WUCNO: 35-8775 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP**

NAME: Boyer Ditch Co., MutualAssoc. INTEREST: 100
ADDRESS:
CITY: STATE: UT ZIP CODE:

LAND OWNED BY APPLICANT? Yes

DATES, ETC.**

Filing: 00/00/0000 Priority: 01/01/1875 Advertise Paper: Date: 00/00/0000 Protested? Approval: 00/00/0000
Proof Due: 00/00/0000 Ext Filed: 00/00/0000 Elec/Proof: Filed: 00/00/0000 Cert. or WUC Issued: 00/00/0000
Rej, Etc.: 00/00/0000

PD Book No. Status/Type of Right: DEC Source of Info: Map: Date Verified: 00/00/0000 Initials:
PD REMARKS REFERENCE -- Name: Interest: Flow: Type of Right: Priority: Source:

LOCATION OF WATER RIGHT**

FLOW: 0.41 cfs SOURCE: Chalk Creek
TRIBUTARY 1: Weber River TRIBUTARY 2:
COUNTY: Weber COMMON DESCRIPTION: DRAINAGE AREA: Weber River

POINT OF DIVERSION -- SURFACE:
(1) S 1255 ft. W 1660 ft. from NE corner, Section 36, T 3N, R 6E, SLBM
Diverting Works: Boyer No. 2 Ditch Source: Chalk Creek

PLACE OF USE OF WATER RIGHT**

NORTH-EAST4	NORTH-WEST4	SOUTH-WEST4	SOUTH-EAST4
NE NW SW SE	NE NW SW SE	NE NW SW SE	NE NW SW SE

USES OF WATER RIGHT**

CLAIMS USED FOR PURPOSE DESCRIBED: 775,765
Referenced To: Claims Groups: Type of Reference -- Claims: Purpose: Remarks:

###IRRIGATION *---NORTH EAST QUARTER--*---NORTH WEST QUARTER--*---SOUTH WEST QUARTER--*---SOUTH EAST QUARTER--* Section
Tot Irr. Acrg.: 10.30* NE NW SW SE * NE NW SW SE * NE NW SW SE * NE NW SW SE * Totals
or a Total of .00 acres. Sole Supply: acres Diversion Limit: PERIOD OF USE: 03/01 TO 11/01

See Prop. Det. 197 b,c,d for acreage, owners, etc. Used to irrigate 10.3 ac. of land located in Secs. 25,26 and 36 T3N, R6E, SLB&M

###STOCKWATERING: 204 Equivalent Livestock Units Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

###DOMESTIC: 23 Persons Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

OTHER COMMENTS**

Weber River Decree No. 775
Not for official use
See Paragraph # 10 W.R. Decree
Proposed Determination No. 197 b,c,d. Pg. 60.

@@

WUCNO: 35-1002 APPLICATION/CLAIM NO.: A29674 CERT. NO.: a1476

CHANGES: a11370 Cert. a1476

OWNERSHIP

NAME: Boyer, Fern J. INTEREST:
ADDRESS: 5050 Ben Lomond Drive
CITY: Ogden STATE: UT ZIP CODE: 84403

NAME: Boyer, Dee F. INTEREST:
ADDRESS:
CITY: STATE: UT ZIP CODE:

NAME: Boyer, Gerald G. INTEREST:
ADDRESS:
CITY: STATE: UT ZIP CODE:

NAME: Boyer, Gregory J. INTEREST:
ADDRESS:
CITY: STATE: UT ZIP CODE:

NAME: Boyer, Stephen W. INTEREST:
ADDRESS:
CITY: STATE: UT ZIP CODE:

NAME: Boyer, Brent W. INTEREST:
ADDRESS:
CITY: STATE: UT ZIP CODE:

LAND OWNED BY APPLICANT?

DATES, ETC.

Filing: 01/28/1958 Priority: 01/28/1958 Advertise Paper: Date: 00/00/0000 Protested? Approval: 04/08/1958
Proof Due: 00/00/0000 Ext Filed: 00/00/0000 Elec/Proof: P Filed: 07/19/1983 Cert. or WUC Issued: 00/00/0000
Adj. Etc.: 00/00/0000

PD Book No. Status/Type of Right: CERT Source of Info: CERT Map: Date Verified: 12/29/1983 Initials: JDO

PD REMARKS REFERENCE -- Name: Interest: Flow: Type of Right: Priority: Source:

LOCATION OF WATER RIGHT

FLOW: 0.015 cfs SOURCE: Underground Water Well

TRIBUTARY 1: TRIBUTARY 2:

COUNTY: Summit COMMON DESCRIPTION: DRAINAGE AREA: Weber River

POINT OF DIVERSION -- UNDERGROUND:
(1) S 1407 ft. E 584 ft. from NW corner, Section 31, T 3N, R 7E, SLBM Diameter of Well: 6 ins. Depth: 170 to ft.

USES OF WATER RIGHT

CLAIMS USED FOR PURPOSE DESCRIBED: 1002
Referenced To: Claims Groups: Type of Reference -- Claims: Purpose: Remarks:

	NORTH EAST QUARTER				NORTH WEST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section Totals
###IRRIGATION Tot Irr. Acrg.: 0.25	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
Sec 31 T 3N R 7E SLBM							0.25										0.25
or a Total of .25 acres.	Sole Supply:				acres	Diversion Limit:			PERIOD OF USE: 04/01 TO 10/31								
###STOCKWATERING: 20 Equivalent Livestock Units	Diversion Limit:				PERIOD OF USE: 01/01 TO 12/31												
###DOMESTIC: 1 Family	Diversion Limit:				PERIOD OF USE: 01/01 TO 12/31												

WUCNO: 35-10773 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP**

NAME: Staley, Elmer D. & Richard S. INTEREST: 100
ADDRESS:
CITY: STATE: UT ZIP CODE:

LAND OWNED BY APPLICANT? Yes

DATES, ETC.**

Filing: 00/00/0000 Priority: 01/01/1872 Advertise Paper: Date: 00/00/0000 Protested? Approval: 00/00/0000

Proof Due: 00/00/0000 Ext Filed: 00/00/0000 Elec/Proof: Filed: 00/00/0000 Cert. or WUC Issued: 00/00/0000

Rej. Etc.: 00/00/0000

PD Book No. Status/Type of Right: DEC Source of Info: Map: Date Verified: 00/00/0000 Initials:

PD REMARKS REFERENCE -- Name: Interest: Flow: Type of Right: Priority: Source:

LOCATION OF WATER RIGHT**

FLOW: 1.72 cfs SOURCE: Chalk Creek

TRIBUTARY 1: Weber River TRIBUTARY 2:

COUNTY: Weber COMMON DESCRIPTION: DRAINAGE AREA: Weber River

POINT OF DIVERSION -- SURFACE:
(1) N 01 ft. E 01 ft. from S4 corner, Section 31, T 3N, R 7E, SLBM
Diverting Works: Conrad Staley Ditch Source: Chalk Creek

PLACE OF USE OF WATER RIGHT**

NORTH-EAST4	NORTH-WEST4	SOUTH-WEST4	SOUTH-EAST4
NE NW SW SE	NE NW SW SE	NE NW SW SE	NE NW SW SE

USES OF WATER RIGHT**

CLAIMS USED FOR PURPOSE DESCRIBED: 773
Referenced To: Claims Groups: Type of Reference -- Claims: Purpose: Remarks:

###IRRIGATION *---NORTH EAST QUARTER--*---NORTH WEST QUARTER--*---SOUTH WEST QUARTER--*---SOUTH EAST QUARTER--* Section
Tot Irr. Acrg.: 43.00* NE NW SW SE * NE NW SW SE * NE NW SW SE * NE NW SW SE * Totals
or a Total of .00 acres. Sole Supply: acres Diversion Limit: PERIOD OF USE: 03/01 TO 11/01

###STOCKWATERING: 1 Equivalent Livestock Units Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

###DOMESTIC: 1 Family Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

OTHER COMMENTS***

Weber River Decree No. 773
Not for official use
See Paragraph #10 W.R. Decree

@@@

WUCNO: 35-529 APPLICATION/CLAIM NO.: A21430 CERT. NO.:

OWNERSHIP***

NAME: Jones, G. Allen INTEREST:
ADDRESS:
CITY: Coalville STATE: UT ZIP CODE: 84017

LAND OWNED BY APPLICANT?

DATES, ETC.***

Filing: 03/09/1950 Priority: 03/09/1950 Advertise Paper: Date: 00/00/0000 Protested? Approval: 09/29/1950

Proof Due: 00/00/0000 Ext Filed: 00/00/0000 Elec/Proof: Filed: 00/00/0000 Cert. or WUC Issued: 00/00/0000

Rej. Etc.: 00/00/0000

PD Book No. Status/Type of Right: NPR Source of Info: APPL Map: Date Verified: 00/00/0000 Initials:

PD REMARKS REFERENCE -- Name: Interest: Flow: Type of Right: Priority: Source:

LOCATION OF WATER RIGHT***

FLOW: 0.015 cfs SOURCE: Underground Water Well

TRIBUTARY 1: TRIBUTARY 2:

COUNTY: Summit COMMON DESCRIPTION: DRAINAGE AREA: Weber River

POINT OF DIVERSION -- UNDERGROUND:
(1) N 1161 ft. W 2590 ft. from SE corner, Section 31, T 3N, R 7E, SLBM Diameter of Well: 6 ins. Depth: 58 to ft.

PLACE OF USE OF WATER RIGHT***

	NORTH-EAST4 NE NW SW SE	NORTH-WEST4 NE NW SW SE	SOUTH-WEST4 NE NW SW SE	SOUTH-EAST4 NE NW SW SE
Sec 31 T 3N R 7E SLBM	* X: X: X: X*	* X: X: X: X*	* X: X: X: X*	* X: X: X: X*

USES OF WATER RIGHT***

CLAIMS USED FOR PURPOSE DESCRIBED: 529
Referenced To: Claims Groups: Type of Reference -- Claims: Purpose: Remarks:

###DOMESTIC: 1 Family Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

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WUCNO: 35-8765 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP**********

NAME: Boyer Ditch Co., Mutual Association INTEREST: 100
ADDRESS:
CITY: STATE: UT ZIP CODE:

LAND OWNED BY APPLICANT? Yes

DATES, ETC.**********

Filing: 00/00/0000 Priority: 01/01/1866 Advertise Paper: Date: 00/00/0000 Protested? Approval: 00/00/0000
Proof Due: 00/00/0000 Ext Filed: 00/00/0000 Elec/Proof: Filed: 00/00/0000 Cert. or WUC Issued: 00/00/0000
Rej, Etc.: 00/00/0000

PD Book No. Status/Type of Right: DEC Source of Info: Map: Date Verified: 00/00/0000 Initials:
PD REMARKS REFERENCE -- Name: Interest: Flow: Type of Right: Priority: Source:

LOCATION OF WATER RIGHT**********

FLOW: 5.14 cfs SOURCE: Chalk Creek
TRIBUTARY 1: Weber River TRIBUTARY 2:
COUNTY: Weber COMMON DESCRIPTION: DRAINAGE AREA: Weber River

POINT OF DIVERSION -- SURFACE:
(1) S 1650 ft. E 825 ft. from NW corner, Section 31, T 3N, R 7E, SLBM
Diverting Works: Boyer #1 Ditch Source: Chalk Creek

PLACE OF USE OF WATER RIGHT**********

	NORTH-EAST4				NORTH-WEST4				SOUTH-WEST4				SOUTH-EAST4			
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE

USES OF WATER RIGHT**********

CLAIMS USED FOR PURPOSE DESCRIBED: 765,775,763,769,
Referenced To: Claims Groups: Type of Reference -- Claims: Purpose: Remarks:

###IRRIGATION	NORTH EAST QUARTER				NORTH WEST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section
Tot Irr. Acrg.: 128.40*	NE	NW	SW	SE *	NE	NW	SW	SE *	NE	NW	SW	SE *	NE	NW	SW	SE *	Totals
Sec 25 T 3N R 6E SLBM *	X:	X:	X:	X*	X:	X:	X:	X*	X:	X:	X:	X*	X:	X:	X:	X*	0.00
Sec 26 T 3N R 6E SLBM *	X:	X:	X:	X*	X:	X:	X:	X*	X:	X:	X:	X*	X:	X:	X:	X*	0.00
Sec 36 T 3N R 6E SLBM *	X:	X:	X:	X*	X:	X:	X:	X*	X:	X:	X:	X*	X:	X:	X:	X*	0.00

or a Total of .00 acres. Sole Supply: acres Diversion Limit: PERIOD OF USE: 03/01 TO 11/01

###STOCKWATERING: 204 Equivalent Livestock Units Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

###DOMESTIC: 23 Persons Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

OTHER COMMENTS**********

Weber River Decree No. 765
Not for official use
See Right 775 for balance of 138.7 acres.
Boyer Ditch Co., Mutual Assoc: Mary J. Boyer 68.1 ac; Wm. H. Staley 23.1 ac;
Walter Clark 19.5 ac; Peter Jacobson 28 ac; Total acreage 138.7 ac.
See Paragraph 10 W.R. Decree
Proposed Determination No. 197 a,c,d Pg.60

WUCNO: 35-3811 APPLICATION/CLAIM NO.: U20958 CERT. NO.:

CHANGES: a11125 Unapproved

OWNERSHIP**********

NAME: Potter, G.W. INTEREST:
ADDRESS:
CITY: Coalville STATE: UT ZIP CODE: 84017

LAND OWNED BY APPLICANT?

DATES, ETC.**********

Filing: 03/20/1960 Priority: 06/08/1899 Advertise Paper: Date: 00/00/0000 Protested? Approval: 00/00/0000

Proof Due: 00/00/0000 Ext Filed: 00/00/0000 Elec/Proof: Filed: 00/00/0000 Cert. or WUC Issued: 00/00/0000

Rej, Etc.: 00/00/0000

PD Book No. Status/Type of Right: UGWC Source of Info: UGWC Map: Date Verified: 00/00/0000 Initials:

PD REMARKS REFERENCE -- Name: Interest: Flow: Type of Right: Priority: Source:

LOCATION OF WATER RIGHT**********

FLOW: 0.012 cfs SOURCE: Underground Water Well

TRIBUTARY 1: TRIBUTARY 2:

COUNTY: Summit COMMON DESCRIPTION: DRAINAGE AREA: Weber River

POINT OF DIVERSION -- UNDERGROUND:
(1) S 258 ft. W 103 ft. from NE corner, Section 6, T 2N, R 7E, SLBM Diameter of Well: 48 ins. Depth: 52 to ft.

USES OF WATER RIGHT**********

CLAIMS USED FOR PURPOSE DESCRIBED: 3811

Referenced To:	Claims Groups:	Type of Reference -- Claims:	Purpose:	Remarks:
###STOCKWATERING:	18 Equivalent Livestock Units	Diversion Limit:	PERIOD OF USE:	01/01 TO 12/31
###DOMESTIC:	9 Persons	Diversion Limit:	PERIOD OF USE:	01/01 TO 12/31

WUCNO: 35-8773 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP

NAME: Staley, Elmer D. & Richard S. INTEREST: 100
ADDRESS:
CITY: STATE: UT ZIP CODE:

LAND OWNED BY APPLICANT? Yes

DATES, ETC.

Filing: 00/00/0000 Priority: 01/01/1872 Advertise Paper: Date: 00/00/0000 Protested? Approval: 00/00/0000

Proof Due: 00/00/0000 Ext Filed: 00/00/0000 Elec/Proof: Filed: 00/00/0000 Cert. or WUC Issued: 00/00/0000

Rej, Etc.: 00/00/0000

PD Book No. Status/Type of Right: DEC Source of Info: Map: Date Verified: 00/00/0000 Initials:

PD REMARKS REFERENCE -- Name: Interest: Flow: Type of Right: Priority: Source:

LOCATION OF WATER RIGHT

FLOW: 1.72 cfs SOURCE: Chalk Creek

TRIBUTARY 1: Weber River TRIBUTARY 2:

COUNTY: Weber COMMON DESCRIPTION: DRAINAGE AREA: Weber River

POINT OF DIVERSION -- SURFACE:
(1) S 265 ft. W 1585 ft. from NE corner, Section 6, T 2N, R 7E, SLBM
Diverting Works: Conrad Staley Ditch Source: Chalk Creek

PLACE OF USE OF WATER RIGHT

NORTH-EAST4	NORTH-WEST4	SOUTH-WEST4	SOUTH-EAST4
NE NW SW SE	NE NW SW SE	NE NW SW SE	NE NW SW SE

USES OF WATER RIGHT

CLAIMS USED FOR PURPOSE DESCRIBED: 773
Referenced To: Claims Groups: Type of Reference -- Claims: Purpose: Remarks:

###IRRIGATION	NORTH EAST QUARTER				NORTH WEST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section
Tot Irr. Acrg.: 43.00	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	Totals
Sec 31 T 3N R 7E SLBM	X	X	X	X					X	X	X	X					0.00

or a Total of .00 acres. Sole Supply: acres Diversion Limit: PERIOD OF USE: 03/01 TO 11/01

###STOCKWATERING: 80 Equivalent Livestock Units Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

###DOMESTIC: 7 Persons Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

OTHER COMMENTS

Weber River Decree No. 773
Not for official use

UMC 783.16 SURFACE WATER INFORMATION

UMC 783.16(a) - GENERAL DESCRIPTION OF SURFACE WATER HYDROLOGY

The Weber River Basin drains a 2080 square mile area and ranges in elevation from 4210 to 11708 feet. Several major reservoirs increase the total usable capacity of the river, most of which is used for irrigation and some recreation. The primary consumptive water usage in the basin is irrigation (Thompson, 1983).

The reclamation area is located adjacent to Chalk Creek, a major tributary to the Weber River. Chalk Creek contributes some 60 to 65 percent of the total flow in the Weber River at their confluence near Coalville (Table 783.16-1). The quality of the creek generally diminishes the quality of the Weber River in nearly every aspect (Table 783.16-2, Table 783.16-3).

Chalk Creek, a perennial stream draining some 132 square miles upstream from the site, is the only surface water body present in the proposed reclamation area. Drawing number 783.16-1 shows several ephemeral drainages in the vicinity of the disturbed area, but none of which traverse the area. Reclamation activities are not expected to affect these drainages.

Chalk Creek appears to be a gaining stream in the vicinity of its confluence with the Weber River. Approximately three miles east of Coalville however, Chalk Creek is apparantly above the water table and from that point upstream is probably recharging the alluvium (Gates, et al, 1984).

The reclamation area is located adjacent to Chalk Creek approximately twelve miles upstream from its confluence with the Weber River. Chalk Creek is the only surface water body which is located in or crosses the area. Drawing numbers 783.16-1 and 783.15-2 (page 783.15- of this document) show the area topography and ephemeral drainages tributary to Chalk Creek. During site reconnaissance no ephemeral streambeds were noted to traverse the reclamation area.

UMC 783.16(b)(1) - Discharge Conditions

Table 783.16-1 provides a discharge range for locations both upstream and downstream from the reclamation area. Table 783.16-4 shows the seasonal flow variation recorded at the gaging station near Coalville (10131000). Peak flow periods occur in

the spring and primarily result from melting snowpack within the drainage area.

UMC 783.16(b)(2) - Surface Water Quality

Available water quality data is included in Tables 783.16-1, 783.16-3 and Table 783.16-5 for sample stations located both upstream and downstream from the reclamation site. The upstream sample location referred to in Tables 783.16-1 and 783.16-3 is several miles upstream from the reclamation site. Surface water monitoring for baseline data is available from the SOAP program being conducted at the adjacent Boyer Mine. Available data from the Earth Fax draft report is included as Table 783.16-6a through 783.16-7b in this section. Sampling locations are shown on drawing number 783.16-1, page 783.16-6 of this section.

TABLE 783.16-1

SUMMARY OF HYDROLOGIC DATA SHOWN IN TABLES 783.16-2 AND 783.16-3

Parameters	Chalk Creek at USGS Gaging Sta. 10131000	Chalk Creek Above Permit Area	Weber River at USGS Gaging Sta. 10130500
Number of Chemical Analyses	6	2	5
Discharge Range (cfs)	114.5-319	12-230	134-790
Dissolved Solids Range (mg/l)	237-446	202-234	163-256
Specific Conductance Range (umhos)	390-775	375-380	290-435
Hardness Range	Very Hard	Very Hard	Hard-Very Hard
Dominant Cation(s) During High Flow	Ca	Ca	Ca
Dominant Cation(s) During Low Flow	Ca,Mg	Ca,Mg	Ca
Dominant Anion(s) During High Flow	HCO3	HCO3	HCO3
Dominant Anion(s) During Low Flow	HCO3	HCO3	HCO3
Salinity Hazard to Irrigation Supply	Medium-High	Medium	Medium
Sodium Hazard to Irrigation Supply	Low	Low	Low
Boron Hazard to Irrigation Supply	None	None	None
Dissolved Solids Hazard to Irrigation Supply	None	None	None
Significant Upstream Diversions	Yes	No	Yes
Significant Upstream Irrigation	Yes	No	Yes

TABLE 783.16-2

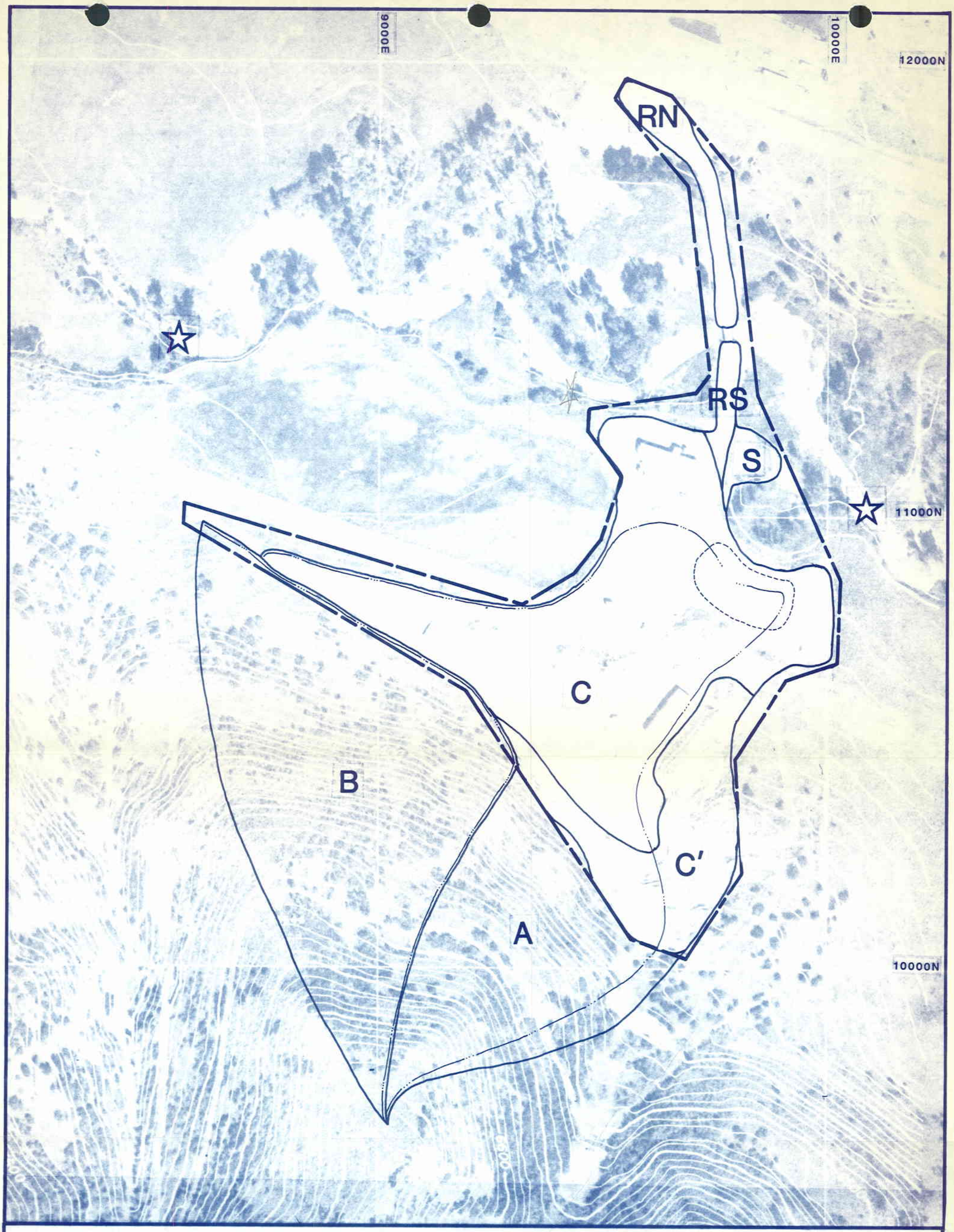
CHEMICAL ANALYSES OF WATER SAMPLES FROM THE WEBER RIVER NEAR COALVILLE

Parameters	At USGS Gaging Station 10130500				
	08/02/79	02/27/80	04/02/80	05/12/80	08/12/80
Discharge (cfs)	174	205	187	790	134
Temperature (degree C)	14.5	5.0	6.0	8.0	16.5
Specific Conductance (umhos)	380	425	435	320	290
pH	8.4	8.5	8.4	7.9	8.2
Dissolved Solids (mg/l)	205	253	256	196	163
Dissolved Silica as SiO2 (mg/l)	0.1	8.4	9.8	11	8.6
Dissolved Calcium as Ca (mg/l)	52	62	62	48	40
Dissolved Magnesium as Mg (mg/l)	12	15	15	12	8.9
Dissolved Sodium as Na (mg/l)	7.8	11	11	8.1	5.8
Dissolved Potassium as K (mg/l)	2.1	2.6	2.8	2.4	1.4
Alkalinity total as CaCO3 (mg/l)	170	190	190	140	130
Dissolved Sulfate as SO4 (mg/l)	18	24	26	19	11
Dissolved Chloride as Cl (mg/l)	10	15	14	1.0	8.2
Dissolved Fluoride as F (mg/l)	0.1	0.2	0.1	0.1	0.2
Dissolved Nitrate plus Nitrite as N (mg/l)	0.13	0.23	0.23	0.25	0.24
Dis. Phosphorus, Orthophosphate as P (mg/l)	0.05	0.00	0.00	0.01	0.01
Dissolved Phosphate, Ortho as PO4 (mg/l)	0.15	0.00	0.00	0.03	0.03
Total Hardness as CaCO3 (mg/l)	180	220	220	170	140
Non-carbonate Hardness as CaCO3 (mg/l)	9	27	27	29	7
Sodium Adsorption Ratio	0.3	0.3	0.3	0.3	0.2
Dissolved Boron as B (mg/l)	60	40	30	30	70
Potassium-40 (pCi/l)	1.6	1.9	2.1	1.8	1.0
Dissolved Oxygen (mg/l)	---	11.0	11.0	9.2	8.1

TABLE 783.16-3

CHEMICAL ANALYSES OF WATER SAMPLES FROM CHALK CREEK

Parameters	At USGS Gaging Station 10131000						Above Permit Area	
	08/02/79	10/25/79	02/27/80	04/02/80	05/12/80	08/12/80	08/02/79	05/12/80
Discharge (cfs)	21	14.5	36	15	319	23.1	12	230
Temperature (degree C)	15.5	11.0	3.0	6.5	5.5	16.0	19.5	5.0
Specific Conductance (umhos)	775	720	590	690	390	650	375	380
pH	7.5	7.6	8.2	8.2	8.1	7.7	8.4	8.0
Dissolved Solids (mg/l)	423	412	361	446	237	408	202	234
Dissolved Silica as SiO2 (mg/l)	2.1	11	7.5	11	7.8	12	0.8	7.0
Dissolved Calcium as Ca (mg/l)	90	84	78	74	60	88	49	57
Dissolved Magnesium as Mg (mg/l)	28	27	24	25	15	27	16	17
Dissolved Sodium as Na (mg/l)	28	30	27	30	9.8	25	7.5	8.9
Dissolved Potassium as K (mg/l)	3.4	3.8	3.0	2.5	1.6	3.5	1.0	1.3
Alkalinity total as CaCO3 (mg/l)	320	290	250	250	190	300	180	190
Dissolved Sulfate as SO4 (mg/l)	35	35	26	33	14	25	8.1	15
Dissolved Chloride as Cl (mg/l)	40	44	44	58	13	43	11	12
Dissolved Fluoride as F (mg/l)	0.4	0.2	0.2	0.2	0.3	0.3	0.1	0.2
Dissolved Nitrate plus Nitrite as N (mg/l)	0.83	0.66	0.31	0.30	0.41	0.93	0.02	0.38
Dis. Phosphorus, Orthophosphate as P (mg/l)	0.03	0.01	0.00	0.01	0.02	0.02	0.01	0.01
Dissolved Phosphate, Ortho as PO4 (mg/l)	0.09	0.03	0.00	0.03	0.06	0.06	0.03	0.03
Total Hardness as CaCO3 (mg/l)	340	320	290	430	210	330	190	210
Non-carbonate Hardness as CaCO3 (mg/l)	20	31	44	180	22	31	8	22
Sodium Adsorption Ratio	0.7	0.7	0.7	1.1	0.3	0.6	0.2	0.3
Dissolved Boron as B (mg/l)	120	90	50	60	40	110	20	30
Potassium-40 (pCi/l)	2.5	2.8	2.2	3.1	1.2	2.6	0.7	1.0
Dissolved Oxygen (mg/l)	---	9.3	10.9	11.0	11.0	6.6	---	---



LEGEND

- PERMIT AREA BOUNDARY
- DRAINAGE AREA BOUNDARY
- HYDRAULIC LENGTH
- SEDIMENTATION POND
- SURFACE WATER MONITORING LOCATION

ACREAGES

A	5.42	S	0.29
B	10.73	RS	0.32
C	9.77	RN	0.93
C'	3.10		

LENGTHS (feet)

A	725	C'	325
B	1726	A-C-C'	1764
C	1305		

N

NOTE: Disturbed area includes C, C', S, RS, and RN for a total of 14.41 acres.

THIS DRAWING WAS PREPARED UNDER MY SUPERVISION:

BARBARA A. FILAS #7007 DATE 11/6/86

REGISTERED PROFESSIONAL ENGINEER, UTAH NO. 7007

SUMMIT MINERALS, INC.

STORM RUNOFF AND DRAINAGE AREAS

BAF 10/16/86
Scale: 1" : 200'
Ref. Dwgs.:

783.16-1

783.16-6

TABLE 783.16-4

STATION 10131000 CHALK CREEK AT COALVILLE UTAH

DISCHARGE (CUBIC FEET/SECOND)
NORMAL MONTHLY MAXIMUMS (ALL DAYS)

YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	ANNUAL
1944	30.0	29.0	23.0	18.0	21.0	50.0	271.	655.	581.	92.0	25.0	29.0	655.
1945	21.0	25.0	22.0	18.0	32.0	152.	179.	289.	170.	44.0	151.	31.0	289.
1946	28.0	31.0	30.0	27.0	41.0	120.	485.	349.	161.	40.0	15.0	17.0	485.
1947	45.0	37.0	30.0	19.0	30.0	220.	123.	399.	210.	82.0	63.0	34.0	399.
1948	28.0	34.0	34.0	37.0	50.0	123.	499.	625.	207.	52.0	50.0	10.0	625.
1949	19.0	25.0	21.0	17.0	21.0	42.0	345.	387.	349.	82.0	24.0	24.0	387.
1950	43.0	27.0	21.0	32.0	37.0	46.0	500.	861.	764.	150.	49.0	51.0	861.
1951	38.0	52.0	40.0	32.0	82.0	74.0	249.	500.	335.	74.0	68.0	26.0	500.
1952	34.0	29.0	26.0	26.0	25.0	38.0	1200.	1200.	519.	150.	49.0	54.0	1200.
1953	20.0	26.0	24.0	38.0	27.0	64.0	110.	314.	349.	61.0	44.0	19.0	349.
1954	21.0	28.0	22.0	21.0	25.0	44.0	104.	145.	57.0	28.0	11.0	25.0	145.
1955	15.0	18.0	15.0	16.0	15.0	41.0	81.0	307.	110.	22.0	15.0	17.0	307.
1956	17.0	33.0	77.0	46.0	21.0	138.	237.	426.	260.	49.0	29.0	20.0	426.
1957	22.0	24.0	31.0	21.0	70.0	40.0	104.	610.	556.	130.	40.0	31.0	610.
1958	26.0	31.0	31.0	22.0	47.0	41.0	206.	274.	91.0	18.0	14.0	11.0	274.
1959	11.0	19.0	25.0	18.0	26.0	29.0	164.	172.	108.	71.0	16.0	44.0	172.
1960	28.0	19.0	15.0	16.0	27.0	216.	95.0	251.	75.0	16.0	8.60	9.80	251.
1961	15.0	21.0	20.0	11.0	15.0	131.	54.0	68.0	46.0	12.0	6.30	5.80	131.
1962	13.0	17.0	16.0	36.0	294.	134.	292.	352.	225.	52.0	19.0	19.0	352.
1963	28.0	20.0	20.0	56.0	160.	36.0	81.0	220.	122.	24.0	19.0	26.0	220.
1964	21.0	21.0	17.0	16.0	15.0	43.0	228.	652.	382.	130.	21.0	16.0	652.
1965	20.0	26.0	102.	47.0	36.0	47.0	347.	590.	503.	205.	96.0	73.0	590.
1966	54.0	47.0	85.0	34.0	27.0	144.	188.	482.	85.0	38.0	15.0	28.0	482.
1967	32.0	26.0	27.0	21.0	22.0	55.0	72.0	693.	506.	303.	36.0	45.0	693.
1968	37.0	30.0	27.0	26.0	44.0	57.0	119.	558.	541.	129.	108.	47.0	558.
1969	51.0	41.0	33.0	52.0	32.0	88.0	395.	545.	239.	157.	33.0	21.0	545.
1970	48.0	33.0	33.0	51.0	34.0	30.0	178.	510.	347.	92.0	45.0	51.0	510.
1971	39.0	58.0	45.0	59.0	48.0	340.	210.	563.	414.	148.	52.0	77.0	563.
1972	46.0	50.0	53.0	42.0	45.0	189.	425.	536.	415.	90.0	25.0	58.0	586.
1973	49.0	41.0	31.0	29.0	26.0	38.0	578.	752.	419.	82.0	34.0	58.0	752.
1974	43.0	48.0	42.0	41.0	39.0	123.	566.	1080.	389.	113.	33.0	23.0	1080.
1975	28.0	31.0	33.0	29.0	25.0	43.0	75.0	615.	798.	262.	41.0	57.0	798.
1976	52.0	39.0	39.0	30.0	65.0	69.0	175.	441.	140.	55.0	26.0	16.0	441.
1977	24.0	21.0	19.0	14.0	15.0	30.0	65.0	47.0	27.0	12.0	7.20	5.80	65.0
1978	9.60	20.0	21.0	17.0	20.0	73.0	155.	496.	333.	112.	40.0	65.0	496.
1979	29.0	32.0	32.0	23.0	37.0	42.0	115.	200.	117.	25.0	40.0	18.0	200.
1980	22.0	21.0	18.0	53.0	52.0	37.0	574.	563.	346.	160.	41.0	34.0	574.
1981	40.0	38.0	27.0	25.0	58.0	47.0	251.	352.	307.	53.0	23.0	40.0	352.
1982	37.0	30.0	42.0	26.0	55.0	66.0	453.	800.	334.	177.	60.0	135.	800.
1983	103.	73.0	55.0	44.0	55.0	163.	458.	1240.	1410.	386.	206.	177.	1410.
1984	71.0	74.0	78.0	64.0	65.0	83.0	399.	1240.	665.	230.	180.	100.	1240.
1985	88.2	81.0	65.0	50.4	48.0	140.	617.	793.	256.	104.	51.0	46.0	793.
PER	103.	81.0	102.	64.0	294.	340.	1200.	1240.	1410.	386.	206.	177.	1410.

