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Valley Camp of Utah, Inc.

Mine Permit Renewal Application

Section R614-301-600 - Geology

Volume I

WORK COPY

December 1989 - Revised

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December 15, 1989

Ms. Sue Linner
Utah Division of Oil, Gas & Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Dear Ms. Linner:

As requested by Valley Camp of Utah, Inc., and as agreed upon in a joint meeting between UDOGM, Valley Camp of Utah, Inc., and Hansen, Allen & Luce, Inc., we are submitting directly to the Division of Oil, Gas and Mining 3 copies of the geology and hydrology permit sections and appendicies as required. The permit has been broken into five volumes within this submittal for your convenience. Volumes I and II include verbage related to Geology and Hydrology respectively. Volume III contains all maps and figures identified in sections 600 and 700 (except for those identified as confidential), and Volume IV includes appendices and references identified in the permit application (except for Appendix R614-301-622.100). Appendix R614-301-622.100 identified in Section 600 of the permit renewal (and marked confidential) is submitted as Volume V.

Should you have any questions, please call.

Sincerly,

David E. Hansen

David E. Hansen, Ph.D., P.E.
Vice-President

DEH/dh

cc: Steve Tanner - Valley Camp of Utah, Inc.

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R614-301-622.200m	Geologic/Hydrologic cross section P-P'	Volume V

R614-301-600. GEOLOGY.

R614-301-610. INRODUCTION.

A description of the geology and other related information is presented below for the Mine Permit area.

R614-301-611. thru 301-612. GENERAL REQUIREMENTS.

A description of the geology within and adjacent to the Mine Permit area is presented within Sections R614-301-621 through 301-627 and the proposed operation within the mine area is presented in Section R614-301-630. All maps, plans and cross sections required by R614-301-622 have been certified and are presented in their appropriate section.

R614-301-620. ENVIRONMENTAL DESCRIPTION.

The Mine Permit area is located on the northern end of the Wasatch Plateau to the south and southwest of the town of Scofield in central Utah. The geology map, R614-301-621a shows the location of the Mine Permit Area with respect to the town of Scofield. The Mine Permit Area lies in a rugged mountainous region characteristic of elevation ranges between approximately 7,800 feet to 10,200 feet above sea level. The Mine Permit Area is within the Wasatch Plateau coal field as well as partially within the Clear Creek gas field.

R614-301-621. ENVIRONMENTAL REQUIREMENTS.

The Mine Permit area lies in the northern end of the Wasatch Plateau, on the west flank of the Clear Creek Anticline (Doelling, 1972). As such, the dip of the strata is generally towards the west, ranging from about four to eight percent (two to five degrees).

With the exception of local alluvial deposits, all of the units exposed on and immediately adjacent to the Mine Permit Area are Cretaceous members of the Mesaverde Group. The Star Point Sandstone, which is exposed at the surface in the east canyons, is approximately 1000 feet thick and nearly devoid of shale (Doelling, 1972). This yellow-gray (salt and pepper) beach sandstone is massive and medium-grained (Spieker, 1931).

Immediately overlying the Star Point Sandstone is the Blackhawk Formation, an interbedded formation of sandstones and shales which is Utah's chief coal producer. The sands in this 1500-foot thick member are fine to medium grained and cemented by either calcite or silica with some iron discoloration. Sandstones of the Blackhawk Formation are more irregular than the sandstones of the Star Point. They also tend to be generally discontinuous in nature, local in extent, and have locally high clay contents (Spieker, 1931; Doelling, 1972). An exception to this is the Aberdeen Sandstone, a coarse-grained, light-colored sand with a thickness of 20 to 90 feet, which can be traced throughout the region (Spieker, 1931).

Spieker (1931) had identified three types of shale in the Blackhawk Formation, all continental in origin. The three types identified are, a common clay shale which is soft and granular, a carbonaceous shale, and a smoke-gray shale usually associated with local coal. As was the case with the sandstones, the shales are irregularly bedded (Spieker, 1931).

Most of the faults in the Mine Permit area have a northerly trend. The faults within the Blackhawk Formation occur basically as zones (Doelling, 1972) with individual slips usually being clean, sharp displacements with little gouge. Both major fault zones in the Mine Permit Area are downdropped to the west and tend to die out to the north (U.S. Geological Survey, 1979). However, some smaller faults have the opposite displacement and create local horsts and grabens. The Connelville Fault forms the western boundary of the Belina Permit Area with a drop which varies from 190 feet at the western central permit boundary to 75 feet near Eccles Canyon (U.S. Geological Survey, 1979). The other major fault in the area, the O'Connor Fault, extends through the center of the Belina Permit area and has a drop of about 350 feet (U.S. Geological Survey, 1979). The Pleasant Valley Fault generally runs parallel to Mud Creek and lies toward the western boundary of the Valcam Loadout Facility. General Geologic Map R614-301-621a is inserted to illustrate local geology.

MAP R614-301-621a

The dominant soils in the area are loamy and are moderately deep (20 to 40 inches) with thin, dark surface horizons (high in organic matter), medium-textured (loamy) surface layers, and moderately fine-textured (clay loam) subsoils. coarse fragment contents tend to be high (35 to 50 percent). A small portion of the area also consists of gravelly and stony colluvial slopes, rock outcrops, and very shallow soils.

R614-301-622. CROSS SECTIONS, MAPS AND PLANS.

The maps, plans and cross sections needed to clarify the geologic data required are presented within the appropriate section and were compiled utilizing the best information available. A summary of geologic mapping included within the permit is shown in Table R614-301-622a.

TABLE R614-301-622a
LIST OF GEOLOGIC MAPS

Map	Comments
R614-301-621a	Geneal Geologic Map.
R614-301-622.100a	Map showing location and elevation of drill holes and Coal seam thickness and depth, and Gas Well Locations.
R614-301-622.200a	Geologic Cross Sections, Coal Outcrop and Subsidence Monitoring Location Map.
R614-301-622.200b	Isopach Map of the Upper O'Connor Coal Seam.
R614-301-622.200c	Isopach Map from the bottom of the Upper O'Connor to the top of the Lower O'Connor.
R614-301-622.200d	Isopach Map of the Lower O'Connor Coal Seam.
R614-301-622.200e	Isopach Map from the top of the Upper O'Connor Coal Seam to the surface.

** R614-301-600. **

TABLE R614-301-622a (Continued)
LIST OF GEOLOGIC MAPS

Map	Comments
R614-301-622.200f	Stratigraphic Geologic cross section A-A'
R614-301-622.200g	Stratigraphic Geologic cross section B-B'
R614-301-622.200h	Stratigraphic Geologic cross section C-C'
R614-301-622.200i	Stratigraphic Geologic cross section D-D'
R614-301-622.200j	Geologic/Hydrologic cross section M-M'
R614-301-622.200k	Geologic/Hydrologic cross section N-N'
R614-301-622.200l	Geologic/Hydrologic cross section O-O'
R614-301-622.200m	Geologic/Hydrologic cross section P-P'

R614-301-622.100. TEST BORINGS AND CORE SAMPLINGS.

The location and elevation of all drill holes in the Mine Permit Area are shown on Map R614-301-622.100a and summarized in Table R614-301-622.100a. Drill hole logs are available for those holes identified by a "*" in the table. Selected drill hole log information has been provided as part of this permit renewal according to the request made by UDOGM during a meeting held on October 24, 1989. Logs selected for inclusion (as requested by DOGM and agreed by the applicant) in this mine permit include 73-24-1, 74-6-1, 75-6-1, 75-24-4, 75-25-3, 75-30-3, and 75-36-1. Copies of these well logs are identified as Figures R614-301-622.100a through 622.100g and are found in Appendix R614-301-622.100 (marked confidential). The applicant considers all information related to these well logs to be confidential, and therefore has submitted this appendix separately from the remaining appendicies of the mine permit.

MAP R614-301-622.100a

TABLE R614-301-622.100a
LIST OF EXPLORATION DRILL HOLES

	Drill Hole No.	Location	Elevation
**	73-24-1	T13S,R6E NENE Sec. 24	9255
	EC-3	T13S,R6E SENW Sec. 24	8763
	76-25-2	T13S,R6E SENW Sec. 24	8798
	76-24-1	T13S,R6E NESW Sec. 24	8767.8
	EC-4	T13S,R6E NESW Sec. 24	8854
	EC-5	T13S,R6E NESW Sec. 24	8857

** R614-301-600. **

TABLE R614-301-622.100a (Continued)
LIST OF EXPLORATION DRILL HOLES

	Drill Hole No.	Location	Elevation
	EC-2	T13S,R6E NESW Sec. 24	8790
**	75-24-4	T13S,R6E SESE Sec. 24	9432.7
	EC-7	T13S,R6E SESW Sec. 24	8904
	EC-6	T13S,R6E SESW Sec. 24	8862.4
*	76-24-1	T13S,R6E SESW Sec. 24	8850
*	75-25-2	T13S,R6E NENE Sec. 25	9379.4
	EC-1	T13S,R6E SWNW Sec. 25	9076
	76-25-2	T13S,R6E NESW Sec. 25	9506
**	75-25-3	T13S,R6E SWSE Sec. 25	9897
	74-25-1	T13S,R6E SWSW Sec. 25	9561
	76-25-1	T13S,R6E SWSW Sec. 25	9561
	76-36-1	T13S,R6E NWNW Sec. 36	9582
*	74-36-2	T13S,R6E SENW Sec. 36	9676
	75-31-2	T13S,R6E SENE Sec. 36	9195
*	75-36-2	T13S,R6E NESW Sec. 36	9939.5
	75-36-3	T13S,R6E SESE Sec. 36	9896.2
**	75-36-1	T13S,R6E SWSW Sec. 36	9872.3
	74-36-1	T13S,R6E SWSW Sec. 36	9873
	74-1-1	T14S,R6E NENE Sec. 1	9824
	74-1-2	T14S,R6E NENE Sec. 1	9810+
*	74-1-3	T14S,R6E NESE Sec. 1	8989
	73-19-1	T13S,R7E SWSW Sec. 19	9367.7
	75-30-1	T13S,R7E NWNW Sec. 30	9240
	75-30-2	T13S,R7E NWNW Sec. 30	9214
**	75-30-3	T13S,R7E NWNW Sec. 30	9179
	73-30-1	T13S,R7E NWSW Sec. 30	9476
	73-31-4	T13S,R7E SWSW Sec. 30	9195
	73-31-1	T13S,R7E SWNW Sec. 31	9276
	75-31-1	T13S,R7E SWNW Sec. 31	9423.1
	75-31-5	T13S,R7E SWSW Sec. 31	9730
**	75-6-1	T14S,R7E NENW Sec. 6	9918.6
**	74-6-1	T14S,R7E SWSW Sec. 6	9710
	75-7-1	T14S,R7E SWSW Sec. 7	9770
*	75-7-2	T14S,R7E SWSW Sec. 7	9823

* Drill holes for which log information is available.
** Drill holes for which log information is provided in Appendix R614-301-622.100 (marked confidential).
\+ Approximate Elevation.

R614-301-622.200. NATURE, DEPTH AND THICKNESS OF STRATUM.

Information relating to the size, shape, thickness, depth and other information relating to the coal seams is contained on Maps R614-301-622.100a, and R614-301-622.200a through 301-622.200m. Additional information is presented through geologic logs to be discussed in Section R614-301-624.310. Section R614-301-624.100 contains a detailed stratigraphic description of a representative geologic section.

MAPS R614-301-622.200a THRU 622.200m

R614-301-622.300. COAL STRIKE, DIP AND CROP LINES.

The outcrop zone of the coal is depicted on Geologic Cross Section Map R614-301-622.200a and is based on the best information available. The strike and dip differs in different parts of the Mine Permit Area. However, the typical dip within the mine is 2.1 degrees in approximately a 225 degree direction. Additional information can be found by reviewing the coal contours shown on the Belina 1 and 2 Progress Maps as well as through a review of the geologic cross sections presented in section R614-301-622.200.

R614-301-622.400. GAS AND OIL WELLS.

There are four gas wells, part of the Clear Creek gas field located within the Mine Permit Area. These four wells are all operated by Cordillera Corp. and only the most northern well, in Section 19, is currently producing. The other three are shut in at the present time. Well locations and depths are shown on Map R614-301-622.100a and summarized in Table R614-301-622.400a.

R614-301-623. ADDITIONAL GEOLOGIC INFORMATION.

The general geology of the Mine Permit Area is summarized in R614-301-621 and a more detailed stratigraphic description is given in R614-301-624.100. Additional information requested by this section is given within the applicable section to follow.

TABLE R614-301-622.400a
LOCAL GAS WELL DATA

LOCATION	DEPTH (ft)	STATUS	COMMENT
T13S, R7E, Sec. 19 NENW	4390	producing	producing from the Ferron
T13S, R7E, Sec. 30 SWSW	5820	shut-in	gas from the Ferron
T13S, R7E, Sec. 31 SWSW	9225	shut-in	gas from the Ferron
T14S, R7E, Sec. 6 SWSW	6222	shut-in	gas from the Ferron

R614-301-623.100. POTENTIALLY ACID OR TOXIC FORMING STRATA.

The rocks contained in the Blackhawk Formation, within which all units involved in the mining activity are a part, are made up of interbedded sandstone, sandy shale, shale and coal. Data available at this time does not suggest that there are any chemical problems with any of these rock types which would be potentially acid or toxic forming.

There has been no data assembled for the rock units above, between and below the coal seams. However, there has been random soil sampling work completed in the Belina Mine area, as well as more extensive data sampling and testing within the adjacent Skyline Mine (located to the west of the Belina mine on the other side of the Connelville fault). The random sample results from the Belina mine give a good indication of the general chemical makeup of the strata as far as the analysis was done. The data collected are presented in Table R614-301-623.100a in parts per million. Some of the information gleaned from the Skyline Permit Application is that 1) the lithology of the stratum immediately below the mineable coals vary from drill hole to drill hole, 2) that the clay content varies from nearly 100% in pure claystones to less than 5% in sandstones, and 3) a slight alkalinity and low sulfur content exists in the roof strata. For more information the reader is refered to the Skyline Permit Application on file with the regulatory agency.

TABLE R614-301-623.100a
GEOCHEMICAL RESULTS FROM SOIL SAMPLES

B	Ca	Cu	Fe	Mg	Mn	P	K	Na	Zn
-	2560	0.02	56	180	9.2	13	112	16	2
-	2480	0.09	54	175	6.8	16	95	12	2
-	2310	0.1	64	167	4.9	9	86	15	2
-	2370	0.15	74	165	8.3	16	69	18	7
-	2280	0.28	59	159	9.5	11	72	10	8
-	2199	0.03	67	128	11.6	11	105	11	2
-	1986	0.05	71	165	9.5	15	120	9	1
-	2455	0.1	75	185	8.5	22	119	12	2
-	2293	0.24	62	167	6.8	16	88	12	1
-	2060	0.25	60	176	8.5	12	79	15	2
-	2410	0.42	46	177	11.2	31	96	11	2
-	2385	0.46	44	186	10.9	29	91	12	2
-	2620	0.25	67	192	14.5	21	114	10	2
-	2180	0.1	68	187	12.6	32	95	12	3
-	2350	0.3	59	173	10.5	21	81	17	2
-	2445	0.05	78	210	6.7	16	110	20	2
-	1910	0.2	52	261	4.9	17	110	7	1
-	2350	0.27	46	190	8.6	26	86	12	2
-	2558	0.3	45	210	9.3	25	79	13	2
-	2375	0.49	46	188	10.4	31	96	11	2
20	1500	14.0	-	-	-	-	-	30	-

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TABLE R614-301-623.100a (Continued)
GEOCHEMICAL RESULTS FROM SOIL SAMPLES

B	Ca	Cu	Fe	Mg	Mn	P	K	Na	Zn
21	1300	14.0	-	-	-	-	-	60	-
16	500	17.0	-	-	-	-	-	86	-
15	700	7.0	-	-	-	-	-	37	-
30	800	6.0	-	-	-	-	-	110	-
39	33700	12.0	-	-	-	-	-	120	-
18	1900	22.0	-	-	-	-	-	140	-
24	4400	21.0	-	-	-	-	-	110	-
18	1000	14.0	-	-	-	-	-	35	-
43	1800	20.0	-	-	-	-	-	110	-
20	700	10.0	-	-	-	-	-	90	-
24	8900	6.0	-	-	-	-	-	90	-
34	21700	8.0	-	-	-	-	-	100	-
41	37300	16.0	-	-	-	-	-	150	-
23	5600	16.0	-	-	-	-	-	360	-
27	11500	18.0	-	-	-	-	-	250	-

Other reported soil sample work for which no data are available, indicate that the molybdenum and selenium levels are below 0.2 ppm, that the acid-base potentials are positive, and the pH of the soil samples ranged from 7.2 to 8.8. Some analyses were completed on some coal samples taken from well corings at the time the wells were drilled. The results of the analyses are shown in Tables R614-301-623.100b and R614-301-623.100c.

TABLE R614-301-623.100b
COAL ANALYSIS (IN PERCENT)

	WELL OR SAMPLING LOCATION									
Parameter	75-7-1(U)	75-7-1(L)	75-6-2(U)	75-6-2(L)	75-6-2(L)	Belina No. 1 Outcrop	75-30-27(U) 75-25-2 (U) 75-31-1 (U)	75-25-3 (L) 73-31-1 (L) 75-25-4 (L)	General Sample	Belina No. 2 Face
Coal Analysis										
Moisture	6.31	5.61	5.76	5.98	6.06	5.99	6.63	6.72	6.22	5.8
Ash	3.25	18.89	24.43	21.17	10.54	10.91	3.03	6.18	4.94	3.7
Volatile	43.63	35.79	35.22	35.21	39.35	38.70	42.23	42.34	42.08	46.7
Fixed Carbon	46.81	39.71	34.59	37.64	44.05	44.40	48.11	44.78	46.76	43.8
Pyritic Sulfer	-	-	-	-	-	-	.09	.23	.14	.17
Total Sulfer	.55	.56	.98	.58	.72	.66	.43	.63	.50	.7
Ash Analysis										
P_2O_5	.06	.18	.38	.23	.74	.14	.15	.21	.05	<.1
SiO_2	59.73	85.18	65.80	69.73	62.76	81.33	61.46	50.49	52.82	60.0
Fe_2O_3	7.39	1.78	2.56	3.13	3.84	2.53	7.48	8.56	6.87	8.8

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TABLE R614-301-623.100b (Continued)
COAL ANALYSIS (IN PERCENT)

	WELL OR SAMPLING LOCATION									
Parameter	75-7-1(U)	75-7-1(L)	75-6-2(U)	75-6-2(L)	75-6-2(L)	Belina No. 1 Outcrop	75-30-27(U) 75-25-2 (U) 75-31-1 (U)	75-25-3 (L) 73-31-1 (L) 75-25-4 (L)	General Sample	Belina No. 2 Face
Al_2O_3	11.47	7.36	22.93	16.47	19.84	7.68	17.25	11.28	10.74	12.0
TiO_2	.93	.42	.75	.61	1.01	.50	.90	.57	.56	.8
CaO_2	8.75	1.35	2.62	2.69	3.25	2.11	5.20	14.65	14.92	5.4
MgO	.97	.32	.72	1.61	.97	2.00	.75	2.22	1.29	1.22
SO_3	8.15	.84	1.17	1.86	3.79	1.97	5.15	9.35	10.16	9.5
K_2O	.81	1.11	2.73	2.58	2.23	1.04	.72	.83	.57	.2
Na_2O	1.28	.36	.24	.36	.47	.40	.68	.48	.71	.67

Notes: (U) Indicates Upper O'Connor Coal Seam
(L) Indicates Lower O'Connor Coal Seam

TABLE R614-301-623.100c
GEOCHEMICAL RESULTS FROM COAL ASH (PPM)

Parameter	Belina No. 1 Outcrop	75-30-2 (U) 75-25-2 (U) 73-31-1 (U)	75-25-3 (L) 73-31-1 (L) 75-25-4 (L)	Belina No. 2 Face
U	20	9	7	-
Th	<8	<4	<4	N/D
Pb	<8	2	2	25
Hg	N/D	.05	.03	.01
W	-	2	2	N/D
Eu	.7	.3	.3	N/D
Sm	2	.7	.9	-
Nd	3	1	2	-
Pr	2	3	2	-
Ce	36	23	22	N/D
La	12	14	9	N/D
Ba	41	71	30	-
Cs	3	10	5	70
Sn	4	2	2	N/D
Cd	<5	<1	<2	1.5
Mo	100	22	8	15
Nb	6	5	4	20
Zr	120	57	54	200
Y	30	20	19	30

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TABLE R614-301-623.100c (Continued)
GEOCHEMICAL RESULTS FROM COAL ASH (PPM)

Parameter	Belina No. 1 Outcrop	75-30-2 (U) 75-25-2 (U) 73-31-1 (U)	75-25-3 (L) 73-31-1 (L) 75-25-4 (L)	Belina No. 2 Face
Sr	280	320	200	700
Rb	3	9	8	-
Br	.3	.3	.1	-
Se	.6	2	<.6	1.1
As	2	1	.8	<1
Ge	<1	<.6	.9	-
Ga	3	3	3	10
Zn	11	4	2	46
Cu	8	7	21	70
Ni	10	10	15	50
Co	17	7	4	15
Fe	+1000	-	-	5000
Mn	13	5	27	-
Cr	39	17	65	50
V	29	19	27	70
Ti	+1000	-	-	3000
Sc	10	4	4	10
Ca	+1000	-	-	20000
K	520	-	-	-
Cl	12	17	-	<1000
S	680	-	-	-
P	200	-	-	-
Si	+1000	-	-	-
Al	+1000	-	-	50000
Mg	700	-	-	7000
Na	+1000	-	-	-
Fl	~16	~23	~7	<20
B	290	38	40	1500
Be	.8	.3	<.1	N/D
Li	-	2	.4	90
Sb	-	-	-	.02
Bi	-	-	-	N/D
Pd	-	-	-	N/D
Pt	-	-	-	N/D
Ta	-	-	-	N/D
Tl	-	-	-	N/D
Yb	-	-	-	3

** R614-301-600. **

TABLE R614-301-623.100c (Continued)
GEOCHEMICAL RESULTS FROM COAL ASH (PPM)

Parameter	Belina No. 1 Outcrop	75-30-2 (U) 75-25-2 (U) 73-31-1 (U)	75-25-3 (L) 73-31-1 (L) 75-25-4 (L)	Belina No. 2 Face
Ag	-	-	-	N/D
Au	-	-	-	N/D
Te	-	-	-	N/D
Hf	-	-	-	N/D
In	-	-	-	N/D

Notes: (U) Indicates Upper O'Connor Coal Seam
(L) Indicates Lower O'Connor Coal Seam
N/D Not Detected

R614-301-623.200. RECLAMATION.

Geologic information is presented within the permit application in sufficient detail to comply with the reclamation activities proposed herein as part of the permit.

R614-301-623.300. SUBSIDENCE.

The subsidence control plan under the Underground Coal Mine and Reclamation activities is presented in Sections R614-301-525 and R614-301-521.142. Also see R614-301-632.

R614-301-624. GEOLOGIC INFORMATION.

A discussion of the general geology of the Mine Permit Area is presented in R614-301-621. The geologic information provided in the following sections gives detailed stratigraphic descriptions and relates the geology to the movement of ground water. Information contained within this geologic section of the permit renewal application is based upon general geologic expertise and reports prepared for the applicant by engineering and geologic consultants. Literature used in the preparation of this permit are included in the reference section of the permit.

R614-301-624.100. GEOLOGIC DESCRIPTION.

All of the stratigraphic units exposed in the Mine Permit Area are part of the Mesaverde Group. The lowest geological unit in the Mine Permit Area is the Star Point Sandstone which is overlain by the Blackhawk Formation. It is within the Blackhawk

Formation that local coal seams are found. A general geologic cross section showing the information discussed below is found in Stratigraphic Map R614-301-622.200f. Additional maps and cross sections which may be usefull to the reader are identified in Section R614-301-622. The plans for reclamation of the Mine Permit Area are presented in R614-301-624.200, R614-301-624.300 and R614-301-625.

STAR POINT SANDSTONE FORMATION

The Star Point Sandstone, the lowest unit exposed in the Mine Permit Area, is a yellow-gray (salt and pepper) beach sandstone with massive beds and is medium-grained (Spieker, 1931). The Sandstone unit is exposed locally on the eastern edge, as well as to the east of the Mine Permit Area. The Star Point Sandstone is extremely tight and yields water in quantities of generally less than 5 to 10 gpm except where fractured. Seepage from the Star Point Sandstone is however an important part of the base flow to the stream in Eccles Canyon.

The Star Point Sandstone is thicker than normal in the Mine Permit Area and is over 1000 feet thick. The unit is a yellow-gray sandstone with beds that are mostly massive with occasional partings of shale or shaley sandstone. The amount of shale present is minor.

BLACKHAWK FORMATION

The Blackhawk Formation (which lies above the Star Point Sandstone unit) is the main unit in the Mine Permit Area and, in fact, is the main coal bearing unit in the region. The unit is approximately 1500 feet thick with the better coal seams being located within the lower 380 feet of the formation. The Blackhawk Formation is an interbedded formation of sandstone and shales. The sandstone beds are generally massive while the shale layers act bentonitic, tending to swell when wet and decomposing into a semi-impervious clay. The sands in this member of the Mesaverde Group are fine to medium grained and cemented by either calcite or silica with some iron discoloration. The sands are also more irregular than the sandstones typical of the Star Point formation, tending to be local in extent and having locally high clay contents (Spieker, 1931; Doelling, 1972). The Aberdeen sandstone is a coarse-grained, light-colored sand with a thickness of 20 to 90 feet, which can be traced throughout the region (Spieker, 1931). The generally discontinuous nature of the Blackhawk sands are only locally important for groundwater since a well defined ground water aquifer capable of moving relatively large volumes of water does not exist.

Spieker (1931) has identified three types of shale in the Blackhawk Formation, all continental in origin. The three types are 1) a common clay shale which is soft and granular, 2) a carbonaceous shale and 3) a smoke-gray shale usually associated with the coal. As was the case with the sandstones, the shales are irregularly bedded (Spieker, 1931).

Stratagraphic Description

A drill log from drill hole 75-24-4 (shown on Map R614-301-622.200f) is used to describe the lower part of the Blackhawk Formation, which is the most important portion of the formation with respect to coal mining operations in that it is within the lower zone where the mined coal is located. Drill hole 75-24-4 is located in the SW quarter of the SW corner of Section 24, T13S,R6W, SLBM as shown on Drill Hole Location Map R614-301-622.100a. This log provides a representative geologic stratigraphic section of the Mine Permit Area. The discussion that follows (related to the analysis of the log) starts at the bottom of the unit, and continues upward.

