B.P. to 7000 B.P. The Plano culture, like the Llano and Folsom cultures before it, was economically partially dependent on large game, bison in particular. However, the Plano culture is characterized by a great diversity of projectile point types. Plano culture projectile points are typically lanceolate, precisely flaked, and non-fluted.

A new hunting technique also became widespread during the Plano subphase, the jump-kill. The jump-kill hunting technique entailed the driving of a herd of bison over the edge of a cliff or arroyo in order to injure or kill the bison.

Evidence of Plano culture inhabitation is predominantly limited to the High Plains east of the Rocky Mountains. The presence of Plano culture hunters in Utah is not widely acknowledged.

The presence of Paleo Indian cultures within Utah was minimal even during the Llano subphase, and tended to decrease with time. The slight Paleo Indian utilization of Utah can possibly be tied to the relative scarcity of the large game species in Utah compared to the Great Plains east of the Rocky Mountains. The widespread increase in aridity following the end of the Pleistocene was more acute west of the Rocky Mountains than on the eastern side, and as a result, the large herbivorous animals utilized by the Paleo Indian cultures were present on the Great Plains in considerably greater numbers.

5.4.1.2 Archaic Phase

Because of the relatively arid conditions of Utah and the Great Basin, large mammal hunting was not a viable subsistence technique in that area. The Great Basin and

adjacent Colorado Plateau of eastern Utah were occupied at an early date by Indian groups who were engaged in a subsistence pattern dependent on smaller game animals and the gathering of wild plant foods.

The utilization of caves and rockshelters by Archaic cultures in Utah has resulted in good temporal sequences for the entire Archaic phase. Radiocarbon dates from Danger Cave (Jennings 1957) verify human inhabitation of the Great Basin as early as 10,000 B.P., but the artifacts retrieved from the lowest levels of Danger Cave are not diagnostic of any recognized culture group.

In addition to Danger Cave, Hogup Cave (Aikens 1970) in the Great Basin, Sudden Shelter (Jennings et al. 1980a) in the southern Wasatch Mountains, and Cowboy Cave (Jennings et al. 1980b) in southeastern Utah have all supplied important data pertinent to the development of a cultural sequence for the Archaic inhabitants of Utah. The Archaic has been divided into three phases based on changes in projectile point types.

The Early Archaic period begins at approximately 8500 B.P. and continues until about 6000 B.P. Subsistence during this period was based on generalized gathering and hunting techniques. A large variety of plant, animal and insect resources was utilized. Hunting was primarily limited to deer and mountain sheep, although antelope and bison were also utilized. The trapping of rabbits and small rodents was also an important source of protein.

The prevalent utilization of caves and rockshelters as habitations in conjunction with the aridity of the area has resulted in conditions suited to the preservation of normally perishable materials. Due to the excellent preservation, it is known that the spear thrower (atlatl) was the implement used for hunting. The atlatl was used with a two- or three-component shaft and stone dart point throughout the Archaic phase. The

Early Archaic period was characterized by four types of dart points, the Pinto, Humboldt, Elko and the Northern Side-notch (Holmer 1978). During this time period, the Elko point type had a limited areal extent confined primarily to the northeastern Great Basin and the northern Colorado Plateau. The Pinto and Humboldt points, generally found in close association in archeological contexts, had the same distribution as the Elko points, but are also found in sites in southern and central Idaho at this time period. The Northern Side-notch point had a very wide distribution during the Early Archaic period encompassing the northern Great Basin, Columbia Plateau, Northern Colorado Plateau and Great Plains.

The Middle Archaic period began about 6000 B.P. and ended about 4500 B.P. Subsistence techniques and the utilization of caves were the same as during the Early Archaic but dart point styles changed and also diversified. Dart points such as the Rocker Side-notched, Sudden Side-notched, McKean Lanceolate, and San Rafael Side-notched were characteristic of this period (Holmer 1978). The Elko point continued to be used during this period in the same areas as it had been during the Early Archaic period. Although the Rocker Side-notched and Sudden Side-notched points were limited in their distribution to central Utah, the McKean Lanceolate and San Rafael Side-notched styles had wider distributions including the Great Plains at this time. Another point style made its appearance during the Middle Archaic, the Gypsum point (Holmer 1978). This point style was very common in the southern Great Basin and northern Colorado Plateau and continued to be utilized through the end of the Late Archaic period.

The Late Archaic period began about 4500 B.P. and ended at roughly 1700 B.P. Subsistence techniques were essentially unchanged from the earlier Archaic periods and the utilization of the Elko and Gypsum point styles was continued although the latter style is generally limited in its occurrence to the

southern half of Utah. At the end of the Late Archaic period, two new technological developments occurred which mark a significant change in prehistoric subsistence patterns: the introduction of corn and the bow and arrow.

Evidence of corn horticulture in the latter part of the Late Archaic period has been found at several locations: Cowboy Cave (Jennings et al. 1980b), Cottonwood Cave in western Colorado (Hurst 1948), and Clyde's Cavern in central Utah (Winter 1973, Winter and Wylie 1974). At all three locations, corn caches were found which dated generally between 1600 B.P. and 2000 B.P. The very late portion of the Late Archaic period also witnessed the advent of the bow and arrow. At Cowboy Cave (Jennings et al. 1980b), Rose Spring arrowheads were recovered from the uppermost level and were dated about 1700 B.P.

The entire Archaic phase is characterized by a gathering and hunting subsistence mode and a sequence of dart point styles which have been defined through the analysis of excavated cave and rock shelter sites. Transient habitation of these caves during the annual migratory round is the most widely accepted interpretation of the Archaic subsistence pattern.

The atlatl was the universal Archaic hunting implement until the very last centuries of the Late Archaic period. However, the advent of the bow and arrow around 1700 B.P. does not seem to have eliminated the utilization of the atlatl during the Late Archaic. Gypsum dart points continued to be manufactured even after the appearance of Rose Spring arrowheads at Cowboy Cave (Holmer in Jennings et al. 1980b).

5.4.1.3 Fremont Period

The Fremont culture of Utah has traditionally been divided into five regional variants: Parowan, Sevier, Great Salt Lake, Uintah, and San Rafael. However, a recent

re-evaluation has resulted in a three-fold division. The Sevier culture now includes the Sevier, Great Salt Lake, and Parowan variants; the Uintah variant is replaced by an, as yet, unnamed northeastern Utah culture, and the San Rafael variant is designated as the Fremont culture. No cultural entity has been defined that can take into account the variation present between these three groups or areas. The differences are ascribed to separate origins (Madsen and Lindsay 1977).

All of these Utah cultures are characterized by the utilization of permanent dwelling, ceramics, and some degree of corn horticulture. According to Madsen, the Sevier culture (ca. 1300-650 B.P.) can be distinguished from the Fremont culture because of the former's primary dependence on wild foods collected from marshland environments west of the Wasatch Plateau. Madsen notes that Sevier villages are normally located near marshland or riverine biomes and consist of deep semi-subterranean dwellings which are frequently clay lined. In addition, adobe surface storage structures are prevalent.

The Fremont culture is found east of the Wasatch Plateau and north of the Colorado River and dates from between 1500 to 700 B.P. The Fremont culture relied heavily on corn horticulture and is characterized by a settlement pattern which is also distinctly different from the Sevier culture (Madsen and Lindsay 1977). Fremont culture villages are relatively small and are located adjacent to permanent streams such as Ivie Creek, Muddy Creek, Ferron Creek, Cottonwood Creek, and Huntington Creek. Fremont culture architecture also differs from that of the Sevier; rock-lined semi-subterranean dwellings and coursed masonry surface storage structures predominate. In addition, Anasazi tradewares are considerably more prevalent in the Fremont culture sites than in the Sevier culture sites.

The unnamed plains-derived culture of northern and northeastern Utah existed from about 1300 to 650 B.P. (Madsen and Lindsay 1977). This culture was dependent upon hunting of bison and the collecting of wild plants. The dwellings are normally shallow basin structures without any clear evidence of the type of superstructure utilized. Unlike the coiled pottery of the Sevier, Fremont, and Anasazi cultures, the unnamed culture produced pottery by the paddle and anvil techniques. It is important to note that there is a considerable spatial overlap of the unnamed culture and the Fremont culture traits in the northern portion of the latter's distribution. There is insufficient data at the present to determine whether the spatial trait overlap is due to alternate occupation, simultaneous occupation by the two cultures or a combination of these two possibilities.

Hunting activities among the Sevier, Fremont, and unnamed cultures are evident from the many varieties of small arrowheads which have been recovered from excavations. Small, stemmed corner-notched (Rose Spring) arrowpoints are present in the earlier phases of all three cultures, but after about 1100 B.P., numerous regional variants developed. Side notch arrowpoint styles (Bear River Side-notched and Uinta Side-notched) were common in the northern part of Utah while Parowan Basal-notched and Bull Creek arrowpoint styles were common in the southwestern and south-central portions of Utah respectively. The Bull Creek points are of particular interest because they are found in high frequencies at both Kayenta Anasazi sites in southern Utah and Fremont sites along the east side of the Wasatch Mountains (Coombs Village, Bull Creek sites, Snake Rock Village, Old Woman, and Poplar Knob) and probably indicate the reciprocal exchange of males for matrimonial purposes (Holmer and Weder 1980).

Dart points, the Elko series and Gypsum, in particular, are also found in association with Fremont sites. This association has been used by Schroedl (1976) to verify the indigenous development of the Fremont culture from Archaic antecedents. Dart points, during the Archaic, were used as both projectile points and knives (Weder in Jennings et al n.d.) but their function in the Fremont context has not yet been evaluated.

In reference to Utah, the Mesa Verde and Kayenta variants of the Anasazi culture are of particular importance. The San Juan Anasazi culture was centered around the Four Corners area where Colorado, New Mexico, Arizona, and Utah meet. The Kayenta Anasazi inhabited the extreme southern periphery of Utah from the San Juan River west to central Utah. As has already been noted, Kayenta influence is particularly evident in a narrow band of sites running from Coombs Village northwards past the Henry Mountains to the Snake Rock Village site adjacent to Interstate 70 on the east side of the Wasatch Plateau.

