0011

CYPRUS PLATEAU MINING CORPORATION
A Cyprus Amax Company

Cyprus Plateau Mining Corporation
Post Office Drawer PMC
Price, Utah 84501
(801) 637-2875

December 3, 1997

RECEIVED
DEC 05 1997
DIV. OF OIL, GAS & MINING

Mr. Mike Herkimer
Environmental Scientist - Permits and Compliance Section
Utah Division of Water Quality
P.O. Box 144870
Salt Lake City, Utah 84114-4870

ACT/007/038 #2

RE: WILLOW CREEK UPDES DISCHARGE PERMIT UTG040012 MODIFICATION

Copy Sharon & Daron

Dear Mr. Herkimer,

Several areas of concern were discussed during our meetings on the proposed discharge from the Willow Creek Mine. The attached evaluation addresses these concerns.

We appreciate your time and consideration of this request, and look forward to your earliest response.

Sincerely,

Ben Grimes
Sr. Staff Project Engineer

Attachment

C: Sharon Falvey - UDOGM

File: WCENV 2.5.2.1.2
Chron: BG971201

HANSEN ALLEN & LUCE INC

SALT LAKE AREA OFFICE
6771 South 900 East
Midvale, Utah 84047
Phone: (801) 566-5599

Mr. Ben Grimes
Cyprus Plateau Mining Company
P.O. Drawer PMC
Price, Utah 84501

November 12, 1997

RE: Willow Creek Impacts due to Mine Discharges.

Dear Ben:

We have reviewed anticipated conditions within Willow Creek which would result from the proposed mine discharges which have been discussed recently with the Utah Division of Environmental Quality. It is our understanding that the issues for which DEQ would like clarification include those bulleted below. Our response to the identified concerns are provided under separate headings following the questions.

- What are the anticipated water quality impacts to Willow Creek?
- What impacts are anticipated to the stream channel downstream of the point of inflow?
- What problems are anticipated as a result of additional discharges into the creek?
- What type of diversion structure is anticipated?

WATER QUALITY IMPACTS

As outlined in the letter from CPMC to Mike Herkimer dated October 6, 1997, the anticipated TDS concentration of discharge water is 2,700 mg/l. Available CPMC data for Willow Creek show quarterly TDS concentrations of 515, 441, 582 and 590 mg/l for the 1st through 4th quarters respectively. Blended TDS concentrations within Willow Creek for these four quarters are anticipated to be 1,592, 1,196, 2,207 and 1,958 mg/l respectively. Although the TDS concentrations are higher than would normally be desired, it is felt that overall stream impacts would be minimal due to the fact that:

1. Hydrologic conditions currently being investigated seem to indicate that Willow Creek east of the mine is a losing stream reach. Water lost is believed to be entering the local ground water system whereafter it moves westward until it re-emerges as surface flow in Willow Creek, or until it reaches the Price River drainage. Water reaching the Price River drainage would tend to move southward down the canyon and enter the Price River as subsurface inflow. Except for a variation in discharge timing, the beginning and ending points of this hydrologic cycle appear to be the same as those proposed through mine discharge directly into Willow Creek.

2. The impacted stream reach is the section immediately above the confluence of Willow Creek with the Price River.
3. The total meandering stream length potentially involved is approximately 2,500 feet (1,500 feet straight line distance).
4. There are no diversions found within the stream reach between the anticipated point of discharge and its confluence with the Price River. It is anticipated that the point of discharge would be in the northward meander of the creek downstream of the trailer offices and the existing lower stream monitoring weir.

STREAM CHANNEL IMPACTS

On October 30, 1997 a site visit was made to evaluate the potential impacts to Willow Creek which could result from increased in-stream flows. Data collected during this site visit included the collection and/or estimation of 9 channel cross sections, local channel slope, and in-stream rock (riprap) sizes between the lower monitoring weir and the Price River. Data collected from this site visit has been summarized within the attached calculation sheets. These summary sheets show flow and cross section data (including x-section graphs) applicable to each section.