The lowest unit of the Blackhawk Formation in the vicinity of the Mine Permit Area is the Flat Canyon coal seam which rests upon the Star Point Formation. The Flat Canyon coal seam is not present over the entire Mine Permit Area, but in the area of drillhole 75-24-4 is found to be separated into two seams. The upper seam is one foot thick and is separated from the lower two foot thick seam by an eight foot shale layer. The 89 foot thick Aberdene Sandstone layer lying above the Flat Canyon coal seam consists mostly of sandstone with some interbedded shales. It is described as a massive, irregularly bedded, gray to brownish quartzose sandstone and being medium to very fine grained. It is also known to have some local carbonatious material present.

The Aberdeen Sandstone tends to grade upward from fine-grained at the base to medium and course-grained at the top and containes thin shaley intervals near the base. The conspicuously white upper few feet of the sandstone are significant because they generally lie immediately beneath the lowest minable coal seam. The chalky white appearance and the texture of this interval is similar to the uppermost part of the Star Point. The white color is imparted by the presence of the clay matrix which apparently formed diagenetically due to the action of acid waters from the overlying coal swamp, or as a result of subaerial weathering.

The Lower O'Connor coal seam overlies the Aberdeen Sandstone unit and at drill hole 75-24-4 is 22.5 feet thick. The Lower O'Connor ranges from 7 to 28.5 feet thick in the Mine Permit Area and contains a two-tenths of a foot thick fine grained sandstone bed within the coal seam. A thin clay seam lies above the top of the coal seam which in turn lies beneath 74 feet of medium to fine grained quartzose sandstone with minor interbedded shale. The quartzose sandstone unit has interbedded brown to reddish brown and gray to white lenses and is referred to as massive and irregularly bedded, while containing some local carbonaceous material. Lying above the 74 foot thick sandstone layer is a 1.5 foot seam of coal which in turn lies beneath 22 feet of sandstone. This upper 22 foot sandstone layer is similar to the 74 foot thick layer just discussed except that it contains more shale beds.

The next geologic unit encountered as we move upward is the Upper O'Connor coal seam. At this location, this coal seam is approximately 22 feet thick and is broken into three sections. The lower portion of the seam consists of six feet of coal followed by nearly four feet of light gray, fine grained, varved (layered) sandstone. Above this sandstone is 9.3 feet of coal followed by two feet of sandstone and then by one foot of coal. The next 406 feet of stratum between the last one foot of coal discussed and the

surface, is made up of interbedded light to dark gray with some buff and tan colored shale, sandstone, and siltstone. The McKinnon Coal Seam is missing in the area of the geologic section, but would generally be located within this 406 foot section. In other areas the McKinnon seam is located approximately 350 feet above the Upper O'Connor seam and is found to be up to 11 feet thick. Much of the McKinnon seam however is very thin and is not mined. Other thin coal seams are also locally present in this interval.

FAULTING

Three major north-south tending faults are found locally within or adjacent to the Mine Permit Area. The three faults are the Connelville Fault, the O'Connor Fault, and the Pleasant Valley Fault. As mining progressed within the Belina Mines, a series of smaller step faults not previously known exist were found to be parallel to, and east of, the main Connelville Fault. Other faulting in the Mine Permit Area has also been encountered that was not previously mapped. The locations of local faults were discussed previously in Section R614-301-621 and are shown on General Geologic Map R614-301-621a in plan view. The geologic cross sections included within this submittal also include faults when encountered in the section. Information concerning the dip of local faults is sparse, however, information that is available seems to indicate that they are vertical or near vertical in most areas.

In addition to the three major north-south tending faults discussed above, there are some smaller easterly trending faults in the area, some of which have been intruded by dikes. The locations of these faults are also shown on General Geologic Map R614-301-621a. These dikes are classed as amprophyes. The major dike passing through the mining operations was found to have coked coal near the contact. This dike is located within the southern half of section 24 appoximately three quarters of a mile south of the Belina mine tunnel entrance. Some increase in metal content was also noted near the contact face including higher than normal pyrite contents in the coal.

GEOLOGIC EFFECTS UPON WATER MOVEMENT

The principle factor controlling the occurence and availability of ground water in any area is lithology. Nearly all of the region surrounding the Mine Permit Area is underlain by rocks of continental and marine origin, consisting predominately of interbedded sandstones and shales (Price and Waddel, 1973). Although some of the sandstones in the region serve as a water bearing strata, their ability to yield water for extended periods of time is largely controlled by the existence of the relatively impermeable interbedded shale layers, which prevent the downward movement of a significant amount of water. Because of this condition, specific areal extents, depths and thicknesses of aquifiers are not easily defined. Price and Arnow (1974) state that the volume of recoverable water in the area is small, averaging less than 600 acre-feet per square mile in the upper 100 feet of saturated rock.

Surface water flow is affected by the geology to the extent that varying geologic structures control the infiltration of ground water. As stated, many of the sandstones and shales present within the Mine Permit Areas impede the infiltration of ground water. On the other hand, faults, fractures, and alluvial fill, where they exist, enhance infiltration thereby

reducing net surface runoff. The dominant fault trends in the Mine Permit Area are in a north-south direction, however, smaller fault systems are noted locally to have an east-west orientation. It is suspected that faulting has only local hydrologic importance within the Blackhawk Formation because of the high clay content of surrounding materials which tends to seal the fracture and either restrict or stop water movement. Fracturing within the lower Star Point Sandstone formation however is not impacted greatly by clays, and therefore secondary permeability created by fracturing tends to increase local water yielding capabilities of this lower system.

Mining within the Blackhawk Formation has shown that faults may, but do not necessarily, provide conduits or a "plumbing system" for transporting groundwater. Investigations have shown that large volumes of water are not produced from faults unless a tension crack associated with a fault has provide an open channel that can drain adjacent sandstone and readily convey water into the mine. Wells drilled into the Blackhawk and Star Point formations produce very little water (usually less than 5 gpm) unless a water conducting fracture(s) is encountered. Consequently, the culinary water supplies for both the Belina Mines and the adjacent Skyline Mine are obtained from wells drilled into faults in the Star Point Formation. Early culinary wells drilled for the Skyline Mine produce less than 10 gpm. Only when a well was drilled into the Connelville Fault zone was an adequate water supply developed. The culinary water supply well for the Belina mines was drilled into the O'Connor Fault, from which it derives a moderate flow (maximum rate - 65gpm).

Another geologic phenomenon capable of altering water movement is caused by "rolling" of a formation. As formations develop waves or rolls through compression or vertical displacement, tension stresses result in the development of cracks which may collect and convey water within the formation. These cracks are generally local in nature and are not as extensive as the local faulting system. The combined effect of faulting and rolling in the formations containing coal seams may create secondary permeability zones which (when compared to most areas in the Blackhawk) would result in higher than anticipated ground water inflow into the Belina Mine.

Examples of these secondary permeabilities is given at the various locations within the mine which have experienced higher than anticipated inflows during mine advancement. Documented inflows over the period of mining are:

* An inflow of approximately three gallons per minute located at about 1,500 feet inside the mine in a northwest direction from the main mine portals.

* An inflow of approximately two gallons per minute located at about 1,500 feet inside the mine in a west-southwest direction from the main mine portals.

* An inflow of approximately ten gallons per minute was noted when a fault was encountered at about 2,600 feet inside the mine in a west-northwest direction from the main mine portals. At approximately 2,000 feet further south along this same fault, there was encountered again another inflow of approximately five gallons per minute. When the fault was encountered for

the third time at a distance of approximately 1,500 feet farther south, no water inflow was reported.

* Water inflow was encountered in the area located approximately 2,500 feet south-southwest of the mine portal when a major roof fall occured. The roof fall was located in a fault zone with a four foot displacement. No other local water was encountered.

Roof falls at other locations have been encountered without the production of water. It appears that water within the mine is generally related to either a zone of shallow overburden, or to a roll in the rock which produces tension cracking. Normal faults generally do not produce water. Large flows occuring within the mine are generally associated with tension cracking, and usually reduce in flow volume over time as the adjacent sandstone is drained.

The abundance of shale in the Blackhawk also acts as an effective barrier to the downward movement of water within the formation, greatly reducing its overall vertical permeability and the amount of water which percolates through the formation to lower units. Water which reaches the Blackhawk percolates downward until it meets a shale layer, afterwhich the water moves horizontally to the surface or another "drain" (i.e. sandstone finger, fault, etc.) within the formation. Investigations at springs and streams in the Mine Permit Area have confirmed that shale layers impede downward percolation of water through the Blackhawk, and that springs are generally located where shale layers outcrop. The fact that most springs are on fairly steep hillsides and not in channel bottoms where a regional aquifer would tend to discharge, provides additional evidence that the springs in the upper elevations of the Blackhawk Formation are draining perched aquifers. These springs tend to receive water from localized rather than regional sources.

A major east-west dike crosses the Mine Permit Area in the Boardinghouse Canyon area. At the location encountered within the Belina mine, the dike was found to be approximately 230 feet thick. It is believed that this dike was formed subsequent to local faulting. The dike was essentially dry at the time it was encountered, and it is felt that the dike itself may be creating a partial barrier to the movement of ground water. This theory is based upon the fact that at the time the dike was encountered within the mine, essentially no water was noted on the north contact face. However, upon traversing the dike, a small amount of dripping was noted to occur from the south contact zone, indicating the presence of local water. After comming in contact with the dike, local ground water may be moving along the contact face in an east-west direction parallel to the dike.

In determining the magnitude of the effects of mining on areal hydrology, it is important to recognize the uses of the hydrologic resources. Within the Mine Permit Area, the principal use of the hydrologic resources is for the watering of livestock and wildlife. The area has numerous springs, seeps, and several streams. The disturbance of some of these sources may result in the need for livestock and wildlife to utilize another adjacent source. However, this has not appeared to be a problem for local livestock and wildlife because of the many local sources which exist within the area.

Additional hydrologic details related to both surface and ground water are given in Section R614-301-700.

R614-301-624.200 thru 301-624.230. REQUIREMENTS WHEN STRATA IS EXPOSED.

This section is not applicable to the applicant since mining activity within the Mine Permit Area will not include any type of open pit mining. Surface disturbances created by roads, work area, portals, etc. will be reclaimed according the reclamation plan.

R614-301-624.300 thru 301-624.340. ANALYSIS OF CORES AND BORINGS.

DRILL LOGS

A limited number of drill logs are available for the Mine Permit Area. However, the nature of these data are such that presenting all available data in this report is impractical or impossible without extensive modifications in format. As an alternative, the information given by the logs not duplicated herein, is incorporated into the geologic sections described in Section R614-301-624.100. Drill hole logs and ground water information are presented on geologic cross sections R614-301-622.200f through 301-622.100m.

CHEMICAL ANALYSES

Chemical analyses of the coal seams that are or have been mined, as well as of the strata above and below the coal seams are summarized in Section R614-301-623.100.

GEOLOGIC PROPERTIES

Mining within the Permit Area has proceeded mostly by conventional room and pillar methods. The coal pillars are generally competent and the roof areas are stable where at least two feet of coal were left. Occasionally, roof falls have occured in areas where less than two feet remained following mining. These roof falls have been more common in zones where the coal and shaley roof layers have been fractured by local faults. During mining, these zones are stabilized with roof bolts. Stabilization using roof bolts has been generally sucessful. Some areas have also been noted where a few inches of local clay has been found to exist above the coal seam.

Various reports prepared for the applicant by consultants have provided valuable information related to geology and related material properties. Pertinent information from these reports has been subtracted from them and is presented in the remaining information within this section. According to these reports, the material properties of the coal used as calculation factors for uniaxial strength, friction angle, and 52 degrees unit weight are 1431 psi, 52 degrees, and 85 pcf respectively. The factor used for the unit weight of the overburden is 150 pcf.

The pre-mining stress condition in the coal deposit was found to be as expected. The vertical stress is approximately equivalent to that of the overburden load, and lateral

stresses are about one-third to one-half of the vertical stress, which is typical for a gravity structures.

The direct measurement of stress in a coal seam has been one of the most difficult tasks of rock mechanics. For this reason, stress measurements from adjacent rock layers have sometimes been used in design. However, stresses in roof and floor rock are necessarily different from those in coal seam because of the difference in properties, and the difference in the rate of stress relief through geologic time since disposition. Care must be taken therefore when using rock stress in the design of coal pillars.

A borehole deformation gage (BDG) was used to measure absolute stress in the coal mass. The BDG actually measures the change in the EX-size drill hole diameter as the stress around the drill hole is relieved by overcoring with a six-inch diameter coring bit. Measured deformations are used in the calculation of two dimensional stresses perpendicular to the drill hole axis. When three sets of these stresses are obtained from three drill holes having different orientations, both the magnitude and the three dimensional orientation of stress can be calculated.

Borehole deformation monitoring is referred to as an overcoring test. The equipment for an overcoring test consists of a drilling unit and a BDG unit. Auxiliary tools are also used to facilitate recovery of cores and insertion and positioning of the gage. The procedure has been standardized with slight variations in the intervals of strain reading during overcoring.

The first set of stress measurement consisted of overcoring of three holes drilled in three different orientations. The first of the three holes was drilled nearly perpendicularly to the rib. In this drill hole, measurements were taken at every two to three feet of depth.

Preliminary analysis of the results from the three drill holes at the first site indicates that the pre-mining stresses are within the expected ranges for a sedimentary rock formation. There appears to be no tectonic influence in this area. Visual observations of the ground conditions in the Belina Mine No. 1 did not detect unusual stress conditions. The results of the test are shown in Table R614-301-624.340a.

Monitoring of short cockle gages indicated that there was virtually no separation of the immediate roof. The horizontal strain of the roof as indicated by HORSI data confirms this. The roof-floor convergence measured with a tape extensometer shows a very slow and gradual closure. However, a sudden closure of 0.1 to 0.15 inches was indicated when active mining was done near the test area. Estimating that one-half of this closure was due to pillar deformation, the data implies that a 200 to 300 psi load was added to the pillars during active mining.

The gages indicated impending changes in the ground conditions for 10 to 20 days prior to a roof fall. Gages closer to the fall gave longer advance warning. Additional anomalies appear to be reflections of small roof falls near a fault.

The influence on Belina Mine No. 2 was also observed as part of the test. The results from the instrument monitoring in the test panel indicated that the roof sagging (flexure)

is minimal. Visual observations of the mined-out area over a one-month period showed little change during that time. No roof or floor puncturing by the pillar was evident. These factors indicate the existence of a strong roof and floor. A strong roof or floor tends to dissipate the stresses rapidly thereby minimizing stress concentration. In addition, the overburden load in Belina No. 1 does not appear to cause a buildup of abutment pressures in the next panel area.

TABLE R614-301-624.340a
SUMMARY OF MINING TEST STRESS MEASUREMENT DATA

Site No.	DH Angle No.	Measured Depth Ft.	Deformation, in 10^{-6} Vertical U_1	45° Left U_2	45° Right U_3	Two Dimensional Stress T,psi	Q,psi	at angle T,deg
1	1	1.0	14508	12320	6950	2251	1502	22
		5.0	8399	5320	7506	1331	1027	-21
		14.0	2232	3780	4170	664	467	5
		22.0	2790	4200	0	594	183	40
	2	20.5	2344	3920	723	541	234	45
	3	21.0	4743	1960	2780	664	389	-8
2	4	1.5	5792	4967	4242	908	759	14
		3.5	7647	7949	6341	1301	1137	35
		5.1	4218	5113	1818	783	455	38
		7.2	2854	4346	2830	641	474	-30
		13.4	3119	3931	2897	605	500	-36
3	5	5.1	10184	3365	7784	1517	852	-20
		6.7	6350	3310	6144	1041	714	-28

The factors discussed above indicate that conditions in the lower seam of the Belina No. 2 mine will not be affected excessively by upper seam mining. The lower seam roof (floor of upper seam) appears to be sufficiently stable to achieve an evenly distributed load transfer. However, the pillars having the same dimension as those in the upper seam would be less stable in the lower seam, due to increase in depth and to some amount of stress concentration.

The Belina No. 2 mine has been partially developed below the West Mains of the Belina No. 1 mine. The main entries in the Belina No. 2 have been in a stable condition since the opening. As overburden increases, entries directly beneath the No. 1 mine show signs of deterioration, and narrow corner edges of pillars begin to spall. Within a fault zone, the roof may cave in more easily than in the upper seam. Without precautionary

measures, cavings tend to be more extensive since the pillars deform more. Otherwise, the ground conditions in the lower seam should be similar to those in the upper seam mine.

If the pillars are left in a regular pattern, and if they have consistent dimensions, no extraordinary support system should be required for the lower seam. However, a method will need to be developed for pre-supporting the faulted/fractured zones.

R614-301-625. ADDITIONAL GEOLOGIC INFORMATION.

N/A

R614-301-626. REQUEST FOR VARIANCE FROM SECTIONS R614-301-624.200 AND R614-301-624.300.

N/A

R614-301-627. OVERBURDEN THICKNESS AND LITHOLOGY.

The Blackhawk Formation, as discussed earlier in this geologic section is exposed over most of the Mine Permit Area. The Blackhawk is made up of interbedded sandstone and shale beds. This interbedded material is the lithology that makes up the overburden over the mined areas. The thickness of the overburden varies within the Mine Permit Area. In some areas the coal is exposed at the surface and in three drill holes the top of the Lower O'Connor Coal seam is over 1100 feet deep. An isopach map of the overburden thickness is presented as R614-301-622.200e.

R614-301-630. OPERATION PLAN.

No significant changes are anticipated in the operation of the mines. The overall plan is discussed in Section in R614-301-542. In effect, underground mining activities will be a continuation of previous operations. Surface activities will utilize existing buildings, facilities, utility corridors, coal storage, cleaning, and loading areas. Water and subsidence monitoring will continue utilizing the control points that have been presented within other sections of this permit.

R614-301-631. CASING AND SEALING OF EXPLORATION HOLES AND BOREHOLES.

All exploration drill holes have been plugged using the procedures required by the U.S. Forest Service. The drill holes were filled with drill cuttings except in specific areas of the hole requiring concrete plugs. Concrete plugs are required, and were extended ten feet above and below any aquifer encountered, as well as being placed across all coal seams. In the vicinity of the surface, all drill holes were backfilled with at least a five foot concrete plug upon which a soil layer was added to conform to local soil conditions.

When plugged, the culinary water well being used by the applicant will be plugged with either 1) bentonite to within five feet of the surface whereafter a concrete plug will be

placed, or 2) concrete to the full depth of the well. In either case, this work will be done as part of the site reclamation.

R614-301-631.100. TEMPORARY CASING AND SEALING.

There has been no need for temporary casing or sealing since all existing abandoned drill holes have been plugged.

R614-301-631.200. PERMANENT CASING AND SEALING.

Since there has been no temporary completion of drill holes there is no need for permanent casing or sealing in addition to that discussed in Section R614-301-631.

R614-301-632. SUBSIDENCE MONITORING.

A subsidence monitoring program is in place at this time. In the past, pedestrian subsidence monitoring surveys have been completed. The method for completion of the pedestrian surveys was to update annually changes that had occured to the surface structure through visual observation and mapping. New subsidence features, or changes in previous features were noted annually. The surveys are conducted over all land surface areas above both pillared and full seam extraction areas. Both sink-holes and ground cracks were noted in these surveys. With the passage of time these subsidence features become less noticeable because of natural weathering and vegetative growth. The locations of subsidence monitoring points are shown on Geologic Cross Section Map R614-301-622.200a.

The current subsidence monitoring program includes the use of aerial surveys for a more complete and accurate survey.

Ground subsidence monitoring surveys have been conducted annually in late summer to determine and document the surface evidences and effects of subsidence. Consistent with expectations, no surface effects of subsidence have been found above areas where pillars have not been pulled, nor have they been found where the overburden above the mined coal seam is greater than approximately 350 to 400 feet.

Additional information related to subsidence can be found in Section R614-301-728.100.

R614-301-640 thru 301-642. PERFORMANCE STANDARDS.

All exploration holes and boreholes have been permanently cased and sealed according to R614-301-631 and as required by the U.S. Forest Service. All monuments and surface markers will also be reclaimed upon termination of all mining operations.

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Valley Camp of Utah, Inc.

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Mine Permit Renewal Application

Section R614-301-700 - Hydrology

Volume II

December 1989 - Revised

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December 15, 1989

Ms. Sue Linner
Utah Division of Oil, Gas & Mining
355 West North Temple
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Dear Ms. Linner:

As requested by Valley Camp of Utah, Inc., and as agreed upon in a joint meeting between UDOGM, Valley Camp of Utah, Inc., and Hansen, Allen & Luce, Inc., we are submitting directly to the Division of Oil, Gas and Mining 3 copies of the geology and hydrology permit sections and appendicies as required. The permit has been broken into five volumes within this submittal for your convenience. Volumes I and II include verbage related to Geology and Hydrology respectively. Volume III contains all maps and figures identified in sections 600 and 700 (except for those identified as confidential), and Volume IV includes appendices and references identified in the permit application (except for Appendix R614-301-622.100). Appendix R614-301-622.100 identified in Section 600 of the permit renewal (and marked confidential) is submitted as Volume V.

Should you have any questions, please call.

Sincerly,

David E. Hansen

David E. Hansen, Ph.D., P.E.
Vice-President

DEH/dh

cc: Steve Tanner - Valley Camp of Utah, Inc.

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R614-301-700. HYDROLOGY.

R614-301-710 thru 301-713. INTRODUCTION.

Specifics related to the general requirements of these sections are given in the sections referenced therein.

R614-301-720. ENVIRONMENTAL DESCRIPTION.

R614-301-721. GENERAL REQUIREMENTS.

GENERAL SURFACE HYDROLOGY

For purposes of discussion within this hydrology section, the Mine Permit Area has been separated into two distinct areas. The larger of the two areas (referred to in both the geology and hydrology sections as the Belina Permit Area) lies to the west of Pleasant Valley and Mud Creek and contains the majority of the total Mine Permit Area. The second and smaller area is associated with the Valcam Loadout and Mine General Office Facilities (referred to as the Valcam Permit Area) and is located along Mud Creek. These two areas are shown on Ground and Surface Water Sampling Location Map R614-301-722.100a.

The total Mine Permit Area is situated in the headwaters of the Price and San Rafael river basins, with the Carbon-Emery county line marking the watershed divide. The Belina portion of the Mine Permit Area crosses over a total of seven small watersheds. Four of the seven are east facing drainages with the remaining three being west facing drainages. East facing drainages include Eccles Canyon, Boardinghouse Canyon, Finn Canyon, and Long Canyon. West facing drainages include Burnout Canyon, James Canyon and Coal Canyon. The Valcam portion of the Mine Permit Area crosses over a total of four small watersheds. Green Canyon is an east facing drainage and the remaining three (Broads Canyon and two unnamed watersheds) are west facing drainages. Local perennial streams which may potentially be impacted by mining include Upper Huntington Creek, Boardinghouse Creek, Eccles Creek and Mud Creek.

Approximately three quarters of the surface water runoff from the total Mine Permit Areas drain to the east through Eccles Creek and other smaller tributaries of Pleasant Valley and Mud Creek. These waters pass through Scofield Reservoir before entering the Price River. The remaining area not tributary to Scofield Reservoir drains to the south and west towards the San Rafael River via Upper Huntington Creek and Electric Lake.

Snowmelt is the primary source of water for the perennial streams in the two major drainage basins with summer precipitation usually producing little runoff (U.S. Geological Survey, 1979). Ephemeral streams are also abundant in the Price and San Rafael river basins, existing primarily at lower elevations where evapotranspiration significantly exceeds precipitation.

Vegetative Cover

The majority of the total Mine Permit Area is covered with the conifer-aspen vegetative type, with a small portion of the land being covered with sagebrush and meadow communities (Bentley et al., 1978). Because of the depth of soil, moderate inherent soil fertility (Rapin, 1977), and high precipitation, the area is abundant in species.

** R614-301-700. **

Aspen Communities occur primarily along the ridges and down the drier slopes to the canyon bottoms. Spruce-fir types are present on north facing slopes where evaporation is low due to the low angle of incidence of the sun's rays and on the west facing slopes where the water supply is more abundant due to the westerly dip of the strata. Sagebrush communities fringe and intermix with the aspen type.

Productivity and percent cover over the area appear to be generally high. This vegetative cover benefits the local hydrologic system, according to Storey et al. (1964) by:

1. Building up and maintaining the organic matter content of the soil, thus developing a more open soil structure which increases infiltration and the moisture storage capacity of the soil as well as protects the surface from the erosive forces of runoff and rainfall impact.

2. Keeping the water spread out over the land, thereby slowing runoff and allowing more time for adsorption, resulting in increased infiltration and decreased overland flow (with its attendant erosion and gully formation): and

3. Shading the ground and minimizing wind movement, reducing snowmelt rates and promoting infiltration.

Water Quality

In general, the chemical quality of water in the headwaters of the Price and San Rafael River Basins is excellent, with these watersheds providing most of the domestic water needs of downstream users. However, this quality rapidly deteriorates downstream as the streams cross shale formations (particularly the Mancos Shale) and receive irrigation return flows from lands situated on Mancos derived soils (Price and Waddell, 1973). Within the Price River Basin, for example, Mundorff (1972) reports that the Price River and its tributaries generally have a dissolved solids content of less than 400 milligrams per liter and are of the calcium bicarbonate type within the upper regions of the Price River drainage. This is consistent with data collected by the applicant which is discussed in detail in Section R614-301-724. Water originating on or traversing Mancos shales within lower reaches of the Price river are of a lower quality and are of the calcium-magnesium-sodium-sulfate type. Typical TDS concentrations within these lower reaches in the area of Wellington are approximately 1700 mg/l. Downstream stations such as at Woodside (located approximately 22 miles upstream from the confluence of the Price River with the Green River) have weighted average TDS concentrations generally between 2000 and 4000 mg/l and consist mostly of sodium sulfate type waters. Data from this location confirms a pattern of rapid downstream water quality degradation.
Sediment yield from the upper portions of the two major basins is probably negligible (Mundorff, 1972). According to the U.S. Soil Conservation Service (1975), erosion rates in the Price and San Rafael river basins vary from 0.1 to 3.0 acre feet per square mile per year. The bulk of the sediment yielded each year at the mouths of major rivers comes from limited areas covered with highly erodible shales (Mundorff, 1972) and not in the upper elevations characteristic of the total Mine Permit Area.

R614-301-722. CROSS SECTIONS AND MAPS.

