

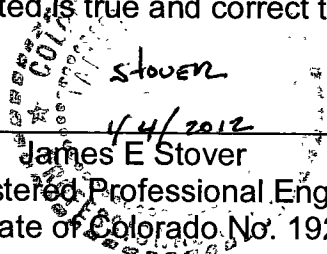
Exhibit 19(19)
Two New Culverts - TR-62
Culverts C75 & C76
Located in East Branch of RDA Upper Diversion Ditch

Notes for Calculations:

1. Culverts C75 and C76 are located in the east branch of the RDA upper diversion ditch.
2. The culverts must be designed to handle the 4.2" 100-year 24-hour event.
3. The drainage area above the culverts totals 25.9 acres of undisturbed oak shrub and 0.75 acres of disturbed area.
4. The undisturbed area has a Midnight soil classification, hydrologic soil group C.
5. Table 1 in Exhibit 15, Cover and production of RDA 9/84 lists 14.79% plant cover for oak-shrub and 27.55% for Conifer Shrub.
6. A curve number of 74 was used for the undisturbed oak shrub based on a C soil type and poor cover (Table 2.2d - Runoff curve numbers for arid and semiarid rangelands, Oak-aspen).
7. A curve number of 94 was used for the disturbed area.
8. The following SEDCAD calculations show that culverts C75 and C76 will see a peak flow of 51.82 cfs and will need to be 42 inches in diameter. (Pages 2 - 8)

ENGINEER'S CERTIFICATION

The calculations and information presented on pages EXH. 19(19)-2 through 19(19)-8 with a date of 01/04/12 were prepared by me during the month of January 2012, and the information presented is true and correct to the best of my knowledge and belief.



James E Stover
Registered Professional Engineer
State of Colorado No. 19230

Date

RDA Culverts 75 and 76

Jim Stover

J. E. Stover & Associates, Inc.
2352 N 7th St Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: jestover@bresnan.net

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	4.200 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	

#1 Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	26.650	26.650	51.82	3.98

Y.20

agreed w/ culvert 157

Structure Detail:

Structure #1 (Culvert)

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (K _e)
60.00	1.00	0.0240	4.00	0.00	0.90

Culvert Results:

Design Discharge = 51.82 cfs

Minimum pipe diameter: 1 - 42 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	25.900	0.100	0.000	0.000	74.000	TR55	49.51	3.761
	2	0.750	0.100	0.000	0.000	94.000	TR55	2.32	0.219
Σ		26.650						51.82	3.981



Exhibit 19(22)

WEST DWDA (DWDA #3)

A new development waste disposal area (DWDA) will be created directly west of the west ventilation fan, and south of the old west portal warehouse. The west DWDA will be a maximum of 90 feet high, with a capacity of approximately 155,000 CY.

Runoff from the DWDA will be routed to expanded Containment area No.2. Expanded containment area No. 2 has been redesigned to contain the 25-year storm event.

A new soil stockpile area has been designed north of the DWDA in order to stockpile material for reclamation of the west DWDA. The new stockpile will be approximately 50 feet high with a capacity of approximately 30,000 CY. Runoff from the new stockpile will be routed to containment area no. 2.

A topsoil stockpile has been situated east of the ventilation fan haul road. A berm will be placed at the toe of the stockpile.

Notes - West DWDA:

1. Runoff from approximately 13.14 acres will be routed to containment area no. 2.
2. The 25 year event is 3.4 inches and has been used to size containment area no. 2. Containment no. 2 has been designed to contain the 25-year event, per Rule 4.05.9(2)(e). Water collected in the pond will be hauled back to Pond 7 for discharge.
3. The 100-year event is 4.2 inches and has been used to design the majority of the ditches near the DWDA. Ditches 27 and 46 (5%) have been designed for the 10-year event (3.0 inches).
4. Undisturbed upland drainage west of the pile is diverted around the pile in ditch D49. Peak flows for D49 were calculated using the 100-year event and portions of the ditch were sized using Manning's Equation in Excel because SedCad cannot handle such a large peak flow. Two sections of D49, the 30% and 64% sections will be 12" grouted riprap.
5. Upland drainage east of the pile is routed to containment area no. 2.
6. Pond (Containment area no. 2) sizing calculations are attached.
7. Pond plan view and sections are attached.

Notes - Soil Stockpile area:

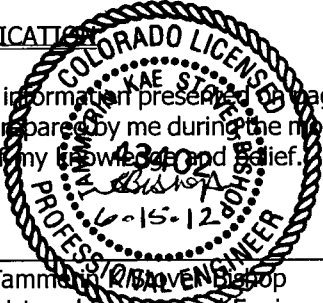
8. Runoff from approximately 1.3 acres associated with the new soil stockpile and will be routed to containment area no. 2.
9. Ditches have been designed using the 10-year event.

Two temporary culverts have been designed to go in D41 for construction access to DWDA #3. Sizing was based on the 10-year event for D41.

Curve numbers are summarized on page EXH 19(22)-2.

ENGINEER'S CERTIFICATION

The calculations and information presented on pages EXH. 19(22)-1 through 19(22)-58 with a dates of 04/17/12 and 06/15/12 were prepared by me during the months of April and June, and the information presented is true and correct to the best of my knowledge and belief.


Tammara R. Raven Bishop
Registered Professional Engineer
State of Colorado No. 43402

Date

EXHIBIT 19 (22)
NEW ELK MINE
PROTECTION OF THE HYDROLOGIC BALANCE
WEST DWDA

STORM EVENTS

10 YEAR 24 HOUR EVENT	3.0 INCHES
25 YEAR 24 HOUR EVENT	3.4 INCHES
100 YEAR 24 HOUR EVENT	4.2 INCHES

The information presented for peak flow calculations is developed with the use of SEDCAD. The output from SEDCAD follows.

Disturbed

Table 2-2d -Runoff curve numbers for arid and semiarid rangelands.
Cover Type - Desert Shrub - Herbaceous mix of grass and weeds

Hydrologic Condition	Poor
Soil Type - Sandy Loam	C
Curve Number	87

Disturbed

Table 2-2d -Runoff curve numbers for arid and semiarid rangelands.
Cover Type - Desert Shrub - Herbaceous mix of grass and weeds

Hydrologic Condition	Fair
Soil Type - Sandy Loam	C
Curve Number	81

Ponderosa Pine-Douglas Fir-Oak (PDO)

Table 2-2c-Runoff curve numbers for other agricultural lands
Cover Type - Pinon Juniper

Hydrologic Condition	Good
Soil Type - Dargol Fuera Vamer	D
Curve Number	71

Coal Mine Waste (DWDA)

Table 2-2c-Runoff curve numbers for other agricultural lands
Cover Type - Desert Shrub - Herbaceous mix of grass and weeds

Hydrologic Condition	Poor
Soil Type - Disturbed Area	C
Curve Number	90

RUN-OFF VOLUME - - Containment Area No. 2

Area	Acres	Curve #	25-Year	Direct	Run-off
			Precip Amount	Run-off	Vol A-F
Coal Mine Waste	4.29	90	3.4	2.355	0.842
PDO	4.15	71	3.4	1.00	0.346
Disturbed (Poor Cover)	3.33	87	3.4	2.093	0.581
Disturbed (Fair Cover)	1.37	81	3.4	1.628	0.186
 TOTAL	 13.14				 1.954 *

**SedCad calculates 1.84 A-F and
will be used as required water volume*

SEDIMENT VOLUME - Containment Area No. 2

Use the universal soil loss equation.

$$A = R K L S C P$$

R = rainfall factor	70.00
K = soil erodibility factor - sandy loam	0.27
LS = combined length slope factor	0.31
Use Ditch 42 - 400' & 2%	
C = cropping management factor - Figure 7	1.00
P = erosion control practice factor	1.00
 A = sediment, tons/acre/year	 5.86

THREE YEAR SEDIMENT VOLUME - CUBIC FEET
13.14 ACRES - 115 #/CF

TOTAL REQUIRED CAPACITY -- (Acre Feet) 1.93

STRUCTURE DETAIL FOR CONTAINMENT AREA NO. 2:

ELEVATION-CAPACITY-TABLE

Sediment Pond designed to Contain 25-year event

Calculations for volume based on average end area method

Elev	End Area	ΔH	Vol.	Vol.	Cumm. Vol.	
7580	3864					
7581.0	4662.0	1	4263.0	0.098	0.098	Sediment Level
7582	5661	1	5161.5	0.118	0.216	
7584	7659	2	13320.0	0.306	0.522	
7586	9851.0	2	17510.0	0.402	0.924	
7588	12257.0	2	22108.0	0.508	1.432	
7590	14875.0	2	27132.0	0.623	2.055	Full Water Elevation
7592						Top of Pond

**Text in blue denotes designed volumes that are directly out of AutoCad*

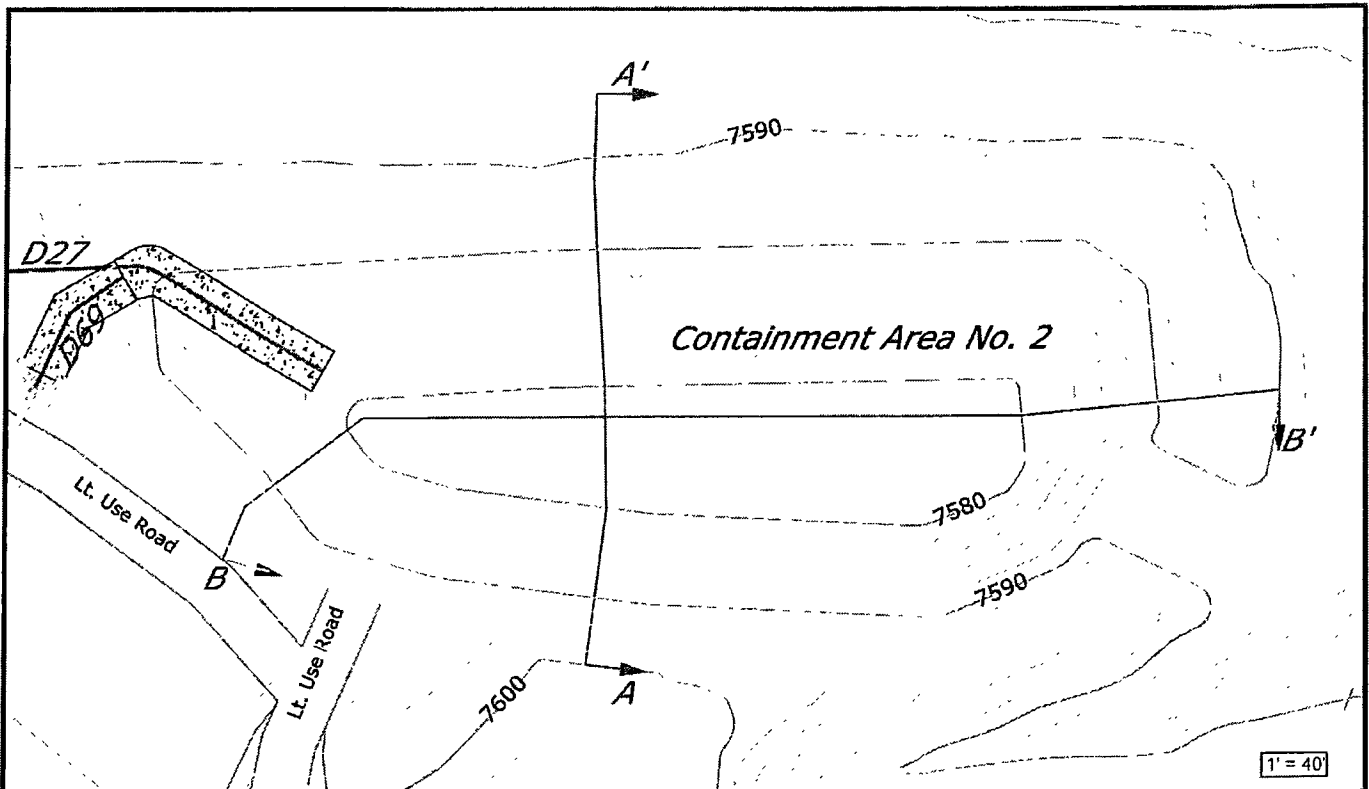
***Text in red denotes Interpolated volumes*

SEDIMENT POND DESIGN STORAGE SUMMARY		
0.1	Ac-Ft	Maximum Sediment Storage***
2.0	Ac-Ft	Available Water Storage
2.1	Ac-Ft	Available Pond Storage

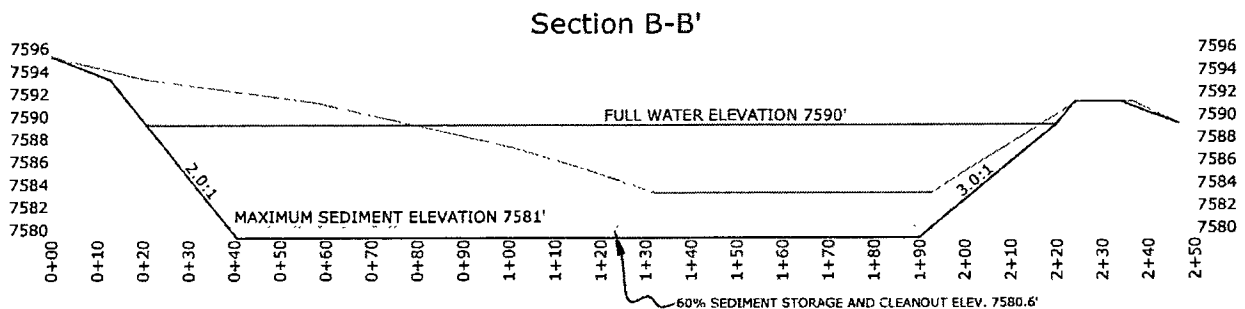
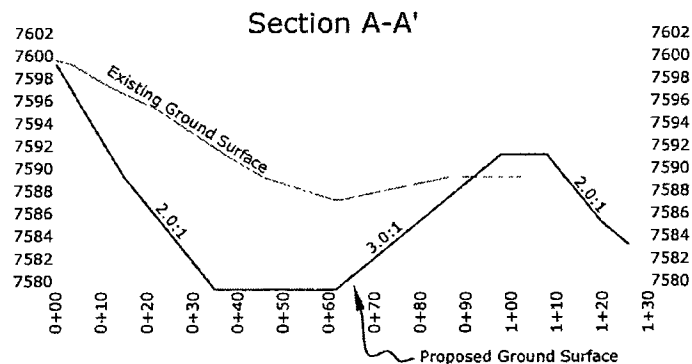
*** Sediment to be cleaned out once it reaches 60% of the maximum storage elevation of 7580.6 ft.

Required storage volumes based on the 25-year event, see preceding pages

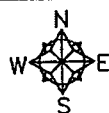
SEDIMENT POND REQUIRED STORAGE SUMMARY		
0.1	Ac-Ft	Required Sediment Storage
1.8	Ac-Ft	Required Water Storage
1.9	Ac-Ft	Required Pond Storage



Containment No. 2 Capacity		
	(Acre-Feet)	
	Water	Sediment
Design	2.0	0.10
Required	1.8	0.10



1" = 40' (Horizontal)



ONE INCH

CONTAINMENT AREA NO. 2 PLAN AND PROFILE

New Elk Mine

West DWDA

Containment Area No. 2

Pond Sizing

Tamme Bishop

J.E. Stover & Associates, Inc.
2352 N. 7th Street, Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: tamme.jestover@bresnan.net

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	3.400 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#24*	0.360	0.360	0.75	0.05
#25*	0.210	0.570	1.20	0.08
#27*	0.200	0.770	1.61	0.11
#22*	0.470	0.470	0.99	0.08
#20	0.450	0.450	1.02	0.09
#13	0.400	0.400	0.89	0.07
#14	0.450	0.850	1.89	0.15
#15	0.250	1.550	3.43	0.28
#16	0.270	1.820	4.02	0.32
#17	0.650	2.470	5.47	0.43
#19	1.000	1.000	2.26	0.20
#8	4.010	4.010	4.92	0.36
#9	0.520	4.530	5.46	0.40
#10	0.440	5.970	8.70	0.67
#11	1.340	7.310	11.69	0.93
#12	0.030	9.810	17.23	1.36
#18	0.010	9.820	17.25	1.36
#23*	0.390	10.680	19.05	1.50
#26*	0.270	10.950	19.62	1.54
#28*	0.050	11.770	21.34	1.66
#21*	1.090	1.090	1.89	0.15
#1	0.280	13.140	23.82	1.84

**Denotes structures with incomplete design parameters. Results for these structures have not been evaluated, and may affect downstream structures.*

New Elk Mine

West DWDA

Ditch Sizing

100-year, 24-hour Event

J.E. Stover & Associates, Inc.
2352 N. 7th Street, Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: tamme.jestover@bresnan.net

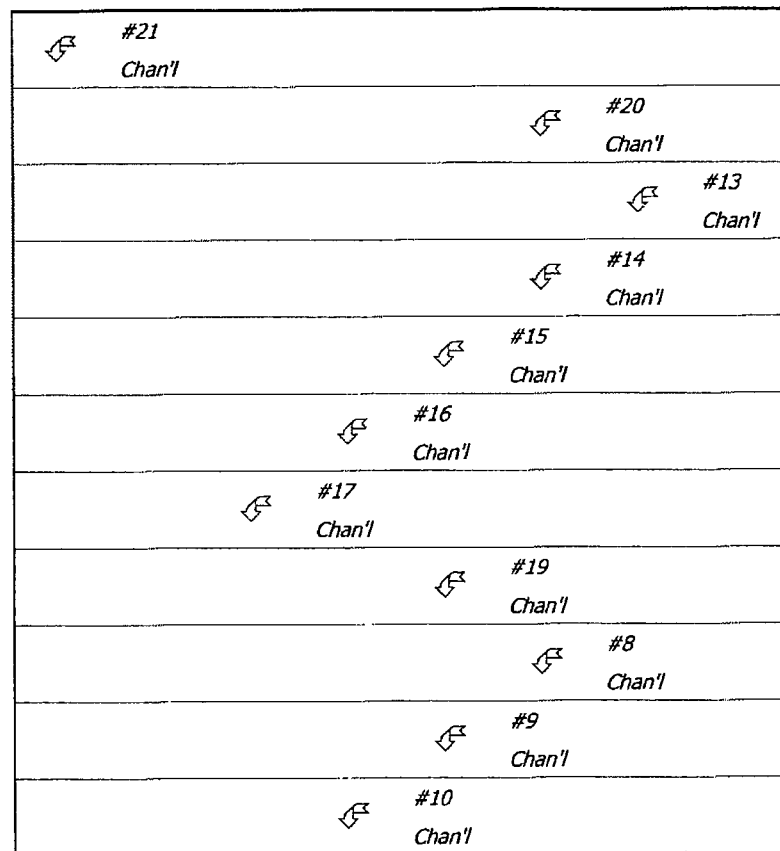
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	4.200 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Catchment No.2
Channel	#8	==>	#9	0.000	0.000	Ditch D30-E
Channel	#9	==>	#10	0.000	0.000	Ditch D40
Channel	#10	==>	#11	0.000	0.000	Ditch D41
Channel	#11	==>	#12	0.000	0.000	Ditch D42
Channel	#12	==>	#18	0.000	0.000	Ditch D46 (32%)
Channel	#13	==>	#14	0.000	0.000	Ditch D30-W
Channel	#14	==>	#15	0.000	0.000	Ditch D43
Channel	#15	==>	#16	0.000	0.000	Ditch D44 (22%)
Channel	#16	==>	#17	0.000	0.000	Ditch D44 (4%)
Channel	#17	==>	#12	0.000	0.000	Ditch D45
Channel	#18	==>	#1	0.000	0.000	Ditch D46 (3.0%)
Channel	#19	==>	#10	0.000	0.000	Ditch D47
Channel	#20	==>	#15	0.000	0.000	Ditch D48
Channel	#21	==>	#1	0.000	0.000	Ditch D27



	#11 Chan'l
	#12 Chan'l
	#18 Chan'l
#1 Null	

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#21*	1.230	1.230	2.92	0.23
#20	0.450	0.450	1.31	0.12
#13	0.400	0.400	1.15	0.09
#14	0.450	0.850	2.44	0.20
#15	0.250	1.550	4.43	0.37
#16	0.270	1.820	5.20	0.43
#17	0.650	2.470	7.06	0.59
#19	1.000	1.000	2.91	0.26
#8	4.010	4.010	7.22	0.54
#9	0.520	4.530	8.04	0.61
#10	0.440	5.970	12.21	0.97
#11	1.340	7.310	16.07	1.31
#12	0.030	9.810	23.21	1.90
#18	1.370	11.180	26.97	2.22
#1	0.700	13.110	31.81	2.62

Structure Detail:

Structure #13 (Riprap Channel)

Ditch D30-W

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	3.0:1	1.5:1	2.7	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.15 cfs	
Depth:	0.17 ft	0.47 ft
Top Width:	3.74 ft	5.09 ft
Velocity:	2.06 fps	
X-Section Area:	0.56 sq ft	
Hydraulic Radius:	0.146 ft	
Froude Number:	0.94	
Manning's n:	0.0330	
Dmin:	0.50 in	
D50:	0.75 in	No Riprap required
Dmax:	1.50 in	

Structure Detail:

Structure #8 (Riprap Channel)

Ditch D30-E

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	1.5:1	3.0:1	1.7	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.22 cfs	
Depth:	0.54 ft	0.84 ft
Top Width:	5.41 ft	6.76 ft
Velocity:	3.20 fps	
X-Section Area:	2.26 sq ft	
Hydraulic Radius:	0.400 ft	
Froude Number:	0.87	
Manning's n:	0.0330	
Dmin:	1.00 in	
D50:	1.50 in	No Riprap required
Dmax:	3.00 in	

Structure Detail:

Structure #9 (Riprap Channel)

Ditch D40

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	1.5:1	1.5:1	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	8.04 cfs	
Depth:	0.15 ft	1.15 ft
Top Width:	3.44 ft	6.44 ft
Velocity*:		
X-Section Area:	0.47 sq ft	
Hydraulic Radius:	0.134 ft	
Froude Number*:		
Manning's n*:		
Dmin:	5.00 in	
D50:	15.00 in	
Dmax:	18.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure Detail:

Structure #10 (Riprap Channel)

Ditch D41

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	1.5:1	1.5:1	12.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	12.21 cfs	
Depth:	0.25 ft	1.25 ft
Top Width:	3.75 ft	6.75 ft
Velocity*:		
X-Section Area:	0.84 sq ft	
Hydraulic Radius:	0.215 ft	
Froude Number*:		
Manning's n*:		
Dmin:	5.00 in	
D50:	15.00 in	
Dmax:	18.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure Detail:

Structure #11 (Riprap Channel)

Ditch D42

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	2.0:1	2.0:1	2.0	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	16.07 cfs	
Depth:	0.79 ft	1.09 ft
Top Width:	6.16 ft	7.36 ft
Velocity:	4.44 fps	
X-Section Area:	3.62 sq ft	
Hydraulic Radius:	0.554 ft	
Froude Number:	1.02	
Manning's n:	0.0320	
Dmin:	1.00 in	
D50:	1.50 in	No Riprap required
Dmax:	3.00 in	

Structure Detail:

Structure #14 (Riprap Channel)

Ditch D43

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	1.5:1	1.5:1	6.2	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.44 cfs	
Depth:	0.23 ft	0.53 ft
Top Width:	3.70 ft	4.60 ft
Velocity:	3.13 fps	
X-Section Area:	0.78 sq ft	
Hydraulic Radius:	0.203 ft	
Froude Number:	1.20	
Manning's n:	0.0410	
Dmin:	1.00 in	
D50:	1.50 in	No Riprap required
Dmax:	3.00 in	

Structure Detail:

Structure #15 (Riprap Channel)

Ditch D44 (22%)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	1.5:1	1.5:1	22.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.43 cfs	
Depth:	0.08 ft	1.08 ft
Top Width:	3.25 ft	6.25 ft
Velocity*:		
X-Section Area:	0.26 sq ft	
Hydraulic Radius:	0.078 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure Detail:

Structure #16 (Riprap Channel)

Ditch D44 (4%)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	1.5:1	1.5:1	4.0	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.20 cfs	
Depth:	0.38 ft	0.68 ft
Top Width:	4.15 ft	5.05 ft
Velocity:	3.81 fps	
X-Section Area:	1.36 sq ft	
Hydraulic Radius:	0.312 ft	
Froude Number:	1.17	
Manning's n:	0.0360	
Dmin:	1.00 in	
D50:	1.50 in	No Riprap required
Dmax:	3.00 in	

Structure Detail:

Structure #17 (Riprap Channel)

Ditch D45

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	3.0:1	2.0:1	3.2	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.06 cfs	
Depth:	0.46 ft	0.76 ft
Top Width:	5.28 ft	6.78 ft
Velocity:	3.75 fps	
X-Section Area:	1.88 sq ft	
Hydraulic Radius:	0.345 ft	
Froude Number:	1.11	
Manning's n:	0.0350	
Dmin:	1.00 in	
D50:	1.50 in	No Riprap required
Dmax:	3.00 in	

Structure Detail:

Structure #12 (Riprap Channel)

Ditch D46 (32%)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	2.0:1	2.0:1	32.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	23.21 cfs	
Depth:	0.18 ft	1.18 ft
Top Width:	3.70 ft	7.70 ft
Velocity*:		
X-Section Area:	0.59 sq ft	
Hydraulic Radius:	0.155 ft	
Froude Number*:		
Manning's n*:		
Dmin:	8.00 in	
D50:	24.00 in	
Dmax:	30.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure Detail:

Structure #19 (Erodible Channel)

Ditch D47

Triangular Erodible Channel Inputs:

Material: Shales and hardpans

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
20.0:1	3.0:1	2.0	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.91 cfs	
Depth:	0.32 ft	0.62 ft
Top Width:	7.35 ft	14.25 ft
Velocity:	2.48 fps	
X-Section Area:	1.17 sq ft	
Hydraulic Radius:	0.159 ft	
Froude Number:	1.09	

Structure Detail:

Structure #20 (Erodible Channel)

Ditch D48

Triangular Erodible Channel Inputs:

Material: Shales and hardpans

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
20.0:1	3.0:1	2.0	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.31 cfs	
Depth:	0.24 ft	0.54 ft
Top Width:	5.45 ft	12.35 ft
Velocity:	2.03 fps	
X-Section Area:	0.64 sq ft	
Hydraulic Radius:	0.118 ft	
Froude Number:	1.04	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#21	1	1.230	0.101	0.000	0.000	81.000	TR55	2.92	0.234
Σ		1.230						2.92	0.234
#20	1	0.450	0.005	0.000	0.000	90.000	TR55	1.31	0.115
Σ		0.450						1.31	0.115
#13	1	0.290	0.004	0.000	0.000	90.000	TR55	0.84	0.074
	2	0.110	0.037	0.000	0.000	87.000	TR55	0.30	0.021
Σ		0.400						1.15	0.094
#14	1	0.330	0.005	0.000	0.000	90.000	TR55	0.96	0.084
	2	0.120	0.027	0.000	0.000	87.000	TR55	0.33	0.023
Σ		0.850						2.44	0.202
#15	1	0.250	0.011	0.000	0.000	87.000	TR55	0.69	0.058
Σ		1.550						4.43	0.375
#16	1	0.150	0.005	0.000	0.000	90.000	TR55	0.44	0.033
	2	0.120	0.013	0.000	0.000	87.000	TR55	0.33	0.023
Σ		1.820						5.20	0.432
#17	1	0.500	0.005	0.000	0.000	90.000	TR55	1.45	0.128
	2	0.150	0.048	0.000	0.000	87.000	TR55	0.41	0.030
Σ		2.470						7.06	0.590
#19	1	1.000	0.010	0.000	0.000	90.000	TR55	2.91	0.258
Σ		1.000						2.91	0.258
#8	1	0.180	0.006	0.000	0.000	90.000	TR55	0.52	0.042
	2	1.400	0.116	0.000	0.000	71.000	TR55	2.40	0.179
	3	2.300	0.099	0.000	0.000	71.000	TR55	3.94	0.293
	4	0.130	0.100	0.000	0.000	87.000	TR55	0.36	0.026
Σ		4.010						7.22	0.540
#9	1	0.450	0.152	0.000	0.000	71.000	TR55	0.68	0.058
	2	0.070	0.001	0.000	0.000	87.000	TR55	0.19	0.011
Σ		4.530						8.04	0.609
#10	1	0.290	0.022	0.000	0.000	90.000	TR55	0.84	0.074
	2	0.150	0.022	0.000	0.000	87.000	TR55	0.41	0.030
Σ		5.970						12.21	0.971
#11	1	1.100	0.005	0.000	0.000	90.000	TR55	3.20	0.284
	2	0.240	0.084	0.000	0.000	87.000	TR55	0.66	0.055

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
Σ		7.310						16.07	1.311
#12	1	0.030	0.002	0.000	0.000	87.000	TR55	0.08	0.004
Σ		9.810						23.21	1.905
#18	1	0.270	0.119	0.000	0.000	87.000	TR55	0.74	0.062
	2	1.100	0.001	0.000	0.000	87.000	TR55	3.02	0.258
Σ		11.180						26.97	2.225
#1	1	0.440	0.001	0.000	0.000	87.000	TR55	1.21	0.102
	2	0.260	0.008	0.000	0.000	87.000	TR55	0.71	0.060
Σ		13.110						31.81	2.622

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	46.15	12.00	26.00	6.790	0.001
#1	1	Time of Concentration:					0.001
#1	2	5. Nearly bare and untilled, and alluvial valley fans	14.63	18.00	123.00	3.820	0.008
#1	2	Time of Concentration:					0.008
#8	1	5. Nearly bare and untilled, and alluvial valley fans	25.00	28.00	112.00	5.000	0.006
#8	1	Time of Concentration:					0.006
#8	2	1. Forest with heavy ground litter	45.83	330.00	720.00	1.710	0.116
#8	2	Time of Concentration:					0.116
#8	3	1. Forest with heavy ground litter	43.55	260.00	597.00	1.660	0.099
#8	3	Time of Concentration:					0.099
#9	1	1. Forest with heavy ground litter	10.94	50.00	457.00	0.830	0.152
#9	1	Time of Concentration:					0.152
#9	2	5. Nearly bare and untilled, and alluvial valley fans	64.52	20.00	31.00	8.030	0.001
#9	2	Time of Concentration:					0.001
#10	1	5. Nearly bare and untilled, and alluvial valley fans	11.15	30.00	269.00	3.330	0.022
#10	1	Time of Concentration:					0.022
#10	2	5. Nearly bare and untilled, and alluvial valley fans	11.15	30.00	269.00	3.330	0.022
#10	2	Time of Concentration:					0.022
#11	1	5. Nearly bare and untilled, and alluvial valley fans	32.20	38.00	118.00	5.670	0.005
#11	1	Time of Concentration:					0.005
#11	2	5. Nearly bare and untilled, and alluvial valley fans	1.91	8.00	418.00	1.380	0.084

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#11	2	Time of Concentration:					0.084
#12	1	5. Nearly bare and untilled, and alluvial valley fans	31.82	14.00	44.00	5.640	0.002
#12	1	Time of Concentration:					0.002
#13	1	4. Cultivated, straight row	27.50	22.00	80.00	4.680	0.004
#13	1	Time of Concentration:					0.004
#13	2	5. Nearly bare and untilled, and alluvial valley fans	2.69	6.00	223.00	1.640	0.037
#13	2	Time of Concentration:					0.037
#14	1	5. Nearly bare and untilled, and alluvial valley fans	28.00	28.00	100.00	5.290	0.005
#14	1	Time of Concentration:					0.005
#14	2	5. Nearly bare and untilled, and alluvial valley fans	7.00	18.00	257.00	2.640	0.027
#14	2	Time of Concentration:					0.027
#15	1	5. Nearly bare and untilled, and alluvial valley fans	14.10	22.00	156.00	3.750	0.011
#15	1	Time of Concentration:					0.011
#16	1	5. Nearly bare and untilled, and alluvial valley fans	30.00	30.00	100.00	5.470	0.005
#16	1	Time of Concentration:					0.005
#16	2	5. Nearly bare and untilled, and alluvial valley fans	4.17	4.00	96.00	2.040	0.013
#16	2	Time of Concentration:					0.013
#17	1	5. Nearly bare and untilled, and alluvial valley fans	31.78	34.00	107.00	5.630	0.005
#17	1	Time of Concentration:					0.005
#17	2	5. Nearly bare and untilled, and alluvial valley fans	3.22	10.00	311.00	1.790	0.048
#17	2	Time of Concentration:					0.048
#18	1	5. Nearly bare and untilled, and alluvial valley fans	0.96	4.00	417.00	0.970	0.119
#18	1	Time of Concentration:					0.119
#18	2	5. Nearly bare and untilled, and alluvial valley fans	43.75	14.00	32.00	6.610	0.001
#18	2	Time of Concentration:					0.001
#19	1	5. Nearly bare and untilled, and alluvial valley fans	16.33	24.00	147.00	4.040	0.010
#19	1	Time of Concentration:					0.010
#20	1	5. Nearly bare and untilled, and alluvial valley fans	22.22	22.00	99.00	4.710	0.005
#20	1	Time of Concentration:					0.005
#21	1	5. Nearly bare and untilled, and alluvial valley fans	2.68	16.00	597.01	1.630	0.101
#21	1	Time of Concentration:					0.101

New Elk Mine

West DWDA

Ditch Sizing

10-year, 24-hour Event

Tamme Bishop

J.E. Stover & Associates, Inc.
2352 N. 7th Street, Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: tamme.jestover@bresnan.net

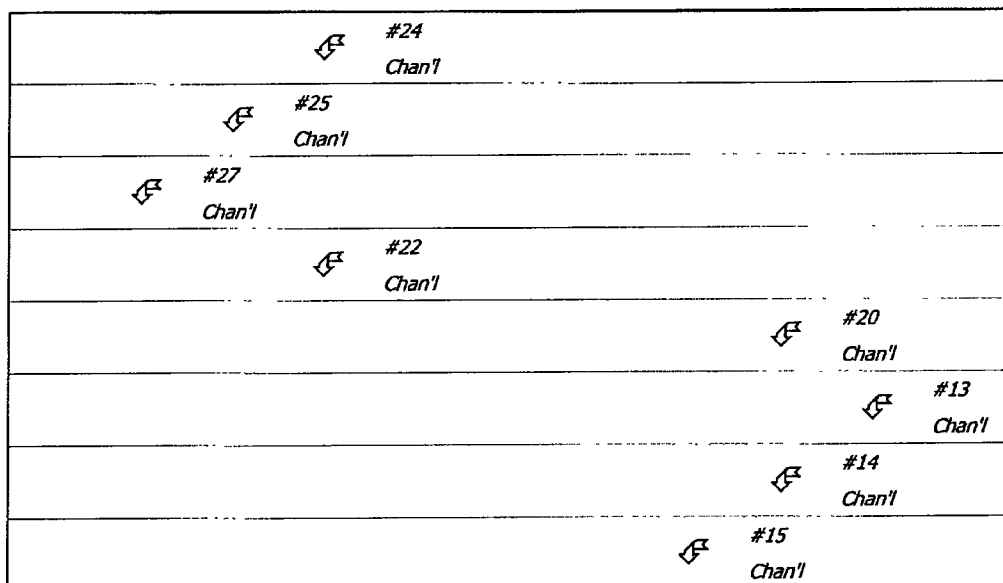
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Catchment No.2
Channel	#8	==>	#9	0.000	0.000	Ditch D30-E
Channel	#9	==>	#10	0.000	0.000	Ditch D40
Channel	#10	==>	#11	0.000	0.000	Ditch D41
Channel	#11	==>	#12	0.000	0.000	Ditch D42
Channel	#12	==>	#18	0.000	0.000	Ditch D46 (32%)
Channel	#13	==>	#14	0.000	0.000	Ditch D30-W
Channel	#14	==>	#15	0.000	0.000	Ditch D43
Channel	#15	==>	#16	0.000	0.000	Ditch D44 (22%)
Channel	#16	==>	#17	0.000	0.000	Ditch D44 (4%)
Channel	#17	==>	#12	0.000	0.000	Ditch D45
Channel	#18	==>	#23	0.000	0.000	Ditch D46 (5.0%)
Channel	#19	==>	#10	0.000	0.000	Ditch D47
Channel	#20	==>	#15	0.000	0.000	Ditch D48
Channel	#21	==>	#1	0.000	0.000	Ditch D27
Channel	#22	==>	#23	0.000	0.000	D50
Channel	#23	==>	#26	0.000	0.000	D53
Channel	#24	==>	#25	0.000	0.000	D51
Channel	#25	==>	#27	0.000	0.000	D52
Channel	#26	==>	#28	0.000	0.000	D54
Channel	#27	==>	#28	0.000	0.000	D68
Channel	#28	==>	#1	0.000	0.000	D69



		#16 Chan'l
		#17 Chan'l
		#19 Chan'l
		#8 Chan'l
		#9 Chan'l
		#10 Chan'l
		#11 Chan'l
		#12 Chan'l
		#18 Chan'l
		#23 Chan'l
		#26 Chan'l
		#28 Chan'l
		#21 Chan'l
#1 Null		

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#24	0.360	0.360	0.64	0.04
#25	0.210	0.570	1.01	0.06
#27	0.200	0.770	1.37	0.09
#22	0.470	0.470	0.83	0.06
#20	0.450	0.450	0.87	0.07
#13	0.400	0.400	0.76	0.05
#14	0.450	0.850	1.61	0.12
#15	0.250	1.550	2.93	0.23
#16	0.270	1.820	3.43	0.26
#17	0.650	2.470	4.67	0.36
#19	1.000	1.000	1.94	0.16
#8	4.010	4.010	3.84	0.27
#9	0.520	4.530	4.25	0.30
#10	0.440	5.970	7.02	0.53
#11	1.340	7.310	9.58	0.74
#12	0.030	9.810	14.30	1.10
#18	0.010	9.820	14.32	1.10
#23	0.390	10.680	15.85	1.21
#26	0.270	10.950	16.33	1.24
#28	0.050	11.770	17.78	1.33
#21*	1.090	1.090	1.55	0.12
#1	0.280	13.140	19.83	1.48

**Denotes structures with incomplete design parameters. Results for these structures have not been evaluated, and may affect downstream structures.*

Structure Detail:

Structure #21 (Erodible Channel)

Ditch D27

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	2.0	0.0250	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.75 cfs	
Depth:	0.52 ft	0.82 ft
Top Width:	2.10 ft	3.30 ft
Velocity:	3.20 fps	
X-Section Area:	0.55 sq ft	
Hydraulic Radius:	0.234 ft	
Froude Number:	1.10	

Structure Detail:

Structure #18 (Riprap Channel)

Ditch D46 (5.0%)

Triangular Riprap Channel Inputs:

Material: Riprap

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	5.0	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	14.32 cfs	
Depth:	1.12 ft	2.12 ft
Top Width:	4.49 ft	8.49 ft
Velocity:	5.69 fps	
X-Section Area:	2.52 sq ft	
Hydraulic Radius:	0.502 ft	
Froude Number:	1.34	
Manning's n:	0.0370	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure Detail:

Structure #22 (Erodible Channel)

D50

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	2.0	0.0250	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.83 cfs	
Depth:	0.40 ft	0.70 ft
Top Width:	1.59 ft	2.79 ft
Velocity:	2.66 fps	
X-Section Area:	0.31 sq ft	
Hydraulic Radius:	0.177 ft	
Froude Number:	1.05	

Structure Detail:

Structure #24 (Erodible Channel)

D51

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	2.5	0.0250	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.64 cfs	
Depth:	0.34 ft	0.64 ft
Top Width:	1.37 ft	2.57 ft
Velocity:	2.70 fps	
X-Section Area:	0.24 sq ft	
Hydraulic Radius:	0.154 ft	
Froude Number:	1.15	

Structure Detail:

Structure #25 (Erodible Channel)

D52

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	17.0	0.0250	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.01 cfs	
Depth:	0.28 ft	0.58 ft
Top Width:	1.13 ft	2.33 ft
Velocity:	6.19 fps	
X-Section Area:	0.16 sq ft	
Hydraulic Radius:	0.126 ft	
Froude Number:	2.90	

Structure Detail:

Structure #23 (Riprap Channel)

D53

Triangular Riprap Channel Inputs:

Material: Riprap

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	6.0	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	15.85 cfs	
Depth:	1.13 ft	1.43 ft
Top Width:	4.50 ft	5.70 ft
Velocity:	6.24 fps	
X-Section Area:	2.54 sq ft	
Hydraulic Radius:	0.504 ft	
Froude Number:	1.47	
Manning's n:	0.0370	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure Detail:

Structure #26 (Riprap Channel)

D54

Triangular Riprap Channel Inputs:

Material: Riprap

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	3.0	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	16.33 cfs	
Depth:	1.28 ft	2.28 ft
Top Width:	5.14 ft	9.14 ft
Velocity:	4.95 fps	
X-Section Area:	3.30 sq ft	
Hydraulic Radius:	0.574 ft	
Froude Number:	1.09	
Manning's n:	0.0360	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure Detail:

Structure #27 (Erodible Channel)

D68

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	5.6	0.0250	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.37 cfs	
Depth:	0.39 ft	0.69 ft
Top Width:	1.57 ft	2.77 ft
Velocity:	4.42 fps	
X-Section Area:	0.31 sq ft	
Hydraulic Radius:	0.176 ft	
Froude Number:	1.76	

Structure Detail:

Structure #28 (Riprap Channel)

D69

Triangular Riprap Channel Inputs:

Material: Riprap

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	7.0	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	17.78 cfs	
Depth:	1.17 ft	2.17 ft
Top Width:	4.66 ft	8.66 ft
Velocity:	6.55 fps	
X-Section Area:	2.72 sq ft	
Hydraulic Radius:	0.521 ft	
Froude Number:	1.51	
Manning's n:	0.0390	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#24	1	0.160	0.003	0.000	0.000	87.000	TR55	0.28	0.018
	2	0.200	0.026	0.000	0.000	87.000	TR55	0.35	0.024
	Σ	0.360						0.64	0.042
#25	1	0.110	0.006	0.000	0.000	87.000	TR55	0.20	0.011
	2	0.100	0.006	0.000	0.000	87.000	TR55	0.18	0.010
	Σ	0.570						1.01	0.063
#27	1	0.200	0.008	0.000	0.000	87.000	TR55	0.35	0.024
	Σ	0.770						1.37	0.088
#22	1	0.170	0.002	0.000	0.000	87.000	TR55	0.30	0.020
	2	0.300	0.026	0.000	0.000	87.000	TR55	0.53	0.039
	Σ	0.470						0.83	0.059
#20	1	0.450	0.005	0.000	0.000	90.000	TR55	0.87	0.073
	Σ	0.450						0.87	0.073
#13	1	0.290	0.004	0.000	0.000	90.000	TR55	0.56	0.044
	2	0.110	0.037	0.000	0.000	87.000	TR55	0.20	0.011
	Σ	0.400						0.76	0.055
#14	1	0.330	0.005	0.000	0.000	90.000	TR55	0.64	0.053
	2	0.120	0.027	0.000	0.000	87.000	TR55	0.21	0.012
	Σ	0.850						1.61	0.120
#15	1	0.250	0.011	0.000	0.000	87.000	TR55	0.44	0.032
	Σ	1.550						2.93	0.226
#16	1	0.150	0.005	0.000	0.000	90.000	TR55	0.29	0.019
	2	0.120	0.013	0.000	0.000	87.000	TR55	0.21	0.012
	Σ	1.820						3.43	0.257
#17	1	0.500	0.005	0.000	0.000	90.000	TR55	0.97	0.082
	2	0.150	0.048	0.000	0.000	87.000	TR55	0.27	0.017
	Σ	2.470						4.67	0.355
#19	1	1.000	0.010	0.000	0.000	90.000	TR55	1.94	0.165
	Σ	1.000						1.94	0.165
#8	1	0.180	0.006	0.000	0.000	90.000	TR55	0.35	0.025
	2	1.400	0.116	0.000	0.000	71.000	TR55	1.23	0.089
	3	2.300	0.099	0.000	0.000	71.000	TR55	2.02	0.145
	4	0.130	0.100	0.000	0.000	87.000	TR55	0.23	0.014

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
Σ		4.010						3.84	0.273
#9	1	0.450	0.152	0.000	0.000	71.000	TR55	0.34	0.026
	2	0.070	0.001	0.000	0.000	87.000	TR55	0.12	0.006
Σ		4.530						4.25	0.304
#10	1	0.290	0.022	0.000	0.000	90.000	TR55	0.56	0.044
	2	0.150	0.022	0.000	0.000	87.000	TR55	0.27	0.017
Σ		5.970						7.02	0.529
#11	1	1.100	0.005	0.000	0.000	90.000	TR55	2.14	0.181
	2	0.240	0.084	0.000	0.000	87.000	TR55	0.43	0.030
Σ		7.310						9.58	0.740
#12	1	0.030	0.002	0.000	0.000	87.000	TR55	0.05	0.002
Σ		9.810						14.30	1.098
#18	1	0.010	0.010	0.000	0.000	87.000	TR55	0.02	0.001
Σ		9.820						14.32	1.098
#23	1	0.040	0.024	0.000	0.000	87.000	TR55	0.07	0.003
	2	0.350	0.024	0.000	0.000	87.000	TR55	0.62	0.050
Σ		10.680						15.85	1.211
#26	1	0.030	0.035	0.000	0.000	87.000	TR55	0.05	0.002
	2	0.240	0.035	0.000	0.000	87.000	TR55	0.43	0.030
Σ		10.950						16.33	1.243
#28	1	0.050	0.013	0.000	0.000	87.000	TR55	0.09	0.004
Σ		11.770						17.78	1.334
#21	1	1.090	0.101	0.000	0.000	81.000	TR55	1.55	0.119
Σ		1.090						1.55	0.119
#1	1	0.100	0.002	0.000	0.000	87.000	TR55	0.18	0.010
	2	0.180	0.000	0.000	0.000	87.000	TR55	0.32	0.022
Σ		13.140						19.83	1.484

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	19.05	8.00	42.00	4.360	0.002
#1	1	Time of Concentration:					0.002
#1	2	5. Nearly bare and untilled, and alluvial valley fans	675.00	81.00	12.00	25.980	0.000

SEDCAD 4 for Windows

Copyright 1998-2010 Pamela J. Schuch

3

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	Time of Concentration:					0.000
#8	1	5. Nearly bare and untilled, and alluvial valley fans	25.00	28.00	112.00	5.000	0.006
#8	1	Time of Concentration:					0.006
#8	2	1. Forest with heavy ground litter	45.83	330.00	720.00	1.710	0.116
#8	2	Time of Concentration:					0.116
#8	3	1. Forest with heavy ground litter	43.55	260.00	597.00	1.660	0.099
#8	3	Time of Concentration:					0.099
#9	1	1. Forest with heavy ground litter	10.94	50.00	457.00	0.830	0.152
#9	1	Time of Concentration:					0.152
#9	2	5. Nearly bare and untilled, and alluvial valley fans	64.52	20.00	31.00	8.030	0.001
#9	2	Time of Concentration:					0.001
#10	1	5. Nearly bare and untilled, and alluvial valley fans	11.15	30.00	269.00	3.330	0.022
#10	1	Time of Concentration:					0.022
#10	2	5. Nearly bare and untilled, and alluvial valley fans	11.15	30.00	269.00	3.330	0.022
#10	2	Time of Concentration:					0.022
#11	1	5. Nearly bare and untilled, and alluvial valley fans	32.20	38.00	118.00	5.670	0.005
#11	1	Time of Concentration:					0.005
#11	2	5. Nearly bare and untilled, and alluvial valley fans	1.91	8.00	418.00	1.380	0.084
#11	2	Time of Concentration:					0.084
#12	1	5. Nearly bare and untilled, and alluvial valley fans	31.82	14.00	44.00	5.640	0.002
#12	1	Time of Concentration:					0.002
#13	1	4. Cultivated, straight row	27.50	22.00	80.00	4.680	0.004
#13	1	Time of Concentration:					0.004
#13	2	5. Nearly bare and untilled, and alluvial valley fans	2.69	6.00	223.00	1.640	0.037
#13	2	Time of Concentration:					0.037
#14	1	5. Nearly bare and untilled, and alluvial valley fans	28.00	28.00	100.00	5.290	0.005
#14	1	Time of Concentration:					0.005
#14	2	5. Nearly bare and untilled, and alluvial valley fans	7.00	18.00	257.00	2.640	0.027
#14	2	Time of Concentration:					0.027
#15	1	5. Nearly bare and untilled, and alluvial valley fans	14.10	22.00	156.00	3.750	0.011
#15	1	Time of Concentration:					0.011
#16	1	5. Nearly bare and untilled, and alluvial valley fans	30.00	30.00	100.00	5.470	0.005
#16	1	Time of Concentration:					0.005
#16	2	5. Nearly bare and untilled, and alluvial valley fans	4.17	4.00	96.00	2.040	0.013
#16	2	Time of Concentration:					0.013

SEDCAD 4 for Windows

Copyright 1998-2010 Pamela L. Schuch

4

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#17	1	5. Nearly bare and untilled, and alluvial valley fans	31.78	34.00	107.00	5.630	0.005
#17	1	Time of Concentration:					0.005
#17	2	5. Nearly bare and untilled, and alluvial valley fans	3.22	10.00	311.00	1.790	0.048
#17	2	Time of Concentration:					0.048
#18	1	5. Nearly bare and untilled, and alluvial valley fans	4.76	4.00	84.00	2.180	0.010
#18	1	Time of Concentration:					0.010
#19	1	5. Nearly bare and untilled, and alluvial valley fans	16.33	24.00	147.00	4.040	0.010
#19	1	Time of Concentration:					0.010
#20	1	5. Nearly bare and untilled, and alluvial valley fans	22.22	22.00	99.00	4.710	0.005
#20	1	Time of Concentration:					0.005
#21	1	5. Nearly bare and untilled, and alluvial valley fans	2.68	16.00	597.01	1.630	0.101
#21	1	Time of Concentration:					0.101
#22	1	5. Nearly bare and untilled, and alluvial valley fans	8.70	2.00	23.00	2.940	0.002
#22	1	Time of Concentration:					0.002
#22	2	5. Nearly bare and untilled, and alluvial valley fans	4.76	10.00	210.00	2.180	0.026
#22	2	Time of Concentration:					0.026
#23	1	5. Nearly bare and untilled, and alluvial valley fans	5.71	12.00	210.00	2.390	0.024
#23	1	Time of Concentration:					0.024
#23	2	5. Nearly bare and untilled, and alluvial valley fans	5.71	12.00	210.00	2.390	0.024
#23	2	Time of Concentration:					0.024
#24	1	5. Nearly bare and untilled, and alluvial valley fans	12.50	6.00	48.00	3.530	0.003
#24	1	Time of Concentration:					0.003
#24	2	5. Nearly bare and untilled, and alluvial valley fans	2.63	4.00	152.00	1.620	0.026
#24	2	Time of Concentration:					0.026
#25	1	5. Nearly bare and untilled, and alluvial valley fans	16.33	16.00	98.00	4.040	0.006
#25	1	Time of Concentration:					0.006
#25	2	5. Nearly bare and untilled, and alluvial valley fans	18.95	18.00	95.00	4.350	0.006
#25	2	Time of Concentration:					0.006
#26	1	5. Nearly bare and untilled, and alluvial valley fans	1.79	3.00	168.00	1.330	0.035
#26	1	Time of Concentration:					0.035
#26	2	5. Nearly bare and untilled, and alluvial valley fans	1.79	3.00	168.00	1.330	0.035
#26	2	Time of Concentration:					0.035
#27	1	5. Nearly bare and untilled, and alluvial valley fans	6.25	5.00	80.00	2.500	0.008

SEDCAD 4 for Windows

Copyright 1988 - 2010 Pamela I. Schuch

5

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#27	1	Time of Concentration:					0.008
#28	1	5. Nearly bare and untilled, and alluvial valley fans	2.63	2.00	76.00	1.620	0.013
#28	1	Time of Concentration:					0.013

New Elk Mine

West DWDA

West Clean Water Diversion

Ditch 49 - Design

100-year, 24-hour event

Tamme Bishop

J.E. Stover & Associates, Inc.
2352 N. 7th Street, Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: tamme.jestover@bresnan.net

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	4.200 inches

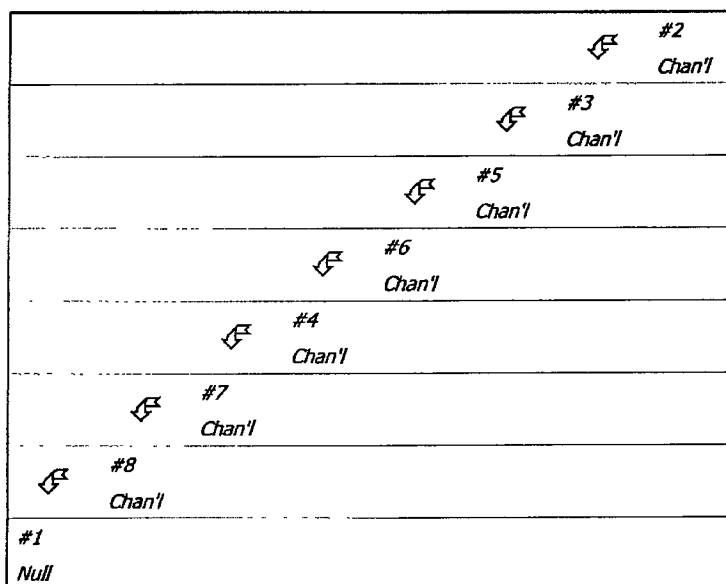
Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	47.350	47.350	53.24	5.97
#3	9.790	57.140	65.04	7.23
#5*	1.340	58.480	65.53	7.41
#6*	0.020	58.500	65.54	7.41
#4	0.070	58.570	65.57	7.42
#7*	0.030	58.600	65.59	7.43
#8*	0.160	58.760	65.67	7.46
#1	0.000	58.760	65.67	7.46

**Denotes structures with incomplete design parameters. Results for these structures have not been evaluated, and may affect downstream structures.*

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	
Channel	#2	==>	#3	0.000	0.000	Ditch 49 (2.0%)
Channel	#3	==>	#5	0.000	0.000	Ditch 49 (8%)
Channel	#4	==>	#7	0.000	0.000	Ditch 49 (9%)
Channel	#5	==>	#6	0.000	0.000	Ditch 49 (1.6%)
Channel	#6	==>	#4	0.000	0.000	Ditch 49 (64%)
Channel	#7	==>	#8	0.000	0.000	Ditch 49 (30%)
Channel	#8	==>	#1	0.000	0.000	Ditch 49 (12%)



Ditch 49 - (2% Slope)

Manning's Equation

Flow In a Trapezoidal Channel

DEPTH	D	1.54	FEET
WIDTH	W	3	FEET
Slope	S	0.02	EXPRESS AS DECIMAL
Mannings "N"	N	0.03	EXPRESS AS DECIMAL
SIDE SLOPE	X	1.5	SLOPE = X:1

AREA=(W*D)+(X*D²)= 8.18 Feet²

WETTED PERIMETER=(W)+2*[((X*D)²+D²)^{1/2}] 8.55 Feet

R=AREA/WETTED PERIMETER 0.96

V=(1.49/N)*(R^{2/3})*(S^{1/2})= 6.82 Ft/Sec

Q = A X V = 55.75 CFS

Q REQUIRED - Peak Discharge 53.24 CFS

Riprap Sizing

D50 = Size of Riprap

$D50 = ((V \times S^{.17}) / 7.58)^2$

D50 = Diameter in feet

V = Velocity

S = Slope

D50 = 0.21 feet 2.6 inches Use Pit Run

Ditch 49 - (8% Slope)

Manning's Equation

Flow In a Trapezoidal Channel

DEPTH	D	1.17	FEET	
WIDTH	W	3	FEET	
Slope	S	0.08	EXPRESS AS DECIMAL	
Mannings "N"	N	0.03	EXPRESS AS DECIMAL	
SIDE SLOPE	X	1.5	SLOPE = X:1	

AREA=(W*D)+(X*D²)= 5.56 Feet²

WETTED PERIMETER=(W)+2*[((X*D)²+D²)^{1/2}] 7.22 Feet

R=AREA/WETTED PERIMETER 0.77

V=(1.49/N)*(R^{2/3})*(S^{1/2})= 11.81 Ft/Sec

Q = A X V = 65.70 CFS

Q REQUIRED - Peak Discharge 65.04 CFS

Riprap Sizing

D50 = Size of Riprap

D50 = ((V X S^{.17})/7.58)²

D50 = Diameter in feet

V = Velocity

S = Slope

D50 = 1.03 feet 12.3 inches Use 12"

Ditch 49 - (9% Slope)

Manning's Equation

Flow In a Trapezoidal Channel

DEPTH	D	1.14	FEET
WIDTH	W	3	FEET
Slope	S	0.09	EXPRESS AS DECIMAL
Mannings "N"	N	0.03	EXPRESS AS DECIMAL
SIDE SLOPE	X	1.5	SLOPE = X:1

AREA=(W*D)+(X*D ²)=	5.37	Feet ²
WETTED PERIMETER=(W)+2*[((X*D) ² +D ²) ^{1/2}]	7.11	Feet
R=AREA/WETTED PERIMETER	0.76	

V=(1.49/N)*(R ^{2/3})*(S ^{1/2})=	12.36	Ft/Sec

Q = A X V =	66.34	CFS

Q REQUIRED - Peak Discharge	65.57	CFS

Riprap Sizing

D50 = Size of Riprap

$D50 = ((V \times S^{.17}) / 7.58)^2$

D50 = Diameter in feet

V = Velocity

S = Slope

D50 =	1.17 feet	14.1 inches	<u>Use 15"</u>

Ditch 49 - (1.6% Slope)

Manning's Equation

Flow In a Trapezoidal Channel

DEPTH	D	1.78	FEET
WIDTH	W	3	FEET
Slope	S	0.016	EXPRESS AS DECIMAL
Mannings "N"	N	0.03	EXPRESS AS DECIMAL
SIDE SLOPE	X	1.5	SLOPE = X:1

$$\text{AREA}=(W*D)+(X*D^2)=10.09 \text{ Feet}^2$$

$$\text{WETTED PERIMETER}=(W)+2*[((X*D)^2+D^2)^{1/2}]9.42 \text{ Feet}$$

$$R=\text{AREA}/\text{WETTED PERIMETER}1.07$$

$$V=(1.49/N)*(R^{2/3})*(S^{1/2})=6.58 \text{ Ft/Sec}$$

$$Q = A \times V = 66.40 \text{ CFS}$$

$$Q \text{ REQUIRED} - \text{Peak Discharge} 65.53 \text{ CFS}$$

Riprap Sizing

D50 = Size of Riprap

$$D50 = ((V \times S^{.17})/7.58)^2$$

D50 = Diameter in feet

V = Velocity

S = Slope

$$D50 = 0.18 \text{ feet} \quad 2.2 \text{ inches} \quad \text{Use Pit Run}$$

Ditch 49 - (7% Slope)

On DOW Land

Manning's Equation

Flow In a Trapezoidal Channel

DEPTH	D	1.16	FEET
WIDTH	W	3	FEET
Slope	S	0.07	EXPRESS AS DECIMAL
Mannings "N"	N	0.03	EXPRESS AS DECIMAL
SIDE SLOPE	X	2	SLOPE = X:1

AREA=(W*D)+(X*D²)= 6.17 Feet²

WETTED PERIMETER=(W)+2*[((X*D)²+D²)^{1/2}] 8.19 Feet

R=AREA/WETTED PERIMETER 0.75

V=(1.49/N)*(R^{2/3})*(S^{1/2})= 10.88 Ft/Sec

Q = A X V = 67.16 CFS

Q REQUIRED - Peak Discharge 65.67 CFS

Riprap Sizing

D50 = Size of Riprap

D50 = ((V X S^{1.49})/7.58)²

D50 = Diameter in feet

V = Velocity

S = Slope

D50 = 0.83 feet 10.0 inches Use 12" Riprap

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	40.000	0.376	0.000	0.000	71.000	TR55	50.70	5.025
	2	7.200	0.055	0.000	0.000	71.000	TR55	12.33	0.919
	3	0.150	0.100	0.000	0.000	87.000	TR55	0.41	0.030
	Σ	47.350						53.24	5.974
#3	1	0.190	0.015	0.000	0.000	87.000	TR55	0.52	0.040
	2	9.600	0.424	0.000	0.000	71.000	TR55	11.71	1.214
	Σ	57.140						65.04	7.229
#5	1	0.140	0.100	0.000	0.000	87.000	TR55	0.38	0.028
	2	1.200	0.083	0.000	0.000	71.000	TR55	2.05	0.153
	Σ	58.480						65.53	7.409
#6	1	0.020	0.100	0.000	0.000	87.000	TR55	0.05	0.002
	Σ	58.500						65.54	7.412
#4	1	0.070	0.100	0.000	0.000	87.000	TR55	0.19	0.011
	Σ	58.570						65.57	7.423
#7	1	0.030	0.100	0.000	0.000	87.000	TR55	0.08	0.004
	Σ	58.600						65.59	7.427
#8	1	0.160	0.010	0.000	0.000	87.000	TR55	0.44	0.032
	Σ	58.760						65.67	7.459
#1	Σ	58.760						65.67	7.459

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	1. Forest with heavy ground litter	35.94	735.00	2,045.00	1.510	0.376
#2	1	Time of Concentration:					0.376
#2	2	5. Nearly bare and untilled, and alluvial valley fans	6.39	32.00	501.00	2.520	0.055
#2	2	Time of Concentration:					0.055
#3	1	5. Nearly bare and untilled, and alluvial valley fans	7.84	12.00	153.00	2.800	0.015
#3	1	Time of Concentration:					0.015
#3	2	1. Forest with heavy ground litter	31.09	670.00	2,155.00	1.410	0.424
#3	2	Time of Concentration:					0.424
#5	2	1. Forest with heavy ground litter	32.41	140.00	432.00	1.440	0.083

SEDCAD 4 for Windows

Copyright 1988-2010 Pamela I. Schuch

2

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	2	Time of Concentration:					0.083
#8	1	5. Nearly bare and untilled, and alluvial valley fans	6.38	6.00	94.00	2.520	0.010
#8	1	Time of Concentration:					0.010

Exhibit 19(23)

DWDA Expansion

The DWDA will be expanded by 0.6 acres in order to provide additional storage until a new DWDA can be permitted.