For evaluation purposes, each x-section was evaluated for both "average" and "high flow" conditions. Average flow was determined based on historic quarterly data, and high flow was determined to be the summation of average quarterly flow plus projected mine discharge flow.

Average Flow

Water flow records were obtained through the internet for two USGS gaging stations on Willow Creek. The first station, "Willow Creek near Castlegate, Utah" (Sta. 09312800) was historically located approximately 4 to 5 miles above the current mine site. Records for this site are available for the periods between 10/1/62 to 9/30/72, and 10/1/73 to 9/30/89. The second station, "Willow Creek at Castlegate, Utah" (Sta. 09312900) was historically located within the general area between the current mine and the Price River. Records for this site are available for the period between 10/1/79 and 9/30/81. As it turns out, the station closest to the proposed discharge point has the inferior record of flows.

In order to obtain a better data base for the desired site, a flow regression was completed for the two historic sites. This flow regression allowed data from the upper site (having the longer period of record) to be used to predict flows at the lower site. The regression of the two sites produced an independent variable coefficient of 1.071145, a constant of 0.1998, and an R^2 of 0.9949. Using the regression equation, quarterly flow averages were predicted for historic station 09312900 of 3.6, 28.9, 4.4, and 1.9 cfs for the 1st through 4th quarters respectively. Please note that in the calculations an average flow value of 28.4 cfs was erroneously used instead of the documented 28.9 cfs. Because the typographic error was conservative, the flow evaluations were not re-run.

High Flow

High flow is defined as combined average Willow Creek flow plus anticipated mine discharge flow. Projected quarterly mine discharges as outlined in the letter to Mike Herkimer dated October 6, 1997 were 3.5, 14.5, 14.5 and 3.5 cfs respectively. As can be seen from the attached calculation sheets, high flows were found to occur during the second quarter of the year and equal 42.9 cfs. Only second quarter data were used for the high flow analysis since they were the most conservative.

Evaluation of X-Sections

As shown on the attached calculation sheets, each x-section was evaluated for both average and high flow conditions. It was found through this evaluation that Cross Section 6 had the highest flow velocity, and was therefore selected as the critical flow section for further analysis. Further analysis included the additional evaluation of flow impacts on bedload stability using the peak annual average flow (85.6 cfs) calculated for the site as well as the calculated all time high record flow (359 cfs). Calculated Safety Factors at Section 6 for the four flow conditions discussed are shown in the following table.

BEDLOAD SAFETY FACTORS FOR VARIOUS FLOW CONDITIONS

Flow Condition	Flow (cfs)	Factor of Safety	
		Bottom	Side
Average Flow	28.4	1.60	0.99
High Flow (Avg. Flow plus Discharge)	42.9	1.27	0.90
Average Annual Peak Flow	85.6	0.87	0.73
Extreme High Flow	359	0.40	0.41

Note from the data that the safety factor for High Flow is substantially greater than that which has been recorded for Average Annual Peak or Extreme High flow conditions. It is the conclusion therefore that bedload variations due to the increased discharge into Willow Creek are well within the limits of the current and historic flow regime.

DIVERSION STRUCTURE

It is currently proposed to locate the diversion structure just downstream of the trailer offices and lowermost monitoring weir. This installation would provide relatively good access from the north side of the bank, and since it is in a stream section that is the farthest from the highway, would help obscure its presence. Different designs will be contemplated for the design of the diversion structure including a simple pipeline diversion, concrete stilling well, riprap energy dissipation pool, and a energy dissipating waterfall structure consisting of a series of drops and pools. The type of structure to be designed will be coordinated with the regulatory agencies involved for approval prior to final design.

CONCLUSIONS AND RECOMMENDATIONS

It is anticipated that the major impact to the lower portion of Willow Creek will include projected increases in TDS as discussed above. Overall impacts of increased TDS loads are however not believed to be of major significance for the following reasons.

- Projected discharges are expected to be temporary in nature. Discharge flows are expected to decrease to match inflow, or be eliminated altogether once the volume of stored water is removed from abandoned mine sections.
- The potentially impacted section of Willow Creek is relatively short. The proposed point of discharge is located approximately 2,500 feet upstream of the confluence of Willow Creek and the Price River..
- There are no diversions of Willow Creek water within the potentially impacted stream section.