5.4.1.4 Shoshonean Phase

The Shoshonean populations, who were the sole inhabitants of Utah at the time of Euro-American contact, have been in the northeastern Great Basin region since approximately 650 B.P. Their origin has been the subject of considerable controversy, however. Several hypotheses have been expressed.

One hypothesis maintains that the Shoshoneans came from the southwest of the Great Basin at about the time of the dispersal of the Sevier, Fremont, and Anasazi agriculturalists (Madsen 1975b and Lamb 1958). Gunnerson's hypothesis (1962) states that the Fremont, Sevier, and Virgin cultures were Shoshonean peoples who had taken up

horticultural and ceramic techniques diffused from the Anasazi, but later reverted to an Archaic subsistence style after a climatic change which made agricultural subsistence techniques unproductive.

Regardless of which hypothesis is correct, Shoshonean groups (Ute, Paiute, Shoshone and Bannock) were inhabiting the Great Basin into eastern Utah at ca. A.D. 1300, roughly coincident with the disappearance of the Fremont and Sevier cultures.

The Shoshonean subsistence pattern was quite similar to the Archaic adaptation. Small familial bands were engaged in a gathering and hunting subsistence utilizing a wide variety of non-domesticated plant, mammal and insect species.

Very little archeological evidence is available for this time period. Two characteristic artifact types can generally be associated with the Shoshonean occupation of Utah. The bow and arrow was utilized for hunting and a type of arrowhead, the Desert Side-notch point, has been correlated with the Shoshonean occupation (Holmer and Weder 1980). The Shoshoneans also utilized ceramics to a small degree. Shoshonean ceramics are easily distinguished from Sevier, Fremont, and Anasazi wares by the former's relative crudeness. Shoshonean ceramics are typically thick-walled, have large temper particles, are poorly smoothed, exhibit little decoration and have been fired in an uncontrolled or oxidizing atmosphere.

5.4.2 The Protohistoric Period

The prehistoric Shoshonean occupation of the Intermountain West continued up to and through the period of Euro-American contact. The Indian groups inhabiting the area of eastern Utah within which the project locality is situated came to be called the Utes.

5.4.2.1 Precontact

The Utes are a group belonging to the Shoshonean (Uto-Aztecan) linguistic family of which there are three branches: Ute-Chemehuevi, Shoshoni, and Mono-Paviotso. The Ute-Chemehuevi branch includes those groups which came to be known as the Utes, Southern Paiutes, and Chemehuevi. Although there is little archeological evidence, the Utes probably were characterized by a social organization and subsistence mode quite similar to all of the other aboriginal groups in the Great Basin and Colorado Plateau. The Utes were pedestrian gatherers and hunters who utilized a relatively large area of western Colorado and eastern Utah (Steward 1974).

The Utes were grouped into loosely organized bands consisting of extended families. Leadership was present only for subsistence task groups. The Utes could be reliably distinguished from the other contemporary aboriginal groups only in terms of linguistic differences.

Group territoriality was developed only in a statistical sense. A particular Ute band might consider a certain area as a home, but the seasonal round of each band was highly variable from year to year. The area with which any band was most familiar was not exclusively utilized by that band. Intermarriage among the various Ute bands tended to maintain linguistic unity but blur the definition of a territorial homeland for any particular band. Except for those Utes who were utilizing the aquatic resources around Utah Lake, local populations were small and mobile (Steward 1974).

5.4.2.2 Early Contact

The presence of the Spanish colony at Santa Fe by 1598 resulted in the first contact between the Utes and Euro-American groups. The relationship which developed

between the Utes and the Spaniards was consistently friendly and resulted in the spread of the horse among the Ute bands. When the Utes obtained the horse, a change in their subsistence occurred. The equestrian Ute was able to travel more widely and more effectively and concentrate on bison hunting (O'Neill 1973).

The utility of the horse was strongly mitigated by environmental factors, however. The maintenance of an extensive horse herd required substantial supplies of grass which generally limited the advantage of the horse to those areas where grass was plentiful such as western Colorado, the Uintah Basin, and along the western slopes of the Wasatch Mountains. The supply of grass also determined the distribution of the bison. The horse was, therefore, not equally valuable to all of the Ute bands. The bands in Colorado were able to support their horses whereas those bands in Utah, eastern Utah, in particular, were unable to utilize the horse effectively and were more likely to eat a horse than to ride it.

Considerable trading activity with the Utes was occurring during the 17th and 18th Centuries. Of particular importance was slave trade (O'Neill 1973). The Utes were able to conduct slave raids on neighboring tribes (especially the Navajo) because of their equestrian status. They then exchanged their slaves for horses and other Spanish goods. Whether the slaves were exchanged with traders travelling into Ute territory, or were driven by the Utes to Spanish settlements, is unknown because of the lack of documented evidence. Until the 1770s, there was little official Spanish interest in the territory of the Utes. However, at that time, King Charles III of Spain decided that an exploration of the areas north of Santa Fe would be beneficial to Spanish control. His developing interest was a reaction to the growing influence and explorations by the British and French in the West.

Charles III felt that it was important to ensure control of trade by the Spaniards since he considered the British and French traders as a threat to Spanish rule (O'Neill 1973).

The first documented Spanish exploration of the area north of Santa Fe was the Dominguez-Escalante Expedition of 1776-1777. This expedition was also the first officially sponsored exploration, the purpose of which was to find a route between Santa Fe and the Spanish settlements in California. Although the expedition was unsuccessful in reaching its goal, it did extensively explore the territory occupied by the Utes who, in all recorded instances, welcomed the Spaniards.

A trail was eventually established between Santa Fe and California which came to be known as the Spanish Trail. The origins of the Spanish Trail are obscure; however, this trail was probably utilized in prehistoric times as evidenced by its association with archeological sites.

5.4.2.3 Late Contact

Beginning in the early 1800s, the fur trade became active in Utah. The Arze-Garcia expedition traded for furs with the Utes at Utah Lake in 1813 and soon thereafter trappers began to actively exploit the area. Etienne Provost was a member of the Choteau-DeMun exploration of 1815 to 1817 and, subsequently, founded his own trapping company which operated primarily within Ute territory. He was subsequently killed by the Utes near the site of the city of Provo, which came to bear his name (O'Neill 1973).

During this time, more detailed information on the Shoshonean peoples of the area was recorded. In particular, specific Ute bands are mentioned with reference to their respective territories. Within the project region, the Weeminuche band conducted its yearly rounds (O'Neill 1973).

The Adams-Onis treaty of 1819, which gave Mexico its independence, resulted in an influx of Americans to Santa Fe. Most of the Americans came to engage in trapping. The newly arrived trappers caused a considerable increase in traffic along the Spanish Trail and an increase in competition for the available fur resources. This competition was not welcomed by the Utes, who were no longer consistently friendly with the Euro-Americans.

Although there were a large number of independent trappers operating in Utah, their activities have not been well documented. Antoine Robidoux was an important trapper, who by 1824, was operating primarily in the Uintah Mountains. William Ashley and Peter Skene Ogden were trapping in the northern Ute territory during the summer of 1824 and, at about the same time, Jedediah Smith was exploring eastern Ute territories to evaluate their trapping potential (O'Neill 1973).

The growing traffic along the Spanish Trail had an important effect on the local Ute bands. Wakara, a Tumpanuwache leader, became quite powerful in the 1820s by conducting horse raids in southern California and returning to Utah by way of the Spanish Trail (Lyman and Denver 1970). He enhanced his power and wealth by exacting tribute from travelers along the trail and by the trading of stolen horses and Pahvant and Paiute slaves (O'Neill 1973). In addition, Wakara and his band actively engaged in fur trapping.

By the late 1830s, there was considerable competition for the fur resources of Utah and western Colorado. Robidoux established a permanent fort and trading center in 1837 near White Rocks in the Uintah Basin to capitalize on the beaver-laden streams of the Uintah Mountains.

The prosperity of the fur trade was not destined to last very long, however. The fierce competition over trapping areas led to widespread disruptive conflicts and, most importantly, the demand for furs used to make the beaver

skin hats which were fashionable in Europe and the eastern United States declined rapidly about 1840 as the fashions changed. Fort Robidoux was burned in 1844 by the Utes, who apparently blamed the trappers for the declining value of their furs (O'Neill 1973; Lyman and Denver 1970).

The decline of the fur trade had a serious impact on the Ute bands of Utah. The entire economic base of the Utes began to disintegrate after 1840. The trading activities with Santa Fe began to dwindle with the decline in the horse and slave trade. The termination of Mexican control of the area in 1846 and the subsequent loss of contact for slave trade into Mexico (Lyman and Denver 1970) was very disruptive to the relationships existing between Utah and Santa Fe.

During the declining years of the fur trade, the largest invasion of Ute territory occurred. Beginning in 1847, Mormon pioneers began to move into Utah and rapidly swelled their numbers through immigration. At first, there was little conflict with the Utes because the major Mormon settlement, Salt Lake City, was on the periphery of the Ute territory and the earliest Mormon expansion was to the north. In 1849, Fort Utah (later to become the town of Provo) was founded near Utah Lake on the traditional campsite of the Tumpanuwache band. Since the Tumpanuwache band, still under the leadership of Wakara, had been forced to revert to their earlier mode of subsistence due to the decline of the fur trade, their utilization of the resources around Utah Lake became of vital importance. The conflicting interests in the Utah Lake vicinity escalated into a series of raids and counterraid during the 1850s which became known as the Walker War. In the end, the Utes were forced to leave the valley and moved east across the Wasatch Mountains (O'Neill 1973).

The next few years were difficult for the Utes, who were being gradually forced to split up into small bands and resume a subsistence mode similar to the precontact period. Some of the bands, however, chose to raid Mormon settlements

and farms to obtain cattle so that they could avoid starvation. These raids became more prevalent during the 1860s. Raids were conducted on the Mormon settlers west of the Wasatch and the Utes returned to the unsettled areas east of the Wasatch with the stolen cattle (O'Neill 1973). Although several bands were responsible for these raids, one man by the name of Black Hawk became the focus of the blame for all the raiding.