Runoff from the DWDA will be routed to culvert C13 via ditches D12 and D14. It is assumed that half of the runoff from the 0.6 acre expansion will go to D12, and half will go to D14.

Ditches 12 and 14 have been designed for the 100-year, 24-hour event. Ditches 12 and 14 as currently approved (per TR-60) have adequate capacity to safely pass the runoff from the DWDA expansion. The revised SedCad design for each ditch follows.

Table 21 lists C13 as 21" culvert, however, a field locate determined that it is actually a 24", therefore, C13 has adequate capacity to handle additional flow from the DWDA expansion. Culvert C13 has been designed for the 10-year, 24-hour event. C13 has requires an $HW/D = 1.1$ in order to convey to design flow.

Until this point, a curve number of 94 has been used for the DWDA. For this analysis, the CN will remain 94, however, 90 is generally accepted by the Division for refuse and will be used for hydrologic analyses pertaining to refuse in the future.

ENGINEER'S CERTIFICATION

The calculations and information presented on pages EXH. 19(23)-1 through 19(23)-11 with a date of 04/20/12 were prepared by me, and the information presented is true and correct to the best of my knowledge and belief.



Tammerin K. Eschman
Registered Professional Engineer
State of Colorado No. 43402

4-20-12
Date

New Elk Coal Mine **MR-112**

DWDA Expansion

Ditches 12 & 14
100-year Event

Tamme Bishop

J.E. Stover & Associates, Inc.
2352 N. 7th Street, Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: tamme.jestover@bresnan.net

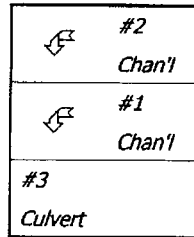
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	4.200 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.000	0.000	Ditch D-12
Channel	#2	==>	#3	0.000	0.000	Ditch D-14
Culvert	#3	==>	End	0.000	0.000	Culvert C-13



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	2.540	2.540	7.85	0.74
#1	3.130	3.130	9.67	0.92
#3	0.000	5.670	17.52	1.66

Structure Detail:

Structure #1 (Erodible Channel)

Ditch D-12

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.00	1.0:1	1.0:1	1.0	0.0250	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.67 cfs	
Depth:	0.69 ft	0.99 ft
Top Width:	4.37 ft	4.97 ft
Velocity:	3.82 fps	
X-Section Area:	2.53 sq ft	
Hydraulic Radius:	0.513 ft	
Froude Number:	0.88	

Structure Detail:

Structure #2 (Erodible Channel)

Ditch D-14

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.00	1.0:1	1.0:1	1.0	0.0250	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.85 cfs	
Depth:	0.61 ft	0.91 ft
Top Width:	4.22 ft	4.82 ft
Velocity:	3.58 fps	
X-Section Area:	2.19 sq ft	
Hydraulic Radius:	0.465 ft	
Froude Number:	0.87	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	2.540	0.003	0.000	0.000	94.000	TR55	7.85	0.745
	Σ	2.540						7.85	0.745
#1	1	2.530	0.003	0.000	0.000	94.000	TR55	7.82	0.742
	2	0.600	0.003	0.000	0.000	94.000	TR55	1.85	0.175
	Σ	3.130						9.67	0.917
#3	Σ	5.670						17.52	1.661

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	36.59	30.00	82.00	6.040	0.003
#1	1	Time of Concentration:					0.003
#1	2	5. Nearly bare and untilled, and alluvial valley fans	4.00	1.00	25.00	2.000	0.003
#1	2	Time of Concentration:					0.003
#2	1	5. Nearly bare and untilled, and alluvial valley fans	37.50	30.00	80.00	6.120	0.003
#2	1	Time of Concentration:					0.003

New Elk Coal Mine

MR-112 & MR-122

DWDA Expansion

Culvert C13

10-year Event

ENGINEER'S CERTIFICATION

The calculations and information presented on pages EXH 19(23)-9 through EXH 19 (23)-15 were prepared by Tamme Bishop under my direct supervision during April 2012 and the information presented is true and correct to the best of my knowledge and belief.

James E. Stover, P.E. Date: 11/14/14
Registered Professional Engineer
State of Colorado No. 19230

Tamme Bishop

J. E. Stover & Associates, Inc.
2352 N 7th St Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: jestover@bresnan.net

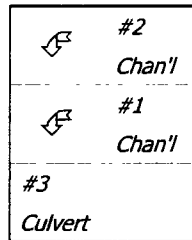
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.000	0.000	Ditch D-12
Channel	#2	==>	#3	0.000	0.000	Ditch D-14
Culvert	#3	==>	End	0.000	0.000	Culvert C-13



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	2.540	2.540	5.44	0.50
#1	3.130	3.130	6.70	0.61
#3	0.000	5.670	12.14	1.11

Structure Detail:

Structure #2 (Erodible Channel)

Ditch D-14

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.00	1.0:1	1.0:1	1.0	0.0250	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.44 cfs	
Depth:	0.49 ft	0.79 ft
Top Width:	3.98 ft	4.58 ft
Velocity:	3.18 fps	
X-Section Area:	1.71 sq ft	
Hydraulic Radius:	0.390 ft	
Froude Number:	0.86	

Structure #1 (Erodible Channel)

Ditch D-12

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.00	1.0:1	1.0:1	1.0	0.0250	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.70 cfs	
Depth:	0.55 ft	0.85 ft
Top Width:	4.11 ft	4.71 ft
Velocity:	3.40 fps	
X-Section Area:	1.97 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.431 ft	
Froude Number:	0.87	

Structure #3 (Culvert)

Culvert C-13

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
133.00	3.00	0.0150	2.20	0.00	0.90

Culvert Results:

Design Discharge = 12.14 cfs

Minimum pipe diameter: 1 - 24 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	2.540	0.003	0.000	0.000	94.000	TR55	5.44	0.497
	Σ	2.540						5.44	0.497
#1	1	2.530	0.003	0.000	0.000	94.000	TR55	5.42	0.495
	2	0.600	0.003	0.000	0.000	94.000	TR55	1.28	0.116
	Σ	3.130						6.70	0.611
#3	Σ	5.670						12.14	1.108

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	36.59	30.00	82.00	6.040	0.003
#1	1	Time of Concentration:					0.003
#1	2	5. Nearly bare and untilled, and alluvial valley fans	4.00	1.00	25.00	2.000	0.003
#1	2	Time of Concentration:					0.003
#2	1	5. Nearly bare and untilled, and alluvial valley fans	37.50	30.00	80.00	6.120	0.003
#2	1	Time of Concentration:					0.003

Exhibit 19(24)

TR-66 RDA Haul Road, RDA Conveyor Area

RDA Conveyor Area, Miscellaneous Culverts:

1. The current drainage configuration networks undisturbed runoff west of the RDA, through a culvert under HWY 12 into C14 and then into C14A. In the proposed drainage configuration, D19 will be extended, C14 will be removed and C14a will not be installed. (C14A was approved with TR-60). The previous flow shown for C14 in Table 21 was 44.4 cfs. Based on drainage areas and SedCad Calculations, that number was not correct. The flow derived for D19, as discussed below, is based on the drainage areas that previously flowed into C14 and are assumed to be correct based on most recent topography and flow patterns.
2. The flow in D19 will increase by 1.7 cfs due to the rerouting of the flow from under State Hwy. 12. Therefore, the flow in C30 will increase by approximately 1.7 cfs based on the extension of D19. Existing culvert C30 is a 36" CMP. It will be removed and replaced with a 48" CMP. Downstream C26 is a 60" and therefore has adequate capacity. C26 at some point was removed from Table 21. It will be put back in the table, and the peak flow used is based on C30 + localized drainage area for D11 on the outlet end of C30 (63.2+2.62). The flow in Ditch 11 has not been revised. Re-routed flow from D19 is conveyed through C30 and will end up in D11.
3. Culverts 26, 30, have been sized with use of Figure 4-18, Inlet Control Nomograph, from the "Handbook of Steel Drainage & Highway Construction Products", as shown on permit page 2.05.15.
4. Culverts 77, 77A** & 78 were sized using the flow from D5. These culverts will be placed in Ditch 5 and will create access to a new employee parking area. Culverts were sized using the aforementioned nomograph.
5. C17C will be placed in an area where Ditch 22 is eroding under the footings of the raw coal conveyor. Culvert 17C was sized based on the size of culverts C17A & B and will be a 36" CMP.

RDA Haul Road:

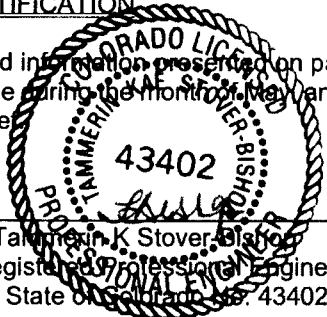
1. Ditches 56, 62, 63, 64, and 67, are assumed to be cut in rock, and therefore rip rap is not required. However, if they are not cut in rock, and the SedCad analysis determined rip rap is required, the appropriate rip rap has been sized and is shown on the applicable SedCad design page. Necessity of rip rap will be determined during construction.
2. Ditches 56, 57, 61 and 62 are routed to flow into culverts 40, 39 and 45 respectively. It is assumed the cut slope leading into the culvert is rock, and therefore no rip rap is required. If conditions during construction demonstrate that the cut is not in rock, rip rap will be required and the design will be revised. The 'dual ditch' configuration is required due to the steep cut and the culverts being placed at the toe of the cut. Ditches 56, 57, 61 and 62 are existing ditches and will not be reconstructed, but simply assigned a name as they became part of the network for the haul road drainage plan.
3. Ditch 55 is an upland diversion ditch, and therefore was designed using the 100-year 24-hour event. The remainder of the ditches and culverts were sized to safely pass the peak flow from the 10-year 24-hour event.
4. Ditch 55 is assumed to be constructed in rock. If it is not, 3" riprap will be required. Culvert 81 is a currently unnamed 48" in-place culvert. A design is attached.
5. Ditches associated with the haul road are not in the disturbed area as defined by Rule 4.05.2(4) and are therefore not routed to a Sediment Pond.

Curve Number Selection:

1. A curve number of 74 was used for the undisturbed oak shrub based on a C soil type and poor cover (Table 2.2d - Runoff curve numbers for arid and semiarid rangelands, Oak-aspen).
2. A curve number of 87 was used for the disturbed area.

ENGINEER'S CERTIFICATION

The calculations and information presented on pages EXH. 19(24)-1 through 19(24)-31 with a date of 05/25/12 were prepared by me during the month of May and the information presented is true and correct to the best of my knowledge and belief.


Tammie K. Stover, Bishop
Registered Professional Engineer
State of Colorado, No. 43402

5-25-12
Date

NECC TR-66

RDA Haul Road Ditches and Culverts

10-year, 24-hour event

Tamme Bishop

J.E. Stover & Associates, Inc.
2352 N. 7th Street, Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: tamme.jestover@bresnan.net

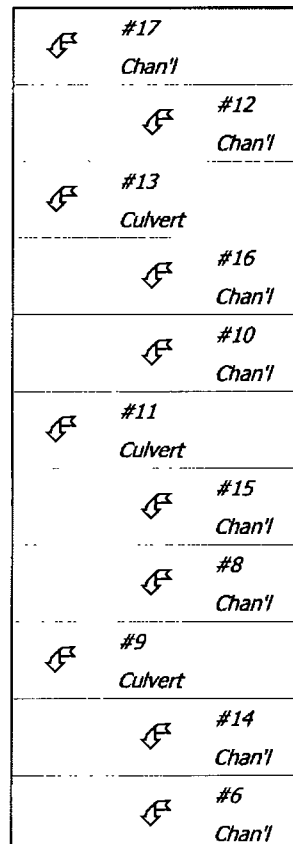
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	
Channel	#2	==>	#3	0.000	0.000	Ditch 55
Culvert	#3	==>	#1	0.000	0.000	Culvert 81
Channel	#4	==>	#5	0.000	0.000	Ditch 56
Culvert	#5	==>	#1	0.000	0.000	Culvert 40
Channel	#6	==>	#7	0.000	0.000	Ditch 57
Culvert	#7	==>	#1	0.000	0.000	Culvert C-B
Channel	#8	==>	#9	0.000	0.000	Ditch 61
Culvert	#9	==>	#1	0.000	0.000	Culvert 39
Channel	#10	==>	#11	0.000	0.000	Ditch 62
Culvert	#11	==>	#1	0.000	0.000	Culvert 45
Channel	#12	==>	#13	0.000	0.000	Ditch 63
Culvert	#13	==>	#1	0.000	0.000	Culvert C-A
Channel	#14	==>	#7	0.000	0.000	Ditch 64
Channel	#15	==>	#9	0.000	0.000	Ditch 65
Channel	#16	==>	#11	0.000	0.000	Ditch 66
Channel	#17	==>	#1	0.000	0.000	Ditch 67



	#7 Culvert
	#4 Chan'l
	#5 Culvert
	#2 Chan'l
	#3 Culvert
#1 Null	

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#17	0.640	0.640	0.75	0.05
#12	3.800	3.800	4.16	0.30
#13	0.000	3.800	4.16	0.30
#16	0.400	0.400	0.71	0.06
#10	2.200	2.200	2.28	0.17
#11	0.000	2.600	2.99	0.22
#15	0.140	0.140	0.25	0.02
#8	7.300	7.300	7.57	0.55
#9	0.000	7.440	7.82	0.57
#14	0.700	0.700	1.24	0.10
#6	0.700	0.700	0.62	0.04
#7	0.000	1.400	1.86	0.14
#4	3.100	3.100	3.51	0.27
#5	0.000	3.100	3.51	0.27
#2	9.100	9.100	7.02	0.68
#3	0.000	9.100	7.02	0.68
#1	0.000	28.080	26.36	2.24

Structure Detail:

Structure #4 (Erodible Channel)

Ditch 56

Triangular Erodible Channel Inputs:

Material: Shales and hardpans

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
0.3:1	1.0:1	0.4	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.51 cfs	
Depth:	1.58 ft	1.88 ft
Top Width:	2.06 ft	2.45 ft
Velocity:	2.15 fps	
X-Section Area:	1.63 sq ft	
Hydraulic Radius:	0.432 ft	
Froude Number:	0.43	

Structure Detail:

Structure #4 (Riprap Channel)

Ditch 56

Triangular Riprap Channel Inputs:

Material: Riprap

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
0.3:1	1.0:1	8.0	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.51 cfs	
Depth:	1.06 ft	2.06 ft
Top Width:	1.37 ft	2.67 ft
Velocity:	4.84 fps	
X-Section Area:	0.73 sq ft	
Hydraulic Radius:	0.288 ft	
Froude Number:	1.17	
Manning's n:	0.0380	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure Detail:

Structure #6 (Erodible Channel)

Ditch 57

Triangular Erodible Channel Inputs:

Material: Shales and hardpans

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	2.0:1	7.0	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.62 cfs	
Depth:	0.25 ft	0.55 ft
Top Width:	1.27 ft	2.77 ft
Velocity:	3.79 fps	
X-Section Area:	0.16 sq ft	
Hydraulic Radius:	0.118 ft	
Froude Number:	1.87	

Structure Detail:

Structure #8 (Riprap Channel)

Ditch 61

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult: x (VxD)
0.00	3.0:1	2.0:1	6.0	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.57 cfs	
Depth:	0.80 ft	1.80 ft
Top Width:	4.00 ft	9.00 ft
Velocity:	4.72 fps	
X-Section Area:	1.60 sq ft	
Hydraulic Radius:	0.372 ft	
Froude Number:	1.31	
Manning's n:	0.0400	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure Detail:

Structure #10 (Riprap Channel)

Ditch 62

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
0.00	0.3:1	1.0:1	13.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.28 cfs	
Depth:	0.82 ft	1.82 ft
Top Width:	1.06 ft	2.36 ft
Velocity*:		
X-Section Area:	0.43 sq ft	
Hydraulic Radius:	0.223 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure Detail:

Structure #12 (Riprap Channel)

Ditch 63

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
0.00	0.3:1	1.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.16 cfs	
Depth:	1.08 ft	2.08 ft
Top Width:	1.40 ft	2.70 ft
Velocity*:		
X-Section Area:	0.75 sq ft	
Hydraulic Radius:	0.293 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure Detail:

Structure #14 (Erodible Channel)

Ditch 64

Triangular Erodible Channel Inputs:

Material: Shales and hardpans

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
0.3:1	1.0:1	10.0	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.24 cfs	
Depth:	0.59 ft	0.89 ft
Top Width:	0.76 ft	1.15 ft
Velocity:	5.55 fps	
X-Section Area:	0.22 sq ft	
Hydraulic Radius:	0.160 ft	
Froude Number:	1.81	

Structure Detail:

Structure #15 (Erodible Channel)

Ditch 65

Triangular Erodible Channel Inputs:

Material: Shales and hardpans

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
0.3:1	1.0:1	10.0	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.25 cfs	
Depth:	0.31 ft	0.61 ft
Top Width:	0.41 ft	0.80 ft
Velocity:	3.65 fps	
X-Section Area:	0.06 sq ft	
Hydraulic Radius:	0.085 ft	
Froude Number:	1.63	

Structure Detail:

Structure #16 (Erodible Channel)

Ditch 66

Triangular Erodible Channel Inputs:

Material: Shales and hardpans

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
0.3:1	1.0:1	10.0	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.71 cfs	
Depth:	0.48 ft	0.78 ft
Top Width:	0.62 ft	1.01 ft
Velocity:	4.83 fps	
X-Section Area:	0.15 sq ft	
Hydraulic Radius:	0.130 ft	
Froude Number:	1.74	

Structure Detail:

Structure #17 (Erodible Channel)

Ditch 67

Triangular Erodible Channel Inputs:

Material: Shales and hardpans

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
0.3:1	1.0:1	10.0	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.75 cfs	
Depth:	0.49 ft	0.79 ft
Top Width:	0.63 ft	1.02 ft
Velocity:	4.91 fps	
X-Section Area:	0.16 sq ft	
Hydraulic Radius:	0.133 ft	
Froude Number:	1.75	

Structure Detail:

Structure #13 (Culvert)

Culvert C-A

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
30.00	7.00	0.0240	2.00	0.00	0.90

Culvert Results:

Design Discharge = 4.16 cfs

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Structure Detail:

Structure #7 (Culvert)

Culvert C-B

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
40.00	5.00	0.0240	1.00	0.00	0.90

Culvert Results:

Design Discharge = 1.86 cfs

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Structure Detail:

Structure #9 (Culvert)

Culvert 39

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (K _e)
55.00	10.00	0.0240	2.00	0.00	0.90

Culvert Results:

Design Discharge = 7.82 cfs

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Structure Detail:

Structure #5 (Culvert)

Culvert 40

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
32.00	6.00	0.0240	2.00	0.00	0.90

Culvert Results:

Design Discharge = 3.51 cfs

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Structure Detail:

Structure #11 (Culvert)

Culvert 45

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (K _e)
35.00	6.00	0.0240	1.50	0.00	0.90

Culvert Results:

Design Discharge = 2.99 cfs

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#17	1	0.120	0.026	0.000	0.000	87.000	TR55	0.21	0.012
	2	0.520	0.057	0.000	0.000	74.000	TR55	0.54	0.039
	Σ	0.640						0.75	0.052
#12	1	3.500	0.118	0.000	0.000	74.000	TR55	3.63	0.265
	2	0.300	0.036	0.000	0.000	87.000	TR55	0.53	0.039
	Σ	3.800						4.16	0.304
#13	Σ	3.800						4.16	0.304
#16	1	0.400	0.034	0.000	0.000	87.000	TR55	0.71	0.057
	Σ	0.400						0.71	0.057
#10	1	2.200	0.119	0.000	0.000	74.000	TR55	2.28	0.166
	Σ	2.200						2.28	0.166
#11	Σ	2.600						2.99	0.223
#15	1	0.140	0.015	0.000	0.000	87.000	TR55	0.25	0.015
	Σ	0.140						0.25	0.015
#8	1	7.300	0.107	0.000	0.000	74.000	TR55	7.57	0.552
	Σ	7.300						7.57	0.552
#9	Σ	7.440						7.82	0.567
#14	1	0.700	0.013	0.000	0.000	87.000	TR55	1.24	0.101
	Σ	0.700						1.24	0.101
#6	1	0.700	0.092	0.000	0.000	71.000	TR55	0.62	0.044
	Σ	0.700						0.62	0.044
#7	Σ	1.400						1.86	0.145
#4	1	2.600	0.072	0.000	0.000	74.000	TR55	2.70	0.197
	2	0.500	0.133	0.000	0.000	87.000	TR55	0.84	0.073
	Σ	3.100						3.51	0.269
#5	Σ	3.100						3.51	0.269
#2	1	9.100	0.319	0.000	0.000	74.000	TR55	7.02	0.679
	Σ	9.100						7.02	0.679
#3	Σ	9.100						7.02	0.679
#1	Σ	28.080						26.36	2.239

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	1. Forest with heavy ground litter	16.88	200.00	1,185.00	1.030	0.319
#2	1	Time of Concentration:					0.319
#4	1	1. Forest with heavy ground litter	36.82	148.00	402.00	1.530	0.072
#4	1	Time of Concentration:					0.072
#4	2	5. Nearly bare and untilled, and alluvial valley fans	1.84	12.00	651.00	1.350	0.133
#4	2	Time of Concentration:					0.133
#6	1	1. Forest with heavy ground litter	6.82	15.00	220.00	0.660	0.092
#6	1	Time of Concentration:					0.092
#8	1	1. Forest with heavy ground litter	44.62	290.00	650.00	1.680	0.107
#8	1	Time of Concentration:					0.107
#10	1	1. Forest with heavy ground litter	33.86	215.00	635.00	1.470	0.119
#10	1	Time of Concentration:					0.119
#12	1	1. Forest with heavy ground litter	38.46	255.00	663.00	1.560	0.118
#12	1	Time of Concentration:					0.118
#12	2	5. Nearly bare and untilled, and alluvial valley fans	10.96	48.00	438.00	3.310	0.036
#12	2	Time of Concentration:					0.036
#14	1	5. Nearly bare and untilled, and alluvial valley fans	36.33	105.00	289.00	6.020	0.013
#14	1	Time of Concentration:					0.013
#15	1	5. Nearly bare and untilled, and alluvial valley fans	6.80	10.00	147.00	2.600	0.015
#15	1	Time of Concentration:					0.015
#16	1	5. Nearly bare and untilled, and alluvial valley fans	12.64	55.00	435.00	3.550	0.034
#16	1	Time of Concentration:					0.034
#17	1	5. Nearly bare and untilled, and alluvial valley fans	3.43	6.00	175.00	1.850	0.026
#17	1	Time of Concentration:					0.026
#17	2	1. Forest with heavy ground litter	36.39	115.00	316.00	1.520	0.057
#17	2	Time of Concentration:					0.057

NECC TR-66

***RDA Haul Road
Ditch 55***

100-year, 24-hour event

Tamme Bishop

J.E. Stover & Associates, Inc.
2352 N. 7th Street, Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: tamme.jestover@bresnan.net

Structure Detail:

Structure #2 (Riprap Channel)

Ditch 55

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	2.0:1	2.0:1	9.0	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.90 cfs	
Depth:	0.57 ft	1.57 ft
Top Width:	5.28 ft	9.28 ft
Velocity:	5.88 fps	
X-Section Area:	2.36 sq ft	
Hydraulic Radius:	0.426 ft	
Froude Number:	1.55	
Manning's n:	0.0430	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure Detail:

Structure #3 (Culvert)

Culvert 81

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (K _e)
95.00	10.00	0.0240	2.00	0.00	0.90

Culvert Results:

Design Discharge = 13.90 cfs

Minimum pipe diameter: 1 - 30 inch pipe(s) required

NECC TR-66

Drainage Revisions near RDA conveyor

Ditch 19

Ditch 11 (localized area)

Tamme Bishop

J.E. Stover & Associates, Inc.
2352 N. 7th Street, Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: tamme.jestover@bresnan.net

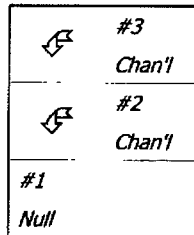
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Structure Networking:

Type	Stru #	(flows Into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	
Channel	#2	==>	#1	0.000	0.000	Ditch 19
Channel	#3	==>	#1	0.000	0.000	Ditch 11 - localized



Structure Detail:

Structure #2 (Erodible Channel)

Ditch 19

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	3.4	0.0250	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.27 cfs	
Depth:	0.66 ft	0.96 ft
Top Width:	2.65 ft	3.85 ft
Velocity:	4.88 fps	
X-Section Area:	0.88 sq ft	
Hydraulic Radius:	0.296 ft	
Froude Number:	1.50	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	1.480	0.051	0.000	0.000	87.000	TR55	2.62	0.214
Σ		1.480						2.62	0.214
#2	1	0.930	0.042	0.000	0.000	87.000	TR55	1.65	0.134
	2	3.800	0.269	0.000	0.000	74.000	TR55	3.10	0.288
Σ		4.730						4.27	0.422
#1	Σ	6.210						6.90	0.636

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	10.00	287.00	1.860	0.042
#2	1	Time of Concentration:					0.042
#2	2	1. Forest with heavy ground litter	18.90	200.00	1,058.00	1.090	0.269
#2	2	Time of Concentration:					0.269
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.55	18.00	396.00	2.130	0.051
#3	1	Time of Concentration:					0.051

Exhibit 19(25)
One New Culvert - TR-70
Determine Effect of Installing New Culvert C-19
Reference Map 13

Basis for Calculations:

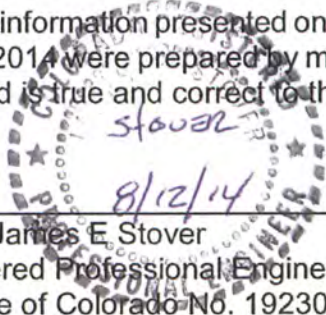
1. New Culvert C-19 adds flow to Ditch D-15 and all ditches and culverts downstream of Ditch D-15. The following table presents the flow values for C-19 and the downstream structures based on approved flow values in Tables 20 and 21.

Structure	Flow (cfs)	Cumulative Flow (cfs)	Comment
C-19	3.98		Flow from C-9, Table 21
D-15	8.75	12.73	Flow of 8.75 cfs from Table 20
C-72		12.73	Conveys D-15 Flow
C-73		12.73	Conveys D-15 Flow
C-74		12.73	Conveys D-15 Flow
C-13	12.14	24.87	10 Year Flow from D-12 and D-14, MR-112
D-32		24.87	Handles Cumulative Flow
C-64		24.87	Conveys D-32 Flow
C-65		24.87	Conveys D-32 Flow
D-32A	0.1	24.97	Flow from Table 20
D-32B	0.34	25.31	Flow from Table 20
D-22A	21.51	46.82	Flow from Table 20
C-22		46.82	Optional Culvert
C-32		46.82	Conveys D-22 Flow to Pond 007A

2. The following SedCad utility runs determine the culvert and ditch sizes based on the flow values in the above table. SedCad runs are not provided for contributing culvert C-13 and Ditch D-22.
3. The revised culvert and ditch sizes and flows are incorporated into Tables 20 and 21.

ENGINEER'S CERTIFICATION

The calculations and information presented on pages EXH 19(25)-2 through 19(25)-11 with a date of August 12, 2014 were prepared by me during the month of August 2014, and the information presented is true and correct to the best of my knowledge and belief.


James E. Stover
Registered Professional Engineer
State of Colorado No. 19230

Date

Culvert C-19

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	1.00	0.0150	1.20	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 3.98 cfs

Maximum Headwater = 1.20 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (15 in)	Discharge (cfs) (18 in)	Discharge (cfs) (21 in)
0.12	0.11	0.13	0.16
0.24	0.31	0.37	0.43
0.36	0.57	0.68	0.79
0.48	0.88	1.05	1.22
0.60	1.22	1.47	1.71
0.72	1.61	1.92	2.24
0.84	2.02	2.42	2.82
0.96	2.47	2.96	3.45
1.08	2.94	3.53	4.11
1.20	3.44	4.13	4.82
1.32	3.97	4.76	5.56
1.44	4.49	5.43	6.33
1.56	4.96	6.12	7.14
1.68	5.39	6.84	7.98
1.80	5.79	7.50	8.85

Ditch D-15

Material: Alluvial silts colloidal

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	1.0	0.0250	0.30			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	12.73 cfs	
Depth:	1.42 ft	1.72 ft
Top Width:	4.26 ft	5.16 ft
Velocity:	4.20 fps	
X-Section Area:	3.03 sq ft	
Hydraulic Radius:	0.591 ft	
Froude Number:	0.88	

Culverts C-72, C-73 & C-74

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
190.00	1.00	0.0150	2.10	1.70	0.90

Culvert Results:

Minimum pipe diameter: 1 - 24 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 12.73 cfs

Maximum Headwater = 2.10 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (21 in)	Discharge (cfs) (24 in)	Discharge (cfs) (30 in)
0.21	0.35	0.40	0.52
0.42	1.00	1.15	1.43
0.63	1.84	2.10	2.62
0.84	2.82	3.23	4.03
1.05	3.94	4.51	5.63
1.26	5.18	5.92	7.40
1.47	6.53	7.46	9.33
1.68	7.98	9.12	11.40
1.89	9.52	10.88	13.60
2.10	11.06	12.74	15.93
2.31	12.26	14.70	18.38
2.52	13.43	16.24	20.94
2.73	14.38	17.75	23.61
2.94	14.86	19.14	26.23
3.15	15.32	20.43	28.37

Ditch D-32

Material: Alluvial silts colloidal

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.5:1	1.5:1	1.0	0.0250	0.30			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.87 cfs	
Depth:	1.28 ft	1.58 ft
Top Width:	5.84 ft	6.74 ft
Velocity:	4.96 fps	
X-Section Area:	5.02 sq ft	
Hydraulic Radius:	0.758 ft	
Froude Number:	0.94	

Culverts C-64 & C-65

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	1.00	0.0150	4.10	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 24 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 24.87 cfs

Maximum Headwater = 4.10 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (21 in)	Discharge (cfs) (24 in)	Discharge (cfs) (30 in)
0.41	0.97	1.11	1.38
0.82	2.72	3.11	3.89
1.23	5.00	5.71	7.14
1.64	7.70	8.80	10.99
2.05	10.74	12.29	15.37
2.46	13.11	15.84	20.20
2.87	15.18	18.69	25.45
3.28	16.65	21.20	29.71
3.69	17.92	23.41	33.57
4.10	19.10	25.11	37.04
4.51	20.22	26.67	40.19
4.92	21.28	28.15	43.14
5.33	22.28	29.54	45.88
5.74	23.25	30.88	48.47
6.15	24.17	32.17	50.92

Ditch D-32A

Material: Stiff clay very colloidal

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.5:1	1.5:1	1.0	0.0250	0.30			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.97 cfs	
Depth:	1.28 ft	1.58 ft
Top Width:	5.85 ft	6.75 ft
Velocity:	4.96 fps	
X-Section Area:	5.03 sq ft	
Hydraulic Radius:	0.760 ft	
Froude Number:	0.94	

Ditch D-32B

Material: Stiff clay very colloidal

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.5:1	1.5:1	1.0	0.0250	0.30			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	25.30 cfs	
Depth:	1.29 ft	1.59 ft
Top Width:	5.87 ft	6.77 ft
Velocity:	4.98 fps	
X-Section Area:	5.08 sq ft	
Hydraulic Radius:	0.764 ft	
Froude Number:	0.94	

Ditch D-22A

Material: Stiff clay very colloidal

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.5:1	1.5:1	1.0	0.0250	0.30			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	46.82 cfs	
Depth:	1.74 ft	2.04 ft
Top Width:	7.22 ft	8.12 ft
Velocity:	5.84 fps	
X-Section Area:	8.02 sq ft	
Hydraulic Radius:	0.969 ft	
Froude Number:	0.98	

Culvert C-22

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	1.00	0.0150	4.00	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 36 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 46.82 cfs

Maximum Headwater = 4.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (30 in)	Discharge (cfs) (36 in)	Discharge (cfs) (42 in)
0.40	1.33	1.59	1.86
0.80	3.75	4.50	5.24
1.20	6.88	8.26	9.63
1.60	10.59	12.71	14.83
2.00	14.81	17.77	20.73
2.40	19.46	23.36	27.25
2.80	24.53	29.43	34.34
3.20	28.90	35.96	41.95
3.60	32.77	42.27	50.06
4.00	36.22	47.70	58.63
4.40	39.37	52.64	65.63
4.80	42.29	57.14	72.28
5.20	45.03	61.31	78.36
5.60	47.60	65.22	84.01
6.00	50.04	68.92	89.30

Culvert C-32

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
30.00	1.00	0.0150	4.00	0.00	0.90

Culvert Results:

C-32 is 33" in diameter. It can handle the design flow with a headwater depth of ~4.5 feet. See the performance curve on the following page.

Detailed Performance Curves

Design Discharge = 46.82 cfs

Maximum Headwater = 4.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (30 in)	Discharge (cfs) (36 in)	Discharge (cfs) (42 in)
0.40	1.33	1.59	1.86
0.80	3.75	4.50	5.24
1.20	6.88	8.26	9.63
1.60	10.59	12.71	14.83
2.00	14.81	17.77	20.73
2.40	19.46	23.36	27.25
2.80	24.53	29.43	34.34
3.20	28.90	35.96	41.95
3.60	32.77	42.27	50.06
4.00	36.22	47.70	58.63
4.40	39.37	52.64	65.63
4.80	42.29	57.14	72.28
5.20	45.03	61.31	78.36
5.60	47.60	65.22	84.01
6.00	50.04	68.92	89.30



Doc Date
12/11/2001

S/E "EXHIBIT 19 -

19

Allen Mine Hydrologic Balance of Surface Runoff "

ALLEN MINE

HYDROLOGIC BALLANCE OF SURFACE RUNOFF

INDEX:	PAGE
Section Narative and References	2
Sedimentation Pond 004	
Summary of Calculations	9
Map with Cross Section	10
Sedimentation Pond 005	
Summary of Calculations	11
Map with Cross Section	12
Sedimentation Pond 006	
Summary of Calculations	13
Map with Cross Section	14
Sedimentation Pond 007	
Summary of Calculations	15
Map with Cross Section	16
Drainage	
Table 1 Undisturbed Drainage Basins	17
Table 2 Undisturbed Drainage Channels	18
Table 3 Disturbed Drainage Basins	19
Table 4 Disturbed Drainage Channels	20
Area Map	21
Calculations	
Runoff and Channel Flow Calculations	22
Calculation Printouts	
Program Printouts	
Reference Materials	

SECTION NARRATIVE AND REFERENCES

NOTE:

This section is composed of design criteria, area runoff and ditch capacity calculations of the sedimentation control structures at the Allen Mine. This reference material is to be used with section 2.05.3 of the permit and in conjunction with maps 9 (A&B) and 13 (A,B, & C).

As a point of clarification, ponds 004, 005, 006, and 007 were named in reference to their NPDES permit numbers for consistency. At the Allen Mine there are no ponds 001, 002, or 003. Labels 001, 002, and 003 refer to water discharge points from sources other than storm runoff.

REFERENCE:

Climatological Data from:

Technical Paper No. 40 Rainfall Frequency
Atlas of the United States (U.S. Department of
Commerce, Weather Bureau, 1961)

Soil and Water Conservation Planning, Ciruela
Canyon (U.S. Department of Agriculture, Soil
Conservation Service, 1976)

Hydrology from:

Hydrology and Sedimentology of Surface Mined
Lands (G.T. Haan & B.J. Barfield, 1978)

Handbook of Steel Drainage & Highway
Construction Products (American Iron and Steel
Institute, 1971)

Allen Mine

Drainage and Sediment Control Plan

Surface water at the Allen Mine is controlled by a system of diversion structures and sedimentation control devices. The system is designed with two separate objectives. First the storm runoff from areas undisturbed by mining is diverted to keep it out of the disturbed surface areas before reporting to the Purgatorie River. The second system controls runoff silting through sedimentation ponds, and by the surfacing of small areas with cleaned gravel to prevent excessive silting.

All engineering work was done using accepted practices with Hydrology and Sedimentology of Surface Mined Lands by Haan and Barfield as guideline. Publications by the Soil Conservation were also used in the engineering design of the system.

Drainage Areas Undisturbed by Mining

Runoff from the undisturbed areas around the mine site is channeled through various ditches and made to report into the Purgatorie River. Runoff from the hillside south of the mine site is diverted around the disturbed areas towards the east and the west from a point due south of the office

building. The runoff flowing west is diverted around the storage yards and reports to the Middle Fork of the Purgatorie River at a point where the main access road crosses the river. The runoff flowing east is diverted around the tipple building and silos and reports to the river approximately 500 feet east of pond 007 beyond the lower most point of the mine site. All ditches have been seeded or rip-rapped as necessary to prevent further silting of the runoff waters. Table 1 lists and describes the undisturbed areas where water is diverted. Table 2 lists and describes the diversion channels.

Drainage Areas Disturbed by Mining

The excessive silting of surface disturbed runoff is controlled by two basic means. Runoff from the large industrial areas and spoil piles near the east portal is diverted to settlement ponds. The west portal areas have been surfaced with gravel to prevent silting. This runoff is channeled into the river and prevented from entering the settlement pond system.

Surface runoff from the active spoils pile along the west side of the main access road and just south of U.S. Highway 12, is channeled to pond 004. This pond is designed to act as a settlement facility for this active spoils area as well as future spoils areas adjacent to the west side of the

pond. Pond 005 is designed to treat the runoff from the storage yards immediately west of it. The pond and the storage yards are located between the railroad and the Purgatorie River near the Colorado and Wyoming Railroad's shops and south of pond 004. Drainage from the south embankment of the active spoils pile mentioned previously, is channeled to pond 006. [The runoff from the storage yards east of pond 005, the topsoil storage areas, the revegetation test plots, and the strip between the railroad tracks and the river extending from the main access road east to pond 006, is also channeled to pond 006 for settlement prior to discharge.] All runoff from the active disturbed areas south of the railroad tracks as well as the small areas below pond 006 north of the tracks, is channeled into pond 007. Tables 3 and 4 list and describe all drainage areas and channels respectively for pond settlement of runoff waters.

not
any
more

Settlement times in the ponds is controlled by perforated drainage risers as well as manually operated stop-gates at the discharge boxes. Because of the manually controlled discharges, short-circuiting of runoff can be eliminated and the entire runoff load sufficiently settled prior to discharge. The emergency spillways will have more than one foot of freeboard when passing the peak flows of the ditches feeding the ponds. They will also pass the runoff from a 25Yr-24Hr storm event with an even greater freeboard. The pond discharge points have concrete box structures and rip-

rap dispersion basins to prevent erosion and re-silting before the water reports to the river. The ponds are designed to hold a sediment load of one-tenth (1/10) acre-foot of sediment per acre of drainage area. The ponds can retain more than the runoff from a 10Yr-24Hr storm event with a full sediment load. The runoff will be retained until the water has cleared, at which time the manually operated discharge gates will be opened. After draining, the gates will be closed to catch further precipitation runoff.

Water quality is also maintained through measures other than sedimentation ponds and diversions. Sedimentation ponds are expensive both in terms of mining costs and in cost to the environment as they destroy much grazing and foraging ground that would otherwise be unaffected. Light-activity areas west of the main access road have been surfaced with gravel in order to prevent silting of runoff waters. The areas around the west portal facilities have been surfaced with six inches of cleaned gravel as an alternative to pond settlement of silt. All waters treated by alternative means report directly to the Purgatorie River.

Engineering Design Calculations

For estimating surface runoff the Soil Conservation Service has identified the topsoil in and around the Allen Mine area

as "Table Mountain Loam". The Table Mountain series in this area consists of sandy to clay loams. They are well drained and have a moderately low (0.25) erosion factor. The more sandy and silty loams are on the hillsides above the main channels and the clay loams tend to be on the low stream terraces. The diverted drainages are from the upper terraces and hillsides which are generally of a more sandy nature and of a greater porosity. In estimating runoff coefficients for these areas, a sandy-clay type of loam was assumed because of the several soil varieties involved. All areas were assumed to have some clay-bearing soils which have high runoff potentials.

Runoff coefficients for the industrial areas were estimated to have a fairly high runoff potential. These areas are the lower horizons of the sandy-clay loams but because of little or no vegetation cover and relatively high traffic levels they will have higher runoff characteristics. Some drainage areas contain areas that have been unaffected or revegetated. The coefficients for these areas reflect the combination of high and low runoff characteristics. The refuse piles, though not presently vegetated, are relatively permeable and will yield little runoff. The runoff coefficients for these areas have, however, been estimated for their final revegetated state which will have a greater runoff potential.

The Rational Method of storm runoff calculation was used throughout. In calculating peak runoffs for the individual areas the rainfall intensity for a storm duration equal to the time of concentration for that area and having a storm occurrence frequency of ten (10) years was used. All formulas and coefficients for calculating surface runoff came from Haan and Barfield. Open channel flows were calculated with Mannings Equation. All culverts were designed to run open so no additional structures would be necessary to provide head to the pipes. Total volume of runoff was calculated using the rainfall intensity of a 10-year-24-hour storm event predicted for this area. The intensity for all areas near and around Stonewall, and Weston, Colorado, is 3.0 inches of rainfall for the 10-year-24-hour event. Weather Bureau Technical Paper No. 40, Rainfall Frequency Atlas of the United States was the source of climatological data for rainfall intensities for the Weston, Colorado, area. Its guidelines were used in estimating storm intensities for storm durations not specifically detailed in the publication. As runoff from different areas reports to a given channel, the total of the peak runoff flows is used as the design flow for the channel. Rather than recalculating a new, longer, saturation period and lesser flow, this calculation yields a simpler and more conservative design.

Allen Mine

Sedimentation Pond 004

Summary of Calculations

Contributing Areas:

<u>Area</u>	<u>Acres</u>	<u>Runoff</u> <u>10Yr-24Hr</u>	<u>Storm Intensity</u> <u>10Yr-Peak (IPH)</u>
004-1	5.8	0.47	3.65

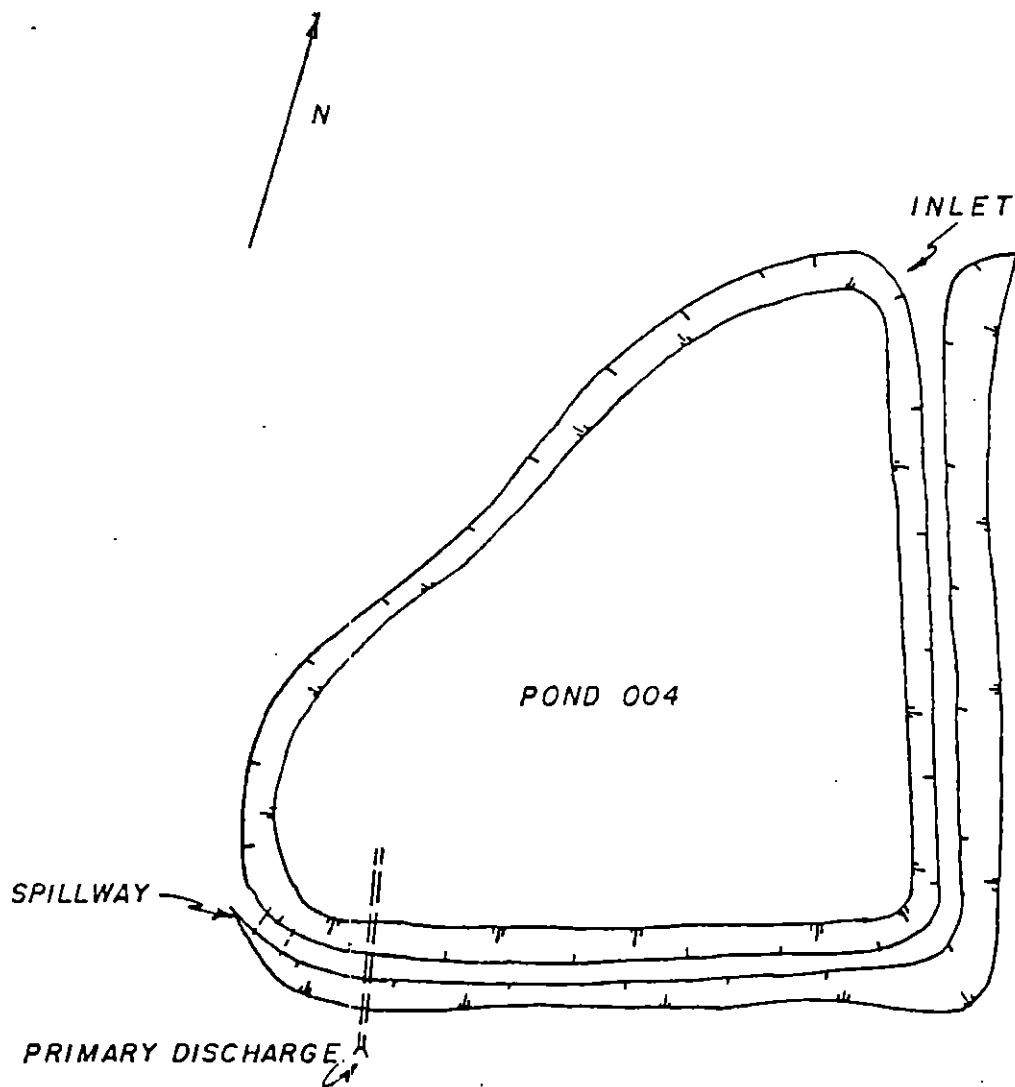
Sediment Detention:

60% Sediment load: 0.06 Ac-Ft per acre requires 0.35 Ac-Ft
100% sediment load: 0.10 Ac-Ft per acre requires 0.58 Ac-Ft

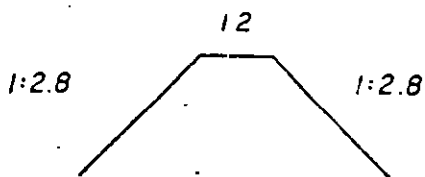
<u>Storage</u>	<u>Volume</u> <u>Ac-Ft</u>	<u>Surface</u> <u>Acres</u>	<u>Elevation</u>
Bottom Pond	-	1.69	7,448.0'
60% Sediment	0.35	1.70	7,448.2'
100% Sediment	0.23	1.72	7,448.5'
Runoff	0.47	1.92	7,449.0'
To Spillway	2.22	2.12	7,452.0'
Top of Pond	-	-	7,454.5'
TOTAL	3.27		

Emergency Spillway:

The spillway will pass a 25-year, 24-hour storm event. A one-foot freeboard will be maintained.



TYPICAL SECTION



SHORT CIRCUIT ANALYSIS

$A = 38,466$

LENGTH = 430

$L:W = 2.22$

CF&I STEEL CORPORATION
MINING DEPARTMENT
ALLEN MINE
SEDIMENTATION POND 004

DRAWN *Ray C. B. Smith* APPROVED _____
TRACED _____ APPROVED _____
CHECKED _____ CHIEF ENGINEER _____
SCALE _____ DATE _____

Allen Mine

Sedimentation Pond 005

Summary of Calculations

Contributing Areas:

<u>Area</u>	<u>Acres</u>	<u>Runoff</u> <u>10Yr-24Hr</u>	<u>Storm Intensity</u> <u>10Yr-Peak (IPH)</u>
005-1	3.1	0.47	2.84

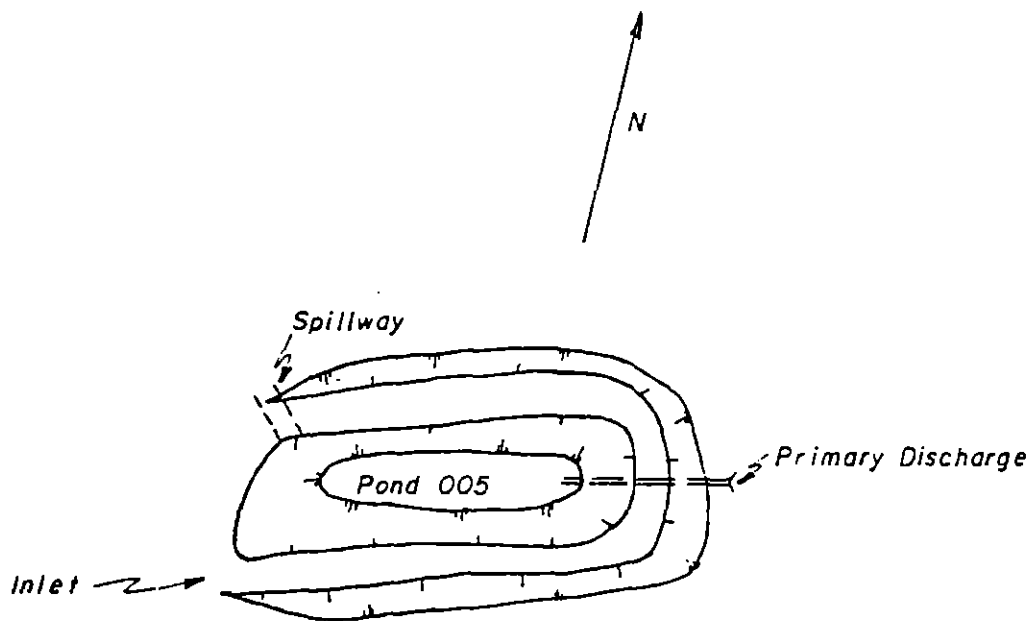
Sediment Detention:

60% Sediment load: 0.06 Ac-Ft per acre requires 0.19 Ac-Ft
100% sediment load: 0.10 Ac-Ft per acre requires 0.31 Ac-Ft

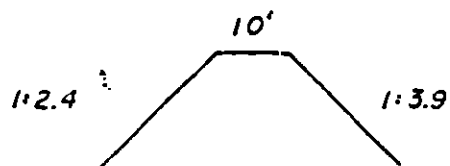
<u>Storage</u>	<u>Volume</u> <u>Ac-Ft</u>	<u>Surface</u> <u>Acres</u>	<u>Elevation</u>
Bottom Pond	-	0.07	7,450.0'
60% Sediment	0.19	0.12	7,452.0'
100% Sediment	0.12	0.14	7,453.0'
Runoff	0.47	0.21	7,456.0'
To Spillway	0.22	0.23	7,457.0'
Top of Pond	-	-	7,459.0'
TOTAL	1.00		

Emergency Spillway:

The spillway will pass a 25-year, 24-hour storm event. A one-foot freeboard will be maintained.