Although a diversion pipeline could be taken all the way to the Price River, it is recommended that the diversion be placed within Willow Creek as outlined above. In addition to increase costs, the difficulties in constructing a pipeline to the Price River would involve the disruption of coal transportation facilities, significant asphalt repair, and the drilling or boring beneath the main railway lines (2 tracks) within Price Canyon. Some of these factors may be extremely difficult (if at all possible) to overcome.

Please call should you have any questions about the information contained herein, or if you need further details.

Sincerely,

HANSEN, ALLEN & LUCE, INC.

By

David E. Hansen, Ph.D., P.E.
Project Manager

Filename: UPDES.Res

HANSEN ALLEN & LUCE INC

CLIENT: CPMC
PROJECT: WILLOW CREEK
FEATURE: WTR QUALITY EVAL
PROJECT NO. 002.18.400

COMPUTED: DEH
CHECKED:
DATE: 10/16/97

CHECK WATER QUALITY IN WILLOW CREEK GIVEN DISCHARGE CONDITIONS AS REQUESTED IN BEN GRIMES LETTER TO MIKE HERKIMER DATED 10/6/97

SOURCE: TDS ± 2700 mg/l

FLOW -
- 1st QTR = 3.5 cfs
- 2nd = 14.5 cfs
- 3rd = 14.5 cfs
- 4th = 3.5 cfs

WILLOW CREEK:

TDS ± 562 - Avg of all data
507 - Avg w/o single high outlier point

FLOW -

MEAN = 5.46 cfs

	QTR (cfs)			
	1	2	3	4
	1.5	2.94	0.31	6.57
	15.21	39.3	0	1.5
	7.58	16.4	0.884	1.3
		6.59	7.49	0.43
		5.52	2.91	
			2.02	
			0.39	
			0.013	
			1.85	
AVG:	8.10	14.15	1.76	0.95

Flow data is sparse. - Use flow data developed in 11/5/97 calculations as incorporated into table below.

$Q_1C_1 + Q_2C_2 = Q_3C_3$ $\quad C_3 = \frac{Q_1C_1 + Q_2C_2}{Q_3}$

QUARTERLY TDS (mg/l) - C_3

		1	2	3	4
	Q_1	3.5	14.5	14.5	3.5
	C_1	2700	2700	2700	2700
	Q_2	3.6	28.9	4.4	1.9
Using Avg Qtly Values - See pg 2	C_2	515	441	582	590
	Q_3	7.1	43.4	18.9	5.4
	C_3	1592	1196	2207	1958

HANSEN ALLEN & LUCE INC

CLIENT CPMC
PROJECT WILLOW CREEK
FEATURE WTR QUAL EVAL
PROJECT NO. 002.18.400

SHEET 2 OF 9
COMPUTED DEH
CHECKED
DATE 10/16/97

TDS VARIATION

	QTR 1	QTR 2	QTR 3	QTR 4
	560	456	566	590
	470	420	550	
	1170	380	632	
		450		
		500		
AVG	733	441	582	590
	515 (w/o 1170 value)			

Issues

1. Willow Creek would have impact between the Point of discharge and the Junction with Price River.
2. There are no known uses in imacted Stretch.
3. Impacted length = ± 2500 ft (1500' straight line)
4. Stream loses ± 0.5 cfs

WILLOW CK STATIONS

	Sta #	
• Willow Ck Near Castlegate, Utah	09312800	Carbon Co
• " " @ " "	09312900	

HydUnit Code: 14060007
Price R. Basin

STA #	Period of Record	File Saved as	QPro filename
09312800	10/1/62 - 9/30/72	WCnrCG2.cgi	~WCnrCG1.wb3
09312800	10/1/73 - 9/30/89	WCnrCG1.cgi	~WCnrCG2.wb3
09312900	10/1/79 - 9/30/81	WCatCG1.cgi	WCatCG1.wb3