* INDICATES A NO-VALUE MONTH

TABLE 783.16-5

WATER QUALITY DATA - USGS GAGING STATION 10131000, CHALK CREEK AT COALVILLE, UTAH

Parameter	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.
					1973-1974							
Flow (cfs)	36	38	37	35	----	39	110	610	252	81	19	21
Temp. (degree C)	8.0	1.5	2.0	0.5	----	2.0	4.0	8.0	14.0	17.0	15.0	16.0
Sp. Cond. (umhos)	650	500	530	540	----	700	730	410	380	585	750	700
					1974-1975							
Flow (cfs)	14	25	19	22	22	35	81	158	456	245	35	48
Temp. (degree C)	10.0	4.0	0.5	0.5	1.0	2.5	2.5	4.5	7.0	8.5	14.5	11.0
Sp. Cond. (umhos)	750	650	700	680	600	520	490	450	320	300	400	600
					1975-1976							
Flow (cfs)	38	31	----	28	29	23	141	344	----	26	23	15
Temp. (degree C)	5.0	3.5	----	1.0	1.0	1.5	7.0	9.0	----	14.0	11.0	13.5
Sp. Cond. (umhos)	500	520	----	600	510	610	480	350	----	600	700	700
					1976-1977							
Flow (cfs)	20	19	18	20	18	12	29	20	11	----	5.5	6.4
Temp. (degree C)	9.5	2.5	1.5	1.0	1.5	4.0	6.0	9.0	12.0	----	13.0	11.0
Sp. Cond. (umhos)	620	630	640	620	630	680	540	670	830	----	880	880
					1977-1978							
Flow (cfs)	5.1	13	20	17	16	72	----	165	415	19	----	19
Temp. (degree C)	10.0	8.5	2.0	2.0	4.5	9.5	----	8.0	12.0	14.0	----	14.0
Sp. Cond. (umhos)	830	790	720	670	580	580	----	495	380	740	----	690
					1978-1979							
Flow (cfs)	21	14	18	23	24	----	84	183	61	8.2	21	14
Temp. (degree C)	8.0	3.0	2.0	1.5	2.5	----	5.0	12.0	12.0	14.0	15.5	16.0
Sp. Cond. (umhos)	660	670	690	570	590	----	550	360	520	690	775	710
					1979-1980							
Flow (cfs)	5.1	15	12	43	----	----	32	423	295	59	18	19
Temp. (degree C)	20.0	4.0	0.0	2.5	----	----	3.0	7.5	8.0	14.0	13.0	12.0
Sp. Cond. (umhos)	790	620	690	500	----	----	600	405	320	540	800	740
					1980-1981							
Flow (cfs)	19	24	22	15	----	25	267	313	86	10	14	26
Temp. (degree C)	9.5	5.0	1.0	1.0	----	4.0	11.0	10.0	10.5	14.5	15.5	16.0
Sp. Cond. (umhos)	700	580	600	610	----	560	350	370	570	800	750	----
					1981-1982							
Flow (cfs)	26	----	13	----	29	28	371	480	254	67	34	55
Temp. (degree C)	9.0	----	2.5	----	2.0	6.0	8.0	9.0	11.0	17.0	17.0	14.0
Sp. Cond. (umhos)	----	----	640	----	600	640	480	----	500	590	680	560
					1982-1983							
Flow (cfs)	----	22	30	24	21	40	224	899	551	108	119	68
Temp. (degree C)	----	3.0	0.0	1.0	3.5	4.5	4.0	7.0	13.0	14.0	16.5	14.0
Sp. Cond. (umhos)	----	690	650	660	640	630	590	440	410	590	590	560
					1983-1984							
Flow (cfs)	72	67	----	53	46	----	107	847	362	148	173	----
Temp. (degree C)	11.0	7.5	----	1.0	0.0	----	5.0	15.0	17.0	14.0	16.0	----
Sp. Cond. (umhos)	445	640	----	660	680	----	720	405	----	600	600	----

TABLE 783.16-6a

WATER QUALITY ANALYSES
CHALK CREEK - UPSTREAM

	06/03/85	08/31/85	11/25/85	02/25/86
Field Measurements				
Temperature (degrees C)	8.0	14.5	7.2	2.0
Flow (cfs)	171.3	25.0	21.4	89.9
pH	7.36	6.97	6.91	7.15
Specific Conductance (umhos/cm at 25 degrees C)	480	450	570	550
Laboratory Measurements				
Aluminum (mg/l)	<0.05	<0.002	0.26	0.04
Ammonia (mg/l)	0.06	0.10	0.24	0.25
Arsenic (mg/l)	0.002	0.025	0.018	0.005
Barium (mg/l)	0.09	0.11	0.14	0.17
Bicarbonate (mg/l)	203	182	197	180
Boron (mg/l)	<0.05	<0.05	<0.05	<0.05
Cadmium (mg/l)	<0.001	0.002	0.003	0.003
Carbonate (mg/l)	<1	0	0	0
Calcium (mg/l)	65	41	47	84
Chloride (mg/l)	26.0	28.2	37.7	67.2
Chromium (mg/l)	0.004	<0.005	<0.005	<0.005
Copper (mg/l)	0.001	0.006	0.006	0.013
Fluoride (mg/l)	0.11	0.10	0.29	0.27
Hardness (mg/l CaCO3)	243	232	305	244
Iron (mg/l)	0.25	<0.03	0.24	0.04
Lead (mg/l)	<0.010	0.023	0.031	0.015
Magnesium (mg/l)	16	19	25	30
Manganese (mg/l)	0.012	0.001	0.039	0.035
Mercury (mg/l)	0.0004	<0.0001	0.0007	<0.0001
Molybdenum (mg/l)	<0.001	<0.05	<0.05	<0.05
Nickel (mg/l)	0.012	0.010	0.005	0.009
Nitrate (mg/l as N)	<0.02	0.23	0.06	3.65
Nitrite (mg/l as N)	<0.02	0.03	<0.01	<0.01
Oil and Grease (mg/l)	<5	<5	<5	<5
Phosphate (mg/l)	0.09	0.28	0.36	<0.01
Potassium (mg/l)	2	3	2	5
Selenium (mg/l)	0.002	0.002	0.004	0.012
Sodium (mg/l)	11	15	7	30
Solids, Dissolved (mg/l)	295	310	400	390
Solids, Settleable (mg/l)	<1	<0.5	<1	<0.5
Solids, Suspended (mg/l)	24	2	13	104
Sulfate (mg/l)	15	11.2	36.1	57.6
Sulfide (mg/l)	0.025	<0.002	0.01	0.02
Zinc (mg/l)	0.013	0.006	0.002	0.022

TABLE 783.16-6b

CHARGE / TDS BALANCE
CHALK CREEK - UPSTREAM

	06/03/85		08/31/85		11/25/85		02/25/86	
	mg/l	meq/l	mg/l	meq/l	mg/l	meq/l	mg/l	meq/l
Calcium	65	3.24	41	2.05	47	2.35	84	4.19
Magnesium	16	1.32	19	1.56	25	2.06	30	2.47
Potassium	2	0.05	3	0.08	2	0.05	5	0.13
Sodium	11	0.48	15	0.65	12	0.52	30	1.31
Sum of Cations		5.09		4.34		4.98		8.10
Bicarbonate	203	3.33	182	2.98	197	3.23	180	2.95
Carbonate	<1	0.00	0	0.00	0	0.00	0	0.00
Chloride	26	0.73	28.2	0.80	37.7	1.06	67.2	1.90
Sulfate	15	0.31	11.2	0.23	36.1	0.75	57.6	1.20
Sum of Anions		4.37		4.01		5.04		6.05
Charge Balance (%)		7.6		4.0		(0.6)		14.5

Laboratory TDS	295	310	400	390
Calculated TDS	236	208	258	362
TDS Balance (%)	11.1	19.7	21.6	3.7

$$\text{Charge Balance (\%)} = \left(\frac{\text{Cations} - \text{Anions}}{\text{Cations} + \text{Anions}} \right) 100$$

$$\text{TDS Balance (\%)} = \left(\frac{\text{Laboratory} - \text{Calculated}}{\text{Laboratory} + \text{Calculated}} \right) 100$$

TABLE 783.16-7a

WATER QUALITY ANALYSES
CHALK CREEK - DOWNSTREAM

	06/03/85	08/31/85	11/25/85	02/25/86
Field Measurements				
Temperature (degrees C)	8.0	18.0	6.0	4.8
Flow (cfs)	187.0	20.6	30.3	118.6
pH	7.30	7.05	7.10	7.08
Specific Conductance (umhos/cm at 25 degrees C)	540	420	570	580
Laboratory Measurements				
Aluminum (mg/l)	<0.05	<0.05	0.81	0.04
Ammonia (mg/l)	0.05	0.06	0.22	0.95
Arsenic (mg/l)	0.002	0.020	0.010	0.009
Barium (mg/l)	0.09	0.11	0.15	0.15
Bicarbonate (mg/l)	196	197	201	218
Boron (mg/l)	<0.05	<0.05	<0.05	<0.05
Cadmium (mg/l)	<0.001	0.001	0.006	0.002
Carbonate (mg/l)	0	0	0	0
Calcium (mg/l)	65	39	49	77
Chloride (mg/l)	27.0	28.9	38.8	65.8
Chromium (mg/l)	0.004	<0.005	0.005	<0.005
Copper (mg/l)	0.003	0.008	0.007	0.010
Fluoride (mg/l)	0.11	0.10	0.15	0.26
Hardness (mg/l CaCO3)	241	221	298	254
Iron (mg/l)	0.34	<0.03	0.46	0.07
Lead (mg/l)	<0.010	0.023	0.041	0.015
Magnesium (mg/l)	16	19	25	28
Manganese (mg/l)	0.012	0.001	0.043	0.048
Mercury (mg/l)	0.0005	<0.0001	0.0004	0.0001
Molybdenum (mg/l)	<0.001	<0.05	<0.05	<0.05
Nickel (mg/l)	0.011	0.010	0.005	0.011
Nitrate (mg/l as N)	<0.02	0.18	0.04	1.76
Nitrite (mg/l as N)	<0.02	0.01	<0.01	<0.01
Oil and Grease (mg/l)	<5	<5	<5	<5
Phosphate (mg/l)	0.08	0.08	0.14	<0.01
Potassium (mg/l)	2	2	2	4
Selenium (mg/l)	0.001	0.001	0.004	0.012
Sodium (mg/l)	14	15	13	25
Solids, Dissolved (mg/l)	305	315	450	405
Solids, Settleable (mg/l)	<1	<0.5	<0.5	<0.5
Solids, Suspended (mg/l)	40	1	11	150
Sulfate (mg/l)	15	12.0	42.8	63.6
Sulfide (mg/l)	0.034	<0.002	0.039	<0.01
Zinc (mg/l)	0.004	0.008	0.012	0.044

TABLE 783.16-7b

CHARGE / TDS BALANCE
CHALK CREEK - DOWNSTREAM

	06/03/85		08/31/85		11/25/85		02/25/86	
	mg/l	meq/l	mg/l	meq/l	mg/l	meq/l	mg/l	meq/l
Calcium	65	3.24	39	1.95	49	2.45	77	3.84
Magnesium	16	1.32	19	1.56	25	2.06	28	2.30
Potassium	2	0.05	2	0.05	2	0.05	4	0.10
Sodium	14	0.61	15	0.65	13	0.57	25	1.09
Sum of Cations		5.22		4.21		5.13		7.33
Bicarbonate	196	3.21	197	3.23	201	3.29	218	3.57
Carbonate	<1	0.00	0	0.00	0	0.00	0	0.00
Chloride	27	0.76	28.9	0.82	38.8	1.09	65.8	1.86
Sulfate	15	0.31	12.0	0.25	42.8	0.89	63.6	1.32
Sum of Anions		4.28		4.30		5.27		6.75
Charge Balance (%)		9.9		(1.1)		(1.3)		4.1

Laboratory TDS	305	315	450	405
Calculated TDS	237	214	271	378
TDS Balance (%)	12.5	19.1	24.8	3.5

$$\text{Charge Balance (\%)} = \left(\frac{\text{Cations} - \text{Anions}}{\text{Cations} + \text{Anions}}\right) 100$$

$$\text{TDS Balance (\%)} = \left(\frac{\text{Laboratory} - \text{Calculated}}{\text{Laboratory} + \text{Calculated}}\right) 100$$

TABLE 783.16-8

SURFACE WATER QUALITY ANALYSES
CHALK CREEK - UPSTREAM

10/09/86

Field Measurements	
Temperature (degrees C)	NA
Flow (cfs)	NA
pH	NA
Specific Conductance (umhos/cm at 25 degrees C)	NA
Laboratory Measurements (mg/l)	
Acidity as CaCO3, SM402Y	<0.10
Alkalinity as CaCO3, SM403	150
Aluminum as Al, SM303C	<0.01
Ammonia as NH3-N, SM417F	0.39
Arsenic (dis) as As, SM304	<0.001
Arsenic (tot) as As, SM304	<0.001
Barium (dis) as Ba, SM303A	0.13
Barium (tot) as Ba, SM303A	0.17
Bicarbonate as HCO3, SM403	173.20
Boron (dis) as B, SM404A	<0.001
Boron (tot) as B, SM404A	<0.001
Cadmium (dis) as Cd, SM304	<0.001
Cadmium (tot) as Cd, SM304	<0.001
Calcium as Ca, SM303A	52.80
Carbonate as CO3, SM403	4.80
Chloride as Cl, SM407A	86.0
Chromium (dis) as Cr, SM303A	<0.001
Chromium (tot) as Cr, SM303A	<0.001
Copper (dis) as Cu, SM303A	<0.01
Copper (tot) as Cu, SM303A	<0.01
Fluoride as F, SM413B	0.12
Hardness as CaCO3, SM314B	202
Iron (dis) as Fe, SM303A	<0.01
Iron (tot) as Fe, SM303A	0.09
Lead (dis) as Pb, SM303A	<0.001
Lead (tot) as Pb, SM303A	0.005

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Magnesium (dis) as Mg, SM313B	24.97
Magnesium (tot) as Mg, SM313B	25.50
Manganese (dis) as Mn, SM303A	<0.01
Manganese (tot) as Mn, SM303A	<0.01
Mercury (dis) as Hg, SM32	<0.0002
Mercury (tot) as Hg, SM320A	<0.0002
Molybdenum (dis) as Mo, SM303A	<0.001
Molybdenum (tot) as Mo, SM303C	<0.001
Nickel (dis) as Ni, SM249.2	<0.01
Nickel (tot) as Ni, SM249.2	<0.01
Nitrate as NO3-N, SM418C	<0.01
Nitrite as NO2-N, SM419	<0.01
Phosphate as PO4-P, SM424G	0.05
Potassium as K, SM303A	2.30
Selenium as Se, SM304	<0.001
Settleable Solids, SM209F	<0.1
Sodium as Na, SM303A	20.70
Sulfate as SO4, SM426D	6
Sulfide as S, EPA9030	<0.10
Suspended Solids, SM209D	2.0
Total Dissolved Solids, SM209B	360
Zinc as Zn, SM303A	<0.005

TABLE 783.16-9

SURFACE WATER QUALITY ANALYSES
CHALK CREEK - DOWNSTREAM

10/09/86

Field Measurements	
Temperature (degrees C)	NA
Flow (cfs)	NA
pH	NA
Specific Conductance (umhos/cm at 25 degrees C)	NA
Laboratory Measurements (mg/l)	
Acidity as CaCO3, SM402Y	<0.10
Alkalinity as CaCO3, SM403	196
Aluminum as Al, SM303C	<0.01
Ammonia as NH3-N, SM417F	1.71
Arsenic (dis) as As, SM304	<0.001
Arsenic (tot) as As, SM304	<0.001
Barium (dis) as Ba, SM303A	0.12
Barium (tot) as Ba, SM303A	0.17
Bicarbonate as HCO3, SM403	190.30
Boron (dis) as B, SM404A	<0.001
Boron (tot) as B, SM404A	<0.001
Cadmium (dis) as Cd, SM304	<0.001
Cadmium (tot) as Cd, SM304	<0.001
Calcium as Ca, SM303A	54.40
Carbonate as CO3, SM403	24.00
Chloride as Cl, SM407A	58.0
Chromium (dis) as Cr, SM303A	<0.001
Chromium (tot) as Cr, SM303A	<0.001
Copper (dis) as Cu, SM303A	<0.01
Copper (tot) as Cu, SM303A	<0.01
Fluoride as F, SM413B	0.13
Hardness as CaCO3, SM314B	228
Iron (dis) as Fe, SM303A	<0.01
Iron (tot) as Fe, SM303A	0.10
Lead (dis) as Pb, SM303A	<0.001
Lead (tot) as Pb, SM303A	<0.001

Revision 1: 12/19/86

Magnesium (dis) as Mg, SM313B	24.01
Magnesium (tot) as Mg, SM313B	25.10
Manganese (dis) as Mn, SM303A	<0.01
Manganese (tot) as Mn, SM303A	<0.01
Mercury (dis) as Hg, SM32	<0.0002
Mercury (tot) as Hg, SM320A	<0.0002
Molybdenum (dis) as Mo, SM303A	<0.001
Molybdenum (tot) as Mo, SM303C	<0.001
Nickel (dis) as Ni, SM249.2	<0.01
Nickel (tot) as Ni, SM249.2	<0.01
Nitrate as NO3-N, SM418C	0.09
Nitrite as NO2-N, SM419	<0.01
Phosphate as PO4-P, SM424G	0.08
Potassium as K, SM303A	2.20
Selenium as Se, SM304	<0.001
Settleable Solids, SM209F	<0.1
Sodium as Na, SM303A	19.40
Sulfate as SO4, SM426D	10
Sulfide as S, EPA9030	<0.10
Suspended Solids, SM209D	<1.0
Total Dissolved Solids, SM209B	375
Zinc as Zn, SM303A	<0.005

CHARGE BALANCE
CHALK CREEK - UPSTREAM

	10/09/86 mg/l	meq/l
Acidity	0.000	0.000
Ammonia	0.390	0.028
Calcium	52.800	2.635
Iron (dis)	0.000	0.000
Magnesium	25.500	2.097
Potassium	2.300	0.059
Sodium	20.700	0.900
Sum of Cations		5.719
Bicarbonate	173.200	2.840
Carbonate	4.800	0.160
Chloride	86.000	2.426
Nitrate	0.000	0.000
Sulfate	6.000	0.125
Sum of Anions		5.551
Charge Balance (%)		1.49

$$\text{Charge Balance (\%)} = \frac{\text{Cations} - \text{Anions}}{\text{Cations} + \text{Anions}} \times 100$$

Revision 1: 12/19/86

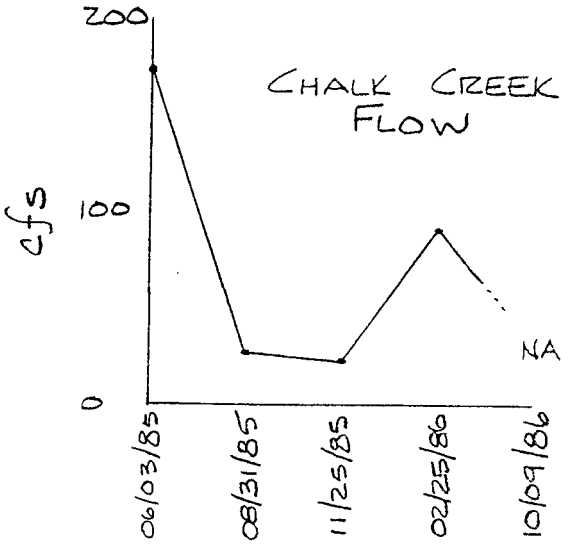
CHARGE BALANCE
CHALK CREEK - DOWNSTREAM

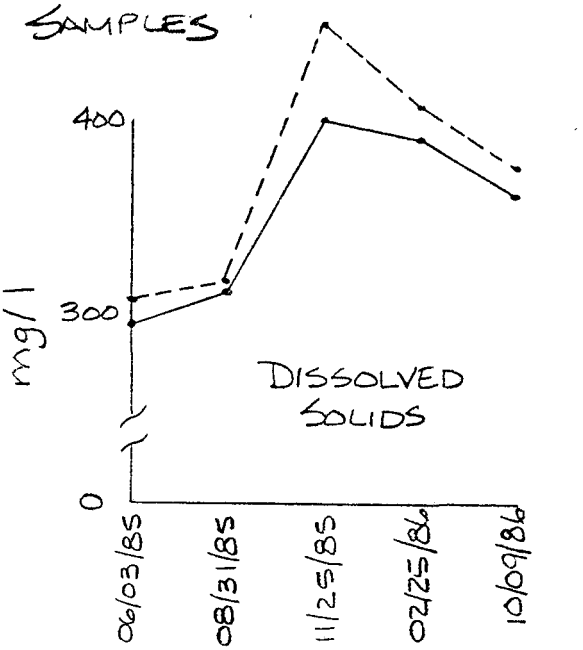
	10/09/86 mg/l	meq/l
Acidity	0.000	0.000
Ammonia	1.710	0.122
Calcium	54.400	2.715
Iron	0.000	0.000
Magnesium	25.100	2.064
Potassium	2.200	0.056
Sodium	19.400	0.844
Sum of Cations		5.801
Bicarbonate	190.300	3.121
Carbonate	24.000	0.800
Chloride	58.000	1.636
Nitrate	0.090	0.001
Sulfate	10.000	0.208
Sum of Anions		5.766
Charge Balance (%)		0.30

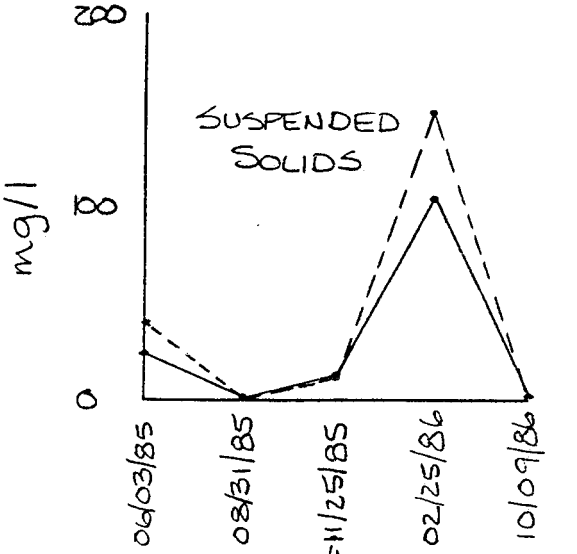
$$\text{Charge Balance (\%)} = \frac{\text{Cations} - \text{Anions}}{\text{Cations} + \text{Anions}} \times 100$$

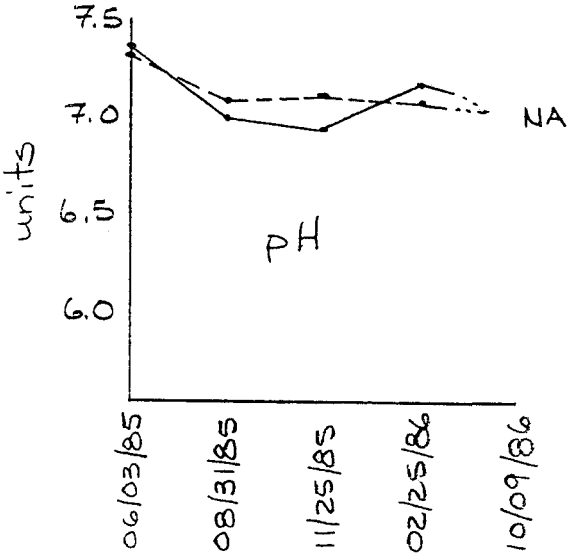
Revision 1: 12/19/86

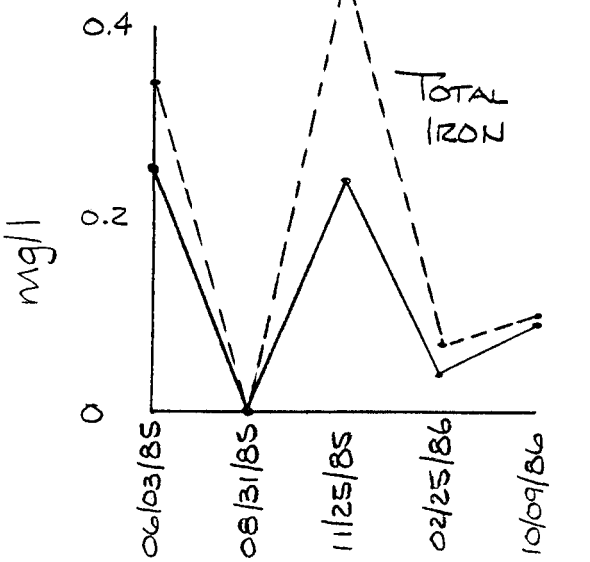
SOLID LINES - UPSTREAM SAMPLES
DASHED LINES - DOWNSTREAM SAMPLES











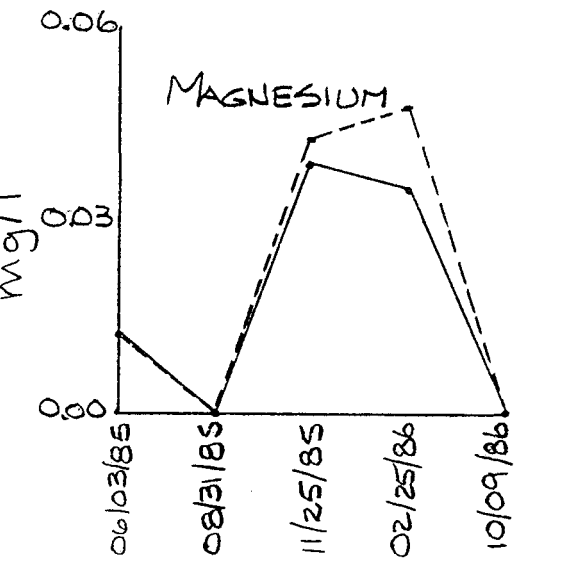
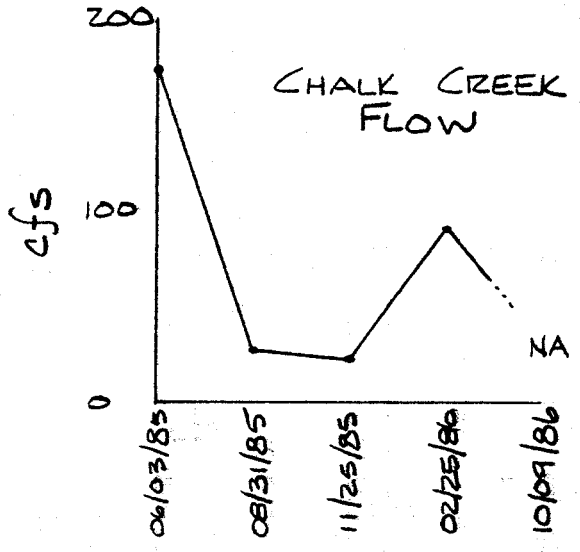
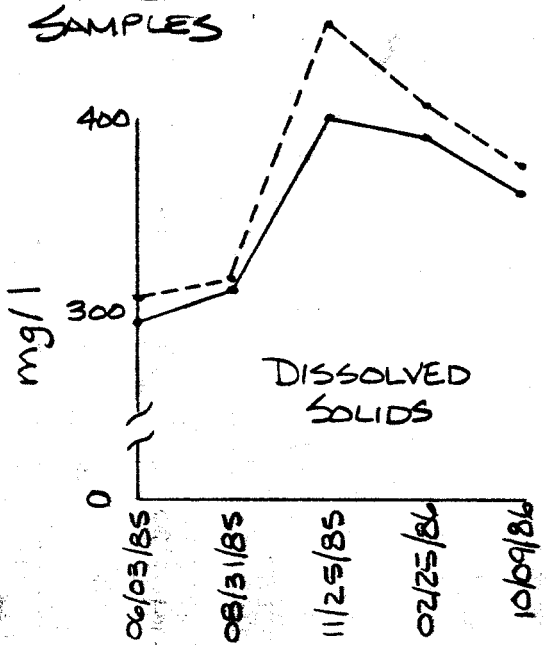
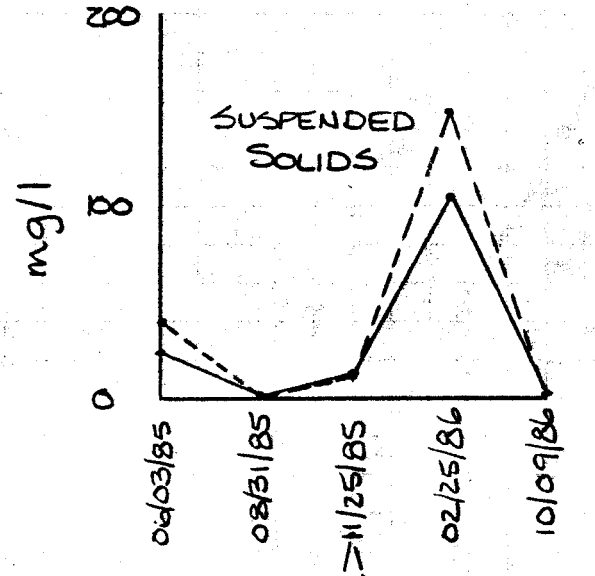


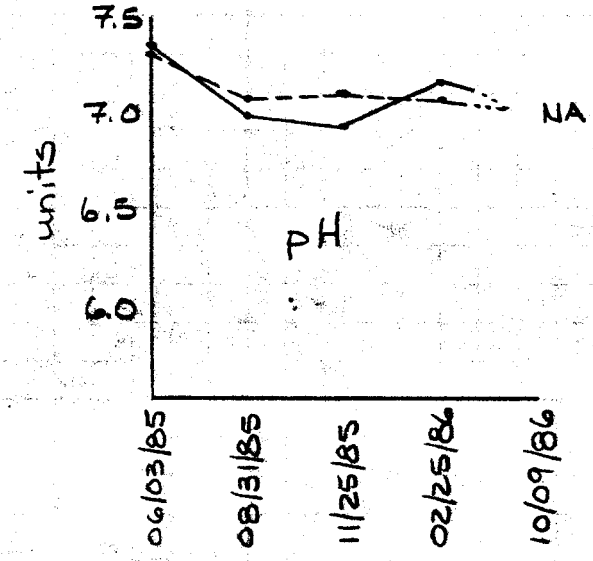
FIGURE 783.16-1 SEASONAL VARIATIONS ON CHALK CREEK