Typical Section



Short Circuit Analysis

Area = 9217
Length = 180
L x W = 3.52

CFBI STEEL CORPORATION
MINING DEPARTMENT
ALLEN MINE
SEDIMENTATION POND 005

DRAWN *Gall, L. D. Gall* APPROVED _____
TRACED _____ APPROVED _____
CHECKED _____ CHIEF ENGINEER
SCALE No Scale DATE 1/29/81

Allen Mine

Sedimentation Pond 006

Summary of Calculations

Contributing Areas:

<u>Area</u>	<u>Acres</u>	<u>Runoff</u> <u>10Yr-24Hr</u>	<u>Storm Intensity</u> <u>10Yr-Peak (IPH)</u>
006-1	2.2	0.20	4.97
006-2	1.4	0.29	2.62
006-3	5.4	0.43	2.54
006-4	3.8	0.60	2.54
006-5	2.8	0.29	4.21
<u>Total</u>	<u>16.4</u>	<u>1.81</u>	

Sediment Detention:

60% Sediment load: 0.98 Ac-Ft per acre requires 0.98 Ac-Ft
100% sediment load: 1.64 Ac-Ft per acre requires 1.64 Ac-Ft

<u>Storage</u>	<u>Volume</u> <u>Ac-Ft</u>	<u>Surface</u> <u>Area</u>	<u>Elevation</u>
Bottom Pond	-	0.67	7,380.0' 7380.63
60% Sediment	0.98	0.78	7,381.4'
100% Sediment	0.66	0.86	7,382.5'
Runoff	1.81	1.02	7,384.5'
To Spillway	4.06	1.30	7,388.0' 7386.15
Top of Pond	-	-	7,390.0' 7390.5
<u>TOTAL</u>	<u>7.51</u>		

Emergency Spillway:

The spillway will pass a 25-year, 24-hour storm event. A one foot freeboard will be maintained.

Allen Mine

Sedimentation Pond 007

Summary of Calculations

Contributing Areas:

<u>Area</u>	<u>Acres</u>	<u>Runoff</u> <u>10Yr-24Hr</u>	<u>Storm Intensity</u> <u>10Yr-Peak (IPH)</u>
007-1	7.0	1.07	3.60
007-2	21.0	2.19	2.24
007-3	1.0	0.16	3.93
007-4	3.8	0.60	2.81
007-5	3.5	0.55	3.29
007-6	<u>1.3</u>	<u>0.21</u>	2.71
Total	37.6	4.78	

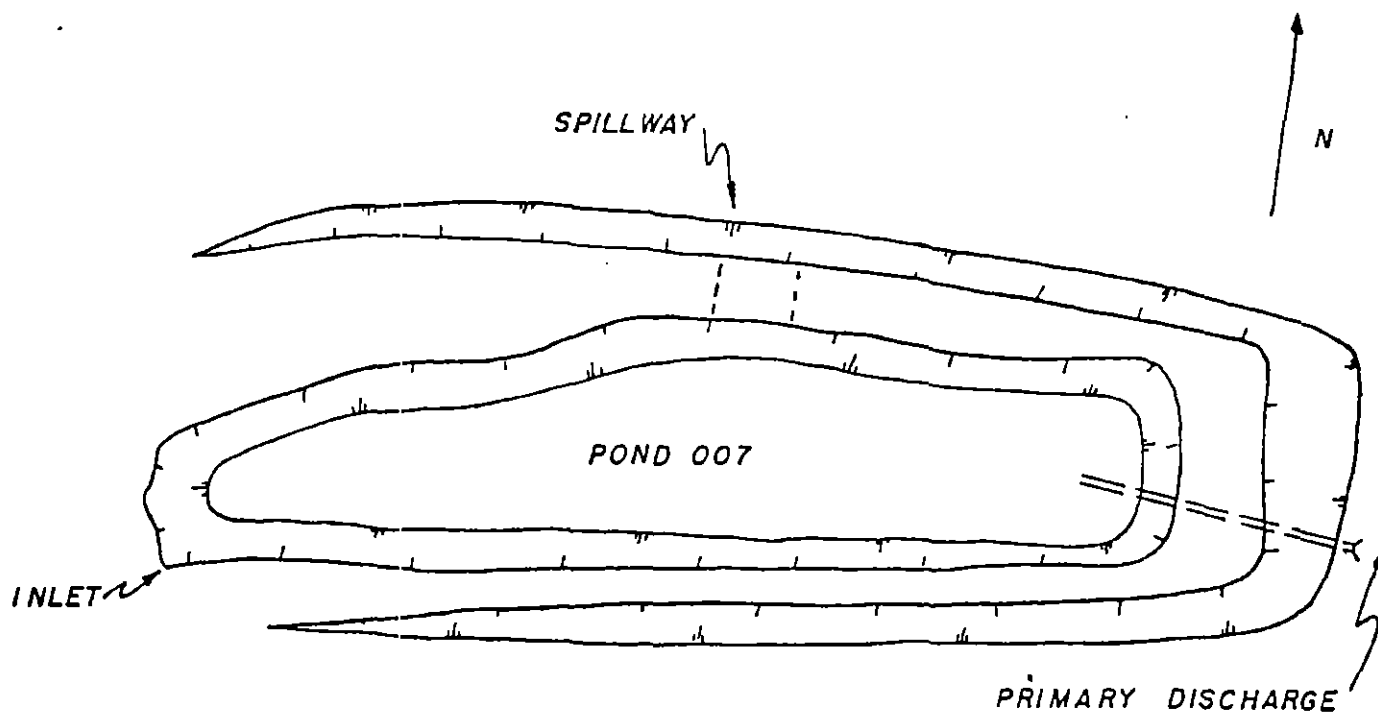
Sediment Detention:

60% Sediment load: 0.06 Ac-Ft per acre requires 2.26 Ac-Ft
100% sediment load: 0.10 Ac-Ft per acre requires 3.76 Ac-Ft

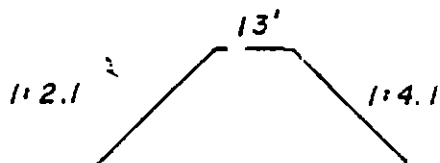
<u>Storage</u>	<u>Volume</u> <u>Ac-Ft</u>	<u>Surface</u> <u>Acres</u>	<u>Elevation</u>
Bottom Pond	-	0.67	7,370.0'
60% Sediment	2.26	0.87	7,372.9'
100% Sediment	1.50	0.98	7,374.5'
Runoff	4.78	1.28	7,379.0' — 2.54 — 2.25
To Spillway	0.65	1.32	7,379.5'
Top of Pond	<u>-</u>	-	7,381.5'
TOTAL	9.19		

Emergency Spillway:

The spillway will pass a 25-year, 24-hour storm event. A one-foot freeboard will be maintained.



TYPICAL SECTION



SHORT CIRCUIT ANALYSIS

AREA = 55,869

L = 440

L:W = 3.5

CF&I STEEL CORPORATION
MINING DEPARTMENT
ALLEN MINE
SEDIMENTATION POND 007

DRAWN *Gay C. B...* APPROVED _____
TRACED _____ APPROVED _____
CHECKED _____ CHIEF ENGINEER
SCALE NONE DATE 1-29-81

Table 1

Allen Mine Undisturbed Drainage Basins

Label	Description	Area Acres	Basin Length Ft	Slope %	Coefficients			Time of Concent Min	10Y-Peak Intens IPH	Runoff	
					Runoff	Ret	CN			10Y-24H Ac-Ft	Peak CFS
JD 1A	Sandy-clay loam Woodland & Pasture	92.5	2,150	46	0.32	0.03	72	21	3.05	6.23	90.14
JD 1B	Sandy-clay loam Woodland & Pasture	70.3	1,725	37	0.32	0.03	72	21	3.02	4.74	68.02
JD 2A	Sandy-clay loam Woodland & Pasture	15.9	1,975	32	0.32	0.03	72	24	2.84	1.07	14.43
JD 2B	Sandy-clay loam Woodland & Pasture	18.9	1,550	35	0.32	0.03	72	20	3.17	1.27	19.14
JD 2C	Sandy-clay loam Woodland & Pasture	68.2	2,250	38	0.32	0.03	72	23	2.95	4.59	64.46

Table 2

Allen Mine

Drainage Structures for Undisturbed Runoff

Undisturbed Areas South of Mine Site

Channel	In-Flow	Shape	Dimensions			Slope %	Length Ft	Man. No.	Flow CFS	10-Yr Peak		
			Dep	Top	Bottom					Flow CFS	Depth FT	Vel FPS
Ditch 1A	UD 1A	Trap	2.0	12.0	0.0	6.6	1,595	0.04	110.6	90.1	1.8	8.8
Ditch 2A	UD 2A	Prab	2.0	10.0		3.5	840	0.04	105.1	14.4	0.8	4.4
CMP-2	D. 1A											
	D. 2A	Circ	4.0			3.7	270	0.024	149.7	104.6	2.5	12.9
Ditch 1B	UD 1B	Trap	2.0	12.0	0.0	3.0	2,680	0.04	74.9	68.0	1.9	6.1
CMP-1	D.1B	Circ	4.0			3.8	130	0.024	151.7	68.0	1.9	11.7
Ditch 2B	UD 2B	Parb	1.0	15.0		8.5	375	0.04	82.0	19.1	0.5	5.3
CMP-3	D.2B	Circ	4.0			3.5	70	0.024	145.6	19.1	1.0	
CMP-3A	CMP3	Circ	4.0			3.1	72	0.024	137.0	19.0	1.0	7.7
Ditch 2C	UD 2C	PRAB	2.0	15.0		7.5	730	0.04	239.0	64.5	1.1	8.1
CMP-4	D.2C	Circ	4.0			6.5	200	0.024	198.4	64.5	1.6	14.1

Discharge to Purgatoire River

Table 3

Allen Mine Disturbed Drainage Basins

Label	Description	Area Acres	Basin Length Ft	Slope %	Coefficients			Time of Concent Min	10Y-Peak Intens IPH	Runoff	
					Runoff	Ret	CN			10Y-24H Ac-Ft	Peak CFS
004-1	Waste Dump	5.8	365	7	0.35	0.025	75	15	3.65	0.47	7.47
005-1	Industrial Area	3.1	1,070	2	0.50	0.02	88	25	2.84	0.47	4.40
006-1	Waste Dump & Reveg	2.5	135	22	0.35	0.025	75	6	4.97	0.20	4.32
006-2	Industrial Area	1.9	980	1	0.50	0.02	88	28	2.62	0.29	2.54
006-3	Waste Dump & Reveg	5.4	1,215	4	0.35	0.003	75	60	1.54	0.43	2.89
006-4	Indstrl Area/Park Lot	3.8	1,420	2	0.50	0.02	89	28	2.64	0.60	5.04
007-1	Gravel Indstrl/Rdways	7.0	1,005	4	0.50	0.02	88	16	3.60	1.07	12.68
007-2	Gravel Indstrl/Rdways	21.0	1,455	4	0.40	0.025	80	37	2.24	2.19	18.82
007-3	Gravel Industrial	1.0	375	3	0.50	0.02	89	12	3.93	0.16	2.03
007-4	Gravel Railroad & Reveg	3.8	1,280	2	0.50	0.02	89	26	2.81	0.60	5.34
007-5	Gravel Railroad & Reveg	3.4	580	2	0.50	0.02	89	17	3.29	0.55	5.68
007-6	Gravel Railroad & Reveg	1.3	1,250	2	0.50	0.02	89	27	2.72	0.21	1.81

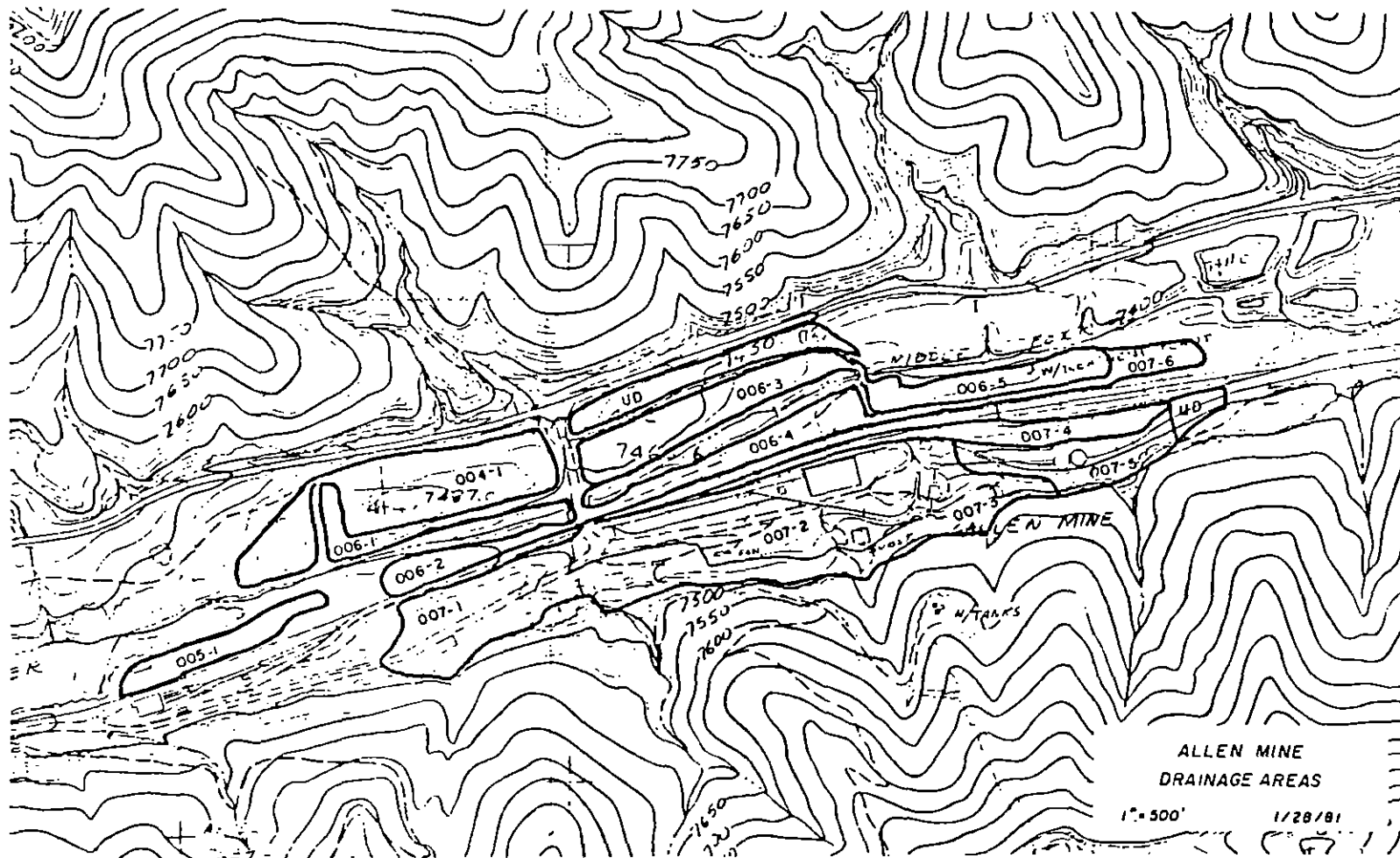
Table 4

Allen Mine

Drainage Structures for Disturbed Runoff

Disturbed Areas of the Mine Site

Channel	In-Flow	Shape	Dimensions			Slope %	Length Ft	Man. No.	Flow CFS	10-Yr Peak		
			Dep	Top	Bottom					Flow CFS	Depth FT	Vel FPS
Ditch 6	004-1	TRAP	2.0	30.0	0.0	0.18	1,155	0.04	47.0	7.5	1.0	
Spillway												
004	D.6	TRAP	2.0	18.0	10.0	1.0	15	0.04	135.0	7.5	0.4	1.8
Inlet												
005	005-1	PRAB	1.5	20.0		2.0	75	0.04	104.0	4.4	0.4	2.0
Spillway												
005	005	TRAP	3.0	28.0	10.0	1.0	25	0.04	332.5	4.4	0.3	1.5
Ditch 7	006-1	TRAP	1.0	20.0	0.0	1.7	1,415	0.04	30.8	4.3	0.5	1.9
Ditch 8	006-3	TRAP	1.5	14.0	0.0	3.1	1,235	0.04	55.4	2.9	0.5	2.5
CMP-9	D.8-1	Circ	2.0			2.1	70	0.024	17.3	2.9	0.6	4.1
Ditch 8-2	006-2	TRAP	1.5	12.0	6.0	1.4	230	0.04	62.4	9.8	0.5	2.6
MP-10	D.8-2	Circ	1.2			2.0	50	0.01	9.9	3.2	0.5	8.3
3 Pipes	D.8-2	Circ	1.2			2.0	50	0.01	29.7	9.8	0.5	8.3
Ditch 8-3	006-5	TRAP	2.0	16.0	8.0	2.1	780	0.04	162.2	15.0	0.5	3.2
006	D.8-3	TRAP	2.0	19.0	10.0	1.0	45	0.04	138.7	15.0	0.6	2.3
Ditch 9-1	007-1	TRAP	1.0	25.0	0.0	1.9	1,695	0.04	40.3	12.7	0.6	2.4
CMP-11	D.9-1	Circ	5.0			1.5	100	0.024	172.8	31.5	1.4	6.7
CMP-12	007-3	Circ	1.5			1.2	160	0.024	6.4	2.0	0.6	3.2
Ditch 9-2	007-4	TRAP	5.0	14.0	3.0	31.4	860	0.04	330.5	38.9	1.8	4.5
Ditch 10	007-5	TRAP	1.0	12.0	0.0	1.9	230	0.04	19.2	5.7	0.6	1.9
CMP-13	D.9-2	Circ	3.5			4.0	120	0.024	109.0	44.6	1.6	10.8
007	007-6	TRAP	2.5	23.0	10.0	1.0	30	0.04	220.3	46.4	1.1	3.4



REDUCTION COPY
SCALE 1" = 765'

Runoff and Channel Flow Calculations

Program Narrative

All runoff and channel flow calculations were performed by a program developed by CF&I for use on a Hewlett-Packard 41-C micro-computer. The calculation print-outs are included with this report. All formulas for the runoff calculations came from Hydrology and Sedimentology of Surface Mined Lands by C.T. Haan and B.J. Barfield, (1978). Rainfall data was from Technical Paper No. 40, Rainfall Frequency Atlas of the United States by the U.S. Department of Commerce, Weather Bureau, (1961).

In determining Peak runoff flows for the various drainages it was first necessary to estimate rainfall intensities for the rainfall durations which would equal the times of concentration for the drainage basins to be evaluated. That is to say that every drainage characteristically has a definite time in which the entire surface is saturated and contributing runoff to the collecting drainage. This time is dependant on the intensity of the storm. Characteristically storm events have a higher intensity as their duration decreases. With the time of concentration and the required storm intensity being dependant on one another, trial times of concentration were tested to calculate the rainfall intensity required to saturate the area. The time of concentration and the calculated intensity most nearly matching the rainfall duration-

intensity curve for storms in the Weston, Colorado, area having a probable frequency interval of 10 years was used to predict the peak runoff. The rainfall duration-intensity curve was developed using the Rainfall Intensity Atlas. Because the Atlas has only limited durations (30-min, 1-hr, etc.) a closest, least-squares fit, logarithmic curve using extrapolation guidelines, also from the Atlas, was developed for the rainfall durations from 5 to 40 minutes, for one minute intervals. This curve, though only an estimate, gave better rainfall intensities for the small drainage areas. Using only the 30-minute intensity available directly from the Atlas would give unacceptable results. The curve is included with the calculation print-outs. The total volume of runoff from a 10-year-24-hour storm event was calculated using a total rainfall of 3.0 inches taken directly from the Atlas.

The computer program developed for these calculations calls for the required parameters to evaluate the runoff. The input parameters for calculating runoff are:

- Acres of land in the basin,
- Length of overland flow across the basin,
- Slope of the basin,
- Runoff coefficient, water absorption,
- Retardance coefficient, flow rate,
- Chart Number, topsoil conditions,
- Time of Concentration, estimate for determination,
- Total Rainfall for storm event, 10-yr-24-hr.

Program output lists all the input parameters and the calculated parameters, which are:

- 10-year peak rainfall intensity to saturate,
- Runoff in inches, 10-yr-24-hr,
- Runoff in acre-feet, 10-yr-24-hr,
- Peak flow in cubic feet per second.

These print-outs have the heading "RUNOFF" for each drainage basin. For open channel flow calculations, the program calls for the following parameters:

- Channel shape, trapezoidal, parabolic, & circular,
- Dimensions, depth, top, and bottom, or, diameter,
- Slope, feet drop per foot run,
- Length, feet,
- Mannings Number, roughness coefficient.

The program then calculates the maximum full flow characteristics of the channel. This maximum flow is not the design flow. The design flow is the total runoff that will influence the channel as calculated previously. The program then prints the input parameters as well as the following calculated values:

- Wetted Perimeter, feet,
- Hydraulic Radius, feet,
- Velocity, feet per second,
- Time through channel, minutes.

The program then asks for any new design parameters. These could be:

- Depth of flow, feet,
- Velocity of flow, feet per second,
- Flow, cubic feet per second,
- Mannings Number, roughness coefficient.

The flow parameters are then recalculated and printed as above. The final design flows included with this application are the values printed under "NEW FLOW" in the lower portion of each "OPFLOW" calculation. A complete printout of the program is included for inspection of the formulas and its general operation.

The program "WATER PIPES" was used to calculate full flowing pipes which cannot be calculated as open channel flows. This program also uses the Manning Formula for pipe roughness and head losses. It gives a more direct calculation of the flow though it is not as accurate as the Darcy-Weisbach Formula. The input parameters call for shape, size, roughness factors (Manning's Number), water head, and other required information to calculate the friction factors for various pipe elements. Entrance, pipe length, constriction, elbow, discharge, and miscellaneous friction factors are calculated. The flow for the available head is then calculated using Bernoulli's Equation and the flow parameters are then printed. New water heads may then be input into the program to design required flows. There were no culverts requiring this calculation as all culverts are designed to flow open.

ALLEN MINE RUNOFF CALCULATIONS

runoff
UD 1A
SIZE
Ac = 92.460
L = 2,150.000
S = 0.455

COEF
C = 0.320
c = 0.030

INTEN
Tc = 21.000
I = 3.647 in

VOL
CN = 72.000
Qin = 3.000
Qrnf = 0.000 in
VOL = 6.226 ac ft

FLOW
Qp = 90.144 cfs

runoff
UD 1B
SIZE
Ac = 70.310
L = 1,725.000
S = 0.370

COEF
C = 0.320
c = 0.030

INTEN
Tc = 21.000
I = 3.827 in

VOL
CN = 72.000
Qin = 3.000
Qrnf = 0.000 in
VOL = 4.735 ac ft

FLOW
Qp = 68.0 cfs

runoff
UD 2A
SIZE
Ac = 15.300
L = 1,475.000
S = 0.700

COEF
C = 0.320
c = 0.030

INTEN
Tc = 24.000
I = 2.637 in

VOL
CN = 72.000
Qin = 3.000
Qrnf = 0.000 in
VOL = 1.071 ac ft

FLOW
Qp = 14.434 cfs

runoff
UD 2B
SIZE
Ac = 18.000
L = 1,550.000
S = 0.351

COEF
C = 0.320
c = 0.030

INTEN
Tc = 20.000
I = 3.168 in

VOL
CN = 72.000
Qin = 3.000
Qrnf = 0.000 in
VOL = 1.271 ac ft

FLOW
Qp = 19.130 cfs

runoff
UD 3C
SIZE
Ac = 63.100
L = 2,250.000
S = 0.385

COEF
C = 0.320
c = 0.030

INTEN
Tc = 33.000
I = 2.954 in

VOL
CN = 72.000
Qin = 3.000
Qrnf = 0.000 in
VOL = 4.591 ac ft

FLOW
Qp = 54.453 cfs

ALLEN MINE RUNOFF CALCULATIONS

004-1

SIZE

$A_c = 5.840$

$L = 365.000$

$S = 0.071$

COEF

$C = 0.350$

$c = 0.025$

INTEN

$T_c = 15.000$

$I = 3.654 \text{ in}$

VOL

$CN = 75.000$

$Q_{in} = 3.000$

$Q_{rnf} = 0.961 \text{ in}$

$VOL = 0.468 \text{ ac ft}$

FLOW

$Q_p = 7.469 \text{ cfs}$

005-1

SIZE

$A_c = 3.100$

$L = 1,070.000$

$S = 0.019$

COEF

$C = 0.500$

$c = 0.020$

INTEN

$T_c = 25.000$

$I = 2.842 \text{ in}$

VOL

$CN = 88.000$

$Q_{in} = 3.000$

$Q_{rnf} = 1.818 \text{ in}$

$VOL = 0.470 \text{ ac ft}$

FLOW

$Q_p = 4.405 \text{ cfs}$

ALLEN MINE RUNOFF CALCULATIONS

Runoff #1

006-1

SIZE

Ac = 2.486

L = 135.000

S = 0.222

COEF

C = 0.356

c = 0.025

INTEN

Tc = 6.000

I = 4.973 iph

VOL

CN = 75.000

Qin = 3.000

Qout = 0.961 in

VOL = 0.199 ac ft

FLOW

Qp = 4.316 cfs

Runoff #2

006-2

SIZE

Ac = 1.940

L = 900.000

S = 0.014

COEF

C = 0.500

c = 0.020

INTEN

Tc = 20.000

I = 2.624 iph

VOL

CN = 80.000

Qin = 3.000

Qout = 1.013 in

VOL = 0.294 ac ft

FLOW

Qp = 2.500 cfs

Runoff #3

006-3

SIZE

Ac = 5.380

L = 1,215.000

S = 0.036

COEF

C = 0.350

c = 0.030

INTEN

Tc = 60.000

I = 1.536 iph

VOL

CN = 75.000

Qin = 3.000

Qout = 0.961 in

VOL = 0.431 ac ft

FLOW

Qp = 2.893 cfs

Runoff #4

006-4

SIZE

Ac = 3.010

L = 1,420.000

S = 0.020

COEF

C = 0.500

c = 0.020

INTEN

Tc = 20.000

I = 2.644 iph

VOL

CN = 80.000

Qin = 3.000

Qout = 1.000 in

VOL = 0.603 ac ft

FLOW

Qp = 5.000 cfs

Runoff #5

006-5

SIZE

Ac = 2.750

L = 245.000

S = 0.074

COEF

C = 0.450

c = 0.025

INTEN

Tc = 10.000

I = 4.210 iph

VOL

CN = 80.000

Qin = 3.000

Qout = 1.250 in

VOL = 0.206 ac ft

FLOW

Qp = 5.200 cfs

ALLEN MINE RUNOFF CALCULATIONS

runoff
007-1
SIZE
Ac = 7.050
L = 1,005.000
S = 0.042

COEF
C = 0.500
c = 0.020

INTEN
Tc = 16.000
I = 3.590 in

VOL
CN = 88.000
Qin = 3.000
Qout = 1.818 in
VOL = 1.068 ac ft

FLOW
Qp = 12.687 cfs

runoff
007-2
SIZE
Ac = 21.000
L = 1,455.000
S = 0.039

COEF
C = 0.400
c = 0.025

INTEN
Tc = 37.000
I = 2.241 in

VOL
CN = 88.000
Qin = 3.000
Qout = 1.250 in
VOL = 2.188 ac ft

FLOW
Qp = 10.827 cfs

runoff
007-3
SIZE
Ac = 1.033
L = 375.000
S = 0.031

COEF
C = 0.500
c = 0.020

INTEN
Tc = 12.000
I = 3.929 in

VOL
CN = 89.000
Qin = 3.000
Qout = 1.900 in
VOL = 0.164 ac ft

FLOW
Qp = 2.029 cfs

runoff
007-4
SIZE
Ac = 3.000
L = 1,200.000
S = 0.028

COEF
C = 0.500
c = 0.020

INTEN
Tc = 26.000
I = 2.013 in

VOL
CN = 89.000
Qin = 3.000
Qout = 1.900 in
VOL = 0.602 ac ft

FLOW
Qp = 5.344 cfs

runoff
007-5
SIZE
Ac = 3.450
L = 500.000
S = 0.024

COEF
C = 0.500
c = 0.020

INTEN
Tc = 17.000
I = 3.294 in

VOL
CN = 89.000
Qin = 3.000
Qout = 1.900 in
VOL = 0.546 ac ft

FLOW
Qp = 5.682 cfs

runoff
007-6
SIZE
Ac = 1.330
L = 1,250.000
S = 0.019

COEF
C = 0.500
c = 0.020

INTEN
Tc = 27.000
I = 2.715 in

VOL
CN = 89.000
Qin = 3.000
Qout = 1.900 in
VOL = 0.211 ac ft

FLOW
Qp = 1.806 cfs

ALLEN MINE CHANNEL CAPACITY CALCULATIONS

CHP 10
DITCH 1A
SHAPE

TRPZ
DEPTH = 2.00
TOP = 12.00
BOTTOM = 0.00
SLOPE = 0.6668
LENGTH = 1,595.00
AREA = 12.00
WET PER= 12.65
HYD RAD= 0.95
MAN NO = 0.0408
VEL = 9.21
FLOW = 110.58
TIME = 2.88

NEW FLOW
DEPTH = 1.95
LENGTH = 1,595.00
AREA = 10.30
WET PER= 11.72
HYD RAD= 0.88
MAN NO = 0.0408
VEL = 8.76
FLOW = 90.11
TIME = 3.04

CHP 11
DITCH 2A
SHAPE

TRPZ
DEPTH = 2.00
WIDTH = 10.00
SLOPE = 0.6651
LENGTH = 840.00
AREA = 13.33
WET PER= 11.07
HYD RAD= 1.20
MAN NO = 0.0408
VEL = 7.88
FLOW = 105.07
TIME = 1.79

NEW FLOW
DEPTH = 0.79
LENGTH = 840.00
AREA = 3.20
WET PER= 6.53
HYD RAD= 0.50
MAN NO = 0.0408
VEL = 4.40
FLOW = 14.43

CHP 12
DITCH 1
SHAPE

CIRC
DIAM = 4.00
SLOPE = 0.8378
LENGTH = 270.00
AREA = 12.57
WET PER= 12.57
HYD RAD= 1.00
MAN NO = 0.0240
VEL = 11.91
FLOW = 149.66
TIME = 0.38

NEW FLOW
DEPTH = 2.46
LENGTH = 270.00
AREA = 8.12
WET PER= 7.22
HYD RAD= 1.12
MAN NO = 0.0240
VEL = 12.08
FLOW = 104.57
TIME = 0.35

CHP 13
DITCH 1B
SHAPE

TRPZ
DEPTH = 2.00
TOP = 12.00
BOTTOM = 0.00
SLOPE = 0.6303
LENGTH = 2,600.00
AREA = 12.00
WET PER= 12.65
HYD RAD= 0.95
MAN NO = 0.0408
VEL = 6.24
FLOW = 74.92
TIME = 7.15

NEW FLOW
DEPTH = 1.93
LENGTH = 2,600.00
AREA = 11.16
WET PER= 12.20
HYD RAD= 0.91
MAN NO = 0.0408
VEL = 6.09
FLOW = 66.02
TIME = 7.32

CHP 14
DITCH 1
SHAPE

CIRC
DIAM = 4.00
SLOPE = 0.6050
LENGTH = 130.00
AREA = 12.57
WET PER= 12.57
HYD RAD= 1.00
MAN NO = 0.0240
VEL = 12.07
FLOW = 151.67
TIME = 0.13

NEW FLOW
DEPTH = 1.03
LENGTH = 130.00
AREA = 5.75
WET PER= 6.04
HYD RAD= 0.96
MAN NO = 0.0240
VEL = 11.74
FLOW = 60.02

ALLEN MINE CHANNEL CAPACITY CALCULATIONS

OFF 10
DITCH 28
SHAPE

PRAB
DEPTH = 1.80
WIDTH = 15.00
SLOPE = 0.8850
LENGTH = 375.00
AREA = 10.80
WET PER= 15.18
HYD RAD= 0.66
MAN NO = 0.0400
VEL = 3.20
FLOW = 82.01
TIME = 0.76

NEW FLOW
DEPTH = 0.51
LENGTH = 375.00
AREA = 3.64
WET PER= 10.78
HYD RAD= 0.34
MAN NO = 0.0400
VEL = 5.26
FLOW = 19.14
TIME = 1.19

CMP 3
SHAPE

CIRC
DIAM = 4.00
SLOPE = 0.8350
LENGTH = 70.00
AREA = 12.57
WET PER= 12.57
HYD RAD= 1.00
MAN NO = 0.0240
VEL = 11.50
FLOW = 145.56
TIME = 0.16

NEW FLOW
DEPTH = 0.96
LENGTH = 70.00
AREA = 2.39
WET PER= 4.14
HYD RAD= 0.58
MAN NO = 0.0240
VEL = 3.82
FLOW = 19.14
TIME = 0.15

OFF 10
CMP 3A
SHAPE

CIRC
DIAM = 4.00
SLOPE = 0.8310
LENGTH = 72.00
AREA = 12.57
WET PER= 12.57
HYD RAD= 1.00
MAN NO = 0.0240
VEL = 10.90
FLOW = 136.99
TIME = 0.11

NEW FLOW
DEPTH = 1.01
LENGTH = 72.00
AREA = 2.49
WET PER= 4.21
HYD RAD= 0.59
MAN NO = 0.0240
VEL = 7.60
FLOW = 19.14
TIME = 0.16

OFF 10
DITCH 20
SHAPE

PRAB
DEPTH = 2.00
WIDTH = 15.00
SLOPE = 0.8750
LENGTH = 730.00
AREA = 20.00
WET PER= 15.71
HYD RAD= 1.27
MAN NO = 0.0400
VEL = 11.95
FLOW = 239.00
TIME = 1.02

NEW FLOW
DEPTH = 1.09
LENGTH = 730.00
AREA = 8.00
WET PER= 11.33
HYD RAD= 0.71
MAN NO = 0.0400
VEL = 8.06
FLOW = 64.46
TIME = 1.56

OFF 10
CMP 4
SHAPE

CIRC
DIAM = 4.00
SLOPE = 0.8650
LENGTH = 200.00
AREA = 12.57
WET PER= 12.57
HYD RAD= 1.00
MAN NO = 0.0240
VEL = 15.73
FLOW = 190.37
TIME = 0.21

NEW FLOW
DEPTH = 1.57
LENGTH = 200.00
AREA = 4.57
WET PER= 5.41
HYD RAD= 0.34
MAN NO = 0.0240
VEL = 14.10
FLOW = 64.46
TIME = 0.24

ALLEN MINE CHANNEL CAPACITY CALCULATIONS

OFF 10
DITCH
SHAPE

TRPZ
DEPTH = 2.00
TOP = 30.00
BOTTOM = 0.00
SLOPE = 0.0018
LENGTH = 1.115.00
AREA = 30.00
WET PER= 30.27
HYD RAD= 0.99
MAN NO = 0.0400
VEL = 1.57
FLOW = 47.01
TIME = 11.86

NEW FLOW
DEPTH = 1.00
LENGTH = 1.115.00
AREA = 7.55
WET PER= 15.13
HYD RAD= 0.50
MAN NO = 0.0400
VEL = 0.99
FLOW = 7.47
TIME = 10.79

OFF 10
004 SPILLWAY
SHAPE

TRPZ
DEPTH = 2.00
TOP = 18.00
BOTTOM = 10.00
SLOPE = 0.0100
LENGTH = 25.00
AREA = 20.00
WET PER= 10.94
HYD RAD= 1.48
MAN NO = 0.0400
VEL = 4.82
FLOW = 134.97
TIME = 0.09

NEW FLOW
DEPTH = 0.30
LENGTH = 25.00
AREA = 4.07
WET PER= 11.69
HYD RAD= 0.35
MAN NO = 0.0400
VEL = 1.34
FLOW = 7.47
TIME = 0.23

OFF 10
INLET 005
SHAPE

PRAB
DEPTH = 1.50
WIDTH = 20.00
SLOPE = 0.0200
LENGTH = 75.00
AREA = 20.00
WET PER= 20.30
HYD RAD= 0.99
MAN NO = 0.0400
VEL = 5.20
FLOW = 104.04
TIME = 0.24

NEW FLOW
DEPTH = 0.35
LENGTH = 75.00
AREA = 2.23
WET PER= 9.66
HYD RAD= 0.23
MAN NO = 0.0400
VEL = 1.98
FLOW = 4.41
TIME = 0.63

OFF 10
005 SPILLWAY
SHAPE

TRPZ
DEPTH = 3.00
TOP = 28.00
BOTTOM = 10.00
SLOPE = 0.0100
LENGTH = 25.00
AREA = 57.00
WET PER= 20.97
HYD RAD= 1.97
MAN NO = 0.0400
VEL = 5.63
FLOW = 332.47
TIME = 0.07

NEW FLOW
DEPTH = 0.27
LENGTH = 25.00
AREA = 2.97
WET PER= 11.73
HYD RAD= 0.25
MAN NO = 0.0400
VEL = 1.49
FLOW = 4.41
TIME = 0.20

ALLEN MINE CHANNEL CAPACITY CALCULATIONS

OPF 10
DITCH 7-1
SHAPE

TRPZ
DEPTH = 1.00
TOP = 28.00
BOTTOM = 0.00
SLOPE = 0.0174
LENGTH = 1,415.00
AREA = 10.00
WET PER= 20.10
HYD RAD= 0.50
MAN NO = 0.0400
VEL = 3.08
FLOW = 30.77
TIME = 7.66

NEW FLOW
DEPTH = 0.40
LENGTH = 1,415.00
AREA = 2.29
WET PER= 9.62
HYD RAD= 0.24
MAN NO = 0.0400
VEL = 1.88
FLOW = 4.32
TIME = 12.52

OPF 10
DITCH 8-1
SHAPE

TRPZ
DEPTH = 1.50
TOP = 14.00
BOTTOM = 0.00
SLOPE = 0.0305
LENGTH = 1,235.00
AREA = 10.50
WET PER= 14.32
HYD RAD= 0.73
MAN NO = 0.0400
VEL = 5.20
FLOW = 55.40
TIME = 3.90

NEW FLOW
DEPTH = 0.50
LENGTH = 1,235.00
AREA = 1.14
WET PER= 4.73
HYD RAD= 0.24
MAN NO = 0.0400
VEL = 2.52
FLOW = 2.09
TIME = 3.17

OPF 10
CMP 9
SHAPE

CIRC
DIAM = 2.00
SLOPE = 2.0000
LENGTH = 70.00
AREA = 3.14
WET PER= 6.28
HYD RAD= 0.50
MAN NO = 0.0240
VEL = 55.16
FLOW = 173.29
TIME = 0.02

NEW FLOW
DEPTH = 0.10
LENGTH = 70.00
AREA = 0.14
WET PER= 1.22
HYD RAD= 0.11
MAN NO = 0.0240
VEL = 20.60
FLOW = 2.69
TIME = 0.06

OPF 10
DITCH 8-2
SHAPE

TRPZ
DEPTH = 1.50
TOP = 12.00
BOTTOM = 6.00
SLOPE = 0.0143
LENGTH = 230.00
AREA = 13.50
WET PER= 12.71
HYD RAD= 1.00
MAN NO = 0.0400
VEL = 4.63
FLOW = 62.44
TIME = 0.33

NEW FLOW
DEPTH = 0.53
LENGTH = 230.00
AREA = 3.75
WET PER= 8.38
HYD RAD= 0.45
MAN NO = 0.0400
VEL = 2.60
FLOW = 9.76
TIME = 1.47

OPF 10
MP 10
SHAPE

CIRC
DIAM = 1.17
SLOPE = 0.0200
LENGTH = 50.00
AREA = 1.07
WET PER= 3.67
HYD RAD= 0.29
MAN NO = 0.0100
VEL = 9.24
FLOW = 9.08
TIME = 0.09

NEW FLOW
DEPTH = 0.46
LENGTH = 50.00
AREA = 0.39
WET PER= 1.59
HYD RAD= 0.25
MAN NO = 0.0100
VEL = 3.29
FLOW = 3.25
TIME = 0.10

OPF 10
DITCH 8-3
SHAPE

TRPZ
DEPTH = 2.00
TOP = 16.00
BOTTOM = 8.00
SLOPE = 0.0200
LENGTH = 780.00
AREA = 24.00
WET PER= 16.94
HYD RAD= 1.42
MAN NO = 0.0400
VEL = 6.70
FLOW = 162.18
TIME = 1.92

NEW FLOW
DEPTH = 0.52
LENGTH = 780.00
AREA = 4.71
WET PER= 10.33
HYD RAD= 0.46
MAN NO = 0.0400
VEL = 3.18
FLOW = 14.97
TIME = 4.09

ALLEN MINE CHANNEL CAPACITY CALCULATIONS

OPT 10
006 SPILLWAY
SHAPE

TRPZ
DEPTH = 2.00
TOP = 19.00
BOTTOM = 10.00
SLOPE = 0.0100
LENGTH = 45.00
AREA = 29.00
WET PER= 19.85
HYD RAD= 1.46
MAN NO = 0.0400
VEL = 4.78
FLOW = 138.72
TIME = 0.16

NEW FLOW
DEPTH = 0.57
LENGTH = 45.00
AREA = 6.40
WET PER= 12.79
HYD RAD= 0.50
MAN NO = 0.0400
VEL = 2.34
FLOW = 14.97
TIME = 0.32

OPT 10
DITCH 9-1
SHAPE

TRPZ
DEPTH = 1.00
TOP = 25.00
BOTTOM = 0.00
SLOPE = 0.0191
LENGTH = 1.695.00
AREA = 12.50
WET PER= 25.00
HYD RAD= 0.50
MAN NO = 0.0400
VEL = 3.23
FLOW = 40.34
TIME = 0.75

NEW FLOW
DEPTH = 0.65
LENGTH = 1.695.00
AREA = 5.25
WET PER= 16.25
HYD RAD= 0.32
MAN NO = 0.0400
VEL = 2.42
FLOW = 12.68
TIME = 11.69

OPT 10
CMP 11
SHAPE

CIRC
DIAM = 5.00
SLOPE = 0.0150
LENGTH = 100.00
AREA = 19.63
WET PER= 15.71
HYD RAD= 1.25
MAN NO = 0.0240
VEL = 0.00
FLOW = 172.73
TIME = 0.19

NEW FLOW
DEPTH = 1.45
LENGTH = 100.00
AREA = 4.71
WET PER= 5.68
HYD RAD= 0.03
MAN NO = 0.0240
VEL = 6.69
FLOW = 31.50
TIME = 0.25

OPT 10
CMP 12
SHAPE

CIRC
DIAM = 1.50
SLOPE = 0.0125
LENGTH = 168.00
AREA = 1.77
WET PER= 4.71
HYD RAD= 0.30
MAN NO = 0.0240
VEL = 3.60
FLOW = 6.36
TIME = 0.74

NEW FLOW
DEPTH = 0.50
LENGTH = 168.00
AREA = 0.63
WET PER= 2.02
HYD RAD= 0.31
MAN NO = 0.0240
VEL = 3.20
FLOW = 2.03
TIME = 0.03

OPT 10
DITCH 9-2
SHAPE

TRPZ
DEPTH = 5.00
TOP = 14.00
BOTTOM = 3.00
SLOPE = 0.0130
LENGTH = 860.00
AREA = 42.50
WET PER= 17.07
HYD RAD= 2.30
MAN NO = 0.0400
VEL = 7.78
FLOW = 330.52
TIME = 1.04

NEW FLOW
DEPTH = 1.75
LENGTH = 860.00
AREA = 0.62
WET PER= 8.20
HYD RAD= 1.05
MAN NO = 0.0400
VEL = 4.51
FLOW = 30.87
TIME = 3.18

ALLEN MINE CHANNEL CAPACITY CALCULATIONS

00f10
DITCH 10
SHAPE

TRPZ
DEPTH = 1.00
TOP = 12.00
BOTTOM = 0.00
SLOPE = 0.0190
LENGTH = 230.00
AREA = 6.00
WET PER = 12.17
HYD RAD = 0.49
MAN NO = 0.0400
VEL = 3.20
FLOW = 19.18
TIME = 1.20

NEW FLOW
DEPTH = 0.63
LENGTH = 230.00
AREA = 2.41
WET PER = 7.71
HYD RAD = 0.31
MAN NO = 0.0400
VEL = 2.36
FLOW = 5.63
TIME = 1.63

00f10
DITCH 10
SHAPE

TRPZ
DEPTH = 2.50
TOP = 23.00
BOTTOM = 18.00
SLOPE = 0.0100
LENGTH = 30.00
AREA = 41.25
WET PER = 23.93
HYD RAD = 1.72
MAN NO = 0.0400
VEL = 5.34
FLOW = 220.32
TIME = 0.09

NEW FLOW
DEPTH = 1.00
LENGTH = 30.00
AREA = 13.78
WET PER = 16.00
HYD RAD = 0.36
MAN NO = 0.0400
VEL = 3.36
FLOW = 46.36
TIME = 0.15

00f10
CRP 13
SHAPE

CIRC
DIAM = 3.50
SLOPE = 0.0400
LENGTH = 120.00
AREA = 9.62
WET PER = 11.00
HYD RAD = 0.37
MAN NO = 0.0240
VEL = 11.33
FLOW = 108.99
TIME = 0.18

NEW FLOW
DEPTH = 1.56
LENGTH = 120.00
AREA = 4.14
WET PER = 5.11
HYD RAD = 0.31
MAN NO = 0.0240
VEL = 10.76
FLOW = 44.55
TIME = 0.19

1. accurate
2. Rough
34.0

MAXWELL MINE
RUNOFF CALCULATIONS

SAMPLE PRINTOUT RUNOFF CALCULATIONS

runoff
004-1
SIZE
Ac = 9.900
L = 360.000
S = 0.100

COEF
C = 0.350
c = 0.025

INTEN
Tc = 13.000
I = 3.795 in

VOL
CN = 75.000
Qin = 3.000
Qrnf = 0.961 in
VOL = 0.793 ac ft

FLOW
Qp = 13.151 cfs

runoff
004-2
SIZE
Ac = 3.400
L = 455.000
S = 0.150

COEF
C = 0.350
c = 0.025

INTEN
Tc = 12.000
I = 3.935 in

VOL
CN = 75.000
Qin = 3.000
Qrnf = 0.961 in
VOL = 0.272 ac ft

FLOW
Qp = 4.617 cfs

runoff — AREA LABEL
004-3
SIZE
Ac = 1.100
L = 890.000
S = 0.016

} AREA SIZE, LENGTH AND SLOPE

COEF — RUNOFF COEFFICIENT
C = 0.500
c = 0.020 — RETARDANCE COEFFICIENT

INTEN — PEAK INTENSITY FOR PEAK FLOW
Tc = 25.000 — TIME OF CONCENTRATION
I = 2.795 in — RAINFALL INTENSITY FOR TIME C.

VOL
CN = 89.000 — CURVE NUMBER
Qin = 3.000 — MAXIMUM STORM EVENT RAINFALL
Qrnf = 1.900 in — RAINFALL RUNOFF INCHES
VOL = 0.174 ac ft — RAINFALL RUNOFF ACRE-Feet

FLOW
Qp = 1.577 cfs — PEAK FLOW RUNOFF CUBIC FEET PER

MAXWELL MINE CHANNEL CAPACITY CALCULATIONS

SAMPLE PAINTOUT OPEN CHANNEL FLOW CALCULATIONS

OPFLO
DITCH 1A
SHAPE

TRPZ
DEPTH = 1.00
TOP = 4.00
BOTTOM = 1.00
SLOPE = 0.0091
LENGTH = 440.00
AREA = 2.50
WET PER = 4.61
HYD RAD = 0.54
MAN NO = 0.0400
VEL = 2.36
FLOW = 5.90
TIME = 3.11

NEW FLOW
DEPTH = 0.90
LENGTH = 440.00
AREA = 2.11
WET PER = 4.24
HYD RAD = 0.50
MAN NO = 0.0400
VEL = 2.23
FLOW = 4.69
TIME = 3.30

OPFLO
DITCH 1A-1

TRPZ
DEPTH = 2.00
TOP = 17.00
BOTTOM = 0.00
SLOPE = 0.0261
LENGTH = 320.00
AREA = 17.00
WET PER = 17.46
HYD RAD = 0.97
MAN NO = 0.0400
VEL = 5.09
FLOW = 100.21
TIME = 0.90

NEW FLOW
DEPTH = 0.63
LENGTH = 320.00
AREA = 1.71
WET PER = 5.54
HYD RAD = 0.31
MAN NO = 0.0400
VEL = 2.74
FLOW = 4.69
TIME = 3.30

OPFLO
CMP-1 — CHANNEL LABEL
SHAPE

CIRC — CHANNEL SHAPE
DIAM = 1.50
SLOPE = 0.0100
LENGTH = 50.00
AREA = 1.77
WET PER = 4.71
HYD RAD = 0.33
MAN NO = 0.0240
VEL = 3.22
FLOW = 5.69
TIME = 0.26

MAXIMUM
FULL FLOW
CHARACTERISTICS

NEW FLOW — DESIGN FOR NEW
FLOW
DEPTH = 1.04
LENGTH = 50.00
AREA = 1.30
WET PER = 2.95
HYD RAD = 0.44
MAN NO = 0.0240
VEL = 3.60
FLOW = 4.69
TIME = 0.23

DESIGN
CHARACTERISTICS

OPFLO
DITCH 1A-3
SHAPE

TRPZ
DEPTH = 1.50
TOP = 7.00
BOTTOM = 2.00
SLOPE = 0.0556
LENGTH = 260.00
AREA = 6.75
WET PER = 7.03
HYD RAD = 0.86
MAN NO = 0.0400
VEL = 7.93
FLOW = 53.55
TIME = 0.55

NEW FLOW
DEPTH = 0.56
LENGTH = 260.00
AREA = 1.66
WET PER = 4.19
HYD RAD = 0.40
MAN NO = 0.0400
VEL = 4.72
FLOW = 7.84
TIME = 0.23

OPFLO
CMP-2
SHAPE

CIRC
DIAM = 2.00
SLOPE = 0.0500
LENGTH = 120.00
AREA = 3.14
WET PER = 6.28
HYD RAD = 0.50
MAN NO = 0.0240
VEL = 3.72
FLOW = 27.40
TIME = 0.23

NEW FLOW
DEPTH = 1.29
LENGTH = 120.00
AREA = 2.15
WET PER = 3.74
HYD RAD = 0.58
MAN NO = 0.0240
VEL = 9.53
FLOW = 20.61
TIME = 0.23

OPFLO
DITCH 1A-2
SHAPE

TRPZ
DEPTH = 1.50
TOP = 7.00
BOTTOM = 0.00
SLOPE = 0.0117
LENGTH = 620.00
AREA = 5.25
WET PER = 7.62
HYD RAD = 0.69
MAN NO = 0.0400
VEL = 3.14
FLOW = 16.46
TIME = 3.30

NEW FLOW
DEPTH = 1.14
LENGTH = 620.00
AREA = 3.01
WET PER = 5.76
HYD RAD = 0.52
MAN NO = 0.0400
VEL = 2.60
FLOW = 7.84
TIME = 0.23

HYDROLOGY PROGRAM

FOR HP 41C CALCULATOR

BY JOSEPH BLAIS

PRP "RUNOFF"

```
01*LBL "RUNOFF"
CF 86 CF 81 FIX 3 ADV
"RUNOFF" SF 12 SF 13
PRA CF 12 CF 13 RDN
"LABEL ?" PROMPT PRA
AROFF "SIZE" PRA
"ACRES ?" PROMPT
STO 32 "LENGTH ?"
PROMPT STO 17
"SLOPE ?" PROMPT
STO 18 "Ac ="
ARCL 32 PRA "L ="
ARCL 17 PRA "S ="
ARCL 18 PRA
```

```
37*LBL F
ADV "COEF" PRA
"RNOF C?" PROMPT
STO 19 "RET C?" PROMPT
STO 26 RCL 17 3 1/X
Y1X RCL 20 * 41 *
RCL 18 3 1/X Y1X /
STO 22 "C ="
ARCL 19 PRA "C ="
ARCL 20 PRA
```

```
67*LBL G
ADV "INTEN" PRA
"TIME C ?" PROMPT
STO 23 RCL 22 RCL 23
/ 1.5 Y1X RCL 19 /
STO 21 "Tc ="
ARCL 23 PRA "I ="
ARCL 21 "T" ACA 185
ACCHR 112 ACCHR 184
ACCHR PRBUF CLA
ARCL 21 PROMPT GTO B
```

- INITIALIZE CALCULATOR TO START RUNOFF CALCULATION.