The areas east of the Wasatch Mountains remained under Ute domination for several years. A Mormon attempt to colonize at Moab was undertaken in 1855, but the Mormon settlers were harassed by the Utes and forced to return to Salt Lake City. It was not until 1877, by which time the Utes had been removed to the Uintah Reservations, that Mormon colonists were able to safely settle east of the Wasatch Mountains (O'Neill 1973).

5.4.3 The Historic Period

The history of the east-central coal areas of Utah begins with the exploration and colonization efforts of the Spanish during the last quarter of the 18th Century. East-central Utah was first explored and mapped by the Dominguez-Escalante Expedition of the 1776-1777, in its efforts to establish a line of communication between the Spanish settlements of New Mexico and Monterey, California (Miller 1968).

Though the Dominguez-Escalante Expedition failed to achieve this end, subsequent attempts from the New Mexico settlements and the travelings of Spanish and American fur trappers, traders and frontiersmen resulted in a connecting route known as the Old Spanish Trail (Miller 1968:Map 20). Along this route, which came up from Santa Fe through the San Juan country, across the Colorado River at Moab, over the Green River at the present site of Green River, across the San Rafael Desert into Castle Valley, then south through

Salina Canyon to southwestern Utah and southern California, passed thousands of horses and numerous trading, trapping and Indian slave trade expeditions (Miller 1968).

By the 1830s, the trail was well established, portions of its route being followed in 1853 by explorer, John C. Fremont and government surveyor, John W. Gunnison, who reported several sets of well-worn tracks near Green River where Interstate 70 presently runs. Other sections of the trail still remain near the Big Hole Wash in Emery County. The primary route of the Old Spanish Trail, plus divergent trails to Utah Lake, Fort Robidoux and Fort Kit Carson, brought the first extended contact into the project area (Miller 1968: Map 20).

Though forts and trading posts were scattered sparsely through southern and central Utah, the first attempts at organized settlement were undertaken by the Mormon Church. In 1855, the Elk Mountain Mission passed southward through Castle Valley to the area of Moab intending to establish a permanent settlement, but Indian hostility forced a quick retreat. The combination of hostile Indians, the desolate appearance of the region, the hardships involved in securing sufficient water for irrigation and doubts about the quality of the soil caused further attempts at colonization of the eastern area of what was then Sanpete County to be dropped for over 20 years (McElprang et al 1949:16).

At a priesthood meeting at Mt. Pleasant on September 22, 1877, encouragement was given to settle Castle Valley; soon after, 75 men from Sanpete Stake were called with Christian G. Larsen as leader. Very few responded, however, because of the aforementioned reasons. Orange Seely was subsequently given the responsibility of superintending the founding of settlements and another call for colonizers was

issued by the Church in the fall of 1878. Some of the earliest settlers of the area who dwelt in dugouts in hills or washes until log houses could be erected were Elias and John Cox, Ben Jones, William Avery and Anthony Humbel. By the fall of 1878, the crops were sufficient and the situation stable enough for the families of these men to join them, a sure sign of an intent to remain (McElprang et al 1949).

Work progressed on the agricultural settlements of Castle Valley and roads were built through the Wasatch Mountains to the more stable areas of western Sanpete County. Additionally, in the fall of 1878, the "Star-Mail Route" was opened between Salina and Ouray, Colorado; it followed the paths of the Old Spanish Trail and the "Gunnison" Trail of years before (McElprang et al 1949:19-21). In just three years the towns of Castle Dale, Wilsonville, Ferron, Green-river (Blake), Huntington, Lawrence, Molen, and Orangeville had been established and the Legislative Assembly in February, 1880, created Emery County, which embraced all of present-day Carbon, Emery, and Grand Counties (Lever 1898:593).

Though the project region was settled for its agricultural and grazing possibilities, it was the area that inspired active settlement and set the mining-dominated industrial base that central and eastern Utah retains to the present.

The first recorded discovery of coal in eastern Utah was by the Gunnison Expedition of 1853 (Powell 1976:13) when they located deposits of coal approximately three miles east of present-day Emery. The isolated location of the Gunnison find, coupled with the hope that the deposits already discovered at Coalville and Wales would prove sufficient for the territory's needs, caused Gunnison's discovery to be forgotten. The subsequent failure of the efforts at Wales to produce good coking coal, and the Union Pacific Railroad's monopolization and price-fixing on the deposits at Coalville, caused a re-evaluation of the potential coal producing areas east of the Sanpete settlements (Powell 1976:13).

As a result, the first effort to exploit the newly found eastern coal deposits was undertaken in 1875 at Connellsville in the upper reaches of Huntington Canyon. The Fairview Coal Mining and Coke Company was organized by men from New York, Salt Lake City, and Fairview. Eleven coke ovens were constructed and the coke was hauled by wagon into Springville. The expense involved with the hauling and the questionable quality of the coke produced caused the failure and abandonment of Connellsville by 1878 after only three years of operation (Powell 1976:13).

The next development of coal resources was begun in the Pleasant Valley area, also in 1875. The Pleasant Valley Coal Company, headed by Milan O. Packard, constructed a wagon road from Springville up Spanish Fork Canyon to Pleasant Valley coal lands in 1876; 1877 saw the opening of the Number 1 Mine in Winter Quarters Canyon (Powell 1976:14). A narrow gauge rail line was completed from Springville through Spanish Fork Canyon in October of 1879 by the Pleasant Valley Railroad Company as the haul to Springville by the wagon road occupied four days in good weather while in winter the road was impassable. This Pleasant Valley area proved to be extremely productive. The first three large scale mines in eastern Utah were established in this area when the Mud Creek Mine was reopened in 1882 followed by the 1884 opening of the Union Pacific Mine at Scofield just east of Winter Quarters (Powell 1976:15).

From the earliest times, the railroads sought to control the supply of coal in the territory, e.g., the Coalville resources and Union Pacific Railroad's control over that source. During the early 1880s, the Denver and Rio Grande Railroad was extending its lines from Colorado through Utah. Though originally graded through Castle Valley and Salina Canyon, the route of the railroad was altered, going through Price and Spanish Fork Canyon and thus taking in the rich coal areas of what was to become Carbon County (McElprang et al 1949:22).

Further expressing its interest in eastern Utah coal, the Denver and Rio Grande Western (Denver and Rio Grande's Utah

holdings) purchased the independently owned Pleasant Valley Railroad Company and Pleasant Valley Coal Company in 1882. Shortly thereafter, Union Pacific Railroad Company (UPRR) penetrated the Pleasant Valley area in order to protect its threatened monopoly on Utah coal (Powell 1976:16). The UPRR formed the Utah Central Coal Company in 1882 and opened the Union Pacific Mine near Scofield in 1884. With the Denver and Rio Grande's Pleasant Valley Coal development (1882), the establishment of Utah Fuel Company in 1887 and the creation of Utah Central Coal of Union Pacific, the railroad companies almost totally dominated the ownership and production of the Utah mines until the early 1900s (Reynolds et al 1948:195).

In 1888, a mine was opened at Castle Gate on the Price River near the mouth of Price Canyon. In about 1899, a new mine began operations at Sunnyside just 24 miles east of present-day Price at the base of the Book Cliffs. The Sunnyside Number 2 Mine also began its production in 1899 with the coal obtained at Sunnyside and at Castle Gate was utilized for coking purposes (Powell 1976:17-18).

In 1906, the first of the coal operations which would remain free from railroad control began production at Kenilworth, three miles east of Helper. This enterprise was financially backed by James Wade and F. A. Sweet and was called the Independent Coal and Coke Company because of its unique ownership status. Sweet, one of Utah's most prominent coal authorities, also opened a mine on the middle fork of Miller Creek in 1908 and named the camp Hiawatha (Reynolds et al. 1948:213). This locality at the foot of Gentry Mountain, about 18 miles southeast of Price, was the scene of further coal mining development in 1911 when Black Hawk mine was opened by Brown and Eccles. Just a few miles to the south in northern Emery County, a small wagon mine was purchased by the Castle Valley Fuel Company and the town, Mohrland, named from the initials of the company's four major figures--Mays, Orem, Heiner

and Rice--was begun. Mr. W. H. Wattis undertook the last development in this area in 1916 at Wattis, several miles north of Hiawatha on the flank of Castle Valley Mountain.

The decade from 1911-1920 saw an increase in activity in the coal regions of east-central Utah with many new mines being opened in hitherto undeveloped areas within the Utah coal producing regions. In 1911, Frank Cameron prospected the region around Panther Canyon on the Price River, and in 1914, the first coal was shipped out by the Utah Fuel Company which had leased the properties to Cameron for development. Cameron also developed and opened a small camp at the base of Castle Rock, about five miles northwest of Helper. Located directly on the main line of the Denver and Rio Grande Western Railroad, the camp's name was changed many times as was its ownership. Originally known as Bear Canyon, it soon was called Cameron for its developer, then Rolapp, and finally, Royal (Reynolds et al. 1948:244).

In 1912, Jesse Knight, one of the most prominent men in Utah mining history, bought 1600 acres of coal land west of Helper to provide coal for his smelting operations in the Tintic District. His mine, at what eventually became known as Spring Canyon, began production in 1913 and was the first of many mines in the Spring Canyon District, one of the most prolific coal producing areas in eastern Utah. Soon after the establishment of Storrs (Spring Canyon), F. A. Sweet opened another mine in Spring Canyon at Standardville, so called because it was considered to be the standard for the development of future mining camps. The year 1914 saw the opening of the Latuda Mine and camp by Liberty Fuel Company, while mines were opened in 1916 at Peerless and Rains. The last mining development undertaken in the Spring Canyon District was Mutual Coal Company's Mutual and Little Standard operations, begun in 1921 and 1925, respectively.

The final major coal producing area to be opened in east-central Utah was the Gordon Creek District. This region had first been prospected in 1908, but was really brought to prominence in 1920 by A. E. Gibson, the superintendent of the Spring Canyon Mine. Mines were developed in this area up until 1925 by Consumers Mutual Coal Company, National Coal Company, and Sweet Coal Company. The operations of all three companies ceased by 1950 (Carr 1972:81).