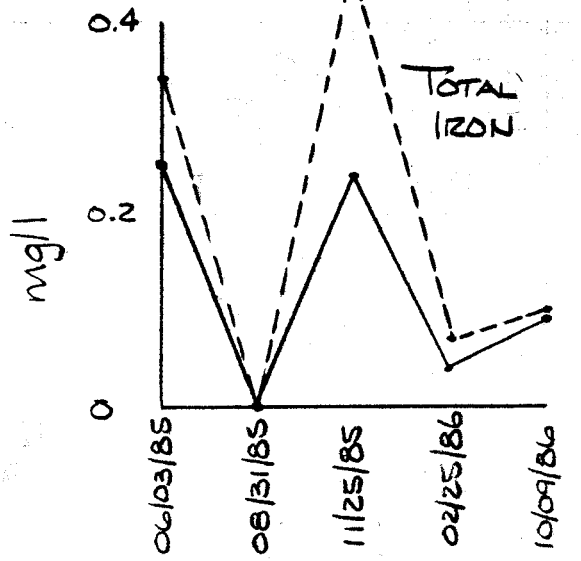
SOLID LINES - UPSTREAM SAMPLES
DASHED LINES - DOWNSTREAM SAMPLES

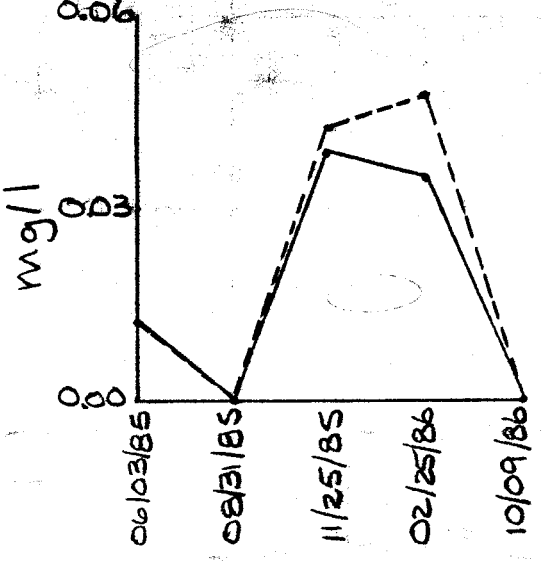




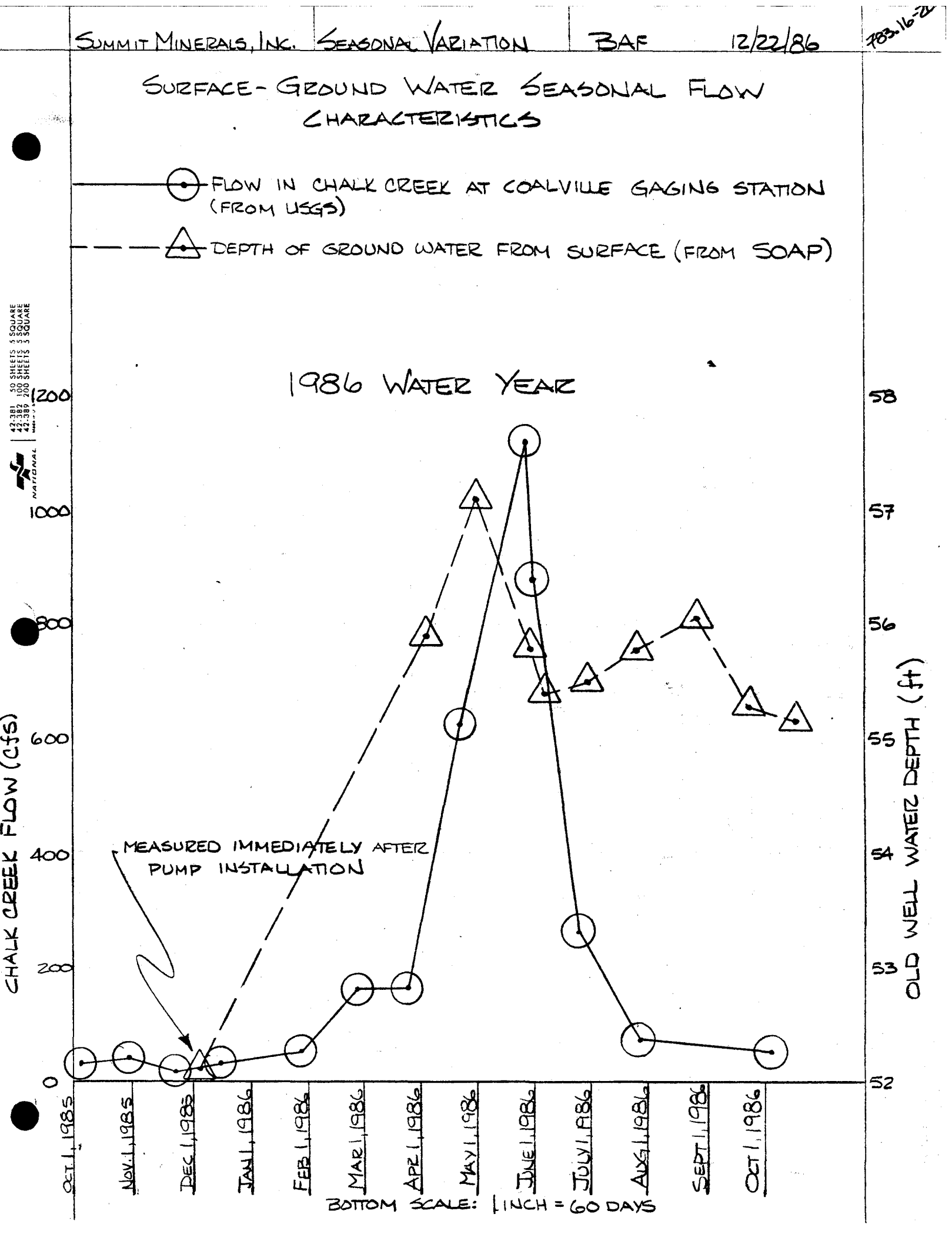








SURFACE-GROUND WATER SEASONAL FLOW CHARACTERISTICS



UMC 783.17 ALTERNATIVE WATER SUPPLY

The reclamation plan does not include provisions for sub-surface excavation or the use of hazardous or toxic materials, so there is no potential impact to ground water. For the same reason there is no potential for the diminution or interruption of surface waters. Untreated surface runoff is the only source of potential contamination of waters flowing in Chalk Creek.

A worst case scenario would be: a precipitation event exceeding the 25 year - 24 hour design could wash out the sedimentation pond allowing untreated runoff from the disturbed area, as well as pond embankment material, to enter Chalk Creek.

According to the Division of Water Rights, as of September, 1986, the Chalk Creek area is closed to new applications for water rights. Should a downstream water user's water supply be contaminated, diminished, or interrupted as a direct result of the reclamation activities, the Operator commits to replace the lost water by one of the following methods: 1) filing a new application for water rights (assuming at such time that the area is again open for applications), 2) filing an exchange right from existing water rights, or 3) obtaining water in bulk from outside sources and trucking such water to the affected water user.

This commitment is made specifically for surface water rights and only for those times when untreated runoff from disturbed areas are shown to have adversely affected the down-stream users water supply. Ground water supply is not a part of this commitment since reclamation activities cannot affect ground water quality or quantity.

UMC 783.18 - CLIMATOLOGICAL INFORMATION

UMC 783.18(a) - GENERAL DESCRIPTION

This section describes the general climatology of the Summit Minerals reclamation area. The climatological data were obtained from a number of sources including records of the National Weather Service Station at Coalville, Utah, from the Hydrologic Atlas of Utah (Jepson and others, 1968), the Utah Weather Guide (Brough and others, 1983), and data presented in the Small Mine Operators Assistance Program (SOAP) study for the Boyer Mine (EarthFax Engineering Inc., 1986). Coalville is the nearest weather monitoring station and is located at Lat. 40 degrees 55 min, Long. 111 degrees 24 min, at an elevation of 5550 feet. The Summit Minerals reclamation area is northeast from the Coalville station at Lat. 40 degrees 57 min 30 sec, Long. 111 degrees 12 min 30 sec, at an elevation of 6280 feet.

The climate of the reclamation area is continental and semiarid. In general the summer season is very short with the normal maximum temperature in the mid-eighties. Spring and fall seasons are highly variable and it is not unusual to have snow in September and as late as mid-June. In the spring precipitation is commonly a mixture of rain and snow. During the fall months the precipitation is mainly in the form of snow. Winters can be very severe with temperatures of minus 30 degrees F or lower at times. Major snowfall is in the months of December, January and February which are also the months with the lowest normal minimum temperature, which averages 13 degrees F for the period. Snow is often on the ground from November until April in depths as much as 6 feet. Two-thirds of the annual average precipitation occurs from October through April (Jeppson and others, 1968).

Winds commonly are light to moderate with estimated maximum average speeds below 20 mph. The prevailing wind direction in the general region is from the northeast. Winds often blow parallel to the canyons except during period of storms.

Table 783.18-1 summaries the climatic information for the Coalville station for the 30-year period 1951-1980. The data are from the National Weather Service weather record files or are based upon calculated or estimated values for the station (Brough and others, 1983). The 30-year averages are updated each 10 years.

Table 783.18-1--Summaries of Climatic Information for the Coalville Weather Station Covering the Period 1951-1980.*

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Means or Totals
Following Information From Weather Record Files:													
TX	37.8	42.4	49.0	59.0	69.6	75.1	85.7	84.2	7.3	66.7	50.9	39.2	61.5
TN	10.9	14.2	19.9	27.4	33.0	39.4	45.4	43.5	35.4	27.1	19.5	13.0	27.4
PP	1.28	1.10	1.35	1.83	1.58	1.12	0.83	0.95	1.03	1.27	1.35	1.35	15.04
SS	16.0	14.7	11.2	2.8	6.0	0.0	0.0	0.0	0.1	1.1	5.8	11.7	69.4
Following Information Based on Calculated or Estimated Values:													
UU	17.5	17.2	46.3	41.9	45.4	23.8	16.0	23.2	24.7	29.1	25.2	17.2	27.3
SO	218	355	457	589	747	778	851	751	636	465	255	247	529
RH	0.40	0.37	0.35	0.28	0.15	0.17	0.06	0.05	0.05	0.07	0.29	0.42	0.22
EP	0.23	0.65	1.78	4.50	5.58	7.13	7.70	6.24	4.85	3.55	1.50	0.65	44.35

EXPLANATION

Normals : By National Weather Service Definition, normals are 30-year averages of a meteorological variable which are updated each 10 years.

TX Normal_Maximum_Temperature : The average of the monthly maximum temperatures covering the period 1951-1980.

TN Normal_Minimum_Temperature : The average of the monthly minimum temperatures covering the period 1951-1980.

PP Normal_Monthly_Precipitation : The average of the monthly precipitation for the period 1951-1980.

SS Average_Monthly_Snow : The average monthly snowfall accumulated for the period of records at the station.

UU Estimated_Daily_Wind : An estimate of the expected average wind movement as it would be experienced above an evaporation pan exposed at the station. The value is an estimate in terms of average miles per day for each month.

SO Estimated_Daily_Solar_Radiation : An estimate of the expected solar radiation measured on a horizontal surface at the station location in langleys per day. The estimate is obtained by use of regression equations developed from measurements at the Salt Lake City Airport.

RH Estimated_Minimum_Humidity : An estimate of the average minimum humidity that can be expected at the station during each month. Calculated from a regression equation developed from humidity measurements taken at all of the first order stations in the nation.

EP Estimated_Pan_Evaporation : Obtained from regression equations using the estimates of daily wind movement, solar radiation, minimum humidity, and saturation vapor pressure.

* From Brough and others, 1983.

UMC 783.18(a)(1) - Average Seasonal Precipitation

Precipitation in the vicinity of the reclamation area varies greatly due to the influence of the Wasatch Mountain range and such local factors as altitude, topography, and geographic location relative to the general west to east storm paths. The normal annual precipitation in the reclamation area is estimated to be greater than at the official National Weather Service station at Coalville. Figure 783.18-1 is a map of the normal annual precipitation for the Coalville area and vicinity, and indicates that the reclamation area probably receives slightly less than 20 inches of precipitation a year. Based on the 30-year averages (Table 783.18-1 and Fig. 783.18-2), most of the precipitation comes mainly during the period October to April, when approximately 14 inches of precipitation falls, mainly as snow. May through September is a period when intense storms of short duration are likely to occur and about six inches of precipitation falls on the average during that period.

Records for the period from 1975 to 1985 indicate that the average monthly precipitation at the Coalville weather station shows two periods of peak activity; one in May and another in September-October (Figure 783.18-2). Overall, that 10-year period appears to have been somewhat wetter than the 30-year period. The 30-year period has different times of peak activities, one in April and another during November-January. Both of the time periods have similar lows in precipitation which occur during February and from June through August. Overall, the 1975-1985 period was slightly wetter than the 30-year period from 1951-1980. The 30-year period has a mean annual precipitation of 15.04 inches, while the 1975-1985 period has 16.41 inches.

The 30-year records for 1951-1980 (Table 783.18-1) indicate that the annual mean snowfall is 69.4 inches for the Coalville station. Snowfall being the heaviest from December through March. The average snow accumulation is about 4.5 feet with expected maximum depths of 6 feet.

Table 783.18-2 presents depth-duration-frequency data for precipitation at the reclamation site. The data were determined by EarthFax Engineering, Inc., as a part of a SOAP study for the Boyer Mine, using methodologies and maps presented by Miller and others (1973).

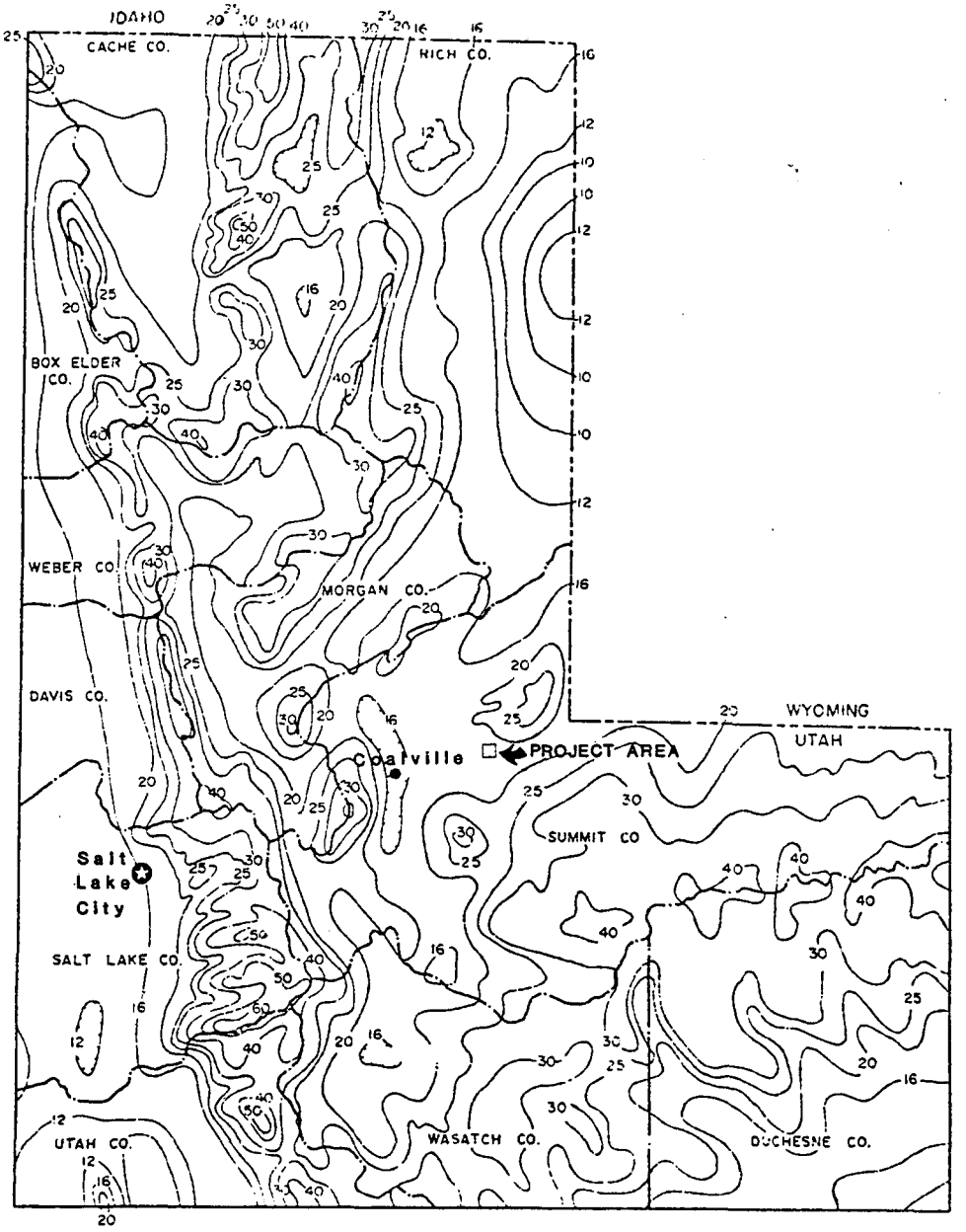


Figure 783.18-1--Normal Annual Precipitation for the Coalville, Utah Area and Vicinity.

Table 783.18-2--Depth-Duration-Frequency Data for Precipitation in the Coalville, Utah Area and Vicinity.

ESTIMATED RETURN PERIODS FOR SHORT DURATION PRECIPITATION
(inches)

Station: Echo Dam — Elevation: 5500
Latitude: 40° 58' — Longitude: 111° 26'

RETURN PERIOD (years)	DURATION									
	5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.17	.26	.32	.45	.57	.60	.62	.68	.73	.79
2	.18	.28	.35	.49	.62	.68	.73	.86	.98	1.10
5	.20	.31	.39	.54	.68	.78	.88	1.13	1.35	1.58
10	.21	.33	.42	.58	.74	.87	1.00	1.32	1.60	1.90
25	.23	.35	.44	.62	.78	.96	1.14	1.58	1.97	2.38
50	.26	.41	.51	.71	.90	1.10	1.30	1.79	2.23	2.68
100	.27	.42	.54	.74	.94	1.18	1.41	1.98	2.49	3.02

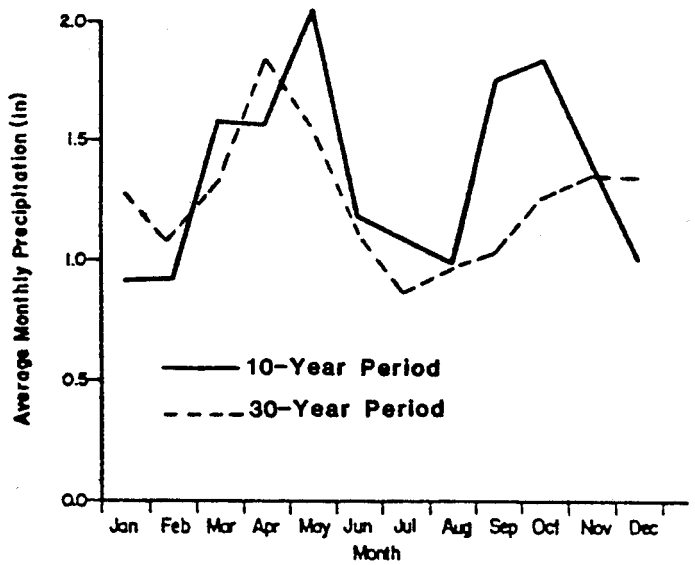


Figure 783.18-2--Average Monthly Precipitation at the Coalville, Utah Weather Station.

UMC 783.18(a)(2) - Prevailing Winds

Generally the winds are light to moderate and have average velocities less than 20 miles per hour. However, wind velocities vary from canyon to canyon. In the reclamation area, the average wind velocity is probably between 10 and 15 miles per hour and comes from the north to northeast. Strong winds are not uncommon in the area, but they never are of the type that could be classified as a tornado. In general, the maximum gusts likely to occur in the area will be in the 40 to 50 mile per hour range and will usually be associated with fronts moving through the region.

UMC 783.18(a)(3) - Temperature Ranges

As is typical of a semiarid-continental climate, the average monthly temperatures in the Coalville region increase steadily from January through July and then decrease through December (Fig. 783.18-3). However, wide daily temperature ranges are common, the result of strong daytime warming and rapid nighttime cooling. Also the temperature is strongly influenced by the elevation and the normal seasonal variables.

The average monthly temperatures range from a low of 21.7 degrees F in January to a high of 63.4 degrees F in July (Fig. 783.18-3). The 30-year normal minimum temperature ranges from 10.9 degrees F in January to 45.4 degrees F in July, with an annual mean minimum temperature of 27.4 degrees F (Table 783.18-1). The 30-year normal maximum temperatures ranges from 37.8 degrees F in January to 85.7 degrees F in July, with an annual mean maximum temperature of 61.5 degrees F (Table 783.18-1). Because of the predominantly cool climate of the area, the average length of the freeze-free period at the site is probably similar to that at Coalville which is approximately 74 days (Brough and others, 1983). At Coalville, the last freeze in the Spring is around June 16th, and the first freeze may come as early as August 20th (Brough and others, 1983).

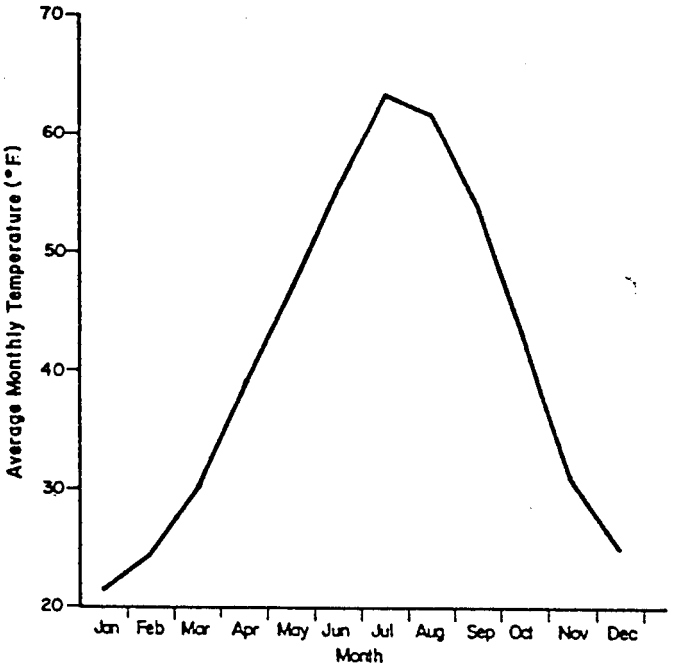


Figure 783.18-3--Average Monthly Temperatures at the Coalville, Utah Weather Station

UMC 783.18(b) - ADDITIONAL DATA

The mean annual evaporation is estimated to be 44.35 inches at the Coalville station. Approximately 90 percent of evaporation occurs from April through November, with almost 50 percent during the period June through August. Transpiration probably is less than 18 inches per year.

The relative humidity ranges from a summer average of about 45 percent to a winter average of 85 percent. The 30-year records indicate that the estimated minimum humidity annual mean is 22 percent. Extremely low average minimum humidity is experienced during July through October.

REFERENCES

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Miller, J. F., Frederick, R. H., and Tracey, R. J., 1973, Precipitation-Frequency Atlas of the Western United States: Volume VI - Utah: Silver Spring, Maryland, National Oceanic and Atmospheric Administration Atlas 2, National Weather Service.

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UMC 783.19 VEGETATION INFORMATION

Vegetation information submitted persuant to this section is included in the Vegetation Appendix contained in this section.

V E G E T A T I O N A P P E N D I X

VEGETATION SURVEY AT THE SUMMIT NO. 1 COAL MINE

SUMMIT COUNTY, UTAH

VEGETATION SURVEY AT THE SUMMIT NO. 1 COAL MINE

SUMMIT COUNTY, UTAH

submitted to

SUMMIT MINERALS, INC.

prepared by

MARY M. BOUCEK

Salt Lake City, Utah

September 1986

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INTRODUCTION

This vegetation study was conducted in order to satisfy state requirements for baseline vegetation information at the site of a previously disturbed coal mine in Summit County, Utah. The study was designed and carried out to fulfill the requirements of the Utah Coal Mining and Reclamation Permanent Program pursuant to UMC 783.19, Vegetation Information.

The Summit Minerals, Inc. No. 1 Coal Mine is an inactive underground coal mine located in Summit County in Range 6 East, Township 3 North, Section 36, SLBM, twelve miles east of Coalville, Utah. Past coal mining at the site has disturbed approximately fourteen acres and no additional surface disturbance is anticipated at this time.

METHODS

Reference Area Establishment

As the mine site has been previously disturbed, this investigation was conducted in a representative vegetation community adjacent to the disturbed area. A permanent reference area was established with the approval of Utah Division of Oil, Gas & Mining (DOGM) Reclamation Biologist, Mr. Lynn Kunzler, in the SW-1/4NE-1/4 of Section 36, above the current disturbed site, at about 6,400 feet elevation. This 2 acre reference area was marked with 1-1/4" diameter wooden survey stakes at each corner (see Appendix A, Vegetation Map). Representative slope and aspect were determined using a standard Brunton compass.

Sampling Methodology

All quantitative sampling was conducted on August 28 and 29, 1986.

COVER

A 1m2 square quadrat was used to estimate vegetation cover within the reference area. At each quadrat location total vegetation cover of living vascular species within or extending into the quadrat was estimated to the nearest 1 percent. Cover of rock, litter, bare ground and cryptogams was also estimated to the nearest 1 percent. Relative cover of major life form groups (shrubs, forbs and grasses) was recorded. Cover of each species occurring within the

quadrat was also estimated as a component of total vegetative cover, the sum of which could exceed 100% depending on the degree of vegetative overlap or structural diversity.

Location of quadrats was randomized in the following manner:

Three transect lines were run in a north to south direction within the reference area (see Vegetation Map). Along each transect, 5 samples were taken, each being randomly located using a random numbers table wherein each digit represented the number of paces from point of transect origin to quadrat #1, from quadrat #1 to quadrat #2, etc.

DENSITY

Shrub density was determined by use of the point-centered quarter method (Cottam and Curtis 1956). From the center of each randomly located cover quadrat, distance to the nearest shrub was measured and recorded. Density was determined according to the formula described in Appendix 1 of the DOGM Vegetation Information Guidelines for Permanent Program Submissions for Coal Mines. Only viable shrubs greater than one foot in height were considered in the determination of density.

Density sample points #1 through #15 were randomized as described above under the cover parameter. Sample points #16 through #40 were randomized in the following manner:

An east to west transect line was selected which bisected the reference area. Along this transect, the 25 additional density sample points were randomly located using a random numbers table wherein each digit represented the number of paces from transect origin to point #16, from point #16 to point #17, etc. At each point, two 1 meter sticks were laid perpendicular to one another in order to outline individual quarters.

PRODUCTIVITY AND RANGE CONDITION

Quantitative data with regards to productivity were not collected from the area since this is a previously disturbed site. The Soil Conservation Service was contacted to conduct an on-site inspection of the reference area in order to supply a statement of estimated productivity and determination of range condition. This inspection was conducted September 5, 1986.

SAMPLE ADEQUACY

The numbers of samples required for estimating cover and shrub density in the reference area was determined by use of the following formula, as contained in DOGM Vegetation Guidelines:

$$n_{min} = t^2 s^2 (d\bar{x})^2 \text{ where,}$$

n_{min} = minimum number of samples required

$\bar{x}$ = sample mean

s = standard deviation of the sample

t = t value for a two tailed test at 80% confidence

d = desired change in the mean (0.1)

For the purposes of this investigation in a mountain shrub community, it was desired to detect a 10% change in the mean with 80% confidence.

Precipitation

Precipitation data were obtained from Utah Agricultural Statistics, 1985 and from direct communication with the office of the Utah State Climatologist, Logan, Utah.

Threatened and Endangered Species

Information with regards to the occurrence of threatened and endangered species in the area of the Blackhawk Mine was obtained through direct communication with the U.S. Fish and Wildlife Service, Threatened and Endangered Species Team, Salt Lake City, Utah.

Wildlife Habitat

Correlation of the vegetation community surrounding the disturbed mine area to potential wildlife habitat was accomplished through qualitative observations and direct communication with the Utah Division of Wildlife Resources, Northern Regional Resource Analyst, Ogden, Utah.

RESULTS AND DISCUSSION

Description of Affected Vegetation Community

It was determined through on site inspection of the old mine site and surrounding vegetation that predominantly the Mountain Shrub Complex community has been impacted by previous disturbance. Therefore, the two acre reference area was established within this mountain shrub complex on a northerly exposure at a slope of 15% to 40%. The mountain shrub complex (Figure 1) consists of two interspersed sub-types differentiated by slightly different soils and subsequent vegetative communities.

The mountain gravelly loam-big sagebrush sub-type is dominated by fairly evenly dispersed big sagebrush (Artemisia tridentata), low rabbitbrush (Chrysothamnus viscidiflorus) and snowberry (Symphoricarpos oreophilus). Saskatoon serviceberry (Amelanchier alnifolia) and bitterbrush (Purshia tridentata) are also well represented. The herbaceous understory is dominated by grasses, the most prevalent of which are Kentucky bluegrass (Poa pratensis), bluebunch wheatgrass (Agropyron spicatum) and Ross sedge (Carex rossii). Common forbs in this type are yarrow (Achillea millefolium), wild onion (Allium spp.), wild buckwheat (Eriogonum spp.), Lewis flax (Linum lewisii), Fendler meadowrue (Thalictrum fendleri) and several species of composite (Asteraceae).

FIGURE 1. MOUNTAIN SHRUB COMPLEX COMMUNITY

The mountain gravelly loam-oak sub-type is dominated by Gambel oak (Quercus gambelii) in the overstory. The herbaceous understory is also dominated by grasses such as bromes (Bromus spp.), wheatgrasses (Agropyron spp.) and Kentucky bluegrass. Other components of the understory are creeping barberry (Mahonia repens), violet (Viola spp.), bedstraw (Galium spp.) and yarrow.

Due to the interspersed nature of the two sub-types in the area of the mine, the vegetation community was treated as one complex and sampled as such. A complete list of those species observed during this investigation is presented in Table 1.

Disturbed Area Vegetation

Within the area disturbed by past mining activity, a variety of introduced and native species has invaded and become well established. Among these are big sagebrush, rubber rabbitbrush (Chrysothamnus nauseosus), thistle (Cirsium spp.), gumweed (Grindelia squarrosa), hound's tongue (Cynoglossum officinale), yellow sweetclover (Melilotus officinalis), cheatgrass (Bromus tectorum) and a variety of borages (Boraginaceae). A disturbed area species list is presented in Table 2.

It is of particular interest to note that in an area directly east of the old mine site, which has undergone some disturbance in the past as evidenced by a sizeable population of thistle, that needle and thread grass (Stipa comata) has become very well established in the understory. This observation may indicate the potential for this native species, as well as others, to revegetate the area after all mine related activity has ceased.

As has been previously noted, the area of the Blackhawk Mine has been disturbed by past mine related activity for many years. Both sand and gravel operations and coal mining have impacted the area. Currently, the surrounding undisturbed areas provide wildlife habitat (discussed later in this report) and limited grazing for domestic livestock, primarily sheep.

Table 1 SPECIES OCCURRING IN THE MOUNTAIN SHRUB COMPLEX REFERENCE AREA

TREES	
Juniperus osteosperma	Utah juniper
J. scopulorum	Rocky Mountain juniper
SHRUBS	
Amelanchier alnifolia	Saskatoon serviceberry
Artemisia tridentata	Big sagebrush
Cercocarpus montanus	True mountain mahogany
Chrysothamnus viscidiflorus	Low rabbitbrush
Mahonia repens	Creeping barberry
Purshia tridentata	Bitterbrush
*Quercus gambelii**	Gambel oak
Rosa woodsii	Woods rose
Symphoricarpos oreophilus	Snowberry
FORBS	
Achillea millefolium	Yarrow
Allium spp.	Wild onion
Asteraceae	composites
Castilleja spp.	Indian paintbrush
Eriogonum spp.	Wild buckwheat
Galium spp.	Bedstraw
Geranium spp.	Geranium
Linum lewisii	Lewis flax
Lupinus sericeus	Silky lupine
Thalictrum fendleri	Fendler meadowrue
Verbascum thapsis	Verbascum
Viola spp.	Violet
GRASS AND GRASS LIKE PLANTS	
Agropyron spicatum	Bluebunch wheatgrass
A. trachycaulum	Slender wheatgrass
Bromus spp.	Brome grass
Carex rossii	Ross sedge
Festuca spp.	Fescue
Poa pratensis	Kentucky bluegrass
Poa spp.	Bluegrass

*For purposes of this investigation, this species was treated as a shrub.

Table 2 SPECIES OBSERVED WITHIN THE DISTURBED AREA OF THE BLACKHAWK MINE

SHRUBS	
Artemisia tridentata	Big sagebrush
Chrysothamnus nauseosus	Rubber rabbitbrush
FORBS	
Boraginaceae	Borages
Brassicaceae	Mustards
Cirsium spp.	Thistle
Cynoglossum officinale	Hounds tongue
Grindelia squarrosa	Gumweed
Helianthus annuus	Sunflower
Melilotus officinalis	Yellow sweetclover
Verbascum thapsis	Verbascum
GRASSES	
Bromus tectorum	Cheatgrass
Stipa comata	Needle & thread grass

Cover

Total ground cover by living vegetation was estimated to be 42.5% through guantitative sampling (Table 3). Relative vegetative cover by shrubs was 47.4%, cover by grass equalled 40.3% and cover by forbs contributed the least at 12.3%. Of the major ground surface categories, litter and vegetation together totalled more than 85% (Table 4).