- LABEL AREA
- SIZE OF AREA - STORE IN 32 A
- LENGTH OF AREA - STORE IN 17 L
- SLOPE OF AREA - STORE IN 18 S
- PRINT AREA DATA

- CALCULATE RAINFALL INTENSITY & TIME OF CONCENTRATION
- RUNOFF COEFFICIENT - STORE IN 19 C
- RETARDANCE COEFFICIENT - STORE IN 20 S
- CALCULATE INTENSITY FOR GIVEN TIME OF CONCENTRATION

$$I = \left(\frac{41C}{S^{1/3} t_c} \right)^{3/2}$$

- TIME OF CONCENTRATION - STORE IN 23 t_c

- CALCULATED INTENSITY - STORE IN 21 I

- REPEAT FROM LABEL G FOR DIFFERENT TIMES OF CONCENTRATION UNTIL CALCULATED INTENSITY NEARLY EQUALS ACTUAL RAINFALL INTENSITY - SEE RAINFALL MAPS

```

100*LBL H
ADV "VOL" PRA "CN?"
PROMPT STO 27
"Q, INCHES?" PROMPT
STO 28 "CN" = "
ARCL 27 PRA "Q" ACA
105 ACCHR 110 ACCHR
" = " ARCL 28 ACA
PRBUF RCL 28 1000
RCL 27 / 10 - STO 31
.2 * - X12 .8
RCL 31 * RCL 29 + /
STO 29 "Q" ACA 114
ACCHR 110 ACCHR 102
ACCHR " = " ARCL 29
"t" ACA 105 ACCHR
110 ACCHR PRBUF
RCL 29 12 / RCL 32 *
STO 30 "VOL" = "
ARCL 30 "t ac" ACA
102 ACCHR 116 ACCHR
PRBUF

```

```

173*LBL I
ADV "FLOW" PRA RCL 19
RCL 21 * RCL 32 *
STO 26 "Q" ACA 112
ACCHR " = " ARCL 26
"t c" ACA 102 ACCHR
115 ACCHR PRBUF STOP
GTO I

```

```

198*LBL "OPFLO"
199*LBL E
CF 00 CF 01 ADV
"OPFLO" SF 12 SF 13
FRA CF 12 CF 13 ROW
"LABEL?" PROMPT PRA
ROFF "SHAPE" PRA
"t?" PROMPT

```

- CALCULATE RAINFALL RUNOFF VOLUME
- CURVE NUMBER - STORE IN 27 CN
- INCHES OF RAINFALL FOR STORM EVENT - STORE 28 Q_{IN}
- S PARAMETER EQUALS $\frac{1000}{CN} - 10$ - STORE IN 31
- INCHES RUNOFF EQUALS $\frac{(Q_{IN} - 0.2S)^2}{Q_{IN} + 0.8S}$ - STORE IN 29 Q_R
- VOLUME RUNOFF EQUALS $\frac{Q_{RAF} \times AREA}{12}$ - STORE IN 30 V
VOL IS IN ACRE-Feet
- PEAK FLOW EQUALS CIA - STORE IN 26 Q_P
- INITIALIZE CALCULATOR TO START
OPEN CHANNEL FLOW CALCULATIONS
- LABEL CHANNEL
- SHAPE OF CHANNEL / TRAPEZOIDAL, PARABOLIC or CIRC

218*LBL A
 AA ASTO 00 ADV
 TRP2 PRA FIX 2
 DEPTH ? PROMPT
 STO 01 *TOP ?* PROMPT
 STO 02 CLX *BOTTOM ?*
 PROMPT STO 03
 SLOPE ? PROMPT
 STO 04 *DEPTH = *
 ARCL 01 PRA
 *TOP = * ARCL 02
 PRA *BOTTOM = *
 ARCL 03 PRA FIX 4
 *SLOPE = * ARCL 04
 PRA FIX 2 RCL 03
 ST- 02 2 ST/ 02
 RCL 02 RCL 03 +
 RCL 01 * STO 05
 RCL 02 RCL 01 R-P 2
 * RCL 03 + STO 06
 XEQ *FULL* GTO D

— TRAPEZOIDAL OR TRIANGULAR SHAPES

- DEPTH OF DITCH — STORE IN 01 D
- TOP DIMENSION — STORE IN 02 T
- BOTTOM DIMENSION — STORE IN 03 B
- SLOPE — STORE IN 04 S

— $AREA = \left(\frac{T+B}{2} + B \right) D$ — STORE IN 05 A

— WETTED PERIMETER = $(2\sqrt{T^2 + D^2}) + B$ — STORE IN 06

272*LBL B
 BB ASTO 00 ADV
 PRAB PRA FIX 2
 DEPTH ? PROMPT
 STO 01 *WIDTH ?*
 PROMPT STO 02
 SLOPE ? PROMPT
 STO 04 *DEPTH = *
 ARCL 01 PRA
 *WIDTH = * ARCL 02
 PRA FIX 4 *SLOPE = *
 ARCL 04 PRA FIX 2
 RCL 01 RCL 02 *
 .6666666 * STO 05
 RCL 01 *12.8 * 3
 RCL 02 / RCL 02 +
 STO 06 XEQ *FULL*
 GTO D

— PARABOLIC SHAPE

- DEPTH OF DITCH — STORE IN 01 D
- TOP WIDTH OF DITCH — STORE IN 02 W
- SLOPE — STORE IN 04 S

— $AREA = D \times W \times \frac{2}{3}$ — STORE IN 05 A

— WETTED PERIMETER = $\frac{D^2 8}{W 3} + W$ — STORE IN 06 P

318*LBL C

CC ASTO 00 ADV

CIRC PRA PSE FIX 2

DIA ? PROMPT STO 01

STO 02 *SLOPE ?*

PROMPT STO 04

DIAM = ARCL 02

PRA FIX 4 *SLOPE =*

ARCL 04 PRA FIX 2

RCL 02 X12 PI * 4 /

STO 05 RCL 02 PI *

STO 06 XEQ *FULL*

— CIRCULAR SHAPE

— DIAMETER — STORE IN 01,02 $\frac{D}{S}$

— SLOPE — STORE IN 04 $\frac{S}{S}$

— FULL AREA = $\frac{\pi D^2}{4}$ — STORE IN 03 $\frac{A}{P}$

— FULL PERIMETER = πD — STORE IN 06 $\frac{P}{P}$

— MAXIMUM FLOW WITHOUT HEAD
APPROACHED BY NEAR FULL CONDITION

353*LBL D

SF 00 ADV

*NEW HD, V, Q, *

H ? PROMPT GTO D

RTH

— CALCULATE DESIGN FLOW FOR ANY
NEW CONDITION

361*LBL A

NEW DEPTH PRA *H ?*

PROMPT STO 11

XEQ IND 00 GTO *PRNT*

— NEW DESIGN DEPTH — STORE IN 11 $\frac{D}{D}$

369*LBL B

NEW VLCTY PRA PROMPT

STO 16 RCL 01 STO 11

.6666666666 STO 14 9

STO 15 XEQ *DH*

GTO *PRNT*

— NEW DESIGN VELOCITY — STORE IN 16 $\frac{V}{V}$

— ASSUME $\frac{D}{D}$ — STORE IN 11

— STORE ADDRESS OF CALCULATED VELOCITY IN 15

— EXECUTE ITERATION ASSUMING NEW $\frac{D}{D}$ TO
CALCULATE NEW VELOCITY TO MATCH DESIGN VELOCITY

392*LBL C

NEW FLOW PRA *H ?*

PROMPT STO 16 RCL 01

STO 11 1.666666666

STO 14 10 STO 15

XEQ *DH* GTO *PRNT*

— NEW DESIGN FLOW — STORE IN 16 $\frac{Q}{Q}$

— ASSUME $\frac{D}{D}$ — STORE IN 11

— STORE ADDRESS OF CALCULATED FLOW IN 15

— EXECUTE ITERATION ASSUMING NEW $\frac{D}{D}$ TO
CALCULATE NEW FLOW TO MATCH DESIGN FLOW

396*LBL D

NEW MAN NO PRA *H ?*

PROMPT STO 08 RCL 01

STO 11 GTO *PRNT*

— NEW DESIGN MANNING'S NUMBER — STORE IN 08 $\frac{M}{M}$

— ASSUME $\frac{D}{D}$ STORE IN 11

485*LBL "dH"

486*LBL 05

RCL IND 15 RCL 11

RCL 14 Y+X / STO 13

RCL 14 ST+ 13 1 -

STO 12 RCL 16

RCL IND 15 - SIGN

RCL L RCL 13 / RCL 11

RCL 12 Y+X / ABS *

ST+ 11 XEQ IND 00

XEQ "FULL" FIX 2

RCL 16 RCL IND 15 RND

X=Y? GTO 05 RTH

441*LBL "PRNT"

CF 00 SF 01 FIX 2

"DEPTH = " ARCL 11

PRA XEQ "FULL" CF 01

GTO D

451*LBL "AA"

RCL 02 RCL 01 R-P

X<Y TAN RCL 11 *

STO 12 RCL 03 +

RCL 11 * STO 05

RCL 12 RCL 11 R-P 2

* RCL 03 + STO 06

RTH

474*LBL "BB"

RCL 02 RCL 01 SQRT /

RCL 11 SQRT * STO 12

RCL 11 * .66666666 *

STO 05 RCL 11 X+2

RCL 12 / 8 * 3 /

RCL 12 + STO 06 RTH

- ITERATION TO CALCULATE NEW DEPTH
TO MEET DESIGN PARAMETERS

- ESTIMATE CORRECTION TO D - STORE PLUS 11

- CALCULATE NEW HYDRAULIC RADIUS

- CALCULATE ALL NEW FLOW PARAMETERS

- CHECK IF DESIGN PARAMETER EQUALS CALCULATED
PARAMETER - REPEAT IF NOT EQUAL

- CALCULATE AND/OR PRINTOUT FINAL
FLOW PARAMETERS AND CHARACTERISTICS

- CALCULATE NEW HYDRAULIC RADIUS FOR
TRAPEZOIDAL / TRIANGULAR SHAPE

- CALCULATE SLOPE ANGLE OF DITCH
USE NEW DEPTH TO CALCULATE NEW AREA
AND WETTED PERIMETER

- CALCULATE NEW HYDRAULIC RADIUS FOR
PARABOLIC SHAPE

- USE NEW DEPTH TO CALCULATE NEW AREA
AND WETTED PERIMETER

```

500*LBL "CC"
RAD RCL 11 RCL 02 2
/ STO 03 - RCL 11
RCL 02 * RCL 11 X12
- SQRT * RCL 11
RCL 03 - RCL 03 /
ASIN RCL 03 X12
STO 12 * + RCL 12 PI
* 2 / + STO 05
RCL 11 2 * RCL 02 -
RCL 02 / ASIN RCL 03
* 2 * RCL 03 PI *
+ STO 06 DEG RTH

```

— CALCULATE NEW HYDRAULIC RADIUS FOR CIRCULAR SHAPE

— USE NEW DEPTH TO CALCULATE NEW AREA AND WETTED PERIMETER

```

553*LBL "FULL"
RCL 05 RCL 06 /
STO 07 FS? 00 GTO 03
FS? 01 GTO 06
"LENGTH ?" PROMPT
STO 24

```

— CALCULATE FULL OR DESIGN FLOW PARAMETERS

— HYDRAULIC RADIUS = $\frac{A}{P}$ — STORE IN 07 R

— LENGTH OF CHANNEL — STORE IN 24

```

565*LBL 06
"LENGTH = " ARCL 24
PRA "AREA = "
ARCL 05 PRA
"WET PER = " ARCL 06
PRA "HYD RAD = "
ARCL 07 PRA FS? 01
GTO 07 "MAN. NO. ?"
PROMPT STO 08

```

— PRINT OUT CHANNEL CHARACTERISTICS

— MANNINGS NUMBER — STORE IN 08 n

```

583*LBL 07
FIX 4 "MAN NO = "
ARCL 08 PRA FIX 2

```

```

589*LBL 08
1.486 RCL 08 / STO 09
RCL 07 .6666666 Y1X
ST* 09 RCL 04 SQRT
ST* 09 RCL 05 RCL 09
* STO 10 FS? 00 RTH
"VEL = " ARCL 09
PRA "FLOW = "
ARCL 10 PRA RCL 24
RCL 09 / 60 /
"TIME = " ARCL X PRA
RTH END

```

— MANNINGS EQUATION TO CALCULATE FLOW

$$A \frac{1.486}{n} R^{2/3} S^{1/2} = Q$$

— PRINT FINAL FLOW CHARACTERISTICS

PRP **

01*LBL "PIPES"
"WATER PIPES" SF 12
PRA CF 12 ADV AON
"LABEL" PROMPT PRA
AOFF ADV CLRG 64.4
STO 02 1 STO 04 11
STO 05 12 STO 06 13
STO 07 FIX 2 GTO "11"

26*LBL I
ADV "NEW HEAD" SF 12
PRA CF 12 SF 02

33*LBL "11"
"WATER HEAD" PROMPT
STO 00 "1" " ARCL X
"1 FT" PRA
"APPROACH VEL" PROMPT
STO 03 "1" " ARCL X
"1 FPS" PRA RCL 03
X12 RCL 02 / ST+ 00
RCL 00 STO 10 "H"
XEQ "TOT" " FT" ACA
PRBUF FS?C 02 GTO 11

62*LBL "ENT"
"ENTRANCE" XEQ "HF"
"COEFFICIENT" PROMPT
STO 10 1 STO 12 SF 01
"SHAPE" PROMPT

73*LBL F
"HIGH" = " PROMPT
STO 08 STO 09 ARCL X
"1 FT" PRA " WIDTH" = "
PROMPT ST+ 09 ARCL X
"1 FT" PRA RCL 08 +
2 * RCL 09 X<>Y /
STO 08 GTO "AR"

96*LBL G
"DIA" = " PROMPT
STO 08 ARCL X "1 FT"
PRA 2 / X12 PI
ST+ 08 * STO 09
RCL 08 / STO 08
GTO "AR"

114*LBL H
"AREA" PROMPT STO 09
"H RAD" PROMPT STO 08

121+LBL "AR"
" AREA = " ARCL 09
"- SQ FT" PRA
" H RAD = " ARCL 08
"- FT" PRA FS?C 01
GTO "STOR"

132+LBL 00
" LGTH = " PROMPT
STO IND 06 ARCL X
"- FT" PRA FIX 4
" H MAN = " PROMPT
ARCL X PRA X12 29.16
* STO 10 RCL 08 4
ENTER↑ 3 / Y↑X
ST/ 10

155+LBL "STOR"
FIX 5 " K" ACA 102
ACCHR " = " ARCL 10
ACA PRBUF RCL 10
STO IND 05 RCL 09
STO IND 07 FIX 2
FS?C 00 GTO "OUTLET"

172+LBL "NEXT"
1 ST+ 04 3 ST+ 05
ST+ 06 ST+ 07 "NEXT"
PROMPT

181+LBL A
"PIPE" XEQ "HF"
"SHAPE" PROMPT

186+LBL B
"ELBOW" XEQ "HF"
GTO "KF"

190+LBL C
"CHANGE" XEQ "HF"
GTO "KF"

194+LBL D
"VALVE" XEQ "HF"
GTO "KF"

198+LBL E
"OUTLET" SF 00
XEQ "HF" GTO "KF"

203+LBL "HF"
ADV SF 12 72 ACCHR
CF 12 102 ACCHR CF 29
FIX 0 RCL 04 ACX
SF 29 FIX 2 3 SKPCHR
ACA PRBUF RTN

222*LBL *KF*

1 STO IND 06 RCL 07 3
- RCL IND X STO 09
COEFFICIENT PROMPT
STO 10 SF 01 GTO *AR*

235*LBL *OUTLET*

11 STO 05 12 STO 06
13 STO 07 1 STO 08
CLST STO 09 STO 10

247*LBL 01

RCL IND 05 RCL IND 06
* RCL 02 / RCL IND 07
X12 / ST+ 09 3
ST+ 05 ST+ 06 ST+ 07
1 ST+ 08 RCL 04
RCL 08 X<=Y? GTO 01

267*LBL 11

RCL 00 RCL 09 / SQRT
STO 01 CLST STO 00 11
STO 05 12 STO 06 13
STO 07 1 STO 04 ADV
SF 12 *FLOW* PRA
CF 12 * Q = *
ARCL 01 *F CFS* PRA
ADV

293*LBL 02

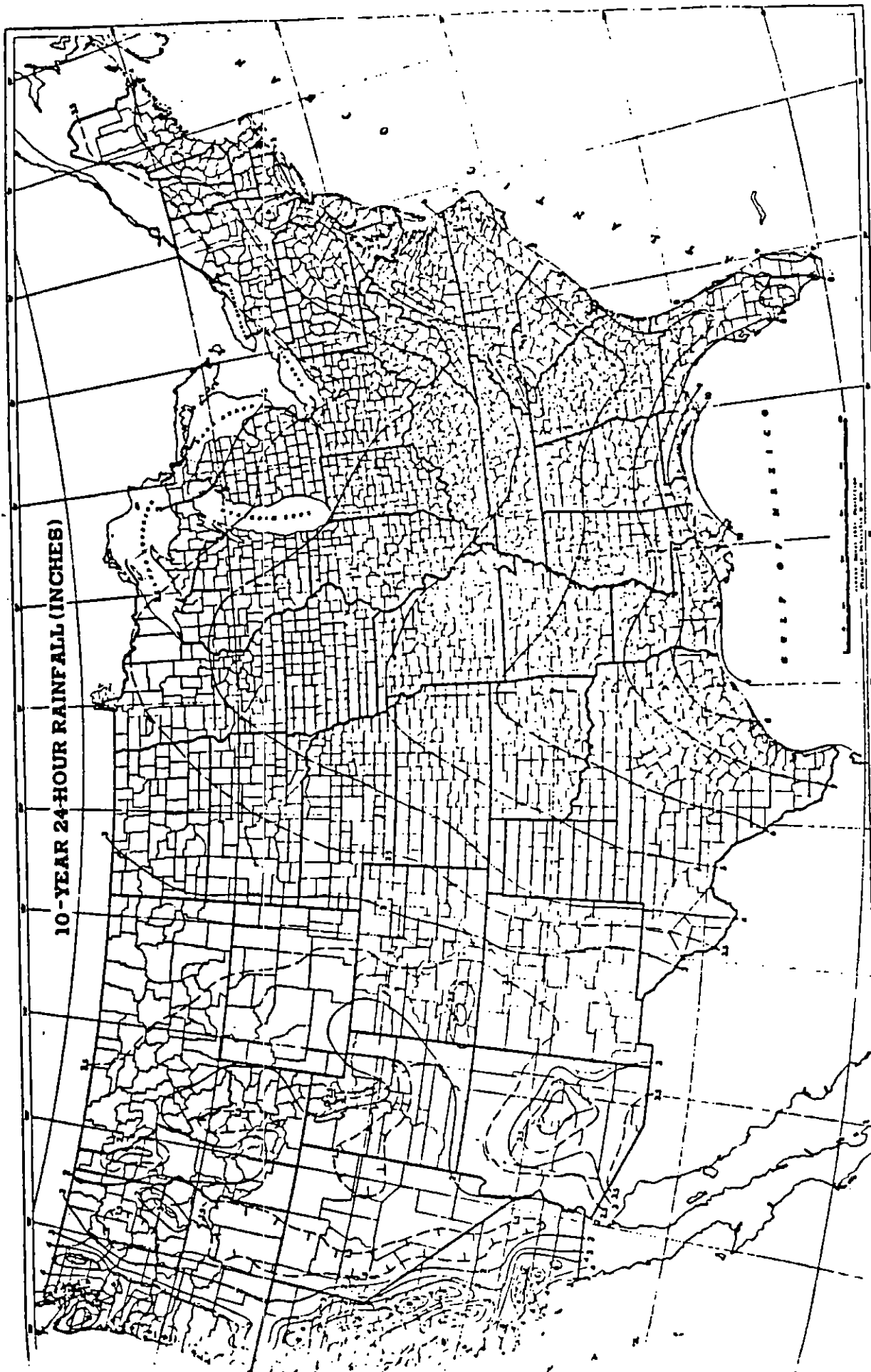
CLA XEQ *HF* RCL 01
RCL IND 07 /
* VEL = * ARCL X
F FPS PRA X12
RCL 02 / STO 10
RCL IND 05 RCL IND 06
* STO 03 ST+ 10 FIX 5
* K* ACA 100 ACCHR
* = * ARCL 03 ACA
PRBUF FIX 2 * H* ACA
ACCHR * = * ARCL 10
F FT ACA PRBUF
RCL 10 ST+ 00 1
ST+ 04 3 ST+ 05
ST+ 06 ST+ 07 RCL 04
RCL 08 X>Y? GTO 02

372*LBL 24

ADV "OUTLET" SF 12
PRA CF 12 ADV RCL 07
3 - RCL IND X RCL 01
X<>Y / STO 03 STO 10
" V" XEQ "OUT" " FPS"
ACA PRBUF RCL L
STO 10 " A" XEQ "OUT"
" SQ FT" ACA PRBUF
RCL 01 STO 10 " Q"
XEQ "OUT" " CFS" ACA
PRBUF FIX 5 RCL 00
RCL 03 X+2 / RCL 02
" STO 10 " K"
XEQ "TOT" PRBUF FIX 2
RCL 00 STO 10 " H"
XEQ "TOT" " FT" ACA
PRBUF RTN

397*LBL "OUT"
ACA 111 ACCHR 117
ACCHR 116 ACCHR
" = " ARCL 10 ACA
RTN

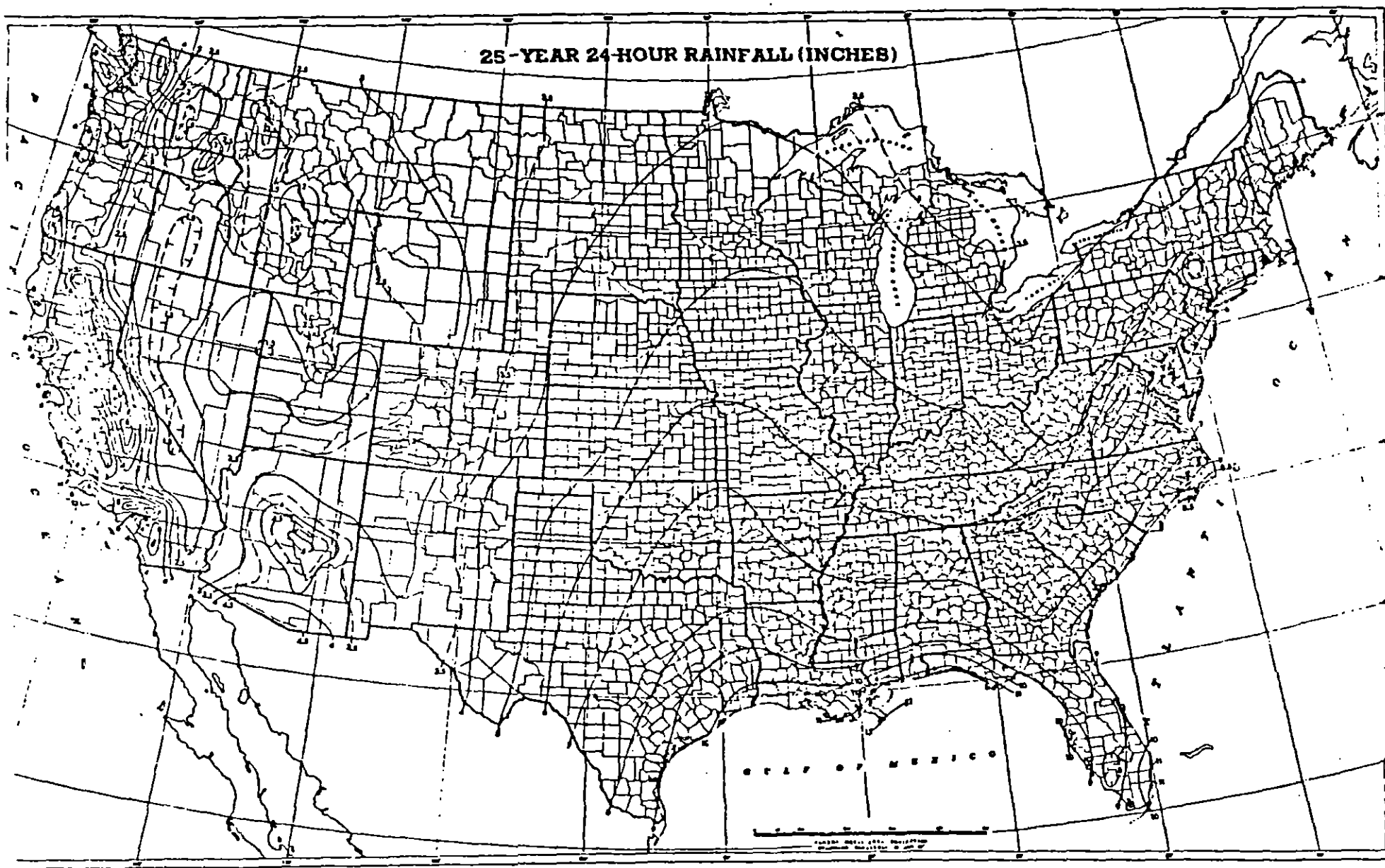
409*LBL "TOT"
ACA 116 ACCHR 111
ACCHR X<>Y ACCHR
" = " ARCL 10 ACA
RTN END



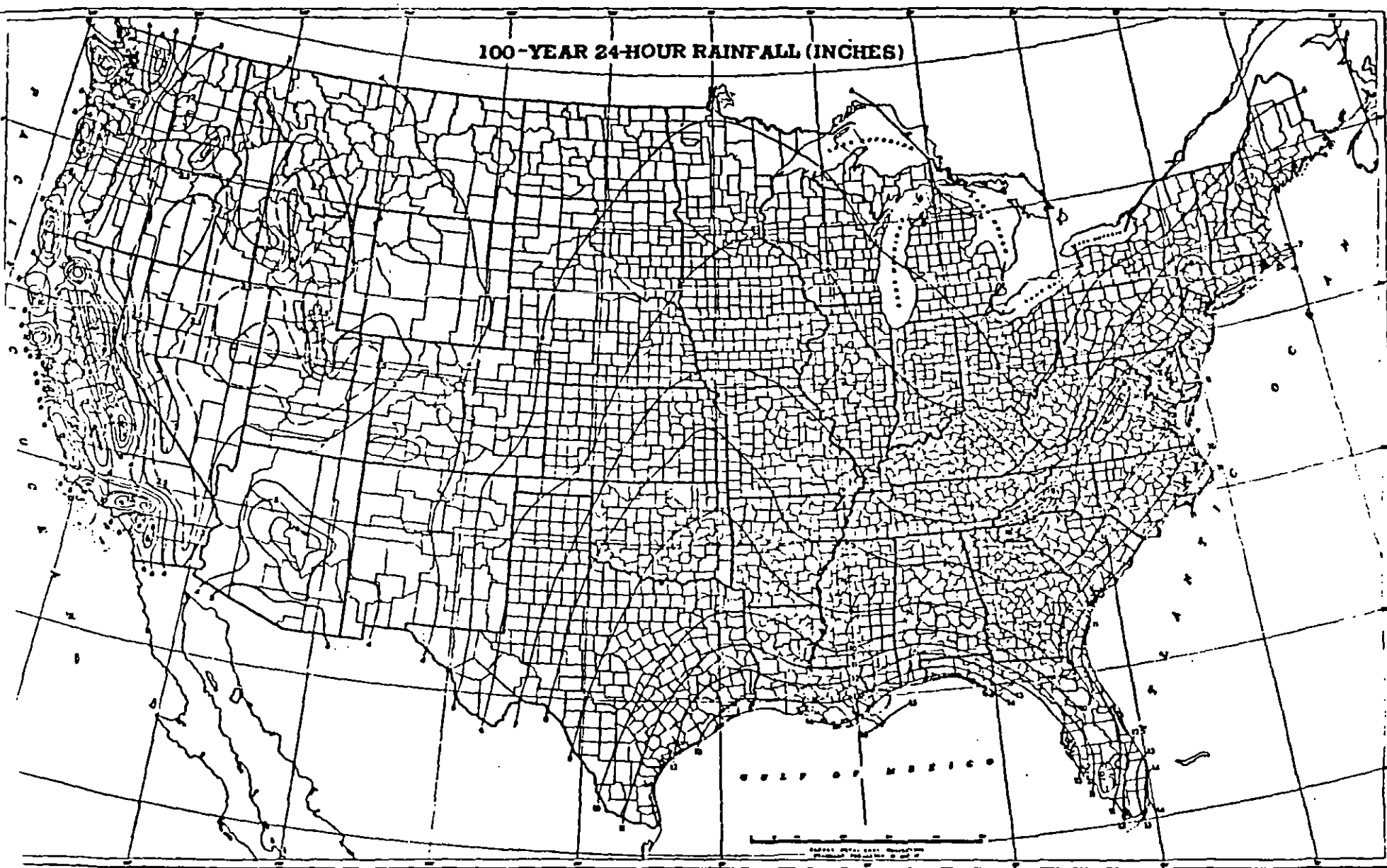
Technical Paper No. 40 Rainfall Frequency

Atlas of the United States (U.S. Department of

Commerce, Weather Bureau, 1)



Technical Paper No. 40 Rainfall Frequency
Atlas of the United States (U.S. Department of
Commerce, Weather Bureau, 1961)



Technical Paper No. 40 Rainfall Frequency
Atlas of the United States (U.S. Department of
Commerce, Weather Bureau, 1961)

TIME - INTENSITY
WESTON, COLO.

LOG

X, Et, Y, R/S

X	Y
5.00	5.33
10.00	4.10
15.00	3.46
20.00	3.00
30.00	2.40
40.00	1.92
60.00	1.60
120.00	0.80

R2=0.98

a=7.35

b=-1.41

PLOT OF LINE

X (UNITS= 1.) ↓

Y (UNITS= 1.) ↑

1.00 6.00
2.40

X	Y
5.0	5.33
6.0	4.82
7.0	4.60
8.0	4.42
9.0	4.25
10.0	4.10
11.0	3.97
12.0	3.84
13.0	3.73
14.0	3.63
15.0	3.53
16.0	3.44
17.0	3.35
18.0	3.27
19.0	3.19
20.0	3.12
21.0	3.05
22.0	2.99
23.0	2.92
24.0	2.86
25.0	2.81
26.0	2.75
27.0	2.70
28.0	2.65
29.0	2.60
30.0	2.55
31.0	2.50
32.0	2.46
33.0	2.42
34.0	2.37
35.0	2.33
36.0	2.29
37.0	2.25
38.0	2.22
39.0	2.18
40.0	2.14

TIME - INTENSITY

DATA FROM:

WEATHER BUREAU TECHNICAL PAPER

X	Y
5.00	5.00
6.00	4.82
7.00	4.60
8.00	4.42
9.00	4.25
10.00	4.10
11.00	3.97
12.00	3.84
13.00	3.73
14.00	3.63
15.00	3.53
16.00	3.44
17.00	3.35
18.00	3.27
19.00	3.19
20.00	3.12
21.00	3.05
22.00	2.99
23.00	2.92
24.00	2.86
25.00	2.81
26.00	2.75
27.00	2.70
28.00	2.65
29.00	2.60
30.00	2.55
31.00	2.50
32.00	2.46
33.00	2.42
34.00	2.37
35.00	2.33
36.00	2.29
37.00	2.25
38.00	2.22
39.00	2.18
40.00	2.14

Hydrology and Sedimentology of Surface Mined

lands (G.T. Haan & B.J. Barfield, 1978)

Description of area	Runoff coefficients
Business:	
Downtown areas	0.70 to 0.95
Neighborhood areas	0.50 to 0.70
Residential:	
Single-family areas	0.30 to 0.50
Multi-units, detached	0.40 to 0.60
Multi-units, attached	0.60 to 0.75
Residential (suburban)	0.25 to 0.40
Apartment dwelling areas	0.50 to 0.70
Industrial:	
Light areas	0.50 to 0.80
Heavy areas	0.60 to 0.90
Parks, cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.35
Railroad yard areas	0.20 to 0.35
Unimproved areas	0.10 to 0.30
Streets:	
Asphaltic and concrete	0.70 to 0.95
Brick	0.70 to 0.85
Roofs	0.75 to 0.95
Lawns; sandy soil:	
Flat, 2%	0.05 to 0.10
Average, 2% to 7%	0.10 to 0.15
Steep, 7%	0.15 to 0.20
Lawns; heavy soil:	
Flat, 2%	0.13 to 0.17
Average, 2% to 7%	0.18 to 0.22
Steep, 7%	0.25 to 0.35

Rural Areas

Topography and Vegetation	Soil Texture		
	Open Sandy Loam	Clay and Silt Loam	Tight Clay
Woodland			
Flat 0-5% slope	0.10	0.30	0.40
Rolling 5-10% slope	0.25	0.35	0.50
Hilly 10-30% slope	0.30	0.50	0.60
Pasture			
Flat	0.10	0.30	0.40
Rolling	0.16	0.36	0.55
Hilly	0.22	0.42	0.60
Cultivated			
Flat	0.30	0.50	0.60

Table 2.25 Retardance Coefficient.

Surface	c
Very smooth asphalt	0.007
Tar and sand pavement	0.0075
Crushed slate roofing paper	0.0082
Concrete	0.012
Tar and gravel pavement	0.0017
Closely clipped sod	0.046
Dense bluegrass turf	0.060

Table 2.20 Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Land Use. (Antecedent Moisture Condition II).

LAND USE DESCRIPTION	HYDROLOGIC SOIL GROUP			
	A	B	C	D
Cultivated land ^{1/} without conservation treatment	72	81	88	91
1 with conservation treatment	62	71	78	81
Pasture or range land: poor condition	68	79	86	89
good condition	39	61	74	80
Wetlands: good condition	30	58	71	78
Wood or Forest land: thin stand, poor cover, no mulch	45	66	77	83
good cover ^{1/}	25	55	70	77
Open Spaces, lawns, parks, golf courses, cemeteries, etc.				
good conditions: grass cover on 75% or more of the area	39	61	74	80
fair conditions: grass cover on 50% to 75% of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious)	81	88	91	91
Residential ^{1/}				
Average lot size				
1/8 acre or less	77	85	90	92
1/4 acre	61	75	83	87
1/3 acre	51	72	81	86
1/2 acre	54	70	80	85
1 acre	51	68	79	84
Average % impervious ^{1/}				
10%	77	85	90	92
20%	61	75	83	87
30%	51	72	81	86
40%	54	70	80	85
50%	51	68	79	84
Paved parking lots, roofs, driveways, etc. ^{1/}	98	98	98	98
Streets and roads:				
paved with curbs and storm sewers ^{1/}	98	98	98	98



999

Doc Date: 12/11/2001

719

S/E "EXHIBIT 19-

Q Ditch 17B and Culvert C50, 12/2/93 //

GREYSTONE®

December 2, 1993

Mr. Joseph Dudash
Colorado Division of Minerals and Geology
1313 Sherman, Room 215
Denver, CO 80203

Subject: NOV 93-037, New Elk Mine, Basin Resources, C-81-014

Dear Mr. Dudash,

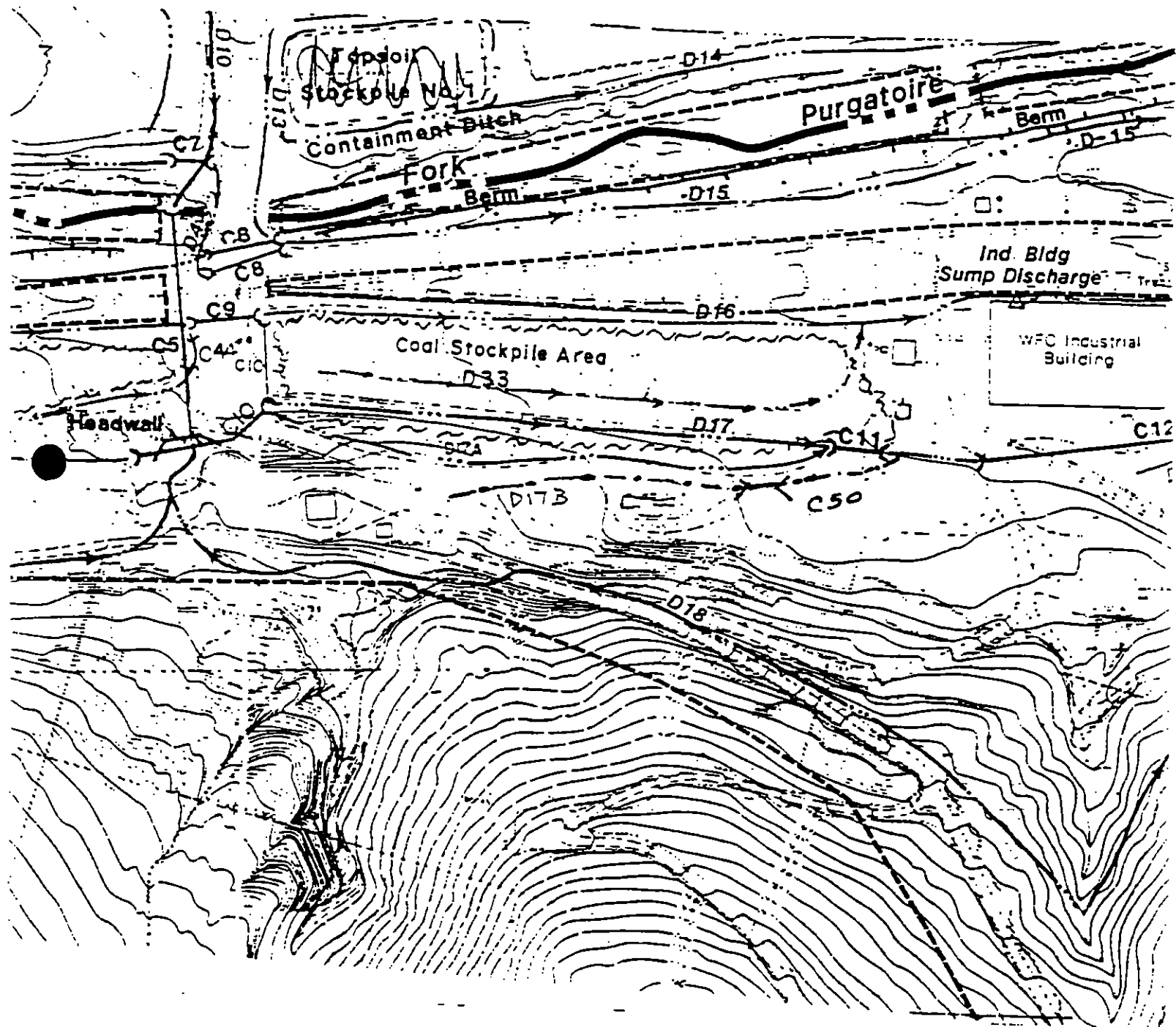
Please review the enclosed designs for Ditch 17B and Culvert C50 which are located on the south side of the road to the fan at New Elk. Attached are three copies of a watershed run for D17B, a ditch design, and a culvert nomograph. I have also enclosed a copy of portion of Map 13 designating the location of the ditch. A certified plan map will follow.

Thank-you in advance for your prompt consideration of this submittal. Please do not hesitate to call if you should have any questions.

Sincerely,

Catherine W. Begej
Catherine W. Begej
Project Manager

cc Mr. Ralph Lopez
Enclosures



TR-27

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

DITCH D17B AND CULVERT C50

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\D17B&C50

Date: 12-01-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\D17B&C50 User: C.W. BEGEJ

Date: 12-01-1993 Time: 23:37:41

DITCH D17B AND CULVERT C50

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.12	87	F	0.017	0.000	0.000	0.0	0.02	0.19
111	2	3.19	79	M	0.073	0.000	0.000	0.0	0.30	3.86
		Type: Culvert				Label: D17B W OF C50				
111	Structure	3.31							0.31	
111 Total IN/OUT		3.31							0.31	4.05
112	1	0.11	87	F	0.008	0.000	0.000	0.0	0.01	0.18
112	2	1.33	79	S	0.019	0.000	0.000	0.0	0.12	1.60
		Type: Null				Label: D17B E OF C50				
112	Structure	1.43							0.45	
112 Total IN/OUT		4.74							0.45	5.84
111 to 112 Routing					0.010	0.393				

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\D17B&C50 User: C.W. BEGEJ

Date: 12-01-1993 Time: 23:37:41

DITCH D17B AND CULVERT C50

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	7	12.00	2.00	2.85	0.00			
				-b	8	420.00	5.70	7.16	0.02	0.017		
1	1	1	2	-a	1	175.00	10.29	0.81	0.06			
				-b	8	357.00	5.60	7.10	0.01	0.073		
1	1	2	1	-a	7	12.00	2.00	2.85	0.00			
				-b	8	170.00	4.35	6.26	0.01	0.008		
1	2	2		-a	3	170.00	35.29	4.16	0.01			
				-b	8	180.00	4.35	6.26	0.01	0.019		

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D17B, NEW ELK, 10-YR 24-HR STORM

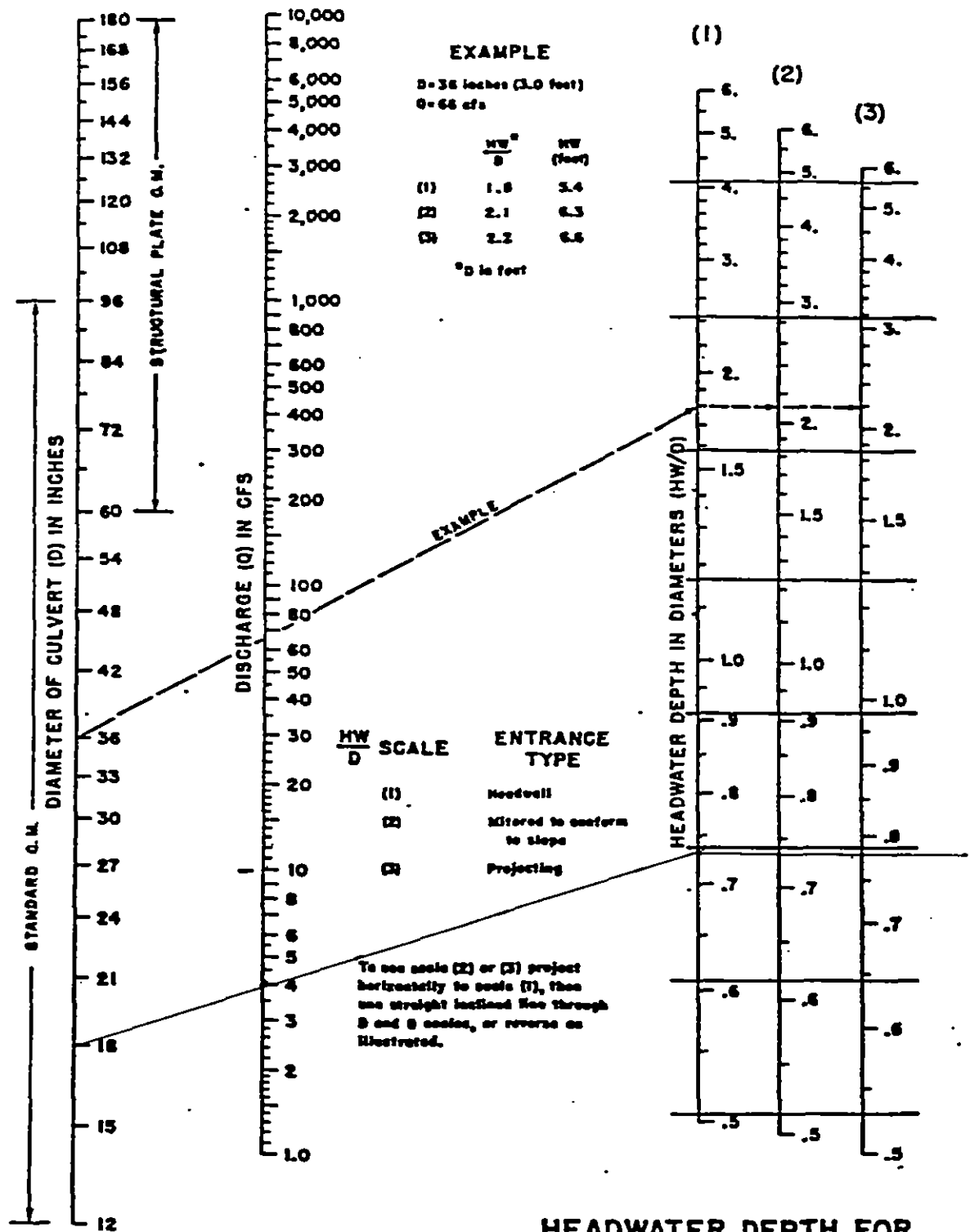
Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR
Discharge	5.84 cfs
Slope	4.35 %
Sideslopes	2.50:1 (L) 2.50:1 (R)
Manning's n	0.030
Max. Velocity	5.00 fps
Material	GRADED LOAM - COBBLES NONCOLLOIDAL
Freeboard	.3 ft

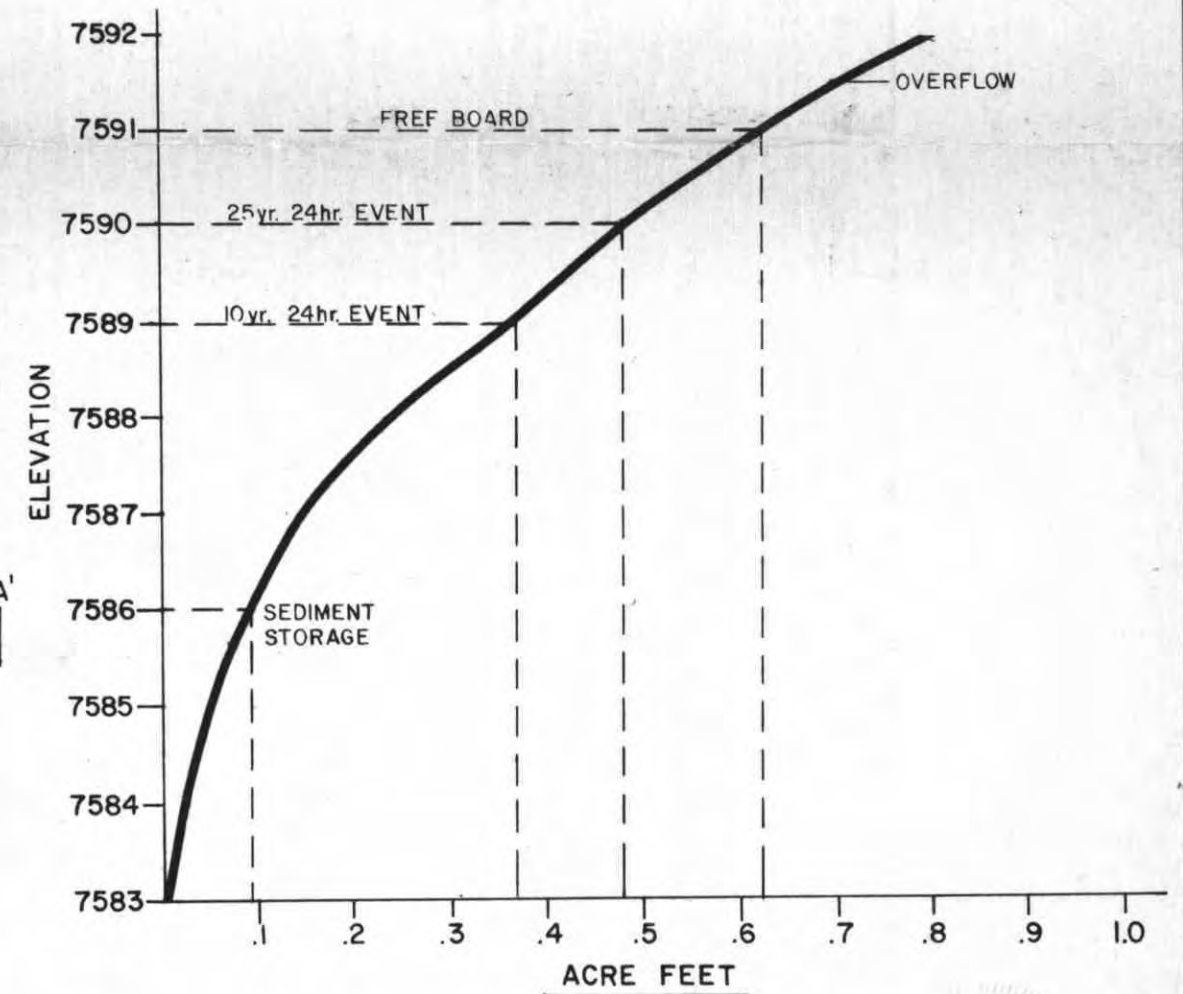
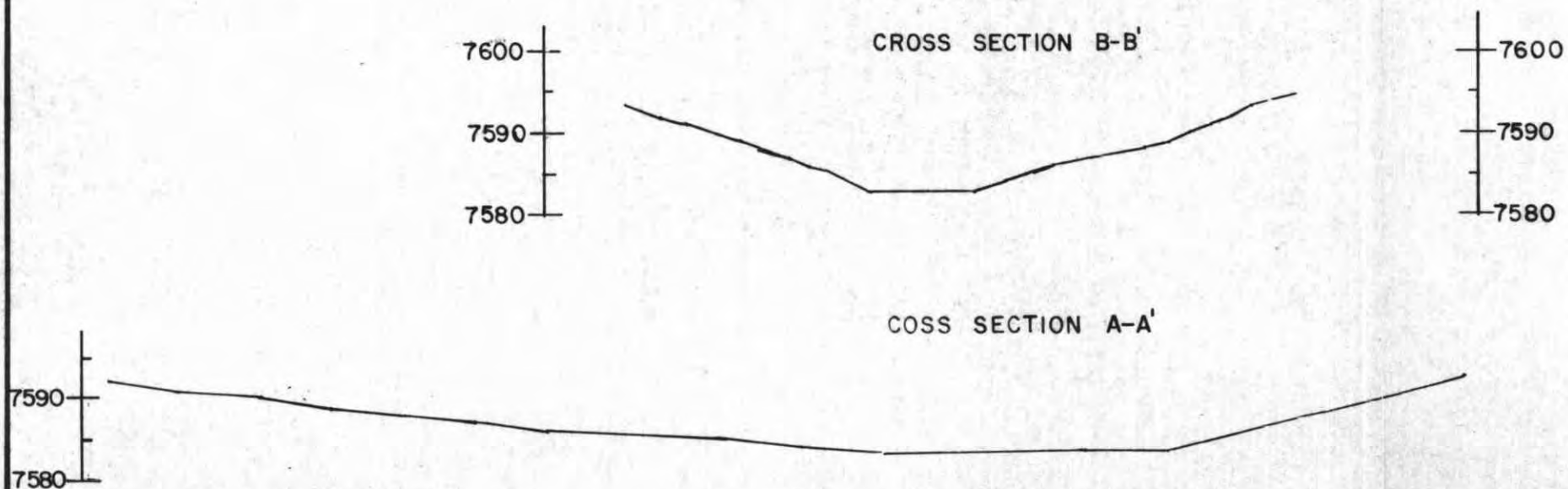
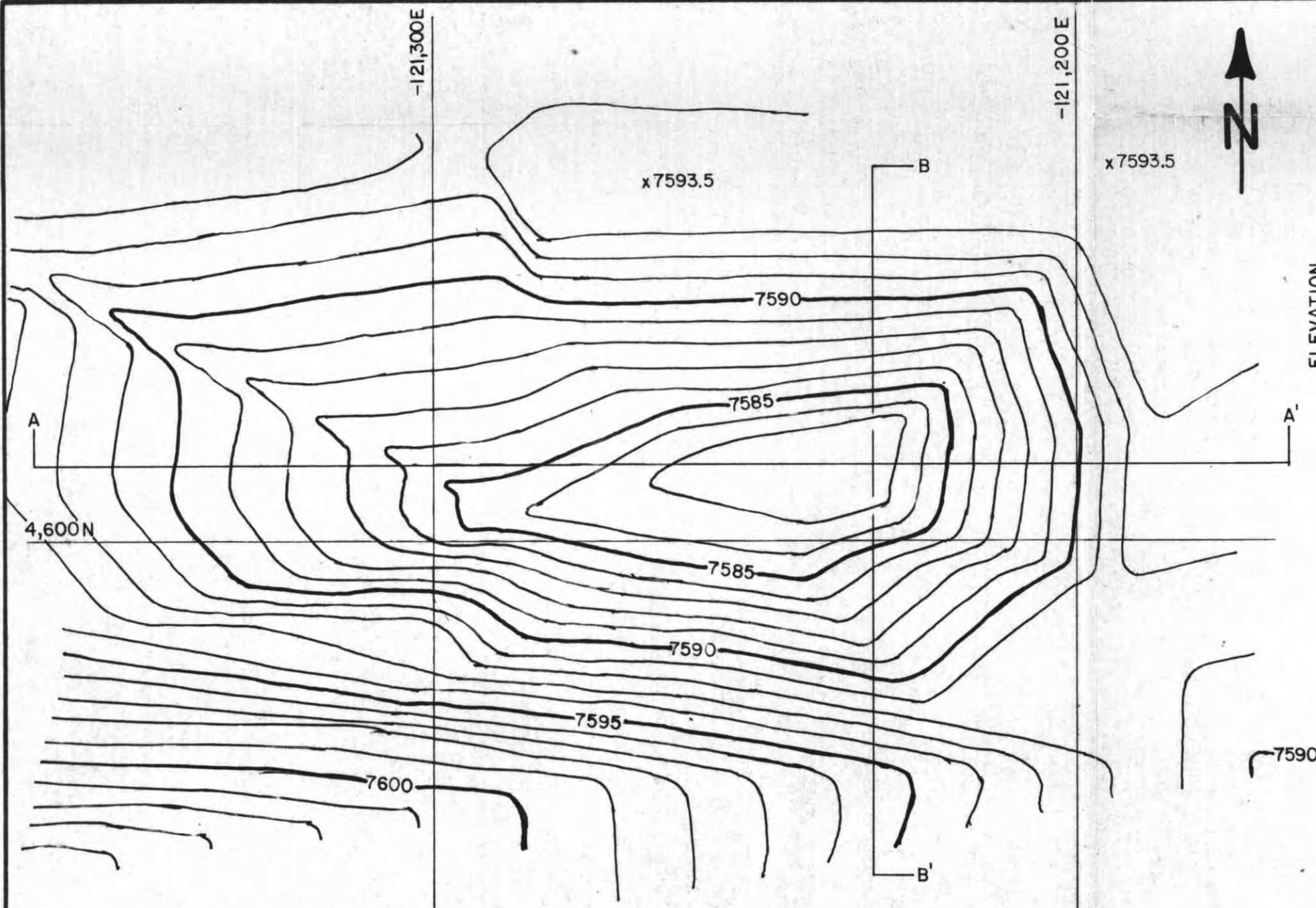
RESULTS:

Actual Discharge	5.85 cfs
Depth	0.69 ft
with Freeboard	0.99 ft
Top Width	3.47 ft
with Freeboard	4.97 ft
Velocity	4.87 fps
Cross Sectional Area	1.20 sq ft
Hydraulic Radius	0.32 ft
Froude Number	1.46



**HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL**

BUREAU OF PUBLIC ROADS JUL 1943



The information presented on this drawing has been reviewed by me and is true and accurate to the best of my knowledge and belief.

