June 24, 1986

TO: Technical File

FROM: Rick P. Summers, Hydrology

RE: Genwal Coal Company, Crandall Canyon Mine, Approval for Construction of Sediment Pond, ACT/015/032, Emery County, Utah.

Summary: At the request of L. P. Braxton and Sue Linner, a technical review of the proposed sediment pond at the Crandall Canyon Mine was conducted in order to grant a partial approval for construction of the new surface facilities at the site. Following this review, it has been determined that approval only can be granted to begin construction of the sediment pond.. Construction of the surface facilities area, including diversions, cannot be initiated at this time due to continuing deficiencies in the proposal. Additionally, it is necessary to grant approval for construction of the in mine sumps (necessary to divert runoff from the pond during construction) in order for the construction of the pond to be initiated.

Body: The approach taken for the technical review is as follows:

1. Verify the drainage boundary and areas of watersheds draining to the pond.

2. Verify the curve number proposed with the vegetation information contained in the MRP.

3. Determine the predicted sediment volume for the pond using USLE techniques.

4. Determine the runoff volume to the pond from the 10 yr. - 24 hr. precipitation event.

5. Determine the peak flow events for the area draining to the pond for the 10 and 25 yr. - 24 hr. precipitation events.

6. Develop a stage-volume curve to insure the pond contains an adequate volume for the predicted runoff and sediment storage.

7. Develop a stage -discharge curve to insure the proposed spillway system can adequately discharge the 25 yr. - 24 hr. peak flow.

8. Review the proposal relative to UMC 817.46 and UMC 817.49.

The results of this review are included as an Appendix to this memo. For each stage of the review, DOGM values were compared to the proposed values (see tables in Appendix). Differences in values ranged as large as 13 percent, but each cumulative error for the runoff volume, sediment volume and available pond volume (the items of critical importance) ranged between 3 and 4 percent.

It must be noted that the sediment volume predicted by the applicant was significantly lower than the value developed by myself. Considering the constraints at the site (i.e. limited space for pond enlargement), I felt that using my predicted sediment volume and using a sediment storage volume in the pond equivalent to 3 years of storage rather than the 10 years proposed by the applicant was the best solution to obtain design compliance. This decision will essentially mean that the applicant will have a more frequent sediment removal schedule than anticipated. The pond will be equipped with two (2) sediment level marker stakes to insure sediment removal will take place as often as required.

Another concern with the proposed design is the use of a curve number of 75 for those areas that are to undergo contemporaneous reclamation. This value was determined assuming a soil group C, a range type cover in poor condition, with a cover value of 80 percent. In order to achieve this cover value, intensive reclamation measures will need to be implemented at the site. The applicant has proposed to cover the area with curlex netting. Careful regrading of the area (including rock removal) will need to be done in order for this netting to be effective.

Additionally, the netting will need to be maintained until a vegetation sampling demonstates that a natural cover of 80 percent has been established. This will need to be a continuing issue for the inspector assigned to the site. It is recommended that a representative of the Division is onsite frequently during the construction phases to insure this installation (and subsequent success of the measures to achieve the required curve number) is done correctly.

Recommendations: It is recommended that the applicant be given approval to construct the sediment pond as proposed in the MRP with the following stipulations:

UMC 789.19-RS

The applicant must obtain approval for the proposed pond design from the Utah State Department of Health and the United States Forest Service prior to intitiation of construction of the sediment pond.

UMC 817.41-RS

The applicant must construct the in-mine sumps proposed in the MRP prior to initiation of construction of the sediment pond.

UMC 817.42-(1)-RS

The applicant must install interim sediment control measures for all areas affected by the construction of the sediment pond. These measures are to include, but are not limited to:

1. Installation and maintenance of silt fencing or straw bales (as per the specifications contained in the MRP) around the outside perimeter of the construction area. These measures are to be installed and functioning prior to any initiation of construction.

2. Installation and maintenance of adequate silt fencing or straw bales (as per specifications contained in the MRP) at all temporary material storage areas (i.e. volume of material removed from pond).

UMC 817.42-(2)-RS

All runoff occuring at the site during construction must be pumped from the pond into the in-mine sumps for holding until the pond construction is complete. The water must be discharged according to the NPDES provisions of the applicant's permit.

UMC 817.46-(3)-RS

The applicant must submit adequate plans for the emergency spillway proposed at the site prior to July 20, 1986 and obtain approval from the Division and the USFS prior to construction of the emergency spillway.