Cross sections and maps as required are provided in sections R614-301-722.100 through 301-722.500.

R614-301-722.100. LOCATION AND EXTENT OF SUBSURFACE WATER.

REGIONAL GROUND WATER HYDROLOGIC SYSTEM

The principle factor controlling the occurrence and availability of ground water in any area is geology. As noted by Price and Waddell (1973), nearly all of the region surrounding the total Mine Permit Area is underlain by rocks of continental and marine origin, consisting predominately of interbedded sandstones and shales. Although some of the sandstones in the region serve as the principal water bearing strata, their ability to yield water for extended periods of time is largely controlled by the existence of relatively impermeable interbedded shale layers, which prevent the downward movement of a significant amount of water.

According the U.S. Geological Survey (1979), ground water in the region exists under water table, artesian, and perched conditions. Water table conditions exist primarily in shallow alluvial deposits along larger perennial streams and in relatively flat lying sedimentary rocks. Artesian conditions exist at greater depths where a confining layer overlies a more permeable member. However, pressures are generally not sufficient to produce flowing wells. Perched or impeded conditions exist where the confining layer lies beneath the water bearing strata.

Because of the high annual precipitation, the Book Cliffs and the adjacent Wasatch Plateau (where the Mine Permit Area is located), act as recharge areas for regional ground water systems (Price and Arnow, 1974). However, only a small portion of the annual precipitation, probably much less than five percent, recharges the ground water supply (Price and Arnow, 1974; U.S. Geological Survey, 1979). Although the depth of water infiltrating through the surface to saturated beds is small (due to the presence of the relatively impermeable shale layers near the surface over much of the area), the total recharge volume from the region is significant because of the areal extent of the zone of recharge.

Price and Arnow (1974) indicate that properly constructed wells in the Price and San Rafael river basins would have only limited yields (normally less than 50 gallons per minute). Wells immediately adjacent to the Mine Permit Area could normally be expected to yield lass than 10 gallons per minute. Increased yields could be expected from wells penetrating highly fractured sandstones.

Rocks in the mountainous areas near the Mine Permit Area generally have low specific yields (0.2 to 0.7 percent) and low hydraulic conductivities (Price and Waddell, 1973). The volume of recoverable water in the area is small, averaging less than 600 acre-feet per square mile in the upper 100 feet of saturated rock (Price and Arnow, 1974).

The quality of ground water in the Price and San Rafael river basins deteriorates with the distance downstream much the same as surface water. Dissolved solids contents in ground water often range from less than 250 mg/l near the Mine Permit Area to 3,000 mg/l near the confluence of the rivers with the Green River (Price and Waddell, 1973). This increase in dissolved solids concentration is the result of increased contact of water and rock as travel

distance increases. Saline shales contribute the major portion of the dissolved constituents found at lower elevations.

Seeps and Springs

As an index of ground water hydrologic conditions in the Mine Permit Area, an inventory was made of existing seeps and springs on, and adjacent to the Mine Permit Area during both the low and high flow seasons of 1978 and 1979. Subsequent to this time additional water quality and flow data has been collected as will be presented within Section R614-301-724.100. During the initial spring surveys, the Mine Permit Area was covered by foot to identify all seeps and springs. Each location was noted on topographic mapping and discharge and quality data was collected. Based on these data, selected sampling locations were chosen to represent flow, quality, and geographic variations throughout the Mine Permit Area. Current sampling locations for the representative seeps and springs are shown on Ground and Surface Water Sampling Location Map R614-301-722.100a. A complete water quality history for each seep and spring identified is presented in Appendix R614-301-722.100, and a more in depth discussion of water quality is presented in section R614-301-724. For additional details related to the complete seep and spring inventory taken in the late 1970's, the reader is referred to the 1980 Vaughn Hansen Associates report entitled "Hydrologic Inventory and Baseline Study of the Valley Camp Lease Area and Adjacent Areas, Carbon and Emery Counties, Utah". Additional data is also available in the 1984 study completed by Cedar Creek Associates entitled "Seep and Spring Inventory and Proposed Seep and Spring Monitoring Program".

MAP R614-301-722.100a

A figure estimating localized ground water contours was prepared in September of 1980 based upon data available from both the applicant and from Coastal States Energy reports. Subsequent to that time no ground water data has been made available for a contour map update due to the 1) the abandonment of local ground water wells which were utilized in the 1980 approximation, and 2) the lack of access to any remaining wells. Map R614-301-722.100b is a reproduction of the 1980 contour map mentioned. Note that the contours generally slope to both the east and west with the local ridgeline (and also county line) forming the divide. It is believed that current hydrologic conditions are similar to those found in 1980, and therefore ground water contours should be similar to those identified in the 1980 analysis. The preparation of a figure showing seasonal variations in ground water contours is not possible due to a lack of seasonal data. No ground water data is available for the Valcam Loadout Area.

MAP R614-301-722.100b

As a result of the 1978 and 1979 seep and spring survey completed by Vaughn Hansen Associates, it was determined that there were in excess of 74 seeps and springs located within the Mine Permit Area, as well as 35 located in areas adjacent to the permit boundary. According to the Vaughn Hansen Associates report (1980) there was an average of one water source encountered for every 37 acres, not including perennial streams. Observations and measurements in the area also indicated that the majority of the seeps and springs continued to flow throughout the low flow period of the year. Travel distance between water supplies is therefore relatively short for the wildlife and livestock which utilize the area. The impact that a decrease in water supply resulting from a drought, mining impacts or other causes

would therefore be relatively mild since other sources of water are located within the close proximity.

Several observations should be made regarding the occurrence of seeps and springs in the Mine Permit Area. First, many springs issue near the base of a sandstone lens (where contact is made with a shale member), often a considerable distance (from a few feet to tens of feet) above the adjacent streambed. This indicates that the shale layers in the Blackhawk Formation act a impeding lenses, carrying at least a portion of the water which percolates through the soil mantle back to the surface where it is eventually discharged into an adjacent stream. Thus, because of the presence of a large amount of shale in the Mine Permit Area, ground water recharge is likely slow.

A second observation deals with the origin of the water issuing from the seeps and springs. Note that a number of springs are located at relatively high elevations. This, together with the fact that the sandstone lenses in the Blackhawk Formation are very discontinuous, implies that much, if not all, of the water found in a given spring originates in the small surface depression of basin immediately adjacent to the spring. It is therefore believed that the springs are supplied by a bedrock member which is extremely local in extent, as opposed to a larger, more regional system. The same conditions presumably apply to springs at lower elevations.

A third observation to be made concerning location is that very few seeps and springs appear to be fault related. This phenomenon has also been noted elsewhere along the Wasatch Plateau. As noted by the U.S. Geological Survey (1979), the shale layers of the Blackhawk Formation are bentonitic, tending to swell when wet and decompose into impervious clay. Apparently, fractures in the Blackhawk Formation seal readily because of the ability of the shale layers to swell and decompose, providing a barrier to water movement.
As a final observation, travertine deposits are often associated with springs in the area. Although this may suggest a deeper seated water source than a localized sandstone, Hem (1970) indicates that this may also result from the high calcium bicarbonate content of the water. This explanation is felt to be reasonable, thereby supporting the hypotheses that faults in the Blackhawk Formation are not ready conveyors of water.

Additional information related water quality of local seeps and springs will be given in section R614-301-724.100.

R614-301-722.200. LOCATION OF WATER BODIES.

Local surface water bodies located in the vicinity of the Mine Permit Area include three reservoirs and perennial stream channels. As can be seen on Ground and Surface Water Sampling Location Map R614-301-722.100a, the largest water body in the general area is Scofield Reservoir which is located approximately three miles north of the Valcam Loadout Facility. Electric Lake, a reservoir built in conjunction with the power generating facility in Huntington Canyon, and Cleveland Reservoir both lie to the south and west of the Belina mines. Both reservoirs lie in a south, southwest direction from the Belina mine with Electric Lake being the closest water body at a distance of approximately 4.5 miles from the mine portals, and with Cleveland Reservoir at a radial distance of approximately 6 miles. Electric Lake lies approximately one mile south and west from the far western permit boundary of the Belina Permit Area. All three reservoirs are well known recreation spots and are heavily

fished during the summer months. Other local water bodies include perennial streams briefly discussed in section R614-301-721, as well as some small unnamed beaver ponds.

R614-301-722.300. LOCATIONS OF MONITORING STATIONS.

Elevations and locations of monitoring stations used to gather baseline data on water quality and quantity are shown in two locations. Information related to the original seep and spring inventory completed in 1978 and 1979 as discussed in section R614-301-722.100 is shown in the original report completed by Vaughn Hansen Associates (1980) and is not reproduced herein due to its voluminous and dated nature. The reader is referred to the original report as referenced for additional details should they be desired. Current surface and ground water sampling locations are shown on Map R614-301-722.100a. The locations of the seeps and springs located on the figure were identified in the field through visual triangulation and altimeter readings.

R614-301-722.400. LOCATION AND DEPTH OF WATER WELLS.

Four wells have been drilled by the applicant (only two of which are currently used for culinary use). At the time of the 1980 Vaughn Hansen Associates report there were also two open holes which provided additional ground water information. All wells (except that used as a water supply) have subsequently been abandoned and reclaimed according to the methodologies presented in Section R614-301-600. At present, only two of the four wells remain within the Mine Permit Area that are potentially used for mining purposes. The other two have been sealed. The two remaining wells are shown on the Surface and Ground Water Rights Map R614-301-724.100a as water right numbers 91-1058, and 91-772. One of the wells is located near the bottom of undisturbed area bypass ditch UDD-1 which lies to the east of the Valcam facility. The second well is located on the south side of Whisky Creek near the downstream slope of Sediment Pond 004A.

During the summer of 1979, Coastal States Energy Company drilled several coal exploration holes on the Skyline Property (located adjacent to the northwestern border of the Mine Permit Area). Five of these locations were selected for conversion to ground water observation wells. Deep observation wells (terminating in the Star Point Formation) with 2-inch casing were installed at each of the five locations. Shallow observation wells (terminating in the Blackhawk Formation, normally above the coal zone) with 2-inch casing were installed at four locations. The casings were perforated throughout the bottom 20 feet, thus providing a measure of the piezometric heads in the respective formations and a determination of whether or not vertical movement was occurring. Since these wells penetrate the same geologic formations that underlie the Mine Permit Area, and because of their proximity to the Mine Permit Area, information obtained gives some indication of aquifer and ground water characteristics in the Mine Permit Area.

Combined information from both the applicant and Coastal States Energy wells have given a substantial amount of information about the ground water and aquifer characteristics.

R614-301-722.500. SURFACE CONFIGURATION.

A 1980 report prepared by Vaughn Hansen Associates indicated that slopes on the Mine Permit Area vary from greater than 75 percent (37 degrees) near the Carbon-Emery

County line to less than 2 percent (1.2 degrees) along the bottom of Pleasant Valley Canyon. The average slope over the area is approximately 28 percent (16 degrees) as determined from a 1:24,000 scale map. Because of the ridgetop location of the property and the variety of channelized flow directions, aspects also vary greatly. However, the Carbon County side of the property does have a dominant aspect to the east. The topography is rugged, with elevations ranging over the Mine Permit Area from about 7840 to 10,044 feet above mean sea level.

Mapping within this section of the Mine Permit is provided at a scale of one foot to 100 feet.

R614-301-723. SAMPLING AND ANALYSIS.

All water quality analyses are conducted according to the methodology in the current edition of "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434. Water quality sampling is also performed when feasible to met the requirements of the same.

A water quality monitoring program has been established by the applicant whereby data is collected and analyzed. The sampling program includes a comprehensive and abbreviated data collection schedule according to the discussion provided in Section R614-301-731.211.

R614-301-724. BASELINE INFORMATION.

R614-301-724.100. GROUND WATER INFORMATION.

Information related to ground water depths and vertical distribution of water as required under this section is presented within numerous sections of this permit. A discussion relating ground water and geology can be found in section R614-301-624.100. A cross section of the approximated ground water level is also shown in conjunction with a geologic cross section taken from well log data on Geologic/Hydrologic Cross Section Maps R614-301-622.200j through 301-622.200m. Ground water contours showing overall aerial extent and general shape of the ground water table is discussed in section R614-301-722.100, and shown on Ground Water Contour Map R614-301-722.100b.

GROUND WATER RIGHTS

An extensive survey of ground water rights for the general vicinity was completed in 1980 by Vaughn Hansen Associates. In order to show the locations of the identified ground water rights in conjunction with the Mine Permit Area, the figure shown in the 1980 report has been reproduced herein as Surface and Ground Water Rights Map R614-301-724.100a. The map indicates through symbols which rights are associated with wells and mine water, as well as those associated with local springs. Details related to owner, source, flow, purpose of use, and period of use are documented in the 1980 Vaughn Hansen Associates report in table form on pages 105 through 113. The water right data as given in the 1980 report is presented separately for both the Price and San Rafael river basins. Ground water right exchanges are also shown in the tables referenced.

MAP R614-301-724.100a

** R614-301-700. **

GROUND WATER QUALITY

Springs

Ground water quality data has been collected from selected springs in the Mine Permit Area. Seasonal water quality for selected water quality parameters for each of the springs identified is also shown on Ground and Surface Water Sampling Locations Map R614-301-722.100a. The water quality sampling schedule used for data collection from these sources is discussed in Section R614-301-723. Springs currently being monitored by the applicant include those identified on the map as S7-11, S24-12, S25-13, S31-13, S36-17, S36-19, and S36-23.

Little water quality data is available for the identified springs during the first quarter of the year due to inaccessibility of the spring site. Generally speaking, the earliest that flow and quality data can be collected is during the month of May for dry years, and as late as June or July for wet years. Of the springs sampled, only one has first quarter data available during the period of record.

The anion-cation diagrams shown on "Ground and Surface Water Sampling Locations with Seasonal Water Quality" Map R614-301-722.100a indicate that the water quality during the second quarter is generally of the highest quality, with a slight deterioration occurring in the third and fourth quarters. First quarter data is not available. Spring water is strongly of the calcium bicarbonate type and generally has TDS values in the 200 to 300 mg/l range. The lowest average TDS is recorded at station S36-19 which drains into Huntington Creek. The highest average TDS (384 mg/l) is shown to occur at station S24-12 during the third quarter of the year. Water quality statistics for each of the identified stations is included in Table R614-301-724.100a.

TABLE R614-301-724.100a
SEASONAL GROUND WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
S7-11	Flow	1	0	-	-	-	-
		2	3	0.001	0.078	0.027	0.036
		3	11	0.000	0.010	0.003	0.003
		4	4	0.000	0.002	0.001	0.001
	TDS	1	0	-	-	-	-
		2	3	91.00	180.00	147.67	40.20
		3	10	146.00	351.00	242.20	60.24
		4	3	219.00	252.00	238.00	13.93
	pH	1	0	-	-	-	-
		2	3	6.70	8.70	7.67	0.82
		3	10	6.80	8.60	7.52	0.60
		4	3	6.60	8.60	7.47	0.84

** R614-301-700. **

TABLE R614-301-724.100a (Continued)
SEASONAL GROUND WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
	Fe (Tot)	1	0	-	-	-	-
		2	1	0.100	0.100	0.100	-
		3	6	0.025	0.660	0.356	0.226
		4	1	0.350	0.350	0.350	-
	Mn (Tot)	1	0	-	-	-	-
		2	3	0.010	0.010	0.010	0.000
		3	7	0.001	0.034	0.018	0.012
		4	3	0.010	0.020	0.013	0.005
S24-12	Flow	1	1	0.002	0.002	0.002	-
		2	8	0.001	0.014	0.004	0.004
		3	13	0.001	0.010	0.003	0.002
		4	6	0.001	0.004	0.003	0.001
	TDS	1	1	268.00	268.00	268.00	-
		2	7	136.00	360.00	315.71	74.05
		3	11	310.00	506.00	384.45	56.37
		4	5	315.00	418.00	373.60	36.65
	pH	1	1	7.40	7.40	7.40	-
		2	8	6.90	8.00	7.50	0.39
		3	12	7.10	8.30	7.61	0.38
		4	6	6.50	8.60	7.45	0.61
	Fe (Tot)	1	1	0.020	0.020	0.020	-
		2	2	0.120	0.360	0.240	0.120
		3	6	0.014	0.330	0.160	0.111
		4	3	0.150	6.270	2.317	2.800
	Mn (Tot)	1	1	0.010	0.010	0.010	-
		2	6	0.010	0.075	0.021	0.024
		3	7	0.004	0.045	0.015	0.013
		4	5	0.010	0.260	0.065	0.098
S25-13	Flow	1	0	-	-	-	-
		2	9	0.003	0.090	0.043	0.031
		3	11	0.001	0.004	0.002	0.001
		4	6	0.000	0.020	0.005	0.007
	TDS	1	0	-	-	-	-
		2	9	44.00	360.00	155.89	107.24
		3	11	135.00	297.00	197.64	43.49
		4	5	70.00	222.00	181.40	56.54
	pH	1	0	-	-	-	-
		2	10	6.80	7.90	7.40	0.32

**** R614-301-700. ****

TABLE R614-301-724.100a (Continued)
SEASONAL GROUND WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
		3	11	7.00	8.30	7.59	0.45
		4	5	6.90	8.80	7.72	0.76
	Fe (Tot)	1	0	-	-	-	-
		2	4	0.300	4.290	1.378	1.683
		3	6	0.025	0.480	0.191	0.159
		4	3	0.220	0.680	0.477	0.192
	Mn (Tot)	1	0	-	-	-	-
		2	8	0.010	0.110	0.028	0.032
		3	7	0.001	0.110	0.027	0.035
		4	5	0.010	0.020	0.014	0.005
S31-13	Flow	1	0	-	-	-	-
		2	6	0.001	0.030	0.016	0.008
		3	11	0.001	0.100	0.014	0.027
		4	4	0.001	0.006	0.003	0.002
	TDS	1	0	-	-	-	-
		2	6	152.00	272.00	219.5	37.00
		3	11	236.00	395.00	286.00	44.52
		4	4	256.00	306.00	275.00	20.22
	pH	1	0	-	-	-	-
		2	6	6.90	7.80	7.57	0.33
		3	11	6.60	8.00	7.41	0.41
		4	4	6.90	8.50	7.53	0.62
	Fe (Tot)	1	0	-	-	-	-
		2	2	0.060	0.110	0.085	0.025
		3	6	0.033	0.240	0.123	0.084
		4	2	0.040	0.065	0.053	0.012
	Mn (Tot)	1	0	-	-	-	-
		2	6	0.001	0.010	0.009	0.003
		3	7	0.001	0.014	0.008	0.004
		4	4	0.001	0.012	0.008	0.004
S36-17	Flow	1	0	-	-	-	-
		2	10	0.004	0.220	0.045	0.065
		3	10	0.000	0.090	0.014	0.026
		4	6	0.004	0.040	0.020	0.015
	TDS	1	0	-	-	-	-
		2	9	192.00	298.00	233.89	27.81
		3	11	220.00	287.00	242.27	18.36
		4	6	231.00	267.00	246.83	11.65

** R614-301-700. **

TABLE R614-301-724.100a (Continued)
SEASONAL GROUND WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
	pH	1	0	-	-	-	-
		2	10	7.40	8.10	7.56	0.25
		3	11	6.70	8.60	7.61	0.58
		4	6	7.00	7.80	7.48	0.27
	Fe (Tot)	1	0	-	-	-	-
		2	4	0.050	0.390	0.220	0.143
		3	6	0.050	0.320	0.157	0.098
		4	4	0.065	0.210	0.119	0.055
	Mn (Tot)	1	0	-	-	-	-
		2	8	0.003	0.020	0.010	0.005
		3	7	0.001	0.027	0.011	0.005
		4	6	0.003	0.010	0.009	0.003
S36-19	Flow	1	0	-	-	-	-
		2	7	0.004	0.035	0.014	0.010
		3	11	0.001	0.004	0.002	0.001
		4	12	0.000	0.001	0.001	0.001
	TDS	1	0	-	-	-	-
		2	6	58.00	170.00	110.33	34.28
		3	11	124.00	262.00	162.00	39.83
		4	1	163.00	163.00	163.00	-
	pH	1	0	-	-	-	-
		2	7	7.20	8.70	7.60	0.50
		3	11	6.80	8.10	7.45	0.39
		4	1	7.00	7.00	7.00	-
	Fe (Tot)	1	0	-	-	-	-
		2	2	0.070	0.160	0.115	0.045
		3	6	0.034	1.350	0.404	0.453
		4	0	-	-	-	-
	Mn (Tot)	1	0	-	-	-	-
		2	6	0.010	0.020	0.012	0.004
		3	7	0.001	0.020	0.011	0.007
		4	1	0.010	0.010	0.010	-
S36-23	Flow	1	0	-	-	-	-
		2	9	0.010	0.018	0.012	0.003
		3	13	0.006	0.170	0.023	0.043
		4	7	0.007	0.010	0.008	0.001
	TDS	1	0	-	-	-	-
		2	9	176.00	249.00	202.44	23.66

**** R614-301-700. ****

TABLE R614-301-724.100a (Continued)
SEASONAL GROUND WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
		3	11	230.00	330.00	262.27	32.57
		4	6	229.00	290.00	247.50	20.04
	pH	1	0	-	-	-	-
		2	9	7.20	8.10	7.53	0.28
		3	12	6.80	7.60	7.18	0.24
		4	7	6.80	7.70	7.31	0.34
	Fe (Tot)	1	0	-	-	-	-
		2	3	0.100	0.500	0.237	0.186
		3	6	0.049	0.244	0.138	0.074
		4	4	0.020	0.114	0.066	0.035
	Mn (Tot)	1	0	-	-	-	-
		2	7	0.001	0.020	0.010	0.005
		3	7	0.002	0.020	0.010	0.006
		4	6	0.005	0.022	0.011	0.005

Mine Discharge

Current mining operations are resulting in the discharge of in-mine waters as granted by NPDES discharge permit number UT-0022985 at the Belina No. 1 mine. Before being discharged into Whisky Creek, all mine waters pass through Sedimentation Pond 005A. Water quality data for the discharge waters is submitted regularly to the regulatory agency and is not reproduced herein. However, summary statistics of basic water quality parameters for the period between January 1981 and June 1989 are given in Table R614-301-724.100b.

TABLE R614-301-724.100b
MINE DISCHARGE WATER QUALITY AND FLOW DATA SUMMARY

Statistic	Flow (cfs)	TDS (mg/l)	TSS (mg/l)	pH	Iron (mg/l)	Oil & Grease
No. of Samples	79	236	242	225	229	211
Minimum	0.00	176.00	0.10	6.70	0.01	<0.01
Maximum	0.94	1190.00	217.00	9.70	4.60	<78.60
Average	0.19	463.77	24.07	7.72	0.56	<2.19
Std Deviation	0.26	124.66	28.30	0.32	0.80	<5.80

** R614-301-700. **

The original data for the parameters shown in the above referenced table were reviewed in order to determine potential mining impacts upon surface water quality resulting from mine discharges. A review of said data indicates the following noted variations.

The total number of recorded values for total iron ranging between 1.0 and 5.0 mg/l have decreased over the last four years. Prior to the fall of 1985, there are 25 samples that are noted to have total iron concentrations that exceeded 1.0 mg/l. Since that time, only three such values have been noted, with the maximum being 2.2 mg/l as recorded in January of 1988. Similarly, total suspended solids appear to have experienced an overall decrease in concentrations.

According to available data, oil and grease concentrations have increased over the eight and a half year period of record summarized above. The increase appears to have occurred during September 1985. Prior to that time, concentrations were generally recorded in the less than 0.5 mg/l range with a few minor exceptions. However, subsequent to that time, more concentrations have been recorded above the 0.5 mg/l value. During the last four years, only one sample (taken February 21, 1986) indicated a concentration value greater than 10 mg/l. The reasons for the overall increase in oil and grease at Sediment Pond 005A are not known at this time, however, the applicant will continue to monitor concentrations for future trends.

No identifiable trends are noted for total dissolved solids, pH, or flow with the exception for flow noted in Section R614-301-728.100.

R614-301-724.200. SURFACE WATER INFORMATION.

The name and location of local surface water bodies is discussed in section R614-301-722.200 and shown on Map R614-301-722.100a. Of these surface water bodies, the only streams identified as being impacted directly by mining operations include Pleasant Valley Creek and Whisky Canyon Creek. Whisky Canyon Creek receives discharge water directly from 1) the Belina mine through Pond 005A and 2) potential discharges from Sediment Pond 004A. Pleasant Valley Creek receives potential discharges from Sediment Ponds 001A, 002A and 003A. These five discharges are governed and controlled under NPDES discharge permit number UT-0022985. The referenced permit became effective March 1, 1988 and continues through July 31, 1992.

SURFACE WATER RIGHTS

An extensive surface water right survey was completed for the Mine Permit Area in 1980 by Vaughn Hansen Associates. Surface water rights identified as a result of the survey are identified on Surface and Ground Water Rights Map R614-301-724.100a. This figure (taken from the 1980 report) has been reproduced herein to allow for a correlation between the location of the identified right and the current mine permit boundary. The figure indicates through symbols the point of diversion associated with the right. As with ground water rights, details related to owner, source, flow, purpose of use, and period of use are documented in the Vaughn Hansen Associates 1980 report in table form on pages 93 through 104. Water right data applicable to the Price and San Rafael river basins has been listed separately. No exchanges were identified in the report for local surface water rights.

**** R614-301-700. ****

SURFACE WATER QUALITY

The quality of waters in the vicinity of the Mine Permit Area are generally of the calcium bicarbonate type as shown in the seasonal anion-cation diagrams shown on Map R614-301-722.100a. There are currently seven surface water monitoring stations that have been used for the collection of water quality data. These stations include VC-1, VC-2, VC-4, VC-5, VC-10, VC-11, and VC-12. The water quality monitoring schedule for these stations was presented in Section R614-301-723. Station VC-5 monitors the quality of water in Whisky Creek above the point of mine discharge 005A or Sediment Pond 004A. Station VC-4 monitors the flow in Whisky Creek below both the mine and pond discharges before entering Eccles Canyon Creek. Stations VC-10, VC-11, and VC-12 monitor the quality of water at the mouths of South Fork, Boardinghouse and Finn Canyons respectively. Stations VC-1 and VC-2 monitor the water at locations above and below areas impacted by the Valcam Loadout Facility.

Seasonal Anion-Cation diagrams have been prepared for all surface water quality stations as shown in Map R614-301-722.100a. The diagrams have been prepared using average quarterly data for all stations. After a review of historical data it was found that little if any trends existed in the water quality data, and that taking averages of all data (as opposed to taking only the last five years) would give the most meaningful results. All surface stations have data available for all four quarters of the year with the exception of stations VC-4, VC-11, and VC-12. Data for the first quarter is not available for these stations due to snow cover.