18378
P.E. No.

Byron S. Walker
Name

*identical to 11/15/93 as-built
that is in permit application*

RECEIVED

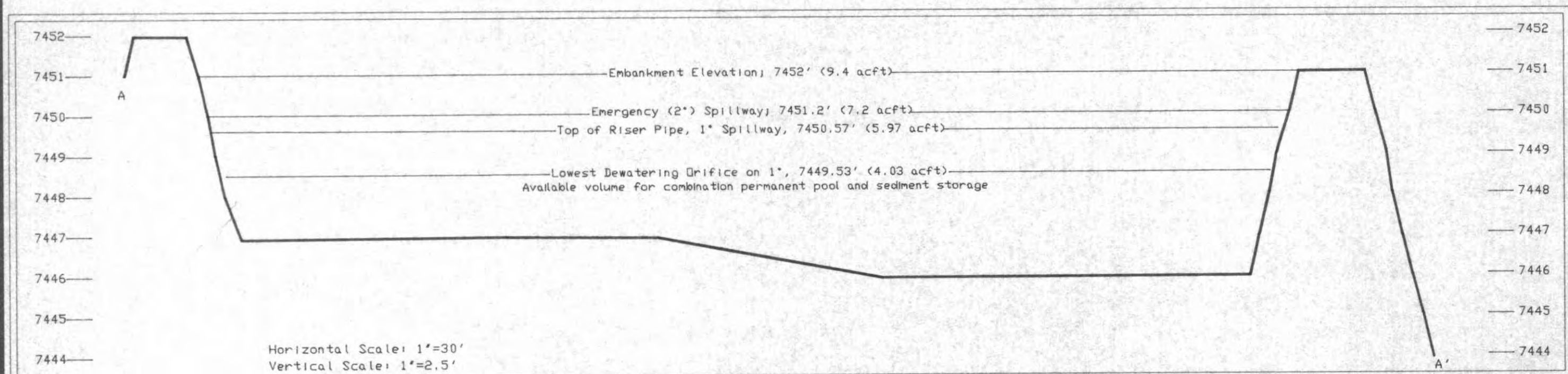
MAY 10 1993

Division of Minerals & Geology

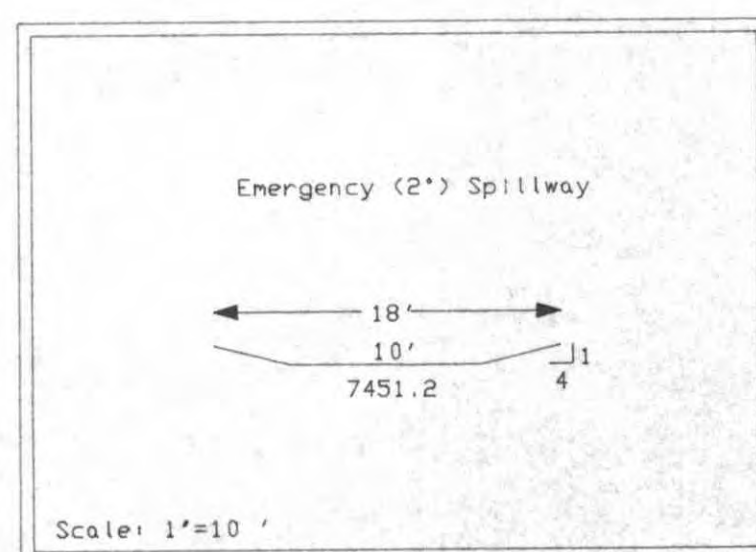
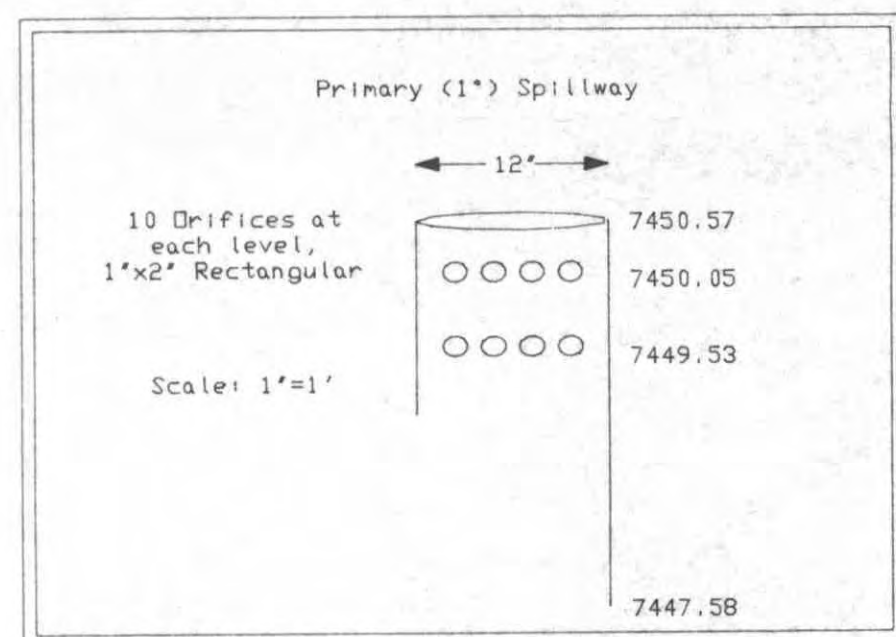


REV	BY	DATE	BASIN RESOURCES, INC.	
			NEW ELK MINE	
			EXHIBIT 19- CONTAINMENT AREA No.2	
			AS BUILT	
			PREPARED BY: R. C. S.	
			DWN BY: R. C. S.	DATE: 4/26/93

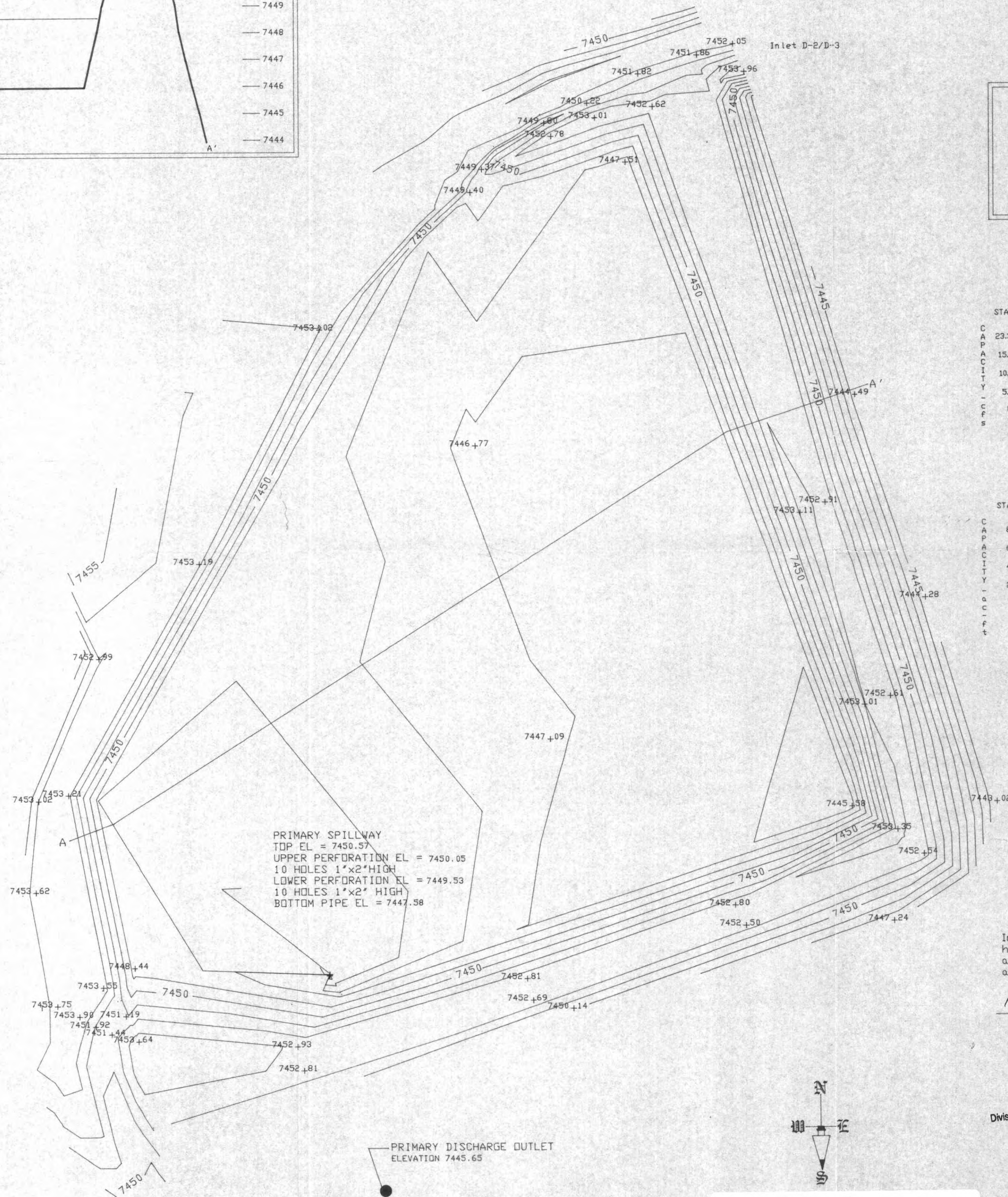
Scale: 1"=20'



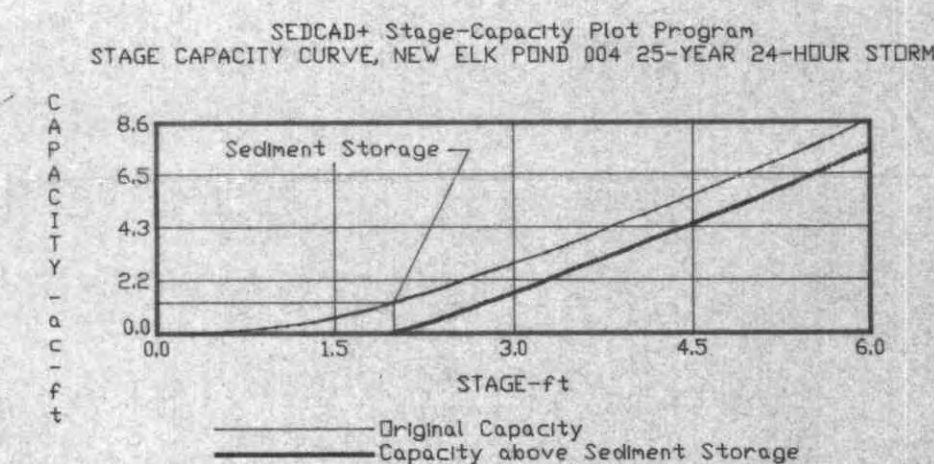
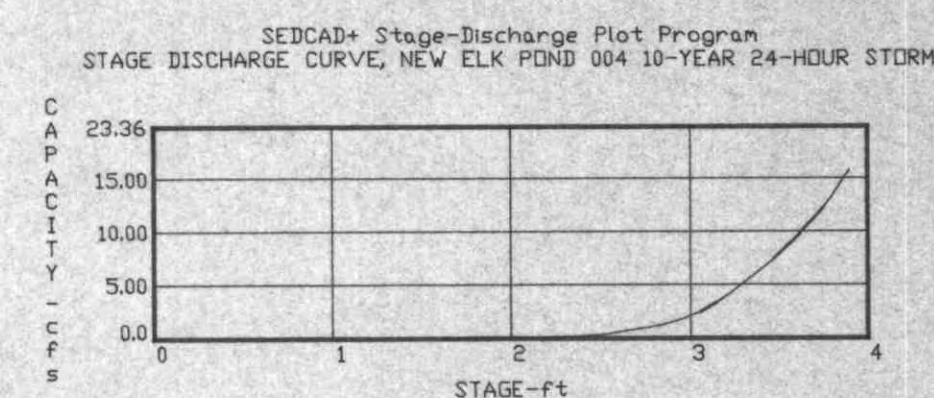
6300ftN



6000ftN



Elevation-Area Capacity Discharge Table				
Elev.	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)
7446	0	0.04	0.00	0.00
7448	2	1.35	1.25	0.00
7449	3	1.80	2.81	0.00
7450	4	1.90	4.60	0.12
7451	5	1.99	6.50	2.25
7452	6	2.08	8.64	23.36



S/E "EXHIBIT 19- Pond 004 As-built"

Information presented on this map has been reviewed by me and is accurate to the best of my knowledge and information

10/31/95 29681
DATE PE#

RECEIVED
NOV 03 1995

Division of Minerals & Geology



BASIN RESOURCES, INC.
NEW ELK MINE

TITLE POND 004 ASBUILT

DESIGN BY: DATE: 10/04/95

DWN BY: DGF SCALE: 1"=30'

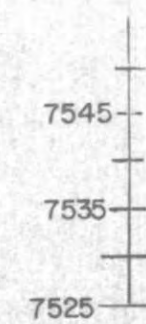
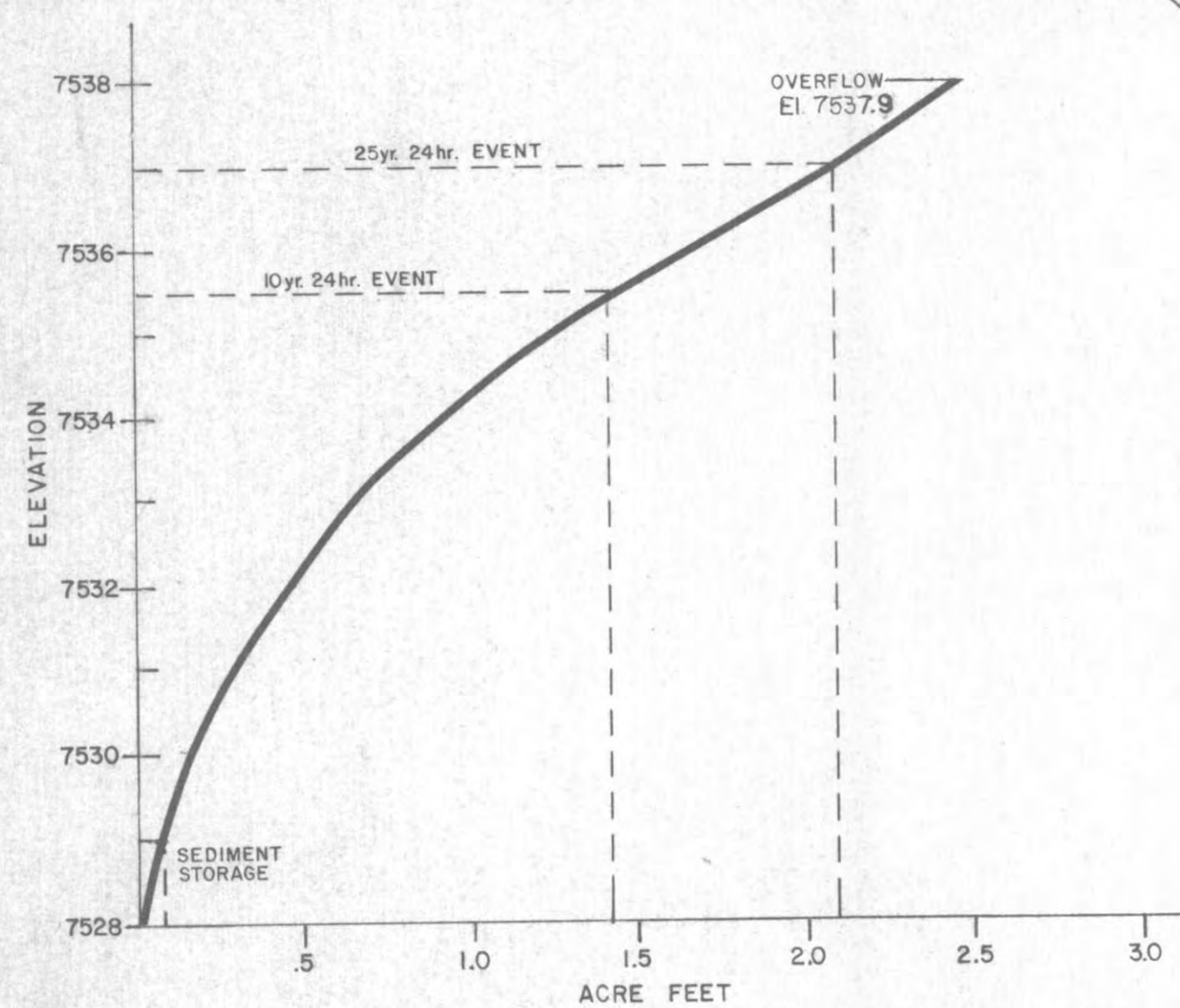
CHK'D BY: DWG NO.

Permit Number: C1981-012
Class: 20 Permit
Section/Exhibit: 101.3
Class: ☐ Revision
Type/Seq:
Class: ☐ Report ☐ Hydro ☐ General
Doc Type:
☐ Application (Coal only) ☐ Bond ☐ Enforcement ☐ Inspection

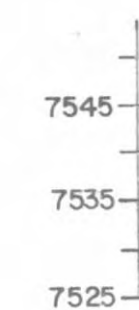


112-39





CROSS SECTION A-A'



CROSS SECTION B-B'

The information presented on this drawing has been reviewed by me and is true and accurate to the best of my knowledge and belief.
 18378 P.E. No. *James A. Schiller* Name
 7 May 1993

*Identical to as-built
 of 11/15/93 that is in
 final application*

RECEIVED
 MAY 10 1993

Division of Minerals & Geology

BASIN RESOURCES, INC.

NEW ELK MINE

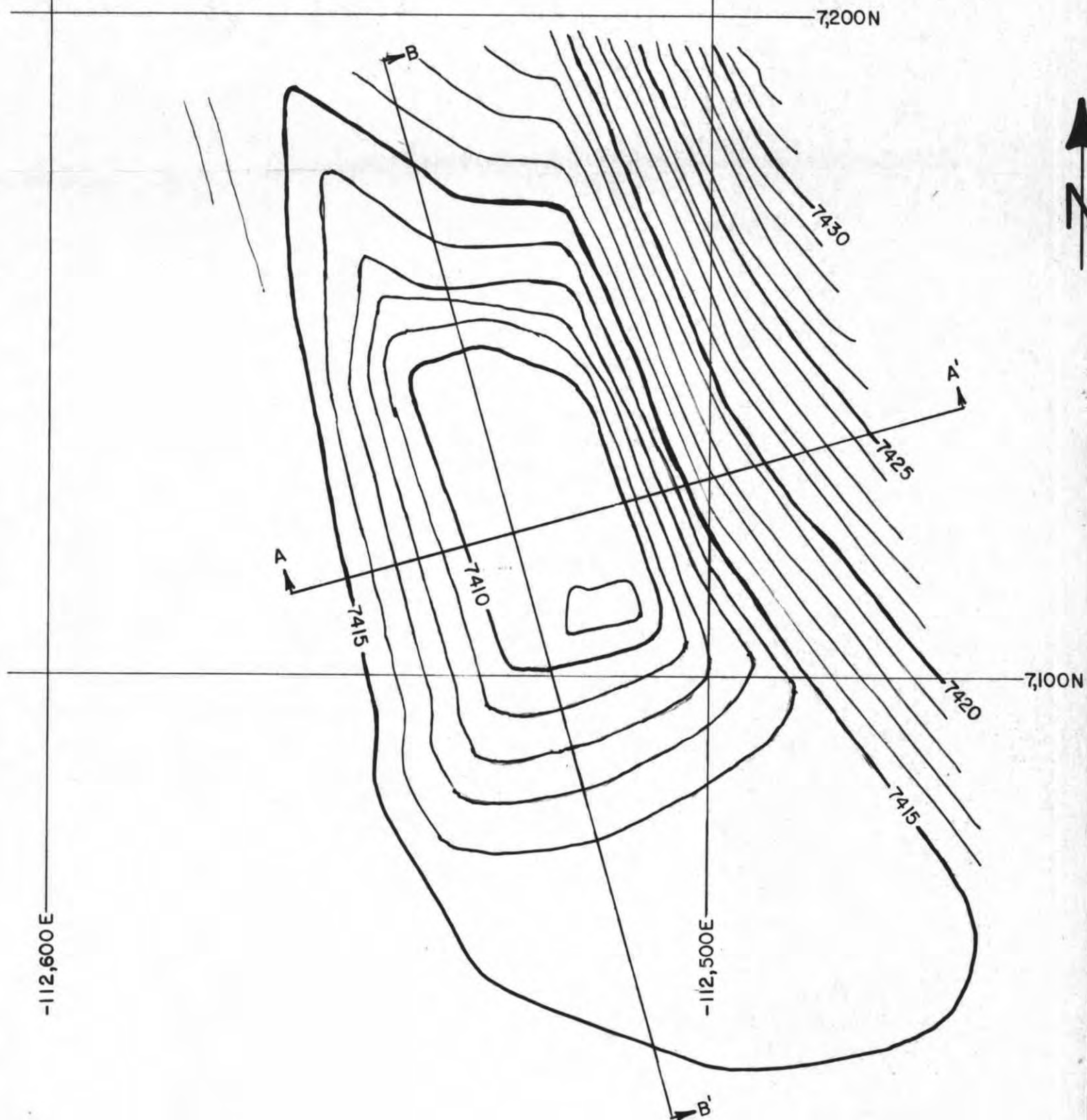
**EXHIBIT 19- CONTAINMENT AREA No. 1
 AS BUILT**

REV	DESCRIPTION	BY	DATE	REV	DESCRIPTION	BY	DATE

Scale: 1" = 20'
 WO NO:

DRAWN BY: R. C. S. PREPARED BY: R. C. S. DATE: 5/06/1993

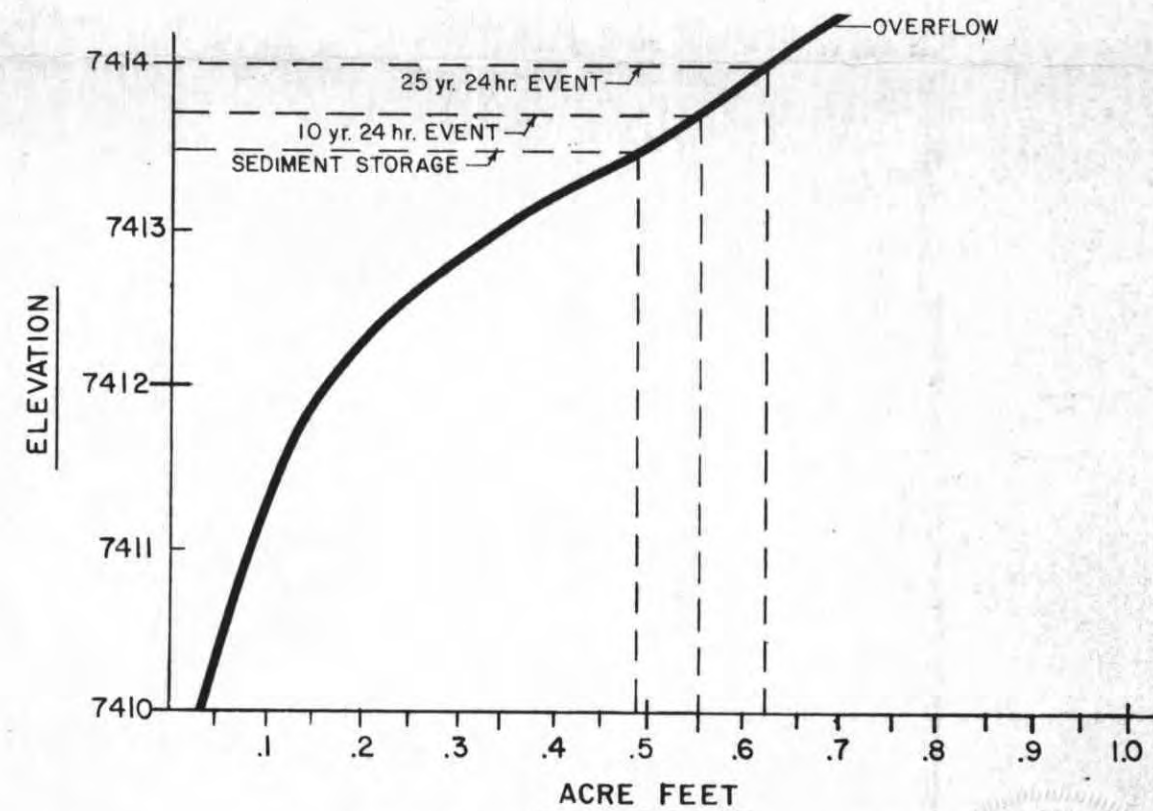




7420
7410

CROSS SECTION B-B'

7420
7410



The information presented on this drawing has been reviewed by me
and is true and accurate to the best of my knowledge and belief.

18378
P.E. No.

Byron T. Walker
Name

identical to as-built of 11/15/93
that is in the permit application
RECEIVED

CROSS SECTION MAX 10 1993

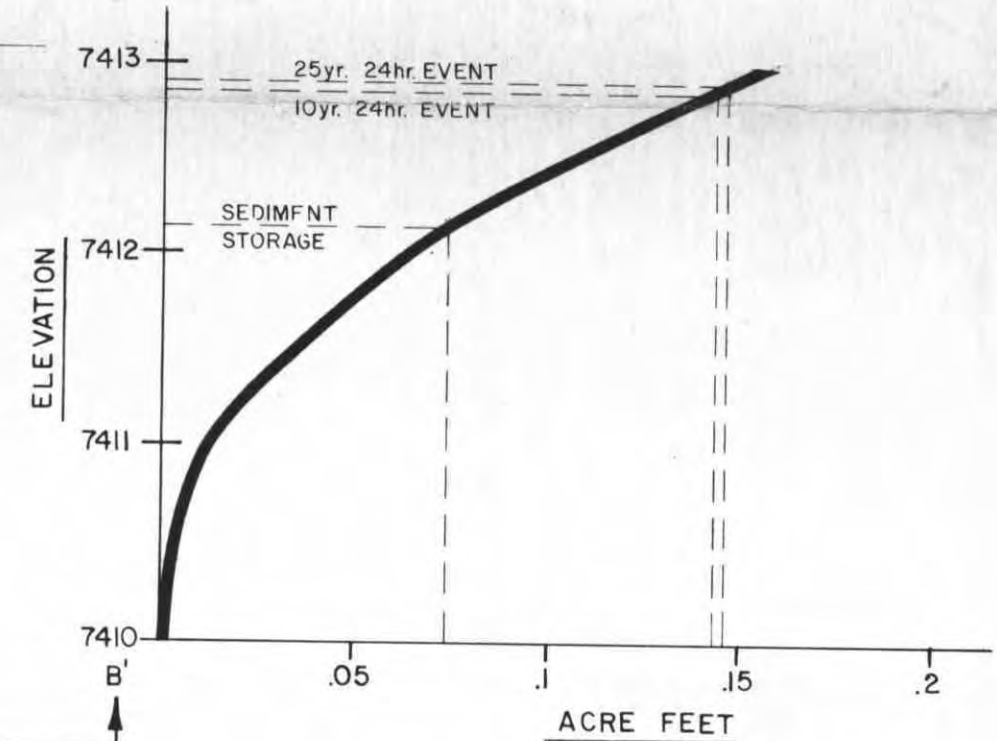
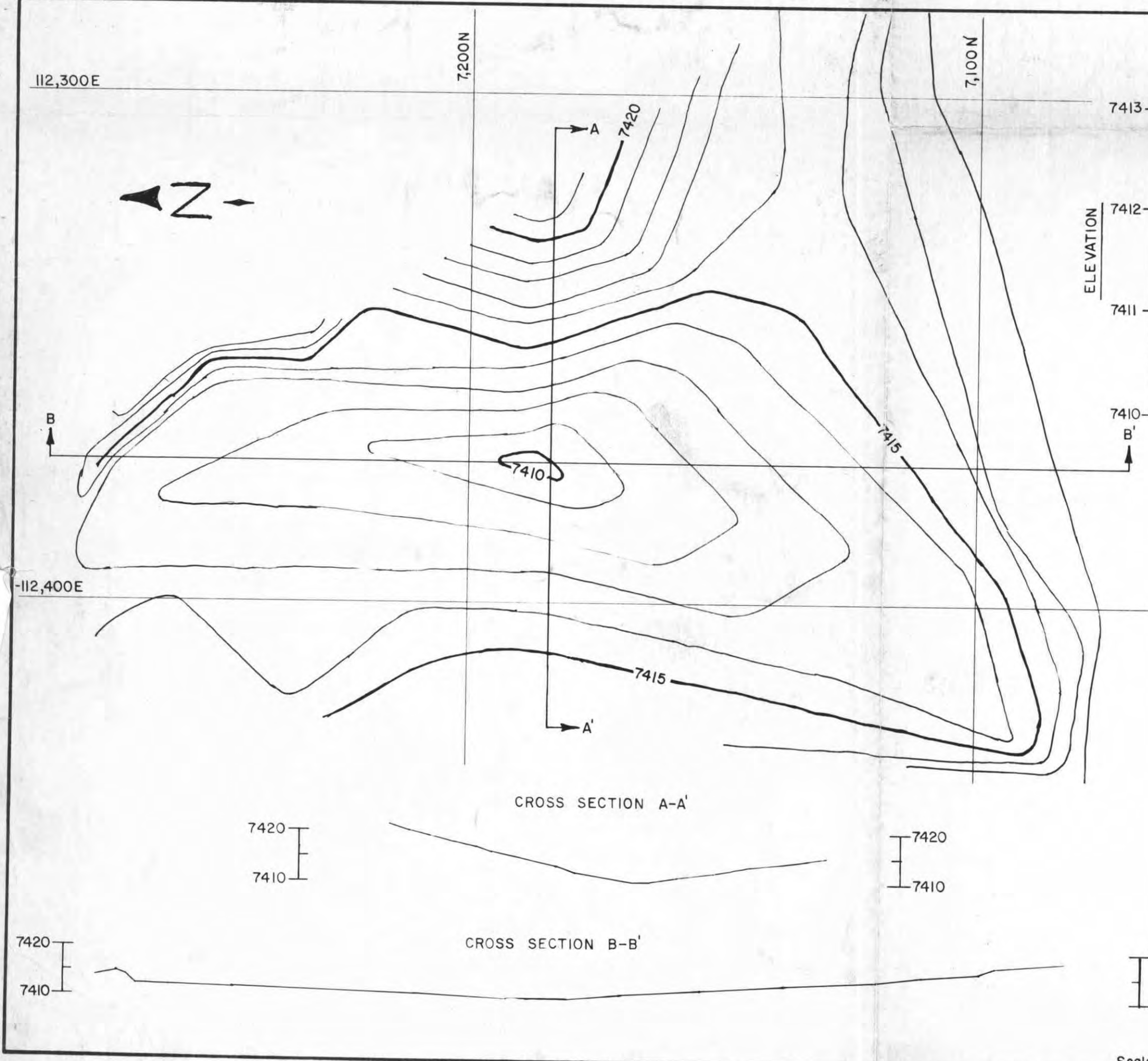
Division of Minerals & Geology



7430
7420
7410

Scale: 1" = 20'

REV	BY	DATE	BASIN RESOURCES, INC.	
			NEW ELK MINE	
			EXHIBIT 19 - CONTAINMENT AREA RDA-SW AS BUILT	
			PREPARED BY: R.C.S.	
			DWN BY: R.C.S.	DATE: 4/24/93



The information presented on this drawing has been reviewed by me and is true and accurate to the best of my knowledge and belief.

10378
P.E. No.

Byron A. Walker
Name

identical to as-built
of 11/15/93 that is
in permit application

RECEIVED

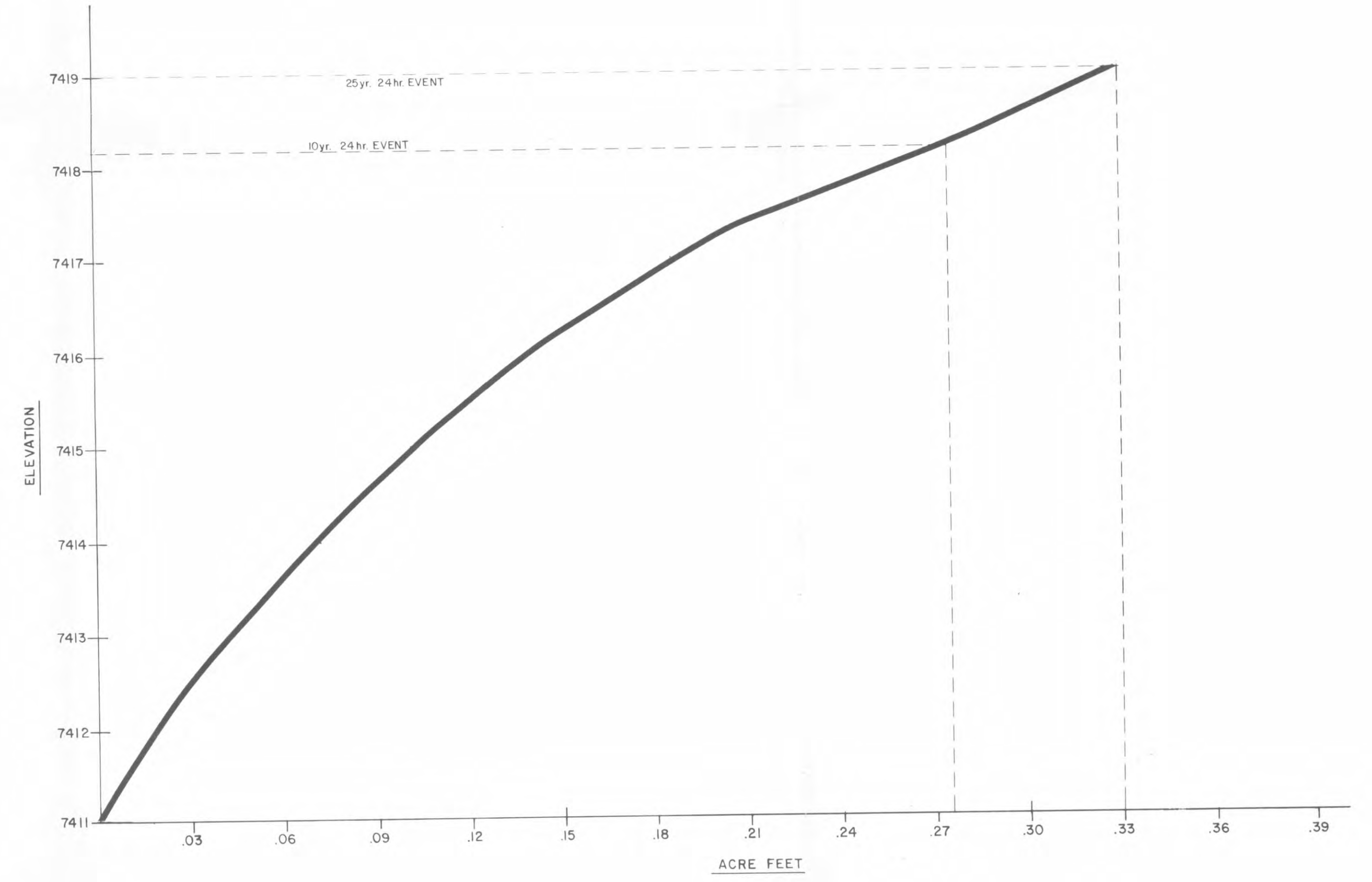
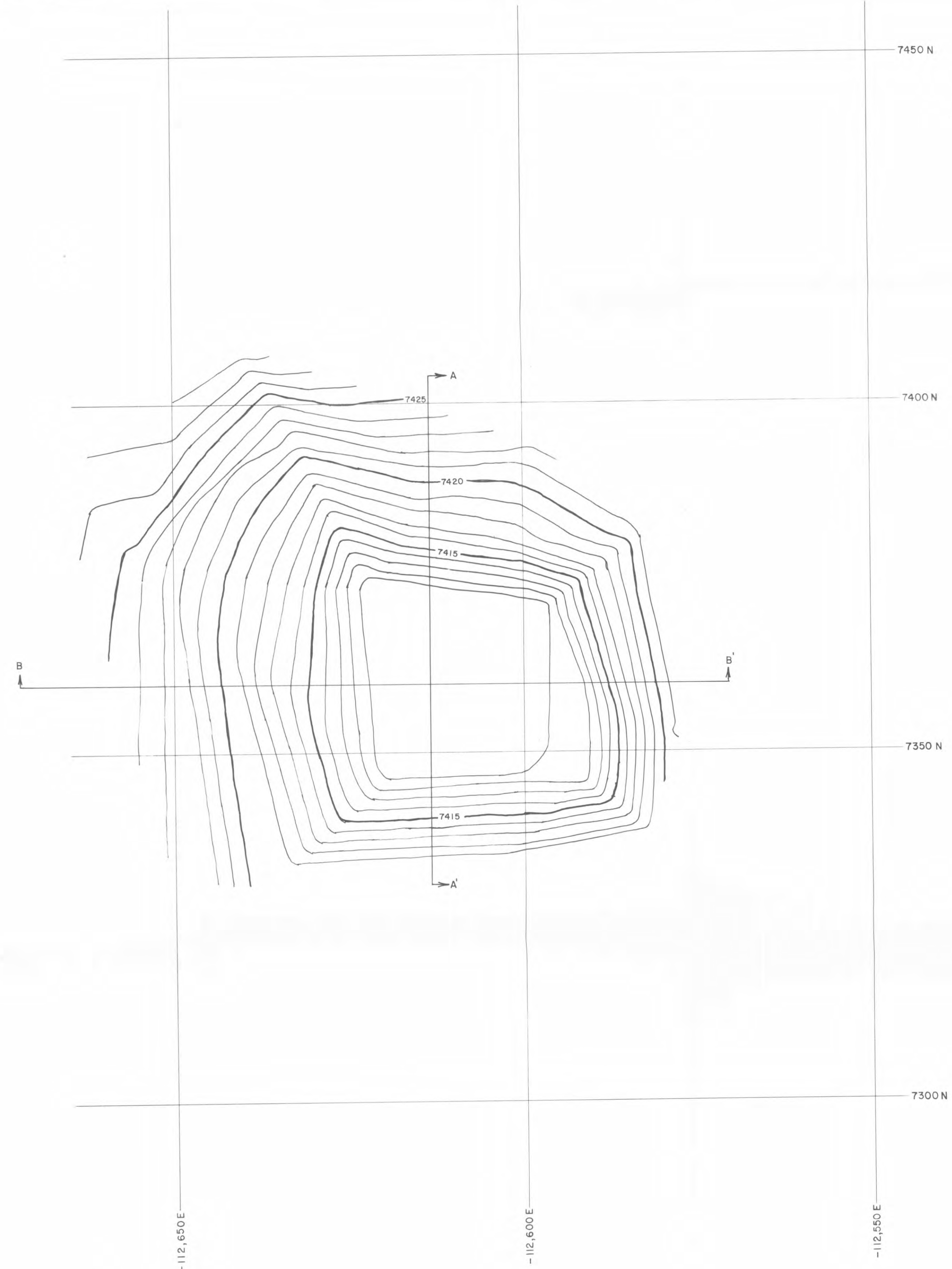
MAY 10 1993

Division of Minerals & Geology



REV	BY	DATE	BASIN RESOURCES, INC	
			NEW ELK MINE	
			EXHIBIT 19 - CONTAINMENT AREA RDA-SE AS BUILT	
			PREPARED BY: R. C. S.	
			DWN BY: R. C. S.	DATE: 2/26/93

Scale: 1" = 20'



The information presented on this drawing has been reviewed by me and is true and accurate to the best of my knowledge and belief.

18378 P.E. No. *Stephen A. Walker* Name

Identical to 11/15/93 as-built that is in permit application

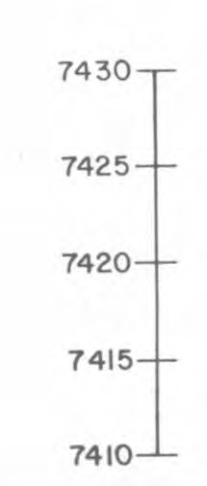
SCANNED

RECEIVED
MAY 10 1993

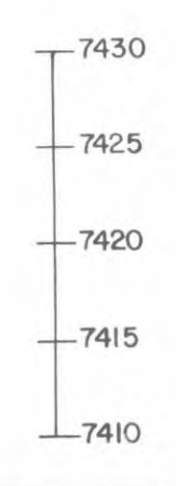
Division of Minerals & Geology

Permit Number: *C1981-012*
Class: *25* Permit
Section/Exhibit: *Vol. 2*
Class: ☐ Revision
Type/Seq:
Class: ☐ Report ☐ Hydro ☐ General
Doc Type:
☐ Application (Coal only) ☐ Bond ☐ Enforcement ☐ Inspection

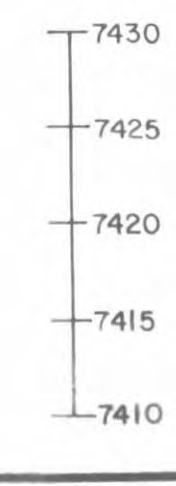
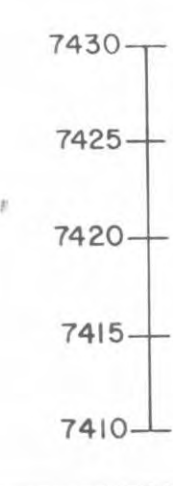
BASIN RESOURCES, INC.							
NEW ELK MINE							
★ EXHIBIT 19- CONTAINMENT AREA RDA-N AS BUILT							
REV	DESCRIPTION	BY	DATE	REV	DESCRIPTION	BY	DATE
						Scale: 1"=10'	
						WO NO:	
DRAWN BY: R.C.S.		PREPARED BY: R.C.S.		DATE: 4/22/1993			

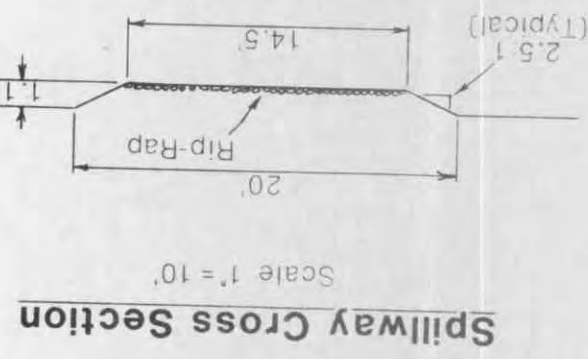
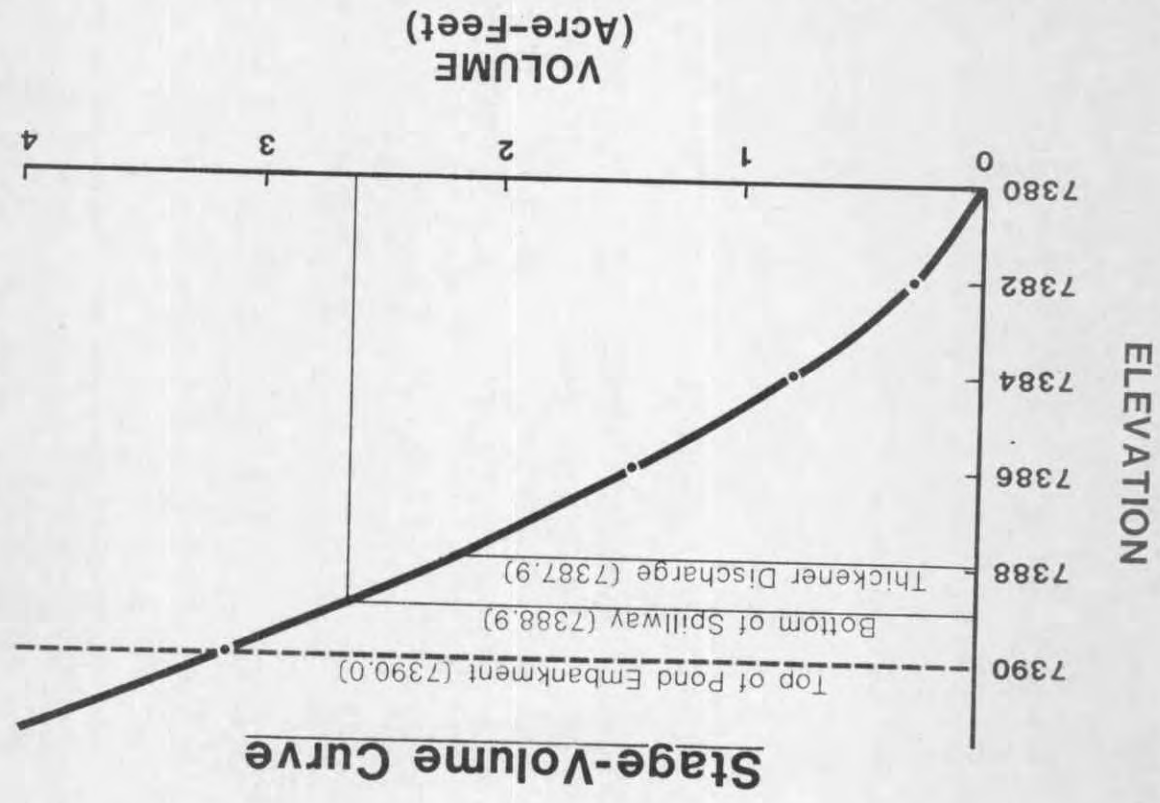


CROSS SECTION B-B'



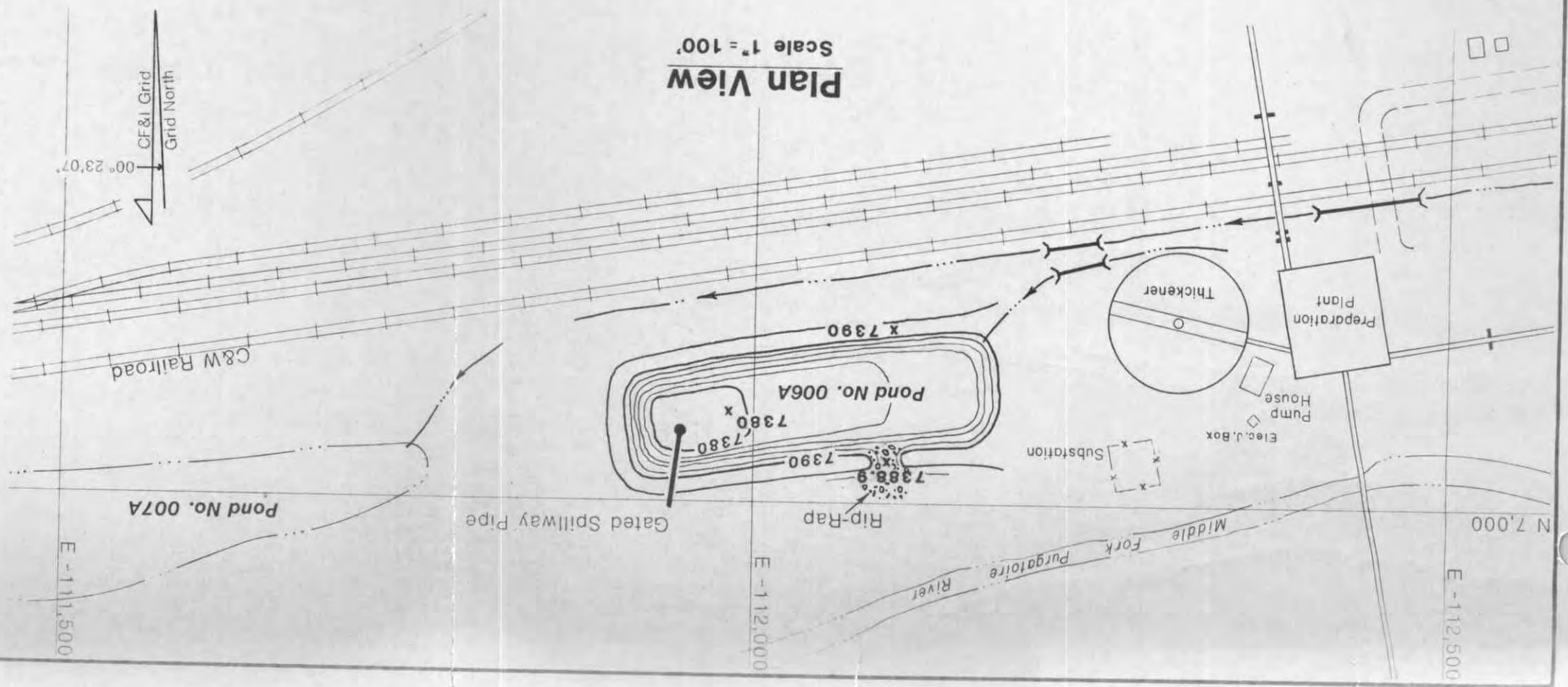
CROSS SECTION A-A'





Top of Pond Embankment (7390.0)
Bottom of Spillway (7388.9)

Plan View
Scale 1" = 100'



The information presented on this map has been reviewed by me and is accurate to the best of my knowledge and information.

Date: 9-17-86
Steven D. Magnuson
P.E. No. 22485

REV	BY	DATE	DESCRIPTION
1	SM	12/16/86	NEW ELK MINE
2	SM	3/19/87	Las Animas County, Colorado
POND 006A MODIFICATIONS			
WYOMING FUEL COMPANY			
PREPARED BY: SMagnuson			
DWN BY: SAdavis			
DATE: 9/15/86			

S/E "EXHIBIT 19"

RECEIVED
MAR 20 1987
MINED LAND
RECLAMATION DIVISION



S/E "EXHIBIT 19-

5/11 Miscellaneous Drainage Supplement //

West Portal Containment Areas 1 and 2 Sizing - no date

West Portal Culvert Data C21 through C25, 3/19/87

MR 40 Culverts 43 and 44, 1/18/92

TR-23 SAE Demonstration for Seven Sites, 2/19/92

West Portal Substation, 9/26/91

West Portal Water Tanks Area 1, 9/26/91

West Portal Water Tanks Area 2, 9/26/91

West Portal Core House, 6/18/91

East Portal Water Tanks, 5/20/91

MR 43 Ditch D17 with D33 Included, 3/27/92

TR 25 Containment Area 1, 6/11/92

East of the Refuse Belt, 6/20/92

West of Refuse Overflow, 6/20/92

Containment Area 2, 6/11/92

West of Refuse Belt 6/20/92

TR-30 New Elk Pumphouse, West Portal SAE, 10/14/93

Culvert 49 West of New Elk Hoist House, 10/14/93

D23A, North Road Ditch, North of the Hoist House, 10/15/93

D23B, North Road Ditch, South of the Hoist House, 10/15/93

SAE for Contaminated Topsoil, 10/15/93

TR-31 Ditch 24 & 24A, Culverts C34, C35, C36, C46, C47, 12/3/93

Culvert C48 on Ditch D26, 12/3/93

TR-33 D18 from Head to 960' West, 10/8/93

SAE Demo, Topsoil Pile 2, NW of Plant, 11/29/93

TR-35 East Side of Dev Coal Waste Pile SAE, 7/6/94

TR-38 Refuse Area Ditch D35C and Culvert C58, 3/7/95

Refuse Area Ditch D36, 3/7/95

Refuse Area Ditch D35D, 3/9/95

Refuse Area Ditch D35A, 3/9/95

Refuse Area Culvert C57, 3/23/95

was 10/14/93
SAE

West Portal Containment Area Sizing
Containment Areas 1 and 2

Containment Area 1

Runoff Volume

Area = 10.3 acres

CN = 80

10 year-24 hour = 2.9 inches

1.25 inches x 10.3 acres x 1 foot/12 inches = 1.07 acre-feet

Sediment Volume 3 Years

$$A = R \text{ KL SC } S_D$$

$$A = (75)(.24)(7)(.16)(.39)(.65) = 5.11 \text{ tons/year/acre}$$

$$5.11 \text{ tons/year/acre} \times 2000 \text{ lbs} \times 1 \text{ ft}^3 / 120.5 \text{ lbs} \times 1 \text{ acre} / 43560 \times .6 \times 3 \text{ years} = .0035 \text{ ac-ft/acre} \times 10.3 \text{ acres} = .04 \text{ ac-ft (nominal)}$$

Current capacity = 150 ft x 150 ft x 4 ft = 90,000 ft³ = 90,000 ft³ / 43560 ft³/acre-foot = 2.07 acre-ft; existing containment can handle runoff.

Containment Area 2

Runoff Volume

Area = 2.9 acres

CN = 80

10 year-24 hour = 2.9 inches

runoff = 1.25 inches

1.25 inches x 2.9 acres x 1 foot/12 inches = 0.30 acre-feet

Sediment Volume 3 years

$$A = R \text{ KL SC } S_D$$

$$A = (75)(.24)(.38)(.02)(.39)(.65) = .03 \text{ tons/year/acre}$$

$$.03 \text{ tons/year/acre} \times 2000 \text{ lbs} \times 1 \text{ ft}^3 / 120.5 \text{ lbs} \times 1 \text{ acre} / 43560 \times .6 \times 3 \text{ years} = .0000206 \text{ acre-ft/acre} \times 2.9 \text{ acres} = .00006 \text{ ac-ft (nominal)}$$

Containment Area 2 sizing = 114 ft x 114 ft x 2 ft = 25,992 ft³ / 43560 ft³/acre-foot = 0.6 acre-feet.

West Portal Culvert Data
C21 through C25

Culvert No.	Contributing Drainage Area (Acres)	CN	Watershed Slope (Ft/Ft)	Slope Adjust. Factor	Discharge per Inch of Runoff (cfs/inch)	Runoff (Inch)	10YR-24HR Peak (cfs)	Minimum Culvert Diameter (inches)
21 ⁽¹⁾	31.3	75	0.400	1.20	36.0	0.96	41.5	36
22 ⁽¹⁾	(same as above)							
23 ⁽²⁾	52.5	75	0.400	1.20	55.0	0.96	63.4	(see culvert analysis for pipes 23, 24 & 25)
24 ⁽²⁾	33.3	75	0.400	1.20	40.0	0.96	<u>46.1</u>	
25 ⁽²⁾	(total of above)						109.5	

(1) Culvert diameter determined using "Culvert Sizing Nomograph", Table 22 using 1-1/2 ft of head on pipe; HW/D = 1.5.

(2) Culvert sizing determined using Hazen-Williams formula for pipe flow below.

West Portal Area
Culvert Analysis
for Pipes 23, 24 and 25

The west portal pipes no. 23, 24 and 25 bypass runoff from the undisturbed drainage area south of the west portal industrial buildings. These pipes are on a fairly steep slope and due to the length need to be analyzed under pipe flow conditions using Hazen-Williams formula. The following analysis determines the maximum flow for pipe no. 25, the collector pipe for pipes nos. 23 and 24.

Hazen Williams Formula

$$Q_{\max} = 0.442 d^{2.63} c (P_1 - P_2 / L)^{0.54}$$

c = 110 (pipe constant)

d = pipe diameter in inches = 42"

P₁ = inlet pressure (psig) = 7.3 psi

P₂ = outlet pressure (psig) = 0 psi

L = pipe length (ft) = 230 ft

Q = flow in gpm

$$Q_{\max} = 0.442 (42)^{2.63} (110) (7.3-0/230)^{0.54}$$

$$Q_{\max} = 140,224 \text{ gpm or } \underline{312.4 \text{ cfs}}$$

The maximum flow which pipe 25 will handle is 312.4 cfs which is more than the required 109.5 cfs.