STA 09312800 Combined to Single File: Filename WCnrCG1.wb3

STATION	QTR 1	2	3	4
Willow Ck nr Castlegate	3.14	26.82	3.96	1.54
Willow Ck at Castlegate	2.21	34.73	4.72	2.04

Curve fit data

Flow nr Castlegate (Q_1)
Flow at Castlegate (Q_2)

$Q_1 * 1.071145 + 0.1998 = Q_2$

Std Error = 1.712358
$R^2 = 0.994953$
Observ = 731
Deg Freedom = 729

Regressed Flows @ Castlegate (filename: flowcomp.wb3)
(Castlegate flows are more representative)

	Qtr 1	2	3	4
Flow	3.56	28.93	4.44	1.85

Adding flows to Willow Creek will only impact stream stability for the highest flows.

Add proposed discharges to highest avg. flow (ie: 28.9 cfs)

Proposed Discharge: 3.5 cfs (1st & 4th Qtrs)
14.5 cfs (2nd & 3rd Qtrs)

PEAK DESIGN Q = 14.5 + 28.4 = 42.9 cfs

Compare flows for both 28.4 and 42.9 cfs conds.

Calculations show Section 6 to have the highest velocities:

Post discharge V = 5.22 fps
Pre discharge V = 4.52 fps

Check Riprap Sizing Safety Factors

Q	Safety Factor bottom	Safety Factor side
28.4	1.16	0.99
42.9	1.27	0.90

Compare these S.F.s versus high flows for same section (use WCnrCG file, then calc corresponding high flows for WCatCG.

Max Q near Castlegate = 335 cfs on May 27, 83

Est. Max Q at Castlegate = 335 (1.071145) + 0.1998 = 359

Checking Flow Characteristics (See Printout "Stale- Extreme Flow Conditions)

S.F. min = 0.40 (much less than 0.9 above)

Check Avg Peak - WCnrCG

DATA

27 - 63'	83 - 68'	9.6 - 74'	198 - 79'	145 - 84'	5.8 - 89'
41	177	75	200	63	
248	14	18	40	83	
40	22	3.9	59	190	
29	11	57	335	30	

Avg Peak Q = 85.6 cfs

Check of Safety Factors for Avg. Annual Peak Flow of 85.6 cfs

Compare w/ High Flow including diverted Flows

Flow Cond.	Q (cfs)	S.F. (bottom)		S.F (side)	
Average	28.4	1.60		0.99	
High Flow	42.9	1.27		0.90	
Avg. Ann Peak	85.6	0.87		0.73	
Extreme High	359	0.40		0.41	

As can be seen, the Safety factor for high flow conditions (ie: Willow Creek plus discharge) is significantly higher than either the Average Annual Peak Flow or the Historic High.

Conclusion:

EROSIONAL IMPACT IS WELL WITHIN CURRENT LIMITS, ie: NO APPRECIABLE CHANGE IS EXPECTED.

CPMC - Willow Creek Mine
Channel Cross Sections - Looking Downstream
Filename: x-sections.wb3

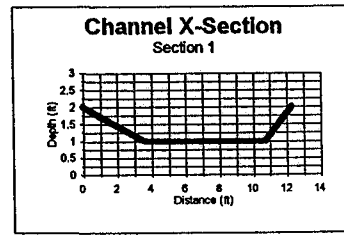
Project # 002.18.400

NOTE: Flow information including Depth, Velocity, and Safety Factors taken from Individual Calculation Sheets. A sample sheet for Station 6 is attached.