After the development of the Gordon Creek area, further work on the coal regions was undertaken in areas that had been opened previously. In 1922, Columbia Steel Company opened a mine at Columbia near the location of Sunnyside in order to further exploit the excellent coking coal obtainable from that region. One very late development of the same coal veins that supported the Columbia operation was initiated in Horse Canyon in 1942 by the United States government to aid steel production at its Geneva plant (Reynolds et al. 1948:252). Both mine and steel plant were taken over by U.S. Steel after WWII and continue in operation to the present.

Most of the mines in east-central Utah continued production through the heavy demand years of WWI and the years of prosperity that followed, but a combination of overdevelopment, the increased use of other natural fuels, rising costs associated with expensive underground haulage, and the Depression of the late 1920s and early 1930s caused several camps to be abandoned. Among the first mines to succumb were the long exploited Pleasant Valley mines. Winter Quarters, near Scofield, was closed down in 1928 while Scofield and Clearcreek experienced reductions of operations during the early 1920s and 1930s, respectively. Rains was also forced to cut back on operations in 1930. Despite these setbacks, as of

1929, there were 22 coal mines operating in Carbon, Emery, and Grand counties, the production of these mines providing 98% of the state's output (Sutton 1949:852).

Economic and production difficulties continued to plague Utah's coal industry during the decade of the 1930s, forcing the closure of the Mutual and Mohrland Mines in 1938. World War II brought a temporary respite to the general downward trend with many mines achieving their highest production levels during the war years and immediately thereafter.

The decade of the 1950s signalled the end for a great number of the eastern Utah coal mining operations as the adaptation of coal for new uses was insufficient to keep pace with this fuel's replacement in many of its traditional roles. The increasing use of natural gas for heating homes and heavy industry use, and the railroad's switch to diesel power were among the developments which severely hurt the coal industry. This bleak picture has drastically changed with the advent of America's "energy shortage," and new technologies for coal use in the future have caused an upswing in coal production in east-central Utah. Mines which were closed, or kept running with skeleton crews, have begun to increase operations during the last decade and the possibility of a new sustained burst of coal mining activity definitely exists (Alexander 1963:244-247).

5.5 Previous Investigations in the Region

Archeological research in the Castle Valley locality began with the Claflin Emerson Expedition. In 1929, Noel Morss and Henry Roberts conducted explorations and limited test excavations under the auspices of this expedition along the Fremont River and as far north as the Muddy River in Emery County. Morss' work resulted in the original definition of the Fremont cultural entity (Morss 1931, Gunnerson 1969). Morss' description of Fremont sites north of the Colorado River was an important contribution to the understanding of the prehistoric horticultural adaptation in the American Southwest.

With the exception of Reagan's description of the large petroglyph panel in Buckhorn Draw (Reagan 1935), there were no archeological investigations in the Castle Valley region for the next 15 years. Between 1952 and 1957, the University of Utah conducted a series of surveys in order to better define the nature of the Fremont occupation in Utah. A large number of Fremont sites was located along the east side of the Wasatch Plateau and several of the sites were subjected to limited test excavations, including 42Em5, the Emery Site (42Em47), and Snake Rock Village (42Sv5). Each of these three sites was a Fremont habitation (Gunnerson 1957). In addition to these Fremont sites, Gunnerson also tested a shallow rock shelter on Silverhorn Wash (42Em8) as a result of a local collector's report that a fluted projectile point resembling the Clovis style had been found eroding from the shelter deposits. Little additional information was obtained by the excavation, however (Gunnerson 1956).

In the 1970s, there was a significant upsurge in archeological activity in the Castle Valley region. In 1970, three sites endangered by vandalism were excavated by the University of Utah. These sites, Windy Ridge Village (42Em73), Crescent Ridge (42Em74), and Power Pole Knoll (42Em75) all proved to be Fremont habitation sites (Madsen 1975a) dating between about 980 B.P. and 1260 B.P.

During the following year, the University of Utah conducted excavations at Clyde's Cavern (42Em177). Clyde's cavern was a locus of summer plant gathering activities during the Late Archaic period, but the majority of the cultural deposits was shown to be the result of summer maize cultivation and wild plant harvesting activities during the subsequent Fremont period (Wylie 1972, Winter and Wylie 1974).

The next site to be excavated in the study area was Joe's Valley Alcove (42Em693). During the summer of 1974, the United States Forest Service excavated this site which had cultural strata, dated by both radiocarbon and typological means, from the Early Archaic, Late Archaic and Fremont periods (E. DeBloois, personal communication). That same summer, a University of Utah field school excavated the Innocents Ridge site, which proved to be yet another Fremont habitation locus (Schroedl and Hogan 1975).

During the early fall of 1975, the Antiquities Section, Division of State History (Utah) conducted an excavation of a small rockshelter as a part of the cultural resource mitigation program for Consolidation Coal Company of Denver, Colorado. This site, known as Pint Size Shelter (42Em625), had two main cultural strata, one dated to the Late Archaic and the other dated to the early Fremont period. Both of these occupations were evidently the result of wild plant procurement activities (Lindsay and Lund 1976).

Other Fremont habitation sites, located farther to the south, have been excavated. These sites include Snake Rock Village (Aikens 1967), Old Woman and Poplar Knob (Taylor 1957), and the Old Road Site and Ivie Ridge Site (Wilson and Smith 1976). These five sites were all Fremont period habitations although Kayenta and Mesa Verde Anasazi ceramics were recovered at low frequencies indicating that there was contact with other cultural groups located farther south.

In addition to these Fremont sites, a deeply stratified rockshelter (Sudden Shelter, 42Sv6) was found to contain occupational strata spanning the entire Archaic period, ca. 8000 B.P. to 3000 B.P. (Jennings et al. 1980a). The original site report indicated that Fremont diagnostics were present on the site when it was originally documented, but these artifacts were no longer present when the excavations were begun. The Sudden Shelter site is of particular importance to the local prehistory and the prehistory of the eastern Great Basin and northern Colorado Plateau because of its numerous well-defined occupational strata which has allowed a fine-grain correlation between certain diagnostic projectile point types and the temporal phases of the Archaic period.

A test excavation of two heavily vandalized rockshelter sites (42Em959 and 42Em960) in Cottonwood Canyon conducted by AERC in 1979 seem to mirror the results of the excavations at the nearby Joe's Valley Alcove. Radiocarbon analyses have not yet been completed, but projectile point correlations indicate that these two sites were occupied during the Early Archaic period, Late Archaic and, most heavily, during the Fremont period (Weder and Hauck, n.d.).

Since 1970, the level of survey intensity has increased drastically. The various cultural resource inventories conducted during the 1970s have generally been the result of natural resource development programs and are too numerous to summarize in the present context. Summaries of these inventories performed before 1978 can be found in Sargent (1977) and Hauck (1979a). The combined inventory results as of 1977 indicate that the majority of the culturally identifiable sites in the general area are Fremont although Archaic sites are also well represented. Protohistoric Numic sites are present but rare (Hauck 1979a:110).

Several cultural resource inventories have been conducted in the general project locality. In 1974, LaMar W. Lindsay, an archeologist temporarily attached to the Bureau of Land Management, recorded site 42Em611, a sparse lithic scatter located on the north bank of Christiansen Wash (see Lindsay 1974). In 1975, an intensive evaluation by Michael S. Berry, an archeologist with the Antiquities Section of the Utah State Historic Preservation Office, involved about 880 acres in the project area. This survey, commissioned by CONSOL, included parts of Sections 27, 28, and 33 (see Figure 2). In his report (Berry 1975), the archeologist noted the presence of sites 42Em625, 626, and 627, all of which were evaluated as not being of National Register status. These sites consist of one lithic scatter and two small rockshelter sites associated with sandstone outcroppings. Pint Size Shelter, or site 625, was subsequently excavated by SHPO personnel in 1975 and reported (see Lindsay and Lund 1976).

AERC began conducting surface evaluations for CONSOL in 1976, just south of the Emery Mine Project area in Dog Valley (Hauck 1976). In 1977 through 1980, a number of consulting projects were conducted for CONSOL by AERC personnel in the general Castle Valley locality. Only one project (CCC-80-2), however, was situated in the Emery Mine Project area and no cultural resources were reported (see Norman and Hauck 1980).

The National Register of Historic Places has been consulted and no registered sites lie within the project boundaries nor will any registered sites be affected by this project. The closest National Register site, the Rochester-Muddy Creek Petroglyph Site, is situated about 3.25 miles to the northeast of the Emery Mine Project area, but will not be affected by the mining project.

5.6 Research Design

AERC's research design, which has been developed for the general central Utah region consists of the following:

1. The determination of presence or absence of a continual sequence of Paleo-Indian, Archaic, Fremont, and Shoshonean utilization of the project area and the local manifestations of these cultural phases when present;
2. the determination of presence or absence of cultural materials which demonstrate the utilization patterns of the Castle Valley locality;
3. the determination of which types of prehistoric cultural activity were conducted in the project area based upon patterns in artifact associations or predominance of particular types of sites;
4. the determination of presence or absence of early historic Euro-American habitation, trapping, trade or travel within the project area; and
5. the determination, on a regional level, of whether the sites in the project area contained any remains demonstrating local interaction between the Sevier and San Rafael variants of the Fremont culture.

Based upon the preceding research conducted in the general area, AERC has hypothesized that the high density cultural resource zone is associated with the pinyon-juniper ecozone, the Ferron Sandstone Member of the Mancos Shale Formation, the proximity of permanent water sources, and the sub-7500 foot elevations. Surfaces within the Castle Valley lowlands contain a variety of historic and prehistoric

cultural resource sites including limited activity sites, e.g., lithic scatters, surface quarries, and ceramic scatters; and occupation sites, i.e., rockshelters, temporary and extended campsites, and habitation (village) sites. (The minimal definition of a limited activity site is an association of four or more flakes and/or lithic tools and/or ceramic sherds observed within the original context of deposition.)

