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KAISER COAL

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John Whitehead
Division of Oil, Gas & Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

RE: SSSF Pond

Dear Mr. Whitehead:

Please find enclose a copy of the revised SSSF Sediment pond design. This submission covers the comments on the SSSF drainage portions of the August 31, 1986 and July 31, 1986 memos from Jim Fricke to the coal file concerning the previous submission.

As requested the curve number methodology was modified to address asphalt, roofs and industrial areas. The resultant curve number increased the runoff to the point that the East Slurry Cell was not sized large enough to handle the expected runoff. To reduce the impact on the East Slurry Cell a new pond was designed to handle the runoff from the surface facility area.

A separate submission will be made which will address the sediment control for the slurry ditch area.

Sincerely,
Kaiser Coal Corporation

Douglas C Pearce

Douglas C Pearce
Mine Engineer

SSSF Pond

The SSSF Pond will be an incised pond located on a prelow disturbed site. Material from the pond (13,000 yd^3) will be stockpiled 300 feet south of the pond. Topsoil will be salvaged to a depth indicated by the Division's soil guidelines. Results of the soil survey and recommended stripping depths will be sent to the Division for approval prior to the start of stripping soil. Topsoil will be stockpiled next to the spoil pile from the pond. The topsoil will be protected from wind and water erosion by planting a quick growing, temporary seed mix and cutting a ditch around the pile. A sign will be posted on the topsoil pile which states, "Topsoil Pile - Do Not Disturb."

Water will be removed from the structure after a minimum 24-hour period with a 2-inch decant pipe. An emergency spillway is provided which will convey from the pond the maximum runoff from a 25 year-24 hour storm event.

SSSF POND DRAINAGE

The SSSF pond drainage runs from the Engineering office to the southwest corner of the coal stockpile. Culverts 2 through 11 drain runoff inside the area. A weighted curve number was generated for each subdrainage area and then applied to the total area. Copies of the computer runoff calculations are attached.

	Area	CN	CN X Area	Weighted CN
Area 2	16.81 Acres Total			
MTH	7.74 Acres	74	572.76	
Roofs-Asphalt	3.95 Acres	98	387.10	
HBC-Industrial	5.12 Acres	88	450.56	
	16.81		1,410.42	83.90
Area 3	20.77 Acres Total			
MTH	15.70 Acres	74	1,161.80	
Roofs-Asphalt	1.33 Acres	98	130.34	
HBC-Industrial	3.74 Acres	88	329.12	
	20.77		1,621.26	78.06
Area 4	11.37 Acres Total			
MTH	10.82 Acres	74	800.68	
HBC-Industrial	0.55 Acres	88	48.40	
	11.37		849.08	74.67
Area 5	1.15 Acres Total			
HBC-Industrial	1.15 Acres	88		88.00
Area 6	2.34 Acres Total			
Roofs	0.08 Acres	98	7.84	
HBC-Industrial	2.26 Acres	88	198.88	
	2.34		206.72	88.34

	Area	CN	CN X Area	Weighted CN
Area 7	8.15 Acres Total			
Roofs	0.34 Acres	98	33.32	
HBC-Industrial	7.81 Acres	88	687.28	
	8.15 Acres		720.60	88.42
Area 8	7.66 Acres Total			
HBC-Industrial	7.66 Acres	88		88.00
Area 9	1.77 Acres Total			
HBC-Industrial	1.77	88		88.00
Area 10	1.10 Acres Total			
HBC-Poor	1.10	79		79.00
Area 11	0.81 Acres Total			
Asphalt-Roofs	0.81	98		98.00
TOTAL	71.93		5,905.40	82.10

Parameters used in the calculation of runoff are as follows:

Weighted CN	82.10
Reach	5,900'
Change In Elevation	980'
Slope	16.61%

Total runoff for the 10 year-24 hour storm is calculated as follows:

0.5499 in/12 in./ft. X 43560 ft^2 per acre X 71.93 acres = 143,582 ft^3

Sediment Load

Using the Universal Soil Loss Equation $A = RKL_sC_p$ where:

R = 20
K = 0.22; % OM = 1.22, % Sand = 62.33; % Silt = 27.78; % Clay = 9.87
L_s = 23; Slope = 16%; Length = .5900', M = 0.5
C_p = .17 Barfield, Table 5.A.3, 20% Cover

Gives a loss of 17.2 tons per acre or 22,512 ft^3 per year

Volume of sediment for a three-year period is:

3,904 ft^3 X 3 years = 67,536 ft^3

Maximum sediment level has been set at elevation 6,591. When sediment reaches 60% of allowed height as indicated by the top of a wooden marker set on the side embankment, the pond will be cleaned.

Pond Volume

Volume of the pond is calculated by measuring the horizontal cross sections at three-foot intervals and then finding an equation which meets those conditions. Elevation 6593 equals the zero height.

1. Area = $Ah^2 + Bh + C$
   Cross-sectional area as a function of height
   0 = 24,000 ft^2
   3 = 27,985 ft^2
   6 = 32,255 ft^3

Substituting the known values into Equation 1 for h = 0,3 and 6 yields 3 equations which are:

2. 0, C = 24,000

3. 3, 9A + 3B + 24,000 = 27,984

4. 6, 36A + 6B + 24,000 = 32,256

Solving Equation 4 for A gives:

5. A = -0.333B + 442.667

Substituting the value from Equation 5 into Equation 3 gives:

Substituting the value from Equation 6 into equation 5 gives:

7. $A = 16$

Equation 1 can then be expressed as:

8. $\text{Area} = 16h^2 + 1280h + 24{,}000$

Integrating Equation 8 gives the volume as a function of height h. (Calculus and Analytic Geometry, George B. Thomas, Section 5-4, p. 238.)

9. $\underset{c}{\overset{h}{\text{Area}}} = V = 5.33\ h^3 + 640\ h^2 + 24{,}000\ h$

Height of sediment can then be calculated using Equation 9 at h = 1', $V = 24{,}645\ ft^3$ which is greater than the expected yearly sediment volume of $22{,}512\ ft^3$.

Using the following information and the methodology present in Summary of Ditch Design Calculations in Appendix III-1 of the Sunnyside Permit, the flow characteristic of the emergency spillway crest section and side slope section can be calculated:

	Crest	Side Slope
Slope	1%	10%
Bottom Width	4	4
Channel Side Slope	2h:1v	2h:1v
Depth of Water Flow	1.50'	0.86'
Velocity	4.08 ft/sec	8.1 ft/sec
n	.035	.041
Total Depth	2'	1.5'

Erosion protection for the pond entrance, emergency spillway, and decant outlet will be grouted rip rap. The rip rap will be dry set using mortar mix or wet set using a premixed slurry grout. This will prevent rolling of rip rap and erosion under the rocks. The decant outlet will use the emergency spillway for protection.

Culverts

Expected runoff for the culverts was calculated using the following parameters. The methodologies used in the calculations are found in the Summary of Ditch Design and Culvert Size and Outlet Protection sections of Appendix III-1 of the Sunnyside Permit. Copies of the computer runoff calculations are attached. The culvert summary table shows the complete design information used to determine culvert adequacy.

Culvert C1 95.7 Acres Area 1

Soil - MTC - Good		
CN	74	
Reach	3,250'	
Change In Elevation	1,020'	
Slope	31.38%	74.00

Culvert C2 0.81 Acres Area 11

Asphalt		
CN	98	
Reach	320'	
Change In Elevation	8'	
Slope	2.5%	98.00

Culvert C3 11.37 Acres Area 4

Soil - MTH - HBC-Industrial		
CN	74.67	
Reach	1,200'	
Change In Elevation	790'	
Slope	65.83%	74.67

Culvert C4 32.14 Acres Area 3 and Area 4

	CN	Area	CN X Area	
Area 3	78.06	20.77	1,621.31	
Area 4	74.67	11.37	848.99	
		32.14	2,470.30	76.86
Reach		2,400'		
Change In Elevation		865'		
Slope		36.04%		