Major species contributing to total vegetation cover (>10%) were big sagebrush, low rabbitbrush, gambel oak, perennial forbs and Kentucky bluegrass. Percent cover by species as a component of total vegetation cover is presented in Table 5. In-plot frequency by species is also included in Table 5. The most frequently encountered species (>50%) in the mountain shrub community were big sagebrush, low rabbitbrush, snowberry, yarrow, Fendler meadowrue, perennial forbs and Kentucky bluegrass.

Table 3 PERCENT COVER BY MAJOR LIFE FORM AND TOTAL VEGETATION COVER IN THE MOUNTAIN SHRUB COMPLEX REFERENCE AREA

Life Form	% of total vegetation cover	% of total ground cover
Shrub	47.4	20.2
Forb	12.3	5.2
Grass	40.3	17.1
TOTAL	-	42.5

Table 4 PERCENT GROUND COVER BY MAJOR CATEGORY IN THE MOUNTAIN SHRUB COMPLEX REFERENCE AREA

Total vegetation	Rock	Litter	Bareground	Cryptogams
42.5	7.8	43.1	5.9	0.7

Table 5 PERCENT GROUND COVER BY SPECIES AS A COMPONENT OF TOTAL VEGETATION COVER IN THE MOUNTAIN SHRUB COMPLEX REFERENCE AREA

Species (alpha code*)	Plot 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	$\bar{x}$	Percent Frequency
Shrubs																	
AMALA							1		3	6	3		2	7	5	2	47
ARTR	25	30	15	15		20	20	30	30	30	20			10	40	19	80
CEMO											4			8		T	13
CHVI	25	35	20	20		10	1	50	15	7	8	8	10	12	10	15	93
MARE					5		2									T	13
PUTR									20							1	7
QUGA			50	50	50											10	20
SYOR	10					1	25			1	20	3	12	15	5	6	60
Forbs																	
ACMI	1	4	T	T	2	1		T			4	4			1	1	67
ALLIU			T	T		T	T						T	T		T	40
CASTI													5			T	7
ERIOG	2		T	T				T	T							T	33
GERAN							1									T	7
LILE		3	T	T		2	3	5								T	40
THFE			5	5		3		T	10	6			5		T	2	53
VIOLA					4											T	7
Unid. Perennials	17	3	T	T	1	8	6	5	10	10	8	31	8	30	12	10	100
Unid. Annuals		T†				T										T	13

Table 5 CONTINUED

Species (alpha code*)	Plot 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	$\bar{x}$	Percent Frequency
Grasses																	
AGSP		5				25	15				15	30				6	33
BROMU					25											2	7
CARO	19	5	15	15					10							4	33
POPR	1	5	5	5	T	30	40	15	20	40	35	30	70	40	35	25	100
Unid. Perennials		30			25			20	10	10						6	33

*Intermountain Range Plant Names and Symbols, USDA Forest Service, general Technical Report INT-38, 1977.

† T = trace (<1%)

Shrub Density

Shrub density within the mountain shrub reference area was estimated to be 11,869 shrubs per acre (29,316 shrubs per hectare). Using the sample standard deviation obtained, the shrub density range is 7589 to 27,225 shrubs per acre. Shrub composition was dominated by big sagebrush, low rabbitbrush and snowberry (Table 6).

Table 6 PERCENT COMPOSITION OF SHRUBS IN THE MOUNTAIN SHRUB COMPLEX RESERVE AREA

Shrub Species	Percent Composition
Amelanchier alnifolia	8
Artemisia tridentata	25
Cercocarpus montanus	1
Chrysothamnus viscidiflorus	21
Purshia tridentata	2
Quercus gambelii	14
Rosa woodsii	1
Symphoricarpos oreophilus	28

Productivity and Range Condition

Annual production in the mountain shrub complex has been estimated by the SCS at 1900 pounds per acre in the Mountain gravelly loam-oak sub-type and 1100 to 1200 pounds per acre in the mountain gravelly loam-big sagebrush sub-type (see Appendix B). On site inspection of the reference area by Mr. Tim Watson, SCS, Coalville, Utah, indicated that the area is in good condition with an upward trend.

Sample Adequacy

Sample adequacy data are presented in Table 7. A statistically adequate number of samples was taken with regards to total vegetation cover (n=15; n_{min}=9). The maximum number of samples was taken (n=40) regarding the shrub density parameter, but additional samples would be required to meet statistical adequacy as detailed under the Methodology section of this report.

Table 7 SAMPLE ADEQUACY

Vegetation Parameter	$\bar{x}$	s	n	n_{min}
Total cover	42.5%	9.7	15	9
Shrub Density	3.67 ft	2.07	40	52

Precipitation

Precipitation received in the region of the Blackhawk Mine in the ten months prior to the August, 1986 sampling exceeded the 30 year average as is demonstrated in Table 8. Therefore, the sampling was conducted during a normal or above normal precipitation year.

Table 8 PRECIPITATION (INCHES) IN COALVILLE, UTAH

	Actual Ppt. 1985-86	30 yr. Average Annual Ppt.
October	2.25	1.27
November	3.32	1.35
December	0.68	1.35
January	0.74	1.28
February	2.82	1.10
March	1.82	1.35
April	3.92	1.83
May	2.18	1.58
June	0.47	1.12
July	1.71	0.83
August	-	0.95
September	-	1.03
TOTAL	18.91	15.04

Threatened and Endangered Species

There are no known threatened or endangered plant species occurring in the area of the Blackhawk Mine, nor are there any species under consideration for listing as such (L. England, personal communication, Sept. 3, 1986).

Wildlife Habitat

This discussion is limited to those species of special significance such as economically or aesthetically important wildlife.

The mountain shrub complex herein described provides habitat for a variety of wildlife, most significant of which is mule deer (Odocoileus hemionus). The area lies within the bounds of critical winter range for this species (Mr. George Wilson, personal communication, Sept. 3, 1986). During periods of light to moderate snowfall mule deer could be expected to make heavy use of the mountain shrub complex for both forage and cover. During periods of extremely heavy snowfall, snow accumulations on these northerly exposures may force deer to more marginal areas as was the case during the winter of 1983. Bitterbrush observed during this investigation was heavily hedged and numerous mule deer pellet groups were noted in the area. Elk (Cervus elaphus) could also be expected to utilize the mountain shrub complex as transitional or limited winter range, but not to the same extent as deer. Moose (Alces alces) would be expected to make occasional use of this habitat.

Riparian vegetation along Chalk Creek north of the mine site could be expected to be used by bald eagle (Haliaeetus leucocephalus) during winter and the entire area supplies habitat, both nesting and hunting, for a variety of raptors.

APPENDIX A

Vegetation Map

9000E

10000E

12000N

ACCESS ROAD

AG

R

R

AG

RA

DM

MSS

MSC

MSC

11000N

10000N

ASP

ASP

LEGEND

AG	AGRICULTURAL
ASP	ASPEN
DM	DISTURBED MINE SITE
MSC	MOUNTAIN SHRUB COMPLEX
MSS	MOUNTAIN SHRUB - SAGEBRUSH
R	RIPARIAN
RA	REFERENCE AREA

PERMIT AREA BOUNDARY

N

SUMMIT MINERALS, INC.

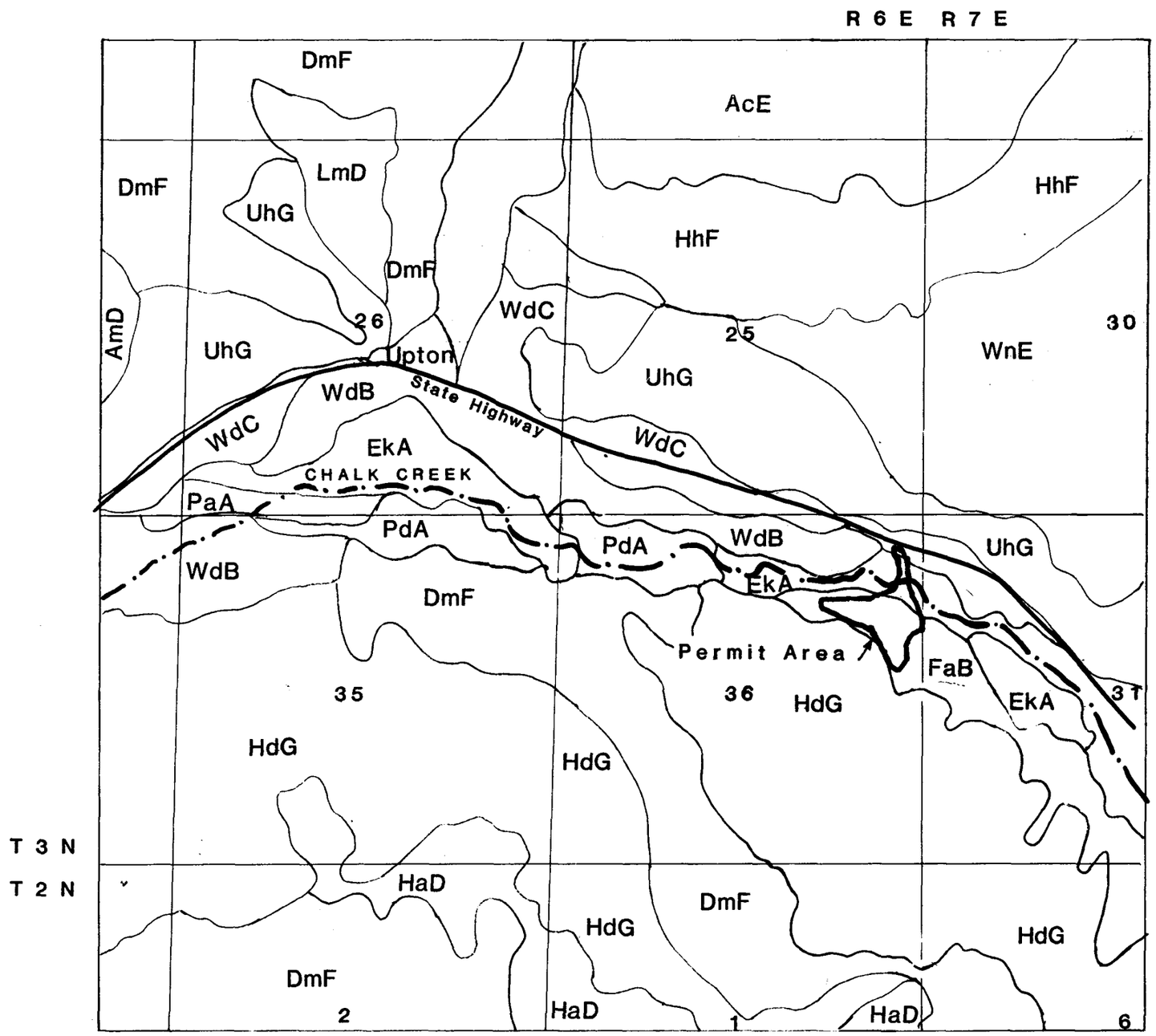
VEGETATION MAP

TT 10/22/86

Scale: 1" : 200'

Ref. Dwgs.:

783.19-1



LEGEND

WdB – Watkins Ridge Loam, 2–5% Slope

WdC – Watkins Ridge Loam, 5–8% Slope

FaB – Toehead Loam

EkA – Kovich Loam

HhF – Hades–Hades,Organic Surface, Complex

DmF – Dunford Organic Surface–Dunford–Ayoub Complex

PdA – Sowcan Loam

UhG – Richsum–Bequinn Family–Gridge Complex

HdG – Horrocks–Yeates Hollow Complex

N

0 1/2 1 mile

APPROXIMATE SCALE

SOIL MAP OF SUMMIT MINERALS PROJECT AREA

RICHARD S. KOPP
Certified Professional Geologist No. 1226
November 7, 1986

APPENDIX B

U.S. Conservation Service Documentation

United States Department of Agriculture

Soil Conservation Service

SUBJECT: Rangesite report.

DATE: September 9, 1986

TO: Mary M. Boucek
P.O. Box 17117
Salt Lake City, Utah 84117

Enclosed is the material for the range site descriptions on the mountain gravelly loam (Oak) and the mountain gravelly loam (ARTR) sites.

The condition of these two sites are good. This is based on looking at the designated plot on September 5, 1986

Lin Watson
Range Conservationist
Soil Conservation Service

Ecological Site Description
SCS-BLM Utah
May 1981

Site Number: _____
Site Name: Mountain Gravelly Loam (Oak)
Habitat Type: _____

I. Physical Characteristics

A. Physiographic Features

1. This site occurs on Foothills & Mountain slopes
(List geomorphic landforms and positions)

Slopes are mostly 15 to 50 percent. with inclusions up to 60%

Elevations range from _____ ~~meters~~ (6500 ft.) ~~on _____ aspects~~ to _____ ~~meters~~ (8500 ft.) ~~on _____ aspects~~.

B. Soils

1. Characteristic soils in this site are greater than 20 inches to ~~60~~ ~~cm~~ deep ~~over~~ _____ and well drained.

They formed in residium and colluvium derived mainly from andesite, sandstone and quartzite parent materials.

(Briefly describe other soil properties that are characteristic of this site as applicable. Include properties such as watertable, calcareousness, texture, permeability, rockiness, alkali or salt, etc. that influence the plant community.)
The soils are a loam with 20-35% rock fragments from 0-10 inches and a clay loam with 25-50% rock fragments from 10 - 60 inches

The water supplying capacity is 25 to 40 cm. (10 to 16 inches). ~~Average annual soil loss in potential is approximately _____ tons/acre. The soil surface factor (SSF) in potential is _____.~~

2. Soil taxonomic units representative of this site:

Taxonomic Unit (list)	Classification	Soil Survey
Horrocks gravelly Loam	Typic argixerolls, Loamy-Sk, Mx. fr. Mesifrigid	Summit County

3. Other soils presently grouped into this site:

Taxonomic Unit (list)	Classification	Soil Survey
Horrocks Cobbly Loam	Typic argixerolls Loamy, Sk Mx fr frigid	Summit County
Dunford Cobbly Loam	Pachic Argixeroll fine loamy Mx. fr.	"
AYOUB	Typic Argixeroll fi Loamy Mx. fr.	

C. Climate Features (Describe only once for each climatic zone within the MLRA)

1. Average annual precipitation is ____ ~~to~~ ____ ~~cm~~ (16 to 24 in.). Approximately 40 % occurs as rain (snow, rain) from March (month) through June (month).

On the average, July through Sept is (are) the driest month(s) and October through June is (are) the wettest month(s).

The mean annual air temperature is 43 °F ~~°C~~ and the soil temperatures are in the frigid regime.

The average freeze-free period is 60 to 90 days.

(List any other climatic features that influence the ecosystems in this zone.)

In average years, plants begin growth around April and end growth around Oct.

D. Potential Natural Plant Community

1. The dominant aspect of the plant community is Oak. The composition by air-dry weight is approximately 75 percent grasses, 15 percent forbs and 10 percent shrubs.

2. Community Composition
(Understory = 100% by wt. if a woodland site)

Plant Symbol	Common Name	Percent by weight (air-dry)
Grass and Grass like		(65)
CAREX	Sedge	10
AGTR	* Slender wheatgrass	15
AGSP	Bluebunch wheatgrass	10
POA++	* Bluegrass	8
BRCAS	* Mountain brome	12
PPGG	Other perennial grasses 1/	10
	Needlegrass	
	Nodding Brome	
	Western wheatgrass	
Forbs		(15)
PPFF	Other Perennial Forbs 1/	15
	Indian paintbrush	
	Owlclover	
	Peavine	
	Meadow rue	
	Showy goldeneye	
	Aster	
	Goldenrod	
	Sweetclover	
Shrubs*		(20)
QUGA	* Gambel oak	10
SYMPH	* Snowberry	5
SSSS	Other Shrubs 1/	5
	Antelope bitterbrush	
	Birchleaf mountainmahogany	
	Oregon grape	

1/ no more than 3% for each species

*Includes forage producing trees where needed for forage interpretations. Example: Oak, maple, aspen suckers, etc.

3. Trees (Overstory)

Plant Symbol	Common Name	Density (#/Ac.)	Percent Canopy Cover	Site Index
* QUGA (list)	Oak	10890	80	

4. Total Annual Air-Dry Production (Understory if a woodland site)

	Kg/ha	Lbs/Ac
Favorable years		2300
Normal years		1900
Unfavorable years		1700

INC 5. Ground cover in potential is approximately _____ percent.
Total canopy cover in potential is approximately _____ percent.

6. Density of major species (>10% compostion by weight)

Common Name	#/Acre
Mountain Brome	6,970
Bluegrass	10,890
Slender wheatgrass	6,970
Oak.	10,890

7. Seral Communities

a. Grazing disclimax. As ecological condition deteriorates due to over grazing, Mountain Brome & Slender wheatgrass will decrease while Sedges and Forbs will increase.

b. Fire disclimax. When the potential natural plant community is burned, Oak decrease while Grasses & Forbs increase.

c. Forbs & Shrubs are most likely to invade this site.

8. The above vegetation description is based on 4 Ten plot transects in Good condition
(# of estimates/transects/condition)

E. Other sites that are commonly associated with this site include:
Mt Stony Loam Oak Mt Clay Mt Loam (Xeric) High Mt Loam Aspen

F. Location of typical example of this site: [illegible] of [illegible]

Ecological Site Description
SCS-BLM Utah
May 1981

Site Number: _____
Site Name: Mountain Swale, Loam (Mountain Big Sagebrush)
Habitat Type: _____

I. Physical Characteristics

A. Physiographic Features

1. This site occurs on Glacial Moraine, Glacial Outwash, Hills, Piedmont and Mountain Slopes
(List geomorphic landforms and positions)

Slopes are mostly 3 to 40 percent. with inclusions up to 60%

Elevations range from _____ ~~meters~~ (5600 ft.) on N aspects to _____ ~~meters~~ (8000 ft.) ~~on~~ S ~~aspects~~.

B. Soils

1. Characteristic soils in this site are 40" to over 60" ~~0~~ deep over bedrock and well drained.

They formed in residuum and colluvium derived mainly from andesite, conglomerate and sandstone parent materials.

(Briefly describe other soil properties that are characteristic of this site as applicable. Include properties such as watertable, calcareousness, texture, permeability, rockiness, alkali or salt, etc. that influence the plant community.)

The soil is a gravelly loam with 15 to 35% rock fragements in the top 12-16 inches, and a clay loam with 15-50% rock fragements from 16 inches on down.

The water supplying capacity is 22 to 30 cm. (9 to 12 inches). ~~Average annual soil loss in potential is approximately _____ tons/acre. The soil surface factor (SSF) in potential is _____~~.

D. Potential Natural Plant Community

1. The dominant aspect of the plant community is Sagebrush / grass. The composition by air-dry weight is approximately 60 percent grasses, 15 percent forbs and 25 percent shrubs.

2. Community Composition
(Understory = 100% by wt. if a woodland site)

Plant Symbol	Common Name	Percent by weight (air-dry)
	Grass and Grass like	(60)
AGTR*	Slender wheatgrass	15
AGSP*	Bluebunch wheatgrass	15
ACTH*	Letterman Needlegrass	15
PPGG	other perennial Grasses 1/	-
	Needlegrass	
	Bluegrass	
	Sedge	
	Bromegrass	
	Cattlebrush Squirreltail	
	Forbs	(15)
PPFF	other perennial Forbs 1/	15
	Eriogonum	
	Geranium	
	Iravine	
	Penstemon	
	Phlox	
	Showy goldeneye	
	Hawksbeard	
	Shrubs*	(25)
ARTR*	Mountain big sagebrush	15
PUTR2	Antelope bitterbrush	5
SSSS	other shrubs 1/	5
	Douglas Rabbitbrush	
	Snowberry	
	Service berry	
	Mountain Mahogany	

*Includes forage producing trees where needed for forage interpretations. Example: Oak, maple, aspen suckers, etc.

1/ no more than 3% for each species

3. Trees (Overstory)

Plant Symbol	Common Name	Density (#/Ac.)	Percent Canopy Cover	Site Index
(list)				

4. Total Annual Air-Dry Production (Understory if a woodland site)

	Kg/ha	Lbs/Ac
Favorable years		1300
Normal years		1100
Unfavorable years		900

Inc < 5. Ground cover in potential is approximately _____ percent.
Total canopy cover in potential is approximately _____ percent.

6. Density of major species (>10% compostion by weight)

Common Name	#/Acre
Slender wheatgrass	10,890
Needlegrass	6,970
Bluegrass	6,970
Mountain Big sagebrush	1,742

7. Seral Communities

a. Grazing disclimax. As ecological condition deteriorates due to over grazing, [illegible] and bluebunch wheatgrass decrease while [illegible] and [illegible] will increase.

b. Fire disclimax. When the potential natural plant community is burned, Mountain Sagebrush and [illegible] decrease while Rabbitbrush and [illegible] will increase.

c. Shrubs and forbs are most likely to invade this site.

8. The above vegetation description is based on 2 Ten plot Transects in Good condition
(# of estimates/transects/condition)

E. Other sites that are commonly associated with this site include: Mt Loam (MTN), Mt Gravelly [illegible], Mt Stony Loam (Oak)

F. Location of typical example of this site: ~~[illegible] foothills in foothills and~~ Sec 20 T1N R8E

Summit Hill 7/8

#41

HdG--Horrocks-Yeates Hollow complex, 30 to 60 percent slopes

This map unit is on south and west facing mountainsides. Slopes are convex with alternating convex and concave contours. The native vegetation is mainly ~~oakbrush, sagebrush and grasses.~~ Cal with scattered open areas of grass and sagebrush, Elevation is 5,600 to 8,400 feet. The average annual precipitation is about 18 to 25 inches, the mean annual air temperature is 42 to 45 degrees F., and the average freeze-free period is 60 to 90 days.

This unit is about 65 percent Horrocks very cobbly loam, 40 to 60 percent slopes, under grass and sagebrush ~~under oak, 20 percent slopes~~ Yeates Hollow gravelly loam, 30 to 50 percent slopes and 15 percent other soils. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Hades loam on concave parts of slopes under sagebrush and grasses, and Harkers gravelly loam under ~~oakbrush~~ Oak and A very cobbly shallow soil on ridges and convex slopes under sagebrush

The Horrocks soil is ~~very~~ deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, sandstone and quartzite. Typically the surface layer is very dark brown very cobbly loam about 10 inches thick. The subsoil is very dark grayish brown or dark brown very cobbly clay loam ~~or very gravelly clay loam~~ about 32 inches thick. The substratum is dark brown very gravelly loam about 17 inches thick over fractured andesite.

Permeability of the Horrocks soil is moderately slow. Available water capacity is about 5 to 7 inches. Water supplying capacity is 8 to 14 inches. Effective rooting depth is 40 to 60 inches. The organic matter content in the surface layer is about 3 to 5 percent. Runoff is very rapid and the hazard of water erosion is severe.

The Yeates Hollow soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from sandstone and quartzite. Typically the surface layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 7 inches of the subsoil is dark brown very gravelly clay loam. The lower 46 inches is dark brown very cobbly clay to very gravelly clay loam.

Permeability of the Yeates Hollow soil is slow. Available water capacity is about 5 to 6 inches. Water supplying capacity is 9 to 13 inches. Effective rooting depth is 40 to 60 inches. The organic matter content in the surface layer is about 3 to 5 percent. Runoff is very rapid and the hazard of water erosion is very severe.

This unit is used as rangeland, wildlife habitat and recreation.

The potential plant community on the Horrocks soil is characterized by ~~mountain brome~~ Thickspike wheatgrass Mountain brome, bluegrass, ~~slender wheatgrass~~, and oak. Suitability for range seeding is ~~fair~~ poor with the main limitations being rock fragments in the soil surface and slope. ~~Areas that have become heavily infested with undesirable plants can be improved by chemical or mechanical treatment and prescribed burning.~~

The potential plant community on the Yeates Hollow soil is characterized by slender wheatgrass, Letterman needlegrass, bluebunch wheatgrass, and mountain big sagebrush. Suitability for range seeding is ~~good~~ poor due to steep slopes. ~~Areas that have become heavily infested with undesirable plants can be improved by chemical or mechanical treatment and prescribed burning.~~

The Horrocks soil is in capability subclass VIIs, nonirrigated, and in Mountain Gravelly Loam (Oak) ~~ecological~~ range site. The Yeates Hollow soil is in capability subclass VIIe, nonirrigated, and in Mountain Gravelly Loam (Mountain Big Sagebrush) ~~ecological~~ range site.

UMC 783.20 - FISH AND WILDLIFE RESOURCES INFORMATION

UMC 783.20(a) - GENERAL DESCRIPTION OF HABITATS

This section gives an inventory of the wildlife resources in the Summit Minerals reclamation area and evaluates the impact of the reclamation project on the fish and wildlife resources. The study includes birds, mammals, amphibians, and reptiles. Because the area to be reclaimed has been worked intermittantly as a coal mine and for the extraction of sand and gravel since the late 1800's, the ecosystem has very likely stabilized itself. Therefore, the impacts of the reclamation project will be insignificant on the wildlife of the area.

METHODOLOGY

The data and information presented here are based on past surveys made in the region and in the immediate area, and on an extensive search of the literature.

AQUATIC RESOURCES

The description of the aquatic resources consists of a review of available information from previous surveys. The water quality determinations are from the SOAP study made for the Boyer Mine and from samples taken by Summit Minerals. All analyses were conducted by certified laboratories. The results of the water samples are reported in section 783.16.

TERRESTRIAL RESOURCES

The literature and the results of past surveys in the immediate area of the reclamation project have been summarized for all terrestrial vertebrates of concern. The species have been categorized to show habitat affinities, high interest species status, and potential to be disturbed. The results are reported in Tables 783.20-1 through 783.20-4 and are listed according to their ecological classification. All species whose ranges may overlap any part of the reclamation area have been considered.

The study was conducted so as to determine the probable and actual inhabitants of the area and to identify habitats essential to their presence and/or persistence. The status of each species observed or known to inhabit the reclamation area were categorized with special attention to those considered endangered, threatened, of economic value, or recreationally important.

The species were categorized by (1) habitat, (2) relative abundance, (3) resident species, (4) seasonal use, and/or (5) high interest species. The term "high interest species" relates to those animals requiring special attention by scientists and/or public management organizations because they are either endangered, threatened, protected game animals, of economic value, or recreationally important. Reasons for such a high interest designation include:

(1) The ranges of some species are small, thereby restricting the population to a few habitats.

(2) Even though populations may be numerically large, the ranges may be small within the entire represented area.

(3) Regardless of population numbers or ranges, very little is known of the current status and in some instances information indicates that populations are declining.

(4) Species are sensitive to impacts and could be put in danger of abnormal declines.

(5) Species are either relic or may have aesthetic or scientific value.

(6) Species are of economic value or recreationally important.

(7) Some combination of the above.

The following sections cover the significant habitats, the interactions, and potential results of impacts on the terrestrial vertebrates. Data are summarized in tables in which high interest species are highlighted. The potential impact on high interest mammalian species during the initial phases of reclamation and prior to completion of the revegetation program have been rated on an impact scale (Table 783.20-1). The impact scale rates the degrees of harm from: No Harm = 0, to Total Loss of the Species in the Area of Concern = 10. The impact scale (Table 783.20-1) was taken from a report made for the Boyer Mine less than a quarter of a mile north of the Summit Minerals reclamation area.

Table 783.20-1.--Possible Impact of the Reclamation Project on High Interest Mammals.

SPECIES	IMPACT SCALE (0-10)*
Badger	0
Bear, Black	0
Bobcat	0
Cottontail, Nuttall's	0
Cougar (Mountain Lion)	0
Coyote	0
Deer, Mule	3
Elk or Wapiti	1
Ermine	0
Fox, Gray	0
Fox, Red	0
Hare, Snowshoe	0
Jackrabbit, Black-tailed	0
Jackrabbit, White-tailed	0
Marten	0
Moose	0
Weasel, Long-tailed	0

* 0 = No Harm 10 = Total Loss of the Species

WILDLIFE HABITAT

The reclamation area is covered in part by several important habitats that are used by species considered of high interest. Five major vegetation habitats from a faunal standpoint are considered: Pinyon-Juniper, Desert Shrub, Sagebrush, Conifer-Aspen, and Mixed Shrub and Grasses.

AQUATIC WILDLIFE HABITAT

No perennial streams pass directly through the reclamation area. Chalk Creek flows along the northern border of the project area and receives runoff from the area to be reclaimed. However, drainage from the reclaimed areas will pass through a sedimentation pond before being discharged into the creek during the 10-year period of reclamation liability. Therefore, the impact on the quality of the water in Chalk Creek will be minimal and there should be little, if any, affect on the biological community in the creek.

Chalk Creek may receive some ground water from the reclamation area. However, because the mining of coal has been discontinued and there are no toxic materials present, there will be no contamination of the ground water supply. Based on past surveys conducted on the stream, the possibility for adverse impacts is considered to be insignificant.

TERRESTRIAL WILDLIFE HABITAT

The reclamation area could potentially be inhabited by upwards of 62 avian, 52 mammalian, 12 reptilian, and 3 amphibian species. Some of those are considered to be high interest species for the habitats found in the reclamation area. The term "high interest species" indicates those animals that are economically valuable or recreationally important; have special scientific, educational, or aesthetic value; or are either endangered, threatened, or protected game species of wildlife.

Tables 783.20-2 through 783.20-4 indicate the species likely to be found in the reclamation area and give the range of mammals, reptiles, and amphibians in the five major vegetation habitats as they relate to the animals of the area.

Birds

Table 783.20-2 indicates the species of birds likely to be found in the reclamation area, the seasons during which they may be sighted, and how common they are to the area. Two of the species are on the endangered species list: (1) the bald eagle, a winter resident; and (2) the peregrine falcon, believed to be a year-round resident of north-eastern Utah. There are no known roosting trees or nesting sites in the reclamation area. Because of the transient nature of these birds no adverse impacts are expected due to the reclamation activities. However, before permanent mining operations are begun, a survey should be requested by the Raptor Biologist from the U. S. Fish and Wildlife Service.

Any possible impacts on the birds are expected to be minimal because of the large area of similar habitats in the region and the status of the birds. The overall effect of the reclamation project will be to enlarge and enhance the habitats for birds.

Table 783.20-2.--Species List, Status, and Seasonal Occupancy of Birds Whose Published Ranges Overlap the Summit Minerals Reclamation Area.

NAME	SEASON OF OCCUPANCY	STATUS
Bluebird, Mountain	Spring, Summer, Fall	Uncommon
Bluebird, Western	All year	Uncommon
Bushtit	All year	Uncommon
Chickadee, Mountain	All year	Common
Chukar	All uear	Unknown
Crow	Spring, Fall, Winter	Common
Dove, Morning	Spring, Summer	Common
EAGLE, BALD	Winter	RARE
Eagle, Golden	All year	Uncommon
FALCON, PEREGRINE	All year	RARE
Falcon, Prairie	All year	Common
Finch, House	All year	Common
Flicker, Common	All year	Common
Flycatcher, Ash-throated	Spring, Summer	Common
Flycatcher, Gray	Spring, Summer	Uncommon
Flycatcher, Western	Spring, Summer	Uncommon
Gnatcatcher, Blue-gray	Spring, Summer	Uncommon
Grouse, Sage	All year	Uncommon
Hawk, Common Night	Spring, Summer	Common
Hawk, Ferruginous	Spring, Summer, Fall	Uncommon
Hawk, Marsh	All year	Uncommon
Hawk, Red-tailed	All year	Common
Hawk, Sparrow	All year	Common
Hawk, Swainson's	Spring, Summer, Fall	Uncommon
Hummingbird, Black-chinned	Spring, Summer	Common
Hummingbird, Broad-tailed	Spring, Summer	Common
Jay, Pinon	All year	Common
Jay, Scrub	All year	Uncommon
Kingbird, Casin's	Spring, Summer	Uncommon
Kingbird, Western	Spring, Summer	Common
Lark, Horned	All year	Common
Magpie, Black-billed	All year	Common
Nuthatch, White breasted	All year	Uncommon
Oriole, Scott's	Spring, Summer	Uncommon
Owl, Great-horned	All year	Uncommon
Owl, Long-eared	All year	Uncommon
Owl, Pigmy	All year	Uncommon
Owl, Saw-whet	All year	Uncommon
Phoebe, Say's	Spring, Summer	Common
Poor-will	Spring, Summer	Common
Raven	All year	Common
Robin	All year	Common
Shrike, Loggerhead	Spring, Summer	Uncommon
Siskin, Pine	All year	Common
Sparrow, Black-chinned	Spring, Summer	Uncommon
Sparrow, Brewer's	Spring, Summer, Fall	Uncommon
Sparrow, Chipping	Spring, Summer	Common
Sparrow, Lark	Spring, Summer	Common
Starling	Spring, Summer, Fall	Uncommon
Swallow, Violet-green	Spring, Summer	Common
Swift, White-throated	Spring, Summer	Uncommon
Titmouse, Plain	All year	Uncommon
Towhee, Rufous-sided	All year	Uncommon
Vireo, Gray	Spring, Summer	Uncommon
Vireo, Solitary	Spring, Summer	Uncommon
Vulture, Turkey	Spring, Summer, Fall	Uncommon
Warbler, Black-throated gray	Spring, Summer	Common
Waxwing, Cedar	All year	Uncommon
Woodpecker, Downy	All year	Uncommon
Woodpecker, Hairy	All year	Uncommon
Wren, Bewick's	Spring, Summer	Uncommon

Mammals

The Summit Minerals reclamation area probably contains about 52 species of mammals. Their names and ranges of habitat are given in Table 783.20-3. In all of the habitats, water is a critical resource and is possibly the limiting factor. Nineteen of the species are considered high-interest species. Fifteen of those are protected by state or federal laws.