5.7 Cultural Resource Descriptions

5.7.1 Site Analyses

A total of 11 previously unrecorded cultural resource sites was located during the AERC unit survey, bringing a site total of 16 with the addition of the four previously recorded sites and the Spanish Trail segment. Sites 42Em1312 (AERC 488N/2), 42Em1313 (488N/3), 42Em1314 (488N/4), 42Em1316 (488N/6), 42Em1321 (488N/12), 42Em611, and the historic Browning Mine (488N/10) are all situated in the Emery Mine Project potential disturbance zone. Five other sites, including 42Em625, 42Em626, 42Em627, 42Em1317 (AERC 488N/7), 42Em1318 (488N/8), and 42Em1319 (488N/9), are located within the mine plan permit area but outside the potential construction disturbance zone. The final three sites, 42Em1311 (488N/1), 42Em1315 (488N/5), and the Spanish Trail are situated outside the potential construction disturbance zone and outside the general project area. A summary of pertinent site characteristics is shown on Table 3 (see Plate 5-1).

Based on the definitions of cultural resource significance (see Chapter IV), none of the cultural resource sites listed on Table 3 are considered eligible for direct nomination to the National Register of Historic Places (NRHP). Those six sites, which have been rated as CRRS:S-2 (see Table 3), are potential candidates for nomination to the Register although Pint Size Shelter (42Em625) has been excavated. Sites 42Em1314, 42Em1321, 42Em626, and 488N/10 have been given CRRS:S-3 ratings and appear to have some scientific value. The five remaining sites, 42Em1312, 42Em1313, 42Em1317, 42Em611, and 42Em627, have marginal resource value and have been rated as CRRS:S-4. Should additional research on any one of these sites provide

information showing that that site has greater cultural value than presently assigned, the site rating will be adjusted accordingly.

Site and isolated artifact locations are shown on Figure 3. This map shows the prehistoric sites are concentrated in the Quitchupah and Christiansen Wash drainages and canyon rims. Additional information on those 13 sites which are in the project area is provided to all relevant government agencies in the site reports which are an appendix to this report.

Table 5-3

Cultural Resource Site Summary

<u>AERC</u> <u>Site No.</u>	<u>Permanent</u> <u>Site No.</u>	<u>Site Type</u>	<u>Culture</u>
NA	42Em611	Lithic scatter	Unknown
NA	42Em625*	Rockshelter	Archaic and Fremont
NA	42Em626	Rockshelter	Unknown
NA	42Em627	Lithic scatter	Unknown
488N/1	42Em1311* +	Rockshelter	Fremont
488N/2	42Em1312	Lithic scatter	Unknown
488N/3	42Em1313	Lithic scatter	Unknown
488N/4	42Em1314	Rockshelter	Unknown
488N/5	42Em1315* +	Rockshelter	Unknown
488N/6	42Em1316*	Rockshelter	Fremont
488N/7	42Em1317	Lithic scatter	Unknown
488N/8	42Em1318*	Rockshelter	Archaic and Fremont
488N/9	42Em1319*	Rockshelter	Archaic and Fremont
488N/10	NA	Browning Mine	Euro-American
488N/11	NA +	Old Spanish Trail	Prehistoric and Euro-American
488N/12	42Em1321	Lithic-ceramic scatter	Fremont

*CRRS:S-2 level of significance

+Site located outside the permit area

NOTE: All cultural resources evaluated in this report are situated on privately owned land.

5.7.2 Comparative Resource Analyses

Of the 13 sites situated in the Emery Mine Project permit area, 12 are prehistoric and one, the Browning Mine site (AERC 488N/10), is historic. Six of the sites are prehistoric rockshelter habitation loci with the remaining six sites being lithic and lithic-ceramic scatters (see Table 3).

The artifacts collected from the project area show a cultural range of Early Archaic through the Fremont period or from about 8300 B.P. until 950 B.P. Two Pinto atlatl points (Figure 4A and B) which date generally between 8300 and 6300 B.P. and the Northern Side-notch point (Figure 4C), which was utilized in central Utah between 6900 and 6300 B.P., demonstrate an Early Archaic presence in the project area. The serrated Gypsum point (Figure 4D) could have been utilized during the Middle Archaic or Late Archaic period since the Gypsum series was in use in southern Utah from about 5000 to after 1000 B.P. (Holmer 1978:70; Fowler, Madsen and Hattori 1973). Non-serrated Gypsum points were recovered from Pint Size Shelter in Stratum 3 which was "bracketed by radio carbon determinations (4520±210 B.P. to 3390±170 B.P.) which closely correspond to Gypsum points dated from 4670±140B.P. to 3360±85 B.P. at Sudden Shelter on Ivie Creek" (Lindsay and Lund 1976:56).

The Fremont ceramics collected or observed on sites 42Em1311, 42Em1318, 42Em1319, and 42Em1321 demonstrate Fremont occupation in the locality perhaps as early as 1800 B.P. based on a radio-carbon sample taken from the initial Fremont occupation of Pint Size Shelter (Lindsay and Lund 1976:57). The fragment of Ivie Creek Black-on-white recovered from 42Em1318 indicates that Fremont occupation of the project area extended to possibly as late as 750 B.P. (Madsen 1977:35).

No evidence of Shoshonean activity in the project area was observed during the field survey.

5.8 Evaluations and Recommendations

5.8.1 Resource Significance Evaluations

An evaluation of cultural resource significance for the 13 known historic and prehistoric sites situated in the Emery Mine permit area and the three sites outside the permit area, is presented in Table 4. Here the site quality indicators are presented with a statement on site condition. The field assessment of significance utilizing the CRRS system is provided in the fourth column. The CRRS system is best explained by quoting from the BLM definition sheet:

Cultural Resource Rating System

The following criteria are established as guidelines. The Bureau recognizes that the assignment of a particular rating is a professional judgment; however, the rationale of these judgments will be explicitly documented as part of the evaluation process.

Assign an evaluation rating (S1, S2, S3, S4) to each site according to the following guidelines and record on the BLM form 6400-3:

S1. S1 sites are those sites which are worthy of preservation in situ. In general, they are sites in relatively good condition with integrity (both internal and external); and are unique or representative; and/or have associations with important events or personages; and/or have yielded, or have a clear potential for yielding, highly significant scientific or educational information.

S2. S2 sites are those sites which contain important scientific or educational data but yet are not worthy of preservation in situ. They are generally not particularly unique, representative, nor do they have important associations. Many contemporary sites may be S2 sites because, although they cannot be clearly and immediately assessed as such, they may become highly significant when evaluated from a future historical perspective.

S3. S3 sites are those sites whose main worth is their potential for contributing data in regards to solving larger problems, such as reconstruction of paleo-environments and human use patterns. These kinds of sites generally show little concentration of artifacts, few features, no important associations, and little or no uniqueness or representativeness.

S4. S4 sites are those sites which have minimal information retrieval possibilities, or which have no integrity, uniqueness, representativeness, or no important associations.

No sites were accorded CRRS:S-1 status as being definite candidates for the National Register of Historic Places.

Six sites including 42Em1311, 42Em1315, 42Em1316, 42Em1318, 42Em1319 and 42Em625 have been rated at a CRRS:S-2 level having the potential for inclusion in the National Register. Four sites were accorded CRRS:S-3 ratings and the remaining five sites have marginal research value being rated as CRRS:S-4. Should future research on any one of these sites provide data demonstrating that a site has a greater cultural value than presently determined, the CRRS rating will be appropriately upgraded.

Table 5-4

Site Significance

<u>Site</u>	<u>Quality</u>	<u>Condition</u>	<u>GRRS Value Rating</u>
42Em611	---	Poor	S-4
42Em625	c, g	Poor	S-2
42Em626	c	Poor	S-3
42Em627	---	Poor	S-4
42Em1311*	c, f, g	Good	S-2
42Em1312	---	Fair	S-4
42Em1313	---	Poor	S-4
42Em1314	c	Poor	S-3
42Em1315*	c	Fair	S-2
42Em1316	c, g	Fair	S-2
42Em1317	---	Fair	S-4
42Em1318	c, g	Poor	S-2
42Em1319	c, g	Fair	S-2
448N/10	g	Poor	S-3
448N/11*	Unknown	Unknown	Unknown
42Em1321	g	Poor	S-3

*Located outside the Emery Mine Project permit area

AERC quality indicators are:

- a) size or layout is unique;
- b) quantity and/or quality of artifacts is unique;
- c) depth is indicated;
- d) environmental location is unique;
- e) unique artifacts, architecture, are or structure exist;
- f) condition is excellent for preservation of materials or data;
- g) site contains specific cultural data relevant to temporal and spatial identifications;
- h) site is scene of an important event; and,
- i) site is associated with an important person.

5.8.2 National Register Criteria for Eligibility

Application of the National Register Criteria of Eligibility, as defined under 36 CFR 60.6, to each of the 13 sites that are situated in the Emery Mine Project area, provides the following information:

- a) None of the 13 sites is associated with events that have made a significant contribution to the broad patterns of our history; or
- b) none of the 13 sites is associated with the lives of persons significant in our past; or
- c) none of the 13 sites embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction;
- d) four sites, all rated as CRRS:S-2, and situated in the permit area, have yielded information important to the prehistory of the region. These sites (42Em625, 1316, 1318, and 1319) may warrant future nomination to the National Register of Historic Places (NRHP) but further testing of sites 1317, 1318, and 1319 should be conducted to substantiate the significance of these sites since the present rating is based solely on surface evaluation. Site 42Em625 was previously tested through excavation in 1975.

Some four sites located within the permit area (see Table 4) are not evaluated. A determination of eligibility cannot be made without testing these sites. Sites placed in this category include 42Em626, 1314, 1321, and 488N/10.

The remaining five sites situated within the permit area, 42Em611, 627, 1312, 1313, and 1317, do not meet any of the criteria for eligibility as outlined in 36 CFR 60.6. These sites are considered ineligible for inclusion in the National Register of Historic Places.

5.8.3 Discussion of Impact Potential on Cultural Resource Sites

Adverse impact potential can be examined on two levels. Direct impact concerns adverse affect occurring as a direct consequence of project development and operation. Indirect impact stems from adverse affect relative to activities which are not part of the project design and planning.