Culvert C5 1.15 Acres Area 5

CN	88
Reach	900'
Change In Elevation	28'
Slope	3.11%

Culvert C6 50.91 Acres Areas 2, 11, 3, 4, 5

	CN	Area	CN X Area	
Area 2	83.90	16.81	1,410.42	
Area 3	78.06	20.77	1,621.26	
Area 4	74.67	11.37	849.08	
Area 5	88.00	1.15	101.20	
Area 11	98.00	0.81	79.38	
		50.91	4,061.34	79.77

Reach	2,900'
Change In Elevation	895'
Slope	30.95%

Culvert C7 2.34 Acres Area 6

CN	88.34	88.34
Reach	1,020'	
Change In Elevation	35'	
Slope	3.43%	

Culvert C8 59.06 Acres Areas 2, 3, 4, 5, 7, 11

	CN	Area	CN X Area	
Area 2	83.90	16.81	1,410.42	
Area 3	78.06	20.77	1,621.26	
Area 4	74.67	11.37	849.08	
Area 5	88.00	1.15	101.20	
Area 7	88.42	8.15	720.60	
Area 11	98.00	0.81	79.38	
		59.06	4,781.94	80.97

Reach	3,770'
Change In Elevation	925'
Slope	24.54%

Culvert C9 27.9 Acres Area 12

Soil - DSG2 - Type B - Good

CN	61
Reach	2,400'
Change In Elevation	605'
Slope	25.20%

Culvert C10 1.77 Acres Area 9

CN	88.00	
Reach	1,160'	
Change In Elevation	40'	
Slope	3.45%	88.00

Culvert C11 Areas 2, 3, 4, 5, 6, 7, 8, 9, 11

	CN	Area	CN X Area	
Area 2	83.90	16.81	1,410.42	
Area 3	78.06	20.77	1,621.26	
Area 4	74.67	11.37	849.08	
Area 5	88.00	1.15	101.20	
Area 6	88.34	2.34	206.76	
Area 7	88.42	8.15	720.60	
Area 8	88.00	7.66	674.08	
Area 9	88.00	1.77	155.76	
Area 11	98.00	0.81	79.38	
		70.83	5,818.54	82.15

Reach	4,970'
Change In Elevation	965'
Slope	19.42%

Ditch SSSF D1

The ditch was designed using the methodologies outlined in the Summary of Ditch design in Appendix III-1 of the Sunnyside Permit. The following is a summary of information on the ditch:

Ditch D1

Q = 19CFS
Slope = 5.0
Bottom Width = 3
Side Slope = 0.5 v:1h
Depth of Water Flow = 0.9'
Total Ditch Depth = 2.0'
Velocity = 6.6 ft/sec
n = .035

Erosion is not needed because the ditch is well vegetated and is not eroding.

INPUT SUMMARY
FOR W.S.: SSSF POND

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 16.6100 PCT
	CURVE NUMBER = 82.10
PRECIP.DEPTH = 1.84 IN	CHANNEL LENGTH = 5900 FT
	TIME OF CONC. = .5027 HR
DURATION = 24.00 HR	AREA = 71.93 AC
NUMBER OF LINES = 374	D = .0670 HR

OUTPUT SUMMARY

RUNOFF DEPTH = .5499 IN
INITIAL ABSTRACTION = .4361 IN
PEAK FLOW = 26.62 CFS (.3670 IPH)
AT T = 12.80 HRS

INPUT SUMMARY
FOR W.S.: SSSF POND

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 16.6100 PCT
	CURVE NUMBER = 82.10
PRECIP.DEPTH = 2.20 IN	CHANNEL LENGTH = 5900 FT
	TIME OF CONC. = .5027 HR
DURATION = 24.00 HR	AREA = 71.93 AC
NUMBER OF LINES = 374	D = .0670 HR