UMC 817.52-RS

The applicant must conduct the construction phase monitoring program as proposed in the MRP. Results of the sample analysis must be submitted to the Division within five (5) working days of sample receipt.

jvb
cc: L. P. Braxton
S. C. Linner
B Team
0847R

Project: Runoff Design volume, Genwal

Date: 5/15/86

Reviewer: R. K. Summers, Hydrology

Assumptions.

	DOGM	GENWAL	comments
Ppt. 10yr-24hr.	2.5	2.5	verified w/ miller maps.
CN:			
disturbed	90	90	
undisturbed	69	69	Base upon % cover values in ref area
Reclaimed	75	75	Based on soil c, 80% mulch cover, Rangeland. Applic. commit to achieve w/ rock removal

Areas

	DOGM	Genwal	+ % dist	comments
WS-4	3.479	3.3	-5.15%	plate 7-3, 1" = 200'
WS-5	2.134	2.0	-6.28%	
Disturbed	2.906	2.7	-7.09%	line around road (by subtraction) A: 1-2-3-6a-11-12-7-90
POND	0.151	0.2	+24%	Based on DOGM storage-elev curve (interpolated) - 6,556.37
undisturbed w/in site	0.231	0.2	-13.57%	areas 2, 5, 7
Reclaimed w/in site	1.746	2.0	+12.68	areas 6a), 9, 11, 12
TOTAL up 3-4	5.035	5.1	+1.28	ok √'s w/ 1
TOTAL up 3-4	10.647	10.4	-2.320	
		Sum	Σ < 3%	ok

Runoff Volume

Area	CN	Q "	DOGM Q (A-F)	GENWAL	Presented
WS-4	69	0.421	0.1220	0.1157 1)	0.19
WS-5	69	0.421	0.0748	0.0701	
Disturbed	90	1.531	0.3707	0.3445	0.34
POND	100	2.5	0.0315	0.0417	0.04
undistr. (w/in site)	69	0.421	0.0081	0.0070	*
Reclaimed (w/in site)	75	0.421	0.0947	0.1084	0.11
TOTALS			0.7018	0.6874	0.680

1) recalculated using General inputs
*) included in WS-3, 4 above

conclusion:

% error from present size to DOGM

3.1063% error

General undersized by:

= 0.022 AF
= 947.6 ft³
= 7,107.8 gals.

VOID space in cobble:
assume: 30% voids and surface area only =
6556 ft² x 1.5' deep = 9834 ft³

minimum pore space needed =
948/9834 = 9.6%

9834 (0.30) = 2,950 ft³ storage avail

Project: Design sediment volume, Gemwal

Date: 5/15/86

Reviewer: Rick Summers, Hydrology

	DOGM	Gemwal	% error
Disturbed Area (sediment in cs)	2.906 (0.2906)	2.7 (0.27) AF	-7.1%

Reclaimed Areas:

	DOGM	Gemwal
R	28.12	26
K	.15	.15
LS	23.87	21.66
CP	0.01	.01

note DOGM includes R includes support rate
→ ref = Iverson, 1984 84/0
→ Jim L. gave factor
< Avg. of 3 areas >

(DOGM use:

VM)	0.01	.01
Area	1.746	2.0

Undisturbed Areas:

R	28.12	26.0
K	.27	0.15
LS	67.063	42.92
CP	0.007	0.005
Area (TOTAL)	5.844	5.7

source: Leatherwood based on soil survey.

(comes from 50% cover L. Kunzler 5/22/86).

DO.

Calc. Soil Loss

Reclaimed:

$A = R \cdot K \cdot LS \cdot CP$

$A = (28.12)(.15)(0.01)(23.87)$

$= 1.007$ Ton/ac/yr

Total $V_s = (1.007)(1.746_{ac})$

$= (1.758 \text{ ton/yr})\left(\frac{ft^3}{90 lb}\right)\left(\frac{2000 lb}{ton}\right)\left(\frac{Acre}{43560 ft^2}\right)$

$= 0.001$ AF/yr

$= 39.065 ft^3$

General uses $= 0.001$ AF/yr. or

$= 39.065 ft^3/yr$

Undeveloped Areas:

$A = R \cdot K \cdot LS \cdot CP$

$= (28.12)(.27)(67.063)(0.007)$

$= 3.564$ Ton/ac/yr

Total $V_s = (3.564)(5.844)$

$= (20.81 \text{ ton/yr})\left(\frac{ft^3}{90 lb}\right)\left(\frac{2000 lb}{ton}\right)\left(\frac{Acre}{43560 ft^2}\right)$

$= 0.011$ AF/yr.