The probability of adverse impact on the known cultural resources situated within the Emery Mine Project area is demonstrated in Table 5. Four of the six CRRS:S-2 sites have a moderate potential for receiving adverse direct impact related to the development of mine facilities while two sites have a low potential for direct disturbance. The potential for these six sites to be destroyed through indirect impact, i.e., activities not related to mining development and construction, varies by site from high to low with vandalism being the primary threat, followed by destruction by cattle and erosion.

Four sites have been accorded a CRRS:S-3 level of significance (see Table 5); these have high to low potential for direct and indirect disturbance.

The remaining five sites have been rated as having marginal cultural value at CRRS:S-4. Direct impact potential on these sites is moderate while the indirect impact potential varies from high to low depending upon the present condition of the site and its visibility.

In summary, some three sites, 42Em1314, 42Em611, and the Browning Mine (488N/10) have a high potential for disruption during mine development. Two other sites (42Em1317 and 42Em1319) have a high potential for being destroyed by vandalism and erosion and a moderate potential for direct adverse affect. Another seven sites have a moderate potential for receiving both direct and indirect adverse disturbance.

Table 5-5

Cultural Resource Impact Potential

<u>Site</u>	<u>CRRS Status</u>	<u>Direct Impact</u>	<u>Indirect Impact</u>	<u>Impact Agent</u>
42Em611	S-4	High	Low	Mine development
42Em625	S-2	Moderate	Moderate	Mine development , vandalism and erosion
42Em626	S-3	Moderate	Moderate	Mine development, vandalism and erosion
42Em627	S-4	Moderate	Moderate	Mine development and erosion
42Em1311	S-2	Low	Low	Erosion
42Em1312	S-4	Moderate	Moderate	Mine development and erosion
42Em1313	S-4	Moderate	Moderate	Mine development and erosion
42Em1314	S-3	High	Moderate	Mine development and erosion
42Em1315	S-2	Low	Moderate	Vandalism and cattle
42Em1316	S-2	Moderate	Moderate	Mine development, vandalism and cattle
42Em1317	S-4	Moderate	High	Erosion and vandalism
42Em1318	S-2	Moderate	Moderate	Vandalism and erosion
42Em1319	S-2	Moderate	High	Erosion and vandalism
488N/10	S-3	High	Moderate	Mine development
488N/11	Unknown	Low	Low	Mine development
42Em1321	S-3	Low	Low	Erosion

These sites include 42Em1312, 42Em1313, 42Em1316, 42Em1318, 42Em625, 42Em626, and 42Em627.

Sites 42Em1311, 42Em1315, 42Em1321, and AERC 488N/11, the Spanish Trail, have a low potential for direct or project-related disturbance and a low to moderate potential for destruction through vandalism. Three of these sites are situated outside the Emery Mine Project permit area (see Figure 3) while the Spanish Trail route has been modified through earlier farming and road construction activities so that its actual location near the permit area is in doubt.

5.8.4 Recommendations

A variety of archeological and historic techniques are available for use in avoiding, protecting or mitigating potential adverse affect to significant cultural resources. Such actions proposed herein are contingent upon comments of the Department of Interior agencies and the State Historic Preservation Office.

Avoidance procedures are the most appropriate means of preserving those CRRS:S-2, S-3, and S-4 sites which will not be endangered by the development and operational phases of the Emery Mine Project and have also a low potential for disturbance through vandalism. Such sites, as shown on Table 5, include 42Em1311, 42Em1315, and the Old Spanish Trail (488N/11) since they are situated outside the mine permit area.

Seven sites, 42Em611, 1312, 1313, 1314, 1316, 1321, and the Browning Mine (488N/10) are all located within the mine disturbance zone (compare Figures 2 and 3) and have been accorded as having high to moderate potential for disturbance during mine developmental and operational phases based upon their locations. The Browning Mine site, 42Em611, 1314, and 1316 are more susceptible to disturbance than are 42Em1312 and 1313. AERC recommends that photographic documentation of the Browning site be utilized in conjunction with oral and written historic research as a means of preserving this site and mitigating project-related disturbance and future vandalism.

Sites 42Em1314 and 1316 appear to be highly susceptible to vandalism as well as to impact during mine development; hence, avoidance is not a viable means of preserving these sites. AERC recommends that limited subsurface testing on these two rockshelters be conducted to better determine their resource value and to obtain archeological information on the cultural sequences attendant at each site. Limited excavation can yield the information on these sites necessary for

determining whether salvage operation is justifiable. In these few cases where valuable cultural materials are identified by the testing, a more complete excavation should be undertaken to remove the pertinent materials and data. Site testing frequently demonstrates that a site does not contain valuable materials or cultural data since all pertinent cultural and environmental data are retrieved during the test excavation. The need for the future preservation of this kind of site can be more accurately weighed after testing since the documentation of the excavation often becomes the primary means of preserving the site.

Sites 42Em611, 1312, 1313, and 1321 can be avoided if mine development is not programmed for the canyon rim or stream bank where these sites are located. All four sites are lithic scatters and should be selectively collected and tested for depth should the expansion of the mine roads or facilities threaten the destruction of the sites. These four sites are of marginal or CRRS:S-3 or S-4 value.

The final six sites lie outside the mine plan disturbance zone but are still within the permit boundary. Avoidance of these six sites is the most fundamental means of mitigating any development-related adverse affect which can occur. Site 42Em625 has been excavated; hence, avoidance is the only alternative for mitigation of direct disturbance. Sites 42Em626, 1318, and 1319 are all rockshelter sites which have a moderate to high potential for disturbance during mine development or by vandalism. AERC recommends that test excavation of all three sites be conducted as a means of obtaining a more definitive statement of their significance and as a means of increasing the sites' cultural data base. Even if no project-related development should threaten these sites, vandals will soon totally destroy the cultural contexts on these sites.

The two remaining sites, 42Em627 and 42Em1317, within the permit area, are lithic scatters of low significance but have moderate to high potential for disruption. AERC recommends that these sites be selectively collected and tested for depth should avoidance from disturbance become impractical during project development.

In summary, AERC can recommend that five sites be tested to determine their depth potential and cultural resource value. These sites are all rockshelters lying within the permit boundary and all are susceptible to future disturbance from the coal mining project or from local vandals. These sites include 42Em626, 1314, 1316, 1318, and 1319.

Six other sites, all lithic scatters of a CRRS:S-3 and S-4 level of significance, should be avoided during mine development. These sites include 42Em611, 627, 1312, 1313, 1317, and 1321. Should avoidance become an impractical means of mitigating either direct or indirect adverse affect, then the threatened site, or sites, should be selectively collected and some subsurface testing for depth should be conducted. Valuable and diagnostic artifacts should be control-collected from these sites. Pertinent subsurface cultural and environmental data should be obtained, if existing, through utilizing appropriate vertical and horizontal controls.

The Browning Mine should be carefully documented prior to disturbance through photography in conjunction with oral and documentary research initiated by a historian.

Since the project permit boundary may extend to the north outside the area evaluated for the purposes of this report, the local segment of the Old Spanish Trail could be affected by the mine development. AERC, therefore, suggests that aerial photos of the locality be examined in conjunction

with an archeological field evaluation to determine the actual location of the Trail within the general permit locality. Once the position of the Trail and its present conditions are understood, a more definite evaluation of its significance in this locality can be determined.

5.9 BIBLIOGRAPHY

Aikens, C. Melvin

- 1967 Excavations at Snake Rock Village and the Bear River No. 2 Site. University of Utah Anthropological Papers, No. 87, Salt Lake City.
1970 Hogup Cave. University of Utah Anthropological Papers, No. 93, Salt Lake City.

Alexander, Thomas G.

- 1963 From Dearth to Deluge: Utah's Coal Industry. Utah Historical Quarterly, Vol. 31, No. 3, Salt Lake City.

Ashcroft, Gaylen L. and E. Arlo Richardson

- Map of Freeze-Free Season, State of Utah. Utah Agricultural Experiment Station, Utah State University and Department of Commerce, ESSA, Environmental Data Services.

Beckwith, E. G.

- 1855 Report of Exploration for a Route for the Pacific Railroad by Captain J. W. Gunnison, Topographical Engineer, near the 38th and 39th Parallels of North Latitude. Reports of Explorations and Surveys, Vol. 2, Washington.

Berge, Dale L.

- 1973 "An Archeological Survey in the Castle Valley Area, Central Utah." Museum of Archaeology & Ethnology, Brigham Young University, Provo. (Manuscript on file)
1974 An Archeological Survey in the Castle Valley Area, Central Utah. Publications in Archaeology, Department of Anthropology and Archaeology, New Series No. 1, Brigham Young University Press, Provo.

- 1976 "Cultural Resource Evaluation of the Clear Creek Substation - Helper - Blackhawk 46 K.V. Transmission Line, Swisher Mine." Department of Archaeology and Anthropology, Brigham Young University, Provo. (Manuscript submitted to the Utah Power & Light Co.)

- 1977b "Cultural Resource Evaluation of the Emery Substation - Dog Valley Mine Distribution Line." Department of Anthropology and Archaeology, Brigham Young University, Provo. (Manuscript submitted to the Utah Power & Light Co.)

- Berge, Dale L. and Michael P. Benson
 1977 "A Cultural Resource Evaluation of the Emery Plant to Emery City Transmission Line." Department of Anthropology and Archaeology, Brigham Young University, Provo. (Manuscript submitted to the Utah Power & Light Co.)
- Berry, Michael S.
 1974 The Evans Mound: Cultural Adaptation in S.W. Utah.
 1975 Archeological, Historical and Paleontological Survey for Consolidation Coal Company and Kemmerer Coal Company in Emery County, Utah. A Special Report, Division of State History, Salt Lake City.
- Carr, Stephen L.
 1972 The Historical Guide to Utah Ghost Towns. Western Epics, Salt Lake City.
- DeBloois, Evan
 n.d. Joe's Valley Alcove. (Unpublished manuscript)
- Doelling, H. H.
 1972 Central Utah Coal Fields Monograph #3. Utah Geological and Minerological Survey, Salt Lake City.
- Durrant, Stephen
 1952 Mammals of Utah. University of Kansas Publications, Museum of Natural History, No. 6, Lawrence.
- Dykman, James L. and Richard A. Thompson
 1976 "The Dog Valley Strip Mine Survey." A Special Report by the Southern Utah State College, Cedar City.
- Earle, B. J.
 1975 "An Archaeological Summary of the Wasatch Plateau, Central Utah." Museum of Archaeology and Ethnology, Brigham Young University, Provo. (Manuscript on file)
- Fowler, D. D., D. B. Madsen, and E. M. Hattori
 1973 Prehistory of Southeastern Nevada. Desert Research Institute Publications in the Social Sciences, No. 6, Reno.
- Gillin, John
 1941 Archeological Investigations in Central Utah. Papers of the Peabody Museum of American Archaeology and Ethnology, Vol. 17, No. 2, Cambridge.
- Gillio, David A.
 1975 "Archeological Survey of Trail Mountain Timber Sale." U. S. Forest Service, Richfield. (Manuscript on file)

Gunnerson, James H.