The higher elevations of the area are used as summer range and possibly calving areas for elk and fawning areas for mule deer. The same areas are probably used by cougar, bobcat, coyote, and bear. The habitats in the foothills are utilized by elk and larger deer during the winter and spring. The lower hills are the major winter areas for mule deer.

Because the reclamation site has been used for mining since the late 1800's, and the disturbed areas are basically devoid of vegetation, the reclamation project will have a positive affect on the wildlife in the region. The overall impact on wildlife will be very positive and will more than compensate for any new, short term negative impacts during the initial phases of the reclamation project.

The expected impacts of the reclamation activities on high interest species is considered below.

Black Bear. The reclamation area provides some potential habitat for black bears, which are not abundant nor active the year around. There are two sensitive periods in the life cycle of the black bear: (1) in February and March when the cubs are born, and (2) during the early summer when the cubs accompany their mother on initial foraging expeditions. Because most of the reclamation activities will be in the late summer and/or early fall, there will be little impact during their sensitive periods.

Bobcat. The reclamation site and adjacent areas provide habitats for bobcats. Very little is know about the Utah bobcat. However, one sensitive period is late February when the kittens are born. May and June are also a sensitive period because it is then when the young bobcats are learning to hunt. However, most of the reclamation activities will be in the late summer and/or early fall and will not cause impacts on those sensitive periods.

Cottontail Rabbit. The entire reclamation site and the adjacent areas provide substantial, yearlong habitats for cottontail rabbits. The young are born between April and July, a sensitive period. The reclamation and revegetation project will enhance their habitat and provide and increased population for hunting. The timing of reclamation activities will not cause any impacts during the sensitive period.

Table 783.20-3.--Species List and Habitats of Mammals Whose Published Ranges Overlap the Summit Minerals Reclamation Area.

MAMMALS	HIGH-INTEREST SPECIES	Pinyon Juniper	Desert Shrub	Sage-brush	Conifer Aspen	Mixed Shrub & Grasses
Badger	X	CR	CR	CR	CR	CR
Bat, Big Brown						US
Bat, Brasilian Free-tailed		US	US	US		US
Bat, Hoary						US
Bat, Silver-haired						US
Bat, Townsend's Bib-eared		US		US		US
Bear, Black	X				CaR	CR
Bobcat	X	CR	CR	CR	CR	CR
Chipmunk, Cliff		CR	CR			CR
Chipmunk, Least		AR	AR	AR	CR	CR
Chipmunk, Uinta		AR	AR	AR	CR	CR
Cottontail, Nuttall's	X				UR	UR
Cottontail, Desert	X	CR	CR	CR		
Cougar (Mountain Lion)	X	UR	UR	UR	UR	UR
Coyote	X	CR	CR	CR	CR	CR
Deer, Mule	X	CR	CR	CR	CR	CR
Ermine	X				UR	
Elk or Wapiti	X					CW
Fox. Gray	X		UR	UR		UR
Fox, Red	X		CaR	CaR		CaR
Gopher, Northern Pocket			CR	CR		CR
Hare, Snowshoe	X				CR	CR
Jackrabbit, Black-tailed	X	CR	CR	CR		
Jackrabbit, White-tailed	X		UR	UR		UR
Marmot, Yellow-bellied					CR	CR
Marten	X				CaR	
Moose	X					CR
Mouse, Canyon		CR				
Mouse, Deer		AR	AR	AR	AR	AR
Mouse, Great Basin Pocket			CR	CR		
Mouse, Western Harvest			UR	UR		
Myotis, California		US	US	US		
Myotis, Fringed		US	US	US		
Myotis, Little Brown		CS	CS	CS		CS
Myotis, Small-footed			US	US		
Porcupine		CR			CR	CR
Raccoon		Ca				Ca
Rat, Ord's Kangaroo			CR	CR		
Ringtail		UR	UR	UR	UR	UR
Shrew, Dusky						UR
Shrew, Masked						UR
Shrew, Mirrium		UR	UR	UR		UR
Skunk, Striped	X	CR	CR	CR	CR	CR
Squirrel, White-tailed Antelope			AR	AR		
Squirrel, Uinta Ground						CR
Squirrel, Rock						CR
Squirrel, Red					CR	
Squirrel, Northern Flying					CR	CR
Vole, Mountain					CR	CR
Vole, Sagebrush			UR	UR		
Weasel, Long-tailed	X	CR	CR	CR	CR	CR
Woodrat, Bushy-tailed				CR	CR	CR

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

Cougar. The reclamation area provides a yearlong habitat for the cougar. Cougars are reported to range throughout the region. However, their movements are dictated by migration patterns, human disturbance, and the availability of their primary food, the mule deer. Because cougars are not abundant and are known to be secretive, it is important not to cause impacts during their sensitive period when the females are accompanied by young learning to hunt and survive. Unfortunately, this period in the life cycle of the cougar is difficult to determine because they are known to reproduce the year around. If the cougar population in the area was high, this would be cause for major concern. But, because their numbers are low and their ranges extensive compared to the size of the reclamation area, the cougars will continue to avoid areas with human activity. Furthermore, because the reclamation activities will be short lived and because the cougars will avoid this area, there will be little impact on the overall cougar population.

Mule Deer. The mule deer that frequent the reclamation area are considered part of a major herd by the Utah Division of Wildlife Resources (UDWR). During the 1970's, the populations of the mule deer herds in Utah decreased because of severe climatic conditions.

The mule deer probably have used the entire reclamation area. However, their use of specific habitats is seasonal. The high elevation mountain brush-grass and conifer-aspen habitats are used for summer range and fawning. The low altitude mountain brush, oak brush, and pinyon-juniper habitats are used as winter range during normal winters. During winters of excessive snowfall the deer move out of the reclamation area and go west to lower altitudes. The revegetation plan for the Summit Minerals site will result in a significant increase in winter range for the deer, because at this time there is little browse on the site. The timing of reclamation activities during late summer and early fall will not cause any impacts on the deer. Overall the reclamation project will be of direct benefit to the deer population around the site.

Snowshoe Hare. The snowshoe hare is present in and around the reclamation site. The animal depends on the conifer-aspen vegetation and also the mixed shrub and grasses habitats the year around. The revegetation schedule calls for a substantial increase in the mixed shrub and grass habitat. This should aid in the survival of the animal. Although the sensitive period for reproduction is from April 1 to August 15, there will be no serious long term impact on the snowshoe hare because of the relatively short-term reclamation activities which might take place near the end of the summer. Any negative impacts will be more than offset by the revegetation program.

Furbearers. Some portions of the reclamation site probably contain a few species commonly called the furbearers: i.e. ermine, long-tailed weasel, badger, and the striped skunk. Obviously, the breeding and the rearing of such nonmigratory species will occur within the reclamation area. However, any such animals which have managed to survive in the site as it now exists will not be bothered by the reclamation activities. Overall, the reclamation process will result in a reduction

of man's activities in the area creating a more stable habitat for such animals.

Small Mammals. Although small mammals do not qualify individually as high interest species, taken together they represent a significant part of the ecosystem. Most are herbivores and are the primary source of food for higher trophic levels; in particular, raptorial birds, canids, and felids. Therefore, they warrant consideration. The reclamation process can only help to reestablish and/or increase such animals. During the reclamation process, there is a chance that burrows will be caved and their continuity changed because of fracturing of the strata. However, this would cause only a temporary alteration in the population density and age structure, and with reduced human activity recovery would be imminent and very rapid. Furthermore, reclamation will result in increases in the present population because of the increase in favorable habitats.

Reptiles and Amphibians

Increasing elevation and latitude rapidly reduces the number and kind of reptiles and amphibians in the ecosystem. In the area under consideration, the geographical and associated climatic factors have eliminated most desert species of reptiles and amphibians. Those left are adapted either to mountain habitats or montane type habitats found in the northern areas of the state. The species of reptiles and amphibians listed in Table 783.20-4 generally have a wide distribution and are considered to be very versatile in their ability to adapt to changing habitats.

Based on a review of the literature, probably up to 12 species of reptiles and three species of amphibians inhabit the reclamation area. All reptiles and amphibians are legally protected in Utah. However, because all of the species listed are widespread throughout similar habitats in Utah, they are not treated as being high-interest species.

Reptiles. The reptiles found in the reclamation area are also found in many similar habitats. Therefore, the proposed reclamation activities will not cause serious impacts on the reptilian population. If the reclamation activities discover any denning sites, they will be preserved until proper procedures to either move the den site to a new location are implemented by proper UDWR personnel or the reclamation plan is modified so as not to disturb the den. This is relatively easy to accomplish and should not cause any great concern.

Amphibians. Because of the wide range and distribution pattern of the three amphibian species that could inhabit the reclamation area, it is doubtful if the reclamation activities would seriously impact even a small portion of the population.

Table 783.20-4.--Species List and Habitats of Reptiles and Amphibians Whose Ranges Overlap the Summit Minerals Reclamation Area.

REPTILES	HIGH-INTEREST SPECIES	Pinyon Juniper	Desert Shrub	Sage-brush	Conifer Aspen	Mixed Shrub & Grasses
Boa, Utah Rubber					US	
Garter Snake, Wandering		US	US	US	US	US
Gopher Snake		CS	CS	CS		CS
Kingsnake, Utah Mountain		US				US
Lizard, Fence		US				US
Lizard, Mountain Short-horned		CS	CS	CS	U	CS
Lizard, Sagebrush		CS	CS	CS		CS
Milk Snake		US	US	US		
Night Snake			US	US		
Racer, Yellow-bellied or Western		US	US	US		US
Rattlesnake, Western Basin		CS	CS	CS		CS
Whipsnake, Striped		US	US	US		
AMPHIBIANS						
Frog, Northern Leopard			CS	CS		
Toad, Great Basin Spadefoot			CS	CS		
Toad, Woodhouse's			US	US		

C = Common U = Uncommon S = Summer Only

Threatened and Endangered Species

There are no known endangered or threatened species of mammals, reptiles or amphibians in the reclamation area, nor are there any in close proximity to the area.

Raptors

Two species of endangered raptors could be found in the reclamation area. These are the bald eagle and peregrine falcon. There are no known roosting trees or nesting sites within the reclamation area. Therefore, the reclamation project should not have any adverse affects on those raptors.

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UMC 783.21 - SOIL RESOURCES INFORMATION

UMC 783.21(a) - GENERAL DESCRIPTION OF SOILS

UMC 783.21(a)(1) - Soil Map

Plate 783.21-1 is a soil map of the reclamation area and adjacent areas. The map was made from a copy of a U. S. Soil Conservation Service (SCS) field map on an aerial photograph. The soil survey was conducted in 1985 and the information is considered to be preliminary.

UMC 783.21(a)(2) - Soil Identification and Methodology

The project area had a soil survey conducted in 1985 by the U. S. Soil Conservation Service. The soils that have been impacted by past mining operations are described herein and are shown on a preliminary soil map of the reclamation and adjacent areas (Pl. 783.21-1). More complete and detailed information is available from the Soil Conservation Service Office in Coalville.

Soil samples were taken by R. S. Kopp, Geologist, from nine sites in or adjacent to the disturbed area. The sample sites are shown on Figure 783.21-1 and details of the sample sites are given in Table 783.21-1. The samples were taken to the Utah State University Soil Testing Laboratory in Logan for analysis. The methods used to analyze the samples are outlined in the appendix to this section beginning on page 783.21-16.

UMC 783.21(a)(3) - Soil Description

Preliminary soil information collected by the U. S. Soil Conservation Service indicates that five soil series, a complex of two of the series, and two phases of a series exist in or adjacent to the disturbed areas which are the subject of this reclamation application. The soils are (1) the Toehead Loam, No. 76, (2) the Kovich Loam, No. 43, (3) the Horrocks-Yeates Hollow Complex, No. 41, and (4) the Watkins Ridge Loam, No. 82 and No. 83.

The major portion of the disturbed area is shown on the SCS air photo map as being in the Toehead loam. The road from the highway into the property crosses portions of the Kovich loam and the Watkins Ridge loam. The area above the disturbed area which provides runoff into the reclamation site is in the Horrocks-Yeates Hollow Complex.

FaB Toehead Loam - 2 to 4 percent slopes.

This very deep, well drained soil is on east facing alluvial fans and stream terraces. It formed in alluvium derived mainly from sandstone, quartzite, and shale. Slopes are mainly convex. The present vegetation is alfalfa and pasture grasses. Elevation is 5,200 to 5,800 feet. The average annual precipitation is about 14 to 18 inches, mean annual air temperature is 42 to 45 degrees F., and the average freeze-free period is 60 to 75 days.

Typically the surface of the soil is very dark grayish brown loam about 18 inches thick. The upper 8 inches of the subsoil is dark brown clay loam. The lower 34 inches is dark yellowish brown and dark brown clay loam.

Included in this unit are small areas of soils that are gravelly below about 14 inches and soils with strong lime layers at 21 to 31 inches. Included areas make up about 20 percent of the total acreage. Also included are small areas of similar soils that are free of lime throughout.

Permeability of the Toehead is moderately slow. Available water capacity is about 10 to 12 inches. Effective rooting depth is 60 inches or more. The organic matter content in the surface layer is about 2 to 5 percent. Runoff is slow and the hazard of water erosion is slight.

This unit is used for irrigated alfalfa and pasture with small grain at times. The Toehead is in capability subclass IVe, irrigated.

Toehead Series. The Toehead soils are fine-loamy, mixed frigid, Cumulic Haploxerolls. A typical pedon of Toehead loam, 2 to 4 percent slopes, can be found about 2 miles south of Henefer, Utah, about 2,350 feet south and 300 feet west of the northeast corner of Section 15, T. 3 N., R. 4 E.

AP- 0 to 7 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry, weak fine subangular blocky structure that parts to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine and a few medium roots; many fine pores; neutral (pH 7.0); clear smooth boundary.

A2- 7 to 18 inches; very dark grayish brown (10YR 3/2) loam, dark brown (10YR 4/3) dry; weak, fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine and a few medium roots; many very fine interstital pores; neutral (pH 7.0); clear smooth boundary.

Bw- 18 to 26 inches; dark brown (10YR 3/3) clay loam, brown (10YR 5/3) dry; moderate, medium subangular blocky structure; hard, firm, sticky and plastic; many very fine, fine and a few medium roots; many very fine tubular pores; moderately calcareous, with disseminated carbonates; mildly alkaline (pH 7.4); clear wavy boundary.

Bk1- 26 to 38 inches; dark yellowish brown (10YR 3/4) clay loam, yellowish brown, (10YR 5/4) dry; weak and moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots; many very fine irregular pores; moderately calcareous, carbonates are disseminated; moderately alkaline (pH 8.0); clear smooth boundary.

Bk2- 38 to 45 inches; dark brown (10YR 4/3) clay loam, brown (7.5YR 5/4) dry; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; a few very fine irregular pores; moderately calcareous, carbonates are disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

Bk3- 45 to 60 inches; dark brown (7.5YR 4/4) clay loam, brown (7.5YR 5/4) dry; weak, fine subangular blocky structure; hard, firm, sticky and plastic; few very fine irregular pores; moderately calcareous with disseminated carbonates; moderately alkaline (pH 8.2).

Bedrock: at a depth of 60 inches or more. The mollic epipedon is 20 to 30 inches thick. The particle-size control section averages 25 to 30 percent clay and 0 to 10 percent rock fragments. A Ck horizon is present in some pedons.

A Horizon: Hue is 10YR or 7.5YR, value is 2 or 3 moist, 4 or 5 dry, and chroma is 2 or 3 moist and dry. Texture is loam. Rock fragment content is 0 to 10 percent. Reaction is neutral or slightly alkaline.

B Horizon: Hue is 10YR or 7.5YR, value is 3 or 4 moist, 5 or 6 dry, and chroma is 2 to 4 moist and dry. Texture is loam or clay loam. Clay content is 25 to 30 percent. Rock fragment content is 0 to 10 percent. Reaction is mildly alkaline or moderately alkaline and moderately calcareous to strongly calcareous.

EKA Kovich Loam - 0 to 2 percent slopes.

This soil unit is found on flood plains and on valley floors. Slopes are mainly concave. The native vegetation is mainly sedge and grass. Elevation is 6,300 to 6,700 feet. The average annual precipitation is about 18 to 25 inches, mean annual air temperature is 42 to 45 degrees F., and the average freeze-free period is 60 to 75 days.

Included throughout this unit are small areas of soil having 10 to 20 inches of peat at the surface. Mapped with the Kovich soil is a similar soil that is calcareous throughout the profile and a soil that lacks rock fragments in the lower part.

The Kovich loam soils are very deep and poorly drained and formed in alluvium from glacial outwash and streams that are derived from a wide variety of rocks. Typically the surface layer is black loam in the upper 9 inches and black or very dark brown clay loam in the lower 20 inches. The upper 15 inches of the substratum is dark brown fine sandy loam. The lower part to a depth of 60 inches is dark brown very gravelly loamy fine sand.

Permeability of the Kovich loam soil is moderately slow. Available water capacity is about 7 to 9 inches. Effective rooting depth is 60 inches for water tolerant plants but is limited to depths of 10 to 20 inches for plants that do not tolerate wetness. The organic matter content in the surface layer is about 5 to 10 percent. Runoff is slow and the hazard of water erosion is slight. A seasonal high water table is at a depth of 0 to 20 inches in all months of the year.

The unit is used for irrigated pasture and home sites. The Kovich loam is in capability unit IVw, irrigated

Kovich Series. The Kovich soils are fine-loamy, mixed, frigid Cumulic Haplaquolls. A typical pedon of Kovich loam, 0 to 2 percent slopes in an area of Kovich-Kovich wet, loams, 0 to 2 percent slopes, is about 1 1/2 miles southeast of Kimball Junction, about 800 feet east and 500 feet north of the southwest corner of Section 20, T. 1 S., R. 4 E.

A1- 0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; slightly hard, friable, slightly sticky and plastic; many very fine and common fine roots; slightly acid (pH 6.2); clear smooth boundary.

A2- 9 to 22 inches; black (10YR 2/1) clay loam, very dark grayish brown (10YR 3/2) dry; common medium (7.5YR 5/6) mottles; weak medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots; few very fine tubular pores; slightly acid (pH 6.4); clear smooth boundary.

A3- 22 to 29 inches; very dark brown (10Yr 2/2) clay loam, dark brown (7.5YR 3/2) dry; few to common, fine distinct (5YR 3/4) mottles; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; neutral (pH 6.6); clear smooth boundary.

2C1- 29 to 44 inches; dark brown (7.5YR 4/4) fine sandy loam, brown (7.5YR 5/4) dry; common medium distinct (7.5YR 5/6) mottles; weak and moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; 10 percent pebbles; neutral (pH 7.0); clear smooth boundary.

2C2- 44 to 60 inches; dark brown (10YR 4/3) very gravelly loamy fine sand, brown (10YR 5/3) dry; single grain; loose; 45 percent pebbles and 10 percent cobbles; medium acid (pH 6.1).

Bedrock: at a depth of 60 inches or more. The mollic epipedon is 24 to 33 or more inches thick. The particle size control section averages 20 to 35 percent clay and less than 35 percent rock fragments.

A Horizon: Hue is 10YR or 7.5YR, value is 2 or 3 moist, 3 or 4 dry, and chroma is 1 or 2 moist and dry. Texture is loam or clay loam. Clay content is 23 to 34 percent. Reaction is slightly acid to mildly alkaline.

2C Horizon: Hue is 10YR or 7.5YR, value is 2 to 4 moist, 4 to 6 dry, and chroma is 2 to 4 moist and dry. Texture is commonly stratified fine sandy loam, loam, very gravelly or very cobbly fine sandy loam or loamy sand. Rock fragment content is 25 to 70 percent. Reaction is neutral or slightly acid to mildly alkaline.

HdG Horrocks-Yeates Hollow Complex - 30 to 60 percent slopes.

This map unit is on south and west facing mountainsides. Slopes are convex with alternating convex and concave contours. The native vegetation is mainly oak with scattered open areas of grass and sagebrush. Elevation is 5,600 to 8,400 feet. The average annual precipitation is about 18 to 25 inches, the mean annual air temperature is 42 to 45 degrees F, and the average freeze-free period is 60 to 75 days.

This unit is about 65 percent Horrocks very cobbly loam, 40 to 60 percent slopes under oak, 20 percent Yeates Hollow gravelly loam, 30 to 50 percent slopes under grass and sagebrush, and 15 percent other soils. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Hades loam on concave parts of slopes under sagebrush and grass, Harkers gravelly loam, organic surface under oak, and a very cobbly shallow soil on ridges and convex slopes under sagebrush.

The Horrocks soil is deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, sandstone, and quartzite. Typically the surface layer is very dark brown very cobbly loam about 10 inches thick. The subsoil is very dark grayish brown or dark brown very cobbly clay loam about 32 inches thick. The substratum is dark brown very gravelly loam about 17 inches thick over fractured andesite. Permeability of the Horrocks soil is moderately slow. Available water capacity is almost 5 to 7 inches. Water supplying capacity is 8 to 14 inches. Effective rooting depth is 40 to 60 inches. The organic matter content in the surface layer is about 3 to 5 percent. Runoff is very rapid and the hazard of water erosion is severe.

The potential plant community on the Horrocks soil is slender wheatgrass, bluegrass, mountain brome, and oak. Suitability for range seeding is poor with the main limitations being rock fragments in the soil surface and slope.

The Yeates Hollow soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from sandstone and quartzite. Typically the surface layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 7 inches of the subsoil is dark brown very gravelly clay loam. The lower 46 inches is dark brown very cobbly clay to very gravelly clay loam.

Permeability of the Yeates Hollow soil is slow. Available water capacity is about 5 to 6 inches. Water supplying capacity is 9 to 13 inches. Effective rooting depth is 40 to 60 inches. The organic matter content in the surface layer is about 3 to 5 percent. Runoff is very rapid and the hazard of water erosion is very severe.

The potential plant community on the Yeates Hollow soil is slender wheatgrass, Letterman needlegrass, bluebunch wheatgrass, and mountain big sagebrush. Suitability for range seeding is poor because of the steep slopes.

The Horrocks-Yeates Hollow Complex unit is used as rangeland, wildlife habitat, and recreation.

The Horrocks soil is in capability subclass VIIs, nonirrigated, and in Mountain Gravelly Loam (Oak) range site. The Yeates Hollow soil is in capability subclass VIIe, nonirrigated, and Mountain Gravelly Loam (Mountain Big Sagebrush) range site.

Horrocks Series. The Horrocks soils are loamy-skeletal, mixed frigid Typic Argixerolls. A typical pedon of Horrocks very cobbly loam, 40 to 60 percent slopes in an area of Horrocks-Yeates Hollow complex, 30 to 60 percent slopes is about 3 miles southwest of Wanship, about 90 feet south and 500 feet east of the northwest corner of Section 36, T. 1 N., R. 4 E.

A- 0 to 10 inches; very dark brown (10YR 2/2) very cobbly loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; surface mantel contains 20 percent cobbles, 30 percent pebbles; neutral (pH 7.0); clear smooth boundary.

Bt1- 10 to 19 inches; very dark grayish brown (10YR 3/2) very cobbly clay loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and few fine roots; few very fine pores; common thin patchy clay films on faces of peds; 25 percent cobbles, 10 percent pebbles; neutral (pH 7.0); clear smooth boundary.

Bt2- 19 to 32 inches; dark brown (10YR 4/3) very cobbly clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and few fine roots; common very fine and few fine pores; common thin patchy clay films on faces of peds; 25 percent pebbles, 15 percent cobbles; neutral (pH 7.0); clear smooth boundary.

BT3- 32 to 42 inches; dark brown (10YR 4/3) very cobbly clay loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; hard firm, slightly sticky and plastic; common very fine roots; few very fine pores; 20 percent cobbles, 20 percent pebbles; neutral (pH 7.0); clear smooth boundary.

C- 42 to 59 inches; dark brown (10YR 4/3) very gravelly loam, brown (10YR 5/3) dry; weak fine subangular blocky structure that parts to weak fine granular; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine pores; 40 percent pebbles; neutral (pH 7.2); clear smooth boundary.

R- 59 inches; andesite bedrock.

Yeates Hollow Series. These soils are clayey-skeletal, montmorillonitic, frigid Typic Argixerolls. A typical pedon of Yeates Hollow very stony loam, 15 to 40 percent slopes in an area of Yeates Hollow-Manila-Harkers complex, 15 to 40 percent slopes, is about 3 3/4 miles southwest of Wanship, about 1,400 feet west and 700 feet north of the southeast corner of Section 22, T. 1 N., R. 4 E.

A- 0 to 12 inches; very dark grayish brown (10YR 3/2) very stony loam, dark brown (10YR 4/3) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine vesicular pores; 20 percent stones, 20 percent cobbles, and 15 percent pebbles; neutral (pH 6.8); clear wavy boundary.

Bt1- 12 to 25 inches; dark brown (7.5YR 4/4) very cobbly clay, brown (7.5YR 5/4) dry; moderate coarse and medium subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine, fine and medium roots; common very fine tubular pores; common thick clay films on faces of peds; 20 percent cobbles and 20 percent pebbles; slightly acid (pH 6.2); abrupt irregular boundary.

Bt2- 25 to 37 inches; pale brown (10YR 6/3) very cobbly clay, very pale brown (10YR 7/3) dry; strong medium and coarse angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine and fine roots; common very fine tubular pores; common thin and moderately thick clay films on faces of peds; 20 percent cobbles and 20 percent pebbles; medium acid (pH 5.8); clear irregular boundary.

Bt3- 37 to 43 inches; yellowish red (5YR 4/6) extremely cobbly clay loam, reddish yellow (7.5YR 6/6) dry; strong fine subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine and fine roots; common very fine tubular pores; 60 percent cobbles and 10 percent pebbles; medium acid (pH 5.6); abrupt irregular boundary.

R- 43 inches; fractured sandstone.

Bedrock: is at a depth of 40 to more than 60 inches. The mollic epipedon is 10 to 19 inches thick. The particle-size control section averages 35 to 45 percent clay and 40 to 80 percent rock fragments.

A Horizon: Hue is 10YR or 7.5YR, value is 2 to 3 moist, 3 to 5 dry, and chroma is 2 or 3 moist and dry. Texture is very stony loam or gravelly loam. Clay content is 20 to 26 percent. Rock fragment content is 15 to 55 percent. Reaction is slightly acid or neutral.

Bt Horizon: Hue is 10YR to 5Yr, value is 3 to 6 moist, 4 to 6 dry, chroma is 3 to 6 moist and dry. Texture is very cobbly clay, very cobbly clay loam, very gravelly clay loam, and extremely cobbly clay loam. Clay content is 35 to 45 percent. Rock fragment content is 40 to 80 percent. Reaction is medium acid or neutral.

WdB Watkins Ridge Loam - 2 to 5 percent slopes.

This very deep and well drained soil is found on gently rolling foothills and alluvial fans. It was formed in alluvium derived mainly from limestone and sandstone. Slopes are concave and convex. The present vegetation is alfalfa, small grain and pasture grasses. Elevations range from 5,600 to 7,000 feet. The average annual precipitation is about 14 to 18 inches, mean annual air temperature is 42 to 45 degrees F., and the average freeze-free period is 60 to 90 days.

Typically the surface layer is a very dark grayish brown loam about 12 inches thick. The upper 4 inches of the subsoil is dark grayish brown clay loam. The lower part, to a depth of 60 inches, is yellowish brown and vary pale brown loam.

Included in this unit are small areas of Ant Flat loam on north facing slopes under big sagebrush and grasses, Richville loam on concave parts of south facing slopes under basin big sagebrush and grasses, and Watkins Ridge soil with clay loam surface texture. Included areas make up about 10 percent of the total acreage. Permeability of the Watkins Ridge soil is moderate. Available water capacity is about 8 to 9 inches. Water supplying capacity is 10 to 14 inches. Effective rooting depth is 60 inches or more. The organic matter content in the surface layer is about 1 to 4 percent. Runoff is slow and the hazard of water erosion is slight.

The unit is used for alfalfa, small grains and pasture. This Watkins Ridge soil is in capability subclass IVe, irrigated.

WdC **Watkins Ridge Loam - 5 to 8 percent slopes.**

This very deep and well drained soil is found on gently rolling foothills and alluvial fans. It formed in alluvium derived mainly from limestone and sandstone. Slopes are concave and convex. The present vegetation is alfalfa, small grains, and pasture grasses. The elevation is 5,600 to 6,000 feet. The average annual precipitation is about 14 to 18 inches, the mean annual air temperature is 42 to 45 degrees F., and the average freeze-free period is 60 to 90 days.

Typically the surface layer is very dark grayish brown loam about 12 inches thick. The upper 4 inches of the underlying material is dark grayish brown clay loam. The lower part to a depth of about 60 inches is yellowish brown and very pale brown loam.

Included in this unit are small areas of Ant Flat loam on northern slopes under big sagebrush and grasses and Richville Loam on concave parts of south slopes under basin big sagebrush and grasses. Included areas compose about 10 percent of the total acreage.

Permeability of the Watkins Ridge soil is moderate. Available water capacity is about 8 to 9 inches. Water supplying capacity is 10 to 14 inches. Effective rooting depth is 60 inches or more. The organic matter content in the surface layer is about 1 to 4 percent. Runoff is medium and the hazard of water erosion is moderate.

The unit is used for alfalfa, small grains and pasture. This Watkins Ridge soil is in capability subclass IVe, irrigated, and VIe, nonirrigated. It is in Upland Loam (Basin Big Sagebrush) ecological site.

Watkins Ridge Series. These soils are fine-loamy, mixed, frigid Typic Calcixerolls. A typical pedon of Watkins Ridge loam in an area of Watkins Ridge-Dennot complex, 15 to 35 percent slopes, is about 1.5 miles west of Coalville, Utah, about 2,400 feet west and 1,700 feet north of the southeast corner of Section 7, T. 2 N., R. 5 E.

A- 0 to 12 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; common very fine vesicular pores; slightly calcareous, lime is disseminated; mildly alkaline (pH 7.6); abrupt smooth boundary.

Bk1- 12 to 16 inches; dark grayish brown (10YR 4/2) clay loam, pale brown (10YR 6/3) dry; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; common fine tubular pores; moderately calcareous, lime is disseminated; mildly alkaline (pH 7.6); abrupt smooth boundary.

Bk2- 16 to 36 inches; yellowish brown (10YR 5/4) loam, very pale brown (10YR 7/4) dry; strong medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine, fine and medium roots; few very fine tubular pores; strongly calcareous, lime is disseminated and veined; moderately alkaline (pH 7.9); clear smooth boundary.

Bk3- 36 to 48 inches; yellowish brown (10YR 5/4) loam, very pale brown (10YR 7/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; strongly calcareous, lime is disseminated and veined; moderately alkaline (pH 8.4); abrupt wavy boundary.

Bk4- 48 to 60 inches; very pale brown (10YR 7/4) loam, white (10YR 8/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated and veined; moderately alkaline (pH 8.4).

Bedrock: is at a depth of 60 inches or more. The mollic epipedon is 8 to 12 inches thick. The particle size control section averages 18 to 34 percent clay and 0 to 20 percent rock fragments.

A Horizon: Hue is 10YR or 7.5Yr, value is 4 or 5 dry, 3 or 4 moist, and chroma is 2 or 3 dry and moist. Texture is loam. Clay content is 18 to 24 percent. Rock fragment content is 0 to 10 percent. Reaction is slightly calcareous and mildly alkaline.

Bk Horizon: Hue is 10YR or 7.5YR, value is 6 to 8 dry, 4 to 7 moist, and chroma is 2 to 5 dry and moist. Texture is loam, silt loam, clay loam, and gravelly clay loam. Clay content is 22 to 32 percent. Rock fragment content is 5 to 15 percent. Reaction is mildly alkaline or moderately alkaline and moderately calcareous to strongly calcareous.

UMC 783.21(a)(4) - Productivity of Existing Soils

U. S. Soil Conservation Service Ecological Site descriptions indicate that some portions of the Summit Minerals reclamation area are in a Mountain Gravelly Loam (Mountain Big Sagebrush) site and other portions are in a Mountain Gravelly Loam (Oak) site. The sites occur on mountain slopes and foothills with slopes that are mostly 3 to 40 percent with inclusions up to 60 percent. The characteristic soils in the sites are 40 inches to over 60 inches deep over bedrock and are well drained. The soils formed in residuum and colluvium derived mainly from andesite, conglomerate, and sandstone. The productivity of the soils is as follows:

Type of Year	Mountain Big Sagebrush (Lbs./Acre)	Oak (Lbs./Acre)
Favorable years	1,200	2,300
Normal years	1,100	1,900
Unfavorable years	900	1,700

UMC 783.21(b) - SUPPLEMENT OR SUBSTITUTE FOR TOPSOIL

Because no topsoil was stockpiled since the area was first used for coal mining almost 100 years ago, Summit Minerals proposes to use the material presently at the surface after scraping off portions of the very uppermost layers which may have become contaminated with coal fines or other undesirable materials. Discussions with Tim Watson of the Coalville Office of the U. S. Soil Conservation Service, James Leatherwood, Soil Scientist, Utah Division Oil, Gas, and Mining, Lynn Kunzler, Reclamation Biologist, Utah Division Oil, Gas, and Mining, and Mary M. Boucek, Consulting Wildlife and Reclamation Biologist, indicate that the material presently on the surface of the area probably will be able to support an active plant community as a result of the proposed revegetation program.