$= 462.43 ft^3/yr.$

General uses $= 0.003$ AF/yr.

$= 130.68 ft^3/yr.$

General 5/15/86

Reclaimed Areas

R factor: from Figure I Zone III, period of sheet erosion is April thru Oct =

April 1 % Annual = 12%
Nov. 1 % Annual = 92%

∴ Period of erosion = 92 - 12 = 80%

From figure Map R-7 price (Israelson)

R = 19 annual

(.8) 19 = 15.20

assume 5 yr. period to reveg. site.
70% prob. in 5 yr. = 15 Tr (Failure not drastic, more freq. clearout)
From Figure 9 p. 22 (Israelson '84)

EI/R ratio = 1.85

R = 28.12

LS value

slope length: assume average of slope.
(took 10 points of plate "Runoff controls" and avg.

$$\bar{L} = \bar{X} = \frac{155 + 26 + 104 + 140 + 21 + 24 + 73 + 128 + 114 + 27}{10}$$

= 81.2' General = 70'

assume an avg. 1½:1 slope over site.

S = 66.7

so, LS = 23.87 Table C-1.

VM From Figure 2-5 (Israelson 78), Straw Mulch Anchored, 1.5 ton/ac' mulch

Undisturbed USLE values

R = see Reclaimed areas

K = 0.27

J. Leatherwood: 5/19/86

52% sand
35% silt
10.7% clay
2.3% OM

LS value:

From WS slope calculations:

WS-4:
S = 71.80%

WS-5:
S = 65.20%

Undisturb in site (Avg 3 values)

S = 70.87%

Length: (Plate 7-3)

WS-4: 690'

WS-5: 540'

Undisturbed w/in site (Avg. 5 values)
L = 27'

SO, Table 2 (UWRL/H-84/03)

WS-4:
LS = 75.12

WS-5
LS = 59.66

DISTURB w/in site:

LS = 14.10 (Table 2)

use wt'd avg.

$$\frac{(3.479)(75.12) + (2.134)(59.66) + (.231)(14.10)}{5.844} = 67.06$$

LS = 67.06

LS Factor undisturbed:

1) WS-2 slope:

$$\frac{(L_e)(C_I)}{Area} = \frac{(1,007.46')(40')}{46,181.96} = 87.26\%$$

2) WS-4 slope

$$\frac{L_e \cdot C_I}{A} = \frac{(1360.19)(80')}{151,546.60} = 71.80$$

3) WS-5

$$\frac{(1515.17)(40)}{92,956.96} = 65.20\%$$

42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE
NATIONAL

Total Pond Volume Required:

		DOGM (AF)	General (AF)
I.	Runoff 10y-24hr	0.7018	0.6874
	Disturbed sed. volume	0.2906	0.27
	Reclaimed sed. vol.	0.003 (3yr)	0.01 (10 yr.) design)
	Undisturbed sed. vol.	0.033 (3yr)	0.030 (10 yr design)
		1.028 AF	0.997 AF

II. Difference (using General inputs & my calcs.) 1.028 - 0.997 = 0.031 AF = 1,350.36 ft³

Proposed size (rounding errors) = 0.99 AF

III. % change
Actual values:

$$\frac{1.028 - 0.997}{0.997} = +3.1\%$$

Proposed values: $\frac{1.028 - 0.99}{0.99} = +3.84\%$

ACCEPT DESIGN VOLUME.

Project: Stage Discharge Curve, Genwal

Date: 5-21-84

Reviewer: Rick Summers, Hydrology

Assumptions:

Input	DOGM	Genwal
Ht of Riser	17.9' (plate 7-4)	16' — error w/ plate 7-4
DIA. Riser	24"	24"
Co inlet	0.6	0.6
Total Head (top riser to outlet)	28.4'	?
Length Barrel	89'	92'
TOTAL LENGTH	106.9	
Diameter Barrel	18"	18"
mannings n (CMP)	0.024	0.024
K_b	0.5	0.5
K_c	1.0	1.0
K_f	6.62	?