- 1956 A Fluted Point Site in Utah. American Antiquity, Vol. 21, No. 4, Salt Lake City.
- 1957 An Archeological Survey of the Fremont Area. University of Utah Anthropological Papers, No. 28, Salt Lake City.
- 1962a Unusual Artifacts from Castle Valley, Central Utah. Miscellaneous Collected Papers, University of Utah Anthropological Papers, No. 60, Salt Lake City.
- 1962b Plateau Shoshonean Prehistory: A Suggested Reconstruction. American Antiquity 28 (1):41-45, Salt Lake City.
- 1969 The Fremont Culture: A Study in Culture Dynamics on the Northern Anasazi Frontier. Papers of the Peabody Museum of Archaeology and Ethnology, Vol. 59, No. 2, Cambridge.

Hauck, F. R.

- 1976a "Archeological Clearance of Drill Locations and Access Roads in the Dog Valley and Molen Reef Localities of Emery and Sevier Counties, Utah." Report prepared for the Consolidation Coal Company by the Archeological-Environmental Research Corporation, Salt Lake City (CCC-76-1).
- 1976b Archeological Reconnaissance in the Dog Valley Locality of Emery County, Utah. Archeological-Environmental Research Corporation, Paper No. 3, Salt Lake City.
- 1978a "Archeological Research of Six Proposed Coal Exploration Drill Sites in the Willow Springs Locality of Sevier County, Utah." Report prepared for the Consolidation Coal Company by the Archeological-Environmental Research Corporation, Salt Lake City (CCC-78-1).
- 1978b "Archeological Research of Proposed Drill Locations and Access Routes in the Ivie Creek Locality of Emery and Sevier Counties, Utah." Report prepared for the Consolidation Coal Company by the Archeological-Environmental Research Corporation, Salt Lake City (CCC-78-2).
- 1979a Cultural Resource Evaluation in Central Utah - 1977. Cultural Resource Series, No. 3, Bureau of Land Management, Utah.
- 1979b "Archeological Reconnaissance of the Emery and Walker Flat Localities of Emery and Sevier Counties, Utah." Report prepared for the Consolidation Coal Company by the Archeological-Environmental Research Corporation, Salt Lake City (CCC-79-1).

- 1980a "Archeological Reconnaissance of Proposed Well Locations in the Walker Flats Locality of Sevier and Emery Counties, Utah." Report prepared for the Consolidation Coal Company by the Archeological-Environmental Research Corporation, Salt Lake City (CCC-80-1A).
- 1980b "Archeological Reconnaissance of Proposed Well Locations in the Walker Flat Locality of Sevier and Emery Counties, Utah." Report prepared for the Consolidation Coal Company by the Archeological-Environmental Research Corporation, Salt Lake City (CCC-80-1B).
- 1980c "Archeological Reconnaissance of Proposed Well Locations in the Walker Flat-Dog Valley Localities of Emery and Sevier Counties, Utah." Report prepared for the Consolidation Coal Company by the Archeological-Environmental Research Corporation, Salt Lake City (CCC-79-1 and CCC-80-1).
- Hayward, C. Lynn, Clarence Cottam, Angus M. Woodbury and Herbert H. Frost
 1976 Birds of Utah. Great Basin Naturalist Memoirs, No. 1. Brigham Young University Press, Provo.
- Helm, Claudia
 1974 "Preliminary Report of an Archaeological Survey in Sevier, Emery and Garfield Counties." Department of Anthropology, University of Utah, Salt Lake City. (Manuscript submitted to the U. S. Forest Service and the Bureau of Land Management and to the National Science Foundation.)
- Holmer, Richard N.
 1978 "A Mathematical Typology for Archaic Projectile Points of the Eastern Great Basin." Unpublished Ph.D. Dissertation, Department of Anthropology, University of Utah, Salt Lake City.
- Holmer, R. N. and D. G. Weder
 1980 Common Post-Archaic Projectile Points of the Fremont Area. Antiquities Section Selected Papers, Volume VII, No. 16, D. B. Madsen, Editor, Salt Lake City.
- Hurst, C. T.
 1948 The Cottonwood Expedition, 1947 - a Cave and a Pueblo Site. Southwestern Lore, Vol. 14, No. 1.
- Jennings, J. D.
 1957 Danger Cave. University of Utah Anthropological Papers, No. 27, Salt Lake City.
 1974 Prehistory of North America. Second edition, McGraw-Hill, Inc., New York.

- Jennings, Jesse D., Alan R. Schroedl and Richard N. Holmer
1980a Sudden Shelter. University of Utah Anthropological Papers, Salt Lake City.
- Jennings, Jesse D., et al
1980b Cowboy Cave. University of Utah Anthropological Papers, Salt Lake City (Manuscript in preparation)
- Johnson, Carl M.
1970 Common Native Trees in Utah. Special Report 22, Agricultural Experiment Station, College of Natural Resources, Utah State University, Logan.
- Kennette, S. D. and F. R. Hauck
1978 "Archeological Reconnaissance in the Scofield Locality of Carbon and Emery Counties, Utah." Report prepared for the Coastal States Energy Company by the Archeological-Environmental Research Corporation, Salt Lake City (CSEC-78-1).
- Lamb, Sydney, M.
1958 Linguistic Prehistory in the Great Basin. International Journal of American Linguistics, Vol. 24.
- Leach, Larry L.
1966 The Archeology of Boundary Village. University of Utah Anthropological Papers, No. 83, Miscellaneous Paper, No. 13, Salt Lake City.
1967 "Archeological Investigations at Deluge Shelter." Department of Anthropology, University of Utah, Salt Lake City. (Manuscript on file)
- Lever, W. H.
1898 History of Sanpete and Emery Counties.
- Lindsay, LaMar
1974 "Report of a Preliminary Archeological Survey of Coal Lease Lands (U-073039, U-073040 and U-073041), Sevier and Emery Counties, Utah. A Special Report prepared by the Bureau of Land Management, Salt Lake City.
- Lindsay, LaMar W. and Christine K. Lund
1976 Pint Size Shelter. Antiquities Section Selected Papers, Vol. III, No. 10, Division of State History, Salt Lake City.
- Lister, Robert H., and Florence C. Lister
1961 The Coombs Site, Part III: Summary and Conclusions. University of Utah Anthropological Papers, No. 41, Glen Canyon Series, No. 8, Salt Lake City.

- Louthan, Bruce D. and Dale L. Berge
 1975 "Archaeological Survey of the Huntington-Sigurd Transmission Line on Bureau of Land Management Lands." Department of Archaeology and Anthropology, Brigham Young University, Provo. (Manuscript subitted to the Utah Power & Light Co.)
- Lupton, C. T.
 1916 Geology and Coal Resources of Castle Valley. U. S. Geological Survey Bulletin, No. 628, Washington, D. C.
- Lyman, June and Norma Denver
 1970 Ute People. An Historical Study. Uintah School District and the Western History Center, University of Utah, Salt Lake City.
- Madsen, David B.
 1975a Three Fremont Sites in Emery County, Utah. Antiquities Section Selected Papers, Vol. I, No. 1, Division of State History, Salt Lake City.
 1975b Dating Paiute-Shoshoni Expansion in the Great Basin. American Antiquity, Vol. 40, No. 1, Washington, D. C.
- Madsen, David B. and LaMar W. Lindsay
 1977 Backhoe Village. Antiquities Section Selected Papers, Vol. IV, No. 12, Division of State History, Salt Lake City.
- Madsen, Rex
 1973 "Topography, Climate and Soil Types as Indicators of Fremont Regional." Paper presented at the Great Basin Anthropological Conference, University of Utah, Salt Lake City.
 1977 Prehistoric Ceramics of the Fremont. Museum of Northern Arizona Ceramic Series, No. 6, Flagstaff.
- Marwitt, John P.
 1968 Pharo Village. University of Utah Anthropological Papers, No. 91, Salt Lake City.
 1973 Median Village and Fremont Culture Regional Variation. University of Utah Anthropological Papers, No. 95, Salt Lake City.
- Matheny, Ray T.
 1971 "Archaeological Survey of Huntington Canyon Salvage Project, June 1971." Department of Anthropology and Archaeology, Brigham Young University, Provo. (Manuscript submitted to Utah Power & Light Co.)
- McDonald, A. J. and F. R. Hauck
 1979 "Archeological Reconnaissance in the Vicinity of Eccles Canyon, Carbon County, Utah." Report prepared for the Coastal States Energy Company by the Archeological-Environmental Research Corporation, Salt Lake City (CSEC-78-1).