Section 1	Left 1:m	B	Right 1:m	S	D50
	3.67	7	1.6	0.02	1.5

Flow	Depth	Velocity
28.4	0.82	3.75
42.9	1.04	4.25

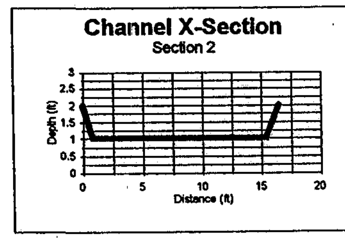
X	Y
0	2
3.67	1
10.67	1
12.27	2



Section 2	Left 1:m	B	Right 1:m	S	D50
	0.86	14.5	1.13	0.03	1.5

Flow	Depth	Velocity
28.4	0.51	3.75
42.9	0.65	4.37

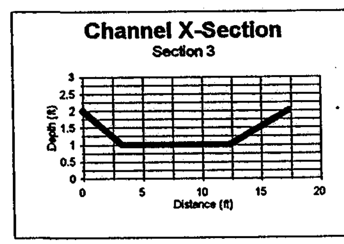
X	Y
0	2
0.86	1
15.36	1
16.49	2



Section 3	Left 1:m	B	Right 1:m	S	D50
	3.29	9	5	0.01	1

Flow	Depth	Velocity
28.4	0.83	2.77
42.9	1.03	3.13

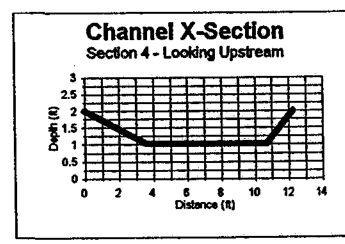
X	Y
0	2
3.29	1
12.29	1
17.29	2



Section 4a	Left 1:m	B	Right 1:m	S	D50
	3.67	7	1.6	0.02	1.5

Flow	Depth	Velocity
28.4	0.82	3.75
42.9	1.04	4.26

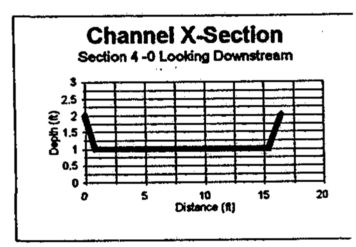
X	Y
0	2
3.67	1
10.67	1
12.27	2



Section 4b	Left 1:m	B	Right 1:m	S	D50
	0.86	14.5	1.13	0.08	2.5

Flow	Depth	Velocity
28.4	0.48	3.98
42.9	0.61	4.65

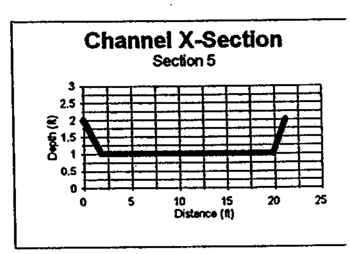
X	Y
0	2
0.86	1
15.36	1
16.49	2



Section 5	Left 1:m	B	Right 1:m	S	D50
	1.91	18	1.34	0.04	2

Flow	Depth	Velocity
28.4	0.42	3.66
42.9	0.53	4.27

X	Y
0	2
1.91	1
19.91	1
21.25	2

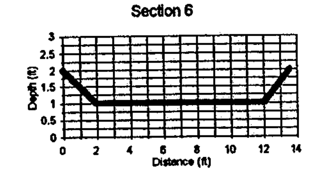


CPMC - Willow Creek Mine
Channel Cross Sections - Looking Downstream

Section 6	Left 1:m	B	Right 1:m	S	D50
	2	10	1.61	0.04	1.5

Flow	Depth	Velocity	S.F. Base	S.F. Side
28.4	0.57	4.52	1.6	0.99
42.9	0.73	5.22	1.27	0.9
85.6	1.09	6.6	0.87	0.73
359	2.43	10.28	0.4	0.41