A study of the variations in the anion-cation diagrams has identified a few interesting correlations. Generally speaking, the highest quality surface water is found during the second quarter period of the year when runoff from snowmelt is the highest. The diagrams shown on the figure indicate a slight increase in anion-cations throughout the year. Stations VC-1 and VC-2 located lower in the system near the Valcam Loadout Facility show relatively constant water quality throughout the year.

Relatively speaking, the water quality of the surface waters is good with total dissolved solids ranging from a low 101 mg/l at station VC-4 during the second quarter to a high of 598 mg/l at station VC-5 near the Belina mine. TDS values (as with overall water quality) generally increases in the third and fourth quarters of the year. Quarterly water quality statistics as required under the regulations for each surface water station are given in Table R614-301-724.200a.

TABLE R614-301-724.200a
SEASONAL SURFACE WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
VC-1	Flow	1	8	4.20	16.60	8.82	4.01
		2	23	2.40	55.90	16.43	13.11
		3	16	3.00	27.50	10.96	7.52

** R614-301-700. **

TABLE R614-301-724.200a (Continued)
SEASONAL SURFACE WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
		4	13	2.70	21.40	6.73	4.60
	TDS	1	9	250.00	730.00	419.56	133.33
		2	25	156.00	458.00	293.32	71.89
		3	16	234.00	531.00	350.81	82.98
		4	17	280.00	550.00	371.76	83.36
	TSS	1	7	11.00	309.00	109.71	116.51
		2	23	12.80	3680.00	245.77	739.40
		3	14	2.00	6460.00	495.89	1654.61
		4	16	1.00	78.00	21.81	18.27
	pH	1	8	7.20	8.70	7.95	0.43
		2	25	6.80	8.90	7.76	0.50
		3	16	7.00	8.70	7.83	0.51
		4	17	6.70	8.20	7.65	0.42
	Fe (Tot)	1	9	0.20	7.66	1.92	2.45
		2	19	0.10	7.51	1.62	1.86
		3	12	0.07	7.25	1.38	2.04
		4	17	0.06	1.75	0.37	0.37
	Mn (Tot)	1	9	0.01	0.33	0.11	0.09
		2	20	0.03	2.11	0.19	0.44
		3	12	0.00	2.00	0.21	0.54
		4	17	0.01	0.10	0.04	0.03
VC-2	Flow	1	7	3.50	14.00	7.43	3.53
		2	24	2.30	45.01	15.96	10.50
		3	13	1.50	10.36	6.31	2.14
		4	13	2.00	11.60	6.24	2.78
	TDS	1	9	280.00	728.00	415.44	125.39
		2	25	160.00	447.00	287.84	79.45
		3	16	240.00	480.00	348.13	70.76
		4	17	295.00	510.00	375.77	78.62
	TSS	1	7	8.00	139.00	53.29	47.46
		2	23	2.20	2820.00	222.75	568.63
		3	14	6.00	14025.00	1047.70	3599.85
		4	16	1.00	53.00	15.99	13.46
	pH	1	9	7.50	9.20	8.03	0.48
		2	26	7.00	8.85	7.79	0.47
		3	16	7.30	8.70	7.89	0.43
		4	17	7.10	8.70	7.73	0.39
	Fe (Tot)	1	9	0.13	4.31	1.08	1.27
		2	19	0.10	7.70	1.67	1.98

**** R614-301-700. ****

TABLE R614-301-724.200a (Continued)
SEASONAL SURFACE WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
		3	12	0.13	3.44	1.14	1.26
		4	17	0.16	1.37	0.45	0.33
	Mn (Tot)	1	9	0.017	0.150	0.080	0.047
		2	20	0.003	1.360	0.153	0.286
		3	12	0.001	6.500	0.588	1.783
		4	17	0.010	0.100	0.044	0.028
VC-4	Flow	1	5	0.00	0.00	0.00	0.00
		2	17	0.00	1.00	0.20	0.31
		3	15	0.00	0.07	0.10	0.02
		4	14	0.00	0.05	0.01	0.01
	TDS	1	0	-	-	-	-
		2	12	40.00	166.00	100.58	37.63
		3	11	110.00	344.00	208.45	54.18
		4	6	145.00	600.00	285.00	147.39
	TSS	1	0	-	-	-	-
		2	13	13.00	89.00	42.15	24.54
		3	11	8.40	15940.00	1477.76	4573.44
		4	6	8.80	498.00	116.47	172.65
	pH	1	0	-	-	-	-
		2	12	6.90	8.70	7.58	0.56
		3	11	7.00	8.40	7.72	0.50
		4	6	7.20	8.70	8.02	0.55
	Fe (Tot)	1	0	-	-	-	-
		2	11	0.13	4.24	0.96	1.09
		3	7	0.05	4.42	1.10	1.42
		4	6	0.10	22.50	3.98	8.28
	Mn (Tot)	1	0	-	-	-	-
		2	11	0.001	0.090	0.027	0.023
		3	7	0.001	6.240	0.929	2.169
		4	6	0.001	0.560	0.105	0.204
VC-5	Flow	1	5	0.00	0.00	0.00	0.00
		2	24	0.00	3.70	1.07	0.99
		3	16	0.00	1.20	0.36	0.37
		4	14	0.00	0.40	0.09	0.14
	TDS	1	1	359.00	359.00	359.00	-
		2	22	138.00	4000.00	591.64	825.30
		3	15	210.00	523.00	374.67	101.57
		4	7	255.00	508.00	382.14	75.28

** R614-301-700. **

TABLE R614-301-724.200a (Continued)
SEASONAL SURFACE WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
	TSS	1	1	3860.00	3860.00	3860.00	-
		2	21	4.40	4050.00	1009.16	1430.77
		3	15	1.00	17030.00	1209.45	4229.33
		4	7	17.00	611.00	140.57	203.61
	pH	1	1	7.60	7.60	7.60	-
		2	23	6.30	9.20	7.63	0.72
		3	15	7.00	8.70	7.96	0.56
		4	7	7.20	9.00	8.04	0.53
	Fe (Tot)	1	1	88.00	88.00	88.00	-
		2	15	0.04	57.50	5.31	14.06
		3	11	0.01	10.25	1.91	2.86
		4	7	0.22	4.25	1.24	1.46
	Mn (Tot)	1	1	1.65	1.65	1.65	-
		2	16	0.01	1.80	0.37	0.63
		3	11	0.00	7.15	0.70	2.04
		4	7	0.01	0.26	0.07	0.09
VC-10	Flow	1	3	0.00	0.00	0.00	0.00
		2	18	0.00	10.20	2.56	2.95
		3	13	0.08	0.90	0.45	0.26
		4	7	0.00	0.80	0.32	0.25
	TDS	1	1	356.00	356.00	356.00	-
		2	15	150.00	393.00	235.73	64.59
		3	13	225.00	459.00	296.00	64.60
		4	9	212.00	384.00	318.67	49.23
	TSS	1	1	38.00	38.00	38.00	-
		2	15	4.40	115.00	34.93	33.29
		3	13	0.00	88.00	18.94	23.66
		4	9	2.00	40.00	15.11	11.70
	pH	1	0	-	-	-	-
		2	16	6.90	8.40	7.48	0.49
		3	13	7.10	8.50	7.82	0.52
		4	9	7.50	8.60	7.98	0.36
	Fe (Tot)	1	1	0.22	0.22	0.22	-
		2	10	0.12	1.36	0.49	0.42
		3	8	0.01	1.33	0.37	0.40
		4	9	0.13	0.49	0.32	0.11
	Mn (Tot)	1	1	0.04	0.04	0.04	-
		2	9	0.02	0.07	0.04	0.02
		3	9	0.01	0.07	0.03	0.02

**** R614-301-700. ****

TABLE R614-301-724.200a (Continued)
SEASONAL SURFACE WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
		4	9	0.01	0.12	0.04	0.03
VC-11	Flow	1	1	0.00	0.00	0.00	-
		2	14	0.49	12.80	3.61	3.50
		3	11	0.27	2.55	1.08	0.68
		4	6	0.50	1.24	0.83	0.24
	TDS	1	0	-	-	-	-
		2	13	114.00	385.00	214.69	76.20
		3	11	253.00	459.00	298.09	53.62
		4	7	252.00	331.00	289.57	24.48
	TSS	1	0	-	-	-	-
		2	13	8.00	201.00	42.54	51.17
		3	11	4.00	140.00	28.25	40.20
		4	7	1.60	123.00	39.40	40.68
	pH	1	0	-	-	-	-
		2	13	6.90	7.90	7.45	0.28
		3	10	6.90	8.40	7.64	0.48
		4	7	6.90	8.50	7.64	0.47
	Fe (Tot)	1	0	-	-	-	-
		2	9	0.18	2.16	0.86	0.73
		3	7	0.01	1.88	0.56	0.62
		4	7	0.03	1.60	0.48	0.53
	Mn (Tot)	1	0	-	-	-	-
		2	9	0.01	0.10	0.04	0.03
		3	7	0.01	0.09	0.04	0.03
		4	7	0.01	0.05	0.03	0.02
VC-12	Flow	1	2	0.00	0.00	0.00	0.00
		2	16	0.00	4.20	1.26	1.47
		3	11	0.00	0.38	0.13	0.12
		4	7	0.00	0.20	0.07	0.07
	TDS	1	0	-	-	-	-
		2	14	105.00	322.00	188.43	60.48
		3	10	238.00	405.00	312.60	55.53
		4	5	260.00	397.00	318.80	44.56
	TSS	1	0	-	-	-	-
		2	14	3.00	228.00	39.06	58.49
		3	10	2.80	174.00	42.00	50.31
		4	5	1.00	104.00	24.60	39.85
	pH	1	0	-	-	-	-

**** R614-301-700. ****

TABLE R614-301-724.200a (Continued)
SEASONAL SURFACE WATER QUALITY STATISTICS

Sta.	Parameter	Qtr.	No. Samples	Min Value	Max Value	Average Value	Standard Dev.
		2	15	7.10	8.70	7.78	0.47
		3	10	7.10	8.20	7.66	0.39
		4	5	7.30	8.40	7.68	0.40
	Fe (Tot)	1	0	-	-	-	-
		2	10	0.02	2.90	0.67	0.79
		3	5	0.03	7.70	2.33	2.89
		4	5	0.11	8.20	1.77	3.22
	Mn (Tot)	1	0	-	-	-	-
		2	10	0.01	0.10	0.03	0.03
		3	6	0.02	0.09	0.04	0.02
		4	5	0.01	0.03	0.02	0.01

R614-301-724.300. GEOLOGIC INFORMATION.

Detailed geologic information as required under this section is given in Section R614-301-600.

R614-301-724.310. PROBABLE HYDROLOGIC CONSEQUENCES.

Geologic information given in Section R614-301-624 is provided in sufficient detail to determine the hydrologic consequences of the mining operation. Details related to hydrologic consequences are discussed in Section R614-301-728.

R614-301-724.320. RECLAMATION & HYDROLOGIC BALANCE.

Geologic information given in Section R614-301-624 is provided in sufficient detail to determine 1) whether reclamation of the Mine Permit Area can be accomplished, and 2) whether material damage to the hydrologic balance outside the Mine Permit Area is prevented. According to the designs and plans as submitted within this permit, reclamation will be completed as outlined in other sections, and minimal damage to the area outside the Mine Permit Area will occur as will be discussed in detail in section R614-301-728.

R614-301-724.400. CLIMATOLOGICAL INFORMATION.

R614-301-724.410. CLIMATOLOGICAL DATA REQUESTS BY THE DIVISION.

The continental climate of the Mine Permit Area is typical of high elevations in the Intermountain Region, with relatively high amounts of precipitation (occurring primarily as snow), low temperatures, and a short growing season.

**** R614-301-700. ****

R614-301-724.411. AVERAGE SEASONAL PRECIPITATION.

According to Jeppson et al, (1968), the Mine Plan Area has a mean annual precipitation of approximately 30 inches. The national weather service recording precipitation gauge installed in Eccles Canyon recorded 29.8 inches of rain and snowfall during 1980. Most precipitation falling on the Mine Plan Area is received in the form of snowfall (approximately 77 percent) during the months of October through April. The remaining 23 percent occurs as rainfall during the months of May through September.

R614-301-724.412. AVERAGE WIND CONDITIONS.

Local air patterns in the Central Utah Coal Basin area tend to follow the general surface drainage patterns controlled by topography. At night, the cooler denser air tends to flow down local drainages producing canyon breezes. Day time breezes tend to reverse this direction and flow up local drainages due to surface heating effects. Regional winds in the Mine Permit Area usually originate from the west and northwest and generally do not exceed 20 miles per hour (U.S. Geological Survey, 1979). Additional wind speed and direction information for the area may potentially be obtained from the mine permit application submitted by Coastal States Energy Company which is on file with UDOGM.

R614-301-724.413. SEASONAL TEMPERATURE VARIATIONS.

Temperatures in the area are highly influenced by elevation (Utah Division of Water Resources, 1975). According to Jeppson et al. (1978), January temperatures range from a mean minimum of about 7 degrees Fahrenheit to a mean maximum of 28 degrees Fahrenheit. July temperatures range from a mean minimum of 40 degrees to a mean maximum of 77 degrees Fahrenheit. The average frost-free season of the Mine Permit Area lasts about 40 days.

R614-301-724.420. ADDITIONAL INFORMATION.

N/A

R614-301-724.500. SUPPLEMENTAL INFORMATION.

According to information provided within this submittal, there are no adverse hydrologic impacts addressed under the PHC, nor are there acid-forming or toxic materials present that require supplemental information as required under this section.

R614-301-724.600. SURVEY OF RENEWABLE RESOURCE LANDS.

Ground water aquifers and their recharge zones do exist on and adjacent to the Mine Permit Area. These ground water aquifer and recharge areas are discussed in Section R614-301-722 of this permit. Additional information related to subsidence can be obtained by referring to Section R614-301-600, and information related to hydrologic consequences of mining can be found in Section R614-301-728.

R614-301-724.700. ALLUVIAL VALLEY FLOOR REQUIREMENTS.

By an earlier determination between the mining facility and the State Regulatory Agency it was determined that neither of the applicants facilities were within an alluvial valley floor. The Belina Permit Area is located within the headwaters of a canyon drainage system, and the Valcam Loadout Facility is located upstream of a valley floor. According to a conversation between Hansen, Allen & Luce engineers and Rick Summers of UDOGM on May 11, 1989, it was learned that UDOGM has a letter from a State Soil Scientist that indicates that the Skyline and Blazon mines are not located in an alluvial valley floor.

According to the Blazon mine report in the possession of UDOGM, the area below the Valcam Loadout Facility is a valley fill area, however, the Valcam loadout area and upstream areas are not. A decision finding resulting from the August 1984 permit application also indicates that the facilities owned by the applicant are not located in an alluvial valley. Reasons generally cited for determining that the requirements for an alluvial valley do not apply are 1) no sub irrigation system is being used in the area, 2) the Mine Permit Area itself is not being used for agricultural or flood irrigation, and 3) the topography is typical of a narrow canyon and not a broad valley.

R614-301-725. BASELINE CUMULATIVE IMPACT AREA INFORMATION.

R614-301-725.100. HYDROGEOLOGIC INFORMATION FROM GOVERNMENT SOURCES.

No known data exists from Federal or State Agencies as requested by this regulation.

R614-301-725.200. HYDROGEOLOGIC INFORMATION FROM APPLICANT.

This information is provided under Sections R614-301-600 and R614-301-728.

R614-301-725.300. APPROVAL REQUIREMENTS.
N/A

R614-301-726. MODELING.

Surface water modeling used within this mine permit renewal application is restricted to the use of a computerized SCS runoff prediction model developed by Hansen, Allen & Luce, Inc, as well as some basic pond routing as required for design. It is understood that all designs implemented as a result of the modeling techniques are reviewed and compared using similar in house techniques by the regulatory agency prior to installation. No ground water modeling has been completed for the applicant.

R614-301-727. ALTERNATIVE WATER SOURCE INFORMATION.

The impacts resulting from local mining include those identified under Section R614-301-724.600 related to subsidence, and those general impacts identified under Section R614-301-728 related to the hydrologic impacts of mining. Alternate water sources for interrupted or affected water supplies are identified in the respective section if applicable.

**** R614-301-700. ****

R614-301-728. PROBABLE HYDROLOGIC CONSEQUENCES (PHC) DETERMINATION.

In addition to the discussion on probable hydrologic consequences of mining provided within this section, the reader is referred to Section R614-301-600 wherein a discussion related to the geologic related impacts of mining is given.

R614-301-728.100. PHC DETERMINATION OF QUALITY AND QUANTITY.

HYDROLOGIC IMPACT OF MINING ACTIVITIES

As has been noted previously in this permit, the Mine Permit Area is covered almost entirely by the Blackhawk Formation. This formation consists of interbedded layers of sandstone and shale separated by various minable and non minable coal seams. The sandstone beds are generally massive while the shale layers act bentonitic, tending to swell when wet and decomposing into a semi-impervious clay. Investigations at springs and streams in the Mine Permit Area have indicated that the shale layers impede downward percolation of water through the Blackhawk. Danielson et al. (1981) observed that the downward movement of water is impeded by shale layers in the Blackhawk which carry the water to a discharge point where the shale layers outcrop. The fact that most springs are on fairly steep hillsides and not in channel bottoms where a regional aquifer would tend to discharge provides additional evidence that the springs in the upper elevations of the Blackhawk Formation (such as those within the Mine Permit Area) are draining perched aquifers. These springs tend to receive water from localized rather than regional sources. Of the 74 springs identified on the Mine Permit Area, only three have water rights for which the listed use is stockwater. Stockwater rights also exist on Boardinghouse, Finn, and along creeks within the Mine Permit Area (Vaughn Hansen Associates, 1980).

In determining the magnitude of the effects of mining on areal hydrology, it is important to recognize the uses of the hydrologic resources. Within the Mine Permit Area, the principal use of the hydrologic resources is for watering livestock and wildlife. The area has numerous springs, seeps, and several streams. It is believed that the disturbance of some of these water sources will not necessarily create a hardship on livestock or wildlife because of the existence of numerous water sources (depending of course on the magnitude of disturbances and the number of sources affected).

Subsidence Effects

Ground surveys have been conducted annually in late summer to determine and document the surface evidences and effects of subsidence. Consistent with expectations, no surface effects of subsidence have been found above areas where pillars have not been pulled. Also as expected, where the overburden above the mined coal seam is greater than about 350 to 400 feet, no surface evidence of subsidence (such as surface cracking) have been noted.

In the summer survey of 1982 some subsidence cracking was documented on the sidehill east of the South Fork of Eccles Creek. In one location a hole had developed down the hill from a small spring (Spring S25-11). The flow of about 1.5 gallons per minute (gpm) from the spring disappeared into the hole. In the 1983 summer survey, subsidence effects were observed to have increased in the South Fork area, and subsidence had also appeared in Whisky Canyon directly south of the Belina No. 1 portal area. Cracks have appeared and

some sink holes have developed. One of these sink holes is in the bottom of the intermittent stream channel in Whisky Canyon. No surface evidences of subsidence were observed in the August 1983 survey in areas having more than about 350 feet of overburden above the mined coal seam, or where pillars have not been pulled. Annual subsidence surveys have continued to be performed for the mine area. A summary map showing subsidence features related to mining activity through 1988 is provided on Subsidence Base Map R614-301-728.100a.

MAP R614-301-728.100a

Subsidence found to exist within the Blackhawk formation of the Mine Permit Area appears to be more significant than that experienced by other local mines. Two explanations are given for this. First, other mines generally have more overburden than is typical of subsided areas of the Belina Mine. Greater overburden thicknesses generally do not permit the development of cracks, holes, or other noticeable surface effects of subsidence because of the distance through which deformation must travel before being noticed on the surface. The second reason for subsidence is that through the mining of local coal reserves the area has been found to contain more faults than were originally known to exist. The frequency of faulting in the Mine Permit Area appears to be higher than that found in other surrounding mines. Faults reduce the ability of a formation to withstand stresses caused by extracting a coal seam and subsequent subsidence. Consequently, in faulted areas, subsidence effects are likely to transmit further vertically.

After studying hydrologic impacts of coal mines in the Blackhawk Formation of the Wasatch Plateau, Danielson et al. (1981) concluded:

> Where subsidence has not been extensive and where water-bearing zones that overlie the Star Point-Blackhawk aquifer are perched, it is unlikely that mine dewatering induces greater recharge to the ground-water system. Neither is it likely under these conditions that the flow of springs that issue from the perched zones or the rate of natural downward leakage into the Star Point-Blackhawk aquifer are affected by mine dewatering. However, natural recharge and discharge relationships can change if hydraulic connection between the perched zones and the Star Point-Blackhawk aquifer is increased by fracturing due to subsidence.

No noticeable changes in the high-elevation, perched springs are expected within the portions of the Mine Permit Area where the pillars are not pulled or where the overburden is greater than about 350 to 400 feet. However, in the remaining areas, as has been documented, subsidence can and does extend to the surface thereby altering the recharge-runoff characteristics of the area. Perched aquifers in these zones may be partially or wholly drained. This may increase the recharge to the regional aquifer, increase the water made in the mine, and/or change the point of discharge of a spring. It is expected that the shale and clay layers which exist within the Blackhawk formation will have a tendency to seal cracks that develop, thus reducing the long-term hydrologic impacts of subsidence.

Subsidence impacts on perched springs within the Mine Permit Area are not expected to reduce significantly base flows in local perennial streams in the area because of 1) the large number of the springs that are found (all of which are not affected similarly), and 2) because of the relatively small flow rates characteristic of high elevation perched springs.

what area: other sections list 74+ springs

In the early summer of 1979, 13 springs with a combined flow of about 0.087 cfs (39 gpm) were identified in this area. The average June flow of Boardinghouse Creek (measured above the major springs near the mouth of the canyon) from 1980 through 1983 has been about 6.2 cfs. Obviously the perched springs on upper Boardinghouse Creek compose a very small portion (1.4 percent) of the flows in the snowmelt season. the average flow of Boardinghouse Creek for the same period in August has been about 1.5 cfs -- still much more than flows of the 13 identified springs (the August combined flows of these 13 springs were not measured, but would be less than 0.087 cfs). The purpose of this example is not to quantify the effect of mining on flow in the perennial streams, but merely to illustrate that even with an unrealistic worst case, drying up small perched springs will not decrease the base flows of the perennial streams significantly.

When subsidence results in the draining of the small perched aquifers into the mine, the drained water will either 1) aid in recharging the regional aquifer and thus eventually result in an increased discharge from the aquifer at some location, or 2) will increase the amount of water that will be discharged from the mine by way of Whisky Creek into Eccles Creek. Surface runoff from small upstream watershed areas will also be captured by subsided areas and contribute to the discharges mentioned.

subsid & sediment

Subsidence has the potential for increasing the discharge of suspended sediment in adjacent streams due to the disturbance of local geology (by potential denuding or by softening of the soil structure). As a result, subsided areas may tend to erode more than unsubsided areas until they are weathered and revegetated. Subsidence is not anticipated in streambeds or perennial streams, since they will be protected from subsidence by limiting adjacent coal mining activities.

subsid & TDS

Subsidence may also impact water quality in local streams. Snowmelt and surface runoff from rainstorms is typically of very good quality as is spring discharge. For example, average concentrations of total dissolved solids (TDS) for spring discharges noted in Section R614-301-700 are generally in the range of approximately 200 to 400 mg/l. It is anticipated that the portion of runoff that is intercepted by subsidence cracks will develop increased concentrations of some water quality parameters (such as TDS). Because the amount of water being potentially captured by subsided areas will be relatively small in comparison with the overall volume of ground water within the Mine Permit Area, it is believed that the overall impact to surface water quality will be minimal.

subsidence is occurring currently w/ no pillar

An additional effect of subsidence which was just alluded to would be the potential for flow from springs unaffected by subsidence to flow into a subsided area. In such cases the springs will still provide a water supply for wildlife and vegetation above the subsided areas.

identify streams & areas w/ no pillar

As has been stated, subsidence is expected to have hydrologic impacts in the areas where pillars are pulled from mine workings and the overburden is less than approximately 350 to 400 feet thick. Perennial streams (i.e. South Fork of Eccles Creek, Whisky Creek, Boardinghouse Creek, Finn Creek, and Long Creek) will be protected from subsidence through the practice of leaving pillars beneath the perennial portions of these streams. Pillars will not be pulled where any perennial stream is located within the area included within the angle of draw of the mine. The currently proposed angle of draw for these buffer zones is 35 degrees from vertical. However, the angle of draw in the Blackhawk Formation is likely considerable less than 35 degrees. When documentation of the actual angle of draw can be obtained, a request will be made to reduce the size of the buffer zones accordingly.

Subsidence Base Map R614-301-728.100a will be updated annually to document potential subsidence areas above the Belina mines. Updated versions of this map along with a report describing the observed subsidence effects will be submitted annually to the Utah Division of Oil, Gas, and Mining. Aerial photogrametric surveys have also been initiated as an aid in determining and monitoring the effects of subsidence.

Mine Dewatering Effects

More water has been encountered inside the Belina No. 1 Mine than was initially anticipated. Significant sources of mine water have generally been associated with faults or rills in the formations. However, consistent with initial projections, some faults have been essentially dry. The identification of additional faults (beyond those originally known to exist) is believed to be one cause of the higher than anticipated amounts of water encountered. Above average precipitation and runoff in 1982 and particularly 1983, and the effects of more surface subsidence than was initially expected are also believed to be contributing to the increased amount of water in the mine.

Water is usually made at the face of the mine workings. Hansen (1979) reports that mines in the Wasatch Plateau coal field generally yield less than 10 gallons per minute per active face, with drifts drying approximately 500 feet up-dip from the face. Once a section dries up, leaks rarely reappear. This condition has been observed locally in the Belina mines with the exception that dry conditions generally develop within 200 feet of the face. Apparently, only a zone of saturated sandstone immediately adjacent to the mine face is dewatered by the drift.

Water made within the mine (except for water intercepted by subsidence cracks) is not expected to have any relation with the perched, undisturbed aquifers. Mine water is either stored within the mine, evaporated, hauled out as moisture on the coal, or discharged into Whisky Creek. The exact quantity of water evaporated and pumped out of the mine via the fan is not known. Data are not available to make such a calculation. However, as reported in the technical review comments from OSM, 19 million gallons (equivalent to only 36 gpm) of water are evaporated annually within the Utah Power and Light Company Wilberg Mine. This estimate is based on an air flow in the Wilberg Mine of 570,000 cfm, with air entering the mine at 45 percent humidity and exiting at 98 percent humidity. Air entering the Belina Mine No. 1 is believed to have greater humidity than the Wilberg mine due to differences in climatic factors between the two mine sites. There will therefore be less potential for moisture pickup through the Belina Mine than in the Wilberg Mine.