Revised 3-19-87

Civil Software Design -- SEDCAD+ Version 3
 Copyright (C) 1987-1990. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: A:\D6A User: C A BOUDREAU

Date: 01-14-1992 Time: 13:35:27
 10 YR 24 HR DITCH D6A HYDRO ONLY
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS SWS	Area (ac)	CN UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	3.98	90 M	0.063	0.000	0.000	0.0	0.63	7.34
Type: Null Label: At Culvert								
111 Structure	3.98						0.63	
111 Total IN/OUT	3.98						0.63	7.34

Civil Software Design -- SEDCAD+ Version 3
 Copyright (C) 1987-1990. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: A:\D6A User: C A BOUDREAU

Date: 01-14-1992 Time: 13:35:27
 10 YR 24 HR DITCH D6A HYDRO ONLY
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

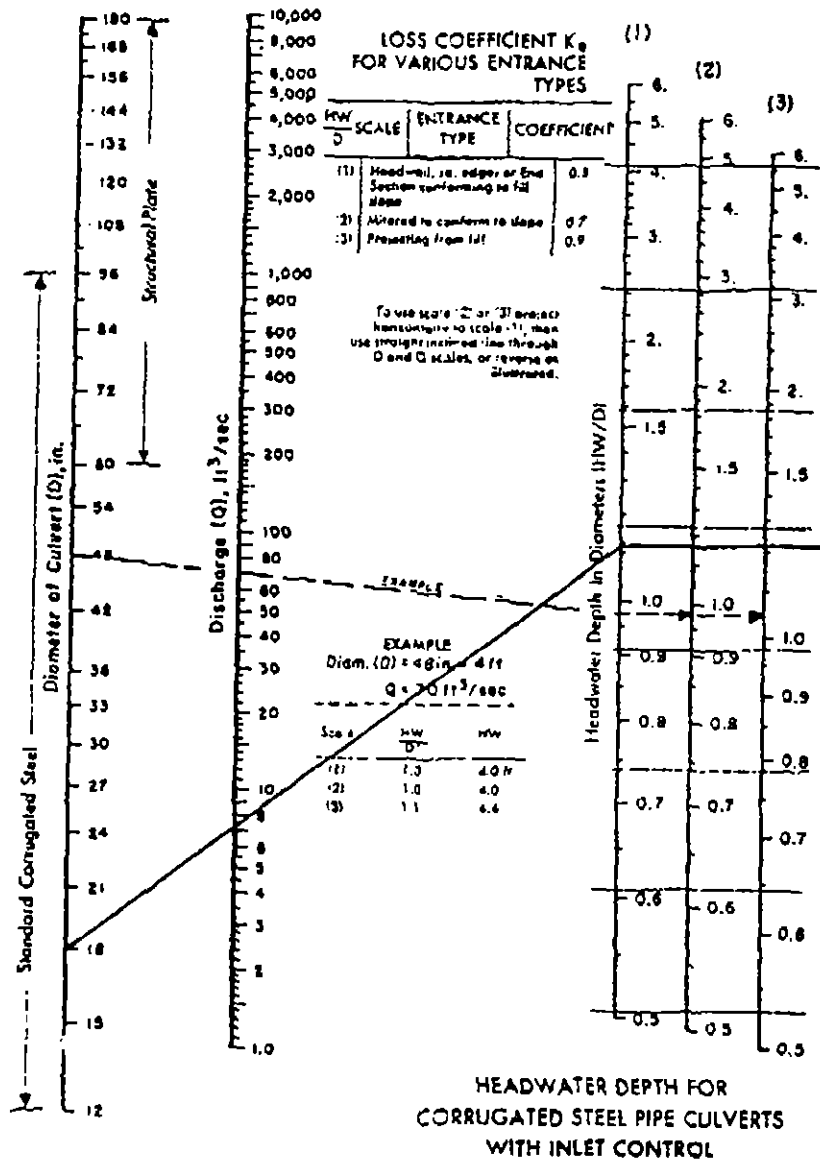
DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

JBS SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1 1 1	1	-a	5	500.00	4.80	2.19	0.06	0.063	

FOR CULVERTS 43 AND 44

CULVERT SIZING NOMOGRAPH



FHWA HEC 5

Figure 4-28 Inlet control nomograph for corrugated steel pipe culverts. The manufacturers recommended keeping HWD/D to a maximum of 1.5 and preferably to no more than 1.0.

Revised 1-18-92

**WYOMING FUEL COMPANY
NEW ELK MINE**

EROSION CONTROL ANALYSIS

Erosion from the West Portal Substation and West Portal Water Tank Areas were modeled using the SEDCAD+ software package to determine if Wyoming Fuel Company's effluent standard will be met while the vegetation is becoming established. The effluent standard for Wyoming Fuel Company's New Elk Mine is 0.50 ml/L. Based on the SEDCAD+ analyses, Wyoming Fuel Company can meet the effluent standard during reclamation. However, alternate sediment control consisting of check dams constructed of hay bales will be installed and maintained to achieve the effluent standard during revegetation of the sites.

Two major assumptions were made to conduct the SEDCAD+ analyses. First, we assumed a mulch will be applied to the sites so that total ground cover equals or exceeds 70 percent. Second, we assumed all water flows off each site through a single exit point. Because characteristics of the sites are such that this second assumption is unlikely, the assumption is essentially a worst case scenario.

The SEDCAD+ analyses indicate three check dams will be needed to meet the effluent standard. One check dam will need to be installed across the entire width of the lower end of the West Portal Substation site. The other two dams will be placed on the northwest side of the West Portal Water Tank area (Area 1). The first of these two dams will need to be placed across the site, midway down the slope. While the second dam will need to be installed across the entire width of the lower boundary of the site. These dams will consist of standard two foot high hay bales buried 6 inches into the ground and placed end to end and anchored with steel pins.

The West Portal Water Tank Area 2 will not require any further modification once the mulch has been placed which equals or exceeds 70 percent cover.

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

WEST PORTAL SUBSTATION

by

Name: C A BOUDREAU

Company Name: Greystone Development Consultants
File Name: A:\WSTPRT2

Date: 09-26-1991

Civil Software Design -- SEDCAD+ Version 3
Copyright (C) 1987-1990. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: A:\WSTPRT2 User: C A BOUDREAU
Date: 09-26-1991 Time: 17:07:23

WEST PORTAL SUBSTATION

Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50 2.60
Submerged Bulk Specific Gravity: 1.17 1.18

Particle Size Distribution(s):

Size (mm)	MIDNIGHT COMP % Finer
76.2000	94.00
4.7700	80.00
SAND 2.0000	72.50
0.4200	67.50
SILT → 0.0740	65.00
CLAY → 0.0030	0.01

=====

Soil Group D

27.5% gravel
7.5% sand
65% silt

Company Name: Greystone Development Consultants
 Filename: A:\WSTPRT2 User: C A BOUDREAU
 Date: 09-26-1991 Time: 17:07:23

WEST PORTAL SUBSTATION

Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.10	89	M	0.018	0.000	0.000	0.0	0.02	0.18
Type: Check Dam Label:										
111	Structure	0.10			2% 6.910 USE 3				0.02	
111	Total IN/OUT	0.10							0.02	0.18

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration^k
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP 70% corr	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
111	1	0.30	74.0	6.0	0.028	0.000	1	0.0				
Type: Check Dam Label:												
111	Structure	.32		2%				0.0				
111	Total IN							0.0	1810	1.16	0.84	0.06
111	Total OUT							0.0	906	0.49	0.35	0.03

Company Name: Greystone Development Consultants
Filename: A:\WSTPRT2 User: C A BOUDREAU
Date: 09-26-1991 Time: 17:07:23

WEST PORTAL SUBSTATION

Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1

Drainage Area from J1, B1, S1, SWS(s)1: 0.1 acres

STRAW Total Contributing Drainage Area: 0.1 acres

POROUS ROCK CHECK DAM INPUTS:

Height (ft)	Slope (%)	Z	Manning's n	Porosity (%)
1.5	6.00	3.0:1	0.025	40.00

Trap Efficiency: 49.98 %

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Peak Sediment Concentration (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration ml/l	24VW (ml/l)	24AA (ml/l)
IN	0.02	0.18	0.0	1810	1.16	0.84	0.06
OUT	0.02	0.18	0.0	906	0.49	0.35	0.03

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

WEST PORTAL WATER TANKS AREA 1

by

Name: C A BOUDREAU

Company Name: Greystone Development Consultants
File Name: A:\WSTH203

Date: 09-26-1991

Civil Software Design -- SEDCAD+ Version 3
Copyright (C) 1987-1990. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: A:\WSTH203 User: C A BOUDREAU
Date: 09-26-1991 Time: 14:51:19
WEST PORTAL WATER TANKS AREA 1
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
GENERAL INPUT TABLE
=====

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.17

Particle Size Distribution(s):

Size (mm)	DARGOL COMPLE % Finer	SOIL GROUP D
76.2000	95.00	
4.7700	91.00	
2.0000	86.00	
0.4200	77.50	
0.0740	63.00	
0.0030	0.01	

Company Name: Greystone Development Consultants
 Filename: A:\WSTH203 User: C A BOUDREAU
 Date: 09-26-1991 Time: 14:51:19
 WEST PORTAL WATER TANKS AREA 1
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	0.13	89	M	0.004	0.000	0.000	0.0	0.02	0.22	
		Type: Check Dam		Label: DAM 1							
111	Structure	0.13								0.02	
111	Total IN/OUT	0.13								0.02	0.22
112	1	0.13	89	M	0.004	0.000	0.000	0.0	0.02	0.22	
		Type: Check Dam		Label: DAM 2							
112	Structure	0.13								0.04	
112	Total IN/OUT	0.25								0.04	0.45
111 to 112 Routing					0.000	0.000					

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)	
R 111	1	0.18	32.0	15.0	0.028	0.000	1	0.0					
		Type: Check Dam		Label: DAM 1									
111	Structure								0.0				
111	Total IN								0.0	2112	1.37	0.94	0.09
111	Total OUT								0.0	1031	0.56	0.38	0.03
R 112	1	0.18	32.0	15.0	0.028	0.000	1	0.0					
		Type: Check Dam		Label: DAM 2									
112	Structure								0.0				

112 Total IN	0.0	1572	0.96	0.66	0.06
112 Total OUT	0.0	912	0.49	0.34	0.03
=====					
11 to 112 Routing	0.004				
=====					

Company Name: Greystone Development Consultants
Filename: A:\WSTH203 User: C A BOUDREAU
Date: 09-26-1991 Time: 14:51:19
WEST PORTAL WATER TANKS AREA 1
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
DAM 1

Drainage Area from J1, B1, S1, SWS(s)1: 0.1 acres
Total Contributing Drainage Area: 0.1 acres

POROUS ROCK CHECK DAM INPUTS:

Height (ft)	Slope (%)	Z	Manning's n	Porosity (%)
1.5	15.00	3.0:1	0.025	40.00

Trap Efficiency: 51.18 %

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration ml/l	24VW (ml/l)	24AA (ml/l)
IN	0.02	0.22	0.0	2112	1.37	0.94	0.09
OUT	0.02	0.22	0.0	1031	0.56	0.38	0.03

J1, B1, S2
DAM 2

Drainage Area from J1, B1, S2, SWS(s)1: 0.1 acres
Total Contributing Drainage Area: 0.3 acres

POROUS ROCK CHECK DAM INPUTS:

Height (ft)	Slope (%)	Z	Manning's n	Porosity (%)
1.5	15.00	3.0:1	0.025	40.00

Trap Efficiency: 41.98 %

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration ml/l	24VW (ml/l)	24AA (ml/l)
IN	0.04	0.45	0.0	1572	0.96	0.66	0.06

OUT 0.04 0.45 0.0 912 0.49 0.34 0.03

999 01

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

WEST PORTAL WATER TANKS AREA 2

by

Name: C A BOUDREAU

Company Name: Greystone Development Consultants

File Name: A:\WSTW01

Date: 09-26-1991

Civil Software Design -- SEDCAD+ Version 3
Copyright (C) 1987-1990. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: A:\WSTW01 User: C A BOUDREAU
Date: 09-26-1991 Time: 17:07:08
WEST PORTAL WATER TANKS AREA 2
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
GENERAL INPUT TABLE
=====

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.17

Particle Size Distribution(s):

Size (mm)	DARGOL COMPLE % Finer	Soil Group D
76.2000	95.00	
4.7700	91.00	
2.0000	86.00	
0.4200	77.50	
0.0740	63.00	
0.0030	0.01	

Civil Software Design -- SEDCAD+ Version 3
 Copyright (C) 1987-1990. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: A:\WSTW01 User: C A BOUDREAU
 Date: 09-26-1991 Time: 17:07:08
 WEST PORTAL WATER TANKS AREA 2
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.20	89	M	0.026	0.000	0.000	0.0	0.03	0.36
Type: Null Label:										
111	Structure	0.20							0.03	

111	Total IN/OUT	0.20							0.03	0.36

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R 111	1	0.18	106.0	2.5	0.028	0.000	1	0.0				
Type: Null Label:												
111	Structure							0.0				

111	Total IN/OUT							0.0	545	0.35	0.22	0.03

=====

Civil Software Design -- SEDCAD+ Version 3
Copyright (C) 1987-1990. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: A:\WSTWO1 User: C A BOUDREAU

Date: 09-26-1991 Time: 17:07:08

WEST PORTAL WATER TANKS AREA 2

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

				Seg. Land Flow					Segment	Time	Muskingum	
J	B	S	SWS	#	Condition	Distance	Slope	Velocity	Time	Conc.	K	X
						(ft)	(%)	(fps)	(hr)	(hr)	(hr)	
1	1	1	1	-a	3	106.00	2.50	1.11	0.03	0.026		

=====

ATTACHMENT A

West Portal Core House

Sedcad+ Demonstration That Existing Site Conditions
Will Meet Applicable Effluent Standards

Company Name: Greystone Development Consultants
Filename: C:\SEDATA\CORE User:
Date: 06-18-1991 Time: 13:07:56
Corehouse Area West Portal
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.17

Particle Size Distribution(s):				
Size (mm)	Table Mtn Loa % Finer	Dargol Comple % Finer	Fury Complex % Finer	Midnight Comp % Finer
76.2000	100.00	95.00	100.00	94.00
4.7000	95.00	91.00	99.00	80.00
2.0000	87.50	86.00	97.00	72.50
0.4200	82.50	77.50	92.50	67.50
0.0740	62.50	63.00	82.50	65.00
0.0030	0.01	0.01	0.01	0.01

Civil Software Design -- SEDCAD+ Version 3.0
 Copyright (C) 1987-1990. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDATA\CORE User:

Date: 06-18-1991 Time: 13:07:56

Corehouse Area West Portal

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	0.25	89	M	0.031	0.000	0.000	0.0	0.04	0.45	
		Type: Null		Label: Corehouse Area West							
111	Structure	0.25								0.04	
111	Total IN/OUT	0.25								0.04	0.45

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)	
R 111	1	0.36	120.0	4.0	0.010	0.000	3	0.0					
		Type: Null		Label: Corehouse Area West									
111	Structure								0.0				
111	Total IN/OUT								0.0	664	0.39	0.24	0.04

=====

999 001

ATTACHMENT B

East Portal Water Tanks

Sedcad+ Demonstration That Additional Gravel / Vegetative Cover
Will Meet Applicable Effluent Standards

Company Name: Greystone Development Consultants

Filename: C:\SEDATA\SEDATA2 User: DMC

Date: 05-20-1991 Time: 12:00:09

East Portal Water Tanks

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: ~~2.50~~ 2.00

Submerged Bulk Specific Gravity: ~~1.171~~ 1.25

Particle Size Distribution(s):

Size (mm)	Table Mtn Loa % Finer	Dargol Comple % Finer	Fury Complex % Finer	Midnight Comp % Finer
76.2000	100.00	95.00	100.00	94.00
4.7000	95.00	91.00	99.00	80.00
2.0000	87.50	86.00	97.00	72.50
0.4200	82.50	77.50	92.50	67.50
0.0740	62.50	63.00	82.50	65.00
0.0030	0.01	0.01	0.01	0.01

Company Name: Greystone Development Consultants
 Filename: C:\SEDATA\SEDATA2 User: DMC
 Date: 05-20-1991 Time: 12:00:09
 East Portal Water Tanks
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS SWS	Area (ac)	CN UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	1.00	88 MF	0.057	0.000	0.000	0.0	0.13	1.61
Type: Null Label: E. Portal Water Tank								
111 Structure	1.00						0.13	
111 Total IN/OUT	1.00						0.13	1.61

0.50

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R 111 1	0.18	230.0	2.5	0.011	0.000	2	0.0				
Type: Null Label: E. Portal Water Tank											
111 Structure		250	2%				0.0				
111 Total IN/OUT							0.0	321	0.21	0.11	0.03

FOR MR-43

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

DITCH D17 WITH D33 INCLUDED, WATERSHED ABOVE CULVERT C11

by

Name: C A BOUDREAU

Company Name: Greystone Development Consultants
File Name: A:\D17

Date: 03-27-1992

Civil Software Design -- SEDCAD+ Version 3
Copyright (C) 1987-1990. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: A:\D17 User: C A BOUDREAU

Date: 03-27-1992 Time: 08:45:42

DITCH D17 WITH D33 INCLUDED, WATERSHED ABOVE CULVERT C11

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

MR-43

Company Name: Greystone Development Consultants
 Filename: A:\D17 User: C A BOUDREAU
 Date: 03-27-1992 Time: 08:45:42
 DITCH D17 WITH D33 INCLUDED, WATERSHED ABOVE CULVERT C11
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	9.11*	85	M	0.141	0.000	0.000	0.0	1.14	11.78
					Type: Null	Label:				
111	Structure	9.11							1.14	
111	Total IN/OUT	9.11							1.14	11.78

=====

Company Name: Greystone Development Consultants
Filename: A:\D17 User: C A BOUDREAU

Date: 03-27-1992 Time: 08:45:42

DITCH D17 WITH D33 INCLUDED, WATERSHED ABOVE CULVERT C11

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

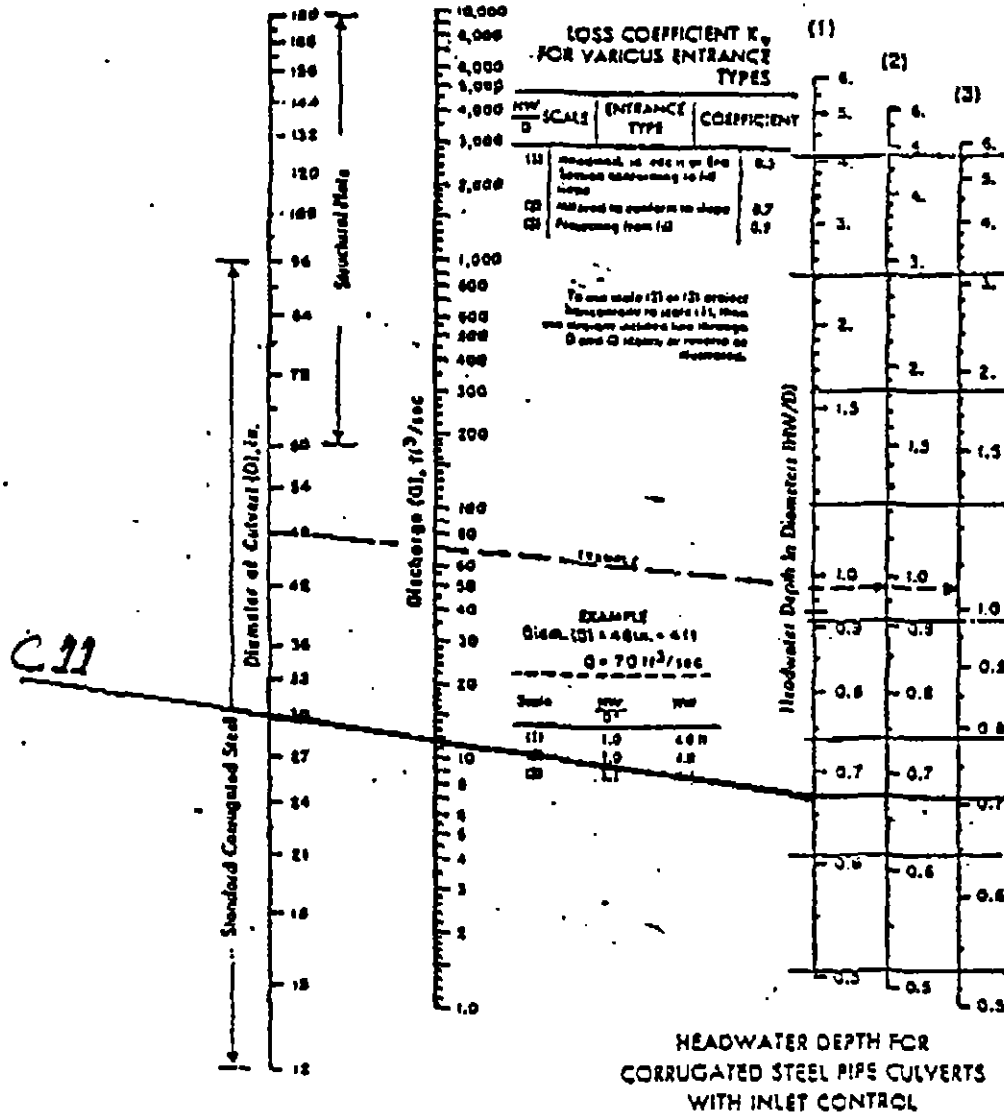
DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	1900.00	14.00	3.74	0.14	0.141		

TABLE 21

CULVERT SIZING NOMOGRAPH



FHWA HEC 5

Culvert flow
0.67 full or
20" Deep

10yr 24hr
Event

From "Handbook of Steel Drainage and Highway Construction Products"

TR-25

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

CONTAINMENT AREA 1 10-YR 24-HR, 25-YR 24 HR EVENT

by

Name: C A BOUDREAU

Company Name: Greystone Development Consultants
File Name: C:\SEDCAD3\DATA\CNTNMNT1

Date: 06-11-1992

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\CNTNMNT1 User: C A BOUDREAU
 Date: 06-11-1992 Time: 10:58:11
 CONTAINMENT AREA 1 10-YR 24-HR, 25-YR 24 HR EVENT
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	15.45*	80	M	0.347	0.000	0.000	0.0	1.51	11.97
					Type: Null	Label:				
111	Structure	15.45							1.51	

111	Total IN/OUT	15.45							1.51	11.97

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M 111	1	0.24	2500.0	4.0	0.180	0.000	1	30.0				
					Type: Null	Label:						
111	Structure							30.0				

111	Total IN/OUT							30.0	25973	20.62	11.43	3.46

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\CNTNMNT1 User: C A BOUDREAU
 Date: 06-11-1992 Time: 10:58:11
 CONTAINMENT AREA 1 10-YR 24-HR, 25-YR 24 HR EVENT
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
 Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	AVG SITE WIDE % Finer
25.4000	100.00
19.0500	82.00
12.7000	68.80
6.3500	35.30
2.0000	21.80
0.8500	14.40
0.4250	10.20
0.1800	5.70
0.1500	4.60
0.0750	1.10
0.0100	0.50
0.0010	0.10
0.0001	0.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\CNTNMNT1 User: C A BOUDREAU
 Date: 06-11-1992 Time: 10:58:11
 CONTAINMENT AREA 1 10-YR 24-HR, 25-YR 24 HR EVENT
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)
1	1	1	1	-a	5	2500.00	4.00	2.00	0.35	0.347	

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\CNTNMNT1 User: C A BOUDREAU
 Date: 06-11-1992 Time: 10:58:07
 CONTAINMENT AREA 1 10-YR 24-HR, 25-YR 24 HR EVENT
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
 Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	AVG SITE WIDE % Finer
25.4000	100.00
19.0500	82.00
12.7000	68.80
6.3500	35.30
2.0000	21.80
0.8500	14.40
0.4250	10.20
0.1800	5.70
0.1500	4.60
0.0750	1.10
0.0100	0.50
0.0010	0.10
0.0001	0.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\CNTNMNT1 User: C A BOUDREAU
 Date: 06-11-1992 Time: 10:58:07
 CONTAINMENT AREA 1 10-YR 24-HR, 25-YR 24 HR EVENT
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	2500.00	4.00	2.00	0.35	0.347		

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\CNTNMNT1 User: C A BOUDREAU
 Date: 06-11-1992 Time: 10:58:07
 CONTAINMENT AREA 1 10-YR 24-HR, 25-YR 24 HR EVENT
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	15.45*	80	M	0.347	0.000	0.000	0.0	2.01	16.08
					Type: Null	Label:				
111	Structure	15.45							2.01	

111	Total IN/OUT	15.45							2.01	16.08

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M 111	1	0.24	2500.0	4.0	0.180	0.000	1	41.4				
					Type: Null	Label:						
111	Structure							41.4				

111	Total IN/OUT							41.4	27000	21.44	11.91	3.61

=====

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

EAST OF THE REFUSE BELT 10 YR. 24 HR. AND 25 YR. 24 HR.

by

Name: C. A. Boudreau

Company Name: Greystone Development Consultants
File Name: C:\SEDCAD3\DATA\ESTREFBL

Date: 06-20-1992

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\ESTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 13:23:26
 East of the Refuse Belt 10 Yr. 24 Hr. and 25 Yr. 24 Hr.
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
 Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	AVG SITE SOIL % Finer
25.4000	100.00
19.0500	82.00
12.7000	68.80
6.3500	35.30
2.0000	21.80
0.8500	14.40
0.4200	10.20
0.1800	5.70
0.1500	4.60
0.0750	1.10
0.0100	0.50
0.0010	0.10
0.0001	0.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\ESTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 13:23:26
 East of the Refuse Belt 10 Yr. 24 Hr. and 25 Yr. 24 Hr.
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	220.00	5.00	2.24	0.03	0.027	

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\ESTRELBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 13:23:26
 East of the Refuse Belt 10 Yr. 24 Hr. and 25 Yr. 24 Hr.
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.54*	85	M	0.027	0.000	0.000	0.0	0.07	0.84
Type: Null Label:										
111	Structure	0.54							0.07	

111	Total IN/OUT	0.54							0.07	0.84

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M 111	1	0.24	150.0	10.0	0.540	0.000	1	4.2				
Type: Null Label:												
111	Structure							4.2				

111	Total IN/OUT							4.2	81650	64.96	35.48	8.25

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\ESTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 13:23:21
 East of the Refuse Belt 10 Yr. 24 Hr. and 25 Yr. 24 Hr.
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
 Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	AVG SITE SOIL % Finer

25.4000	100.00
19.0500	82.00
12.7000	68.80
6.3500	35.30
2.0000	21.80
0.8500	14.40
0.4200	10.20
0.1800	5.70
0.1500	4.60
0.0750	1.10
0.0100	0.50
0.0010	0.10
0.0001	0.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\ESTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 13:23:21
 East of the Refuse Belt 10 Yr. 24 Hr. and 25 Yr. 24 Hr.
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	220.00	5.00	2.24	0.03	0.027	

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\ESTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 13:23:21
 East of the Refuse Belt 10 Yr. 24 Hr. and 25 Yr. 24 Hr.
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS SWS	Area (ac)	CN UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	0.54*	85 M	0.027	0.000	0.000	0.0	0.09	1.06
Type: Null Label:								
111 Structure	0.54						0.09	
111 Total IN/OUT	0.54						0.09	1.06

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M 111 1	0.24	150.0	10.0	0.540	0.000	1	5.4				
Type: Null Label:											
111 Structure							5.4				
111 Total IN/OUT							5.4	82205	65.40	36.04	8.57

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

WEST OF REFUSE OVERFLOW 10 YR. 24 HR AND 25 YR. 24 HR.

by

Name: C. A. Boudreau

Company Name: Greystone Development Consultants
File Name: C:\SEDCAD3\DATA\WSTREFOV

Date: 06-20-1992

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFOV User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:21
 West of Refuse Overflow 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
 Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	AVG SITE WIDE % Finer
25.4000	100.00
19.0500	82.00
12.7000	68.80
6.3500	35.30
2.0000	21.80
0.8500	14.40
0.4250	10.20
0.1800	5.70
0.1500	4.60
0.0750	1.10
0.0100	0.50
0.0010	0.10
0.0001	0.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFOV User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:21
 West of Refuse Overflow 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	525.00	5.00	2.24	0.07	0.065	

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFOV User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:21
 West of Refuse Overflow 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.66*	85	M	0.065	0.000	0.000	0.0	0.21	2.58
Type: Null Label:										
111	Structure	1.66							0.21	
111	Total IN/OUT	1.66							0.21	2.58

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M 111	1	0.24	510.0	5.0	0.540	0.000	1	10.5				
Type: Null Label:												
111	Structure							10.5				
111	Total IN/OUT							10.5	67271	53.52	28.98	6.98

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFOV User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:16
 West of Refuse Overflow 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
 Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	AVG SITE WIDE % Finer
25.4000	100.00
19.0500	82.00
12.7000	68.80
6.3500	35.30
2.0000	21.80
0.8500	14.40
0.4250	10.20
0.1800	5.70
0.1500	4.60
0.0750	1.10
0.0100	0.50
0.0010	0.10
0.0001	0.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFOV User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:16
 West of Refuse Overflow 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	525.00	5.00	2.24	0.07	0.065	

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFOV User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:16
 West of Refuse Overflow 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.66*	85	M	0.065	0.000	0.000	0.0	0.27	3.25
Type: Null Label:										
111	Structure	1.66							0.27	
111	Total IN/OUT	1.66							0.27	3.25

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M 111	1	0.24	510.0	5.0	0.540	0.000	1	13.7				
Type: Null Label:												
111	Structure							13.7				
111	Total IN/OUT							13.7	67765	53.91	29.50	7.23

=====

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

CONTAINMENT AREA 2 10-YR 24-HR, 25-YR 24 HR EVENT

by

Name: C A BOUDREAU

Company Name: Greystone Development Consultants
File Name: C:\SEDCAD3\DATA\CNTNMNT2

Date: 06-11-1992

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SEDCAD3\DATA\CNTNMNT2 User: C A BOUDREAU
Date: 06-11-1992 Time: 10:58:57
CONTAINMENT AREA 2 10-YR 24-HR, 25-YR 24 HR EVENT
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	AVG SITE WIDE % Finer
25.4000	100.00
19.0500	82.00
12.7000	68.80
6.3500	35.30
2.0000	21.80
0.8500	14.40
0.4250	10.20
0.1800	5.70
0.1500	4.60
0.0750	1.10
0.0100	0.50
0.0010	0.10
0.0001	0.00

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SEDCAD3\DATA\CNTNMNT2 User: C A BOUDREAU
Date: 06-11-1992 Time: 10:58:57
CONTAINMENT AREA 2 10-YR 24-HR, 25-YR 24 HR EVENT
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	350.00	4.30	2.07	0.05	0.046		

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\CNTNMNT2 User: C A BOUDREAU
 Date: 06-11-1992 Time: 10:58:57
 CONTAINMENT AREA 2 10-YR 24-HR, 25-YR 24 HR EVENT
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	2.90*	80	M	0.046	0.000	0.000	0.0	0.28	3.67
Type: Null Label:										
111	Structure	2.90							0.28	
111	Total IN/OUT	2.90							0.28	3.67

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M 111	1	0.24	350.0	4.3	0.180	0.000	1	3.5				
Type: Null Label:												
111	Structure							3.5				
111	Total IN/OUT							3.5	17472	13.90	7.22	1.71

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\CNTNMNT2 User: C A BOUDREAU
 Date: 06-11-1992 Time: 10:58:53
 CONTAINMENT AREA 2 10-YR 24-HR, 25-YR 24 HR EVENT
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
 Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	AVG SITE WIDE % Finer
25.4000	100.00
19.0500	82.00
12.7000	68.80
6.3500	35.30
2.0000	21.80
0.8500	14.40
0.4250	10.20
0.1800	5.70
0.1500	4.60
0.0750	1.10
0.0100	0.50
0.0010	0.10
0.0001	0.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\CNTNMNT2 User: C A BOUDREAU
 Date: 06-11-1992 Time: 10:58:53
 CONTAINMENT AREA 2 10-YR 24-HR, 25-YR 24 HR EVENT
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	350.00	4.30	2.07	0.05	0.046		

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\CNTNMNT2 User: C A BOUDREAU
 Date: 06-11-1992 Time: 10:58:53
 CONTAINMENT AREA 2 10-YR 24-HR, 25-YR 24 HR EVENT
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	2.90*	80	M	0.046	0.000	0.000	0.0	0.38	4.78
					Type: Null	Label:				
111	Structure	2.90							0.38	
111	Total IN/OUT	2.90							0.38	4.78

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M 111	1	0.24	350.0	4.3	0.180	0.000	1	4.8				
					Type: Null	Label:						
111	Structure							4.8				
111	Total IN/OUT							4.8	17554	13.97	7.39	1.76

=====

999 001

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

WEST OF REFUSE BELT 10 YR. 24 HR AND 25 YR. 24 HR.

by

Name: C. A. Boudreau

Company Name: Greystone Development Consultants
File Name: C:\SEDCAD3\DATA\WSTREFBL

Date: 06-20-1992

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:12
 West of Refuse Belt 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
 Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):	
Size (mm)	AVG SITE WIDE % Finer
25.4000	100.00
19.0500	82.00
12.7000	68.80
6.3500	35.30
2.0000	21.80
0.8500	14.40
0.4250	10.20
0.1800	5.70
0.1500	4.60
0.0750	1.10
0.0100	0.50
0.0010	0.10
0.0001	0.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:12
 West of Refuse Belt 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

				Seg. Land Flow					Segment	Time	Muskingum	
J	B	S	SWS	#	Condition	Distance	Slope	Velocity	Time	Conc.	K	X
						(ft)	(%)	(fps)	(hr)	(hr)	(hr)	
1	1	1	1	-a	5	330.00	9.00	3.00	0.03	0.030		

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:12
 West of Refuse Belt 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS SWS	Area (ac)	CN UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	0.66*	85 M	0.030	0.000	0.000	0.0	0.08	1.03
Type: Null Label:								
111 Structure	0.66						0.08	
111 Total IN/OUT	0.66						0.08	1.03

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M 111 1	0.24	130.0	16.0	0.540	0.000	1	10.8				
Type: Null Label:											
111 Structure							10.8				
111 Total IN/OUT							10.8	167139	132.97	73.07	17.48

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:08
 West of Refuse Belt 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
 Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	AVG SITE WIDE % Finer
25.4000	100.00
19.0500	82.00
12.7000	68.80
6.3500	35.30
2.0000	21.80
0.8500	14.40
0.4250	10.20
0.1800	5.70
0.1500	4.60
0.0750	1.10
0.0100	0.50
0.0010	0.10
0.0001	0.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:08
 West of Refuse Belt 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	330.00	9.00	3.00	0.03	0.030	

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SEDCAD3\DATA\WSTREFBL User: C. A. Boudreau
 Date: 06-20-1992 Time: 12:18:08
 West of Refuse Belt 10 YR. 24 HR and 25 YR. 24 HR.
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.66*	85	M	0.030	0.000	0.000	0.0	0.11	1.29
					Type: Null	Label:				
111	Structure	0.66							0.11	
111	Total IN/OUT	0.66							0.11	1.29

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M 111	1	0.24	130.0	16.0	0.540	0.000	1	14.1				
					Type: Null	Label:						
111	Structure							14.1				
111	Total IN/OUT							14.1	168284	133.88	74.28	18.09

=====



GREYSTONE®

TR-30

S/E "EXHIBIT 19 -
MISC. DRAINAGE
SUPPLEMENT -
RECEIVED PART 2 11"

October 15, 1993

OCT 15 1993

Mr. Joseph Dudash
Colorado Division of Minerals and Geology
1313 Sherman, Rm. 215
Denver, CO 80203

Colorado Division of Minerals and Geology

Subject: Technical Revision 30, New Elk Mine, Basin Resources,
C-81-014

Dear Mr. Dudash,

Please include the accompanying SEDCAD+ documentation for two small area exemptions (SAEs) with Technical Revision 30. The demonstration for the pump house documents the area's ability to meet effluent limitations without any additional structures. The pump house SAE assumed that the vegetative cover adjacent to the pump house and west of the road had 20% vegetative cover and 50% total cover to arrive at a cover practice (CP) value of 0.078. The demonstration for the contaminated soil requires a berm to contain the 25-year 24-hour storm event with 1' of freeboard. Basin Resources is anticipating that the contaminated soil SAE will have a limited lifetime, until remediation can occur.

Delineations of these small area exemptions on permit application maps will arrive under separate cover. Please do not hesitate to call if you have any questions.

Sincerely,

Catherine W. Begej
Project Manager

cc Ralph Lopez, Basin Resources
Enclosures



Doc Date:12/11/2001

EX 19

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SAE DEMO

NEW ELK PUMPHOUSE, WEST PORTAL, 10-YR 24-HR STORM EVENT

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\PUMPHSE

Date: 10-14-1993

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\PUMPHSE User: C.W. BEGEJ
Date: 10-14-1993 Time: 14:57:34
NEW ELK PUMPHOUSE, WEST PORTAL, 10-YR 24-HR STORM EVENT
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
GENERAL INPUT TABLE
=====

Specific Gravity: 2.65
Submerged Bulk Specific Gravity: 1.49

Particle Size Distribution(s):		
Size	CeO LOAM	AlA SIL CL LO
(mm)	% Finer	% Finer
2.0000	100.00	100.00
1.0000	75.00	99.00
0.5000	64.00	98.00
0.2500	60.00	97.00
0.1250	53.00	95.00
0.0640	44.00	92.00
0.0160	30.00	71.00
0.0040	17.00	47.00
0.0010	0.00	0.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\PUMPHSE User: C.W. BEGEJ
 Date: 10-14-1993 Time: 14:57:34
 NEW ELK PUMPHOUSE, WEST PORTAL, 10-YR 24-HR STORM EVENT
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.12*	85	M	0.016	0.000	0.000	0.0	0.02	0.19
		Type: Null Label: NEW ELK PUMPHOUSE								
111	Structure	0.12							0.02	

111	Total IN/OUT	0.12							0.02	0.19

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)	
R 111	1	0.32	10.0	1.0	0.078	0.000	1	0.0					
		Type: Null Label: NEW ELK PUMPHOUSE											
111	Structure								0.0				

111	Total IN/OUT								0.0	621	0.31	0.21	0.02

=====

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

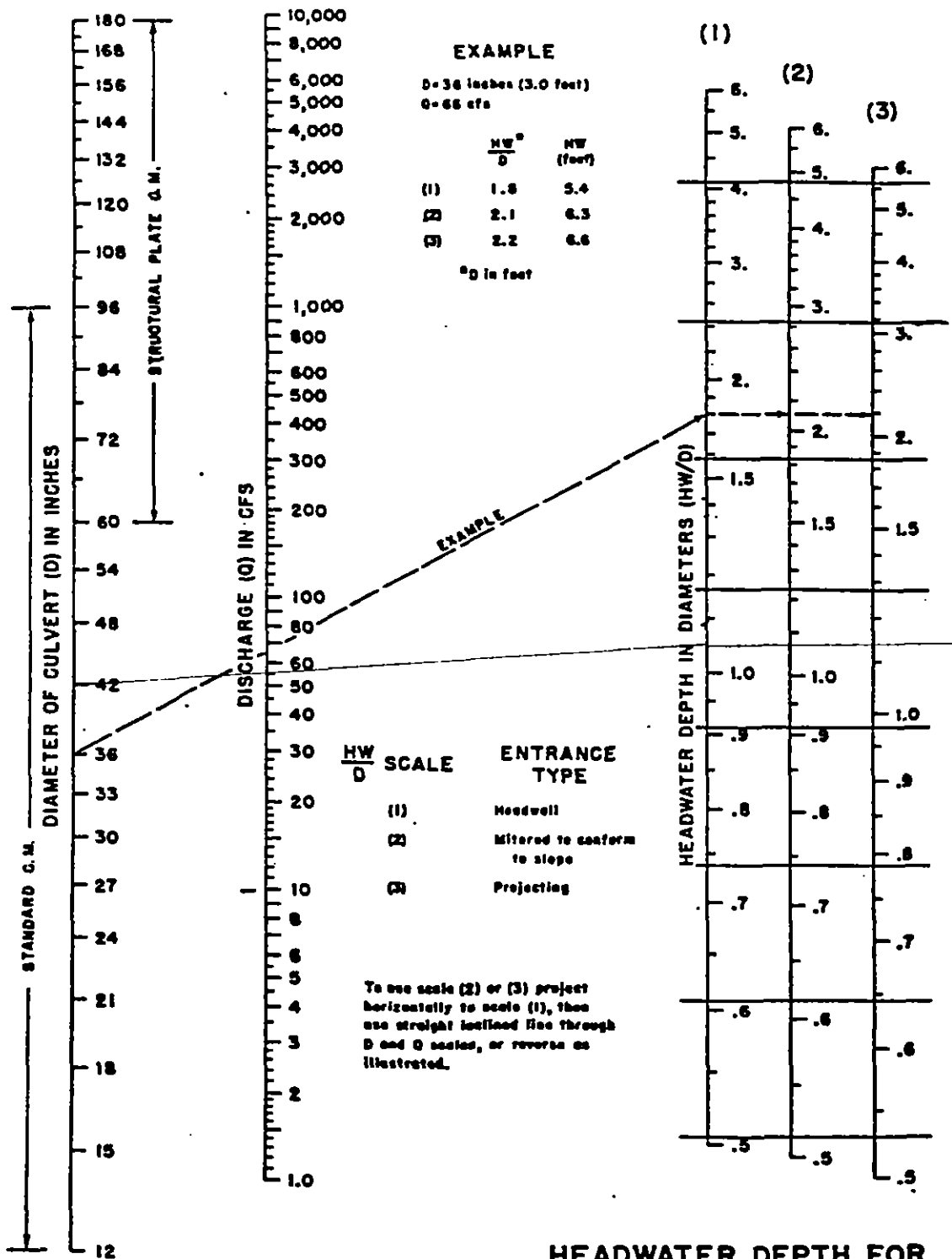
Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\PUMPHSE User: C.W. BEGEJ
Date: 10-14-1993 Time: 14:57:34
NEW ELK PUMPHOUSE, WEST PORTAL, 10-YR 24-HR STORM EVENT
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Flow Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	60.00	1.00	1.00	0.02	0.016		



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1943

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

D23A, N RD DITCH, N OF THE HOIST HOUSE, 10-YR 24-HR STORM

by

Name: C. W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\D23A

Date: 10-15-1993

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\D23A User: C. W. BEGEJ
Date: 10-15-1993 Time: 10:51:11
D23A, N RD DITCH, N OF THE HOIST HOUSE, 10-YR 24-HR STORM
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.08	85	M	0.019	0.000	0.000	0.0	0.01	0.12
					Type: Null	Label: D23A				
111	Structure	0.08							0.01	
111	Total IN/OUT	0.08							0.01	0.12

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\D23A User: C. W. BEGEJ

Date: 10-15-1993 Time: 10:51:11

D23A, N RD DITCH, N OF THE HOIST HOUSE, 10-YR 24-HR STORM
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	7	12.00	2.00	2.85	0.00			
				-b	8	275.00	2.00	4.24	0.02	0.019		

SEDCAD+ ERODIBLE CHANNEL DESIGN

D23A

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR
Discharge	0.12 cfs
Slope	2.00 %
Sideslopes	2.50:1 (L) 2.50:1 (R)
Manning's n	0.030
Max. Velocity	5.00 fps
Material	GRADED LOAM - COBBLES NONCOLLOIDAL
Freeboard	.3 ft

RESULTS:

Actual Discharge	0.12 cfs
Depth	0.19 ft
with Freeboard	0.49 ft
Top Width	0.93 ft
with Freeboard	2.43 ft
Velocity	1.37 fps
Cross Sectional Area	0.09 sq ft
Hydraulic Radius	0.09 ft
Froude Number	0.79

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

D23B, N RD DITCH, S OF THE HOIST HOUSE, 10-YR 24-HR STORM

by

Name: C. W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\D23B

Date: 10-15-1993

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\D23B User: C. W. BEGEJ
Date: 10-15-1993 Time: 10:51:13
D23B, N RD DITCH, S OF THE HOIST HOUSE, 10-YR 24-HR STORM
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS SWS	Area (ac)	CN UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	0.06	85 M	0.015	0.000	0.000	0.0	0.01	0.09
Type: Null Label: D23B								
111 Structure	0.06						0.01	
111 Total IN/OUT	0.06						0.01	0.09

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\D23B User: C. W. BEGEJ
Date: 10-15-1993 Time: 10:51:13
D23B, N RD DITCH, S OF THE HOIST HOUSE, 10-YR 24-HR STORM
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	12.00	2.00	1.41	0.00			
				-b	8	205.00	2.00	4.24	0.01	0.015		

SEDCAD+ ERODIBLE CHANNEL DESIGN

D23B

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	0.10 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES NONCOLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	0.10 cfs
Depth	0.18 ft
with Freeboard	0.48 ft
Top Width	0.88 ft
with Freeboard	2.38 ft
Velocity	1.32 fps
Cross Sectional Area	0.08 sq ft
Hydraulic Radius	0.08 ft
Froude Number	0.79

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SAE DEMO FOR CONTAMINATED TOPSOIL AWAITING REMEDIATION-25-YR 24-HR BRM

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\OILTSSAE

Date: 10-15-1993

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\OILTSSAE User: C.W. BEGEJ
Date: 10-15-1993 Time: 12:13:06
SAE DEMO FOR CONTAMINATED TOPSOIL AWAITING REMEDIATION-25-YR 24-HR BRM
Storm: 3.40 inches, 25 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	12.00	33.33	5.77	0.00			
				-b	8	54.00	2.00	4.24	0.00	0.004		

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\OILTSSAE User: C.W. BEGEJ
 Date: 10-15-1993 Time: 12:13:06
 SAE DEMO FOR CONTAMINATED TOPSOIL AWAITING REMEDIATION-25-YR 24-HR BRM
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS SWS	Area (ac)	CN UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	0.02	82 M	0.004	0.000	0.000	0.0	0.00	0.04
	Type: Null Label: CONTAM SOIL SAE							
111 Structure	0.02						0.00	
111 Total IN/OUT	0.02						0.00	0.04

=====

Contaminated soil will be consolidated into a circular pile with a radius less than or equal to 17'. and a perimeter of 107'. A triangular ditch with 2.5:1 and 3:1 sideslopes will contain .00378 ac-ft of storage with a depth of 0.75'. The berm will be 1.75' to allow 1' of freeboard to ensure compliance with Rule 4.05.6(11)(e). Specific calculations follow.

The dirt pile requires 0.0028 acft of storage from the following calculation:

3.4" of precipitation generates 1.7" runoff/inch precipitation at a CN of 82.

$$1.7"/12" \times .02 \text{ acres} = .02833 \text{ ac-ft}$$

The ditch at 0.75' depth holds 0.00378 ac-ft.

$$0.5 \times 4.125' \text{ (top width)} \times 0.75' \text{ (depth)} \times \frac{107' \text{ (perimeter)}}{43560 \text{ ft}^2/\text{acre}} = 0.00378 \text{ acft}$$

TR-31

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

DITCH 24 & 24A, CULVERTS C35, C36, C34, C46, C47 - 10-YR 24-HR STORM

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\D24C20A

Date: 12-03-1993

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\D24C20A User: C.W. BEGEJ
 Date: 12-03-1993 Time: 11:46:10
 DITCH 24 & 24A, CULVERTS C35, C36, C34, C46, C47 - 10-YR 24-HR STORM
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	0.17	85	F	0.011	0.000	0.000	0.0	0.02	0.26	
		Type: Culvert		Label: D24 AND C35							
111	Structure	0.17								0.02	
111	Total IN/OUT	0.17								0.02	0.26
112	1	0.42	85	F	0.011	0.000	0.000	0.0	0.05	0.65	
		Type: Culvert		Label: D24 AND C36							
112	Structure	0.42								0.07	
112	Total IN/OUT	0.59								0.07	0.92
111 to 112 Routing					0.011	0.356					
121	1	0.19	85	F	0.024	0.000	0.000	0.0	0.02	0.30	
		Type: Null		Label: D24 W OF CLEAN COAL							
121	Structure	0.19								0.02	
121	Total IN/OUT	0.19								0.02	0.30
211	1	0.82	85	M	0.021	0.000	0.000	0.0	0.10	1.28	
211	2	0.25	85	M	0.016	0.000	0.000	0.0	0.03	0.39	
		Type: Culvert		Label: D24 AND C34							
211	Structure	1.07								0.23	
211	Total IN/OUT	1.85								0.23	2.88
112 to 211 Routing					0.013	0.356					
221	1	0.68	73	S	0.006	0.050	0.307	0.0	0.05	0.60	
221	2	0.25	85	F	0.000	0.049	0.227	0.0	0.03	0.39	
221	3	0.07	85	M	0.049	0.016	0.354	0.0	0.01	0.11	
221	4	0.19	85	F	0.050	0.002	0.185	0.0	0.02	0.29	
		Type: Culvert		Label: D24 AND C46							
221	Structure	1.18								0.11	
221	Total IN/OUT	1.18								0.11	1.39
311	1	0.61	85	F	0.041	0.000	0.000	0.0	0.08	0.95	

311	2	4.82	85	M	0.043	0.000	0.000	47.2	0.60	7.50
		Type: Culvert		Label: D24A/C47 & D24/C20						
311	Structure	5.43							1.02	

Total IN/OUT		8.47							1.02	59.91
=====										
211 to 311 Routing		0.035 0.341								
=====										

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\D24C20A User: C.W. BEGEJ
 Date: 12-03-1993 Time: 11:46:10
 DITCH 24 & 24A, CULVERTS C35, C36, C34, C46, C47 - 10-YR 24-HR STORM
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	70.00	42.86	6.55	0.00			
				-b	8	115.00	1.48	3.65	0.01	0.011		
1	1	2	1	-a	5	70.00	57.14	7.56	0.00			
				-b	8	115.00	1.50	3.67	0.01	0.011		
1	2	1	1	-a	5	80.00	5.00	2.24	0.01			
				-b	8	225.00	2.00	4.24	0.01	0.024		
2	1	1	1	-a	5	140.00	35.71	5.98	0.01			
				-b	8	225.00	2.00	4.24	0.01	0.021		
2	1	1	2	-a	5	50.00	33.00	5.74	0.00			
				-b	8	190.00	1.50	3.67	0.01	0.016		
2	2	1	1	-a	3	100.00	35.00	4.14	0.01	0.006		
2	2	1	1	-1	5	63.64	100.00	10.00	0.00			
				-2	5	250.05	2.00	1.41	0.05		0.050	0.307
2	2	1	2	-a	5	35.00	100.00	10.00	0.00	0.000		
2	2	1	2	-1	5	250.05	2.00	1.41	0.05		0.049	0.227
2	2	1	3	-a	5	250.00	2.00	1.41	0.05	0.049		
2	2	1	3	-1	8	250.05	1.90	4.14	0.02		0.016	0.354
2	2	1	4	-a	5	250.00	1.90	1.38	0.05	0.050		
2	2	1	4	-1	5	10.00	1.00	1.00	0.00		0.002	0.185
3	1	1	1	-a	5	5.00	33.00	5.74	0.00			
				-b	8	550.00	1.50	3.67	0.04	0.041		
3	1	1	2	-a	5	100.00	33.00	5.74	0.00			
				-b	8	550.00	1.70	3.91	0.04	0.043		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

CULVERT C48 ON DITCH D26

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants

File Name: C:\SCAD\DT\BASIN\D26C48

Date: 12-03-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\D26C48 User: C.W. BEGEJ
 Date: 12-03-1993 Time: 12:19:03
 CULVERT C48 ON DITCH D26
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	49.34	80	M	0.147	0.000	0.000	0.0	4.83	49.84	
		Type: Culvert		Label: CULVERT C48							
111	Structure	49.34								4.83	

111	Total IN/OUT	49.34								4.83	49.84
=====											

12-3-93

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\D26C48 User: C.W. BEGEJ

Date: 12-03-1993 Time: 12:19:03

CULVERT C48 ON DITCH D26

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	560.00	100.00	2.53	0.06			
				-b	8	1100.00	58.18	22.88	0.01			
				-c	8	1680.00	5.36	6.94	0.07			
				-d	8	250.00	20.00	13.42	0.01	0.147		

=====

12-3-93

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D24A

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	0.95 cfs	
Slope	1.50 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES NONCOLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	0.95 cfs
Depth	0.43 ft
with Freeboard	0.73 ft
Top Width	2.14 ft
with Freeboard	3.64 ft
Velocity	2.07 fps
Cross Sectional Area	0.46 sq ft
Hydraulic Radius	0.20 ft
Froude Number	0.79

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D24

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	12.42 cfs	
Slope	1.50 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	12.42 cfs
Depth	1.12 ft
with Freeboard	1.42 ft
Top Width	5.61 ft
with Freeboard	7.11 ft
Velocity	3.94 fps
Cross Sectional Area	3.15 sq ft
Hydraulic Radius	0.52 ft
Froude Number	0.93

12-3-93

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D24

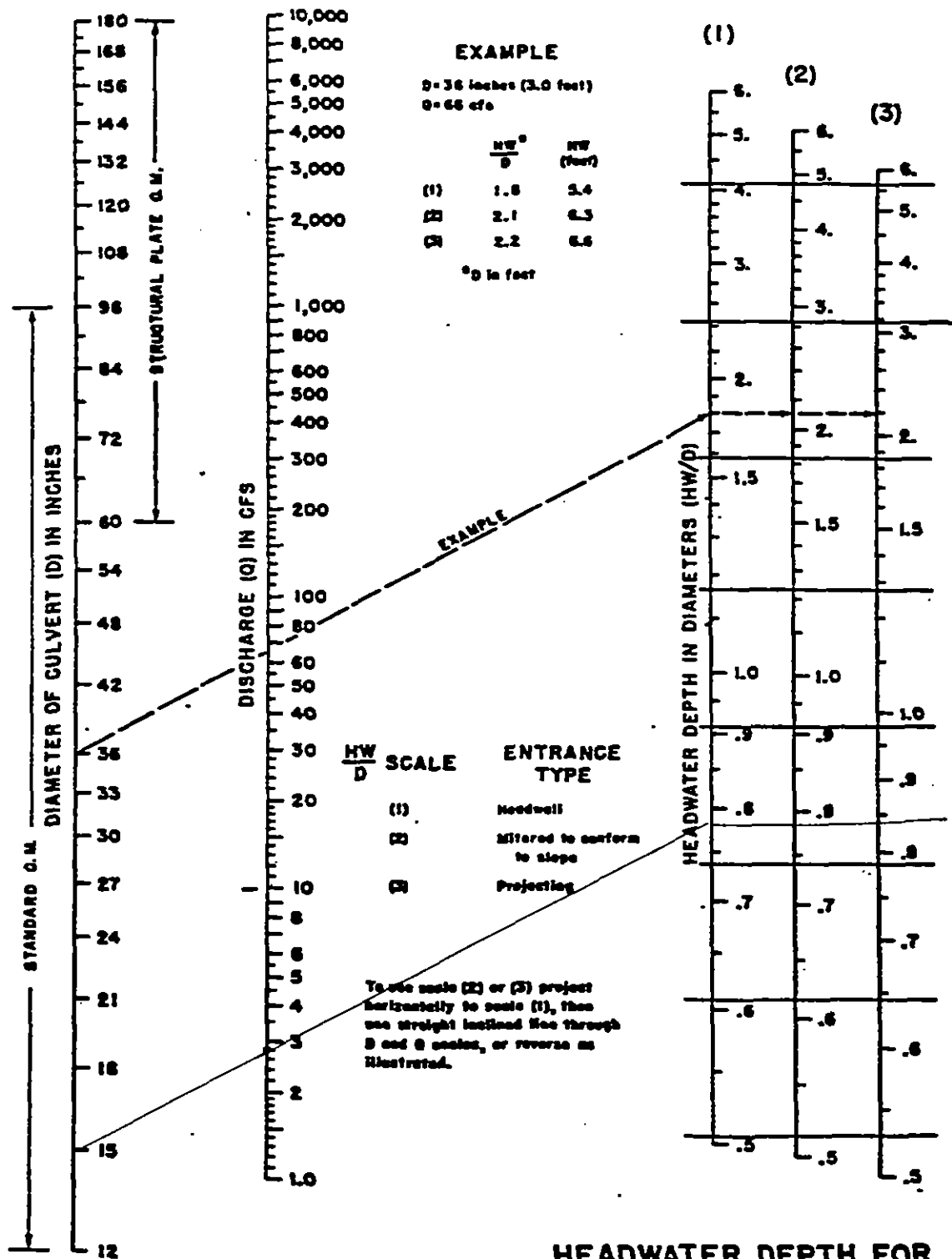
Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	12.42 cfs	
Slope	1.50 %	
Sideslopes	1.50:1 (L)	1.50:1 (R)
Bottom Width	2.00 ft	
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES NONCOLLOIDAL	
Freeboard	.3 ft	