- McElprang, Stella, et al.
1949 Castle Valley. Daughters of the Utah Pioneers,
Emery County Chapter, Salt Lake City.
- Miller, David E., compiler
1968 Utah History Atlas, Second Edition. Smith Printing
Service, Salt Lake City.
- Morss, Noel
1931 The Ancient Culture of the Fremont River in Utah.
Papers of the Peabody Museum of American Archaeology
and Ethnology, Vol. 12, No. 3, Cambridge.
1954 Clay Figurines of the American Southwest. Papers
of the Peabody Museum of American Archaeology and
Ethnology, Vol. 49, No. 1, Cambridge.
- National Archives of the United States
1973 Advisory Council on Historic Preservation, Part
800 - Procedures for the Protection of Historic and
Cultural Properties. National Register, Vol. 39,
No. 18, Washington, D. C.
- Norman, V. G. and F. R. Hauck
1977 "An Archeological Survey of a Drill Site on
Whetstone Creek in the East Mountain Locality."
Report prepared for the Utah Power and Light Company
by Archeological-Environmental Research Corporation,
Salt Lake City (UPL-77-12).
1979 "Archeological Survey in the Eccles Canyon Locality
of Carbon County, Utah." Report prepared for the
Coastal States Energy Company by the Archeological-
Environmental Research Corporation, Salt Lake City
(CSEC-78-1).
1980 "Archeological Evaluation of a Proposed PCB
Transformer Structure Site at the Emery Deep Mine in
Emery County, Utah." Report prepared for Consolidation
Coal Company by the Archeological-Environmental Research
Corporation, Salt Lake City (CCC-80-2)
- O'Neill, Floyd A.
1973 "A History of the Ute Indians of Utah Until 1890."
Doctoral dissertation submitted to the University of
Utah, Salt Lake City.
- Powell, Allan Kent
1976 A History of Labor Union Activity in the Eastern
Utah Coal Fields: 1900-1934. University of Utah, Salt
Lake City.

Ranch, Rebecca

- 1980 "A Cultural Resource Evaluation of the Soldier Creek Coal Mine Property in Emery County, Utah." A report prepared for the Soldier Creek Coal Company by the Archeological Center at the University of Utah, Salt Lake City.

Reagan, Albert B.

- 1935a An Archaeological Trip to Buck Horn Draw - Indians Worshipping the Sun. Utah Academy of Sciences, Arts, and Letters, Vol. XII, Salt Lake City.
- 1935b Trip to Bull Hollow Wash, May 3-4, 1935. Utah Academy of Sciences, Arts, and Letters, Vol. XII, Salt Lake City.

Reynolds, Thursey, J., et al

- 1948 Centennial Echoes from Carbon County. Daughters of the Utah Pioneers of Carbon County, Salt Lake City.

Sargent, Kay

- 1977 "Emery County: An Archeological Summary." Division of State History, Salt Lake City.

Schroedl, Alan R.

- 1976 "The Archaic of the Northern Colorado Plateau." Unpublished dissertation, Department of Anthropology, University of Utah, Salt Lake City.

Schroedl, Alan R. and Patrick F. Hogan

- 1975 Innocents Ridge and the San Rafael Fremont. Antiquities Section Selected Papers, Vol. I, No. 2, Division of State History, Salt Lake City.

Smith, T. M. and F. R. Hauck

- 1979a "An Intensive Inventory of Drill Sites and Access Roads in the East Mountain Locality of Emery County, Utah." Report prepared for the Utah Power and Light Company by the Archeological-Environmental Research Corporation, Salt Lake City (UPL-79-10).
- 1979b "An Intensive Inventory of the Proposed UPL Cottonwood Creek - Wilberg Mine Portal Area (UPL-79-5)." Report prepared for Utah Power and Light Company by the Archeological-Environmental Research Corporation, Salt Lake City.

Steward, Julian

- 1974 Ute Indians I. Aboriginal and Historical Groups of the Ute Indians of Utah. Garland Publishing Inc., New York and London.

- Sutton, Wain, ed.
 1949 Utah Centennial History, Vol. II. Lewis Historical Publishing Company, New York.
- Taylor, Dee Calderwood
 1957 Two Fremont Sites and Their Position in Southwestern Prehistory. University of Utah Anthropological Papers, No. 29, Salt Lake City.
- Tripp, George
 1966 A Clovis Point From Central Utah. American Antiquity, Vol. 27, No. 3.
 1967 Bill Mobely does it again! Utah Archeology, Vol. 13, No. 1.
- Utah Water and Power Board
 Map of the Normal Annual Precipitation, 1931-1960, State of Utah.
- Vienneau, Azor
 1973 The Bottle Collector. Petheric Press, Halifax, Nova Scotia.
- Walker, J. Terry
 1977 "Archeological Investigations on Trough Springs Ridge and Near the Huntington Canyon-Electric Lake Dam." Department of Anthropology and Archaeology, Brigham Young University, Provo. (Manuscript on file)
- Weder, D. G. and F. R. Hauck
 1977 "An Archeological Survey of Proposed Drill Stations on East Mountain, Emery County, Utah." Report prepared for the Utah Power & Light Company by the Archeological-Environmental Research Corporation, Salt Lake City (UPL-77-10).
 n.d. "Test Excavation of Two Rock Shelters in Cottonwood Canyon, Emery County, Utah. AERC Manuscript in preparation.
- Wilson, Curtis J. and Howard L. Smith
 1976 Interstate Highway I-70 Salvage Archeology, Antiquities Section Selected Papers, Vol. II, No. 7, Division of State History, Salt Lake City.
- Winter, Joseph C.
 1973 The Distribution and Development of Fremont Maize Agriculture: Some Preliminary Interpretations. American Antiquity, Vol. 38, No. 4.

- Winter, Joseph C. and Henry G. Wylie
1974 Paleoecology and Diet at Clyde's Cavern. American Antiquity, Vol. 39(2):303-315, Washington, D. C.
- Wormington, H. M.
1955 A Reappraisal of the Fremont Culture. Proceedings of the Denver Museum of Natural History, No. 1, Denver.
1964 Ancient Man in North America. The Denver Museum of Natural History, Popular Series, No. 4, Denver.
- Wylie, Henry G.
1972 "Report of Excavations at Clyde's Cavern (42Em177) Emery County, Utah." Department of Anthropology, University of Utah, Salt Lake City. (Manuscript on file)

APPENDIX

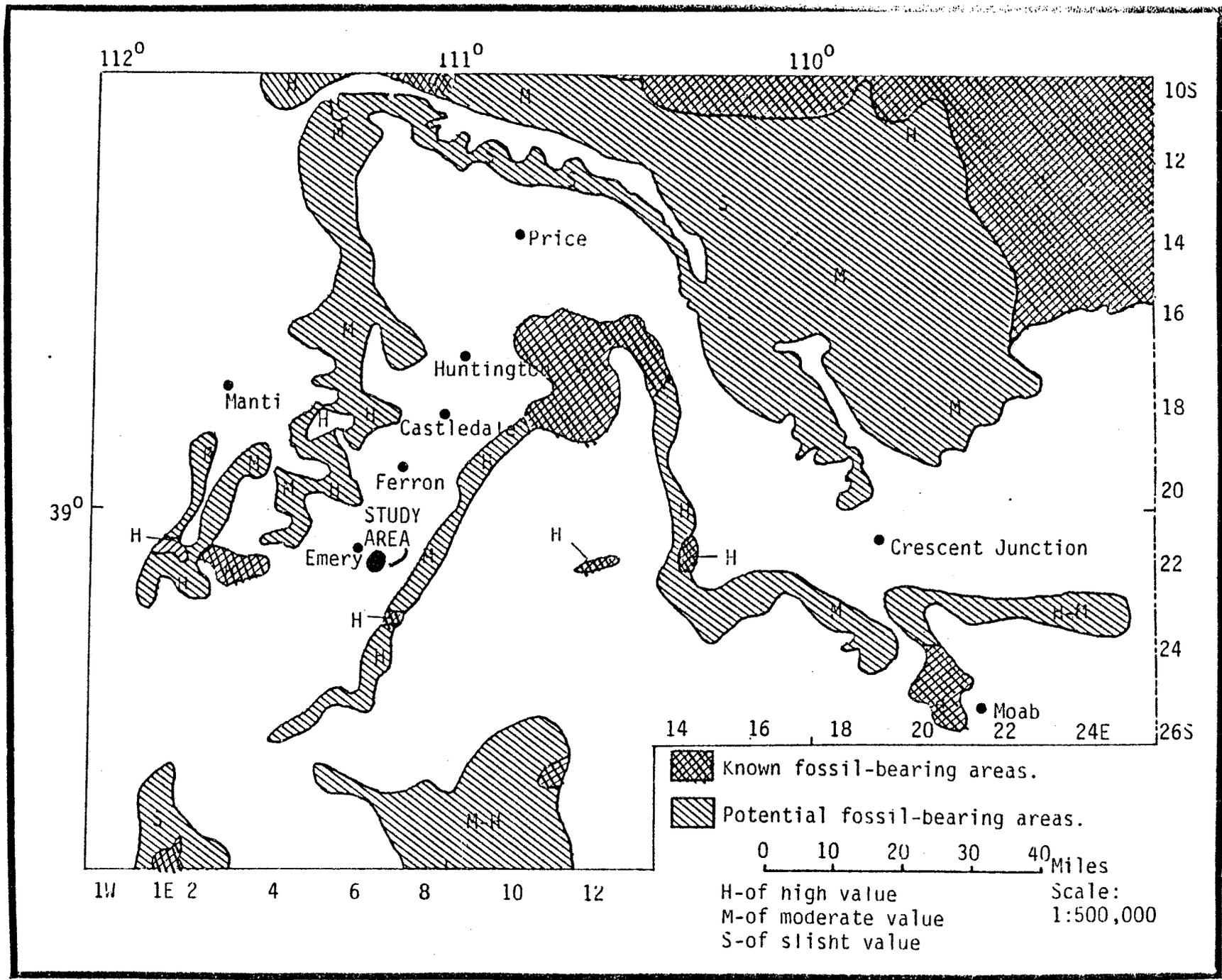
(Site Report Forms sent to
relevant government agencies)

5.10 Paleontology

Plant and vertebrate fossil-bearing rocks have been found throughout the region. Figure 5-5 shows the general distribution of fossil-bearing rocks and their value as fossil-bearing units. The North Horn formation of late Cretaceous and Paleocene age contains dinosaur and mammal remains and is particularly important. The Emery Mine does not lie in an area of recognized significance as shown on Figure 5-5. (BLM, 1979) Fossil plant material may be anticipated wherever coal is found.

Map of Central Utah coal region showing vertebrate and plant fossil-bearing areas.
 (Source: BLM, 1979)

FIGURE 5-5



 Known fossil-bearing areas.

 Potential fossil-bearing areas.

0 10 20 30 40 Miles

H-of high value
 M-of moderate value
 S-of slight value

Scale:
 1:500,000