The air flow through both the Belina No. 1 and No. 2 Mines is approximately 565,000 cfm (405,000 cfm from Belina No. 1 Mine), approximately that of the Wilberg Mine air flow rate. Considering the humidity comparison made above, it is estimated that the water loss due to evaporation in the Belina No. 1 and No. 2 Mines will be less than 36 gpm. The amount of water hauled away as culinary wastewater is equivalent to an annual average flow of about 1.4 gpm. Approximately 16 pounds (0.26 gallons) of water leave the mine with each ton of coal shipped from the mine. At an eventual maximum production rate of 2,016,000 tons per year (only abut 750,000 tons were shipped in 1982), this amounts to an equivalent flow of 7.4 gpm.

Flow measurements have been made of the mine water discharge from the Belina No. 1 Mine since 1977 (there has been no discharge from the Belina No. 2 Mine). Discharges

statistics for available data for the period between January 1981 and June 1989 are shown in Table R614-301-728.100a. Discharges at the Belina No. 1 mine increased during 1983 over that recorded for the prior six-year period. The increases experienced are believed to be the result of 1) increased natural recharge to the ground water system resulting from variations in the local climatic cycle, 2) an expansion of mine workings thereby resulting in the interception of additional waters, and 3) the interception of water, or dewatering of small perched water systems as a result of local subsidence.

The peak mine discharge of approximately 422 gpm was recorded on August 12, 1983. Current 1988 and 1989 discharges are ranging between 22 and 346 gpm (.05 to .77 cfs). Because mine discharges have been constant for a number of years, Whisky Creek is now being categorized by UDOGM as a perennial stream. During the three-year period between 1980 and 1982, the U.S. Geological Survey recorded and published flow records for Eccles Creek. At that time the Belina Mine discharge accounted for approximately 2.2 percent of the flow of Eccles Creek and about 0.7 percent of the flow of Mud Creek below Winter Quarter Canyon.

TABLE R614-301-728.100a.
DISCHARGE STATISTICS FROM THE BELINA NO. 1 MINE IN CFS (1981-1989).

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Count	7	5	6	9	8	7	6	5	8	7	7	4	79
Minimum	0	0	0	0	0	0	.02	.02	0	0	0	0	0
Maximum	.40	.07	.53	.77	.46	.93	.50	.32	.94	.31	.93	.15	.40
Average	.08	.03	.14	.11	.18	.39	.19	.11	.42	.12	.29	.06	.19
Std Deviation	.13	.03	.19	.23	.18	.36	.21	.11	.36	.13	.35	.06	.26

As pointed out by Waddell et al. (1983), mining activities may have the effect of redistributing the flow along a stream. For example, flow discharged from the Belina mines would probably reach Mud Creek eventually if the mines did not exist, but would be added at different discharge points (such as seepage zones in Eccles or Mud Creeks). Intercepting water in the mine probably most likely has the effect of increasing the base flows in Whisky Creek, Eccles Creek, and Mud Creek during the mining period. When the mining operation ends, base flows may be reduced slightly until mine cavities are filled. However, as pointed out, the magnitude of the increase or decrease of baseflows has been, and is expected to be relatively small when compared to the flow of the principal receiving streams.

A probable beneficial effect of mine dewatering that may partially or completely offset the slight negative effect on water quality previously described as a result of subsidence was noted by Vaughn Hansen Associates (1980). Because the Belina mines act as interceptor drains, the ground water that is brought to the surface may under certain circumstances have a lower dissolved solids content than would have existed if the water were to continue its downward movement through shale layers, dissolving increased amounts of salt with distance (Southern Utah Association of Governments, 1977; Hansen,

1979). In this regard, local mines will have a slightly beneficial impact on the chemical quality of water in area streams by decreasing contact time with the shale layers of the Blackhawk.

Suspended sediment and oil and grease increases in water being discharged from the mine are removed through a sedimentation pond (005A) located at the discharge point of the Belina No. 1 mine. Effluent is treated through the series of basins within the pond to maintain regulatory requirements prior to discharge into adjacent streams. data support

Because of the high alkalinity and low acidity concentrations in the area (differing normally by one of two orders of magnitude), acid drainage problems should not occur as a result of mining. This is fortified by the fact that coal in the area has a low sulphur content (U.S. Geological Survey, 1979). data support

There is the potential for mine dewatering to divert some water from the Huntington Creek Drainage into the Mud Creek Drainage through in-mine pumping used to maintain operations. However, the coal seam is down-dipped towards Huntington Creek to the west. As areas are mined and abandoned on the west side of the Mine Permit Area, they will collect water which was encountered in mine sections normally within in the Mud Creek drainage. It is difficult at this time to identify the flow paths of in mine water due to the constant need for change within the mine to accommodate mining operations. Consequently, it is uncertain which surface water basin may receive additional water at the expense of the other. It is anticipated however that the potential trans-basin effect is small (less than 1 percent) and insignificant to either Huntington Creek or Mud Creek baseflows.

There has been some concern expressed regarding the fact that flows from a spring on the west side of Pleasant Valley Canyon near the Valcam Loadout Facility diminished several years ago. Investigation by the applicant related to this matter has shown that the decrease in flows occurred during the 1977 drought. For example, Gooseberry Creek, a nearby gaged stream, experienced only 19 percent of its 44-year average during the 1977 water year. Dry precipitation periods are expected to produce lower than normal spring flows in the periods that follow. The spring in question has been noted by mine personnel to now be flowing at a rate generally consistent with those flow rates noted prior to the decrease. The spring is located on the opposite side of Mud Creek from the Valcam Loadout Facility. Present data values & spring depletion curves

Impacts upon Water Rights

As discussed previously, ground water intercepted within the mine and discharged in Whisky Creek will have the effect of redistributing flows within the hydrologic system, thereby potentially impacting both surface and ground water rights (which are discussed in Section R614-301-724.100) within and adjacent to the Mine Permit Area. The impact however is believed to be minimal. According to best information available, ground water within the Belina Permit Area has a general east west flow direction with the ground water divide located approximately alone the Carbon and Emery county lines. Waters entering the ground water system west of the ground water divide flow to the west towards Huntington Creek and Electric Lake. Those on the east flow toward Mud Creek,

with the large majority feeding the area upstream and south of the confluence of Mud and Eccles Creeks.

Water entering the mines from various sources is conveyed to the surface and discharged into Whisky Creek, which in turn flows into Eccles Creek and Mud Creek. This discharged water is developed within the mine from various locations and includes water which would have naturally flowed through time into both Huntington and Mud Creeks. The amount of water diverted in this manner from Huntington Creek is not recovered downstream within the same drainage basin from which it was taken, but it is rather discharged into the Mud Creek drainage. Water rights which potentially use this water at downstream locations within the Huntington Creek drainage could potentially be impacted by this interbasin transfer of water.

In addition, east flowing ground water within the western half of the Mine Permit Area has the potential for entering Mud Creek at locations upstream of the confluence between Eccles and Mud Creeks. This potential exists through water table seepage along perennial streams, or from local springs. Although mine discharges will enter Mud Creek (and thereby remain in the same drainage basin), they will do so at the confluence with Eccles Creek and therefore not be available for use at upstream locations where water rights may potentially exist.

It is believed that Mud Creek on the east, and Huntington Creek on the west serve as boundaries to impacts which may potentially be created by discharging water from the mine. The potential impacts to surface and ground water rights resulting from mine discharges should therefore be confined within these boundaries.

Impacts to water rights associated with the perched aquifer system could occur as a result of subsidence. In areas where overburden is less than 350 to 400 feet, subsidence cracking can extend to the surface thereby altering the recharge/runoff characteristics of the area. Alterations can include partial or complete draining of perched aquifer systems if cracking is intercepted. Although it is impossible to predict the exact effects of subsidence on existing rights, an examination of the location of rights relative to potential subsidence impact areas help identify which rights may be impacted. From subsidence, spring and water right identification mapping included within this permit, it is found that the majority of rights which could potentially be effected by subsidence are those ground water rights associated with high perched systems, or stream flows which derive their base flow from high perched systems. A relatively few number of rights exist in these upper areas.

Impacts to surface water rights from subsidence could result from two areas. The first is related to the runoff-recharge characteristics of the area which are potentially altered where subsidence cracking extends to the surface. The small amount of surface runoff traversing a hillside could become trapped in a subsidence feature and enter the ground water system before reaching the natural stream course. Water thus trapped would however return to the surface at some other downstream location which may or may not (depending upon the location of the water right in question) impact local rights (either positively or negatively). The second impact would be through the interruption of a ground water source in its return path to the surface. Ground water movement and natural flow paths may potentially be interrupted by the presence of a newly formed

subsidence failure or crack. The path provided by this new subsidence feature may redirect ground water flows to lower levels within the system before returning them to the surface, whereas the water may have returned to the surface at a higher elevation if the subsidence feature had not been encountered. The overall effects upon surface water rights due to subsidence however are believed to be small due to the relatively low flow rate characteristics of the local geology.

Of the groundwater rights (shown on Map R614-301-724.100a) within the Mine Permit Area potentially affected by subsidence, three rights (91-3595, 91-3596 and 91-1058) are associated with wells, and 3 rights (91-1643, 91-3499, and 91-3500) are associated with springs. All three wells are owned by the applicant and all but the well associated with water right number 91-1058 have been abandoned. The three springs mentioned are all located in the southwest corner of Section 31 as shown on the water rights map. This zone has less than 300 feet of overburden, and therefore could potentially be affected by subsidence. Water right number 91-3500 (Spring S31-13) is included in the water monitoring program to represent the three identified springs and will be monitored as a base for impacts due to subsidence.

Drawdown in the regional water table resulting from mine discharges may result in the diminution of flows in water table springs and perennial streams receiving seepage from the regional water table. However, the impacts associated with mine dewatering upon any given stream is anticipated to be small. Should they be required, water rights 91-3587 and 91-3588 in Boardinghouse and Finn canyons, and spring right 91-3586 in Lower Boardinghouse Canyon (owned by the applicant) could be used for mitigation to impacts. The monitoring program initiated by the applicant will help to identify both the short and long term effects of mining on water rights. Thus far, no impacts related to mining are distinguishable through the use of time plots of flow data.

Local wells, particularly those associated with water rights 91-1114 and 91-1560 (located in Eccles Canyon and owned by Utah Fuels), could potentially be affected to a small degree by mine dewatering. The overall impact to these wells however is anticipated to be small and should not impact significantly the ability of the well owner to continue to pump water from the well.

ALTERNATIVE WATER SUPPLIES AND HYDROLOGIC MITIGATING FACTORS

Although, impacts from the mine are not anticipated to significantly diminish the flows associated with any particular water right, the monitoring plan has been formulated to observe and aid in predicting such effects. In the event that an impact is determined, one of the following alternative means of water supply would be used by the applicant to replace an interrupted supply of any legal owner of such rights.

1. Private contractors living within the district could be retained to haul water to specific locations from applicant owned sources within Pleasant Valley.

2. The affected water right could be purchased by the applicant.

3. The applicant has two wells within the Mine Permit Area which could be utilized to supply supplemental amounts of water for both private or industrial use.

4. The applicant could initiate an exchange of water right with the State Engineer to exchange water owned by the applicant in Scofield Reservoir for water currently found at any one of the other 71 springs found within or adjacent to the Mine Permit Area for which water rights have not been filed. This option would in most cases be acceptable to the State Engineer if it could be shown that the spring upon which water is being filed is not critical to downstream rights between the spring and Scofield Reservoir.

As indicated above, the applicant owns several water rights on or in the vicinity of the Mine Permit Area, some of them being the more significant water rights in the area. A list of local water rights is shown in the Vaughn Hansen Associates (1980) report. Water rights listed in the report as being owned by the North American Coal Company are now owned by the applicant. The larger rights include: Clear Creek Springs (0.5 cfs), Clear Creek Mine Tunnel No. 3 (0.446 cfs), O'Connor Mine (0.047 cfs and 0.030 cfs), the Belina Mine Well (7.7 acre-feet per year), and stockwater rights on Boardinghouse and Finn Creeks (unspecified amounts). Although the applicant owns the water right on Clear Creek Tunnel No. 3, there is no longer a discharge associated with the tunnel, and therefore would not by useful for water right mitigation. Should the flow reappear, it would be available for mitigation of impacted water rights. The applicant has also transferred 15 acre-feet per year of water rights to the town of Scofield.

It is fully expected that if mining activities within the Mine Permit Area result in noticeable diminution of base flows in streams or springs, that the diminution would be less than the rights owned by the applicant. These supplies can be used to provide compensation to potentially damaged users. Meanwhile, downstream users are benefiting from the portion of these rights not currently utilized by the applicant.

In addition, the abandonment of certain sections of the mine will allow inflowing water to create a storage reservoir thereby again contributing to ground water flow. When mining in a particular section of the mine has been completed, that section of the mine is sealed off and allowed to fill with water to a level determined safe by MSHA. In areas where only pillar splitting occurs, this level could be as much as 10 feet. By allowing the water to be pumped to or stored in abandoned mine areas in this manner, the ground water system is stabilized, and surface discharges are eliminated.

R614-301-729. CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT (CHIA).

R614-301-729.100. DIVISION ASSESSMENT.

To be completed by the Division.

R614-301-729.200. DIVISION REVIEW.

To be completed by the Division.

**** R614-301-700. ****

R614-301-730. OPERATION PLAN.

R614-301-731. GENERAL REQUIREMENTS.

General requirements given under this section are discussed specifically in Sections R614-301-731.110 through 301-765 as appropriate.

R614-301-731.100. HYDROLOGIC-BALANCE PROTECTION.

R614-301-731.110. GROUND WATER PROTECTION.

R614-301-731.111. GROUND WATER QUALITY.

inappropriate sentence for section

Ground water quality within the Mine Permit Area is protected through the control of surface waters and containment facilities. Surface runoff facilities have been designed to control and convey all disturbed area waters into sedimentation ponds located at both the Belina and Valcam facilities. These facilities are discussed more fully in Section R614-301-740.

not true SMC's - add RO directed from disposal areas.

Acidic and toxic forming materials are not present within the Mine Permit Area and therefore do not impact the local ground water system. Mine shop areas using special chemicals or fluids in association with mine equipment contain and dispose of waste products in accordance with State law. Attempts are made to minimize areas used for the storage of mining equipment such that potential contamination zones are controlled.

need steps

Waste rock and materials developed within the mine either remain within the mine or are returned to the mine and are not disposed of on the surface, thereby eliminating and controlling the need for surface waste disposal facilities. This method of disposal maintains a natural environment for developed wastes.

really? (sic)

R614-301-731.112. SURFACE COAL MINING AND RECLAMATION ACTIVITIES.

N/A

R614-301-731.120. SURFACE WATER PROTECTION.

R614-301-731.121. SURFACE WATER QUALITY.

HANDLING OF EARTH MATERIALS

The Belina No. 1 and 2 mines are relatively small mines located within the headwaters of a small drainage basin known as Whisky Canyon in which no acidic or toxic forming materials are known to exist. Surface facilities at the Belina Permit Area include miscellaneous buildings, a coal stock pile, and truck loadout facility, and a sedimentation pond. Little earth movement occurs within the area. Some slopes have been modified through the mining process (such as slope cuts for the installation of the coal pile and loadout facility). Some of these disturbed slopes lie within the runoff

containment areas feeding the sediment pond thereby controlling runoff contamination through potential increased sediment loadings. Disturbed slopes lying without the runoff control area have been reshaped and revegetated according to reclamation requirements. Whether within or without the sediment control area, all non vertical cut slopes have been regraded and revegetated. The revegetation of these slopes will help to control to the degree possible sediment load increases.

Facilities located at the Valcam Loadout Facility include miscellaneous buildings, a coal truck dump, a coal stockpile, and a train loadout structure. As with the Belina Permit Area, the Valcam loadout area has some slope cuts which were required for placement of the loadout facilities since they are located within a relatively narrow canyon. All surface drainage within this Mine Permit Area is controlled through the use of three sedimentation ponds which will be discussed in Section R614-301-740. No known acidic or toxic materials are known to exist within the Mine Permit Area which would create any potential related water quality deterioration controlled under this regulation.

GROUND WATER DISCHARGES

The only mine related ground water discharge existing within the Mine Permit Area is the NPDES discharge from the Belina mines (Sediment Pond 005A). Discharge from Pond 005A enters Whisky Creek at the upper end of the mining facilities. No known acidic or toxic forming materials are known to exist with which the mine discharge could intermix and thereby deteriorate surface water quality. Water quality related to the mine discharge is discussed more fully in Section R614-301-731.200.

RUNOFF FACILITIES

All surface runoff facilities have been designed to either collect and deliver disturbed area runoff to one of the four sediment ponds located within the facility, or to divert undisturbed water away from disturbed areas thereby protecting its pristine quality. Complete details related to the mine runoff and conveyance facilities are discussed in Section R614-301-742.

R614-301-731.122. SURFACE WATER QUANTITY.

All undisturbed area surface waters are diverted around the Mine Permit Area through undisturbed area bypass ditches and/or culverts thereby protecting the integrity of natural flow volumes and rates. Only the relatively small amount of rainfall falling directly upon the disturbed areas of the mine are temporarily diverted from their natural watercourse. This water is collected and diverted into sedimentation ponds wherein water quality is improved. The amount of disturbed area runoff (originating as precipitation), and collected in these ponds is relatively minor in comparison with natural drainage flow rates. Upon mine abandonment, the disturbed areas will be reclaimed and natural runoff will be restored.

R614-301-731.200. WATER MONITORING.

R614-301-731.210. GROUND WATER MONITORING.

** R614-301-700. **

R614-301-731.211. GROUND WATER MONITORING PLAN.

Spring Monitoring

The ground water monitoring plan used and implemented by the applicant includes the parameters and sampling schedule shown in Table R614-301-731.211a. The locations of the sampling sites are shown on Ground and Surface Water Sampling Locations with Seasonal Water Quality Map R614-301-722.100a, and information related to quality of the waters is discussed in Section R614-301-722.

TABLE R614-301-731.211a
WATER QUALITY ANALYTICAL SCHEDULE

Parameter	Month of Sample					Type of Sample	
	April	May	June	July	September or October	Surface Water	Ground Water
Field Measurements							
Air Temperature	X	X	X	X	X	X	X
* Dissolved Oxygen	Once During Period				X	X	X
Flow	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X
Specific Conductivity @25°C	X	X	X	X	X	X	X
Water Temperature	X	X	X	X	X	X	X
Laboratory Analyses							
* Acidity	Once During Period				X	X	X
Bicarbonate	X	X	X	X	X	X	X
Calcium	X	X	X	X	X	X	X
Carbonate	X	X	X	X	X	X	X
Chloride	X	X	X	X	X	X	X
* Iron, Total	Once During Period				X	X	
Magnesium	X	X	X	X	X	X	X
* Manganese, Total	Once During Period				X	X	X
* Oil & Grease	Once During Period				X	X	
Potassium	X	X	X	X	X	X	X
* Settleable Solids	Once During Period				X	X	
Sodium	X	X	X	X	X	X	X
Sulfate	X	X	X	X	X	X	X
Total Dissolved Solids	X	X	X	X	X	X	X
* Total Hardness	Once During Period				X	X	X
* Total Suspended Solids	Once During Period				X	X	

* Indicates data collected under the comprehensive sampling schedule.

** R614-301-700. **

The ground water monitoring program as requested by O.S.M. consists of stations S7-11, S24-12, S25-13, S31-13, S36-17, S36-19, and S36-23. As shown in the table, a comprehensive set of water quality parameters is measured biannually. The list of comprehensive parameters was developed from UDOGM guidelines minus those parameters shown to be less than standard limitations developed by the State Department of Health for designated uses.

Comprehensive sampling and testing is completed biannually, one sample being taken during high runoff in the snowmelt period, and the other being taken in the low runoff period of September or October. The comprehensive schedule is in short an expansion of the abbreviated schedule which is used to analyze data collected during April, May, June, July, and again in late September or early October. Once during the April through July period, and again during the September or October sampling, the additional data (attributed to the comprehensive schedule) shown in the table are collected in addition to that collected under the abbreviated schedule.

Mine Discharge

Mine water discharges from Sediment Pond 005A are monitored according to the current NPDES permit. Grab samples taken monthly are analyzed for pH, TDS, Iron, and Oil and Grease. Flow and TSS samples are taken bi-monthly. All discharge samples are collected at the Parshall Flume installed at the pond outlet prior to mixing of the mine discharge water with Whisky Creek. A copy of all water quality data analyses will be submitted to the appropriate agencies prior to the 28th of the month following the sample. All historic data and sample results are on file at the offices of the Division of Oil, Gas and Mining.

In-Mine Waters

The in-mine ground water monitoring program consists of 1) monitoring ground water inflow to the Belina Mine from individual or collected sources which exceed five gallons per minute (for discharge periods in excess of 30 consecutive days), and 2) determining the consumption of ground water through evaporation, production, and mine discharge.

When new sources or areas of measurable flow are encountered (5 gpm or more for a period in excess of 30 days), a sampling program will be initiated on a quarterly sampling schedule. Data submittals of sampling completed will be made to the regulatory agency on a quarterly basis, including a copy of a map indicating the location of new flow sources. Quarterly sampling will continue until flows diminish to less than 5 gallons per minute, or until the regulatory authority approves discontinuance of the sampling site.

An annual in-mine ground water monitoring report will be submitted to the regulatory authority within 90 days after the end of the reporting year. Included within the report will be an estimate of ground water consumption resulting from ventilation, evaporation, coal production, and mine discharge.

**** R614-301-700. ****

R614-301-731.212. GROUND WATER MONITORING SUBMITTALS.

Ground water quality and quantity data is submitted quarterly to the Division as required under this regulation. Data showing noncompliance of the permit conditions will continue to be brought immediately to the attention of the Division, with follow up action as required under R614-301-145 and R614-301-731 being taken.

R614-301-731.213. SIGNIFICANT AQUIFER DETERMINATION.

It has previously been determined that the materials lying beneath the Mine Permit Area generally consist of one of two types of geologic formations. The upper formation is identified as the Blackhawk formation which consists of three types of shale, all continental in origin. It is within this formation that the three major coal seams are identified. The lower formation consists of the Star Point Sandstone. Both formations are generally tight, and therefore are generally incapable of yielding large amounts of water. The exception to this statement might be in the case where movement occurs through tension cracking. In the 1983 hydrology report prepared by Vaughn Hansen Associates, it is stated that "testing has shown the Star Point Sandstone to be extremely tight, yielding water in quantities of less than 5 to 10 gpm". Similarly, in a report prepared by Cordova, 1964, it is noted that the Blackhawk sands are 1) generally discontinuous in nature, 2) have low specific yields, and 3) are only locally important.

The regional importance of the Blackhawk sands as an aquifer is again minimized when it is understood that downward moving water is often impeded by discontinuous shale barriers within the formation. The presence of the shale tends to redirect any ground water movement to the surface or other drain system (such as a sandstone finger).

In summary, the overall water carrying capability of the geologic stratum within, and adjacent to the Mine Permit Area is low, and therefore, the geologic stratum does not play a significant part in regional water movement. It could also be said that in general terms, a ground water aquifer of major importance does not exist within the permit or adjacent area.

R614-301-731.214 thru 301-731.214.2. MONITORING THROUGH BOND RELEASE.

The ground water monitoring program identified in Section R614-301-731.211 will continue through reclamation and bond release unless modified through subsequent permit renewals or through action by the regulatory agency.

R614-301-731.215. INSTALLATION/REMOVAL OF MONITORING EQUIPMENT.

All monitoring equipment which is potentially used for the purpose of measuring water quality and or quality of ground water will be properly installed, maintained, operated during the mining process, and will be removed when no longer needed.

R614-301-731.220. SURFACE WATER MONITORING.

R614-301-731.221. SURFACE WATER MONITORING PLAN.

The surface water monitoring plan used and implemented by the applicant includes the parameters and sampling schedule shown in Table R614-301-731.211a. The locations of the sampling sites are shown on Map R614-301-722.100a, and information related to quality of the waters is discussed in Section R614-301-722.

The surface water monitoring program as requested by O.S.M. consists of stations VC-1, VC-2, VC-4, VC-5, VC-10, VC-11, and VC-12. As with ground water sampling, a comprehensive set of water quality parameters is measured biannually. The list of comprehensive parameters was developed from UDOGM guidelines minus those parameters shown to be less than standard limitations developed by the State Department of Health for designated uses. For additional information related to water quality monitoring, the reader is referred to Sections R614-301-731.211 and R614-301-722.

R614-301-731.222. DETERMINATION OF MINING IMPACTS.

The surface water monitoring plan used by the applicant is presented in Section R614-301-731.211. Water quality samples will be taken for those parameters listed in Table R614-301-731.211a according to the time schedule identified. Should a significant trend be identified through analysis and/or plotting of the data, the applicant will investigate the potential causes of the trend as well as identify remedial actions which may be feasibly implementation to either stop or reverse the trend.

R614-301-731.222.1 thru 301-222.2. ADDITIONAL MONITORING REQUIREMENTS.

The additional monitoring requirements for R614-301-731.222.1 are met as shown in Table R614-301-731.211a. Requirements of 40 CFR Parts 122 and 123, R614-301-751, and by the Utah Division of Environmental Health for National Pollutant Discharge Elimination System (NPDES) permits are being met as discussed in Section R614-301-751.

R614-301-731.223. SURFACE WATER MONITORING SUBMITTALS.

Surface water quality and quantity data is submitted regularly to the Division as required under this regulation on a quarterly basis. Data showing noncompliance of the permit conditions will continue to be brought immediately to the attention of the Division, with follow up action as required under R614-300-145 and R614-301-731.

R614-301-731.224 thru 301-731.224.2. MONITORING THROUGH BOND RELEASE.

The surface water monitoring program identified in Section R614-301-731.221 will continue through reclamation and bond release unless modified through subsequent permit renewals or through action by the regulatory agency.

R614-301-731.225. INSTALLATION/REMOVAL OF MONITORING EQUIPMENT.

All monitoring equipment which would potentially be used for the purpose of measuring water quality and or quality of surface water will be properly installed,

maintained, operated during the mining process, and will be removed when no longer needed.

R614-301-731.300 thru 301-731.320. ACID AND TOXIC FORMING MATERIALS.