RESULTS:

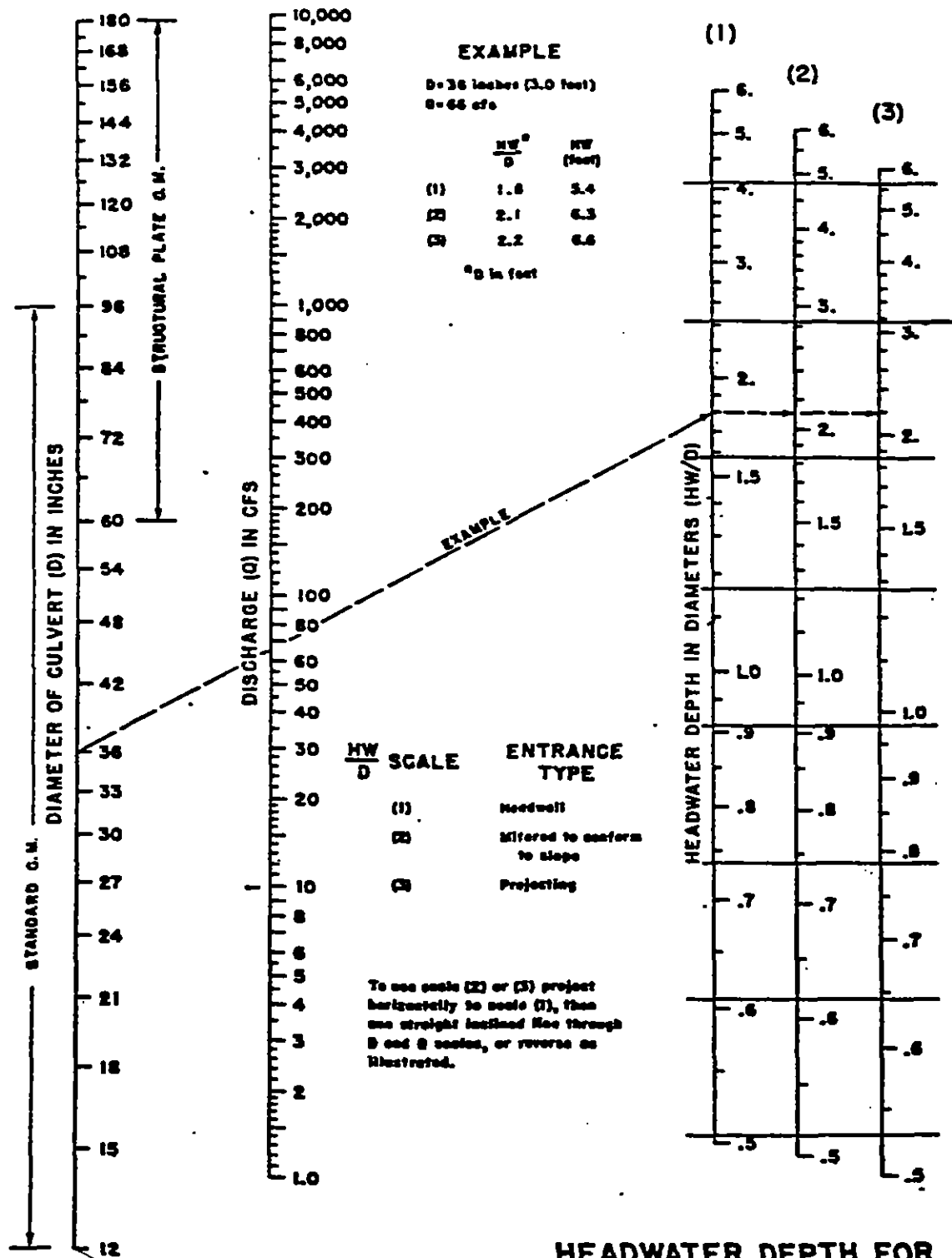
Actual Discharge	12.41 cfs
Depth	0.89 ft
with Freeboard	1.19 ft
Top Width	4.67 ft
with Freeboard	5.57 ft
Velocity	4.18 fps
Cross Sectional Area	2.97 sq ft
Hydraulic Radius	0.57 ft
Froude Number	0.92



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1943

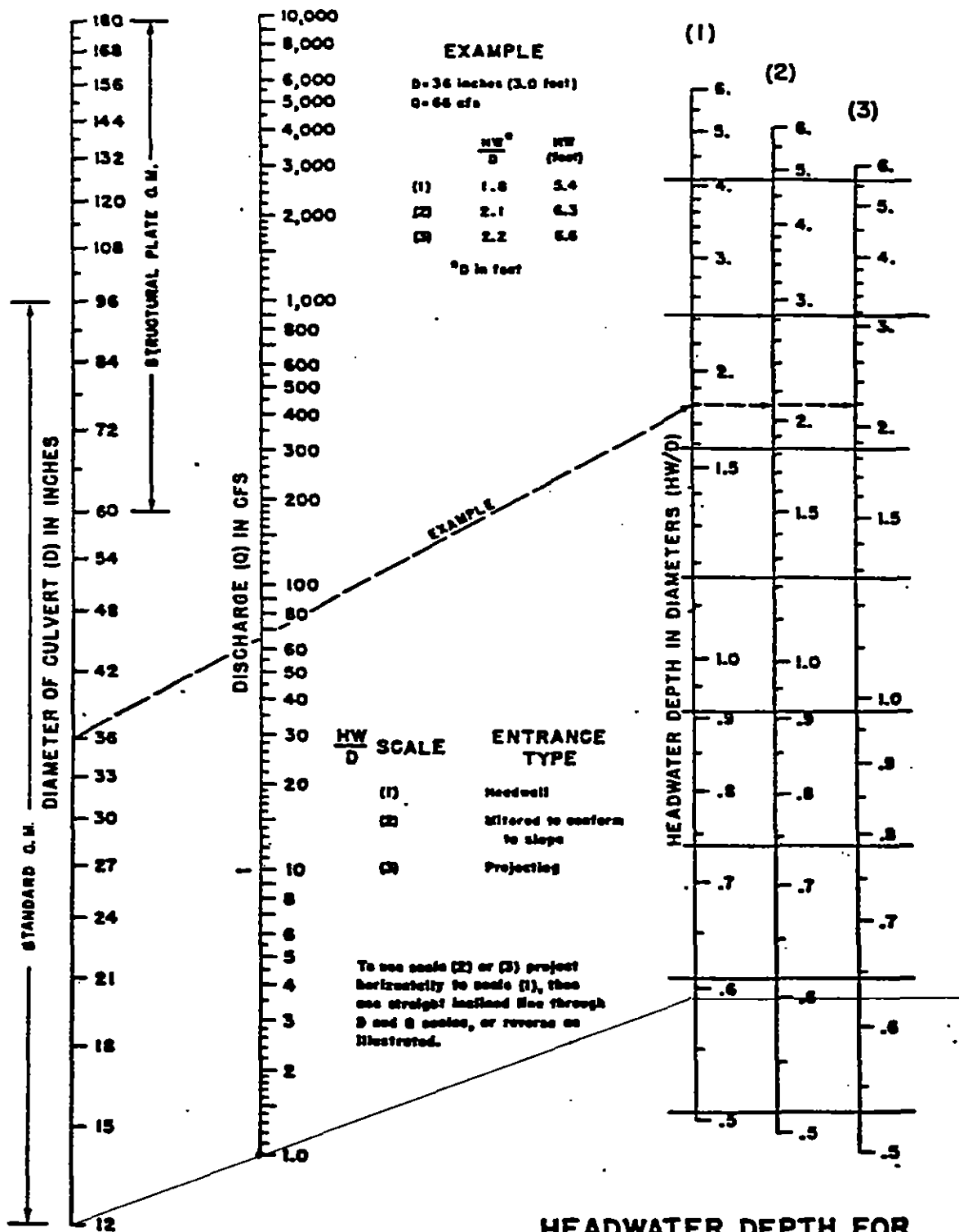
12-3-93



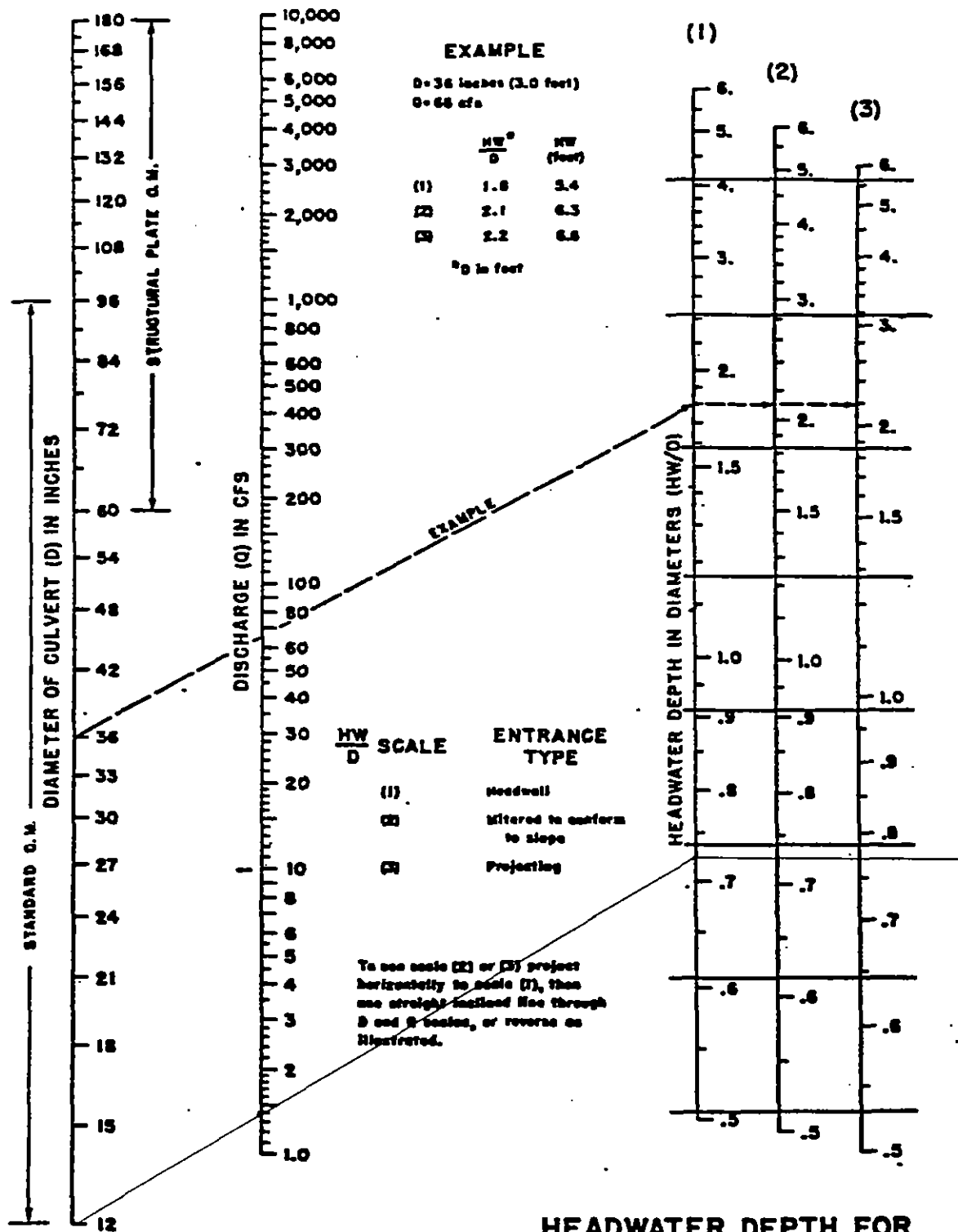
HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1933

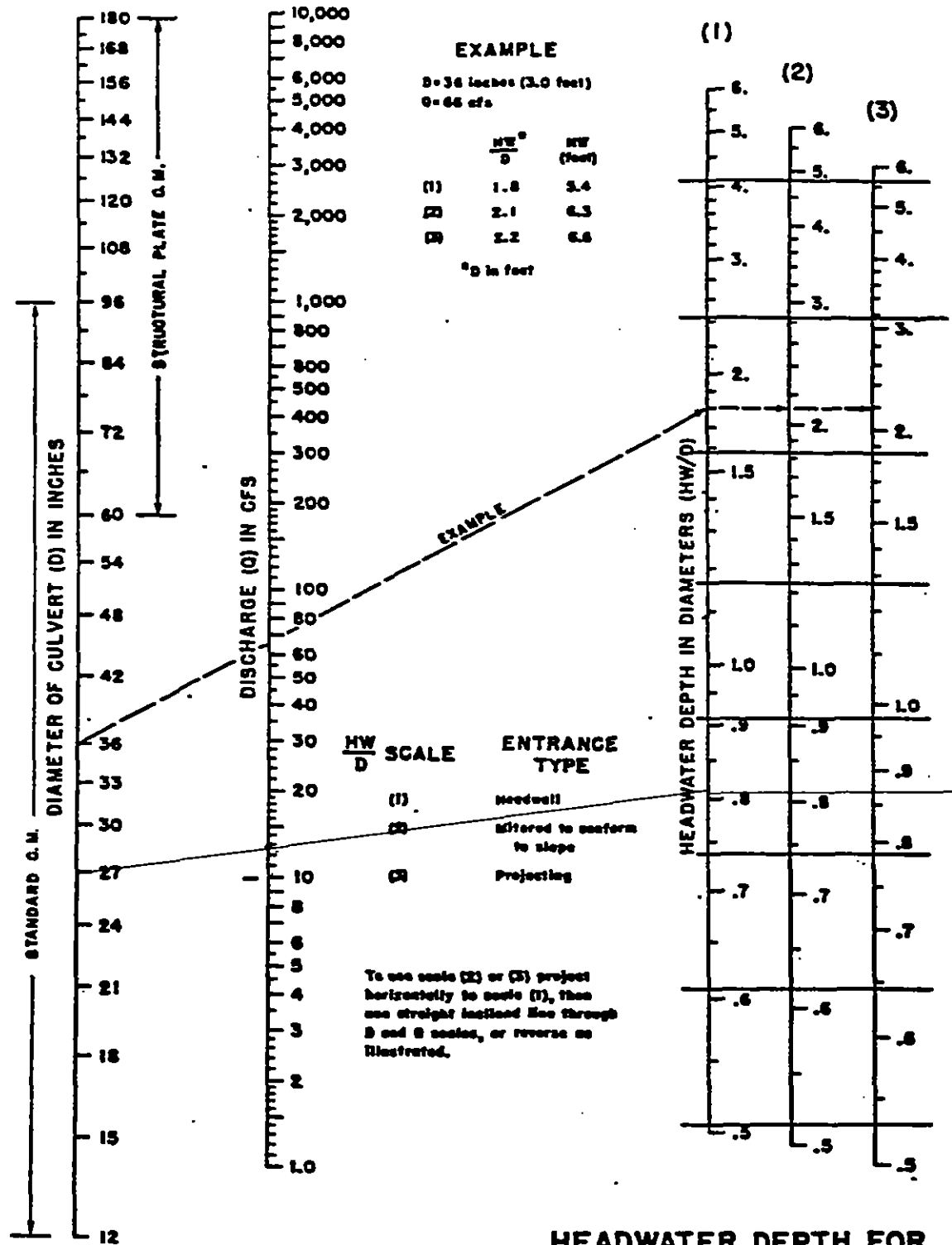
12-3-93



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL



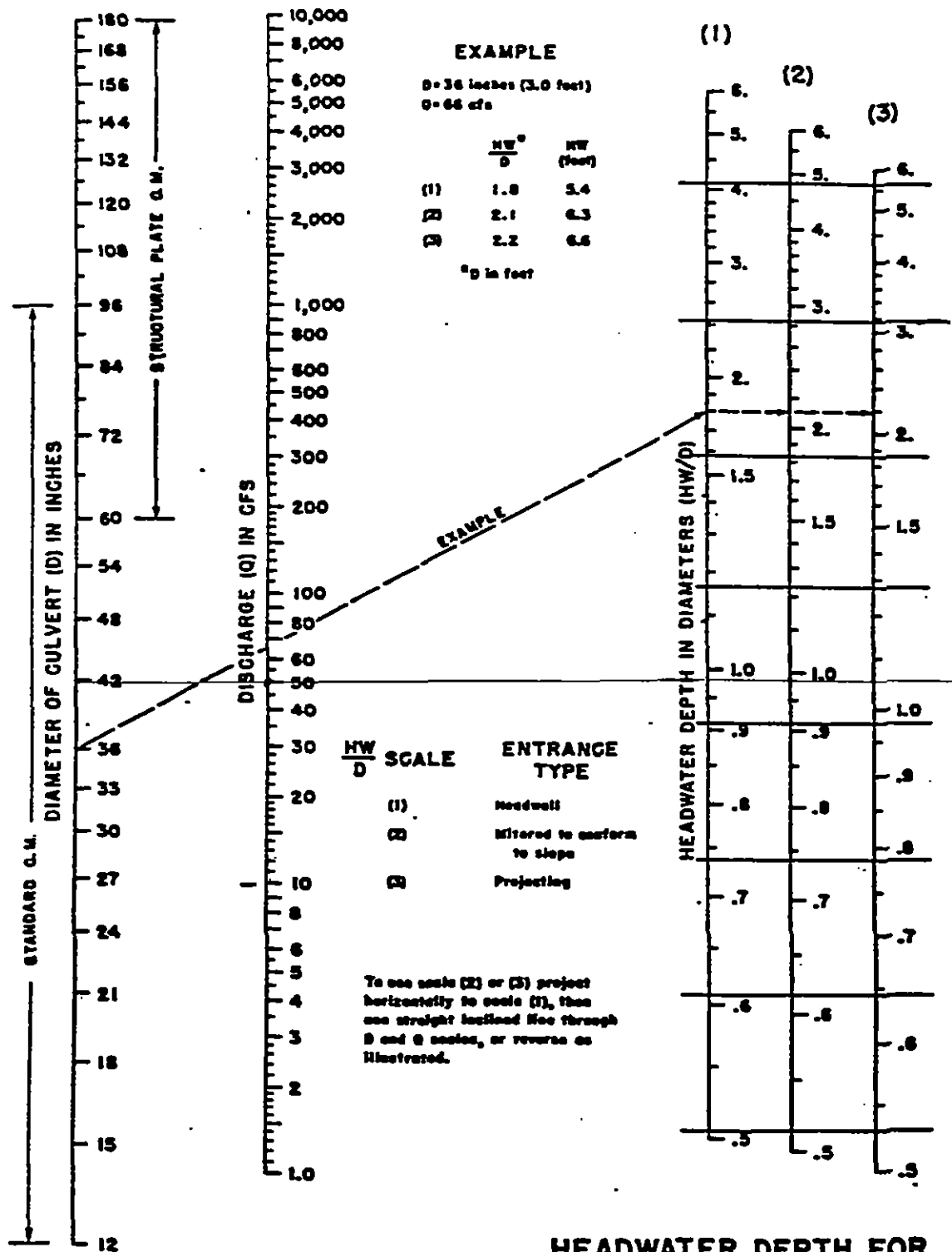
HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

12-3-93

BUREAU OF PUBLIC ROADS JAN. 1963



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

TR-33

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

D-18 FROM HEAD TO 960' WEST

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\D18NELK

Date: 10-08-1993



Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\D18NELK User: C.W. BEGEJ

Date: 10-08-1993 Time: 15:38:40

D-18 FROM HEAD TO 960' WEST

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	3	200.00	40.00	4.43	0.01			
				-b	7	700.00	34.29	11.79	0.02			
				-c	8	960.00	6.25	7.50	0.04	0.064		

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\D18NELK User: C.W. BEGEJ
 Date: 10-08-1993 Time: 15:38:40
 D-18 FROM HEAD TO 960' WEST
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
 D-18 REACH ALONG RD

Drainage Area from J1, B1, S1, SWS(s)1: 11.7 acres
 Total Contributing Drainage Area: 11.7 acres

MATERIAL: Rock Riprap
 Triangular Riprap Channel
 Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
14.76		2.0:1	2.0:1	6.3	0.041

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.50	29.87**	2.0	0.222	10.56
w/ Freeboard: 0.80		3.2		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----		----D50----		----D10----	
(ft)	(in)	(ft)	(in)	(ft)	(in)
1.88	22.50	1.50	18.00	0.50	6.00

Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT 1.14	14.76

SEDCAD+ NONERODIBLE CHANNEL DESIGN

D18 FROM HEAD TO 960' WEST

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	14.76 cfs	
Slope	6.25 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Manning's n	0.038	
Material	BEDROCK	
Freeboard	.3 ft	

RESULTS:

Depth	1.10 ft
with Freeboard	1.40 ft
Top Width	4.40 ft
with Freeboard	5.60 ft
Velocity	6.11 fps
Cross Sectional Area	2.42 sq ft
Hydraulic Radius	0.49 ft
Froude Number	1.45

Spec. copy

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SAE DEMO, TOPSOIL PILE 2, NW OF PLANT

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\TOP2SAE1

Date: 11-29-1993

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\TOP2SAE1 User: C.W. BEGEJ
Date: 11-29-1993 Time: 17:33:46
SAE DEMO, TOPSOIL PILE 2, NW OF PLANT
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.35

Particle Size Distribution(s):

Size (mm)	TABLE MTN-LOA % Finer
2.0000	100.00
1.0000	75.00
0.5000	64.00
0.2500	60.00
0.1250	53.00
0.0630	44.00
0.0160	30.00
0.0040	17.00

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\TOP2SAE1 User: C.W. BEGEJ
 Date: 11-29-1993 Time: 17:33:46
 SAE DEMO, TOPSOIL PILE 2, NW OF PLANT
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.06*	79	F	0.021	0.000	0.000	0.0	0.10	1.28
		Type: Null				Label: TOPSOIL PILE #2				
111	Structure	1.06							0.10	

111	Total IN/OUT	1.06							0.10	1.28

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R 111	1	0.15	12.0	20.0	0.012	0.000	1	0.1				
		Type: Null				Label: TOPSOIL PILE #2						
111	Structure							0.1				

111	Total IN/OUT							0.1	750	0.41	0.21	0.05

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\TOP2SAE1 User: C.W. BEGEJ
 Date: 11-29-1993 Time: 17:33:46
 SAE DEMO, TOPSOIL PILE 2, NW OF PLANT
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	3	120.00	30.00	3.83	0.01			
				-b	8	310.00	5.00	6.71	0.01	0.021		

=====

TR-35

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

10-YR 24-HR EVENT, E SIDE OF DEV COAL WASTE PILE SAE, STRAW OR SILT FE

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants

File Name: C:\SCAD\DT\BASIN\NEWSTSAE

Date: 07-06-1994

Company Name: Greystone Development Consultants

Filename: C:\SCAD\DT\BASIN\NEWSTSAE User: C.W. BEGEJ

Date: 07-06-1994 Time: 08:26:00

10-YR 24-HR EVENT, E SIDE OF DEV COAL WASTE PILE SAE, STRAW OR SILT FE

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.65

Submerged Bulk Specific Gravity: 1.35

Particle Size Distribution(s):

Size (mm)	CLAY LOAM % Finer	TABLE MTN LOA % Finer
2.0000	100.00	100.00
1.0000	90.00	75.00
0.5000	88.00	64.00
0.2500	85.00	60.00
0.1250	82.00	53.00
0.0640	74.00	44.00
0.0160	56.00	30.00
0.0040	38.00	17.00
0.0020	19.00	12.00
0.0010	9.00	9.00

Company Name: Greystone Development Consultants

Filename: C:\SCAD\DT\BASIN\NEWSTSAE

User: C.W. BEGEJ

Date: 07-06-1994 Time: 08:26:00

10-YR 24-HR EVENT, E SIDE OF DEV COAL WASTE PILE SAE, STRAW OR SILT FE

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.11*	74	M	0.010	0.000	0.000	0.0	0.01	0.11
		Type: Check Dam				Label: E SIDE OF DEV WST				
111	Structure	0.11							0.01	
111	Total IN/OUT	0.11							0.01	0.11

=====

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment

SCp: Peak Sediment Concentration

SSp: Peak Settleable Concentration

24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours

24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R 111	1	0.32	10.0	45.0	0.038	0.000	1	0.0				
		Type: Check Dam				Label: E SIDE OF DEV WST						
111	Structure							0.0				
111	Total IN							0.0	10169	3.70	2.66	0.12
111	Total OUT							0.0	4461	0.11	0.08	0.00

=====

Company Name: Greystone Development Consultants

Filename: C:\SCAD\DT\BASIN\NEWSTSAE User: C.W. BEGEJ

Date: 07-06-1994 Time: 08:26:00

10-YR 24-HR EVENT, E SIDE OF DEV COAL WASTE PILE SAE, STRAW OR SILT FE

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	3	30.00	45.00	4.70	0.00			
				-b	8	220.00	5.50	7.04	0.01	0.010		

Company Name: Greystone Development Consultants

Filename: C:\SCAD\DT\BASIN\NEWSTSAE User: C.W. BEGEJ

Date: 07-06-1994 Time: 08:26:00

10-YR 24-HR EVENT, E SIDE OF DEV COAL WASTE PILE SAE, STRAW OR SILT FE

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
E SIDE OF DEV WST

Drainage Area from J1, B1, S1, SWS(s)1: 0.1 acres
Total Contributing Drainage Area: 0.1 acres

POROUS ROCK CHECK DAM INPUTS:

Height (ft)	Slope (%)	Z	Manning's n	Porosity (%)
1.2	5.00	99.0:1	0.032	15.00

Trap Efficiency: 56.22 %

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration ml/l	24VW (ml/l)	24AA (ml/l)
IN	0.01	0.11	0.0	10169	3.70	2.66	0.12
OUT	0.01	0.11	0.0	4461	0.11	0.08	0.00

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

10 YEAR 24 HOUR STORM EVENT FOR WS-D, REFUSE AREA

Ditch D35C and Colvert C58

by

Name: LW

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\BASREF\WSD

Date: 03-07-1995

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASREF\WSD User: LW
 Date: 03-07-1995 Time: 11:26:00
 10 YEAR 24 HOUR STORM EVENT FOR WS-D, REFUSE AREA
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	0.21	84 M	0.005	0.000	0.000	0.0	0.02	0.31
111 2	0.13	89 F	0.007	0.000	0.000	0.0	0.02	0.23
	Type: Null		Label: WS-D INTO D35C					
111 Structure	0.34						0.04	
111 Total IN/OUT	0.34						0.04	0.54

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASREF\WSD User: LW
 Date: 03-07-1995 Time: 11:26:00
 10 YEAR 24 HOUR STORM EVENT FOR WS-D, REFUSE AREA
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

				Seg. Land Flow					Segment	Time	Muskingum	
J	B	S	SWS	#	Condition	Distance	Slope	Velocity	Time	Conc.	K	X
						(ft)	(%)	(fps)	(hr)	(hr)	(hr)	
1	1	1	1	-a	8	185.22	10.00	9.49	0.01	0.005		
1	1	1	2	-a	7	30.00	5.00	4.50	0.00			
				-b	8	185.22	10.00	9.49	0.01	0.007		

[REDACTED] 01

CIVIL SOFTWARE DESIGN

SED CAD+ Version 3

10 YEAR 24 HOUR STORM EVENT FOR RIDGE, REFUSE AREA

Ditch D36

by

Name: LW

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\BASREF\RIDGE

Date: 03-07-1995

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASREF\RIDGE User: LW

Date: 03-07-1995 Time: 11:26:27

10 YEAR 24 HOUR STORM EVENT FOR RIDGE, REFUSE AREA

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	2.60	91 F	0.059	0.000	0.000	0.0	0.43	4.94
	Type: Null Label: GRAVEL RIDGE - D36							
111 Structure	2.60						0.43	
111 Total IN/OUT	2.60						0.43	4.94

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASREF\RIDGE User: LW
 Date: 03-07-1995 Time: 11:26:27
 10 YEAR 24 HOUR STORM EVENT FOR RIDGE, REFUSE AREA
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	190.83	5.00	2.24	0.02			
				-b	8	863.46	5.00	6.71	0.04	0.059		

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D-35A

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	2.09 cfs	
Slope	10.00 %	
Sideslopes	1.50:1 (L)	1.50:1 (R)
Bottom Width	2.00 ft	
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES NONCOLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	2.09 cfs
Depth	0.19 ft
with Freeboard	0.49 ft
Top Width	2.58 ft
with Freeboard	3.48 ft
Velocity	4.71 fps
Cross Sectional Area	0.44 sq ft
Hydraulic Radius	0.16 ft
Froude Number	2.00

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D-35C

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	0.54	cfs
Slope	10.00	%
Sideslopes	1.50:1 (L)	1.50:1 (R)
Bottom Width	2.00	ft
Manning's n	0.030	
Max. Velocity	5.00	fps
Material	GRADED LOAM - COBBLES NONCOLLOIDAL	
Freeboard	.3	ft

RESULTS:

Actual Discharge	0.53	cfs
Depth	0.09	ft
with Freeboard	0.39	ft
Top Width	2.26	ft
with Freeboard	3.16	ft
Velocity	2.90	fps
Cross Sectional Area	0.18	sq ft
Hydraulic Radius	0.08	ft
Froude Number	1.79	

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D-35D

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	2.25 cfs	
Slope	10.00 %	
Sideslopes	1.50:1 (L)	1.50:1 (R)
Bottom Width	2.00 ft	
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES NONCOLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	2.25 cfs
Depth	0.20 ft
with Freeboard	0.50 ft
Top Width	2.61 ft
with Freeboard	3.51 ft
Velocity	4.83 fps
Cross Sectional Area	0.47 sq ft
Hydraulic Radius	0.17 ft
Froude Number	2.01

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D36

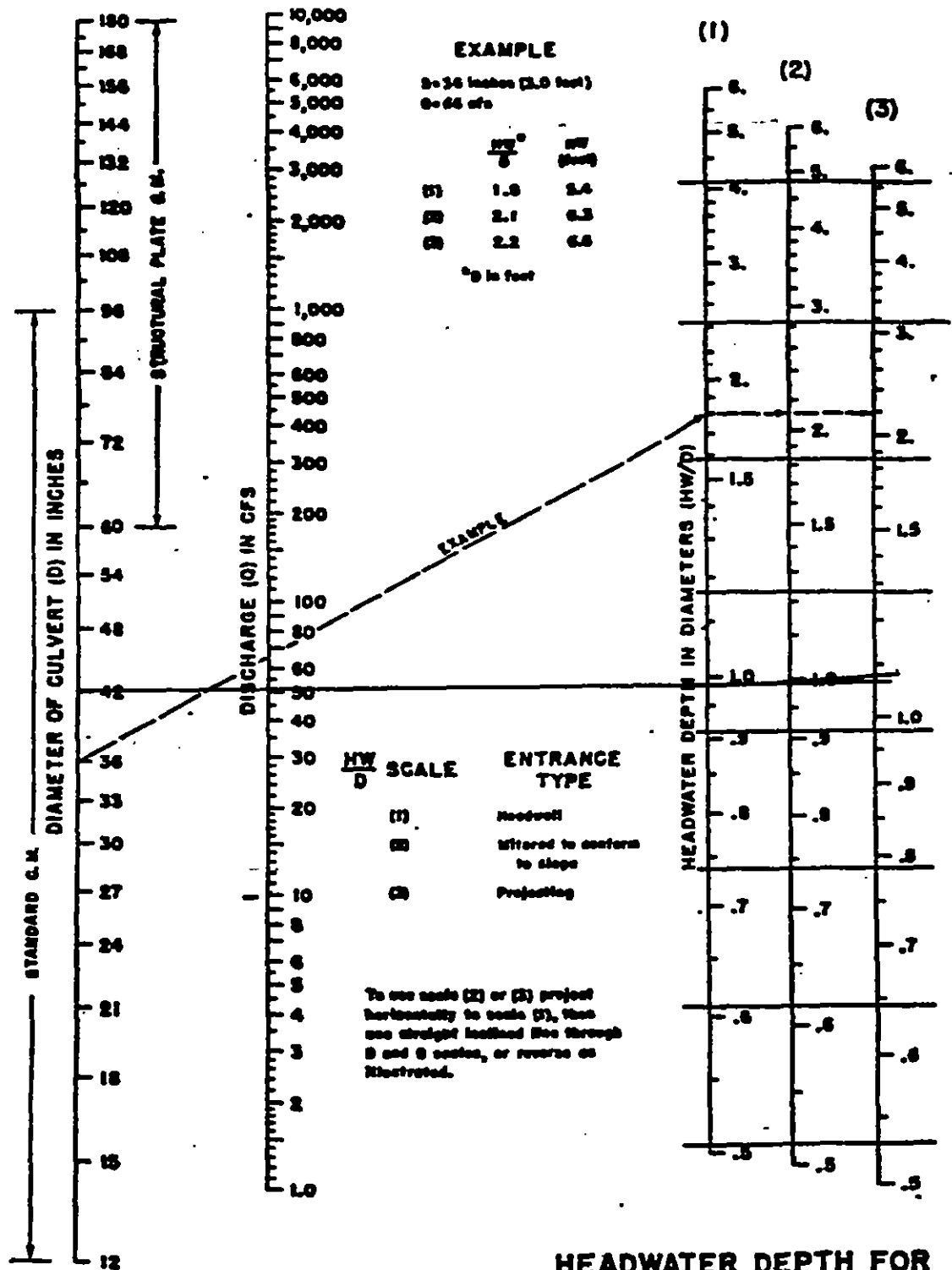
Limiting Velocity Technique Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	4.94 cfs	
Slope	5.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.025	
Max. Velocity	6.00 fps	
Material		
Freeboard	.3 ft	

RESULTS:

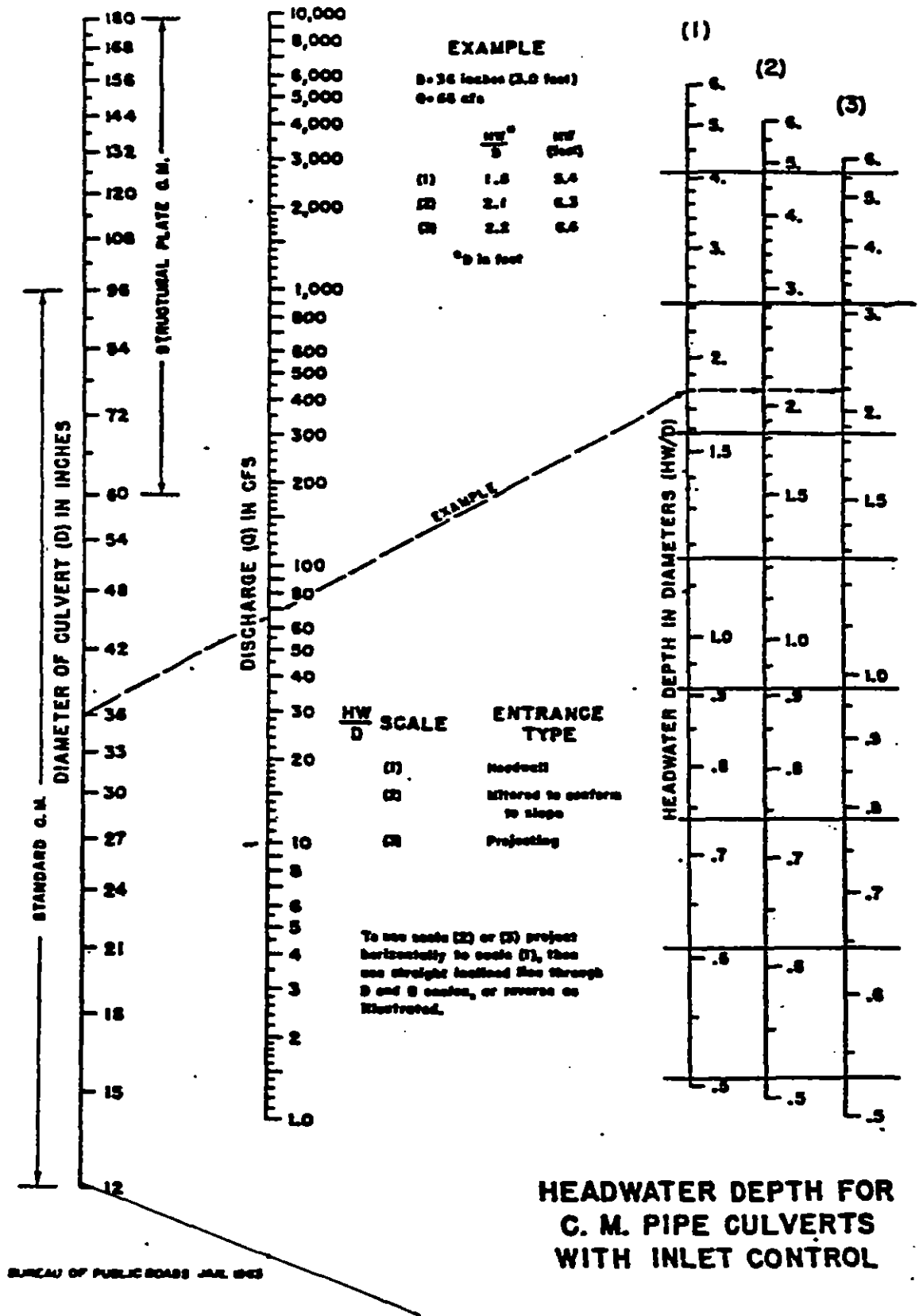
Actual Discharge	4.93 cfs
Depth	0.59 ft
with Freeboard	0.89 ft
Top Width	2.96 ft
with Freeboard	4.46 ft
Velocity	5.63 fps
Cross Sectional Area	0.88 sq ft
Hydraulic Radius	0.27 ft
Froude Number	1.82



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1943

March 23, 1995



CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

WS-E, REFUSE AREA

Ditch D35D

by

Name: LW

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\BASREF\WSE

Date: 03-09-1995

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\BASREF\WSE User: LW

Date: 03-09-1995 Time: 09:09:47

WS-E, REFUSE AREA

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: --0.1-hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	1.17	84 M	0.037	0.000	0.000	0.0	0.14	1.75
111 2	0.28	89 F	0.013	0.000	0.000	0.0	0.04	0.50
Type: Null Label: WS-E INTO D35D								
111 Structure	1.45						0.18	
111 Total IN/OUT	1.45						0.18	2.25

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\BASREF\WSE User: LW

Date: 03-09-1995 Time: 09:09:47

WS-E, REFUSE AREA

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	187.30	58.00	1.93	0.03			
				-b	7	342.82	58.00	15.33	0.01			
				-c	8	158.74	10.00	9.49	0.00	0.037		
1	1	1	2	-a	7	30.00	5.00	4.50	0.00			
				-b	8	407.00	10.00	9.49	0.01	0.013		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

10 YEAR 24 HOUR STORM EVENT FOR WS-B, REFUSE AREA

Ditch D35A

by

Name: LW

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

File Name: C:\SEDCAD3\BASREF\WSB2

Date: 03-09-1995

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASREF\WSB2 User: LW
 Date: 03-09-1995 Time: 08:47:24
 10 YEAR 24 HOUR STORM EVENT FOR WS-B, REFUSE AREA
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.93	84	M	0.039	0.000	0.000	0.0	0.11	1.39
111	2	0.39	89	F	0.018	0.000	0.000	0.0	0.06	0.70
		Type: Null				Label: WS-B INTO D35A				
111	Structure	1.32							0.17	
111	Total IN/OUT	1.32							0.17	2.09

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASREF\WSB2 User: LW
 Date: 03-09-1995 Time: 08:47:24
 10 YEAR 24 HOUR STORM EVENT FOR WS-B, REFUSE AREA
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	129.41	38.64	1.57	0.02			
				-b	8	571.81	10.00	9.49	0.02	0.039		
1	1	1	2	-a	7	30.00	5.00	4.50	0.00			
				-b	8	571.81	10.00	9.49	0.02	0.018		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

TR-38

100 YEAR 24 HOUR STORM EVENT FOR WS-A, REFUSE AREA

Culvert C57

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

File Name: C:\SEDCAD3\BASREF\WSAAA

Date: 03-23-1995

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASREF\WSAAA User: CWB
 Date: 03-23-1995 Time: 12:01:58
 100 YEAR 24 HOUR STORM EVENT FOR WS-A, REFUSE AREA
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	23.18	79	M	0.125	0.000	0.000	0.0	4.11	51.22
		Type: Null		Label: WS-A, CLEARWTR DITCH						
111	Structure	23.18							4.11	
111	Total IN/OUT	23.18							4.11	51.22

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASREF\WSAAA User: CWB
 Date: 03-23-1995 Time: 12:01:58
 100 YEAR 24 HOUR STORM EVENT FOR WS-A, REFUSE AREA
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	a	1	183.75	27.21	1.32	0.04			
				b	7	310.19	62.50	15.91	0.01			
				c	8	1955.00	5.00	6.71	0.08	0.125		

=====



Doc Date:12/11/2001

VOL 3

S/E "EXHIBIT 19-

~~19~~ New Elk D4, South Side of Dev Waste Pile, 8/29/97 "

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK D4, SOUTH SIDE OF DEVELOPMENT WASTE PILE, B SOILS

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D4

Date: 08-29-1997

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D4 User: CWB
Date: 08-29-1997 Time: 16:08:06
NEW ELK D4, SOUTH SIDE OF DEVELOPMENT WASTE PILE, B SOILS
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	60.00	40.30	6.35	0.00			
				-b	8	1018.00	1.77	3.99	0.07	0.073		

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D4 User: CWB

Date: 08-29-1997 Time: 16:08:12

NEW ELK D4, SOUTH SIDE OF DEVELOPMENT WASTE PILE, B SOILS

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.76	82	F	0.073	0.000	0.000	0.0	0.15	1.83
111	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
Type: Earthen Channel Label: D4, S WASTE PILE										
111	Structure	0.76							0.15	
111	Total IN/OUT	0.76							0.15	1.83

=====

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D4 User: CWB
Date: 08-29-1997 Time: 16:08:12
NEW ELK D4, SOUTH SIDE OF DEVELOPMENT WASTE PILE, B SOILS
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
D4, S WASTE PILE

Drainage Area from J1, B1, S1, SWS(s)1-2: 0.8 acres
Total Contributing Drainage Area: 0.8 acres

MATERIAL: GRADED SILTS TO COBBLES COLLOIDAL
Triangular Earthen Channel
Limiting Variable: Velocity = 5.500 fps
Sediment-laden Water

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
1.83		2.5:1	2.5:1	1.8	0.030

	Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
	0.53	2.60	2.7	0.246	0.89
w/ Freeboard:	0.83		4.2		

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	0.15	1.83



Doc Date: 12/11/2001

VOL. 3

S/E "EXHIBIT 19-

11
New Elk Dev Waste Pile, D10, 100-Yr Ditch, 8/29/97

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK DEVELOPMENT WASTE PILE, D10, 100-YR DITCH, E SIDE, B SOILS

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\DEVWST

Date: 08-29-1997

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\DEVWST User: CWB
Date: 08-29-1997 Time: 16:26:52
NEW ELK DEVELOPMENT WASTE PILE, D10, 100-YR DITCH, E SIDE, B SOILS
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
GENERAL INPUT TABLE
=====

Detailed Between Structure Routing:

J	B	S	To #	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
1	1	2	1	1	8	257.27	4.60	6.43	0.01	0.011	0.395

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\DEVWST User: CWB
 Date: 09-03-1997 Time: 07:51:25
 NEW ELK DEVELOPMENT WASTE PILE, D10, 100-YR DITCH, E SIDE, B SOILS
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.92	79	S	0.172	0.003	0.269	0.0	0.16	1.15
111	2	0.34	82	M	0.168	0.000	0.000	0.0	0.07	0.69
111	3	70.35	64	S	0.181	0.000	0.000	0.0	6.37	38.51
		Type: Null Label: FENCELINE,RD, UPLAND								
111	Structure	71.61							6.60	

111	Total IN/OUT	71.61							6.60	40.35
=====										
112	1	0.10	79	M	0.011	0.000	0.000	0.0	0.02	0.22
112	2	0.15	82	F	0.018	0.000	0.000	0.0	0.03	0.36
		Type: Riprap Channel Label: D10:DITCH, E PILE SL								
112	Structure	0.25							6.65	

112	Total IN/OUT	71.86							6.65	40.46
=====										
111 to 112 Routing					0.011	0.395				
=====										
121	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null Label:								
121	Structure	0.00							0.00	

121	Total IN/OUT	0.00							0.00	0.00
=====										
211	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null Label:								
211	Structure	0.00							6.65	

211	Total IN/OUT	71.86							6.65	40.46
=====										
112 to 211 Routing					0.000	0.000				
=====										

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\DEVWST User: CWB
Date: 09-03-1997 Time: 07:51:25
NEW ELK DEVELOPMENT WASTE PILE, D10, 100-YR DITCH, E SIDE, B SOILS
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S2
D10:DITCH, E PILE SL

Drainage Area from J1, B1, S2, SWS(s)1-2: 0.2 acres
Total Contributing Drainage Area: 71.9 acres

MATERIAL: Rock Riprap
Triangular Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
40.46		3.0:1	3.0:1	4.6	0.043

	Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
	0.82	20.03**	4.9	0.389	5.51
w/ Freeboard:	1.12		6.7		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----	----D50----	----D10----
(ft) (in)	(ft) (in)	(ft) (in)
2.19 26.25	1.75 21.00	0.58 7.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	6.65	40.46





999

Doc Date: 12/11/2001

EX 20

S/E "EXHIBIT 19-

NEW ELK MINE
REFUSE AREA SEDIMENTATION POND "

CERTIFICATION

Construction of the RDA Pond, MSHA Impoundment No. 1211-C0-09-0039 was done according to the pond plan and design dated August 24, 1984.



NEW ELK MINE
REFUSE AREA SEDIMENTATION POND

CERTIFICATION

The following design has been done in accordance with the current, prudent engineering practices for earth embankment dams.

S.D. Maguire

Peak Project Management, LLC

34115 County Road 20.8 Trinidad, CO 81082

Telephone: (719) 846-4975 Fax: (719) 846-4931 (719) 859-0111

ronthompson@wildblue.net

RECEIVED
SEP 28 2007

NEW ELK COAL COMPANY
New Elk Mine
Permit No. CO-81-012

**Division of Reclamation,
Mining and Safety**

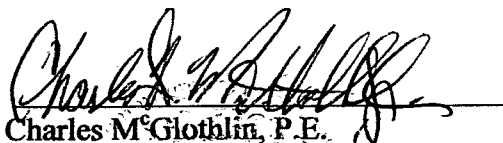
Re: As-Built Certification for Sedimentation Pond 001

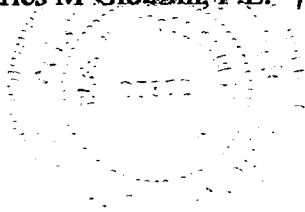
Design plans for sedimentation pond number 001, compiled in Figure 5 of the New Elk Mining Permit, certified by Charles McGlothlin, dated 2/15/02, have been reviewed by Ronald Thompson, a Mine Engineer experienced in sediment control design and construction and a MSHA certified impoundment inspector, and Charles McGlothlin, a Registered Professional Engineer in the State of Colorado. Mr. Thompson monitored all phases of construction on a regular basis under the direction of Mr. McGlothlin.. 07?

This inspection was conducted as required by Section 4.05.6 of the Regulations of the Colorado Mined Land Reclamation Board for Coal Mining. As-Built construction details are shown on Survey drawing dated 7/13/2007 as certified by Gary Terry PLS No. 12160 and are hereby incorporated into this Engineering Certification.

During construction the Emergency Spillway was moved eastward approximately 200 feet to lie in the center of the north face of the pond. This does not materially affect the operation of the pond.

I HEREBY CERTIFY THAT POND 001 WAS CONSTRUCTED IN ACCORDANCE WITH THE ABOVE REFERENCED DESIGN PLANS. FIELD MODIFICATIONS, AS MAY BE NOTED ABOVE HAVE NOT ADVERSELY IMPACTED CRITICAL DESIGN CRITERIA FOR POND VOLUME, AND EMBANKMENT AND EMERGENCY SPILLWAY DIMENSION. PRIMARY SPILLWAY CONSTRUCTION CONFORMS TO THE ORIGINAL PLAN DIMENSIONS DESIGNED AND CERTIFIED BY CHARLES McGLOTHLIN, REGISTERED PROFESSIONAL ENGINEER.


Charles McGlothlin, P.E.



Handwritten notes:
- "Engineering not" (with a checkmark)
- "P. 12160"

Peak Project Management, LLC
34115 County Road 20.8 Trinidad, CO 81082
Telephone: (719) 846-4975 Fax: (719) 846-4930 Cell: (719) 859-0111
ronthompson@wildblue.net

January 28, 2008

Kent Gorham
Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

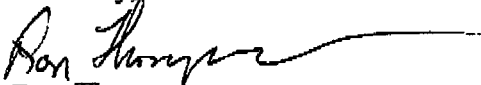
Re: New Elk Mine Permit No. C-81-012
MR-87 Pond 001 As-built Certification
Correction

Dear Mr. Gorham:

Please note and correct the following typographical error in the As-built certification for New Elk Pond 001: The correct date for the design plans for sedimentation pond 001 should be 2/22/07 not 2/15/02.

Please contact me if you have any questions.

Sincerely,


Ron Thompson
Agent

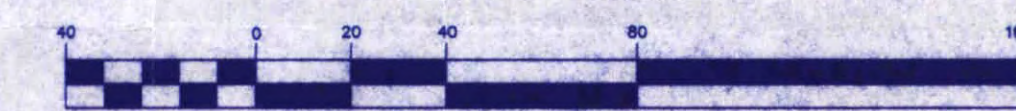
Addendum to Pond 001 As-built

NEW ELK COAL COMPANY

POND 001
NEW ELK MINE
COUNTY OF LAS ANIMAS,
STATE OF COLORADO.



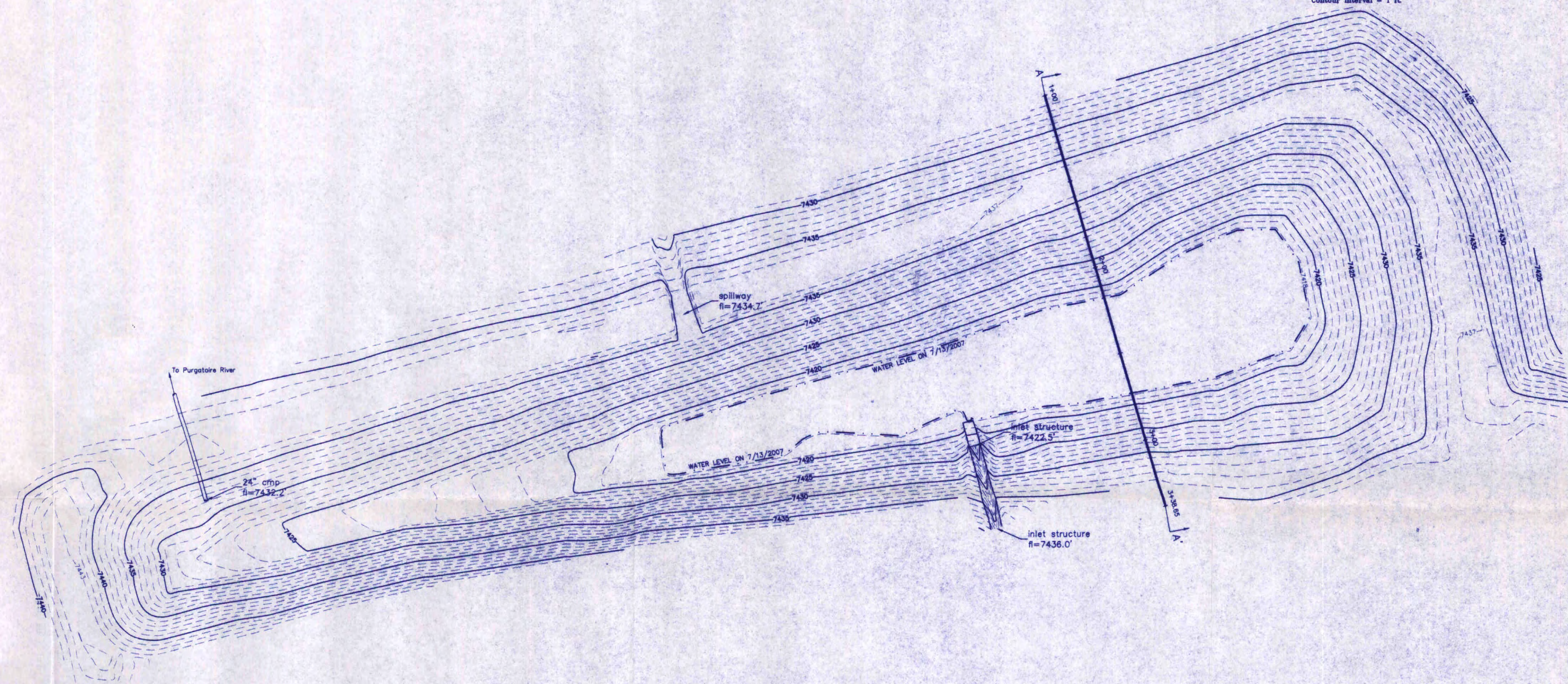
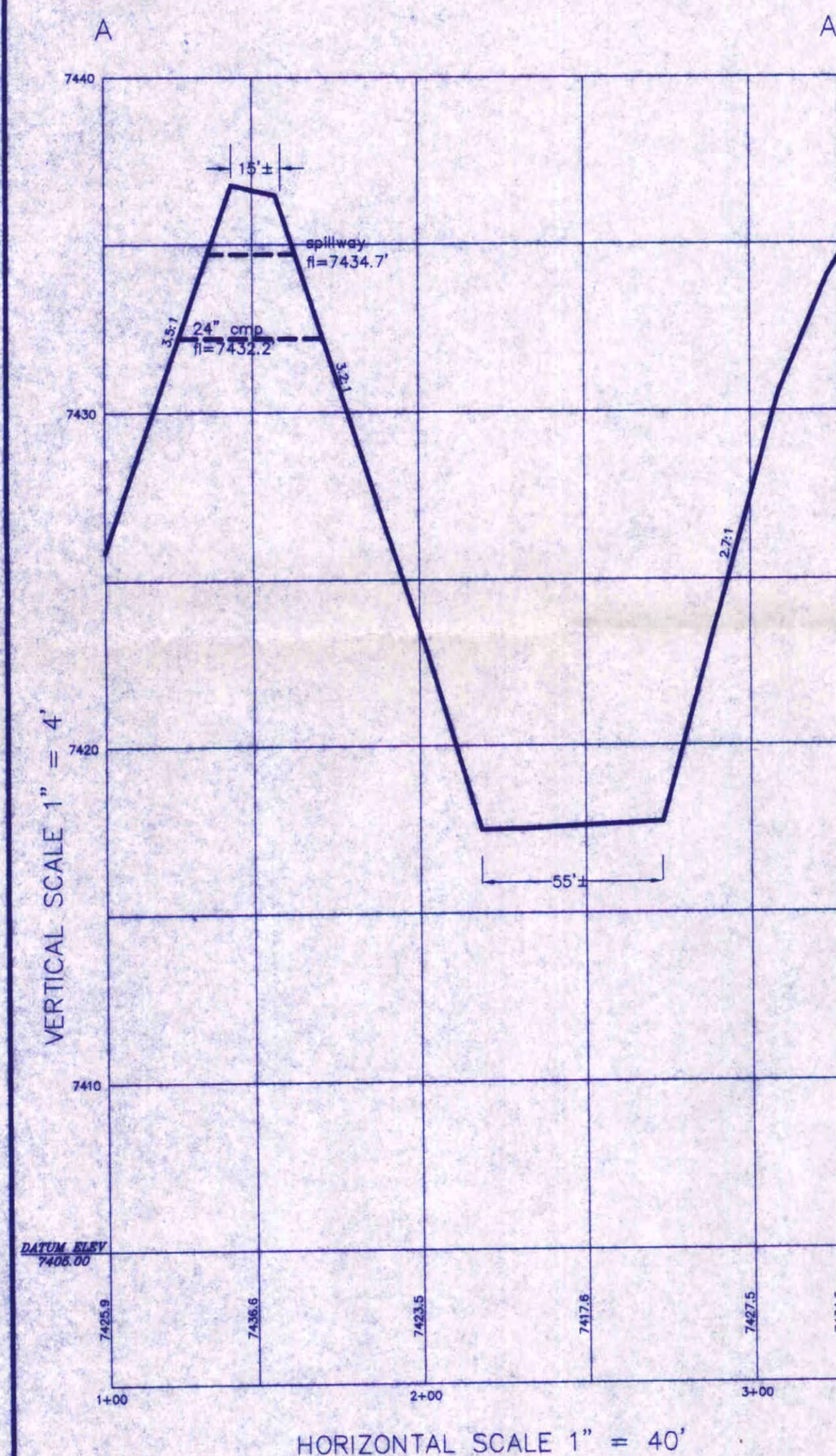
GRAPHIC SCALE



(IN FEET)
1 inch = 40 ft.