In order to ascertain what amendments and fertilizers will be needed to help promote the new vegetation to be planted, five soil samples were taken from the disturbed area (numbers 5 through 9), two samples were from along the border of the disturbed area where revegetation has started naturally (numbers 1 and 4), and two samples were from the reference area (numbers 2 and 3). Figure 783.21-1 shows the location of the samples and Table 783.21-1 gives details of the sample procedures and sites. Table 783.21-2 gives the results of the analyses.

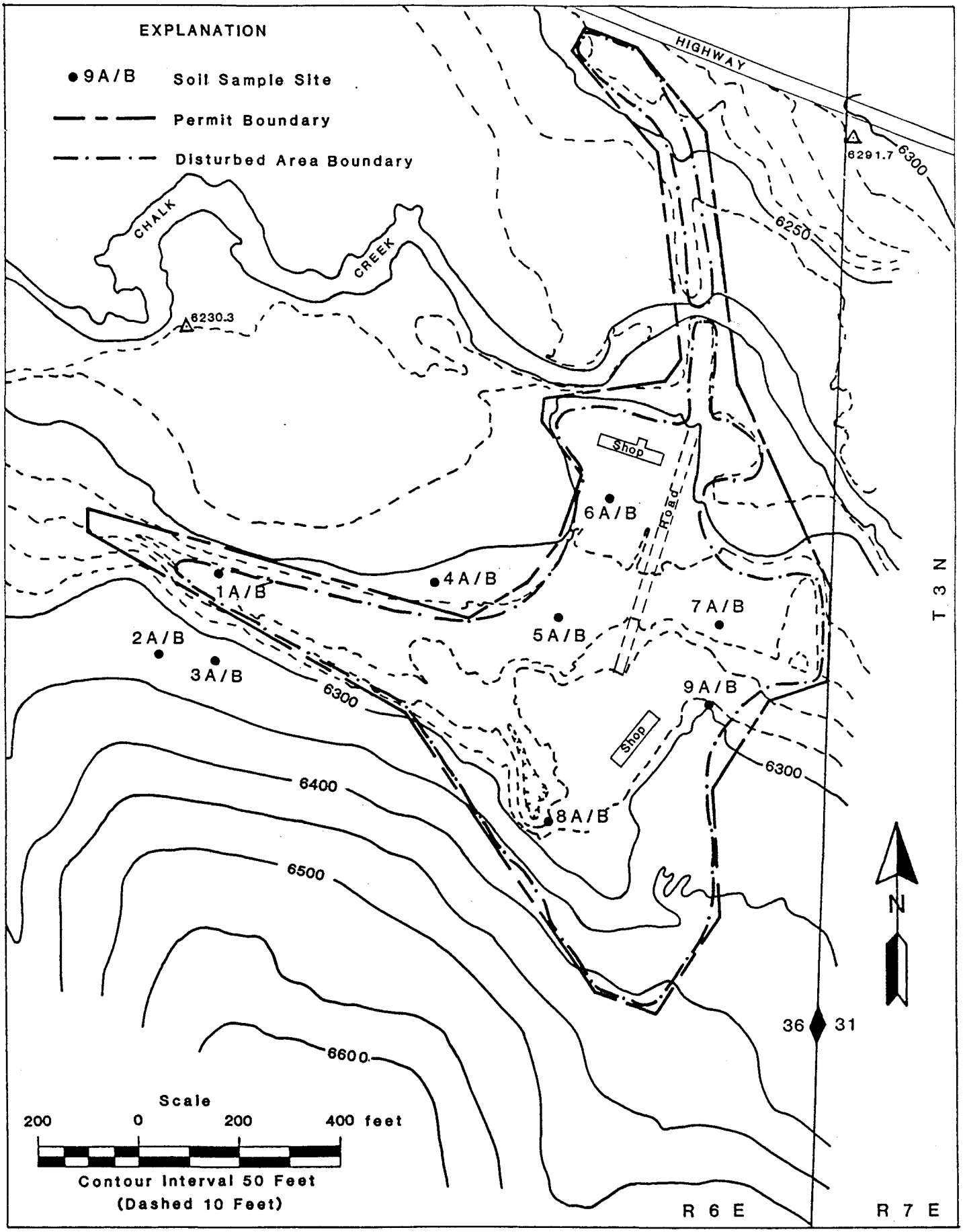


Figure 783.21-1.--Location of soil samples for Summit Minerals reclamation project.

Table 783.21-1.--Soil Sample Record Indicating Depth, Location, and Type of Sample for Summit Minerals Reclamation Project.

COMPANY: Summit Minerals, Inc., 221 West 2100 South Salt Lake City, Utah 84115 DATE: SEPT. 9, 1986

SITE: Summit Minerals #1 Coal Mine Disturbed Area

SAMPLE NUMBER	DEPTH (in inches)	LOCATION	TYPE OF SAMPLE
#1A	0 - 6	West end of disturbed area. (Possible test site)	Shovel and pick.
#1B	6 - 12	Same as #1A.	Same as #1A.
#2A	0 - 9	Reference Area - in Brush.	Cylindrical auger.
#2B	9 - 15	Same as #2A.	Same as #2A.
#3A	0 - 12	Reference Area - Grass area.	Cylindrical auger.
#3B	12 - 21	Same as #3A.	Same as #3A.
#4A	0 - 6	Along Fence North of Pipeline.	Shovel and pick.
#4B	6 - 12	Same as #4A.	Same as #4A.
#5A	0 - 6	Near Center of Pad.	Pick and Shovel.
#5B	6 - 12	Same as #5A.	Same as #5A.
#6A	0 - 6	Just North of Sediment Pond.	Pick and Shovel.
#6B	6 - 12	Same as #6A.	Same as #6A.
#7A	0 - 6	Crusher Site Near Power Pole.	Pick and Shovel.
#7B	6 - 9	Same as #7A.	Same as #7A.
#8A	0 - 9	Fill in Front of Black Hawk Portal #1.	Channel.
#8B	9 - 21	Same as #8A.	Same as #8A.
#9A	0 - 9	Undisturbed Sand & Gravel Bank Back of Shop.	Channel.
#9B	9 - 21	Same as #9A.	Same as #9A.

Two samples were taken at each sample site. The "A" sample was generally of the top six to nine inches of the profile and in many instances represented the top portion of the A horizon. The "B" samples were from the next 6 to 15 inches of the profile and either represented the bottom of the A horizon or a portion of the top of the B horizon. At each site the sample was terminated because of encountering a large cobble, or in the case of the auger samples because of a large pebble.

Table 783.21-2.--Results of Soil Analyses from Summit Minerals Reclamation Area.

USU No.	Ident.	Texture*	Lime**	pH	mmhos /cm ECe	ppm P	ppm K	ppm Fe	ppm Zn	ppm NO_3-N	%>2mm
86-1606	#1A	SL	0	7.3	.3	20	137	15.6	4.3	3.7	9
86-1607	#1B	SL	0	7.0	.2	23	115	30.0	1.7	.8	16
86-1608	#2A	OM	0	6.7	.4	32	365	68.8	6.5	10.2	14
86-1609	#2B	SiL	0	6.8	.2	40	346	65.2	2.6	2.6	41
86-1610	#3A	SiL	0	6.7	.3	39	>400	52.8	4.5	3.1	15
86-1611	#3B	SiL	0	6.8	.3	35	378	46.2	2.5	2.0	12
86-1612	#4A	SiL	0	7.3	.6	37	295	22.4	3.8	20.1	20
86-1613	#4B	SiL	0	7.3	.3	32	255	30.4	3.5	4.7	15
86-1614	#5A	L	++	8.0	.5	15	92	11.1	3.6	1.7	34
86-1615	#5B	L	++	7.9	.5	14	67	13.5	1.3	1.1	60
86-1616	#6A	L	+	7.6	.5	21	86	25.4	4.0	4.5	46
86-1617	#6B	L	+	7.6	.5	25	88	19.8	2.6	2.9	49
86-1618	#7A	L	++	8.2	.5	13	63	8.3	.7	2.0	53
86-1619	#7B	L	++	8.3	.4	13	67	11.2	.6	2.5	64
86-1620	#8A	SL	++	8.1	.5	16	52	7.7	.7	7.9	63
86-1621	#8B	SL	++	8.2	.4	12	51	8.4	.6	2.9	62
86-1622	#9A	L	++	8.0	.5	12	116	7.4	.8	4.7	54
86-1623	#9B	L	++	8.2	.7	5.9	56	7.2	.5	4.8	38

*SL = Sandy Loam
OM = Organic Matter
SiL = Silty Loam
L = Loam

** 0 = no lime
+ = little lime
++ = alot of lime

lwt

The two samples from the reference area (numbers 2 and 3) are silty loams with some concentration of organic matter in the surface layer. The plus 2 mm fraction ranges from 12 to 15 percent. The bottom sample of one (2B) had 41 percent plus 2 mm. This probably is not representative and is possibly due to several large pebbles being captured by the auger. The two border samples (numbers 1 and 4) are silty to sandy loams with plus 2 mm fractions ranging from 9 to 20 percent. The samples from the disturbed area (numbers 5 through 9) are classified as loams or sandy loams and have plus 2 mm fractions which range from 34 to 64 percent.

The reference area samples and the border samples contain no lime while those from the disturbed area have a lime content which probably ranges from 1 percent to more than 5 percent.

The reference area and border samples are neutral, having pH values which range from 6.7 to 7.3. The samples from the disturbed area are moderately alkaline with pH readings ranging from 7.6 to 8.3. Overall the pH and ECe indicate that there are no salt problems with any of the samples.

Phosphorus values for the reference area and border area samples range from 20 to 40 ppm while those from the disturbed area samples range from 5.9 to 25 ppm. Those levels should be adequate for range revegetation purposes. The one sample (9B) which was somewhat low in phosphorus (5.9 ppm) was from the lower portions of the profile sampled and represents material from the edge of the sand and gravel deposit. A response to phosphorus fertilizer is questionable, but approximately 20-30 lbs. of phosphate per acre is probably desirable.

Potassium levels for samples from the reference area and border area were very high and ranged from 115 to more than 400 ppm. Values for the disturbed area samples ranged from 51 to 116 ppm. Generally, range revegetation efforts do not require potassium fertilization when soil test values are greater than 50 ppm.

Iron levels are considered to be more than adequate for all of the samples. The zinc content for the reference area, border area, and the two westernmost disturbed area samples (numbers 5 and 6) are high. The zinc content of the other samples are somewhat low, but are considered adequate for range revegetation efforts. Therefore, there should be no concern about iron or zinc.

The nitrogen levels are quite variable. Overall it appears that some form of nitrogen should be applied to help make the soil more productive during the revegetation effort. James Leatherwood, DOGM Soil Scientist, has suggested that the nitrogen requirement be met by applying two tons of alfalfa per acre, which would be tilled- or ripped-in to a depth of 6 to 8 inches in the disturbed area. Such an application would also aid in overcoming the relatively high plus 2 mm fraction found throughout the disturbed area.

The appendix at the end of this section contains copies of the soil laboratory results and a letter which recommends fertilizer requirements.

S O I L A P P E N D I X

SOIL LABORATORY RESULTS

UTAH STATE UNIVERSITY • LOGAN, UTAH 84322
UMC 48
Telephone (801) 750-2217

Soil, Plant and Water
Analysis Laboratory

October 6, 1986

Richard Kopp
Summit Minerals, Inc.
221 West 2100 South
Salt Lake City, Ut 84115

Sample received September 11, 1986.

USU No.	Ident.	Texture*	Lime**	pH	mmhos/cm ECe	ppm P	ppm K	ppm Fe	ppm Zn	ppm NO_3-N	%>2mm
86-1606	#1A	SL	0	7.3	.3	20	137	15.6	4.3	3.7	9
86-1607	#1B	SL	0	7.0	.2	23	115	30.0	1.7	.8	16
86-1608	#2A	OM	0	6.7	.4	32	365	68.8	6.5	10.2	14
86-1609	#2B	SiL	0	6.8	.2	40	346	65.2	2.6	2.6	41
86-1610	#3A	SiL	0	6.7	.3	39	>400	52.8	4.5	3.1	15
86-1611	#3B	SiL	0	6.8	.3	35	378	46.2	2.4	2.0	12
86-1612	#4A	SiL	0	7.3	.6	37	295	22.4	3.8	20.1	20
86-1613	#4B	SiL	0	7.3	.3	32	255	30.4	3.5	4.7	15
86-1614	#5A	L	++	8.0	.5	15	92	11.1	3.6	1.7	34
86-1615	#5B	L	++	7.9	.5	14	67	13.5	1.3	1.1	60
86-1616	#6A	L	+	7.6	.5	21	86	25.4	4.0	4.5	46
86-1617	#6B	L	+	7.6	.5	25	88	19.8	2.6	2.9	49
86-1618	#7A	L	++	8.2	.5	13	63	8.3	.7	2.0	53
86-1619	#7B	L	++	8.3	.4	13	67	11.2	.6	2.5	64
86-1620	#8A	SL	++	8.1	.5	16	52	7.7	.7	7.9	63
86-1621	#8B	SL	++	8.2	.4	12	51	8.4	.6	2.9	62
86-1622	#9A	L	++	8.0	.5	12	116	7.4	.8	4.7	54
86-1623	#9B	L	++	8.2	.7	5.9	56	7.2	.5	4.8	38

*SL = Sandy Loam
OM = Organic Matter
SiL = Silty Loam
L = Loam
lwt

** 0 = no lime
+ = little lime
++ = alot of lime

K. Torres

UTAH STATE UNIVERSITY • LOGAN, UTAH 84322
UMC 48
Telephone (801) 750-2217

Soil, Plant and Water
Analysis Laboratory

October 1, 1986

Richard Kopp
Summit Minerals, Inc.
221 West 2100 South
Salt Lake City, Ut 84115

Dear Mr. Kopp,

Enclosed are the analytical results for the soil samples submitted to our lab. The texture is an estimated texture and the lime content is also qualitative. The pH & ECe levels indicate there are not any salt problems with these samples.

The critical levels at which we recommend phosphorus (P) fertilization for agronomic crops are values less than 10 ppm. For range revegetation efforts the level would be much lower, so the only sample which may be deficient is sample #9B. A response to P fertilizer is questionable but a rate of about 30 lbs P_2O_5/Ac would suffice.

Growth responses to potassium (K) are very inconsistent with the seed mix you will plant. Soil test values greater than 50 ppm K should not require fertilizer. The critical levels for agronomic crops are around 80-100 ppm K.

The iron (Fe) levels are all quite adequate. Samples 1-6 are high in zinc content while samples 7-9 are somewhat low for production of certain agronomic crops. I do not feel you need to be concerned about iron or zinc.

The nitrogen levels (NO_3-N) appear quite variable, which is not unexpected. It is difficult to predict nitrogen requirements for plants due to the number of soil and climatic factors affecting its availability. By summing the NO_3-N values for a given location you will have a value which can be compared to other locations. (e.g. sample 1 = 3.7 + 0.8 = 4.5 ppm total NO_3-N). Samples totaling 12+ ppm NO_3-N probably do not require additional nitrogen. The rates should be 20-40 lbs N/Ac. The only detrimental effects which can occur from applying nitrogen include stimulation of weedy plants, and suppression of leguminous plants. It is sometimes recommended to not apply nitrogen until the plants are growing and only do so if plant symptoms show a need.

My general recommendation would be to apply no more than 20-40 lbs N ~~lbs~~/Ac and 20-30 lbs P_2O_5/Ac. As I have outlined, not all of the sites require these amounts. Contact me if you have further questions or additional analyses.

Sincerely,

K. Topper

Karl Topper
Lab Supervisor

KT/lwt

USU SOIL TESTING LABORATORY
METHODS SUMMARY (FERTILITY)
(of -2mm soil)

1. pH. Make a soil paste as described in USDA Handbook 60, page 84 (1954). Allow to stand at least 30 minutes. Re-stir, insert electrodes and obtain pH reading to nearest 0.1 unit.

2. Salinity. (electrical conductivity of saturation extract, EC_e). Filter the paste from (1) above and read EC_e by means of a conductivity cell and meter. Report to nearest 0.1 mmho/cm for values <10; to nearest whole unit above 10.
(Note: a probe suitably designed and calibrated may be inserted into the unfiltered paste for rough screening of samples into the categories (a) less than or (b) more than 1.0 mmho/cm. Samples in category (b) must be filtered, and EC_e determined on the extract.)

3. Phosphorus. Olsen's bicarbonate procedure.
Extracting solution is 0.5 M $NaHCO_3$ at pH 8.5.
Soil : solution ratio 1:20.
Decolorizing carbon is necessary.
Shaking time 30 minutes.
Filter.
Determine P in the extract colorimetrically.
Report ppm P in soil (nearest 0.1 ppm for values <10; to nearest whole ppm above 10).

4. Potassium.
Determine K in the $NaHCO_3$ extract for phosphorus, by means of AA or flame emission. Special techniques are often required to reduce problems caused by the $NaHCO_3$ tending to plug aspirators or burner slits. Best procedures must be determined for each instrument.

(Note: if it is not possible to use the $NaHCO_3$ extract in available instruments, the soil may be extracted with NH_4OAc, 1 N, pH 7.0, soil: solution ratio 1:10. Shake for 30 minutes, filter, and determine K by flame or AA. Results will be higher than in $NaHCO_3$ extract, but differences are not great when K is 100 ppm or less.)

5. Lime. (semi-quantitative)
Moisten a small sample with water, then add a few drops of 2N HCl. Report on the basis of efforvescence:
0 = none + = little ++ = much.

6. Texture. Estimate by feel, comparing as necessary with samples of known composition.

7. Nitrate-N.
Use chromotropic acid procedure or equivalent. (See paper by Haby and Larson in proceedings of 1976 conference of NWPFA.)

8. Zinc (and Fe, Cu, Mn on special request)
Extract with buffered DTPA solution.
Detailed procedure is enclosed.

Soil Sample Preparation.

Receive the sample, record its identification, assign a lab number to it, and set it to dry in a shallow pan on a shelf. A fan may be used to speed drying, at room temperature.

Pass the sample through a 2-mm round hole or No. 10 wire mesh sieve. Grind soil lumps (not rocks or coarse organic materials) and add the -2mm portion to the sample to be tested. Discard the portion > 2mm. (Note: for some very rocky samples, it may be desirable to record total sample weight and weight of the >2 mm material.) Blend the -2 mm soil thoroughly and place it in a suitable container showing proper sample number.

DTPA Test for Zinc

EXTRACTANT

To about 700 ml of Zn-free water, add the following:

(a) 1.97 g of DTPA acid (diethylenetriamine pentaacetic acid) also known as [[(Carboxymethyl) imino] bis (ethylenenitrilo)] tetraacetic acid. J.T. Baker E376 or equivalent.

(b) 14.92 g triethanolamine

(c) 1.11 g Ca Cl_2 (or 1.47 g $CaCl_2$-$2H_2O$)

Dilute to 1 liter and adjust pH to 7.30 with HCl.

PROCEDURE

1. To 10 g soil add 20 ml of extractant
2. Shake at moderate speed for 1 hour.
3. Filter.
4. Analyze filtrate for Zn by AA.
5. Calculate ppm Zn on soil basis.

UMC 783.22 - LAND-USE INFORMATION

UMC 783.22(a) - GENERAL DESCRIPTION OF LAND CONDITION

The present condition of the surface of the land within the reclamation area can best be described as poor to fair for any other major use besides mining at the present time. The soils within the disturbed area are somewhat limited in their agronomic usefulness. However, soil studies indicate that with very little additions of amendments and limited fertilizer the soils will be able to support more than adequate range-type plant life.

UMC 783.22(a)(1) - Uses of the Land

The existing land uses within the reclamation area and adjacent areas are indicated on maps which show the condition of the land at the time of filing this application (i.e Plate 783.14-4 and Plate 784.23-1). Previous land use for the reclamation area and adjacent areas included the underground mining of coal for over 100 years, the surface mining of sand and gravel for at least 50 years, undeveloped natural vegetation for livestock and wildlife grazing, and hunting. Other land uses for the adjacent areas include that for summer residences, areas generally within 500 feet of the highway along Chalk Creek.

UMC 783.22(a)(2) - Analysis of Land Use

At the present time, the main land use is for coal mining and the extraction of sand and gravel. After reclamation of the surface, the prime land use will be the same use that the land had prior to mining; namely, undeveloped grazing and hunting. The potential of the area to support alternative uses is limited and somewhat questionable. Because of the reclamation area's proximity to highway transportation and Chalk Creek it has some potential for summer home sites or even for more permanent type single-family resident housing for individuals working at the Boyer Mine, just north of the site, or for workers at the oil fields to the east. However, current zoning would have to be changed to allow for such development. Also, an adequate water supply would have to be developed. At the present time there are no available water rights to sustain any such development. Therefore, it is doubtful that even minor housing development can take place.

Recreational opportunities in the reclamation area, particularly hunting of deer and elk are also somewhat limited because of the summer homes which are less than a mile from the area. Hunting of birds and small game such as rabbits will be restored to near previous pre-mining status. It is anticipated that the majority of the recreational activities will remain situated in the lands above and south of the reclamation site and that the area will continue to provide access to such areas.

The prospects for renewed coal mining activities and the extraction of the sand and gravel resource are very likely. In fact, the extensive reclamation of the site before final determination that coal will not be mined in the near future seems inadvisable and a waste of financial resources.

The potential for development of the coal resource should be considered very high. Because of the area's proximity to rail and highway transportation and the high quality of the coal, the coal is a valuable resource which will be fully explored and developed in the very near future.

The sand and gravel resource meets road base specifications with very little processing being required. Therefore, it can be definitely said that sand and gravel mining will occur as new roads are built or old ones upgraded and repaired. The sand and gravel also is valuable for aggregate in cement. Further commercial and residential development in the Park City and Coalville regions will also bring this deposit back into production.

UMC 783.22(a)(2)(i) - Capability of the Land

At the present time, prior to any reclamation efforts, the capability of the land is limited to activities associated with mining. The reclamation site has basically no vegetative cover. The surface is relatively flat and will provide favorable sites for reestablishment of an excellent vegetative cover of grasses and woody plants.

The hydrologic capability of the reclamation site is limited. The available surface water supplies is limited to the flow found in the perennial drainage, Chalk Creek. Most ground water is limited to the amount found in springs and seeps, none of which are found in the reclamation area. Only relatively minor amounts of subsurface water has been encountered during recent underground mining. Therefore, ground water supplies would be extremely limited. Although water flow into Chalk Creek is sufficient to support other land uses, the extent of the area capable of benefiting from that water in the immediate area of the reclamation site is limited.

UMC 783.22(a)(2)(ii) - Productivity of the Land

U. S. Soil Conservation Service Ecological Site descriptions indicate that some portions of the Summit Minerals reclamation area are in a Mountain Gravelly Loam (Mountain Big Sagebrush) site and other portions are in a Mountain Gravelly Loam (Oak) site. The sites occur on mountain slopes and foothills with slopes that are mostly 3 to 40 percent with inclusions up to 60 percent. The characteristic soils in the sites are 40 inches to over 60 inches deep over bedrock and are well drained. The soils formed in residuum and colluvium derived mainly from andesite, conglomerate, and sandstone. The productivity of the land is as follows:

Type of Year	Mountain Big Sagebrush (Lbs./Acre)	Oak (Lbs./Acre)
Favorable years	1,200	2,300
Normal years	1,100	1,900
Unfavorable years	900	1,700

UMC 783.22(b) - PREVIOUS MINING IN RECLAMATION AREA

Records of the mining activities in the reclamation site are very sketchy and unclear concerning precise dates and types of mining activities that took place. Maps are included in this application which show each of the phases where past underground coal mining has taken place. Based on information obtained to date those activities are as follows:

Just west of the permit area, the N. B. Morby Shaft was sunk through 57 feet of gravel and conglomerate in 1879 and drifted on the dip of an 8-foot coal bed (Doelling, 1972). From this entry, additional entries were opened by subsequent operators and developed into the Blackhawk Mine (Plate 771.23-1, Randall, 1952) which was intermittently worked until sometime in the mid-1950's. Those openings were buried during the preparation of the face in 1974-75 for the development of entries by Utah Coal & Energy, Inc. in the permit area (Plate 771.23-2). For the most part, this last development took place before August 3, 1977, but records are unclear concerning if any coal may have been mined after that date.

UMC 783.22(b)(1) - Mining Method Used

Early mining was by hand mining, mule tramming, and working when an order for coal was received. Later mining was mainly by continuous mining methods with some attempts at beginning room and pillar methods.

UMC 783.22(b)(2) - Coal Bed or Other Strata Mined

The coal bed is commonly identified as the Wasatch coal bed which has been the only really commercially important bed in the Coalville mining district. Based on records from several mines in the district, the Wasatch bed varies in thickness from 5 to 14 feet. The coal in the Black Hawk mine varies from 8 to 6 feet thick.

Based on the small outcrop of the Upton Sandstone Member found by Trexler (1966) along the South Fork of Chalk Creek and Trexler's identification of the Grass Creek Sandstone Member near the Boyer mine north of the permit area, it would seem very possible that the coal bed is Dry Hollow Coal.

UMC 783.22(b)(3) - Extent of Coal and Other Material Removed

Based on the workings indicated on the "old" Blackhawk Mine map (Plate 771.23-1), it is estimated that some 129,000 tons of coal were extracted. Based on the entries made by Utah Coal and Energy (Plate 771.23-2), it is estimated that 13,000 tons of coal were removed.

UMC 783.22(b)(4) - Dates of Past Mining

Coal was first mined from the area in and around the reclamation site in 1879, when the Morby shaft was sunk. Coal was mined on a "wagon mine" basis from 1879 to 1953 from the "old" Blackhawk Mine shown on Plate 771.23. Mining from the "new" Black Hawk Mine by Utah Coal and Energy began sometime during the period 1974-75. Records are unclear, but the actual mining of coal probably stopped sometime in the mid-1970's. Sample analysis records indicate shipment of at least "10 loads" from August 1978 to November 1978. However, the records are unclear as to exactly when the coal was mined.

UMC 783.22(b)(5) - Pre-Mining Land Use

From a historical point of view, the pre-mining land use, prior to any underground coal mining, was wildlife habitat and undeveloped lands. The reclamation site has supported mining activities since 1879. Prior to that date, the land use was undeveloped natural vegetation for livestock and wildlife grazing and hunting. The soils within the reclamation area have always been somewhat limited in their agronomic usefulness because of their extensive gravelly nature and the steep slopes that existed prior to the establishment of sand and gravel operations. Examination of aerial photographs beginning in 1953

indicate that the major portion of the flat areas that exist now in the reclamation area are the result of the sand and gravel operations. The coal mining operations that have followed the extraction of the sand and gravel have basically leveled and smoothed the surface of the reclamation area.

UMC 783.22(c) - EXISTING LAND USE

The existing land use for the reclamation area is for coal mining purposes and the extraction of sand and gravel.

LOCAL LAW LAND USE CLASSIFICATION

The Summit County Planning Commission indicates that the main portion of the reclamation site is classified as Agricultural Grazing (AG1). That classification allows for both open pit and tunnel mining, for oil and gas wells, and one dwelling per 40 acres. The areas along the highway and generally within 500 feet of the road, are classified as Rural Residential (RR1 and RR2). The RR1 classification allows for lots of 1 acre in size. On the other hand, the RR2 classification allows for half acre lots but requires that they have at least 110 feet of frontage along the highway.

UMC 783.24 MAPS: GENERAL REQUIREMENTS

UMC 783.24(a) - Location of Ownership Boundaries

Surface ownership is shown on Figure 782.13-1 on page 782.13-2 of this document. Subsurface excavation is not a part of this plan.

UMC 783.24(b) - Location of Boundaries Showing Right of Entry

The access road and permit area boundaries are shown on plate number 784.23-1.

UMC 783.24(c) - Extent of Mining Activities

Coal mining activities are not a part of this plan.

UMC 783.24(d) - Location of Buildings

Buildings located within 1000 feet of the proposed permit area are shown on figure 783.24-1 on page 784.24-3 of this section. The buildings identified as the "Boyer Mine Facilities" are buildings used to support underground coal mine operations. The houses identified as the "Boyer House" and the "Morby House" are seasonal single family dwellings. The buildings within the permit area boundary are used by the Operator for equipment storage and to support site maintenance activities.

UMC 783.24(e) - Location of Man-Made Features

Figure 783.24-1 shows the location of the buried natural gas pipeline which traverses the permit area. There are no major electrical transmission lines, agricultural drainage tile fields or other pipelines known to pass over or through the proposed permit area.

UMC 783.24(f) - Location of Revegetation Reference Area

The proposed reference area for measuring success of revegetation is shown on drawing number 784.19-1.

UMC 783.24(g) - Location of Water Supply Intakes

The locations of water supply intakes as recorded at the Division of Water Rights is included in the Water Rights and Well Information Appendix in section 783.15. Locations are also shown on drawing number 783.15-2 on page 783.15-6 of this document.

The location of the outfall of the sedimentation pond is shown on plate number 784.24-2.

UMC 783.24(h) - Location of Public Roads

State Route 133 is shown on figure 783.24-1 to pass within 100 feet of the permit area boundary.

UMC 783.24(i) - Location of Parks and Historic Resources

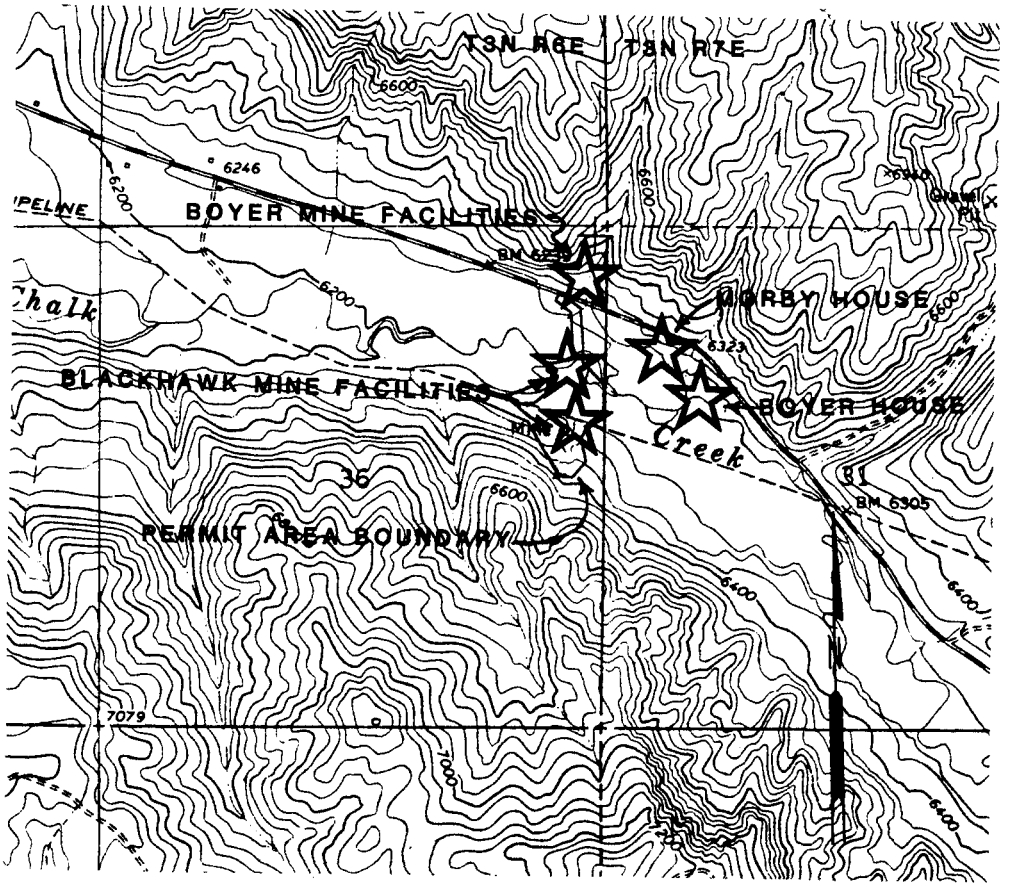
There are no known public parks, cultural or historic resources listed or eligable for listing in the National Register of Historic Places, or archeological sites within the proposed permit or adjacent areas. See section 783.12 of this document.

UMC 783.24(j) - Location of Cemeteries and Burial Grounds

There are no known cemeteries or Indian burial grounds within 100 feet of the proposed permit area.

UMC 783.24(k) - Location of Scenic Rivers

There is no land within the proposed permit or adjacent areas known to be within the boundaries of any units of the National System of Trails or the Wild and Scenic Rivers System, including study rivers designated under Section 5(a) of the Wild and Scenic Rivers Act.



USGS Upton Quadrangle
Scale: 1" = 2000'

Figure 783.24-1 Buildings within 1000 feet of the permit area.