No known acid or toxic forming materials are known to exist within the Mine Permit or adjacent area.

R614-301-731.500. DISCHARGES.

R614-301-731.510 thru 301-731.513. DISCHARGES INTO AN UNDERGROUND MINE.

All mine portals and surface runoff facilities are situated such that discharges into the underground mine are not possible.

R614-301-731.520 thru 301-731.522. GRAVITY DISCHARGES FROM AN UNDERGROUND COAL MINE.

All mine portals are situated upgradient from all mine workings, and are thereby protected from gravity mine wastewater discharges. Post mining sealing of the mine portals is discussed in the section related to mine reclamation. <city section

R614-301-731.600 thru 301-731.620. STREAM BUFFER ZONES.

Where possible, all coal mining facilities are located with at least the required 100 foot stream buffer zone. A few areas within the Mine Permit Area are not able to comply completely with this regulation due to prelaw conditions at the mine. Those areas not able to comply are prelaw and can be identified by inspection of the respective hydrologic surface mapping. The major area not able to meet this regulation is located near the entrance to the Valcam Loadout Facility at the point where Mud Creek crosses under the highway and infringes upon Sediment Pond 002A. A plan view of this area is shown on Valcam Sediment Control Facilities Map R614-301-731.720a.

Four stream buffer zone signs have been placed within the Valcam Permit Area, and four have been placed within the Belina Permit Area. The four signs placed at the Valcam facility are all located east of Mud Creek along the western edge of mine accessible areas as shown on Map R614-301-731.720a. Those stream buffer zone markers placed within the Belina Permit Area are located along Whisky Creek. One is located at the road crossing at the west end of the mine area, two are placed along the upper reaches of the creek before it flows into Culvert C-40-42, and the fourth is located along the embankment of Sediment Pond 004A. The locations of those placed at the Belina facilities can be identified on Map R614-301-731.720d.

R614-301-731.700. CROSS SECTIONS AND MAPS.

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R614-301-731.710. LOCATIONS OF WATER SUPPLY USER INTAKES.

Only one water user supply intake is known to exist for current surface water users which flows into, out of and within the Mine Permit Area. This diversion is a relatively new diversion located within the northern reaches of the Valcam Permit Area as shown on Map R614-301-731.720a. The diversion is owned by Robert Radakovich of Price, Utah, and is diverted via a diversion structure and corrugated metal pipe. The diverted water is used for downstream pasture irrigation purposes. Other diversions (not shown herein) exist downstream of the Mine Permit Area and are used by local land owners to irrigate fields and pasture land.

R614-301-731.720. LOCATIONS OF SURFACE RUNOFF/CONVEYANCE AND TREATMENT FACILITIES.

Maps showing all surface water diversion, collection, conveyance, treatment, storage and discharge facilities are included as Sediment Control Facilities Maps R614-301-731.720a through 301-731.720d. Map R614-301-731.720a includes the runoff conveyance facilities for the Valcam loadout and General Office area. Maps R614-301-731.720b and R614-301-7731.720c include areas associated with the Belina Haul Road between Eccles Canyon and the Belina Mine. Map R614-301-731.720d covers the area associated with the Belina Mine. Additional information related to the runoff, conveyance and treatment facilities is given in Section R614-301-742.

MAPS R614-301-731.720a thru 301-731.720d

R614-301-731.730. LOCATIONS OF WATER MONITORING STATIONS.

A map identifying water monitoring locations and elevations as required under this regulation was shown previously as Map R614-301-722.100a.

R614-301-731.740. LOCATIONS OF PONDS, IMPOUNDMENTS, COAL WASTE BANKS AND EMBANKMENTS.

The only existing and/or proposed facilities requiring identification under this regulation are Sedimentation Ponds 001A, 002A, 003A and 004A already presented on Maps R614-301-731.720a and R614-301-731.720d.

R614-301-731.750. CROSS-SECTIONS OF PONDS, IMPOUNDMENTS, COAL WASTE BANKS AND EMBANKMENTS.

Cross sectional details related to Sedimentation Ponds 001A, 002A, 003A, and 004A are shown on Figures R614-301-731.750a and 301-731.750b.

FIGURES R614-301-731.750a thru 301-731.750b

R614-301-731.760. OTHER RELEVANT CROSS-SECTIONS AND MAPS.

N/A

**** R614-301-700. ****

R614-301-731.800. WATER RIGHTS AND REPLACEMENT.

A contingency plan has been accepted by the applicant for the replacement of water supply to an owner of interest in the event that the water supply becomes adversely impacted by contamination, diminution, or interruption proximately resulting from the mining activities. Under such conditions, the potential alternative means of water supply listed previously in Section R614-301-728.100 would be utilized to replace the interrupted supply of any legal owner of such rights.

It is believed that the overall mining impacts upon the local water supply are, and will remain minimal, and that the two methods of water replacement discussed above for potentially affected existing water supplies will never have to be utilized or implemented.

R614-301-732. SEDIMENT CONTROL MEASURES.

R614-301-732.100. SILTATION STRUCTURES.

Information requested within this regulation is discussed fully in Sections R614-301-733 and R614-301-742.

R614-301-732.200 thru 301-732.220. SEDIMENTATION PONDS.

Requirements given by this section are discussed and covered within the specific sections referenced by the regulation.

R614-301-732.300. DIVERSIONS.

Diversion requirements specified by this regulation are discussed and met in Section R614-301-742.300.

R614-301-732.400 thru 301-732.420. ROAD DRAINAGE.

Information related to road drainage characteristics which deal with the physical design, certification, and other related information can be found in Sections R614-301-300 and R614-301-500. Information related to surface runoff hydraulics and associated ditch design is presented within Section R614-301-742.300. Comments related to reclamation are found in Section R614-301-762.

R614-301-733. IMPOUNDMENTS.

R614-301-733.100. GENERAL PLANS.

General requirements of this section not discussed herein can be found within Section R614-301-742.

R614-301-733.110. CERTIFICATION.

General plans for impoundments were developed prior to the implementation of the State and Federal regulations and therefore certification as to their design and construction is not available. However, details related to existing structural dimensions and visual conditions are given to the best degree possible through Section R614-301-512. Additional certification can also be given related to the hydraulic characteristics as will be discussed in Section R614-301-742.

R614-301-733.120. MAPS AND CROSS SECTIONS.

Sediment pond locations are identified on Maps R614-301-731.720a and 301-731.720d. Sediment pond cross sections and resurveyed contours are shown on Figures R614-301-731.750a and 301-731.750b.

R614-301-733.130. POND DESCRIPTION.

All four sedimentation ponds collecting runoff within the Mine Permit Area were constructed prior to the implementation of 30 CFR 77. Because the date of construction of the four ponds was prior to the implementation of 30 CFR 77, they are not subject to it. However, as required, all four ponds are inspected quarterly. Extensive data related to the four ponds was compiled earlier in a report prepared by Hansen, Allen & Luce, Inc. in the spring of 1989 entitled "Analysis of Sediment Pond Design and Hydrologic Analysis of Undisturbed Area Bypass Channels and Small Exemption Areas". The information available within said report as required under this section has been incorporated into this permit renewal.

Three of the referenced sedimentation ponds (001A, 002A and 003A) are located within the Mine Permit Area utilized for the Valcam Loadout Facility. The fourth pond (004A) is located at the downstream end of the Belina Permit Area. All four sediment ponds have been constructed with 18 inch diameter vertical standpipes for both the principal and emergency spillways except for pond 004A which uses an open channel design for the emergency spillway. A summary of design criteria is provided in Table R614-301-733.130a.

It was noted during the spring of 1989 that the principal spillway discharge pipes for all four ponds have been fitted with a short reduction section and bolted closed so as to prevent discharge. The applicant was apprised of the situation wherein it was understood that the reduction and bolted sections of the spillway outfalls would be removed by the date that this submittal was to be made to conform to the design as documented in Hansen, Allen & Luce, 1989.

An additional design change has been made to the dewatering devices for all sedimentation ponds as a result of problems caused by winter ice buildup. Freeze-thaw and icing of pond spillways has historically damaged dewatering valves which were installed on the standpipes for pond evacuation. In order to eliminate continued maintenance and the potential for discharge violations if a valve were to crack and leak, the dewatering device is to be changed. In place of a valve, all principal standpipes will be fitted with a manual dewatering device to consist of a short pipe sleeve and screw cap

which will remain in place except when the pond is to be evacuated. The screw cap will be installed on the inside of the standpipe to help protect it from ice damage. When required, the cap will be removed, and the pond will be allowed to drain. Additional descriptions related to each of the ponds is given below.

TABLE R614-301-733.130a
SEDIMENT POND SPILLWAY DATA SUMMARY

	Embankment Crest Elevation		PRINCIPAL SPILLWAY					EMERGENCY SPILLWAY				
Sed Pond	Existing Minimum ft.	Proposed Minimum ft.	Pipe Spillway Type	Outfall* Crest Dia. ft.	Invert Elev. ft.	Outfall++ Elev. ft.	Pipe Length ft.	Spillway Type	Outfall* Dia. ft.	Invert Elev. ft.	Outfall** Elev. ft.	Length ft.
001A	7821.1	7821.1	Standpipe	1.5	7816.1	7813.0	60	Standpipe	1.5	7818.8	7813	60
002A	7837.4	7838.0	Standpipe	1.5	7835.4	7828	74	Standpipe	1.5	7836.3	7828	74
003A	7868.0	7868.0	Standpipe	1.5	7863.2	7854.5	74	Standpipe	1.5	7865.5	7854.5	74
004A	8877.5	8878.2	Standpipe	-	8874.9	8859	80	Open Channel	-	8875.9*	-	-

* Existing spillway crest is at elev. 8876.3. The crest of the emergency spillway in Sediment Pond 004A is to be lowered to 8875.9 ft.
\+ Outfall invert elevations were determined from 1-inch = 50-foot scale maps with a five-foot contour interval except on the embankments of the ponds where the contour interval is 2 feet.
++ Outfall length scaled from 1-inch = 50-foot scale maps for ponds 001A through 003A and a 1-inch = 100-foot scale map for pond 004A.

SEDIMENT POND 001A

Sediment pond 001A is located toward the north end of the disturbed Valcam Permit Area as shown on Map R614-301-731.720a. In general, the pond collects surface runoff from the extreme north and eastern ends of the Mine Permit Area. Runoff originating within the eastern half of the Mine Permit Area is collected via two convenience ditches (D-1 and D-2) which run parallel to the railroad tracks. In addition to the convenience ditches, the railroad tracks themselves provide a hydrologic barrier. The railroad facility and associated ditches generally bisect the Mine Permit Area in a north and south direction as shown on the map.

Pond 001A is an irregularly shaped sedimentation pond located along the eastern edge of the Pleasant Valley Creek flood plain with a cross dimension of approximately one fifth its length as shown on Map R614-301-731.720a, and Survey Detail Map R614-301-731.750a. The new interior and exterior contours shown on the survey detail map were prepared shortly after sediment was removed in October of 1988. Newly prepared Stage-Capacity and Discharge Rating Curves are shown in Figure R614-301-731.750c.

FIGURE R614-301.731.750c

Sediment pond 001A is fitted with both a principal and an emergency spillway which are capable of meeting the flow and storage requirements of the regulations. During a site visit in the spring of 1989, and in response to this permit renewal, a staff engineer for Hansen, Allen & Luce made a visual survey of the pond related to historic hydraulic performance. It was noted that at that time, both the principal and emergency spillways, outlet onto a riprap apron containing an average rock size of approximately four inches.

**** R614-301-700. ****

It was also noted that no erosion was evident at the outlets to either discharge pipe. Site evidence would indicate that adequate erosion protection has been provided for the maximum historical event passing through the pond.

Subsequent to the removal of sediment from Pond 001A in the fall of 1988 it was noted that water was being collected within the pond. A survey of water elevations within the pond and along the adjacent creek bed was conducted in November of 1989 to determine the possible source of the water. Survey results indicated at that time that the water level within the pond was the same as that in the creek along the south end of Pond 001A (recorded at an elevation of 7808 feet). It is believed that the water reflects the natural local ground water table as connected to the adjacent creek system. The water contained within the pond is not anticipated to have any negative effects upon pond operation since the volume of water contained therein is well within the volume specified for sediment storage. Water now found within the volume reserved for sediment storage will be replaced by inflowing sediments through time. This process will continue until sediment levels rise above local ground water tables.

SEDIMENT POND 002A

Sediment pond 002A is located at approximately the mid section of the disturbed Valcam Permit Area, and immediately north of the entrance to the facility as shown on Map R614-301-731.720a. In general, the pond collects surface runoff from the western side of the railroad tracks and Mine Permit Area including the area in the vicinity of the Valcam bathhouse and Western Coal Carriers Shop (on the north) to the northern half of the stockout tube on the south as shown on the map. Runoff originating within the disturbed area is collected via small convenience ditches which enter the pond from the east and south. The railroad tracks located east of the pond provide a hydrologic barrier thereby preventing runoff from areas tributary to ponds 001A or 003A from intermixing with pond 002A inflows.

Pond 002A is a small triangular shaped sedimentation pond located adjacent to State Highway 96. New interior and exterior contours (shown on Survey Detail Map R614-301-731.750a) were prepared shortly after sediment was removed in October of 1988. Newly prepared Stage-Capacity and Discharge Rating Curves are shown in Figure R614-301-731.750d.

FIGURE R614-301.731.750d

Sediment pond 002A is fitted with both a principal and an emergency spillway which are capable of meeting the flow and storage requirements of the regulations. During a site visit in the spring of 1989, and in response to this permit renewal, a staff engineer for Hansen, Allen & Luce made a visual survey of the pond related to historic hydraulic performance. As with pond 001A, it was noted that both the principal and emergency spillways outlet onto a riprap apron. The average rock size contained within the apron is approximately five inches. It was also noted that no erosion was evident at the outlets to either discharge spillway. Local vegetation surrounding the spillways likewise indicates the absence of erosion, and the adequacy of design based upon the maximum historical event passing through the pond.

One area of concern related to Pond 002A is the potential for erosion to occur on the western outer embankment adjacent to Pleasant Valley Creek. Flows within Pleasant Valley Creek are diverted from the west side of State Highway 96 to the east side via a culverted creek crossing. Both the road crossing and sediment pond have been in place for a number of years without incident, however recent modifications made to the creek by non mining personnel (believed to be associated with the fish and game department) appear to be having some negative impacts upon the pond. Concrete road barriers have been placed within the creek at the outlet of the highway culvert. It is understood that these barriers were an attempt to provide for a more suitable fish habitat by 1) slowing culvert velocities sufficiently to allow small fish to migrate upstream through the culvert, and 2) provide a pool habitat at the outlet to the highway culvert. Both wildlife objectives have apparently been met by the installations, however hydraulic consequences may be realized.

The road barriers were placed in the creek through the use of a small crane which lifted the barriers out into the creek. It is understood that in an attempt to place one of the barriers on the far side of the creek, the crane being used became unstable, and the barrier had to be dropped to prevent the crane from tipping over. The dropped barrier ended up in such a position that it redirects a portion of the creek flows into the embankment rather than protecting it. During high flow periods, this situation could result in unnecessary erosion damage to Pond 002A.

In order to protect the embankment from additional erosion, a plan will be implemented wherein a large diameter riprap facing will be placed along the stream side of pond 002A at the locations directly impacted by the creek flows. Subsequent to installation of the riprap, the embankment will be visually inspected quarterly to monitor its effectiveness as a deterrent against additional erosion. Should erosional problems become evident, the Division will be notified, and corrective actions will be taken to remedy the situation.

SEDIMENT POND 003A

Sediment pond 003A is a small rectangularly shaped sedimentation pond located adjacent to State Highway 96 at the far south end on the disturbed Valcam Permit Area immediately south of the Valcam stockout tube as shown on Map R614-301-731.720a. In general, pond 003A collects surface runoff from the small disturbed area south of the stockout tube and crusher building as shown on the referenced map. Runoff originating within the disturbed area is collected via small convenience ditches which enter the pond from the north. Runoff originating along the eastern side of the railroad tracks is diverted to the pond via a 24 inch CMP culvert located north of the conveyor belt as shown. The new interior and exterior contours shown on Survey Detail Map R614-301-731.750b was prepared shortly after sediment was removed in October of 1988. Newly prepared Stage-Capacity and Discharge Rating Curves for Pond 003A are shown in Figure R614-301-731.750e.

FIGURE R614-301.731.750e

Sediment pond 003A is fitted with both a principal and an emergency spillway which are capable of meeting the flow and storage requirements of the regulations. During a site visit in the spring of 1989, and in response to this permit renewal, a staff engineer for Hansen, Allen & Luce made a visual survey of the pond related to historic hydraulic performance. As with ponds 001A and 002A, it was noted during the site visit that both the principal and emergency spillways exit onto a riprap apron containing an average rock size of approximately two to three inches. It was also noted that no erosion was evident at the outlets to either discharge spillway. The absence of erosion indicates the adequacy of design based upon the maximum historical event passing through the pond.

SEDIMENT POND 004A

Sediment pond 004A is a small roughly square shaped sedimentation pond located at the eastern end of the Belina Permit Area as shown on Map R614-301-731.720d. Pond 004A collects surface runoff from all disturbed areas at the Belina mine complex. Runoff originating within the disturbed area is collected via numerous small convenience ditches which enter the pond along its southwest corner. Undisturbed area runoff bypasses the pond and eventually ends up in Whisky Canyon Creek. New interior contours as shown on Survey Detail Map R614-301-731.750b are based upon conditions shortly after sediment was removed in October of 1988. Newly prepared Stage-Capacity and Discharge Rating Curves for Pond 004A are shown in Figure R614-301-731.750f.

FIGURE R614-301.731.750f

Sediment pond 004A is fitted with both principal and emergency spillways. The principal spillway consists of a vertical standpipe, the emergency spillway consists of a channel overflow. Combined, they are capable of meeting the flow and storage requirements of the regulations. During a site visit in the spring of 1989, and in response to this permit renewal, a staff engineer for Hansen, Allen & Luce made a visual survey of the pond related to historic hydraulic performance. At the time of the site visit, the applicant was in the process of reconstructing the emergency spillway in response to wildlife damage noted in the structure. A subsequent site visit confirmed that the spillway repairs had been completed by the applicant. Both the principal and emergency spillways exit onto the downstream slope of the sediment pond onto a ripraped embankment.

SEDIMENT POND 005A

Sediment Pond 005A is located south of the Belina mine portals adjacent to the fan portal and is used exclusively for the improvement of mine discharge water. The pond is a five cell concrete unit with a design capacity of 250 gallons per minute as constructed during the third quarter of 1983. It provides primary settling, three stages of filtration, and a final clarifier. Design details were submitted to both the Division of Oil, Gas & Mining; and the Utah State Department of Health in 1981, and after having received approval, the pond was constructed in the third quarter of 1983. The discharge structure associated with the pond is a parshall flume and corrugated metal pipe which discharges mine waters into Whisky Creek immediately above the inlet to Culvert C-40-42. The location of Sediment Pond 005A and the discharge culvert are shown on Map

R614-301-731.720d. Plan and section views of Pond 005A are included in Appendix R614-301-742.221a.

In October, 1986, approval was given for the installation of a 6 inch abandoned section water bypass line. This line discharges at the same location as Pond 005A beyond the parshall Flume. This line originates at the seals in the First East Mains section of the Belina No. 1 Mine. The water collected behind these seals is pumped to the point of discharge.

R614-301-733.140. SUBSIDENCE SURVEY.

None of the four sediment ponds located within the Mine Permit Area lie above mine workings, nor are they in the zone of influence of subsidence and therefore are not susceptible to the potential effects of subsidence.

R614-301-733.150. HYDROLOGIC AND GEOLOGIC INFORMATION.

Preliminary hydrologic and geologic information as required by this section is found within the geologic and hydrologic impacts sections of this permit.

R614-301-733.160. FUTURE DESIGN PLAN CERTIFICATION STATEMENT.

No future designs are anticipated for the Mine Permit Area beyond those submitted with this permit renewal.

R614-301-733.200. PERMANENT AND TEMPORARY IMPOUNDMENTS.

R614-301-733.210. CONSTRUCTION REQUIREMENTS.

All four sedimentation ponds located within the Mine Permit Area were constructed prior to the effective date of the current mining regulations and are therefore exempt from some current construction regulations including 30 CFR 77.

R614-301-733.220 thru 301-733.226 PERMANENT IMPOUNDMENTS.

N/A

R614-301-733.230. AUTHORIZATION OF TEMPORARY IMPOUNDMENTS.

N/A

R614-301-733.240. POTENTIAL HAZARD NOTIFICATION.

The applicant agrees to notify the Division according to R614-301-515.200 should a potential hazard to the impoundment be disclosed.

R614-301-734. DISCHARGE STRUCTURES.

Information related to discharge structures is provided in Section R614-301-742.

**** R614-301-700. ****

R614-301-735. DISPOSAL OF EXCESS SPOIL.

N/A

R614-301-736. COAL MINE WASTE.

All coal mine wastes generated are returned to the mine for disposal.

R614-301-737. NON-COAL MINE WASTE.

See information provided in Section R614-301-747.

R614-301-738. TEMPORARY CASING AND SEALING OF WELLS.

The casing and sealing of wells is discussed in Sections R614-301-631 and R614-301-748.

R614-301-740. DESIGN CRITERIA AND PLANS.

R614-301-741. GENERAL REQUIREMENTS.

R614-301-742 thru 301-742.126. SEDIMENT CONTROL MEASURES.

Sediment control measures incorporated within the Mine Permit Area include the 1) revegetation of disturbed areas, and the installation of 2) paved roadways, 3) concrete ditch sections, 4) runoff conveyance ditches, 5) road culverts, and 6) sedimentation ponds. Throughout much of the Mine Permit Area, the ditch and culvert installations consist of what the applicant considers convenience ditches and culverts. These convenience structures have been installed to maintain relatively dry road conditions, and to prevent runoff from concentrating at truck crossings. Additional details related to these structures is provided in Sections R614-301-742.200 through 301-742.423.5.

R614-301-742.200 thru 301-742.214. SILTATION STRUCTURES.

Applicable regulations as required in these sections are met through the information provided in Section R614-301-742.220. The sediment ponds located on the Mine Permit Area are not subject to 30 CFR 77.

R614-301-742.220. SEDIMENTATION PONDS.

R614-301-742.221 thru 301-742.221.39. GENERAL REQUIREMENTS.

Presented below are the methodologies used in the analysis of Sediment Ponds 001A through 004A, the analysis and design of runoff conveyance facilities, and the results of the analyses pertaining to the regulatory requirements. Information available in the 1988 report prepared by Hansen, et. al, 1989 has been incorporated into this permit to facilitate the presentation of material applicable to the mine permit application. Survey details for

each pond (including pond contours and critical cross sections) are shown on Figures R614-301-731.750a and 301-731.750b.

DESIGN METHODOLOGY

Runoff Volume

The storage volume in each existing sedimentation pond was analyzed to determine if there is sufficient storage to contain runoff from the 10-year 24-hour event without resulting in discharge through the principal or emergency spillways. The technique used to calculate the required volume is described below.

The runoff depth resulting from a given rainfall depth was determined using the runoff curve number technique, as defined by the U.S. Soil Conservation Service (1972). According to the curve number methodology, the relationship between storm rainfall, soil moisture storage, and runoff can be expressed by the equations:

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \qquad (1)$$

$$CN = \frac{1000}{10 + S} \qquad (2)$$

where:

Q = direct runoff depth, inches;
P = storm rainfall depth, inches;
S = maximum infiltration depth (defined as the maximum possible difference between P and Q), inches; and
CN = curve number, dimensionless.

Use of Equations 1 and 2 requires the selection of a curve number, which is a function of vegetative cover and the hydrologic soil groups. Curve numbers for the study area were selected from information provided by the USDA Soil Conservation Service (1972), by U.S. Bureau of Reclamation (1977), and from personal hydrologic judgment following field observation. Volume weighted curve numbers were used for heterogeneous areas.

Values of precipitation (P) were selected for the design return periods from Richardson (1971), using the Clear Creek precipitation frequency data based on a 24-hour storm. A rainfall return period of 10 years was used for pond design, and a return period of 6 years was used for ditch and culvert design.

Equation 1 is based on the assumption that Ia = 0.2S, where Ia is the initial abstraction from storm rainfall, defined as the rainfall which must fall before runoff begins (i.e., to satisfy interception, evaporation, and soil-water storage). Therefore, determination of runoff from Equation 1 is valid only when Precipitation is greater than 0.2S. Below this point, no runoff can occur. Once Q was determined from the above equation, the runoff

volume for sediment pond design was calculated by multiplying the runoff depth by the drainage area.

Flow Hydrographs and Peak Discharge

The peak discharge from a given design storm was calculated for the mine area utilizing a computer program developed by Hansen, Allen, and Luce Inc. entitled "HYDRO." "HYDRO" implements the SCS Unit Hydrograph method as presented in Chapter 10 of NEH-4.

The Unit Hydrograph methodology utilizes the runoff depth equations presented earlier (Equations 1 and 2) as well as the relationships shown on Figure R614-301-742.221a, "Dimensionless Curvilinear Unit Hydrograph and Equivalent Triangular Hydrograph". A hydrograph of a single block of rainfall excess with duration D is shown in the upper portion of the above mentioned figure. The lower portion of the figure contains the resultant runoff hydrograph. For runoff from excess rainfall, the area under the hydrograph curve and the area enclosed by the rainfall hydrograph represent the same volume of water (Q) as calculated using equation 1.

FIGURE R614-301-742.221a

The peak flow rate for the dimensionless unit hydrograph is represented by q_p, while t_p represents the time to peak, which is defined as the flow from the start of the hydrograph to q_p. The base time (t_b) is the duration of the hydrograph. The time from the center of mass of rainfall excess to the peak of the runoff hydrograph is the lag time (t_L). The time of concentration (t_c) is defined as the time required for flow from the hydraulically most remote point in a basin to reach the basin outlet. According to the U.S. Soil Conservation Service (1972), the watershed lag is equal to 0.6 t_c and the time of concentration (t_c) is equal to 1.5 t_p. By combining these two expressions, one can see that $t_p = 1.11t_L$ where both variables are as previously defined. The watershed lag (t_L) is defined as:

$$t_L = \frac{(h_l^{0.8})(S+1)^{0.7}}{1900\ Y^{0.5}} \qquad (3)$$

where:

t_L = watershed lag, in hours;
h_l = hydraulic length, or the length of the mainstream to the farthest divide, in feet;
S = is as previously defined; and Y = average watershed slope, in percent.