$K_f = 184.6 n^2 L / D^{4/3}$

$= 6.62$

Stage - Q Data:
(From HP)

Elev.	Head (above 1° spillway)	Weir Q (cfs)	Orifice Q (cfs)	Pipe Q (cfs)
7782.6	0	0	0	0
7782.8	.2	1.840	6.765	24.715
7783.0	.4	5.212	9.567	24.804
7783.2	.6	9.588	11.717	24.893
7783.4	.8	14.782	13.530	24.981
7783.6	1.0	20.686	15.127	25.067
7783.8	1.2	27.230	16.570	25.157
7784.0	1.4	34.360	17.898	25.245
Emergency Kicks in @ 7784.0	2.7	—	24.856	25.806
	3.0	—	26.20	25.934
	4.0	—	30.25	26.356

> Determine Head required for pipe flow to kick in. >

@ 3' head.

1° Spillway = 7782.6
Emerg. Crest = 7784.0

Project: Genwal Sediment Pond - Inflow Peak

Date: 6-23-86

Reviewer: R. Summers, Hydrology

Assumptions:

1) Peaks reporting to culverts C-3, C-4 will occur simultaneously (worst case). see plate 7-5.

2) Inputs

C-3:

	DOGM	Genwal	comments
Ppt. 10yr	2.5	2.5	
Ppt_{25yr}	2.92	2.92	
Area	10.647	10.4	see 5-15-86 memo
Hyd. length	9.5" = 1900'		Plate 7-4, up WS-4
Δ elev.	8765 - 7800' = 965'		
CN	76.135 say 77.0		wt'd value from 5-15-86 memo 5.81 ac = 69, .151 = 100, 1.746 = 75, 2.906 = 90
T_c	0.057 hrs.		Kirpitchie formula.

Alt. approach - subtract out what won't go to pond
From 5-15-86 Tech review

Total to pond =	10.65 ac	(DOGM)
	10.40 ac	(Genwal)
minus: Area 12	- 0.410 ac	
POND AREA	0.951 ac	

6-23-86

Results

	DOGM	GSNWAL
Q_{10-24}	8.80 cfs	~ 4.6 cfs (see C-3 design)
Q_{25-24}	11.91 cfs	~ 8.44 cfs (see spillway sediment calcs)
T_c	0.057 hrs.	
$Q_{in.0}$	.7042"	
Q_{in-25}	1.0082"	

Conclusions

1) DOGM value is larger due to conservative approach. 2 ws, 1 peak was calculated rather than routing 3 subwatersheds

2) Stage-Discharge Curve (see Memo of 5-21-86) shows capacity of 16-17 cfs before emergency spillway functions.

3) Therefore, accept design.

16-17 cfs > 11.91 cfs

Project: Stage-Volume Curve, Grenwal Sed. Pond

Date: 5/13/88

Reviewer: Rick Summers, Hydrology

Values:

1° spillway = 7782.6'

Emerg. Crest = 7784.

Elev (Ft)	Area Ft² DOGM	Area Ft² Grenwal	Volume Ft³ DOGM	Volume Ft³ Grenwal	Cumulative Volume DOGM	Cumulative Volume Grenwal
7771	955.09	914.76				
			2,619.60	2,657.16	2,619.60 (0.60 AF)	2,657.16 (0.61 AF)
7773	1665.51	1742.40				
			4,064.10	4,312.44	6683.70 (0.153)	6969.60 (0.160)
7775	2395.59	2,570.04				
			5,714.57	6,141.96	12,398.27 (0.285)	13,111.56 (0.301)
7777	3,315.98	3,571.92				
			7761.43	8,276.4	20,159.70 (0.463)	21,387.96 (0.491)
7779	4445.45	4,704.48				
			10,006.10	10,802.88	30,165.80 (0.693)	32,190.84 (0.739)
7781	5560.65	6,098.4				
			12,365.75	13,634.28	42,531.75 (0.976)	45,825.12 (1.052)
7783	6805.30	7,535.88				
			15,017.12	16,552.80	57,548.87 (1.321)	62,377.9 (1.432)
7785	8,211.82	9,016.92				