OUTPUT SUMMARY

RUNOFF DEPTH = .7889 IN
INITIAL ABSTRACTION = .4361 IN
PEAK FLOW = 39.85 CFS (.5494 IPH)
AT T = 12.74 HRS

INPUT SUMMARY
FOR W.S.: SSSF C1

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 31.3800 PCT
	CURVE NUMBER = 74.00
PRECIP.DEPTH = 1.84 IN	CHANNEL LENGTH = 3250 FT
	TIME OF CONC. = .2900 HR
DURATION = 24.00 HR	AREA = 95.70 AC
NUMBER OF LINES = 636	D = .0387 HR

OUTPUT SUMMARY

RUNOFF DEPTH = .2781 IN
INITIAL ABSTRACTION = .7027 IN
PEAK FLOW = 19.00 CFS (.1969 IPH)
AT T = 12.65 HRS

INPUT SUMMARY
FOR W.S.: SSSF C2

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 2.5000 PCT
	CURVE NUMBER = 98.00
PRECIP.DEPTH = 1.84 IN	CHANNEL LENGTH = 320 FT
	TIME OF CONC. = .0638 HR
DURATION = 24.00 HR	AREA = .81 AC
NUMBER OF LINES = 2838	D = .0085 HR

OUTPUT SUMMARY

RUNOFF DEPTH = 1.6093 IN
INITIAL ABSTRACTION = .0408 IN
PEAK FLOW = 1.12 CFS (1.3669 IPH)
AT T = 12.50 HRS

INPUT SUMMARY
FOR W.S.: SSSF C3

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 65.8300 PCT
	CURVE NUMBER = 74.67
PRECIP.DEPTH = 1.84 IN	CHANNEL LENGTH = 1200 FT
	TIME OF CONC. = .0885 HR
DURATION = 24.00 HR	AREA = 11.37 AC
NUMBER OF LINES = 2049	D = .0118 HR

OUTPUT SUMMARY

RUNOFF DEPTH = .2937 IN
INITIAL ABSTRACTION = .6785 IN
PEAK FLOW = 3.53 CFS (.3078 IPH)
AT T = 12.51 HRS

INPUT SUMMARY
FOR W.S.: SSSF C4

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 36.0400 PCT
	CURVE NUMBER = 76.86
PRECIP.DEPTH = 1.84 IN	CHANNEL LENGTH = .2400 FT
	TIME OF CONC. = .1955 HR
DURATION = 24.00 HR	AREA = 32.14 AC
NUMBER OF LINES = 936	D = .0261 HR

OUTPUT SUMMARY

RUNOFF DEPTH = .3597 IN
INITIAL ABSTRACTION = .6021 IN
PEAK FLOW = 10.59 CFS (.3268 IPH)
AT T = 12.56 HRS

INPUT SUMMARY
FOR W.S.: SSSF C5

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 3.1000 PCT
	CURVE NUMBER = 88.00
PRECIP.DEPTH = 1.84 IN	CHANNEL LENGTH = 900 FT
	TIME OF CONC. = .2100 HR
DURATION = 24.00 HR	AREA = 1.15 AC
NUMBER OF LINES = 872	D = .0280 HR

OUTPUT SUMMARY

RUNOFF DEPTH = .8369 IN
INITIAL ABSTRACTION = .2727 IN
PEAK FLOW = .93 CFS (.8001 IPH)
AT T = 12.55 HRS

INPUT SUMMARY
FOR W.S.: SSSF C6

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 30.9500 PCT
	CURVE NUMBER = 79.77
PRECIP.DEPTH = 1.84 IN	CHANNEL LENGTH = 2900 FT
	TIME OF CONC. = .2247 HR
DURATION = 24.00 HR	AREA = 50.91 AC
NUMBER OF LINES = 816	D = .0300 HR

OUTPUT SUMMARY

RUNOFF DEPTH = .4586 IN
INITIAL ABSTRACTION = .5072 IN
PEAK FLOW = 21.39 CFS (.4166 IPH)
AT T = 12.58 HRS

INPUT SUMMARY
FOR W.S.: SSSF C7

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 3.4300 PCT
	CURVE NUMBER = 88.34
PRECIP.DEPTH = 1.84 IN	CHANNEL LENGTH = 1020 FT
	TIME OF CONC. = .2178 HR
DURATION = 24.00 HR	AREA = 2.34 AC
NUMBER OF LINES = 842	D = .0290 HR