Values of Y were obtained from methods outlined by Craig and Rankl (1977). The hydraulic length was taken from an appropriate topographic map, and S was determined from Equation 2 once the runoff curve number was estimated.

The peak discharge of the dimensionless unit hydrograph is defined as:

$$q_p = \frac{484\ A\ Q}{T_p} \tag{4}$$

where:

q_p = peak discharge constant, in cfs;
A = drainage area, in square miles;
Q = direct runoff depth, inches;
T_p = time elapsed from the beginning of runoff to the hydrograph peak, in hours; and
484 = a conversion factor.

The 24-hour rainfall distribution used in the analysis was the NOAA type II storm as shown in Figure R614-301-742.221b, "Twenty-Four Hour Rainfall Distributions".

FIGURE R614-301-742.221b

Dimensionless unit hydrographs are developed by simulating many natural unit hydrographs using the time to peak and the peak discharge constant. Haan and Barfield (1978) proposed a dimensionless unit hydrograph based on the gamma function:

$$\frac{q(t)}{q_p} = \left[\frac{t}{t_p}\, e^{(1-t/tp)}\right]^{C3tp} \tag{5}$$

where:

q(t) = hydrograph ordinate at time t, cubic feet per second; and

the parameters q_p and t_p are as previously defined, and C_3 is a parameter defined by:

$$Q = q_p\ t_p\ (e/C_3t_p)^{(C_3t_p)}\ G(C_3t_p) \tag{6}$$

where:

Q = runoff volume (one inch for a unit hydrograph),
G = gamma function,

and all other variables are as previously defined.

Figure R614-301-742.221c, "Variation in Hydrograph Shape with Variation in C_3t_p", shows how shape of the hydrograph defined by Equation 5 changes as C_3t_p changes. The higher the value of C_3t_p, the sharper the peak of the hydrograph.

FIGURE R614-301-742.221c

Estimates of the peak discharge to be expected from various precipitation events were made using the dimensionless hydrograph procedure illustrated on Figure R614-301-

742.221a. The dimensionless unit hydrograph method involves the development of a runoff hydrograph from a complex rainstorm. The storm is divided into blocks of uniform intensity of duration D and distributed in accordance with the 24-hour rainfall distribution illustrated on Figure R614-301-742.221c. Values of D must be less than or equal to t_p. Practically, the selection of D as a multiple of t_p will ensure that the peak will be encountered.

Rainfall excess is generated from the rainfall depths of duration D, and the rainfall-runoff relationship expressed in Equation 1. The rainfall excess (runoff) from each time increment of duration D is then multiplied by the unit hydrograph ordinates to produce a component hydrograph. Each of the component hydrographs are then lagged by a time increment D and are consecutively summed to produce the synthetic runoff hydrograph.

Because individual hydrographs were not routed through conveyance structures or ponds, the synthetic peak is considered conservative. Calculated flow rates for each pond or conveyance structure using the above described methods are shown and discussed later.

Pond Spillway Capacity

Spillway capacity requirements for the ponds were based on runoff from the 25-year, 24-hour storm. This design event is conservative based upon the new Federal guidelines allowing the use of the 25-year, 6-hour storm. The 6-hour storm event is more applicable to those storm events experienced in Utah as a result of overall climate and topography. Spillway capacity requirements were determined according to the peak discharge methodology presented above.

The stage-discharge relationship of the corrugated metal risers and conduits used in the pond spillway design was determined from methods outlined by Haan and Barfield (1978), who indicate that the discharge of the spillway is calculated as the smallest of the possible flows due to weir flow, orifice flow, or pipe flow at any stage. The coefficients suggested by Haan and Barfield (1978) were used in the appropriate equations.

Weir flow is determined by the equation:

$$q = CLH^{3/2} \tag{7}$$

where:

- q = flow rate in cfs;
- C = coefficient determined by entrance conditions;
- L = length of the weir crest, in feet, or the circumference of the riser; in feet; and
- H = head of water above the riser inlet, in feet.

The entrance coefficient (C) is determined by:

$$C = 3.27 + 0.4\ H/W \tag{8}$$

where C and H are previously defined and W is the height of the weir crest above the channel bottom, in feet.

Orifice flow occurs when the flow is restricted by the opening. It can be determined as:

$$q = CA\,(2gH)^{1/2} \tag{9}$$

where:

- q = as previously defined;
- C = coefficient dependent upon the orifice geometry (0.6 in this case);
- A = cross-sectional area of the opening, in square feet;
- g = gravitational constant (32.2 ft/s^2); and
- H = head above the orifice inlet, in feet.

Pipe flow occurs when the friction of the pipe controls the flow. According to Haan and Barfield (1978), this flow type can be described by:

$$q = \frac{A\,(2gh)^{1/2}}{(1 + K_e + K_b + K_c\,L)^{1/2}} \tag{10}$$

where q, A, g, and H are as previously defined and:

- K_e = entrance loss coefficient (1.0 in this case);
- K_b = correction factor for energy loss in bends (0.5 in this case);
- K_c = friction factor; and
- L = pipe length, in feet.

K_c can be determined by the equation:

$$K_c = \frac{5087\,n^2}{d^{4/3}} \tag{11}$$

where:

- n = Manning's roughness coefficient; and
- d = inside diameter of the pipe, in inches.

The rating curve for the open channel flow spillway for Sediment Pond 004A was developed by using the weir flow equation (equation 7) with the coefficient (C) determined from tables presented in Brater and King (1976) for broad crested weirs and for weirs of trapezoidal cross-section.

The stage-discharge relationship for the emergency spillway for Pond 004A was determined from the broad crested weir equation which is defined as:

$$q = CLH^{3/2} \tag{12}$$

where:

q = Flow rate, cfs
C = Entrance coefficient
L = Width, feet
H = Water Depth, feet

Calculations related to the design capacity of the emergency discharge spillway are included within Appendix R614-301-742.221a.

Sediment Storage Volume

The storage volume in each sediment pond was analyzed to determine if there was sufficient storage to contain the accumulated sediment volume from a three-year period. The amount of sediment to be yielded to the sediment ponds was determined from the Universal Soil Loss Equation (Israelsen et al., 1984). In accordance with this equation, soil erosion caused by water is determined from:

$$A = R \cdot K \cdot LS \cdot VM \tag{13}$$

where:

A = computed amount of soil loss, in tons/acre/year;
R = rainfall factor, in foot-tons/acre/hour;
K = soil erodibility factor, in tons/acre/year/unit of R;
LS = topographic factor (length and steepness of slope), dimensionless; and
VM= erosion control factor, dimensionless.

Values for R and K were determined from Israelsen et al. (1984). The topographic factor (LS) was determined from:

$$LS = \frac{65.41\ S^2}{S^2 + 10{,}000} + \frac{4.56\ S}{(S^2 + 10{,}000)^{0.5}} + 0.065\ (L/72.6)m \tag{14}$$

where:

L = average overland flow length, in feet;
S = average steepness of slope, in percent; and
m = an exponent dependent upon the steepness of slope (0.3 for slopes less than 0.5%, 0.5 for slopes 0.51% to 10%, and 0.6 for slopes greater than 10%).

Values for VM were determined from the Israelsen et al. (1984).

All four sediment ponds are capable of storing at least the three year accumulated sediment requirements, and are designed so as to be cleaned when 60% of the design storage volume has been reached. The design elevations for the 60% sediment cleanout requirements are shown on Figures R614-301-731.750a and R614-301-731.750b. Table R614-301-742.221a has been inserted to summarize the sediment storage volume requirements as well as the projected time to 60% cleanout. The last column in the table indicates the number of years projected before the 60% cleanout elevation is reached. This value was obtained by dividing the required 60% cleanout volume by the projected 1-year sediment volume shown in column three of the table.

Based upon data shown in Table R614-301-742.221a, the applicant agrees to survey the ponds contained within this permit renewal every two years, unless time projections indicate that the 60% sediment storage volume will be exceeded within the two year projection, whereupon the pond will be surveyed annually. Survey data obtained will indicate the required timing for cleaning of each respective pond. As an aid to determining sediment storage, the applicant will also provide an appropriate method of determining approximate sediment storage volume. Such aids may include (but not be limited to) markings on a standpipe spillway indicating depth to 60% sediment storage, or some other post or marker placed within or adjacent to the pond. Since pond conditions vary, the method of identifying the approximate estimate of cleanout elevation must be flexible.

TABLE R614-301-742.221a
TIME PROJECTIONS TO 60% SEDIMENT CLEANOUT VOLUME

Sed Pond Cleanout No.	Three-Year Sediment Vol. Ac-Ft	One-Year Sediment Vol. Ac-Ft	Available Sediment Volume Ac-Ft	60% Sediment Volume Ac-Ft	Time to 60% Sediment Years
001A	0.94	0.31	1.3	0.78	2.5
002A	0.1	0.033	0.3	0.18	5.5
003A	0.51	0.17	0.8	0.48	2.8
004A	0.75	0.25	1.81	1.09	4.3

REQUIRED POND VOLUMES AND DETENTION STORAGE

Runoff Storage Requirements

Runoff volumes from tributary areas to the sediment ponds were determined from the SCS curve number methodology presented above. Tributary areas for Sediment Ponds

001A through 004A are illustrated on Maps R614-301-731.720a and R614-301-731.720d. Tributary areas were subdivided and classified in accordance with vegetation type and surface condition and a separate curve number was estimated for each separate classification. Tributary subareas to the sediment ponds were classified as disturbed areas for which a curve number of 90 was assumed, paved areas for which a curve number of 98 was assumed, reclaimed areas for which a curve number of 80 was assumed, sage/grass areas for which a curve number of 75 was assumed, and forested/aspen areas for which a curve number of 70 was assumed. A breakdown of areas contributing to pond runoff is presented in Table R614-301-742.221b.

TABLE R614-301-742.221b
TRIBUTARY AREAS TO SEDIMENT PONDS

Sed Pond No.	Disturbed Area ac	Paved Area ac	Forested/Aspen Area ac	Sage/Grass Area ac	Reclaimed Area ac	Total Area ac
001A	8.13	-	-	3.4	-	11.53
002A	6.3	0.82	-	-	-	7.12
003A	4.0	0.18	1.65	1.0	-	6.83
004A	17.3	-	15.1	-	4.7	37.1

Based on a precipitation depth of 2.45 inches for the 10-year, 24-hour precipitation event (the design event) and the curve numbers for the various subareas presented above, a weighted curve number based on runoff volume was determined for the total tributary area for each sediment pond. Using this volume weighted curve number and the precipitation depth for the 10-year, 24-hour storm, the estimated runoff depth for each pond was predicted using equations 1 and 2 as presented in the methodology section. The runoff volume to each pond from the 10-year, 24-hour event was then predicted by multiplying the runoff depth by the tributary area to the sediment pond. The results of the estimated runoff volume to each pond from the design precipitation event are presented in Table R614-301-742.221c. This becomes the required runoff storage volume that must be present in the sediment ponds in order to totally contain the runoff from the design precipitation event.

Sediment Storage Requirements

The mean annual sediment yield to the sediment ponds was estimated using the modified universal soil loss equation as presented in the methodology section of this report. Areas were again subdivided based on characteristics of the subareas that would affect erosion, such as vegetation type and steepness of slope. Calculations for sediment yield to each pond are presented in Appendix R614-301-742.221a. The estimated 3-year

sediment yield to the ponds are presented in Table R614-301-742.221c along with the runoff projections for the ponds.

TABLE R614-301-742.221c
ESTIMATED RUNOFF VOLUME TO SEDIMENT PONDS FROM THE 10-YEAR, 24-HOUR PRECIPITATION EVENT AND 3-YEAR SEDIMENT YIELD TO PONDS

Sed Pond	Area Acres	Volume Weighted Curve Number	Runoff Depth Inches	10-year,24-hour Runoff Volume ac-ft	3-Year Sed Yield ac-ft
001A	11.53	86.4	1.229	1.18	0.93
002A	7.12	91.2	1.581	0.94	0.10
003A	6.83	85.0	1.139	0.65	0.51
004A	37.1	83.0	1.018	3.15	0.75

A summary of sediment criteria is given in Table R614-301-742.221d. A column has been included within the table indicating the 60 percent (of available storage) cleanout elevation as requested by the Division.

TABLE R614-301-742.221d
SEDIMENT STORAGE CHARACTERISTICS

Sediment Pond No.	Required 3 Year Sediment Storage (acre-feet)	Available Sediment Storage (acre-feet)	Decant Elevation (feet msl)	60 Percent Cleanout Elevation (feet msl)
001A	0.94	1.3	7812.0	7809.5
002A	0.1	0.3	7829.0	7827.6
003A	0.51	0.8	7860.0	7858.4
004A	0.75	1.81	8870.25	8868.8

Available Pond Storage

A pond storage survey was conducted after the cleaning of Sediment Ponds 001A through 003A in October and November of 1988. A survey of Sediment Pond 004A

was conducted in August of 1988. The surveys were conducted by mine personnel and certified by a qualified registered professional engineer. Certified survey details are shown on Figures R614-301-731.750a and 731.750b.

Survey plats showing contour data were used to prepare stage-capacity relationships for each pond during the hydraulic analysis phase of previous permit renewals. The contours presented on the plats were planimetered, from which an area for each contour was determined. Volumes were then computed by using the average end area method. The stage-capacity curves for ponds 001A through 004A developed as a result are shown in Figures R614-301-731.750c through 731.750f. Also illustrated are the elevations of the primary and emergency spillways, the proposed elevation of the decants for the ponds, the available versus required runoff storage volume of each pond between the elevation of the primary spillway and the proposed decant level, and an indication of the available sediment storage volume below the proposed decant elevation versus the estimated 3-year accumulated sediment yield to the ponds.

As is indicated by the details presented in Figures R614-301-731.750c through 731.750f, there is sufficient storage capacity in each pond to provide for at least the estimated 3-year sediment yield to the ponds and to provide for total containment of the runoff volume from the 10-year, 24-hour precipitation event.

Pond Detention Time

The decants, which will be the dewatering devices for the ponds, will be manually operated. The ponds have sufficient storage capacity to totally contain the runoff volume from the 10-year, 24-hour precipitation event between the proposed decant elevations indicated above and the primary spillways. The water level in the ponds will be maintained at or below the decant level in anticipation of a runoff producing event. The decants will also be maintained in a closed position such that during a runoff producing event (of equal or lesser magnitude to that of the design event) the runoff from the event would be totally contained by the pond. The runoff from a precipitation event will be maintained in the pond for a period of at least 24 hours and then released in accordance with the NPDES permit for the pond.

SPILLWAY CAPACITY

As indicated previously, the sediment ponds are to have a combination of a principal and an emergency spillway with the capacity to safely discharge the runoff from a 25-year, 24-hour precipitation event. The elevation of the crest of the emergency spillway is to be a minimum of 1.0 foot above the crest of the principal spillway and the minimum elevation of the top of the settled embankment is to be at least 1.0 foot above the water surface in the pond under design flow conditions for the 25-year, 24-hour precipitation event.

All of the sediment ponds have principal and emergency spillways. A summary of the physical characteristics of the principal and emergency spillways for the sediment ponds is presented earlier in Table R614-301-733.130a. The principal and emergency spillways for sediment ponds 001A through 003A consist of 18-inch diameter corrugated metal

standpipe type spillways. The principal spillway for sediment pond 004A consists of an 18-inch diameter corrugated metal standpipe type spillway and the emergency spillway consists of an emergency overflow open channel type spillway.

Peak flow projections from the 25-year, 24-hour precipitation event of 2.92 inches were made using a computer watershed model based on the USDA Soil Conservation Service's unit hydrograph curve number methodology. Watershed characteristics, which are input parameters to the model, include the tributary areas to the ponds, volume weighted curve numbers, average watershed slope, and the hydraulic length. Peak flow projections from the 25-year, 24-hour precipitation event along with their respective watershed characteristics are presented for each pond in Table R614-301-742.221e.

Discharge rating curves were prepared for the principal spillway, the emergency spillway, and the combined spillway capacity of the principal and emergency spillways for each pond. The rating curves were derived in accordance with the methodology previously described for spillway standpipes and for the open channel spillway. Calculations and spillway rating curves for ponds 001A through 004A can be found in Appendix R614-301-742.221a.

The peak flow projections presented in Table R614-301-742.221e were then superimposed on the spillway rating curves to determine the required water surface elevation in the pond to pass the design event. The design hydrograph from the 25-year, 24-hour precipitation event was not routed through the pond. Thus, the required head-water depth over the spillways to pass the peak flow from the design event is conservative.

TABLE R614-301-742.221e
WATERSHED CHARACTERISTICS AND PEAK-INFLOW TO SEDIMENT PONDS FROM THE 25-YEAR, 24-HOUR PRECIPITATION EVENT

Sed Pond	Area Acres	Volume Weighted Curve Number	Hydraulic Length ft.	Watershed Slope %	25-yr, 24 hr Peak Flow cfs
001A	11.53	86.4	2760	38.0	18.3
002A	7.12	91.2	860	17.8	13.7
003A	6.83	85.0	1100	32.0	10.7
004A	37.10	83.0	2040	40.0	52.0

As indicated on Figure R614-301-731.750c, the crest elevation of the emergency spillway in Sediment Pond 001A is 2.7 feet higher than the crest of the principal spillway. The combined spillways of Sediment Pond 001A can pass the peak discharge of 18.3 cfs at an elevation of 7819.35 feet, MSL. With the top of the embankment of Sediment Pond 001A

set at elevation 7821.1 feet, the sediment pond can pass the design event with more than one foot of freeboard. Thus the spillway capacity of the pond is adequate as designed.

As indicated on Figure R614-301-731.750d, the crest elevation of the emergency spillway in Sediment Pond 002A is 0.9 foot higher than the crest of the principal spillway, which nearly meets the requirement for a one-foot separation between the two spillways. The combined spillways of Sediment Pond 002A can pass the peak discharge of 13.7 cfs at an elevation of 7836.7 feet, MSL. With the minimum top of the embankment of Sediment Pond 002A set at elevation 7837.4 feet, the sediment pond cannot pass the design event with one foot of freeboard. However, the embankment is wide enough in the area of the pond where the embankment elevation is only 7837.4 feet to allow for the embankment in this area to be raised to elevation 7838.0 feet. Thus the spillway capacity of the pond can be made to be adequate by raising the embankment in the low area by 0.6 foot.

As indicated on Figure R614-301-731.750e, the crest elevation of the emergency spillway in Sediment Pond 003A is 2.3 feet higher than the crest of the principal spillway. The combined spillways of Sediment Pond 003A can pass the peak discharge of 10.7 cfs at an elevation of 7864.75 feet, MSL. With the top of the embankment of Sediment Pond 003A set at elevation 7868.0 feet, the sediment pond can pass the design event with more than one foot of freeboard. Thus the spillway capacity of the pond is adequate as is.

The rating curve presented on Figure R614-301-731.750f for Sediment Pond 004A includes both the rating curves for the principal spillway, and the open-channel emergency spillway for the pond. Valley Camp personnel have surveyed the emergency channel spillway, and indicate that the channel is trapezoidal in cross-section with a bottom width of approximately 13 feet, a top width of 21.5 feet and a channel depth of 2.1 feet. The existing spillway crest for the principal spillway in Sediment Pond 004A is at 8874.93 feet and the existing crest of the emergency spillway is at elevation 8875.9 feet.

Pond Stability Analysis

Since the slopes of Sediment Ponds 001A through 003A do not meet the criteria that the combined upstream and downstream slopes be less than 1v:5h, with neither slope steeper than 1v:2h, a stability analysis was conducted for Ponds 001A through 003A as requested by the Division. Chen-Northern, Inc., a geotechnical engineering consulting firm was contracted to perform stability analyses for Sediment Ponds 001A through 003A. Chen-Northern's report of their stability analysis is presented in Appendix R614-301-742.221b. A summary of the results of their analysis is presented below.

Chen-Northern used soil strength values for Sediment Pond 001A from a report by Garco Testing Laboratories dated December 2, 1988. In-place density, direct shear, soil classification and cohesion properties were determined by Garco Testing laboratories from samples taken from the embankment of Sediment Pond 001A. Soil strength values for Ponds 002A and 003A were taken from a report prepared by Rollins, Brown and Gunnell, Inc. dated November 16, 1988. Tests were conducted by Rollins, Brown and Gunnell, Inc. on soil samples taken from one test pit each excavated into the embankment of Sediment Ponds 002A and 003A. These two reports by Garco and Rollins, Brown and Gunnell, as

well as the summary report completed by Chen-Northern, Inc. are presented in Appendix R614-301-742.221b.

The geometry of the embankments of the ponds were scaled from the 1-inch equals 50-foot scale mapping provided by Valley Camp. From this mapping Chen-Northern reported that the steepest upstream and downstream slopes for these ponds appeared to be 2.2h:1v upstream to 2.8h:1v downstream for pond 001A, 1.9h:1v upstream to 1.7h:1v downstream for pond 002A, and 1.5h:1v upstream to 1.8h:1v downstream for pond 003A. Chen-Northern determined the safety factors for each slope of these three ponds under rapid-drawdown conditions. In their analysis they assumed the soil beneath the elevation of the principal spillway to be saturated. Their minimum calculated safety factor under rapid-drawdown conditions was 1.3 for the 1.9h:1v upstream slope of Sediment Pond 002A. Chen-Northern reported that the safety factors under rapid-drawdown conditions should be greater than 1.1. Thus, the minimum safety factor computed by Chen-Northern is in excess of that required under rapid-drawdown conditions.

Chen-Northern also assessed the stability of the worst case condition, which appeared to be Sediment Pond 003A, under static and dynamic conditions. They reported the safety factors calculated for Sediment Pond 003A to be 2.0 for static and 1.6 for dynamic conditions. These safety factors correspond to the upstream slopes. They report that the safety factors for the downstream slope are slightly higher. These safety factors are greater than the required safety factors under static and dynamic conditions of 1.5 and 1.1, respectively. Chen-Northern indicates that "the safety factors obtained appear to be suitable for the purpose of the ponds."

Outlets

All pond outlet structures have been constructed to discharge onto riprap pads. Design details are not available for these structures because they were installed prior to regulatory control, however, they all appear to be operating well and no serious outlet problems are noted at the present time. A field survey completed by Hansen, Allen & Luce, Inc. of Salt Lake City in the spring of 1989 indicated that the discharges to Ponds 001A, 002A, and 003A were all located on riprap bedding, and that no erosion of the outlet devices was noted. No riprap design methodology exists for the emergency discharge to Pond 004A because of the steepness of the embankment upon which the spillway is located. However, large diameter rock has been placed down the entire slope of the embankment within the flow path of the discharge channel. The riprap appears to be doing a reasonable job of controlling discharge erosion. Outlets will continue to be monitored for integrity as required under the regulations.

Summary

None of the sedimentation ponds associated with the Mine Permit are located within a perennial stream, and all are located immediately downstream of disturbed mine areas. Each sedimentation pond has been designed with a non-clogging dewatering device and contains sediment storage volumes in excess of the three year storage requirements.

The decants, which will be the dewatering devices for the ponds, will be manually operated. The ponds have sufficient storage capacity to totally contain the runoff volume from the 10-year, 24-hour precipitation event between the proposed decant elevations and the primary spillways as documented herein. The water level in the ponds will be maintained at or below the decant level in anticipation of a runoff producing event. The decants will also be maintained in a closed position such that during a runoff producing event (of equal or lesser magnitude to that of the design event) the runoff from the event would be totally contained by the pond. Disturbed area runoff originating from a precipitation event will be held within the pond for a period of at least 24 hours and then released in accordance with the NPDES permit for the pond.

The ponds used by the applicant have been in use for an extended period of time and information related to construction is not available, however, no problems related to short circuiting, or settlement have been noted. The embankment for pond 004A was noted to be approximately 1.0 foot low as a result of the recent modifications which were made to the emergency spillway. The applicant makes a commitment to correct this situation in response to this permit submittal.

A thorough inspection of the sediment ponds and embankments will be done on a quarterly basis as required under Section R614-301-514.330. When examining for stability and performing a general inspection, the inspector will be looking for any of the following conditions:

* Seepage from the down stream side of the embankment.
* Erosion of embankment slopes.
* Continuity of emergency spillway.
* Erosion around entrance or exit of discharge pipe.
* Clogged principal or emergency spillway.
* A check of slope stakes for obvious slope movement (if utilized).
* Sediment level.
* Placement of wave erosion protection (if utilized).
* Erosion at spillway discharges.
* Clogging of the dewatering device.

R614-301-742.222. PONDS MEETING MSHA AND 30 CFR REQUIREMENTS.

N/A

R614-301-742.223 thru 301-742.223.2. PONDS NOT MEETING MSHA AND 30 CFR REQUIREMENTS.

All four sedimentation ponds have combined spillways capable of carrying the 25-year, 6-hour precipitation runoff event. The designs for each pond were initially completed for the 25-year, 24-hour precipitation event in lieu of the 6-hour event. Runoff derived from a 24-hour precipitation event is higher than that for the 6-hour event. The designs as shown in the 1989 report prepared by Hansen, Allen & Luce., and as reproduced within this permit renewal application are therefore conservative.

**** R614-301-700. ****

R614-301-742.230 thru 301-742.232. OTHER TREATMENT FACILITIES.

Other than those specified above, no other treatment facilities exist within the Mine Permit Area.

R614-301-742.240. EXEMPTIONS.

A total of six Alternative Sediment Control Structure areas (ASCA's) are identified within the Total Permit Area for which exclusion from further permitting is being requested. Two of these ASCA's (ASCA 1 and 2) are associated with the Valcam Loadout Facility, one (ASCA 3) is associated with the General Office west of the Valcam Loadout Facility, and three (ASCA 4 through ASCA 6) are associated with the Belina mine. The locations of ASCA 1 through ASCA 3 are presented on Map R614-301-731.720a, and ASCA 4 through ASCA 6 are presented on Map R614-301-731.720d.

The three general qualifying criteria that must be met in order for an area to qualify as a ASCA are:

1. The area cannot be tributary to a sediment pond.
2. The area must have some form of a treatment structure to treat runoff from the area.
3. The summation of the areas of the ASCA's must be less than fifteen percent of the total disturbed area.

Runoff from the ASCA's is not tributary to any of the sediment ponds and several alternative sediment treatment structures are already in place. A commitment by the applicant to complete those not yet in place prior to final approval of this mine re-permit has been made. Table R614-301-742.240a is inserted to provide a breakdown of areas included within each ASCA. Table R614-301-742.240b provides a breakdown of total tributary area which impacts each ASCA. The total disturbed tributary areas (not including Forested/Aspen and Sage/Grass areas) to sediment ponds 001A through 004A is 41.43 acres, and as shown in the referenced tables the total tributary area to all ASCA'S is 6.7 acres. Thus, the total area of the proposed ASCA's is approximately 13.9 percent of the total disturbed area of the mine, meeting criteria No. 3 presented above. Maps R614-301-731.720a through 301-731.720d show the locations of sediment control facilities, and ASCA's found within the Mine Permit Area.