UMC 783.25 CROSS-SECTIONS, MAPS, AND PLANS

UMC 783.25(a) - Locations of Test Borings

Coal exploration drilling is not a part of this plan.

UMC 783.25(b) - Monitoring Locations

The locations of water monitoring stations are shown on drawing number 783.16-1. Area topography is shown on this drawing so that approximate elevations of sampling points can be obtained.

UMC 783.25(c) and (d) - Coal Seam Characteristics

Coal mining activities are not a part of this plan.

UMC 783.25(e) - Location of Mine Workings

The location of known mine workings in and adjacent to the proposed permit area are shown on Plate numbers 771.23-1 and 771.23-2.

UMC 783.25(f) - Location and Extent of Subsurface Water

Drawing number 783.15-2 shows the springs and seeps recorded within a one mile radius of the reclamation area. Plate number 783.15-1 shows drill logs from water wells drilled in the vicinity of the reclamation area.

UMC 783.25(g) - Location of Surface Water Bodies

The location of all surface water bodies within the reclamation area is shown on drawing numbers 783.15-2 and 783.16-1.

UMC 783.25(h) - Location of Previously Surface-Mined Areas

The proposed permit area includes the disturbed area shown on plate number 784.23-1. The disturbance was made persuant to underground coal mine activities by a previous owner/operator.

UMC 783.25(i) - Location of Water Treatment Facilities

The sedimentation pond is shown on plate number 784.23-2 in plan view and on plate number 784.23-3 in cross-section. The spoil pile from sedimentation pond excavation is also shown on those plates. No other spoil, waste, or air pollution control facilities are proposed in this plan.

UMC 783.25(j) - Location of Wells

There are no oil or gas wells within the permit area. The locations of water wells in the reclamation and adjacent areas are shown in section 783.15 on drawing number 783.15-2 of this document. Cross-sectional well logs are shown on plate number 783.15-1.

UMC 783.25(k) - Slope Map

Additional surface disturbance is not a part of this plan.

UMC 783.25(l) - Certification

All maps, plans, and cross-sectoins submitted persuant to this section have been certified by a registered professional engineer or professional geologist.

UMC 783.27 - PRIME FARMLAND INVESTIGATION

The entire reclamation area is deemed unsuitable for prime farmland based on the following:

(1) The land has not been historically used as cropland.

(2) Portions of the land have slopes that are 10 percent or greater.

(3) The land is not irrigated or naturally subirrigated. Furthermore, there are no available water rights of an agricultural nature in conjunction with the land within the reclamation area.

(4) The soil is excessively rocky so as to prohibit most farming activities.

(5) On the basis of soil surveys of the land within the reclamation area, there are no soil map units that have been designated prime farmland by the U. S. Soil Conservation Service.

Based on all of the above aspects, the only possible conclusion is that there are no Prime Farmlands within the reclamation area. See page 783.27-2 for a copy of the SCS Negative Declaration.

United States Department of Agriculture
Soil Conservation Service

SUBJECT: Prime farm land

DATE: Dec. 15, 1986

TO: Barb Tibbs
221 W. 2100 S.
Salt Lake City, Utah 84115

I can not find any prime farm land on the property in Chalk Creek. I have checked the soils maps and other data in the office.

Jim Watson

Figure 783.27-1: Prime Farmland Negative Declaration

UMC 784.11 OPERATION PLAN: GENERAL REQUIREMENTS

Appropriate signs and markers have been placed to show the permit area boundary, property identification, and stream buffer zones. These signs and markers will remain in place through the bond release period.

UMC 784.11(b)(1) - Construction, Use, and Removal of Sedimentation Pond

The sedimentation pond proposed in this application is an incised pond. Construction techniques will include excavation using a rubber tired front end loader (see Reclamation Plan Appendix for a more detailed discussion of proposed excavation). Dewatering structures will be fabricated and installed as discussed in the Hydrologic Evaluation Appendix of this document.

The sedimentation pond has been designed for full containment of a 10 year - 24 hour precipitation event, and overflow structures have been designed to pass the 25 year - 24 hour event. Pond inflows will be contained a minimum of 24 hours prior to being manually discharged into Chalk Creek. Monitoring of sedimentation pond discharges will be as required by the approved NPDES permit. Results obtained through the NPDES monitoring will be provided to the Division within 90 days after they are received by the Applicant.

Sedimentation pond removal will be according to the plans provided in the Reclamation Plan Appendix on pages RP-23 and RP-24, and shown on plate number 784.23-2.

UMC 784.11(b)(5) - Removal of Mine Facilities

There are three buildings within the proposed permit area. Each is a steel structure built on a concrete foundation. Their locations are shown on Plate numbers 784.23-1 and 784.23-2. They are currently used as necessary to store equipment used in site maintenance. No maintenance or modification to any building is proposed in this plan.

Each building, along with access roads, will be left after reclamation for the surface owner to use to support his ranching operations.

The tipple shown on Plate number 784.23-1 is a concrete structure which was apparantly once used as a coal loading facility. This structure will be demolished, disposed of on site, and backfilled according to the plans in section 784.13.

UMC 784.11 OPERATION PLAN: GENERAL REQUIREMENTS

UMC 784.11(b)(1) - Construction, Use, and Removal of Sedimentation Pond

The sedimentation pond proposed in this application is an incised pond. Construction techniques will include excavation using a rubber tired front end loader (see Reclamation Plan Appendix for a more detailed discussion of proposed excavation). Dewatering structures will be fabricated and installed as discussed in the Hydrologic Evaluation Appendix of this document.

The sedimentation pond has been designed for full containment of a 10 year - 24 hour precipitation event, and overflow structures have been designed to pass the 25 year - 24 hour event. Pond inflows will be contained a minimum of 24 hours prior to being manually discharged into Chalk Creek. Monitoring of sedimentation pond discharges will be as required by the approved NPDES permit. Results obtained through the NPDES monitoring will be provided to the Division within 90 days after they are received by the Applicant.

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UMC 784.11 OPERATION PLAN: GENERAL REQUIREMENTS

UMC 784.11(b)(5) - Removal of Mine Facilities

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UMC 784.13 RECLAMATION PLAN: GENERAL REQUIREMENTS

UMC 784.13(a) - Plan Summary

The reclamation of the Summit Minerals, No. 1 Coal Mine is based on a total of 14.41 disturbed acres. Of those disturbed acres, 1.77 acres will be left to support the post mining land use, and the remaining 12.64 acres will be reclaimed according to this plan.

The reclamation project is expected to take approximately six weeks (1032 man hours) to complete. This includes three weeks of backfilling and grading, two weeks of planting in the fall, and one week of planting in the spring. The total cost of reclamation is expected to be $99,822 (1986 dollars).

A general description of the proposed reclamation activities begins on page 1 of the Reclamation Plan and Bond Estimate Appendix in this section.

UMC 784.13(b)(1) - Completion Timetable

The reclamation activities proposed in this plan will take six weeks to complete. A detailed timetable for the completion of each major step in the reclamation plan is included on page 5 of the Reclamation Plan and Bond Estimate Appendix in this section.

UMC 784.13(b)(2) - Cost Estimate

The total cost of reclamation under this plan is $99,822 (1986 dollars). A detailed estimate of the proposed reclamation activities, including calculations and assumptions is included in the Reclamation Plan and Bond Estimate Appendix in this section.

UMC 784.13(b)(3) - Final Surface Configuration

Existing and reclaimed surface configurations are shown on Plate numbers 784.23-1, 784.23-2 and 784.23-3. The cross-sections shown on Plate number 784.23-3 show the proposed cut and fill areas required to achieve the final configuration. A material balance, surface grading and compacting methods, and discussions on soil stabilization is included in the Reclamation Plan and Bond Estimate Appendix in this section.

The proposed surface grading operations have been designed

to closely resemble the general surface configuration of surrounding terrain, while being capable of supporting the postmining land use.

The use of hazardous, toxic, or acid forming materials is not a part of this plan, so groundwater will not be impacted by reclamation activities.

The regraded slopes are shown on Plate number 784.23-2. The proposed slope is not uniform, but makes a transition from the steep, primarily undisturbed upslopes to the flatter reclaimed pad area. This transition is consistant with the configuration of the adjacent, undisturbed valley area. Regraded slopes have been designed for the most moderate slope possible while still maintaining a close resemblance to the surrounding area. No cut-and-fill terraces or permenant depressions are proposed in this plan.

Final grading and seed bed preparation will be accomplished along the contour to minimize any potential erosion or instability. Steep slopes will be prepared by hand as described in the Reclamation Plan and Bond Estimate Appendix of this section.

A discussion of highwalls is included in the Reclamation Plan and Bond Estimate Appendix of this section. No spoil, waste materials, debris, or equipment will be disposed of on the downslope of a steep slope.

A minor amount of coal and/or coal waste will be backfilled according to this plan. The use of acid forming or toxic materials is not proposed in this plan. As discussed in the Reclamation Plan and Bond Estimate Appendix of this section, any coal material will be backfilled using a bulldozer. Backfilling with a bulldozer inherently provides minimal lifts and constant compacting while manipulating the materials. Soil cover over the coal material will be a minimum of three feet thick, which should provide a suitable barrier for the establishment of vegetation.

The proposed backfilling and grading plan has been designed to minimize the erosion potential by controlling surface runoff, minimizing slope gradients, and minimizing the time required in executing the reclamation activities. In the event that rills or gullies exceeding 9 inches form in areas that have been regraded, they will be filled, graded, compacted as necessary, and revegetated according the the Revegetation Plan Appendix of this section.

UMC 784.13(b)(4) - Topsoil Handling Plan

The special handling of topsoils and subsoils is not a part of this plan. No topsoil or subsoil material was segregated at

the time of disturbance for use during reclamation activities. Based on soil sample analyses (section 783.21 of this document), existing disturbed soils are expected to be adequate to support revegetation with only a few soil amendments.

UMC 784.13(b)(5) - Revegetation Plan

A plan for revegetation as required in UMC 817.111 through 817.117 is included in the Revegetation Plan Appendix in this section.

UMC 784.13(c)(7) - Disposal of Waste

Because the disturbed area was once used to support underground coal mining activities, there is evidence of some surface spillage of coal and/or coal waste materials. This is addressed in the Reclamation Plan Appendix of this document. The Applicant will sample the material and have it analyzed for the following parameters: acid-base potential, pH, conductivity, boron, and selenium. Results will be provided to the Division when received by the Operator. Should it be necessary, appropriate revisions to the Reclamation Plan can be made based on the sample results.

UMC 784.13(b)(8) - Portal Sealing Plan

Subsequent to coal mining activities in the late 1970's by a previous owner/operator, two mine portals were left open. In October or November of 1984 during cleanup operations on site, the portals were sealed as per the mine superintendent's letter dated December 4, 1984 (Figure 784.13-1). The Operator feels that the placement and compaction of 27 feet of the incombustible sloughage material in and around the caved No. 1 portal area was the only practical way to seal the opening and that this method adequately meets the requirements of UMC 817.17 and 30 CFR 75.1711-2.

The No. 2 portal however, was basically in tact when fill material was introduced. The Operator proposes to excavate and remove the fill material during reclamation activities and permenantly seal the opening as shown on drawing number 784.13-1, page 784.13-7 of this section.

UMC 784.13(b)(9) - Compliance with Health and Safety Standards

The Operator has applied for a National Pollutant Discharge Elimination System (NPDES) permit from the Environmental Protection Agency for the outfall from the sedimentation pond in compliance with the Clean Water Act (33 U.S.C. Sec. 1251 et seq.). A copy of this filing is included in this document as Figure 784.13-2.

the time of disturbance for use during reclamation activities. Based on soil sample analyses (section 783.21 of this document), existing disturbed soils are expected to be adequate to support revegetation with only a few soil amendments.

UMC 784.13(b)(5) - Revegetation Plan

A plan for revegetation as required in UMC 817.21 through 817.25 is included in the Revegetation Plan Appendix in this section.

UMC 784.13(b)(8) - Portal Sealing Plan

Subsequent to coal mining activities in the late 1970's by a previous owner/operator, two mine portals were left open. In October or November of 1984 during cleanup operations on site, the portals were sealed as per the mine superintendent's letter dated December 4, 1984 (Figure 784.13-1). The Operator feels that the placement and compaction of 27 feet of the incombustible sloughage material in and around the caved No. 1 portal area was the only practical way to seal the opening and that this method adequately meets the requirements of UMC 817.17 and 30 CFR 75.1711-2.

The No. 2 portal however, was basically in tact when fill material was introduced. The Operator proposes to excavate and remove the fill material during reclamation activities and permenantly seal the opening as shown on drawing number 784.13-1, page 784.13-7 of this section.

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December 5, 1984

Mr. Jack Higgins
Summit Minerals

Dear Mr. Higgins:

On or about 10/15/84, at the Blackhawk Mine located approximately twelve miles east of Coalville, Utah, cleanup work was being performed by myself and two other employees at my direction.

At this time portals #1 and #2 were open, to the extent that neither had been properly sealed and both were caved. Number 2 was caved to within eight feet of a corrigated overcast type portal, extending underground eighteen feet. Number 1 portal was caved to surface and a similar portal structure was buckled by sluffage from the high wall directly above both portals.

On returning to work after the weekend of 10/18/84 we noticed where children had been riding bicycles and playing in and around the old portals area.

Several families live in the immediate area of the mine site with children. It was then determined that the open portals were very hazardous.

At this time we sealed both portals using a bulldozer and the existing sluffage material from the high wall area. All the portal canopy structure was removed from portal #1 and material was dozed into the subsidance area and compacted by the dozer in 1 foot lifts or layers to a total of 27 feet of cover.

Portal 2 had relatively sound integrity, considering a future mining operation. We filled portal opening with sluffage material, making it inaccessable but still basically intact. This work has been completed as of 11/6/85.

Clayton Timothy
Superintendent Summit Minerals

CT/cn

Figure 784.13-1a - Sealing of Portals at the Blackhawk Mine

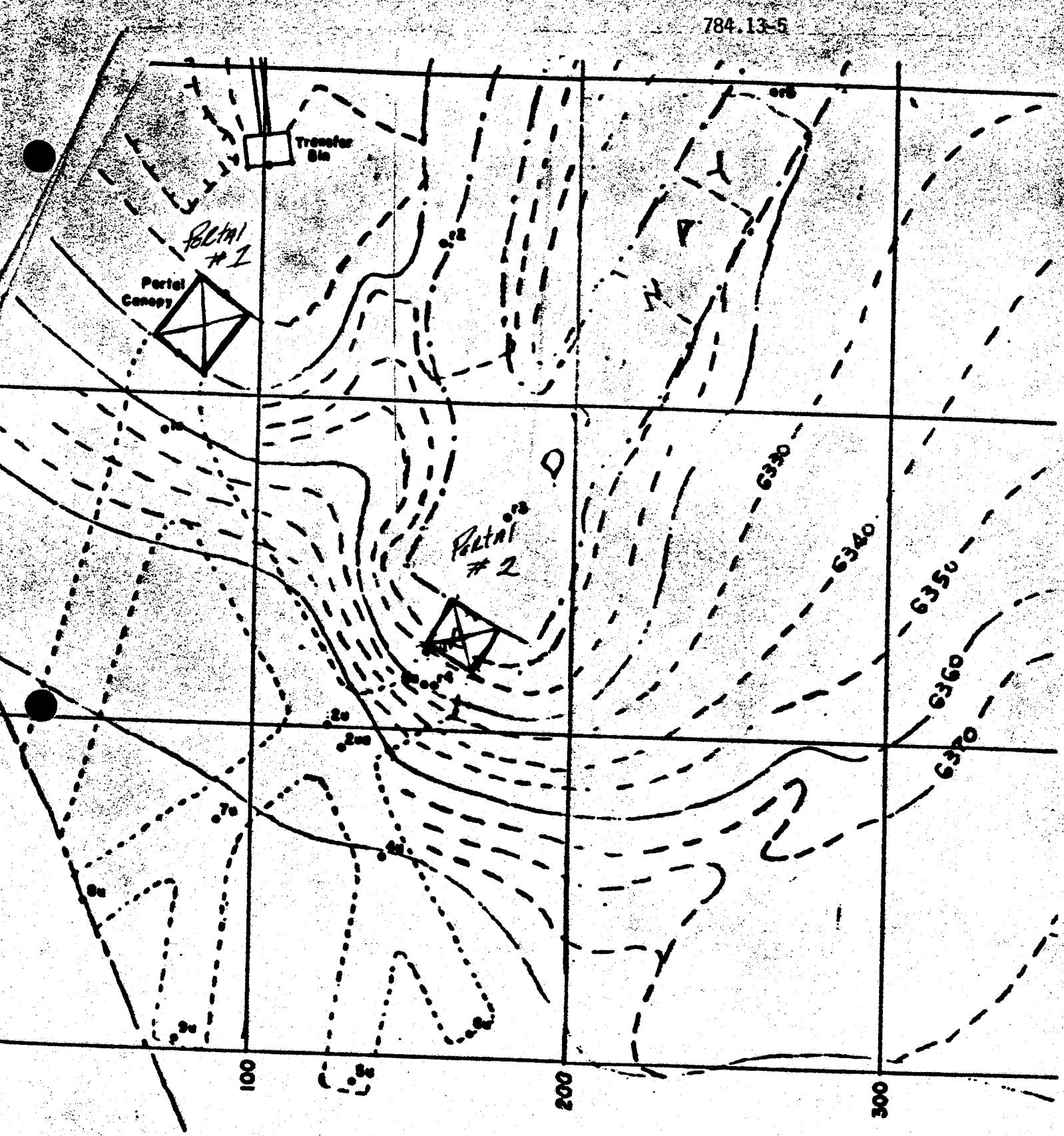


Figure 784.13-1b - Sealing of Portals at the Blackhawk Mine

SUMMIT MINERALS, INC.

221 West 2100 South
Salt Lake City, Utah 84115
(801) 486-1861

October 24, 1986

Mr. Bob Burm
U. S. Environmental Protection Agency
1 Denver Place
999 18th Street
Denver, CO 80202-2413

Dear Mr. Burm:

Please find enclosed EPA Form 3510-1, 3510-2C, and supporting information required for application for a National Pollutant Discharge Elimination System (NPDES) permit under the Clean Water Act, 33 U.S.C. 1251.

The NPDES application is made on behalf of Summit Minerals, Inc. No. 1 Coal Mine for the sole purpose of discharging contained surface runoff water from a sedimentation pond. Effluent waters from the operation of an underground coal mine are not a part of this application. Should it become necessary at some future date to discharge effluent waters from the underground operation, Summit Minerals, Inc. will apply for a separate outfall or an appropriate revision on this outfall in a timely manner which complies with the requirements for coal mining activities.

At your direction, Summit Minerals, Inc. requests that the Regulatory Authority waive all analyses required under Part V of Form 2C for the following reasons:

1) Runoff from the disturbed area is an existing condition resulting from a previous owner/operator. Installation of the sedimentation pond will only improve the existing runoff characteristics now entering the creek.

2) Because the pond is not yet constructed, there is no existing concentrated outfall location to sample which would provide meaningful data.

Should you have any questions or require additional information, contact Barbara Filas at (801) 486-1861. Your prompt consideration of this application would be appreciated.

Sincerely,

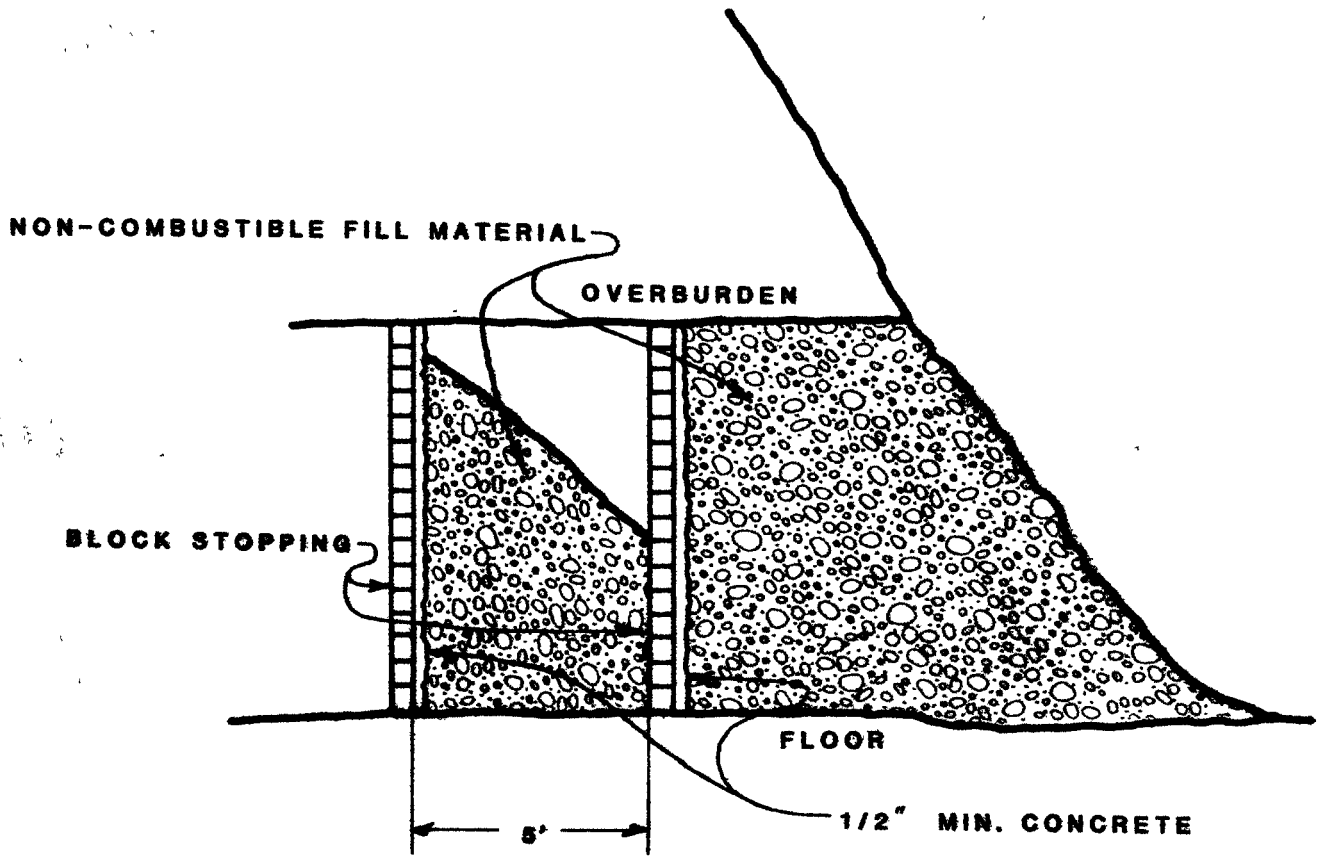
John L. Higgins, President

Figure 784.13-2 - NPDES Application Proof of Filing

BILL OF MATERIALS:

350 8" X 8" X 16" Solid Masonry Block at $1.03/Block

6 80# Sacks Mortar Mix at $3.10/Sack (1 sack:4cf)



NOTE: Prices and mortar volume assumptions are based on a 10/27/86 quote from Buener Block Co., 2800 South West Temple, Salt Lake City, Utah.

THIS DRAWING WAS PREPARED UNDER MY SUPERVISION:

BARBARA A. FILAS — DATE

REGISTERED PROFESSIONAL ENGINEER, UTAH NO. 7007

SUMMIT MINERALS, INC.	
PORTAL SEALING PLAN	
B.A.F. 10/27/86	784.13-1
Scale: 1":4'	
Ref. Dwgs.	

RECLAMATION PLAN APPENDIX

RECLAMATION PLAN AND BOND ESTIMATE

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REVISION 1 - 12/19/86

TABLE OF CONTENTS

SUMMIT MINERALS / RECLAMATION PLAN / TR 10/7/85

THE RECLAMATION OF THE SUMMIT MINERALS, INC. No. 1 COAL MINE IS BASED ON A TOTAL OF 14.41 DISTURBED ACRES. OF THOSE DISTURBED ACRES, 1.77 ACRES WILL BE LEFT TO SUPPORT POST MINING LAND USE. THE REMAINING 12.64 ACRES WILL BE RECLAIMED ACCORDING TO THIS PLAN.

CROSS SECTIONS SHOWING EXISTING AND RECLAIMED SURFACES ARE SHOWN ON PLATE No. 784.243 AND. REFERENCED ON PLATE NOS. 784.23-1 : 784.232. THE CUT-FILL BALANCE DEVELOPED PERSUANT TO THESE ROAD SECTIONS IS SHOWN ON PAGE 7 OF THE APPENDIX. SOME 25,300 LCY OF MATERIAL WILL BE MOVED TO ACHIEVE THE FINAL RECLAIMED CONFIGURATION SHOWN ON PLATE No. 784.23-2

THE SURFACE OWNERS HAVE INDICATED THAT THEY WISH TO HAVE ALL SITE IMPROVEMENTS SUCH AS BUILDINGS, THE BRIDGE OVER CHALK CREEK, THE CULVERT (IRRIGATION DITCH ONLY), AND THE ACCESS ROAD LEFT IN PLACE FOLLOWING RECLAMATION TO SUPPORT THE LAND USE OF GRAZING. THE BUILDINGS WILL BE USED TO SUPPORT RANCHING OPERATIONS AND THE ACCESS ROAD AND BRIDGE PROVIDE SITE ACCESS.

BACKFILLING AND GRADING WILL BE ACCOMPLISHED USING A CATERPILLAR D9U BULLDOZER. THE CONCRETE TIPPLE STRUCTURE IS THE ONLY SIGNIFICANT STRUCTURE WHICH IS RECLAIMED UNDER THIS PLAN. BECAUSE THIS STRUCTURE WAS APPARANTLY USED AS A COAL LOADING FACILITY AT ONE TIME, SOME COAL AND/OR COAL WASTE MATERIAL WAS SPILLED IN THE VICINITY OF THE TIPPLE. THERE IS NO REASON TO BELIEVE THAT THE EXTENT OF THE COAL MATERIAL IS GREATER THAN SURFACE SPILLAGE.

UNDER THIS PLAN, THE TIPPLE STRUCTURE WILL BE BROKEN UP AND BACKFILLED. DURING SITE GRADING, ANY COAL (BLACK) MATERIAL EXPOSED WILL BE BACKFILLED WITH THE CONCRETE, PRIMARILY IN THE EXISTING DEPRESSION SHOWN ON CROSS SECTION B-B' (PLATE 784.23-3). CONCRETE, COAL, AND ASPHALT WILL BE PLACED, THEN FILL MATERIAL PLACED ON TOP OF IT TO A MINIMUM THICKNESS OF FOUR FEET. BECAUSE FILL WILL BE PLACED WITH THE D9U, LIFTS WILL BE MINIMAL, AND SUCCESSIVE DOZING WILL COMPACT FILL MATERIAL INTO THE VOIDS CREATED BY BROKEN CONCRETE AND ASPHALT.

SHOULD THE EXTENT OF COAL MATERIAL IN THE TIPPLE AREA BE GREATER THAN ANTICIPATED, IT WILL STILL BE DISPOSED OF IN THE MANNER PREVIOUSLY DESCRIBED. CUT-FILL VOLUMES WILL INCREASE, BUT DUE TO THE CONSERVATIVE ASSUMPTIONS MADE IN THE BACKFILLING AND GRADING BOND ESTIMATE, THE TOTAL BOND AMOUNT OF $106,312 SHOULD BE ADEQUATE TO COVER THE UNANTICIPATED VOLUMES.

REVISION 1 - 12/19/86

THE RECLAMATION OF THE SUMMIT MINERALS, INC. No. 1 COAL MINE IS BASED ON A TOTAL OF 14.41 DISTURBED ACRES. OF THOSE DISTURBED ACRES, 1.77 ACRES WILL BE LEFT TO SUPPORT THE POST MINING LAND USE. THE REMAINING 12.64 ACRES WILL BE RECLAIMED ACCORDING TO THIS PLAN.

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BACKFILLING AND GRADING WILL BE ACCOMPLISHED USING A CATERPILLAR D9L BULLDOZER. THE CONCRETE TIPPLE STRUCTURE IS THE ONLY SIGNIFICANT STRUCTURE WHICH IS RECLAIMED UNDER THIS PLAN. BECAUSE THIS STRUCTURE WAS APPARANTLY USED AS A COAL LOADING FACILITY AT ONE TIME, SOME COAL AND/OR COAL WASTE MATERIAL WAS SPILLED IN THE VICINITY OF THE TIPPLE. THERE IS NO REASON TO BELIEVE THAT THE EXTENT OF THE COAL MATERIAL IS GREATER THAN SURFACE SPILLAGE.

UNDER THIS PLAN, THE TIPPLE STRUCTURE WILL BE BROKEN UP AND BACKFILLED. DURING SITE GRADING, ANY COAL (BLACK) MATERIAL EXPOSED WILL BE BACKFILLED WITH THE CONCRETE, PRIMARILY IN THE EXISTING DEPRESSION SHOWN ON CROSS SECTION B-B' (PLATE 784.23-3). CONCRETE, COAL, AND ASPHALT WILL BE PLACED, THEN FILL MATERIAL PLACED ON TOP OF IT TO A MINIMUM THICKNESS OF THREE FEET. BECAUSE FILL WILL BE PLACED WITH THE D9L, LIFTS WILL BE MINIMAL, AND SUCCESSIVE DOZING WILL COMPACT FILL MATERIAL INTO THE VOIDS CREATED BY BROKEN CONCRETE AND ASPHALT.

SHOULD THE EXTENT OF COAL MATERIAL IN THE TIPPLE AREA BE GREATER THAN ANTICIPATED, IT WILL STILL BE DISPOSED OF IN THE MANNER PREVIOUSLY DESCRIBED. CUT-FILL VOLUMES WILL INCREASE. BUT DUE TO THE CONSERVATIVE ASSUMPTIONS MADE IN THE BACKFILLING AND GRADING BOND ESTIMATE, THE TOTAL BOND AMOUNT OF $106,312 SHOULD BE ADEQUATE TO COVER THE UNANTICIPATED VOLUMES.

REVISION 1 - 12/10/01

THE RECLAMATION OF THE SUMMIT MINERALS, INC. NO. 1 COAL MINE IS BASED ON A TOTAL OF 14.41 DISTURBED ACRES. OF THOSE DISTURBED ACRES, 1.77 ACRES WILL BE LEFT TO SUPPORT THE POST MINING LAND USE. THE REMAINING 12.64 ACRES WILL BE RECLAIMED ACCORDING TO THIS PLAN.

CROSS SECTIONS SHOWING EXISTING AND RECLAIMED SURFACES ARE SHOWN ON PLATE NO. . AND REFERENCED ON PLATE NOS. . THE CUT-FILL BALANCE DEVELOPED PERSUANT TO THESE CROSS SECTIONS IS SHOWN ON PAGE OF THIS APPENDIX. SOME 25,300 LCY OF MATERIAL WILL BE MOVED TO ACHIEVE THE FINAL RECLAIMED CONFIGURATION SHOWN ON PLATE NO. .

THE SURFACE OWNERS HAVE INDICATED THAT THEY WISH TO HAVE ALL SITE IMPROVEMENTS SUCH AS BUILDINGS, THE BRIDGE OVER CHALK CREEK, THE CULVERT (IRRIGATION DITCH ONLY), AND THE ACCESS ROAD LEFT IN PLACE FOLLOWING RECLAMATION TO SUPPORT THE LAND USE OF GRAZING. THE BUILDINGS WILL BE USED TO SUPPORT RANCHING OPERATIONS AND THE ACCESS ROAD AND BRIDGE PROVIDE SITE ACCESS.

BACKFILLING AND GRADING WILL BE ACCOMPLISHED USING A CATERPILLAR D9L BULLDOZER. THE CONCRETE TIPPLE STRUCTURE IS THE ONLY SIGNIFICANT STRUCTURE WHICH IS RECLAIMED UNDER THIS PLAN. BECAUSE THIS STRUCTURE WAS APPARENTLY USED AS A COAL LOADING FACILITY AT ONE TIME, SOME COAL AND/OR COAL WASTE MATERIAL WAS SPILLED IN THE VICINITY OF THE TIPPLE. THERE IS NO REASON TO BELIEVE THAT THE EXTENT OF THE COAL MATERIAL IS GREATER THAN SURFACE SPILLAGE.

UNDER THIS PLAN, THE TIPPLE STRUCTURE WILL BE BROKEN UP AND BACKFILLED. DURING SITE GRADING, ANY COAL (BLACK) MATERIAL EXPOSED WILL BE BACKFILLED WITH THE CONCRETE, PRIMARILY IN THE EXISTING DEPRESSION SHOWN ON CROSS SECTION B-B' (PLATE 784.13-3). CONCRETE, COAL, AND ASPHALT WILL BE PLACED, THEN FILL MATERIAL PLACED ON TOP OF IT TO A MINIMUM THICKNESS OF THREE FEET. BECAUSE FILL WILL BE PLACED WITH THE D9L, LIFTS WILL BE MINIMAL, AND SUCCESSIVE DOZING WILL COMPACT FILL MATERIAL INTO THE VOIDS CREATED BY BROKEN CONCRETE AND ASPHALT.