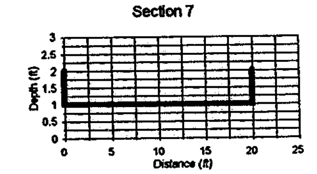
X	Y
0	2
2	1
12	1
13.61	2



Section 7	Left 1:m	B	Right 1:m	S	D50
	0.01	20	0.01	0.03	0.5

Flow	Depth	Velocity
28.4	0.38	3.76
42.9	0.49	4.42

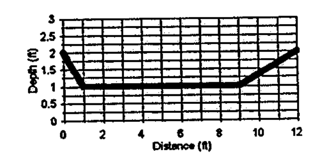
X	Y
0	2
0.01	1
20.01	1
20.02	2



Section 8	Left 1:m	B	Right 1:m	S	D50
	1	8	3	0.03	1.5

Flow	Depth	Velocity
28.4	0.7	4.31
42.9	0.89	4.94

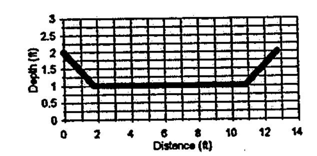
X	Y
0	2
1	1
9	1
12	2



Section 9	Left 1:m	B	Right 1:m	S	D50
	1.8	9	2	0.03	1.5

Flow	Depth	Velocity
28.4	0.66	4.22
42.9	0.83	4.85

X	Y
0	2
1.8	1
10.8	1
12.8	2



TRAPEZOIDAL Channel Flow Calculations using Mannings Equation

Client:	CPMC	Date:	06-Nov-97
Project No.:	002.18.400	Time:	04:41 PM
Channel Section:	Willow Creek - Station 6	Computed:	DEH
	Average Flow Conditions		

			UNITS
GENERAL CRITERIA:	Design Flow:	28.40	cfs
	Bottom Width:	10.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	1.6	1/m2
	Friction Factor:		
	Assumed D50:	1.50	feet
	Calc n Value:	0.042	
	Used:	0.042	
	Min. Bottom Slope:	0.040	ft/ft
	Max. Bottom Slope:	0.040	ft/ft
	Freeboard:	1.00	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.57	feet
	Q-1.49AR(2/3)S(1/2)/n =	-0.000	Accuracy
	Required Depth:	1.57	feet
	Area:	6.28	ft2
	Perimeter:	12.35	feet
	Hydraulic Radius:	0.51	feet
	Velocity:	4.52	ft/sec
	Maximum Allowable Velocity:	2.5	ft/sec
	Riprap Ck (V < V allowable):	Required	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.57	feet
	Q-1.49AR(2/3)S(1/2)/n =	-0.000	Accuracy
	Required Depth:	1.07	feet
	Area:	6.28	ft2
	Perimeter:	12.35	feet
	Hydraulic Radius:	0.51	feet
	Velocity:	4.52	ft/sec
	Riprap Ck (V < V allowable):	Required	

DESIGN CRITERIA:	Bottom Width:	10.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	1.6	1/m2
	Min. Bottom Slope:	4.0 %	
	Max. Bottom Slope:	4.0 %	
	Min Channel Depth:	1.57	feet
	Riprap (Min S):	Required	
	Riprap (Max S):	Required	

Comment:

RIPRAP DESIGN - Using the RED BOOK (Applied Hydrology and for Disturbed Areas)

Client:	CPMC	Date:	06-Nov-97
Project No.:	002.18.400	Time:	04:54 PM
Channel Section:	Willow Creek - Station 6	Computed:	DEH

DESIGN CRITERIA:

		UNITS
Design Flow:	28.40	cfs
Bottom Width:	10.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	1.60	1/m2
Friction Factor:	0.04	
Min. Bottom Slope:	0.04	ft/ft
Max. Bottom Slope:	0.04	ft/ft
Freeboard:	1.00	feet
Depth (Min. S):	0.57	feet
Depth (Max. S):	0.57	feet
Angle Repose (Ar):	42	degrees

Nb = 21T/(G(SG-1)D)
SFb = (Cos a tan b)/(sin a + Nb tan b)
Tmax= 0.76GdS
Ns = 21Tmax/(G(SG-1)D)
A = Atan(1/m)
B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar))+Sin(Ar))
n = Ns(1+Sin(Ar+B)/2)
SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

	Smin	Smax	
D50	0.50	0.50	feet
T	1.42	1.42	lb/ft2
Nb	0.58	0.58	
Tmax	1.08	1.08	lb/ft2
Ns	0.44	0.44	
m Critical	1.60	1.60	
A (m crit)	32.01	32.01	degrees
B	20.23	20.23	degrees
Nsp	0.30	0.30	
SFb	1.60	1.60	
SFs	0.99	0.99	