Runoff volumes from the 10-year, 24-hour precipitation event were determined for 1) ASCA areas, and 2) that area specific to ASCA areas including adjacent tributary areas. Calculated volumes of runoff derived from the 10 year, 24 hour precipitation event for both ASCA areas as well as ASCA plus adjacent tributary areas are shown in Table R614-301-742.240c. A comparison of the total runoff volume from the ASCA's themselves (0.83 acre-feet) versus the runoff volume from the 10 year, 24 hour precipitation event to the sediment ponds (5.92 acre-feet) indicates that the runoff volume from the ASCA's is approximately 14 percent of the runoff volume controlled by the sediment ponds. Calculations are shown in Appendix R614-301-742.221a.

TABLE R614-301-742.240a
ASCA AREA BREAKDOWNS

ASCA No.	PAVED AREA (ac-ft)	DISTURBED AREA (ac-ft)	SAGE/GRASS AREA (ac-ft)	FOREST/ASPEN AREA (ac-ft)	TOTAL AREA (ac-ft)
1	-	1.13	-	-	1.13
2	0.11	1.00	-	-	1.11
3	0.75	0.87	-	0.5	2.12
4	-	0.19	-	-	0.19
5	-	1.16	-	-	1.16
6	-	0.95	-	-	0.95

TABLE R614-301-742.240b
TOTAL ASCA PLUS TRIBUTARY AREA BREAKDOWNS

ASCA No.	PAVED AREA (ac-ft)	DISTURBED AREA (ac-ft)	SAGE/GRASS AREA (ac-ft)	FOREST/ASPEN AREA (ac-ft)	TOTAL AREA (ac-ft)
1	-	1.13	-	-	1.13
2	0.60	1.00	-	-	1.60
3	0.75	0.87	-	0.50	2.12
4	-	0.19	-	0.37	0.56
5	-	1.16	-	-	1.16
6	-	0.95	1.00	1.34	3.29

Five undisturbed area bypass channels have been designed for the Mine Permit Area as shown on the maps referenced. These ditches aid in the control of sediment transport by preventing runoff from undisturbed areas from crossing over disturbed drainages where higher sediment transport rates are possible.

TABLE R614-301-742.240c
10 YEAR, 24 HOUR RUNOFF VOLUMES FROM ASCA'S AND FROM ASCA'S PLUS TRIBUTARY AREAS

ASCA No.	10 Year, 24 Hour Runoff Volume From ASCA Areas Only (ac-ft)	10 Year, 24 Hour Runoff Volume From ASCA Plus Tributary Areas (ac-ft)
1	0.14	0.14
2	0.14	0.23
3	0.27	0.27
4	0.02	0.03
5	0.14	0.14
6	0.12	0.22
Total	0.83	1.03

Depressions throughout the Mine Permit Area collect and retain surface runoff from small disturbed drainage areas where it either infiltrates to the ground water system, or is evaporated. These depressions help collect and retain moving sediment, as well as reduce total runoff thereby reducing erosion.

Where practical, natural vegetation is allowed to grow into runoff conveyance facilities in order to reduce overall erosion rates. Vegetative stands and the associated root network aid in holding soil in place thereby reducing sediment transport. An example of this type of erosion prevention is found in the ditch sections near the General Office within the Valcam Permit Area.

Paved roadways also aid in reducing erosion within the Mine Permit Area. They also aid in reducing the amount of air pollution through dust and particulate matter caused by motor vehicles. Concrete ditch sections located along the Belina Haul Road to the Belina mine, and along selected road sections at the mine itself act in the same manner as paved roadways and reduce erosion.

Revegetation of disturbed areas and ditch sections reduce erosion rates by re-establishing vegetative growth. The additional water holding and water retention capacity of vegetated areas acts in conjunction with root zones to reduce soil movement.

The great majority of surface runoff conveyance facilities within the Mine Permit Area have been in place for an extended period of time. The amount of erosion evident at each of the facilities is therefor indicative of the type and amount of erosion that is anticipated to occur as a result of runoff characteristics. In some locations, the placement of riprap has been a successful deterrent to continued erosion.

Rock gabions have been placed within some small channel sections to prevent upstream erosion. In cases where erosion would normally exist, this type of control prevents undercutting and forces the water to back up behind the gabion until water can flow over the top of the structure. When this happens, the slope and runoff velocity of the channel remains constant thereby maintaining controlled sediment load rates. An example of ditch sections using rock gabions successfully can be seen in the ditches located at the entrance to the Valcam Loadout Area.

Sediment traps or basins are located at selected sites within the Mine Permit Area to reduce the amount of sediment being carried to downstream locations. These traps reduce local ditch runoff velocities thereby allowing the larger sediment to be dropped out.

Straw bales placed within the ditch section act as small filter dams which have two effects. First, they create a damming effect which reduces flow velocity (thereby reducing sediment loadings), and second, they filter out larger sediment particles. These straw bales are placed perpendicular to the ditch channel, and are kept in place through the use of steel rebar or other similar device which is driven through the bale and anchored securely into the ground.

Each of the sediment control measures outlined above were considered for use at each of the ASCA's located within the Mine Permit Area. Table R614-301-742.240d provides a summary of the proposed treatment facilities for each ASCA.

R614-301-742.300. DIVERSIONS.

R614-301-742.310 thru 301-742.314. GENERAL REQUIREMENTS.

Surface runoff diversions in place within the Mine Permit Area consist of small ditches and culverts which carry water from various locations throughout the mine plan area to downstream sedimentation facilities. In general, these conveyance ditches and culverts are considered convenience structures, used to aid in the conveyance of excess water thereby preventing the accumulation of water and the creation of muddy or boggy areas. By collecting and conveying the water to the sedimentation ponds in this manner, mine traffic becomes more controlled and fewer travel problems exist.

Sediment control measures utilized in ditch and diversion sections include bypass channels, depressions, paved roadways or ditch sections, riprap, rock gabions, sediment traps or basins, straw bales, and vegetation. A brief description of the sediment reducing characteristics of each of these control measures was presented in Section R614-301-742.240.

Runoff conveyance facilities associated with the Mine Permit Area are shown on Sediment Control Facilities Maps R614-301-731.720a through 301-731.720d. Map R614-301-731.720a shows those facilities associated with the Valcam Loadout Facility (including the General Office), Maps R614-301-731.720b and R614-301-731.720c show runoff facilities along the Belina Haul Road between Eccles Canyon and the Belina mine, and Map R614-301-731.720d shows those associated with the Belina mine area. Some drainage areas for these facilities are not shown completely on the 1 inch to 100 foot scale maps upon which they have been drawn, and detailed topography for them is not available. Drainage boundaries are shown

however on Drainage Basin Boundary Map R614-301-742.310a for those runoff facilities where drainages cover extensive areas not mapped in detail on the maps discussed above, such as Belina Haul Road culverts and undisturbed area bypass culverts and ditches.

MAP R614-301-742.310a

TABLE R614-301-742.240d
PROPOSED ASCA TREATMENT FACILITIES

Facility	ASCA 1	ASCA 2	ASCA 3	ASCA 4	ASCA 5	ASCA 6
Bypass Channel	X	X			X	X
Depressions		X			X	X
Nat. Vegetation	X	X	X		X	X
Paved		X	X			
Revegetation			X		X	X
Riprap	X	X			X	X
Rock Gabion						
Sediment Basin	X	X		X	X	X
Straw Bale(s) (Loose)	X	X		X	X	X
Total Acres	1.1	0.4	2.3	1.0	0.2	0.8

The numbering sequence used on the maps for both culverts and ditches is based upon a sequential numbering of culverts from north to south. All culverts start with a "C" designation, followed by a culvert number, thereafter followed by the culvert diameter. The culvert with the entrance farthest north carries therefore a designation of "C-1-diameter". The numbering sequence is consistent throughout the Valcam and Belina Permit Areas. The lowest culvert and ditch numbers occur at the far north end of the Valcam Permit Area and increase in a southern direction until the highest number is reached at the southern most end of the Belina Permit Area.

Ditch numbering is tied directly to the culvert associated with the ditch, or if no culvert exists, with the closest culvert. All disturbed area ditch sections carry a "D" designation, followed by a ditch number (which is tied to the closest culvert). In the event that two or more ditches are associated with any given culvert, the ditch number would be followed by a letter of the alphabet, indicating multiple ditch sections. For example, the five ditches associated with Culvert C-12-24 shown on Sediment Control Facilities Map R614-301-731.720a, are numbered D-12A through D-12E. Undisturbed area bypass ditches (one of which is located at the VALCAM Loadout Facility, and four at the Belina Mine Facility) are numbered UDD-1 through UDD-5.

**** R614-301-700. ****

The design methodology used in estimating the peak flows for all diversion facilities is presented in Section R614-301-742.220 of this permit renewal. The 10-year, 6-hour precipitation event (1.55 inches) was used for design as obtained from Richardson (1971). The areas contributing runoff to each drainage system were subdivided in accordance with cover complex; i.e. paved area, disturbed area, sage/grass area, and forest/aspen area. A curve number of 98 was assumed for paved areas, a curve number of 90 was assumed for disturbed areas, a curve number of 75 was assumed for sage/grass areas, and a curve number of 70 was assumed for forest/aspen areas. Volume weighted curve numbers were determined to represent the composite area.

DISTURBED AREA DITCHES

A field reconnaissance of surface runoff characteristics of the Mine Permit Area was conducted by Hansen, Allen & Luce engineers in the spring of 1989. As part of their field investigation, data was collected related to ditch and culvert characteristics within the Mine Permit Area. Main ditch and culvert sections were identified at that time which were considered to be of major importance to the conveyance of disturbed area runoff. Data summaries showing the characteristics of these ditch and culvert sections are shown on Tables R614-301-742.310a and R614-301-742.310b respectively.
Because many of the ditch and culvert sections are dependent upon runoff flows from adjacent areas, the culvert and ditch analyses completed for this permit submittal include all those facilities located within the Mine Permit Area. However, only those considered to be of major importance to the runoff characteristics of the area are included within the tables referenced in this section of the permit. Those ditches not listed in the tables referenced are classified as not needing formal design, and are installed using a generic triangular ditch design with a depth of between one half to one foot. Ditch sections along the Belina Haul Road are concrete lined thereby controlling erosion, and therefore design calculations have not been generated, nor are they included within tables of this mine permit. Maps R614-301-731.720a through 301-731.720d show the layouts of each ditch and culvert section within the Mine Permit Area. Calculations for both ditches and culverts (where required) are presented in Appendix R614-301-742.310.

UNDISTURBED AREA BY-PASS DITCHES

Hansen, et. al. (1989) provided a hydrologic analysis of the undisturbed area by-pass channels and culverts within the Belina and Valcam Permit Areas. This hydrologic analysis included an estimate of the peak flowrate from the 6-hour precipitation event. There are two undisturbed area by-pass culverts (C-4-42 and C-14-42) and five open channels (UDD-1 through UDD-5) for which peak flows from the above referenced design events were estimated. The design check of bypass culverts was completed using the 100-year, 6-hour precipitation event, and the 10-year, 6-hour precipitation was used for the design check of undisturbed area drainage ditches. It is important to note that some renumbering of culverts was implemented in response to this permit renewal, and therefore caution is advised when comparing data shown herein with previous documentation. For example, the culvert listed as C-12-42 in the 1989 Hansen, et. al. report has been renamed C-14-42. Calculations for both undisturbed area bypass ditches and culverts are presented in Appendix R614-301-742.310.

TABLE R614-301-742.310a
DITCH FLOW CHARACTERISTICS

Ditch No.	Runoff Area (ac)	Weighted Cn	Peak Flow (cfs)	Mannings n	Slope Max (ft/ft)	Slope Min (ft/ft)	Side Slope (1:m)	Bottom Width (ft)	Flow Depth (ft)	Maximum Velocity (fps)	Riprap D50 (ft)
D-1	8.2	85.9	3.9	.03	.03	.05	2	1	0.5	4.7	N/A
D-3	5.6	85.5	2.6	.03	.015	.10	2	0	0.7	2.7	N/A
D-5B	2.8	91.5	2.2	.03	.03	.11	2	0	0.3	4.8	N/A
D-7A	0.8	90.0	0.6	.03	.02	.08	2	0	0.9	3.5	N/A
D-7B	1.6	91.9	1.3	.03	.045	.11	2	1	0.3	4.5	N/A
D-12D	1.6	93.0	1.4	.03	.02	.02	2	0	0.5	2.6	N/A
D-13A	2.1	80.1	0.6	.03	.03	.18	2	0	0.4	4.8	N/A
D-13B	2.2	80.7	0.7	.03	.15	.35	2,15	2	0.2	4.6	N/A
D-16B	0.7	90.0	0.5	.03	.01	.10	2	0	0.4	3.7	N/A
D-30	2.3	82.8	4.5	-	.10	.13	-	Concrete Ditch Installed at Roadside			
D-33A	14.3	83.4	5.4	-	.04	.04	-	Concrete Ditch Installed at Roadside			
D-33B	13.4	86.0	6.6	.03	.04	.04	2,15	0	0.5	3.7	N/A
D-34A	1.3	85.0	0.6	.03	.02	.02	2	0	0.4	2.2	N/A
D-34B	3.0	88.2	1.9	.03	.02	.05	2	0	0.6	4.1	N/A
D-35	4.6	89.3	3.0	.03	.02	.02	2	0	0.7	3.2	N/A
D-37*	1.4	90.0	1.0	.03	.18	.18	2,15	0	0.2	4.0	N/A
	3.8	90.0	2.6	.03	.02	.10	2,15	0	0.8	4.1	N/A
	3.8	90.0	2.6	.04	.30	.30	2	2	0.2	5.9	0.75
D-44A	1.5	80.0	0.4	.03	.10	.10	2	0	0.3	3.6	N/A
D-44B	1.8	77.8	0.4	.03	.17	.21	2	0	0.2	4.5	N/A

* Values are for Upper, Middle and Lower sections respectively.

TABLE R614-301-742.310b
CULVERT FLOW CHARACTERISTICS

Culvert No.	Runoff Area (ac.)	Weighted CN	Pipe Dia. (in.)	Pipe Slope (ft/ft)	Available HW/D Ratio	Inlet Capacity (cfs)	Pipe Capacity (cfs)	Design Flow Rate (cfs)	Comment
C-1-32	8.2	85.9	32	.25	1.9	45.0	132.0	3.9	Flow from D-1
C-4-42	88.0	61.7	42	.03	1.9	90.0	94.4	4.0	Flow from Undisturbed Area
C-5-18	3.4	-	18	.03	1.5	9.0	16.9	2.6	Flow from D-5A,B
C-6-18	4.5	-	18	.025	2.7	13.0	9.0	3.4	Flow from D-6,C-5-18
C-7-24	2.4	-	24	.05	1.4	16.5	27.4	1.8	Flow from D-7A,B
C-8-18	1.6	-	18	.04	1.5	9.0	11.4	1.2	Flow from D-8,D-9A,B
C-10-18	12.8	75	18	.10	1.5	9.0	18.0	1.2	Flow from D-10
C-11-12	0.8	91.3	12	.08	1.0	2.0	5.5	0.6	Flow from Tributary Area
C-12-24	1.1	-	24	.02	2.0	22.0	17.3	0.9	Flow from D-12A,B
C-14-42	242.0	67.5	42	.03	1.9	90.0	94.4	21.9	Flow from Undisturbed Area
C-15-24	4.2	82.8	24	.05	1.6	18.5	27.4	1.6	Flow from D-15
C-19-48	1482.0	74.3	48	.06	2.1	130.0	190.6	77.0	Flow from Undisturbed Area
C-21-48	2072.0	73.0	48	.01	8.3	215.0	276.0	92.6	Flow from Tributary Area
C-22-24	22.0	70.5	24	.057	1.4	17.0	29.3	0.8	Flow from Tributary Area
C-23-24	22.0	70.5	24	.08	1.8	20.0	34.7	0.8	Flow from Tributary Area
C-24-24	20.0	75.0	24	.12	2.1	22.0	42.5	2.0	Flow from Tributary Area
C-25-36	151.0	72.7	36	.12	7.3	130.0	125.2	7.0	Flow from Tributary Area
C-26-24	14.0	75.0	24	.18	2.0	22.0	52.0	1.5	Flow from Tributary Area
C-27-24	14.7	71.0	24	.43	2.3	24.0	80.6	0.6	Flow from UDD-2
C-28-24	35.0	74.8	24	.30	4.3	35.0	67.1	3.3	Flow from UDD-2,Tributary Area
C-30-24	12.3	82.8	24	.04	2.0	21.0	24.5	4.5	Flow from D-30
C-32-36	5.9	73.8	36	.04	2.6	80.0	72.3	0.6	Flow from D-32A,B
C-33-24	27.7	-	24	.17	2.0	22.0	50.5	12.0	Flow from D-33A,B
C-34-24	4.3	-	24	.30	2.2	22.0	67.2	2.5	Flow from D-34A,B
C-36-12	4.9	-	12	.30	2.2	4.0	10.6	1.1	Flow from D-36,C-38-6

TABLE R614-301-742.310b (Continued)
CULVERT FLOW CHARACTERISTICS

Culvert No.	Runoff Area (ac.)	Weighted CN	Pipe Dia. (in.)	Pipe Slope (ft/ft)	Available HW/D Ratio	Inlet Capacity (cfs)	Pipe Capacity (cfs)	Design Flow Rate (cfs)	Comment
C-38-6	2.2	76.1	6	.07	3.0	1.3	0.8	0.4	Flow from Tributary Area
C-39-8	1.8	70.0	8	.08	2.8	2.0	1.9	0.1	Flow from D-39A,B
C-40-42	54.9	70.0	42	.30	4.3	140.0	265.3	5.3	Flow from C-41-12,C-44-24, and Tributary Area
C-41-12			12	.17	2.4	4.5	8.0	1.0	Flow from Mine Discharge
C-44-24	74.2	70.0	24	.08	3.2	29.0	34.7	2.5	Flow from Undisturbed Area

Undisturbed area bypass channel UDD-1 is associated with the Valcam Loadout Facility, and bypass channels UDD-2 through UDD-5 are associated with the Belina Mine facility. The locations and tributary areas of these culverts and channels are shown on Maps R614-301-731.720a through 301-731.720d, and on Map R614-301-742.310a.

Summary data for tributary areas to the undisturbed area by-pass channels are presented in Table R614-301-742.310c. Peak flow projections from the precipitation events referenced above along with the respective watershed characteristics are presented in Table R614-301-742.310d. Calculations and computer printouts of the hydrographs from the analysis, as well as hydraulic channel designs for culverts and ditches UDD-1 through UDD-5 are shown in Appendix R614-301-742.310.

Two intermittent and one perennial streams have been diverted within the Mine Permit Area, all three of which have been in place for many years. Both intermittent streams are located within the Valcam Permit Area and are culverted. These culverted streams are identified as culverts C-4-42 and C-12-42 on Map R614-301-731.720a. The perennial stream diversion (identified as culvert C-40-42 on Map R614-301-731.720d) is also a culverted section which lies beneath the coal loadout pad of the Belina Permit Area.

TABLE R614-301-742.310c
TRIBUTARY AREA TO UNDISTURBED AREA BY-PASS CHANNELS

Channel	Forested/Aspen Area Acres	Sage/Grass Area Acres	Total Area Acres
UDD-1	0.0	6.7	6.7
UDD-2	13.3	1.4	14.7
UDD-3	0.0	8.1	8.1
UDD-4	5.5	0.0	5.5
UDD-5	7.2	0.0	7.2

** R614-301-700. **

TABLE R614-301-742.310d
UNDISTURBED AREA WATERSHED CHARACTERISTICS AND PEAK FLOW

Channel	Area Acres	Volume Weighted Curve Number	Hydraulic Length ft	Watershed Slope %	10-yr/6-hr Peak Flow cfs
UDD-1	6.7	75	700	27	0.84
UDD-2	14.7	71	1900	37	0.57
UDD-3	8.1	75	1500	32	0.85
UDD-4	5.5	70	1250	31	0.19
UDD-5	7.2	70	1100	28	0.25

R614-301-742.320 thru 301-742.324. DIVERSION OF PERENNIAL AND INTERMITTENT STREAMS.

The hydraulics (including inlet and pipe flow conditions) for all three culverts have been checked against the 100-year, 6-hour precipitation runoff event. Calculations and data summaries for these three culverts are presented with the remainder of Mine Permit Area culverts in Section R614-301-742.310.

R614-301-742.330 thru 301-742.333. DIVERSION OF MISCELLANEOUS FLOWS.

All flow diversions within the Mine Permit Area are discussed in Section R614-301-742.310.

R614-301-742.400 thru 301-742.423.5. ROAD DRAINAGE.

Roads located within the Mine Permit Area have been in place for a number of years, and no new roads are contemplated at this time. All existing roads are constructed with side slopes to facilitate surface drainage. In the future, should any new roads be required, the Division will be notified, and all roads will be constructed in such a manner so as to provide for proper drainage. Road drainage will be accomplished by 1) sloping the road surface towards the inner embankment and 2) constructing an accompanying drainage ditch paralleling the roadway when required to prevent excessive erosion, or to prevent spillage into another runoff drainage basin. After collecting surface runoff, the drainage ditch system diverts surface runoff to a downstream channel or sedimentation pond. When runoff is derived from undisturbed surface areas, the road drainage system redirects surface flows to natural channels. When runoff is derived from disturbed surface areas, the runoff is diverted through a sedimentation pond.

All roads have been constructed on the most stable available surfaces and no stream fords are used throughout the Mine Permit Area. Runoff calculations for culverts located beneath roadways are based upon the 10-year, 6-hour runoff event according to the SCS runoff prediction methodology presented earlier in this permit. Where critical, trash racks have been installed at road culverts to provide for the removal of runoff debris. For the most part, these trash racks are located at undisturbed area bypass culverts, at the inlet of major culverts lying at the base of mine highwalls, and along the Belina Haul Road connecting Eccles Canyon with the Belina mine. Small culverts found within the disturbed Mine Permit Area are generally not provided with trash racks or inlet/outlet headwalls. These devices are not provided because should a failure occur, all runoff would be recollected within a downstream culvert and or ditch section, and carried to the appropriate sedimentation pond for water quality control. The applicant accepts the responsibility to repair or replace all damaged culverts as required for efficient mine operation.

R614-301-743 thru 301-743.300. IMPOUNDMENTS.

The requirements of this section are discussed and met in Section R614-301-742.220 within the discussion on sedimentation ponds.

R614-301-744 thru 301-744.200. DISCHARGE STRUCTURES.

Information related to discharge structures for sedimentation ponds and diversions located within the Mine Permit Area is found in Sections R614-301-742.220 and R614-301-742.300 respectively.

R614-301-745 thru 301-745.400. DISPOSAL OF EXCESS SPOIL.

N/A

R614-301-746. COAL MINE WASTE.

R614-301-746.100 thru 301-746.120. GENERAL REQUIREMENTS.

Currently there are no coal mine wastes generated within the Mine Permit Area. Should any be developed in the future (which is not anticipated), they will be returned to underground mine workings for disposal. By returning the wastes to underground storage, they would be placed back into the natural environment from which they came thereby eliminating surface impacts and minimizing overall hydrologic impacts. This method of disposal is preferred and meets the desires of Section R614-301-746.400.

R614-301-746.200 thru 301-746.222. REFUSE PILES.

N/A

R614-301-746.300 thru 301-746.340. IMPOUNDING STRUCTURES.

N/A

**** R614-301-700. ****

R614-301-746.400 thru 301-746.430. RETURN OF COAL PROCESSING WASTES TO ABANDONED UNDERGROUND WORKINGS.

No coal processing wastes are generated by the applicant in its operation. The only waste which is returned to the mine is sediment which has been removed from pond 004A. The sediment disposal site for pond 004A within the mine is located in the West mains near First and Second South.

R614-301-747 thru 301-747.300. DISPOSAL OF NON-COAL MINE WASTES.

All non-coal mine wastes are stored in metal trash containers and hauled from the Mine Permit Area by private contractors to the Carbon County Landfill. Sewage waste is hauled to the Price sewage treatment plant by a contract hauler. Non-coal wastes awaiting transport are stored in storage bins or tanks in order to ensure the non-degradation of surface or underground waters.

R614-301-748. CASING AND SEALING OF WELLS.

All water wells currently used within the Mine Permit Area have been cased as required, and those wells abandoned have been sealed as discussed in Section R614-301-631 according to the requirements of this section to:

1. Prevent acid or other toxic drainage from entering the ground or surface water.

2. Minimize the disturbance to the hydrologic balance of the Mine Permit Area.

3. Ensure the safety of people, livestock, fish and wildlife, and machinery.

Water wells exposed by coal mining and reclamation operations will be permanently closed unless otherwise approved by the Division.

R614-301-750 thru 301-755. PERFORMANCE STANDARDS.

All performance standards required within this section of the regulations have been previously discussed within other sections of this permit renewal. All discharges from the mines or disturbed mine areas are governed under NPDES discharge permit number UT-0022985 (included in Appendix R614-301-750), and efforts are being made to comply with all Utah and federal water quality laws. Efforts include the installation and maintenance of numerous runoff control ditches and culverts, the maintenance of four sedimentation ponds, the installation of numerous silt traps and silt fences, and the revegetation of disturbed areas. All disturbed areas will be reclaimed upon mine abandonment.

All mine road drainage is controlled through the collection and treatment of disturbed area runoff in local sedimentation ponds with the exception of the Belina Mines Haul Road between Eccles Canyon and the Belina Mines. A concrete ditch system has been installed alongside the paved road which prevents erosion of the hillside and or road base, and allows for the diversion and bypass of natural waters without excessive impact.

**** R614-301-700. ****

Other areas of concern raised through the regulations is the disposal of excess spoil, coal mine waste, and non-coal mine waste. These issues are likewise discussed earlier within Sections R614-301-745 and R614-301-746.

Casing and sealing of wells will be managed to comply with Sections R614-301-738, R614-301-748 and R614-301-765.

R614-301-760 thru 301-765. CHANNEL RECLAMATION.

The discussion and details related to channel reclamation (including appropriate figures) is found in Volume VI. Volume VI will be recombined with this volume for the final permit application submittal.

Valley Camp of Utah, Inc.

Mine Permit Renewal Application

Maps and Figures

Volume III

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