SHOULD THE EXTENT OF COAL MATERIAL IN THE TIPPLE AREA BE GREATER THAN ANTICIPATED, IT WILL STILL BE DISPOSED OF IN THE MANNER PREVIOUSLY DESCRIBED. CUT-FILL VOLUMES WILL INCREASE, BUT DUE TO THE CONSERVATIVE ASSUMPTIONS MADE IN THE BACKFILLING AND GRADING BOND ESTIMATE, THE TOTAL BOND AMOUNT OF $99,822 SHOULD BE ADEQUATE TO COVER THE UNANTICIPATED VOLUMES.

THE HIGHWALL WHICH TRAVERSES MUCH OF THE SOUTHERN EXTENT OF THE DISTURBED AREA WILL NOT BE REGRADED. AS SHOWN ON PLATE NO. 784.23-2, THE TOE OF THE HIGHWALL WILL BE GRADED TO PROVIDE A UNIFORM CONTACT BETWEEN THE STEEP UNDISTURBED SLOPES AND THE MODERATE RECLAIMED SLOPES.

FIGURE RP-1 SHOWS THE SOUTHWESTERN END OF THE HIGHWALL. JUDGING BY THE APPARENTLY UNDISTURBED VEGETATION STAND ABOVE THE HIGHWALL, THIS HIGHWALL MAY BE A NATURALLY OCCURRING FEATURE.

FIGURE RP-1 : SOUTHWESTERN END OF HIGHWALL, LOOKING SOUTHWEST

FIGURE RP2 SHOWS THE SOUTHEASTERN EXTENT OF THE HIGHWALL. THE PHYSICAL GAP BETWEEN THE LEFT SIDE OF FIGURE RP.1 AND THE RIGHT SIDE OF FIGURE RP-2 IS APPROXIMATELY 30-40 FEET. THERE IS OBVIOUSLY SOIL DISTURBANCE ABOVE THIS HIGHWALL, BUT VOLENTEER VEGETATION IS FAIRLY WELL ESTABLISHED.

BEDDING PLANES IN THIS AREA DIP WESTERLY AT APPROXIMATELY 17° (783.14-4), AND THIS HIGHWALL TRENDS NW-SE. AS SUCH, THE SOIL-ROCK CONTACT ZONE IS DIPPING INTO THE MOUNTAINSIDE, LENDING STABILITY TO THE CONTACT. THIS

CONTACT IS WELL SHOWN IN FIGURE RP-2.

FIGURE RP-2 : SOUTHEASTERN END OF HIGHWALL, LOOKING SOUTH

BY COMPARING THE UNDISTURBED SOIL CONTACT IN FIGURE RP-1 TO THE DISTURBED CONTACT IN FIGURE RP-2, SURFACE SLOPES OF THE DISTURBED CONTACT DO NOT APPEAR EXCESSIVE. UNDER THIS PLAN, THE DISTURBED CONTACT ZONE WILL BE REVEGETATED ACCORDING TO THE PLAN FOR SLOPES GREATER THAN 15%. (ALL WORK IS DONE BY HAND). REVEGETATION HANDWORK CAN BE ACCOMPLISHED WITHOUT DESTROYING THE EXISTING STAND OF VEGETATION. AFTER FERTILIZER, SEED, MULCH, NETTING AND TRANSPLANTS ARE IN PLACE, THE SOIL IN THIS CONTACT ZONE, WITH THE ADDITIONAL VEGETATIVE COVER, WILL BE AT LEAST AS STABLE (PROBABLY MORE STABLE DUE TO THE LESSER SLOPE) AS THE UNDISTURBED CONTACT SHOWN IN FIGURE .

REVEGATATION OF UNACCESSABLE SLOPES GREATER THAN 15% WILL BE ACCOMPLISHED BY HAND IN ACCORD WITH THE REVEGETATION PLAN. THE DISTURBED UP-SLOPES OF THE SAND AND GRAVEL EXCAVATION (THE SOUTHERNMOST PORTION OF THE DISTURBED AREA) WILL BE MANIPULATED BY HAND ONLY. NO FORMAL GRADING IS PROPOSED EXCEPT FOR THE FILL IN THE TOE AREA. THE PRE-DISTURBANCE CONFIGURATION OF THIS AREA WAS AN ALLUVIAL FAN - ie STEEPLY SLOPING

UP-SLOPES, FANNING OUT TO A MORE GRADUAL SLOPE ON THE DOWN-SLOPES. BY LEAVING THE STEEPER UP-SLOPES, AND BACKFILLING THE DOWN-SLOPES TO ABOUT 3H:1V (PLATE No. 784.23-2), THE ORIGINAL CONTOUR IS APPROXIMATED. THE MULCH AND POLYPROPELENE NETTING TO BE USED ON THE STEEPER SLOPES WILL PROVIDE FOR SOIL STABILIZATION UNTIL A STAND OF VEGETATION IS ESTABLISHED.

RECLAMATION SCHEDULE

END SEPTEMBER	WEEK 1	BULLDOZER / BACKFILLING & GRADING 980 LOADER / SED. POND EXCAVATION 913 LOADER / REOPEN PORTAL, SCRAP CUTTING TORCH / SCRAP STEEL JACKHAMMER / CONCRETE DEMOLITION LABORERS (2) / SCRAP, PORTAL SEAL SUPERVISOR (1) / 7 MAN CREW
	WEEK 2	BULLDOZER / BACKFILLING & GRADING 980 LOADER / SED POND EXCAVATION LABORERS (2) / SCARIFY SLOPES > 15% SUPERVISOR (1) / 4 MAN CREW
	WEEK 3	BULLDOZER / FINAL GRADING, RIPPING 980 LOADER / SED. POND, RIPRAP BACKHOE / DIVERSION DITCHES LABORERS (2) / RIPRAP, FERTILIZE SLOPES SUPERVISOR (1) / 5 MAN CREW
MID OCTOBER	WEEK 4	TRACTOR / DISC, FERTILIZE SEED, CRIMP HELPER / FERTILIZE, SEED - TRACTOR PICKUP TRUCK / HAYBLOWER HELPER / HAYBLOWER LABORERS (2) / HANDWORK, SEED, MULCH SUPERVISOR (1) / 2-5 MAN CREW
	WEEK 5	LABORERS (2) / HANDWORK, NET SUPERVISOR (1) / 2 MAN CREW
EARLY SPRING	WEEK 6	LABORERS / TRANSPLANT SEEDLINGS SUPERVISOR / CREW AS REQUIRED

NOTE: FLOWS INTO THE SEDIMENTATION POND WILL BE MONITORED UNTIL SUCH TIME THAT THE WATER WILL MEET APPLICABLE STATE AND FEDERAL REQUIREMENTS FOR A RECEIVING STREAM. AT THAT TIME, THE POND AND DIVERSIONS WILL BE RECLAIMED ACCORDING TO THE PLAN (PP. RP-23, 24). VEGETATION WILL BE MONITORED AS DESCRIBED IN THE REVEGETATION APPENDIX CONTAINED IN THIS DOCUMENT.

REVISION 1 - 12/19/86

UP-SLOPES, FANNING OUT TO A MORE GRADUAL SLOPE ON THE DOWN-SLOPES. BY LEAVING THE STEEPER UP-SLOPES, AND BACKFILLING THE DOWN-SLOPES TO ABOUT 3H:1V (PLATE No. 784.23-2), THE ORIGINAL CONTOUR IS APPROXIMATED. THE MULCH AND POLYPROPELENE NETTING TO BE USED ON THE STEEPER SLOPES WILL PROVIDE FOR SOIL STABILIZATION UNTIL A STAND OF VEGETATION IS ESTABLISHED.

BECAUSE THE DISTURBED COAL MINE AREA HAS BEEN USED FOR THE EXCAVATION OF GRAVELS, THERE IS GRAVEL AVAILABLE ON SITE FOR USE AS RIPRAP. A D_{50} = 3 INCH IS READILY AVAILABLE IN SUITABLE QUANTITIES ON SITE FOR ALL RIPRAP REQUIREMENTS. COSTS FOR RIPRAP IS NOT INCLUDED IN THE BOND ESTIMATE, AS A RESULT. EQUIPMENT COST FOR RIPRAP EXCAVATION AND PLACEMENT, AS WELL AS LABOR COST FOR RIPRAP PLACEMENT IS INCLUDED IN THE BOND ESTIMATE.

RECLAMATION SCHEDULE

END SEPTEMBER	WEEK 1	BULLDOZER / BACKFILLING & GRADING 980 LOADER / SED. POND EXCAVATION 913 LOADER / REOPEN PORTAL, SCRAP CUTTING TORCH / SCRAP STEEL JACKHAMMER / CONCRETE DEMOLITION LABORERS (2) / SCRAP, PORTAL SEAL SUPERVISOR (1) / 7 MAN CREW
	WEEK 2	BULLDOZER / BACKFILLING & GRADING 980 LOADER / SED. POND EXCAVATION LABORERS (2) / SCARIFY SLOPES >16% SUPERVISOR (1) / 4 MAN CREW
	WEEK 3	BULLDOZER / FINAL GRADING, RIPPING 980 LOADER / SED POND, RIPRAP BACKHOE / DIVERSION DITCHES LABORERS (2) / RIPRAP, FERTILIZE SLOPES SUPERVISOR (1) / 5 MAN CREW
MID OCTOBER	WEEK 4	TRACTOR / DISC, FERTILIZE SEED, CRIMP HELPER / FERTILIZE, SEED TRACTOR PICKUP TRUCK / HAYBLOWER HELPER / HAYBLOWER LABORERS (2) / HANDWORK, SEED, MULCH SUPERVISOR (1) / 2-5 MAN CREW
	WEEK 5	LABORERS (2) / HANDWORK, NET SUPERVISOR (1) / 2 MAN CREW
EARLY SPRING	WEEK 6	LABORERS / TRANSPLANT SEEDLINGS SUPERVISOR / CREW AS REQUIRED

DISTURBED AREA ACRES (SEE PLATE NO.)

C	9.77 Ac		14.41 AC
3'	3.10 Ac	ACCESS (S)	(0.32 AC)
POND	0.29 AC	ACCESS (E)	(0.93 AC)
ACCESS (S) OF EXISTING	0.32 AC	ACCESS ON EXIST AREA	(0.28 AC)
ACCESS (E) OF SOUTH	0.93 AC	BLDGS	(0.25 AC)

TOTAL DISTURBED = 14.41 AC. TOTAL TO RECLAIM = 12.64 AC

OF 12.64 ACRES: 3.61 ACRES > 15% SLOPES

9.03 ACRES < 15% SLOPES

AREA OF BUILDINGS:

So. BLDG	120 X 35	4200
	30 X 20 X 2	1200
	35 X 20	700
No. BLDG	135 X 25	3375
	15 X 20	300
	20 X 25	500
SM. BLDG	10 X 15	150

10,425 ≅ 0.24 AC

AREA OF ACCESS ROAD ON PAD AREA:

ACCESS ROAD	420 X 16	6720
HEADING EAST	250 X 10	2500
HEADING WEST	300 X 10	3000

12,220 ≅ 0.28 AC

MATERIAL BALANCE

SECTION	CUT					FILL		
	AREA (SQIN)	ADJ (FT)(1)	BANK VOL (CY)	LOOSE VOL (CY)(3)	PLACED VOL (CY)(3)	AREA (SQIN)	ADJ (FT)(2)	PLACED VOL (CY)
A-A'	2.41/5	80	3570	4463	3927	0.43/5	70	557
B-B'	5.15/5	80	7630	9538	8393	6.07/5	90	10117
C-C'	1.70/5	130	4093	5116	4502	0.78/5	120	1733
D-D'	—	—	—	—	—	2.26/5	85	3557
E-E'	—	—	—	—	—	0.61/5	95	1073
ASPHALT	30'X50'X1/12'		5	7	7			
CONCRETE	60'X50'X4'		444	622	622			
X-X'						0.19/5	50	176

TOTAL VOLUME = 17,450 PCY TOTAL VOLUME = 17,213 PCY

CLOSE ENOUGH...

(1) SECTION Y-Y', PLATE , THIS DOCUMENT

(2) SECTION Z-Z', PLATE , THIS DOCUMENT

NOTE: SED. POND EVALUATED SEPARATELY, PAGE .

(3) SURFACE MINING, E. P. PFLEIDER, ED., 1968, TABLE 8.3-1, p 466.

SUMMIT MINERALS, INC BACKFILLING & GRADING BAF 10/3/86 pp-7

SEDIMENTATION POND

EXCAVATION REQUIRED = 9764 BCY (SEE PLATE NO. 784.23-3)

9764 BCY = 12205 LCY (3) = 10740 PCY (3)

ADJACENT SPOIL PILE = 5208 PCY (SEE PLATE NO 784.23-3)

5208 PCY = 5918 LCY (3) 5532 PCY = 6287 LCY (3)

EXCESS SPOIL = 5532 PCY

EXCESS SPOIL WILL BE PLACED AT THE TOE OF THE GRAVEL PIT AND GRADED AT A 3:1 SLOPE. THIS WILL PROVIDE ADDITIONAL STABILIZATION OF THE PIT SLOPE, AS WELL AS APPROXIMATING THE CONTOUR OF THE ORIGINAL ALLUVIAL FAN.

EXISTING SLOPES ARE APPROXIMATELY 61.1% AND REGRADED SLOPES WILL BE APPROXIMATELY 5.6% (SEE 4.3 HYDROLOGIC EVALUATION). BACKFILL WILL BE PLACED AT A 3:1 SLOPE. THE SPAN OF THE FILL WILL BE ABOUT 80 FEET, SO:

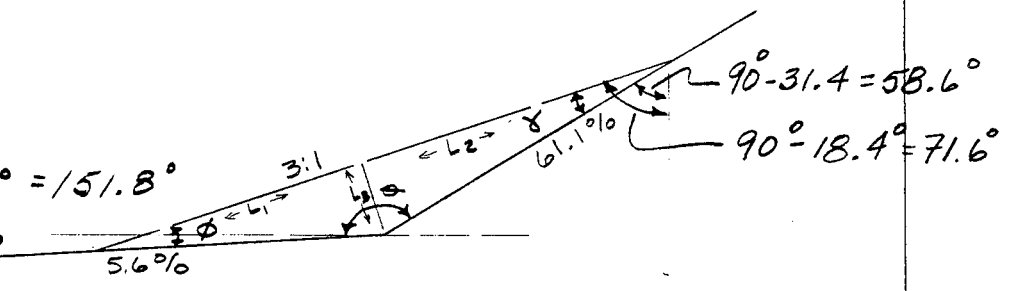
$\tan^{-1}(0.611) = 31.4°$

$\tan^{-1}(0.056) = 3.2°$

$\theta = 180° - 31.4° - 3.2° = 151.8°$

$\gamma = 71.6° - 58.6° = 13.0°$

$\phi = 180° - 151.8° - 13.0° = 15.2°$



$$5532 = \frac{(L_1 L_3/2 + L_2 L_3/2)80}{27}$$

$L_1 = L_3/\tan\phi = 3.68 L_3 \quad L_2 = L_3/\tan\gamma = 4.33 L_3$

$5532(27) = 40(3.68)L_3^2 + 40(4.33)L_3^2$

$L_3 = 21.6$ FT $\Rightarrow L_1 = 79.5$ FT $\Rightarrow L_2 = 93.5$ FT

HORIZ EXTENT = $173\cos(\tan^{-1}(1/3)) = 164$ FT

(AS PLOTTED ON PLATE 784.23-4)

RECLAMATION EQUIPMENT

1 CATERPILLAR D9L BULLDOZER W/ 3 SHANK REAR RIPPER

1 CATERPILLAR 980 WHEEL LOADER

1 EIMCO 913 PERMISSABLE - DIESEL - WHEEL LOADER

1 JACK HAMMER

1 ACETYLENE TORCH

1 48 HP BACKHOE

EARTHMOVING REQUIREMENT - BULLDOZER

FROM CUT - FILL BALANCE	19117	CY (LOOSE)
ADDITIONAL FROM SED. POND	5532	CY (LOOSE)
CONCRETE & ASPHALT	629	CY (LOOSE)
	25278	CY (LOOSE)

AVG HAUL DISTANCE $\cong$ 400 FT (SEE CROSS-SECTIONS, PLATE)

THE FOLLOWING ASSUMPTIONS ARE BASED ON THE METHODS DESCRIBED IN "CATERPILLAR PERFORMANCE HANDBOOK", EDITION 8, CATERPILLAR TRACTOR CO, PEORIA IL, OCTOBER 1977.

ESTIMATED DOZING PRODUCTION = 430 LCY/HR

JOB CONDITION CORRECTION FACTORS:

- AVERAGE OPERATOR 0.75
- MATERIAL SHOULD BE EASILY DOZED 1.00
- EFFICIENCY - 50 MIN/HR 0.84
- GRADE - 5.6% UPHILL 0.92

NOTE - "SURFACE MINING", PFLEIDER, ED, 1968, TABLE 8.3-1, MATERIAL WEIGHT OF MOIST LOAM ≅ 2080 - 2250 LB/CY - LOOSE. CAT CURVES ASSUME A LOOSE DENSITY OF 2300 LB/CY. NO DENSITY CORRECTION WILL BE USED.

PRODUCTION CORRECTION: $(430\ LCY/HR)(0.75)(0.84)(0.92) = 249\ LCY/HR$

$$\frac{25{,}278\ LCY}{(249\ LCY/HR)(8\ HR/DA)} = 12.7\ DA$$

TO INCLUDE RIPPING TIME,

USE: 3 WEEKS - BULLDOZER REQUIREMENT

SEDIMENTATION POND EXCAVATION - 980 LOADER

VOLUME TO BE PLACED IN ADJACENT SPOIL PILE = 5918 LCY

VOLUME TO BE PLACED AT TOE OF GRAVEL PIT = 6287 LCY

AVG. HAUL DISTANCE TO ADJACENT SPOIL PILE ≅ 300 FT

AVG. HAUL DISTANCE TO TOE OF GRAVEL PIT ≅ 800 FT

USE: 6000 LCY AT 300 FT

USE: 6300 LCY AT 800 FT

THE FOLLOWING ASSUMPTIONS ARE BASED ON THE METHODS DESCRIBED IN "CATERPILLAR PERFORMANCE HANDBOOK", EDITION 8, CATERPILLAR TRACTOR CO., PEORIA IL. OCTOBER 1977.

BASIC CYCLE TIME	0.40 MIN
BANK MATERIAL	0.04
INCONSISTENT OPERATION	0.04

TOTAL MANEUVER, LOAD, DUMP TIME = 0.48 MIN

HAUL DISTANCE = 300 FT AT APPROX. 8% GRADE
(DESIGN GRADE OF ROADWAY OUT OF SED. POND)

LOADED (8% GRADE)	0.38 MIN
EMPTY (USE MIN. CURVE)	0.27

TOTAL HAUL TIME TO SPOIL PILE = 0.65 MIN

HAUL DISTANCE = 800 FT AT APPROX. 6% GRADE
(DESIGN GRADE OF ROADWAY OUT OF SED POND = 8%;
RECLAIMED SURFACE APPROX. GRADE = 5.6%)

LOADED (6% GRADE)	0.77 MIN
EMPTY (USE MIN. CURVE)	0.53

TOTAL HAUL TIME TO BASE OF PIT = 1.30 MIN

USE: CYCLE TIME (300 FT) = 1.13 MIN

USE: CYCLE TIME (800 FT) = 1.78 MIN

EFFICIENCY FACTORS:

BUCKET FILL	0.95
AVG. OPERATOR	0.75
50 MIN. HRS.	0.83

USE 5.5 CY BUCKET

TIME REQUIRED :

$$\frac{(5.5\ LCY/CYC)(0.75)(8\ HR/DA)(0.83)(60\ MIN/HR)(0.75)}{1.13\ MIN/CYC}$$

$$= 1,382\ LCY/DA$$

$$\frac{6000\ LCY}{1,382\ LCY/DA} = 4.4\ DA$$

$$\frac{(5.5\ LCY/CYC)(0.95)(8HR/DA)(0.83)(60\ MIN/HR)(0.75)}{1.78\ MIN/CYC}$$

$$= 877\ LCY/DA$$

$$\frac{6300\ LCY}{877\ LCY/DA} = 7.2\ DA$$

INCLUDE TIME FOR RIPRAP PLACEMENT,

USE 3 WEEKS - 980 LOADER REQUIREMENT

DIVERSION DITCH EXCAVATION - 48 HP BACKHOE

DITCH NO.	LENGTH	VOL. OF EXC.	TOTAL VOL.
No.1	928	3CF/F	103 CY
No.2	1075	4CF/F	159 CY
No.3	380	3CF/F	42 CY
No.4	655	3CF/F	73 CY /377

1986 MEANS : 48 HP BACKHOE FOR DRAINAGE DITCH EXCAVATION - PRODUCTIVITY = 90 CY/DA ⇒ 4.2 DA

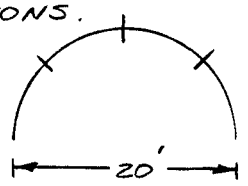
USE 1 WEEK - BACKHOE REQUIREMENT

SCRAP STEEL DISPOSAL - PERMISSIBLE LOADER

AN EIMCO 913 DIESEL POWERED PERMISSIBLE WHEEL LOADER WILL BE USED FOR SCRAP STEEL DISPOSAL. ALL SCRAP STEEL AND MISCELLANEOUS DEBRIS WILL BE PUT INSIDE THE REOPENED MINE PORTAL PRIOR TO ITS PERMENANT CLOSURE (SEE DESCRIPTION IN PART 784.13 OF THIS DOCUMENT). ALL STEEL WILL BE CUT TO MANEUVERABLE SIZES (NOMINAL 5'X8' SECTIONS), LOADED INTO THE BUCKET, AND TRANSPORTED DIRECTLY INSIDE THE MINE PORTAL.

AMOUNT OF CUTTING REQUIRED:

APPROX. 4 STEEL ARCHES
ASSUME EACH IS 20 FT DIA, 35FT LONG
CUT LENGTHWISE INTO 4 SECTIONS.



L-CUTS - $35(3) = 105$ LF

$4(105) = 420$ LF

VERTICAL CONVEYORS
ASSUME EACH IS 40FT LONG AND 3 FT DIA.

PROBABLY NO CUTTING REQUIRED

INCLUDING MISC. SCRAP AND CONTINGENCIES,

ASSUME: 1000 LF OF STEEL TO CUT

ASSUME WELDER AND TORCH ON SITE FOR 1-40 HR WEEK

$$\frac{1000\ LF}{(40\ HR)(50\ MIN/HR)} = 0.50\ LF/MIN$$ OK

VERY CONSERVATIVE!

EIMCO 913 LOADER IS RATED AT APPROX. 100 HP (PER EIMCO MINING MACHINERY INTERNATIONAL - 537 W 600 S, SALT LAKE CITY, UT). FOR COST PURPOSES, IT WILL BE COMPARED WITH A CATERPILLAR 930 WHEEL LOADER, WHICH ALSO HAS A 100 HP RATING.

THE LOADER WILL EASILY BE ABLE TO KEEP UP WITH THE CUTTING UP OF SCRAP STEEL, PRELIMINARY WORK WILL INCLUDE EXCAVATING (REOPENING) MINE PORTAL.

USE: 1 WEEK - LOADER REQUIREMENT

USE: 1 WEEK - ACETYLENE TORCH

IT IS EXPECTED THAT THE CONCRETE AND ASPHALT DEMOLITION CAN BE ACCOMPLISHED WITH THE HEAVY EQUIPMENT ALREADY DISCUSSED. FOR THE PURPOSE OF A PRUDENT ESTIMATE, WE WILL INCLUDE A COST FOR HAVING A JACKHAMMER FOR TWO DAYS...

USE: 2 DAYS - JACKHAMMER

AFTER ALL BACKFILLING AND GRADING IS ACCOMPLISHED, A 3 SHANK REAR RIPPER WILL BE USED ON THE D9U FOR SCARIFYING - SEED BED PREPARATION. IT IS EXPECTED THAT THE SOIL WILL BE EASILY RIPPED AND CAN BE DONE IN ONE OR TWO DAYS. DUE TO THE CONSERVATIVE ESTIMATE OF BULLDOZER TIME REQUIREMENT, THE 3 WEEK VALUE WILL NOT BE CHANGED. THE RIPPER IS ASSUMED ON SITE FOR ONE WEEK.

USE: 1 WEEK - RIPPER REQUIREMENT

BACKFILLING AND GRADING COST (INCL. SOIL SCARIFICATION)

EQUIPMENT	TIME REQ'D	EQ. COST	OP. COST	OPERATOR[1]	TOTAL COST	COMMENTS
DOZER	3 WK	16,455/MO[2]	43.75/HR[2]	238.80/DA	25,287	
RIPPER	1 WK	705/WK[2]	3.00/HR[2]	INCLUDED	825	DOZER OPERATOR
BACKHOE	1 WK	171.60/DA[1]	INCLUDED[1]	238.80/DA	2,052	
TORCH	1 WK	18.00/WK[1]	0.05/HR[1]	272.80/DA	1,384	
J'HAMMER	2 DA	4.81/HR[1]	INCLUDED	22.19/HR	432	
PERM. LOADER	1 WK	1310/WK[2]	9.95/HR[2]	238.80/DA	2,902	
980 LOADER	3 WK	9855/MO[2]	28.40/HR[2]	238.80/DA	16,845	
LABORER[3]	6 WK			184.40/DA	5532	2 LABORERS SLOPES & RIPRAP
FOREMAN	3 WK			207.60/DA	3114	

TOTAL B & G COST = $59,141

PORTAL SEAL MATERIALS[4] = $379

(1) MEANS COST DATA - 1986

(2) RENTAL RATE BLUE BOOK - 1986

(3) TWO GENERAL LABORERS FOR LOADING SCRAP AND MISC. DEBRIS. REOPENING AND BUILDING PERMENANT MINE SEALS WILL ALSO BE ACCOMPLISHED IN THIS TIME. RIPRAP, AVAILABLE ON SITE, WILL BE HAULED TO LOCATIONS ADJACENT TO DIVERSION DITCHES WITH THE 980 LOADER, AND HAND SPREAD IN THE DITCH CHANNELS. SEEDBED PREP. ON SLOPES >15%

CULVERTS AND DECANT

CORRUGATED PRICES PER R. LARSEN ARM 20, 155 N. 900 W. SALT LAKE CITY, QUOTED 10/22/86:

12"	$ 5.69/FT	
18"	8.36/FT	
24"	11.07/FT	
36"	16.53/FT	
18X24 REDUCER	106.00 EA	(6' TOTAL LENGTH)
18" 90-ELBOW	40.00 EA	

DECANT:

18"	NEED 82 FT @	$8.36/FT	686
24"	NEED 1 FT @	11.07/FT	11
36"	NEED 3 FT @	16.53/FT	50
18X24 REDUCER	NEED 1		106
18X18-90	NEED 1		40
4' (3) ANTI SEEP COLLAR	(ASSUME 20 EA)		60
			953

TOTAL PLUS 10% FABRICATION $1048 DECANT

CULVERT

12"	NEED 140 FT @	$5.69/FT	$797 CULVERT

EXISTING SEDIMENTATION POND RECLAMATION

THE EXISTING SEDIMENTATION POND, CONSTRUCTED BY A PREVIOUS OWNER/OPERATOR, IS LOCATED IN THE CHALK CREEK FLOOD PLAIN. IT APPEARS TO HAVE BEEN MISUSED AND THE SEDIMENTATION USES TO THE IMPOUNDING STRUCTURE. IT DOES NOT APPEAR STRUCTURALLY OR VOLUMETRICALLY ADEQUATE FOR USE AS A SEDIMENTATION POND DURING RECLAMATION ACTIVITIES. THE OPERATOR PROPOSES TO REUSE THIS POND CONSURRENTLY WITH SITE RECLAMATION. THUS, AND THE NEW POND SHOWN ON PLATE NO. 784.23-1 WILL BE CONSTRUCTED AND USED. THE SEDIMENTATION POND SHOWN ON PLATE NO. 784.23-2 IS TO BE REMOVED AND RESEEDED.

FIGURE 784.13-1 SHOWS THIS POND IN PLAN AND CROSS SECTION. IT IS EXPECTED THAT THIS STRUCTURE CAN BE BACKFILLED USING THE D7H BULLDOZER IN AN HOUR OR TWO. ALL THAT IS REQUIRED IS TO DOZE THE IMPOUNDING FILL MATERIAL INTO THE INCISED POND AREA. THIS IS A VERY MINOR JOB.

THE AREA OF THIS DISTURBANCE IS APPROXIMATELY 0.29 ACRES (REF. DWG NO. 783.16-1). BECAUSE IT IS LOCATED IN THE FLOOD PLAIN OF CHALK CREEK, NO SEDIMENTATION CONTROL STRUCTURES BEYOND THE EXISTING VEGETATIVE FILTER WILL BE USED. THIS AREA IS INCLUDED IN THE "SMALL AREA EXEMPTION" REQUEST ON PAGE 20 OF APPENDIX 784.14. THIS AREA IS INCLUDED AS A DISTURBED AREA SUBJECT TO REVEGETATION UNDER THE PLAN.

IT SHOULD BE NOTED THAT RECLAMATION OF THIS POND WILL INVOLVE BACKFILLING AND GRADING WITHIN THE STREAM BUFFER ZONE.

REVEGETATION EQUIPMENT

FORD 555A FARM TRACTOR WITH DISC, [illegible] DRILL, HAYBLOWER, [illegible]

TIME REQUIREMENT

TRACTOR / FERTILIZER SPREADER

ASSUME SPREAD WIDTH IS 8 FT, TRACTOR AT 4 MPH

$$8\,\text{FT}\ \frac{5280\,\text{FT}}{\text{MI}}\ \frac{4\,\text{MI}}{\text{HR}}\ \frac{1\,\text{AC}}{43560\,\text{FT}^2} = 3.88\ \text{AC/HR}$$

$$\left(\frac{9.03\,\text{AC}}{3.88\,\text{AC/HR}}\right)\left(\frac{50\,\text{MIN}}{60\,\text{MIN}}\right)\left(\frac{\text{DA}}{8\,\text{HR}}\right) = \underline{0.24\,\text{DA}}$$

PICKUP TRUCK / HAYBLOWER - FERTILIZER

ASSUME BLOWER RANGE IS 50 FT. AREA COVERED PER STOP = $\pi(50)^2 \cong 7800$ SF

$$\left(\frac{4000\,\text{LB}}{\text{AC}}\right)\left(\frac{\text{AC}}{43560\,\text{SF}}\right)\left(\frac{7800\,\text{SF}}{\text{STOP}}\right)\left(\frac{\text{SF-E}}{65\,\text{LB}}\right) = 11\ \text{BALES/STOP}$$

ASSUME 10 MIN TO BREAK UP 11 BALES AND FEED BLOWER AND MOVE 100 FT

ASSUME 50 MIN HOURS AND 8 HOUR DAY

$$(9.03\,\text{AC})\left(\frac{43560\,\text{FT}^2}{\text{AC}}\right)\left(\frac{\text{STOP}}{7800\,\text{FT}^2}\right)\left(\frac{10\,\text{MIN}}{\text{STOP}}\right)\left(\frac{\text{HR}}{50\,\text{MIN}}\right)\left(\frac{\text{DA}}{8\,\text{HR}}\right)$$

$$= \underline{1.26\,\text{DA}}$$

TRACTOR / DISC

ASSUME DISC WIDTH IS 10 FT, TRACTOR AT 4 MPH

$$(10\,\text{FT})\left(\frac{5280\,\text{FT}}{\text{MI}}\right)\left(\frac{4\,\text{MI}}{\text{HR}}\right)\left(\frac{1\,\text{AC}}{43560\,\text{FT}^2}\right) = 4.85\ \text{AC/HR}$$

$$\left(\frac{9.03\ AC}{4.85\ AC/HR}\right)\left(\frac{50\ MIN}{60\ MIN/HR}\right)\left(\frac{DA}{8\ HR}\right) = \underline{0.19\ DA}$$

TRACTOR / RANGELAND DRILL

ASSUME DRILL CAPACITY IS 10 FT, TRACTOR AT 4 MPH

$= \underline{0.19\ DA}$

PICKUP TRUCK / HAY BLOWER - MULCH

$$\left(\frac{2000\ LB}{TON}\right)\left(\frac{TON}{2000\ LB}\right)\left(\frac{7800\ FT^2}{STD}\right)\left(\frac{BALE}{250\ FT^2}\right) = 5.5\ BALES$$

ASSUME 6 MIN TO BREAK UP 5.5 BALES AND FEED BLOWER PER MILE TRIP. ALSO 50 MIN PER AND REFUEL.

$$\therefore\ 9.03\ AC\left(\frac{43560\ FT^2}{1\ AC}\right)\left(\frac{STD}{7800\ FT^2}\right)\left(\frac{6\ MIN}{STD}\right)\left(\frac{HR}{50\ MIN}\right)\left(\frac{DA}{8\ HR}\right)$$

$= \underline{0.76\ DA}$

TRACTOR / CRIMPER (DISC)

ASSUME CRIMPER IS 10 FT, TRACTOR AT 4 MPH

$= \underline{0.19\ DA}$

IT IS ASSUMED THAT PICKUP TRUCKS ARE INCLUDED UNDER THE SUBCONTRACTORS OPERATING COST SINCE SITE ACCESS FOR LABORERS IS INCLUDED IN THIS COST.

TRACTOR REQUIREMENT = 0.81 DA

USE: 2 DA TRACTOR REQUIREMENT