OUTPUT SUMMARY

RUNOFF DEPTH = .8571 IN
INITIAL ABSTRACTION = .2640 IN
PEAK FLOW = 1.92 CFS (.8137 IPH)
AT T = 12.55 HRS

INPUT SUMMARY
FOR W.S.: SSSF C8

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 24.5400 PCT
	CURVE NUMBER = 80.97
PRECIP.DEPTH = 1.84 IN	CHANNEL LENGTH = 3770 FT
	TIME OF CONC. = .2998 HR
DURATION = 24.00 HR	AREA = 58.06 AC
NUMBER OF LINES = 616	D = .0400 HR

OUTPUT SUMMARY

RUNOFF DEPTH = .5045 IN
INITIAL ABSTRACTION = .4701 IN
PEAK FLOW = 24.78 CFS (.4232 IPH)
AT T = 12.63 HRS

INPUT SUMMARY
FOR W.S.: SSSF C9

STORM:	WATERSHED:
DISTRIBUTION = SCS TYPE 2	LAND SLOPE = 25.2000 PCT
	CURVE NUMBER = 61.00
PRECIP.DEPTH = 1.84 IN	CHANNEL LENGTH = 2400 FT
	TIME OF CONC. = .3587 HR
DURATION = 24.00 HR	AREA = 27.90 AC
NUMBER OF LINES = 517	D = .0479 HR

OUTPUT SUMMARY

RUNOFF DEPTH = .0453 IN
INITIAL ABSTRACTION = 1.2787 IN
PEAK FLOW = .19 CFS (.0069 IPH)
AT T = 0.00 HRS

INPUT SUMMARY
FOR W.S.: SSSF C10

STORM:		WATERSHED:	
DISTRIBUTION =	SCS TYPE 2	LAND SLOPE =	3.4500 PCT
		CURVE NUMBER =	88.00
PRECIP.DEPTH =	1.84 IN	CHANNEL LENGTH =	1160 FT
		TIME OF CONC. =	.2439 HR
DURATION =	24.00 HR	AREA =	1.77 AC
NUMBER OF LINES =	753	D =	.0325 HR

OUTPUT SUMMARY

RUNOFF DEPTH =	.8379 IN		
INITIAL ABSTRACTION =	.2727 IN		
PEAK FLOW =	1.39 CFS	(	.7804 IPH)
AT T =	12.55 HRS		

SSSF - SLURRY AREA CULVERT SUMMARY

Culvert	Peak Flow (CFS)	Diameter (Ft)	Slope (%)	Depth Water Flow (Ft)	Water Velocity (Ft/Sec)	L / 100 S_o	Control	Head Water (Ft)	Length (Ft)	Needs Erosion Protection
C1	19.00	3.0	1.0	1.50	5.17	30	Inlet	2.1	30	Yes
C2	1.12	1.0(1)	1.0	0.54	2.50	350	Pipe Full	1.5	350	No
C3	3.53	1.5	2.0	0.69	4.41	35	Out-let	1.0	70	No
C4	10.59	2.0	10.0	0.71	10.50	10	Inlet	1.8	100	Yes
C5	0.93	1.0(1)	1.0	0.48	2.40	80	Pipe Full	0.4	80	No
C6a	21.39	2.5	2.3	1.40	7.27	35	Inlet	2.5	80	Yes
C7	1.92	1.0(1)	2.0	0.61	3.80	50	Pipe Full	1.1	100	No
C8	24.78	3.0	2.0	1.50	7.20	25	Inlet	2.5	50	Yes
C9	0.19	1.0(1)	1.5	0.18	1.90	30	Pipe Full	0.0	60	No
C10	1.39	1.0(1)	2.0	0.50	3.50	20	Pipe Full	0.4	40	No
C11	29.73	3.0	5.0	1.30	10.50	24	Inlet	2.8	120	Yes

Notes:

(1) A pipe full nomograph was used to evaluate the culverts because 12" culverts do not appear on culvert capacity charts published by the Portland Cement Association.