TOTAL VOLUME 57,548.87 | 62,379.92

1.321 AF | 1.432

% error: +7.751 %

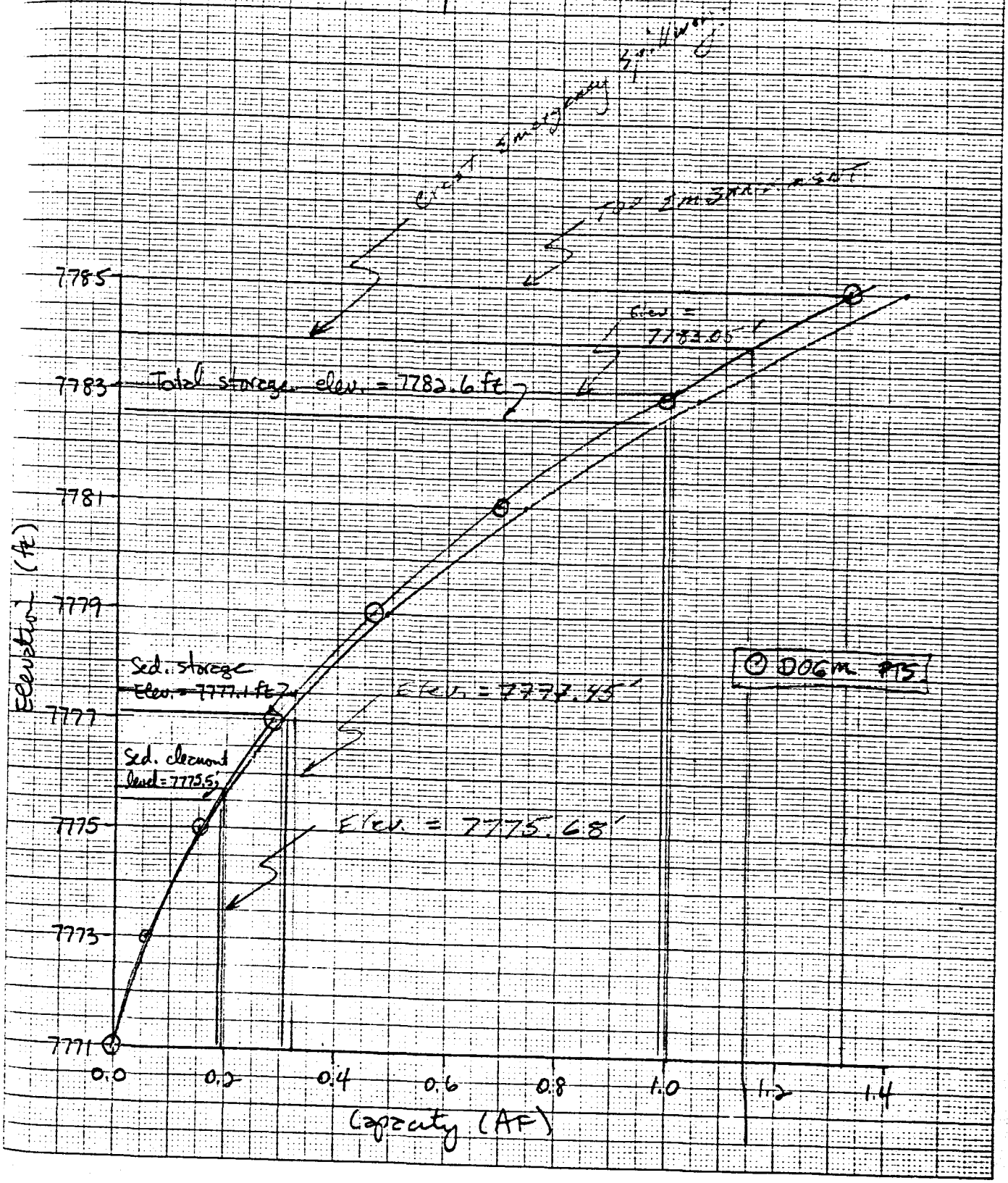
TOTAL VOLUME Available

Vol. (Ft³) DOGM	Vol. (Ft³) Grenwal	Elev. (Ft.) DOGM	Elev. (Ft.) Grenwal	comment
8,537.76 (0.196 AF)	8,102.2 (0.186)		7775.5'	sed. clean out
14,244.12 (0.327)	13,503.6 (0.310)		7771.1'	sed storage
44,779.7 (1.028)	43,127.4 (0.99)		7782.6'	1° decant
		7784.0	7784.0	Emerg. Spillway

K. White

1 May 1986

6-27-02

4/

Stage-capacity curve for proposed Genwal sedimentation pond