Contour Interval = 1 ft.

PROFILE



VOLUMES

VOLUME = 15.69 ACRE FEET
(BASED ON SPILLWAY ELEVATION 7434.7')

VOLUME = 11.78 ACRE FEET
(BASED ON CMP OUTLET ELEVATION 7432.2')

VOLUME = 10.02 ACRE FEET
(BASED ON ELEVATION 7430')

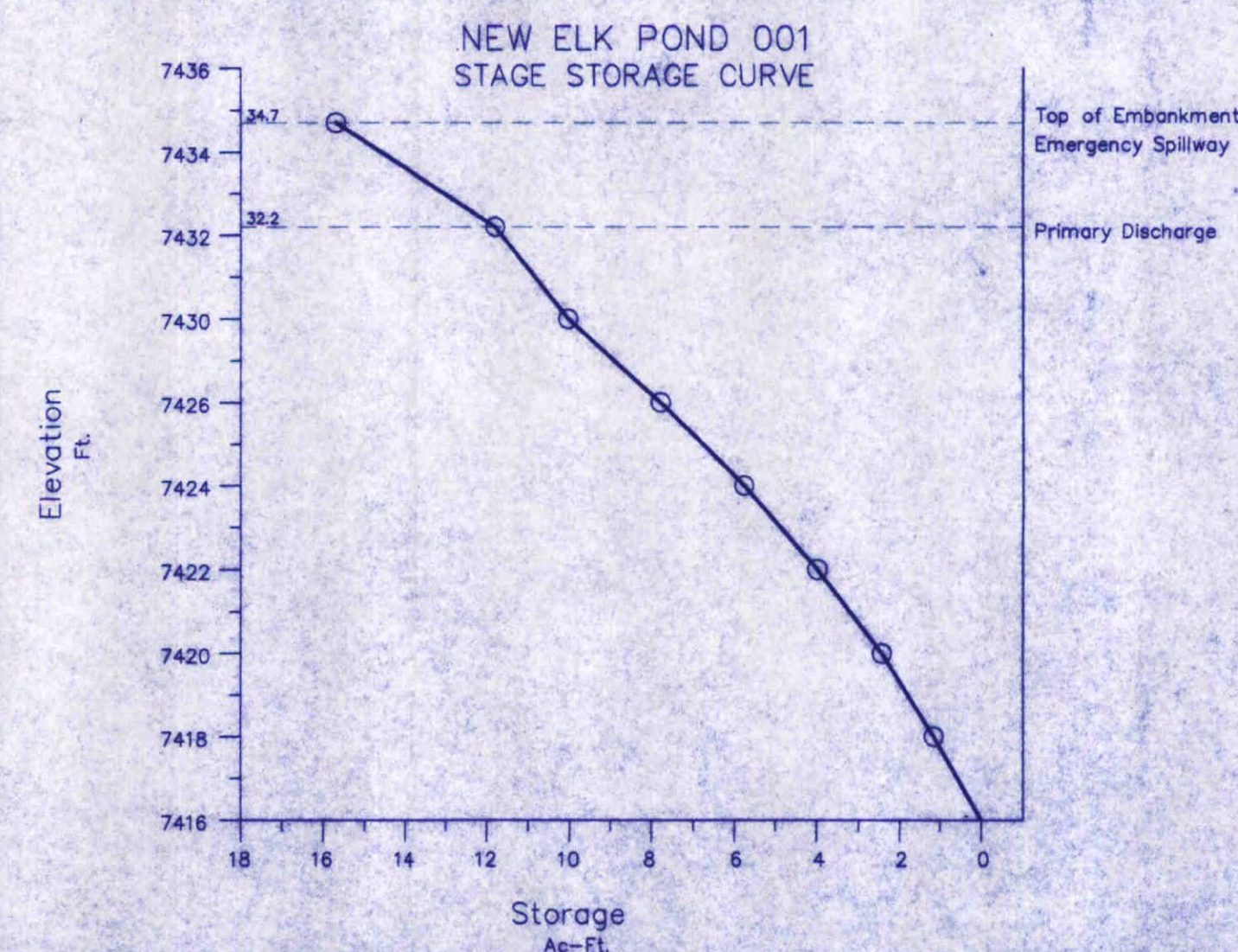
VOLUME = 7.77 ACRE FEET
(BASED ON ELEVATION 7428')

VOLUME = 5.75 ACRE FEET
(BASED ON ELEVATION 7426')

VOLUME = 3.98 ACRE FEET
(BASED ON ELEVATION 7424')

VOLUME = 2.44 ACRE FEET
(BASED ON ELEVATION 7422')

VOLUME = 1.16 ACRE FEET
(BASED ON ELEVATION 7420')



SURVEYOR'S CERTIFICATE

THE UNDERSIGNED REGISTERED PROFESSIONAL LAND SURVEYOR
CERTIFIES THAT THE SURVEY REPRESENTED BY THIS PLAT WAS
SURVEYED UNDER HIS SUPERVISION AND DIRECTION AND IS
CORRECT TO THE BEST OF HIS KNOWLEDGE AND BELIEF.



GARY L. TERRY
P.L.S. 12160

RECEIVED

SEP 28 2007

Division of Reclamation,
Mining and Safety

TERRY SURVEYING INC.

P.O. BOX 801 TOWNSEND, COLORADO 81082

NEW ELK MINE, LAS ANIMAS COUNTY, CO

SURVEY FOR

DRAWN BY: nle

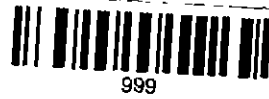
CHECKED BY: G. Terry

DATE: 07/13/2007

DRAWING NO.:

SHEET 1 OF 1

MS87



Doc Date: 12/11/2001

VOL. 3

S/E¹¹ EXHIBIT 19-

2

Pond 004, 1995 As-Built Survey (TR-39), 9/26/95

11

EXHIBIT 19

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

POND 004, 1995 AS-BUILT SURVEY

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\BASIN\RISER3

Date: 09-26-1995

TR 39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB

Date: 09-26-1995 Time: 16:19:02

POND 004, 1995 AS-BUILT SURVEY

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50

Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	COAL PILE % Finer	LOAM % Finer
2.0000	100.00	100.00
1.0000	74.00	75.00
0.5000	47.00	64.00
0.2500	30.00	60.00
0.1250	22.00	53.00
0.0630	3.00	44.00
0.0160	2.00	30.00
0.0040	1.00	17.00
0.0030	0.00	0.00

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB

Date: 09-26-1995 Time: 16:19:02

POND 004, 1995 AS-BUILT SURVEY

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.28*	89	M	0.068	0.000	0.000	0.0	0.19	2.30
111	2	3.82*	89	M	0.088	0.000	0.000	0.0	0.58	6.84
111	3	0.89*	89	F	0.051	0.127	0.356	0.0	0.13	1.59
		Type: Pond		Label: D3, D2(E & N), D2(S)						
111	Structure	5.99							0.90	
111	Total IN	5.99							0.90	10.62
111	Total OUT								0.32	0.11

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment

SCp: Peak Sediment Concentration

SSp: Peak Settleable Concentration

24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours

24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R 111	1	0.40	140.0	35.0	0.200	0.000	1	36.8				
R 111	2	0.40	160.0	35.0	0.900	0.000	1	607.9				
R 111	3	0.32	40.0	50.0	0.900	0.127	2	57.4				
		Type: Pond		Label: D3, D2(E & N), D2(S)								
111	Structure							702.0				
111	Total IN							702.0	738632	568.00	335.66	99.32
111	Total OUT							0.0	0	0.00	0.00	0.00

0.43 acre-ft

12/31

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB

Date: 09-26-1995 Time: 16:19:02

POND 004, 1995 AS-BUILT SURVEY

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	199.93	2.00	1.41	0.04			
				-b	5	78.19	50.00	7.07	0.00			
				-c	3	21.60	50.00	4.95	0.00			
				-d	8	428.90	2.50	4.74	0.03	0.068		
1	1	1	2	-a	5	117.47	2.00	1.41	0.02			
				-b	5	58.59	50.00	7.07	0.00			
				-c	8	969.30	2.00	4.24	0.06	0.088		
1	1	1	3	-a	5	53.41	50.00	7.07	0.00			
				-b	8	753.14	2.00	4.24	0.05	0.051		
1	1	1	3	-1	8	1945.16	2.00	4.24	0.13		0.127	0.356

TR-39

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
Date: 09-26-1995 Time: 16:19:02
POND 004, 1995 AS-BUILT SURVEY
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

TR-39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB

Date: 09-26-1995 Time: 16:19:02

POND 004, 1995 AS-BUILT SURVEY

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

LAST POND ONLY TABLE

=====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
 Total Contributing Drainage Area: 6.0 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	12.0	----
Riser Height (ft)	2.70	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	120.00	----
Barrel Slope (%)	2.00	----
Manning's n of Pipe	0.024	----
Spillway Elevation	7450.6	----
Lowest Elevation of Holes	7449.5	----
# of Holes/Elevation	10	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	7451.2
Crest Length (ft)	----	15.0
Z:1 (Left and Right)	-- --	3.6 3.6
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage* (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
1.28	2.50	20.00	DEPOSITS

TR-39

*Sediment Capacity based on Average Annual R of 50.0 for 3.0 year(s)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	0.90	10.62	702.0	738632	568.00	335.66	99.32
OUT	0.32	0.11	0.0	0	0.00	0.00	0.00

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
7450.0	100.00	49.85

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 7.0 days

TR 39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:02
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

POND INPUT/OUTPUT TABLE

=====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
 Total Contributing Drainage Area: 6.0 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	12.0	----
Riser Height (ft)	2.70	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	120.00	----
Barrel Slope (%)	2.00	----
Manning's n of Pipe	0.024	----
Spillway Elevation	7450.6	----
Lowest Elevation of Holes	7449.5	----
# of Holes/Elevation	10	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	7451.2
Crest Length (ft)	----	15.0
Z:1 (Left and Right)	-- --	3.6 3.6
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage* (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
1.28	2.50	20.00	DEPOSITS

Handwritten: R39

*Sediment Capacity based on Average Annual R of 50.0 for 3.0 year(s)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	0.90	10.62	702.0	738632	568.00	335.66	99.32
OUT	0.32	0.11	0.0	0	0.00	0.00	0.00

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
7450.0	100.00	49.85

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 7.0 days

TR-39

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:02
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

ELEVATION-DISCHARGE TABLE

Civil Software Design -- SEDCAD+ Versi
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:02
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

ELEVATION-DISCHARGE TABLE

=====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
 Total Contributing Drainage Area: 6.0 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
7448.03	0.0	0.0	0.0
7448.10	0.0	0.0	0.0
7448.40	0.0	0.0	0.0
7448.70	0.0	0.0	0.0
7449.00	0.0	0.0	0.0
7449.30	0.0	0.0	0.0
7449.53	0.0>0.80	0.0	0.0
7449.60	0.0	0.0	0.0
7449.90	0.1	0.0	0.1
7450.00	0.1>0.80	0.0	0.1
7450.20	0.2	0.0	0.2
7450.50	0.3	0.0	0.3
7450.57	0.3	0.0	0.3
7450.80	1.1	0.0	1.1
7451.10	2.8	0.0	2.8
7451.20	3.0	0.0	3.0
7451.40	3.4	3.5	7.0
7451.70	4.0	8.8	12.8
7451.73	4.0	9.3	13.4
7451.83	4.1	11.1	15.2
7451.93	4.1	14.7	18.8
7452.00	4.1	19.2	23.4

Handwritten: R39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB

Date: 09-26-1995 Time: 16:19:02

POND 004, 1995 AS-BUILT SURVEY

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

=====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3:

6.0 acres

Total Contributing Drainage Area:

6.0 acres

SW#1: Perforated Riser

SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
7446.00	0.00	0.04	0.00		
7448.00	2.00	1.35	1.25		
7448.03	0.00	1.36	1.28	0.00	Top of Sediment Storage (0 Stage)
7448.10	0.07	1.39	0.10	0.00	
7448.40	0.37	1.52	0.53	0.00	
7448.70	0.67	1.66	1.01	0.00	
7449.00	0.97	1.80	1.53	0.00	
7449.30	1.27	1.83	2.08	0.00	
7449.53	1.50	1.85	2.50	0.00	Low Orifice of SW#1
7449.60	1.57	1.86	2.63	0.04	
7449.90	1.87	1.89	3.19	0.10	
7449.95	1.92	1.89	3.29	0.11	Peak Stage
7450.00	1.97	1.90	3.38	0.12	
7450.20	2.17	1.92	3.76	0.21	
7450.50	2.47	1.94	4.34	0.28	
7450.57	2.54	1.95	4.48	0.30	Stage of SW#1
7450.80	2.77	1.97	4.93	1.07	
7451.10	3.07	2.00	5.52	2.75	
7451.20	3.17	2.01	5.72	3.00	Stage of SW#2
7451.40	3.37	2.03	6.13	6.97	
7451.70	3.67	2.06	6.74	12.83	
7451.73	3.70	2.06	6.80	13.36	
7451.83	3.80	2.07	7.01	15.16	
7451.93	3.90	2.08	7.21	18.81	
7452.00	3.97	2.08	7.36	23.36	

.7 feet difference?

Δ1.6'
OK

TR-39

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

POND 004, 1995 AS-BUILT SURVEY

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\BASIN\RISER3

Date: 09-26-1995

TR-39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
Date: 09-26-1995 Time: 16:19:18
POND 004, 1995 AS-BUILT SURVEY
Storm: 3.40 inches, 25 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):		
Size (mm)	COAL PILE % Finer	LOAM % Finer
2.0000	100.00	100.00
1.0000	74.00	75.00
0.5000	47.00	64.00
0.2500	30.00	60.00
0.1250	22.00	53.00
0.0630	3.00	44.00
0.0160	2.00	30.00
0.0040	1.00	17.00
0.0030	0.00	0.00

TR-39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:18
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.28*	89	M	0.068	0.000	0.000	0.0	0.24	2.82
111	2	3.82*	89	M	0.088	0.000	0.000	0.0	0.72	8.39
111	3	0.89*	89	F	0.051	0.127	0.356	0.0	0.17	1.95
Type: Pond Label: D3, D2(E & N), D2(S)										
111	Structure	5.99							1.13	
111	Total IN	5.99							1.13	13.05
111	Total OUT								0.39	0.14

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment
 SCp: Peak Sediment Concentration
 SSp: Peak Settleable Concentration
 24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
 24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R 111	1	0.40	140.0	35.0	0.200	0.000	1	46.7				
R 111	2	0.40	160.0	35.0	0.900	0.000	1	772.8				
R 111	3	0.32	40.0	50.0	0.900	0.127	2	72.9				
Type: Pond Label: D3, D2(E & N), D2(S)												
111	Structure							892.5				
111	Total IN							892.5	743532	571.76	339.24	103.10
111	Total OUT							0.0	0	0.00	0.00	0.00

TR-39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:18
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	199.93	2.00	1.41	0.04			
				-b	5	78.19	50.00	7.07	0.00			
				-c	3	21.60	50.00	4.95	0.00			
				-d	8	428.90	2.50	4.74	0.03	0.068		
1	1	1	2	-a	5	117.47	2.00	1.41	0.02			
				-b	5	58.59	50.00	7.07	0.00			
				-c	8	969.30	2.00	4.24	0.06	0.088		
1	1	1	3	-a	5	53.41	50.00	7.07	0.00			
				-b	8	753.14	2.00	4.24	0.05	0.051		
1	1	1	3	-1	8	1945.16	2.00	4.24	0.13		0.127	0.356

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:18
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====
 LAST POND ONLY TABLE
 =====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
 Total Contributing Drainage Area: 6.0 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	12.0	----
Riser Height (ft)	2.70	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	120.00	----
Barrel Slope (%)	2.00	----
Manning's n of Pipe	0.024	----
Spillway Elevation	7450.6	----
Lowest Elevation of Holes	7449.5	----
# of Holes/Elevation	10	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	7451.2
Crest Length (ft)	----	15.0
Z:1 (Left and Right)	-- --	3.6 3.6
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage* (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm

1.15 2.63 20.00 DEPOSITS

TR-39

*Sediment Capacity based on Average Annual R of 50.0 for 3.0 year(s)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	1.13	13.05	892.5	743532	571.76	339.24	103.10
OUT	0.39	0.14	0.0	0	0.00	0.00	0.00

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
7450.1	100.00	49.85

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 7.0 days

TR-39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:18
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

POND INPUT/OUTPUT TABLE

=====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
 Total Contributing Drainage Area: 6.0 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	12.0	----
Riser Height (ft)	2.70	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	120.00	----
Barrel Slope (%)	2.00	----
Manning's n of Pipe	0.024	----
Spillway Elevation	7450.6	----
Lowest Elevation of Holes	7449.5	----
# of Holes/Elevation	10	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	7451.2
Crest Length (ft)	----	15.0
Z:1 (Left and Right)	-- --	3.6 3.6
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage* (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
1.15	2.63	20.00	DEPOSITS

TR-39

*Sediment Capacity based on Average Annual R of 50.0 for 3.0 year(s)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	1.13	13.05	892.5	743532	571.76	339.24	103.10
OUT	0.39	0.14	0.0	0	0.00	0.00	0.00

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
7450.1	100.00	49.85

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 7.0 days

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:18
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

ELEVATION-DISCHARGE TABLE

=====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
 Total Contributing Drainage Area: 6.0 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
7447.93	0.0	0.0	0.0
7448.00	0.0	0.0	0.0
7448.10	0.0	0.0	0.0
7448.40	0.0	0.0	0.0
7448.70	0.0	0.0	0.0
7449.00	0.0	0.0	0.0
7449.30	0.0	0.0	0.0
7449.53	0.0>0.80	0.0	0.0
7449.60	0.0	0.0	0.0
7449.90	0.1	0.0	0.1
7450.00	0.1>0.80	0.0	0.1
7450.20	0.2	0.0	0.2
7450.50	0.3	0.0	0.3
7450.57	0.3	0.0	0.3
7450.80	1.1	0.0	1.1
7451.10	2.8	0.0	2.8
7451.20	3.0	0.0	3.0
7451.40	3.4	3.5	7.0
7451.70	4.0	8.8	12.8
7451.73	4.0	9.3	13.4
7451.83	4.1	11.1	15.2
7451.93	4.1	14.7	18.8
7452.00	4.1	19.2	23.4

TR-39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:18
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 3.40 inches, 25 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

=====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
 Total Contributing Drainage Area: 6.0 acres

SW#1: Perforated Riser
 SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
7446.00	0.00	0.04	0.00		
7447.80	1.80	1.19	0.99		
7447.93	0.00	1.29	1.15	0.00	Top of Sediment Storage (0 Stage)
7448.00	0.07	1.35	0.09	0.00	
7448.10	0.17	1.39	0.23	0.00	
7448.40	0.47	1.52	0.67	0.00	
7448.70	0.77	1.66	1.15	0.00	
7449.00	1.07	1.80	1.67	0.00	
7449.30	1.37	1.83	2.21	0.00	
7449.53	1.60	1.85	2.63	0.00	Low Orifice of SW#1
7449.60	1.67	1.86	2.76	0.04	
7449.90	1.97	1.89	3.33	0.10	
7450.00	2.07	1.90	3.51	0.12	
7450.06	2.13	1.90	3.63	0.14	Peak Stage
7450.20	2.27	1.92	3.90	0.21	
7450.50	2.57	1.94	4.47	0.28	
7450.57	2.64	1.95	4.61	0.30	Stage of SW#1
7450.80	2.87	1.97	5.06	1.07	
7451.10	3.17	2.00	5.66	2.75	
7451.20	3.27	2.01	5.86	3.00	Stage of SW#2
7451.40	3.47	2.03	6.26	6.97	
7451.70	3.77	2.06	6.87	12.84	
7451.73	3.80	2.06	6.93	13.36	
7451.83	3.90	2.07	7.14	15.16	
7451.93	4.00	2.08	7.35	18.81	
7452.00	4.07	2.08	7.49	23.36	

TR-39

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

POND 004, 1995 AS-BUILT SURVEY

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\BASIN\RISER3

Date: 09-26-1995

XR-39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
Date: 09-26-1995 Time: 16:19:34
POND 004, 1995 AS-BUILT SURVEY
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
GENERAL INPUT TABLE
=====

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):		
Size (mm)	COAL PILE % Finer	LOAM % Finer
2.0000	100.00	100.00
1.0000	74.00	75.00
0.5000	47.00	64.00
0.2500	30.00	60.00
0.1250	22.00	53.00
0.0630	3.00	44.00
0.0160	2.00	30.00
0.0040	1.00	17.00
0.0030	0.00	0.00

TR-39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB

Date: 09-26-1995 Time: 16:19:34

POND 004, 1995 AS-BUILT SURVEY

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.28*	89	M	0.068	0.000	0.000	0.0	0.32	3.65
111	2	3.82*	89	M	0.088	0.000	0.000	0.0	0.96	10.86
111	3	0.89*	89	F	0.051	0.127	0.356	0.0	0.22	2.52
		Type: Pond Label: D3, D2(E & N), D2(S)								
111	Structure	5.99							1.50	
111	Total IN	5.99							1.50	16.93
111	Total OUT								0.57	0.22

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Sedimentology-

SED: Sediment

SCp: Peak Sediment Concentration

SSp: Peak Settleable Concentration

24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours

24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R 111	1	0.40	140.0	35.0	0.200	0.000	1	63.4				
R 111	2	0.40	160.0	35.0	0.900	0.000	1	1047.6				
R 111	3	0.32	40.0	50.0	0.900	0.127	2	98.8				
		Type: Pond Label: D3, D2(E & N), D2(S)										
111	Structure							1209.8				
111	Total IN							1209.8	750912	577.44	343.69	107.85
111	Total OUT							0.0	0	0.00	0.00	0.00

TR-39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:34
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	199.93	2.00	1.41	0.04			
				-b	5	78.19	50.00	7.07	0.00			
				-c	3	21.60	50.00	4.95	0.00			
				-d	8	428.90	2.50	4.74	0.03	0.068		
1	1	1	2	-a	5	117.47	2.00	1.41	0.02			
				-b	5	58.59	50.00	7.07	0.00			
				-c	8	969.30	2.00	4.24	0.06	0.088		
1	1	1	3	-a	5	53.41	50.00	7.07	0.00			
				-b	8	753.14	2.00	4.24	0.05	0.051		
1	1	1	3	-1	8	1945.16	2.00	4.24	0.13		0.127	0.356

=====

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB
 Date: 09-26-1995 Time: 16:19:34
 POND 004, 1995 AS-BUILT SURVEY
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====
 LAST POND ONLY TABLE
 =====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
 Total Contributing Drainage Area: 6.0 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	12.0	----
Riser Height (ft)	2.70	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	120.00	----
Barrel Slope (%)	2.00	----
Manning's n of Pipe	0.024	----
Spillway Elevation	7450.6	----
Lowest Elevation of Holes	7449.5	----
# of Holes/Elevation	10	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	7451.2
Crest Length (ft)	----	15.0
Z:1 (Left and Right)	-- --	3.6 3.6
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage* (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.98	2.80	20.00	DEPOSITS

*Sediment Capacity based on Average Annual R of 50.0 for 3.0 year(s)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	1.50	16.93	1209.8	750912	577.44	343.69	107.85
OUT	0.57	0.22	0.0	0	0.00	0.00	0.00

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
7450.2	100.00	49.85

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 7.0 days

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB

Date: 09-26-1995 Time: 16:19:34

POND 004, 1995 AS-BUILT SURVEY

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

POND INPUT/OUTPUT TABLE

=====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
 Total Contributing Drainage Area: 6.0 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
=====		
Riser Diameter (in)	12.0	----
Riser Height (ft)	2.70	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	120.00	----
Barrel Slope (%)	2.00	----
Manning's n of Pipe	0.024	----
Spillway Elevation	7450.6	----
Lowest Elevation of Holes	7449.5	----
# of Holes/Elevation	10	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	7451.2
Crest Length (ft)	----	15.0
Z:1 (Left and Right)	-- --	3.6 3.6
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage* (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.98	2.80	20.00	DEPOSITS

TR-39

*Sediment Capacity based on Average Annual R of 50.0 for 3.0 year(s)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	1.50	16.93	1209.8	750912	577.44	343.69	107.85
OUT	0.57	0.22	0.0	0	0.00	0.00	0.00

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
7450.2	100.00	49.85

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 7.0 days

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB

Date: 09-26-1995 Time: 16:19:34

POND 004, 1995 AS-BUILT SURVEY

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

ELEVATION-DISCHARGE TABLE

=====

J1, B1, S1
D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
Total Contributing Drainage Area: 6.0 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
7447.80	0.0	0.0	0.0
7447.80	0.0	0.0	0.0
7448.00	0.0	0.0	0.0
7448.10	0.0	0.0	0.0
7448.40	0.0	0.0	0.0
7448.70	0.0	0.0	0.0
7449.00	0.0	0.0	0.0
7449.30	0.0	0.0	0.0
7449.53	0.0>0.80	0.0	0.0
7449.60	0.0	0.0	0.0
7449.90	0.1	0.0	0.1
7450.00	0.1>0.80	0.0	0.1
7450.20	0.2	0.0	0.2
7450.50	0.3	0.0	0.3
7450.57	0.3	0.0	0.3
7450.80	1.1	0.0	1.1
7451.10	2.8	0.0	2.8
7451.20	3.0	0.0	3.0
7451.40	3.4	3.2	6.6
7451.70	4.0	8.0	12.0
7451.80	4.1	9.5	13.6
7451.90	4.1	11.1	15.2
7452.00	4.1	14.7	18.8
7452.00	4.1	19.2	23.4

TR-39

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\BASIN\RISER3 User: CWB

Date: 09-26-1995 Time: 16:19:34

POND 004, 1995 AS-BUILT SURVEY

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

=====

J1, B1, S1
 D3, D2(E & N), D2(S)

Drainage Area from J1, B1, S1, SWS(s)1-3: 6.0 acres
 Total Contributing Drainage Area: 6.0 acres

SW#1: Perforated Riser
 SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
7446.00	0.00	0.04	0.00		
7447.50	1.50	0.96	0.67		
7447.80	0.00	1.18	0.98	0.00	Top of Sediment Storage (0 Stage)
7447.80	0.00	1.19	0.00	0.00	
7448.00	0.20	1.35	0.26	0.00	
7448.10	0.30	1.39	0.40	0.00	
7448.40	0.60	1.52	0.83	0.00	
7448.70	0.90	1.66	1.31	0.00	
7449.00	1.20	1.80	1.83	0.00	
7449.30	1.50	1.83	2.37	0.00	
7449.53	1.73	1.85	2.80	0.00	Low Orifice of SW#1
7449.60	1.80	1.86	2.93	0.04	
7449.90	2.10	1.89	3.49	0.10	
7450.00	2.20	1.90	3.68	0.12	
7450.20	2.40	1.92	4.06	0.21	
7450.22	2.42	1.92	4.09	0.22	Peak Stage
7450.50	2.70	1.94	4.64	0.28	
7450.57	2.77	1.95	4.77	0.30	Stage of SW#1
7450.80	3.00	1.97	5.23	1.07	
7451.10	3.30	2.00	5.82	2.75	
7451.20	3.40	2.01	6.02	3.00	Stage of SW#2
7451.40	3.60	2.03	6.42	6.63	
7451.70	3.90	2.06	7.04	11.99	
7451.80	4.00	2.06	7.24	13.55	
7451.90	4.10	2.07	7.44	15.18	
7452.00	4.20	2.08	7.65	18.83	
7452.00	4.20	2.08	7.66	23.36	

TR-39



S/E "EXHIBIT 19 - Pond Design
Details"

Pond 005

**10 year - 24 hour
As-Built Perforated Riser**

LW/GS

Greystone
5231 S. Quebec Street
Greenwood Village, CO 80111

Phone: 303-850-0930
Email: greystone@greystone-consultants.com

TR-45
2/2000

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	2.900 inches

Particle Size Distribution:

Size (mm)	Coal Pile	Loam
2.0000	100.000%	100.000%
1.0000	74.000%	75.000%
0.5000	47.000%	64.000%
0.2500	30.000%	60.000%
0.1250	22.000%	53.000%
0.0630	3.000%	44.000%
0.0160	2.000%	30.000%
0.0040	1.000%	17.000%
0.0030	0.000%	0.000%

SEDCAD 4 for Windows

Copyright 1998 Pamela J. Schwab
Civil Software Design

4

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	In	3.100	3.100	3.80	0.45	4.0	14,947	8.10	4.34
	Out			1.43	0.45	0.8	2,409	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
2.0000	100.000%	100.000%
1.0000	91.494%	100.000%
0.5000	78.075%	100.000%
0.2500	73.195%	100.000%
0.1250	64.656%	100.000%
0.0630	53.677%	100.000%
0.0160	36.598%	100.000%
0.0040	20.739%	100.000%
0.0030	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

Pond Inputs:

Initial Pool Elev:	7,451.30
Initial Pool:	0.10 ac-ft
*Sediment Storage:	0.01 ac-ft
Dead Space:	20.00 %

**Sediment capacity based on Average Annual R of 50.0 for 3 year(s)*

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Number of Holes per Elev
12.00	3.17	12.00	100.00	2.00	0.0240	7,453.60	8

Pond Results:

Peak Elevation:	7,452.30
H'graph Detention Time:	0.77 hrs
Pond Model:	CSTRS
Dewater Time:	0.55 days
Trap Efficiency:	80.71 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,450.12	0.073	0.000	0.000	Top of Sed. Storage
7,450.20	0.074	0.006	0.000	
7,450.30	0.077	0.014	0.000	
7,450.40	0.079	0.022	0.000	
7,450.50	0.081	0.030	0.000	
7,450.60	0.084	0.038	0.000	
7,450.70	0.086	0.046	0.000	
7,450.80	0.088	0.055	0.000	
7,450.90	0.091	0.064	0.000	
7,451.00	0.093	0.073	0.000	
7,451.10	0.096	0.083	0.000	
7,451.20	0.098	0.092	0.000	
7,451.30	0.101	0.102	0.000	Low hole SPW #1

SEDCAD 4 for Windows

Copyright 1998 Pamela J. Schwab
Civil Software Design

7

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,451.40	0.104	0.113	0.266	9.40
7,451.50	0.106	0.123	0.376	0.85
7,451.60	0.109	0.134	0.461	0.60
7,451.70	0.112	0.145	0.532	0.50
7,451.80	0.114	0.156	0.594	0.45
7,451.90	0.117	0.168	0.917	0.35
7,452.00	0.120	0.180	1.079	0.25
7,452.10	0.122	0.192	1.212	0.20
7,452.20	0.124	0.204	1.329	0.20
7,452.30	0.126	0.216	1.432	0.40 Peak Stage
7,452.30	0.126	0.216	1.435	
7,452.40	0.128	0.229	1.532	
7,452.50	0.130	0.242	1.890	
7,452.60	0.132	0.255	2.086	
7,452.70	0.134	0.268	2.252	
7,452.80	0.136	0.282	2.401	
7,452.90	0.138	0.296	2.539	
7,453.00	0.140	0.309	2.667	
7,453.10	0.142	0.324	3.055	
7,453.20	0.143	0.338	3.281	
7,453.30	0.145	0.352	3.475	
7,453.40	0.146	0.367	3.653	
7,453.50	0.148	0.381	3.818	
7,453.60	0.150	0.396	3.974	Spillway #1
7,453.70	0.151	0.411	4.122	
7,453.80	0.153	0.427	4.263	
7,453.90	0.155	0.442	4.399	
7,454.00	0.156	0.457	4.531	
7,454.10	0.158	0.473	4.658	
7,454.20	0.160	0.489	4.781	
7,454.30	0.161	0.505	4.901	
7,454.40	0.163	0.521	5.018	
7,454.50	0.165	0.538	5.131	
7,454.60	0.166	0.554	5.243	
7,454.70	0.168	0.571	5.351	
7,454.80	0.170	0.588	5.457	
7,454.90	0.171	0.605	5.561	
7,455.00	0.173	0.622	5.663	
7,455.10	0.175	0.640	5.764	
7,455.20	0.177	0.657	5.862	
7,455.30	0.179	0.675	5.958	

SEDCAD 4 for Windows

Copyright 1998 Pamela J. Schwab
Civil Software Design

8

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,455.40	0.180	0.693	6.054	
7,455.50	0.182	0.711	6.147	
7,455.60	0.184	0.729	6.239	
7,455.70	0.186	0.748	6.330	
7,455.80	0.188	0.766	6.419	
7,455.90	0.189	0.785	6.507	
7,456.00	0.191	0.804	6.594	
7,456.10	0.193	0.823	6.680	
7,456.20	0.195	0.843	6.765	
7,456.30	0.197	0.862	6.848	
7,456.40	0.199	0.882	6.931	
7,456.50	0.200	0.902	7.012	
7,456.60	0.202	0.922	7.093	
7,456.70	0.204	0.943	7.172	
7,456.80	0.206	0.963	7.251	
7,456.90	0.208	0.984	7.329	
7,457.00	0.210	1.005	7.406	
7,457.10	0.211	1.026	7.482	
7,457.20	0.212	1.047	7.558	
7,457.30	0.213	1.068	7.632	
7,457.40	0.214	1.089	7.706	
7,457.50	0.215	1.111	7.779	
7,457.60	0.216	1.133	7.852	
7,457.70	0.217	1.154	7.924	
7,457.80	0.218	1.176	7.995	
7,457.90	0.219	1.198	8.066	
7,458.00	0.220	1.220	8.136	
7,458.10	0.221	1.242	8.205	
7,458.20	0.222	1.264	8.274	
7,458.30	0.223	1.286	8.342	
7,458.40	0.224	1.308	8.410	
7,458.50	0.225	1.331	8.477	
7,458.60	0.226	1.353	8.543	
7,458.70	0.227	1.376	8.609	
7,458.80	0.228	1.399	8.675	
7,458.90	0.229	1.422	8.740	
7,459.00	0.230	1.445	8.804	

Detailed Discharge Table

SEDCAD 4 for Windows

Copyright 1998 Pamela J. Schwab
Civil Software Design

Elevation	Perf. Riser (cfs)	Combined Total Discharge (cfs)
7,450.12	0.000	0.000
7,450.20	0.000	0.000
7,450.30	0.000	0.000
7,450.40	0.000	0.000
7,450.50	0.000	0.000
7,450.60	0.000	0.000
7,450.70	0.000	0.000
7,450.80	0.000	0.000
7,450.90	0.000	0.000
7,451.00	0.000	0.000
7,451.10	0.000	0.000
7,451.20	0.000	0.000
7,451.30	2.00>0.000	0.000
7,451.40	0.266	0.266
7,451.50	0.376	0.376
7,451.60	0.461	0.461
7,451.70	0.532	0.532
7,451.80	2.00>0.594	0.594
7,451.90	0.917	0.917
7,452.00	1.079	1.079
7,452.10	1.212	1.212
7,452.20	1.329	1.329
7,452.30	1.435	1.435
7,452.40	2.00>1.532	1.532
7,452.50	1.890	1.890
7,452.60	2.086	2.086
7,452.70	2.252	2.252
7,452.80	2.401	2.401
7,452.90	2.539	2.539
7,453.00	2.00>2.667	2.667
7,453.10	3.055	3.055
7,453.20	3.281	3.281
7,453.30	3.475	3.475
7,453.40	3.653	3.653
7,453.50	3.818	3.818
7,453.60	3.974	3.974
7,453.70	4.122	4.122
7,453.80	4.263	4.263
7,453.90	4.399	4.399
7,454.00	4.531	4.531

SEDCAD 4 for Windows

Copyright 1998 Pamela J. Schwab
Civil Software Design

10

Elevation	Perf. Riser (cfs)	Combined Total Discharge (cfs)
7,454.10	4.658	4.658
7,454.20	4.781	4.781
7,454.30	4.901	4.901
7,454.40	5.018	5.018
7,454.50	5.131	5.131
7,454.60	5.243	5.243
7,454.70	5.351	5.351
7,454.80	5.457	5.457
7,454.90	5.561	5.561
7,455.00	5.663	5.663
7,455.10	5.764	5.764
7,455.20	5.862	5.862
7,455.30	5.958	5.958
7,455.40	6.054	6.054
7,455.50	6.147	6.147
7,455.60	6.239	6.239
7,455.70	6.330	6.330
7,455.80	6.419	6.419
7,455.90	6.507	6.507
7,456.00	6.594	6.594
7,456.10	6.680	6.680
7,456.20	6.765	6.765
7,456.30	6.848	6.848
7,456.40	6.931	6.931
7,456.50	7.012	7.012
7,456.60	7.093	7.093
7,456.70	7.172	7.172
7,456.80	7.251	7.251
7,456.90	7.329	7.329
7,457.00	7.406	7.406
7,457.10	7.482	7.482
7,457.20	7.558	7.558
7,457.30	7.632	7.632
7,457.40	7.706	7.706
7,457.50	7.779	7.779
7,457.60	7.852	7.852
7,457.70	7.924	7.924
7,457.80	7.995	7.995
7,457.90	8.066	8.066
7,458.00	8.136	8.136

SEDCAD 4 for Windows

Copyright 1998 Pamela J. Schwab
Civil Software Design

11

Elevation	Perf. Riser (cfs)	Combined Total Discharge (cfs)
7,458.10	8.205	8.205
7,458.20	8.274	8.274
7,458.30	8.342	8.342
7,458.40	8.410	8.410
7,458.50	8.477	8.477
7,458.60	8.543	8.543
7,458.70	8.609	8.609
7,458.80	8.675	8.675
7,458.90	8.740	8.740
7,459.00	8.804	8.804

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	3.100	0.138	0.000	0.000	88.000	M	3.80	0.447
Σ		3.100						3.80	0.447

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soll K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.240	450.00	2.00	0.3300	1.0000	2	4.0	14,947	8.10	4.34
Σ								4.0	14,947	8.10	4.34

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.40	12.00	500.00	1.540	0.090
		8. Large gullies, diversions, and low flowing streams	1.33	8.00	600.01	3.460	0.048
#1	1	Time of Concentration:					0.138

Pond 007

***10 Year - 24 Hour
As-Built Perforated Riser***

LW/GS

Greystone
5231 S. Quebec Street
Greenwood Village, CO 80111

Phone: 303-850-0930
Email: greystone@greystone-consultants.com

TR-45
2/2000

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	2.900 inches

Particle Size Distribution:

Size (mm)	Coal Pile	Loam
2.0000	100.000%	100.000%
1.0000	74.000%	75.000%
0.5000	47.000%	64.000%
0.2500	30.000%	60.000%
0.1250	22.000%	53.000%
0.0630	3.000%	44.000%
0.0160	2.000%	30.000%
0.0040	1.000%	17.000%
0.0030	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#3	16.400	16.400	15.24	1.71	49.8	54,658	30.83	13.88
#1 In	37.600	54.000	38.06	6.22	221.6	57,019	29.02	16.10
Out			2.95	5.54	26.4	8,638	0.01	0.00

Particle Size Distribution(s) at Each Structure

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
1.0000	83.261%
0.5000	71.050%
0.2500	66.609%
0.1250	58.838%
0.0630	48.847%
0.0160	33.305%
0.0040	18.873%
0.0030	0.000%

Structure #1:

Size (mm)	In	Out
2.0000	100.000%	100.000%
1.0000	95.201%	100.000%
0.5000	86.650%	100.000%
0.2500	83.081%	100.000%
0.1250	73.388%	100.000%
0.0630	60.926%	100.000%
0.0160	41.541%	100.000%
0.0040	23.540%	100.000%
0.0030	0.000%	0.000%

Structure Detail:

Structure #3 (Null)

Structure #1 (Pond)

Pond Inputs:

Initial Pool Elev:	7,372.20
Initial Pool:	1.25 ac-ft
*Sediment Storage:	0.46 ac-ft
Dead Space:	20.00 %

**Sediment capacity based on Average Annual R of 50.0 for 3 year(s)*

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Number of Holes per Elev
12.00	5.83	12.00	100.00	2.00	0.0240	7,375.50	4

Pond Results:

Peak Elevation:	7,375.49
H'graph Detention Time:	10.41 hrs
Pond Model:	CSTRS
Dewater Time:	3.01 days
Trap Efficiency:	88.10 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,370.65	0.733	0.000	0.000	Top of Sed. Storage
7,370.70	0.737	0.034	0.000	
7,370.80	0.747	0.108	0.000	
7,370.90	0.757	0.183	0.000	
7,371.00	0.767	0.259	0.000	
7,371.10	0.777	0.336	0.000	
7,371.20	0.787	0.415	0.000	
7,371.30	0.797	0.494	0.000	
7,371.40	0.807	0.574	0.000	
7,371.50	0.818	0.655	0.000	
7,371.60	0.828	0.737	0.000	

SEDCAD 4 for Windows

Copyright 1998 Pamela J. Schwab
Civil Software Design

7

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,371.70	0.838	0.821	0.000	
7,371.80	0.849	0.905	0.000	
7,371.90	0.859	0.990	0.000	
7,372.00	0.870	1.077	0.000	
7,372.10	0.874	1.164	0.000	
7,372.20	0.879	1.252	0.000	Low hole SPW #1
7,372.30	0.883	1.340	0.102	10.45*
7,372.40	0.887	1.428	0.144	7.46*
7,372.50	0.891	1.517	0.176	6.11*
7,372.60	0.896	1.607	0.203	5.32*
7,372.70	0.900	1.697	0.227	4.78*
7,372.80	0.904	1.787	0.351	3.10*
7,372.90	0.909	1.877	0.413	2.66*
7,373.00	0.913	1.968	0.464	2.50
7,373.10	0.918	2.060	0.509	2.30
7,373.20	0.922	2.152	0.549	2.10
7,373.30	0.926	2.244	0.688	1.80
7,373.40	0.931	2.337	0.765	1.55
7,373.50	0.935	2.431	0.831	1.40
7,373.60	0.940	2.524	0.889	1.35
7,373.70	0.944	2.619	0.943	1.25
7,373.80	0.949	2.713	1.095	1.10
7,373.90	0.953	2.808	1.185	1.00
7,374.00	0.957	2.904	1.262	0.95
7,374.10	0.962	3.000	1.333	0.90
7,374.20	0.966	3.096	1.398	0.85
7,374.30	0.971	3.193	1.561	0.80
7,374.40	0.975	3.290	1.662	0.75
7,374.50	0.980	3.388	1.750	0.70
7,374.60	0.986	3.487	1.831	0.65
7,374.70	0.992	3.586	1.907	0.65
7,374.80	0.999	3.685	2.080	0.65
7,374.90	1.005	3.785	2.190	1.05
7,375.00	1.011	3.886	2.288	1.20
7,375.10	1.018	3.987	2.379	1.10
7,375.20	1.024	4.090	2.464	1.05
7,375.30	1.030	4.192	2.646	1.15
7,375.40	1.037	4.295	2.766	1.30
7,375.49	1.043	4.390	2.955	2.30 Peak Stage
7,375.50	1.043	4.400	2.975	Spillway #1
7,375.60	1.050	4.504	3.116	

SEDCAD 4 for Windows

Copyright 1998 Pamela J. Schwab
Civil Software Design

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,375.70	1.056	4.610	3.242	
7,375.80	1.063	4.715	3.358	
7,375.90	1.069	4.822	3.468	
7,376.00	1.076	4.929	3.573	
7,376.10	1.082	5.037	3.673	
7,376.20	1.089	5.146	3.770	
7,376.30	1.095	5.255	3.862	
7,376.40	1.102	5.365	3.953	
7,376.50	1.108	5.475	4.041	
7,376.60	1.115	5.587	4.126	
7,376.70	1.122	5.698	4.209	
7,376.80	1.128	5.811	4.311	
7,376.90	1.135	5.924	4.474	
7,377.00	1.142	6.038	4.632	
7,377.10	1.148	6.152	4.784	
7,377.20	1.155	6.268	4.931	
7,377.30	1.162	6.383	5.073	
7,377.40	1.169	6.500	5.213	
7,377.50	1.176	6.617	5.348	
7,377.60	1.182	6.735	5.473	
7,377.70	1.189	6.854	5.501	
7,377.80	1.196	6.973	5.528	
7,377.90	1.203	7.093	5.555	
7,378.00	1.210	7.213	5.583	
7,378.10	1.217	7.335	5.610	
7,378.20	1.224	7.457	5.636	
7,378.30	1.231	7.579	5.663	
7,378.40	1.238	7.703	5.690	
7,378.50	1.245	7.827	5.716	
7,378.60	1.252	7.952	5.742	
7,378.70	1.259	8.078	5.769	
7,378.80	1.266	8.203	5.795	
7,378.90	1.273	8.330	5.821	
7,379.00	1.280	8.458	5.846	
7,379.10	1.288	8.587	5.872	
7,379.20	1.296	8.716	5.898	
7,379.30	1.304	8.846	5.943	
7,379.40	1.312	8.976	5.999	
7,379.50	1.320	9.108	6.054	

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation	Perf. Riser (cfs)	Combined Total Discharge (cfs)
7,370.65	0.000	0.000
7,370.70	0.000	0.000
7,370.80	0.000	0.000
7,370.90	0.000	0.000
7,371.00	0.000	0.000
7,371.10	0.000	0.000
7,371.20	0.000	0.000
7,371.30	0.000	0.000
7,371.40	0.000	0.000
7,371.50	0.000	0.000
7,371.60	0.000	0.000
7,371.70	0.000	0.000
7,371.80	0.000	0.000
7,371.90	0.000	0.000
7,372.00	0.000	0.000
7,372.10	0.000	0.000
7,372.20	1.75>0.000	0.000
7,372.30	0.102	0.102
7,372.40	0.144	0.144
7,372.50	0.176	0.176
7,372.60	0.203	0.203
7,372.70	1.75>0.227	0.227
7,372.80	0.351	0.351
7,372.90	0.413	0.413
7,373.00	0.464	0.464
7,373.10	0.509	0.509
7,373.20	1.75>0.549	0.549
7,373.30	0.688	0.688
7,373.40	0.765	0.765
7,373.50	0.831	0.831
7,373.60	0.889	0.889
7,373.70	1.75>0.943	0.943
7,373.80	1.095	1.095
7,373.90	1.185	1.185
7,374.00	1.262	1.262
7,374.10	1.333	1.333
7,374.20	1.75>1.398	1.398
7,374.30	1.561	1.561

SEDCAD 4 for Windows

Copyright 1998 Pamela J. Schwab
Civil Software Design

10

Elevation	Perf. Riser (cfs)	Combined Total Discharge (cfs)
7,374.40	1.662	1.662
7,374.50	1.750	1.750
7,374.60	1.831	1.831
7,374.70	1.75>1.907	1.907
7,374.80	2.080	2.080
7,374.90	2.190	2.190
7,375.00	2.288	2.288
7,375.10	2.379	2.379
7,375.20	1.75>2.464	2.464
7,375.30	2.646	2.646
7,375.40	1.75>2.766	2.766
7,375.50	2.975	2.975
7,375.60	3.116	3.116
7,375.70	3.242	3.242
7,375.80	3.358	3.358
7,375.90	3.468	3.468
7,376.00	3.573	3.573
7,376.10	3.673	3.673
7,376.20	3.770	3.770
7,376.30	3.862	3.862
7,376.40	3.953	3.953
7,376.50	4.041	4.041
7,376.60	4.126	4.126
7,376.70	4.209	4.209
7,376.80	4.311	4.311
7,376.90	4.474	4.474
7,377.00	4.632	4.632
7,377.10	4.784	4.784
7,377.20	4.931	4.931
7,377.30	5.073	5.073
7,377.40	5.213	5.213
7,377.50	5.348	5.348
7,377.60	5.473	5.473
7,377.70	5.501	5.501
7,377.80	5.528	5.528
7,377.90	5.555	5.555
7,378.00	5.583	5.583
7,378.10	5.610	5.610
7,378.20	5.636	5.636
7,378.30	5.663	5.663

SEDCAD 4 for Windows

Copyright 1998 Pamela J. Schwab
Civil Software Design

11

Elevation	Perf. Riser (cfs)	Combined Total Discharge (cfs)
7,378.40	5.690	5.690
7,378.50	5.716	5.716
7,378.60	5.742	5.742
7,378.70	5.769	5.769
7,378.80	5.795	5.795
7,378.90	5.821	5.821
7,379.00	5.846	5.846
7,379.10	5.872	5.872
7,379.20	5.898	5.898
7,379.30	5.943	5.943
7,379.40	5.999	5.999
7,379.50	6.054	6.054

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	2.500	0.007	0.000	0.000	75.000	M	2.55	0.187
	2	1.900	0.230	0.000	0.000	88.000	M	2.18	0.274
	3	5.400	0.178	0.000	0.000	75.000	M	3.38	0.403
	4	3.800	0.279	0.000	0.000	89.000	M	4.32	0.573
	5	2.800	0.025	0.000	0.000	80.000	M	3.62	0.274
Σ		16.400						15.24	1.711
#1	1	7.000	0.270	0.000	0.000	88.000	M	7.69	1.009
	2	21.000	0.617	0.000	0.000	80.000	M	11.11	2.057
	3	1.000	0.200	0.000	0.000	89.000	M	1.23	0.151
	4	3.800	0.430	0.000	0.000	89.000	M	3.81	0.573
	5	3.500	0.283	0.000	0.000	89.000	M	3.96	0.528
	6	1.300	0.450	0.000	0.000	89.000	M	1.28	0.196
Σ		54.000						38.06	6.225

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#3	1	0.200	135.00	22.00	0.3500	1.0000	2	20.0	152,754	89.56	44.37
	2	0.200	980.00	1.50	0.5000	1.0000	2	2.8	17,024	9.07	4.88
	3	0.200	1,200.00	3.50	0.3500	1.0000	2	6.9	30,216	15.80	8.08
	4	0.200	1,400.00	2.00	0.5000	1.0000	2	8.7	25,583	13.47	7.30
	5	0.200	245.00	7.00	0.4500	1.0000	2	11.3	58,103	34.07	17.56
Σ								49.8	54,658	30.83	13.88
#1	1	0.200	1,005.00	4.20	0.7000	1.0000	2	69.6	112,239	59.09	32.27
	2	0.200	1,455.00	3.90	0.7000	1.0000	2	78.6	60,633	27.68	15.82
	3	0.200	375.00	3.10	0.7000	1.0000	2	2.9	32,163	17.30	9.32
	4	0.200	1,280.00	2.00	0.6000	1.0000	2	9.5	27,577	14.01	7.68
	5	0.200	580.00	2.40	0.6000	1.0000	2	8.6	27,372	14.40	7.80
	6	0.200	1,250.00	1.90	0.6000	1.0000	2	2.7	22,808	11.52	6.35
Σ								221.6	57,019	29.02	16.10

Subwatershed Time of Concentration Details:



Doc Date: 12/11/2001

VOL. 3

S/E "EXHIBIT 19-

~~19~~ Postmining Drainage Calculations, 10/23/97 //

Exhibit 19
Postmining Drainage
Calculations

CERTIFICATION

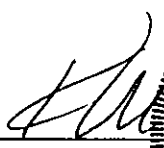
I certify that the designs for drainage through the reclaimed topography at New Elk were reviewed by me and found to reflect conservative, standard engineering practices. These designs were performed with the software SEDCAD+ and reflect non-erosive passage of the 100-year 24-hour storm of 4.2 inches through diversions which are armored with riprap in almost all cases.

Curve numbers were assigned to reflect conditions at initial reclamation in all areas except the Refuse Disposal Area (RDA), where the area would be reclaimed before the pond was removed and final drainage was installed. Undisturbed vegetation at the site is ponderosa pine-oak forest on the north facing slopes and an oak-juniper community on the south facing slopes. All natural, undisturbed soils have a D hydrologic classification. Disturbed areas adjacent to the river were originally loams with a B hydrologic classification. Curve numbers have been assigned a C classification reflecting limited topsoil replacement. It is assumed that the railroad embankment will stay in place, and that its coarse texture reflects an earthen material with an A hydrologic classification.

Table 19-1: Curve Numbers utilized in Post-Mining Topography Drainage Calculations

Description	Hydrologic Soil Classification	Vegetative Community	Curve Number
Undisturbed, North Facing Slopes	D	Ponderosa Pine- Oak, 80% Total Cover	72
Undisturbed, South Facing Slopes	D	Oak-Juniper, 50 % Total Cover	79
Railroad Embankment	A	Hard Surface Dirt Road	74
Newly Reclaimed Alluvium	C	Fallow	91
Reclaimed RDA	D	Dryland Pasture & Range, 60% Total Cover	83

The information contained herein is accurate to the best of my knowledge and belief.


Mike Kolm
Colorado P.E. 25662
Professional Engineer

COLORADO REGISTERED PROFESSIONAL ENGINEER
EARL M. KOLM
25662

Table 19-2: New Elk Post Mine Drainage					
Ditch	100-Year 24-Hour Discharge (cfs)	Slope (%)	Type ¹	Shape ^{2,3}	Depth (ft)
D1A	68	39	27" Riprap	6' Trap	0.43
D1B	68	3.9	12" Riprap	6' Trap	1.11
D2A	36.76	35	18" Riprap	6' Trap	0.38
D2B	36.76	5.2	9" Riprap	6' Trap	0.82
D3A	52.89	27	18" Riprap	6' Trap	0.61
D3B	52.89	5	9" Riprap	6' Trap	0.98
D3C	52.89	18	15" Riprap	6' Trap	0.76
D3D	52.89	5	9" Riprap	6' Trap	0.98
D4A	230.11	3	21" Riprap	6' Trap	1.75
D5	136.34	4.3	15" Riprap	6' Trap	1.49
D6	241.44	1.6	21" Riprap	6' Trap	1.77
D7	55.98	2.5	9" Riprap	6' Trap	1.01
D8	35.22	12.9	12" Riprap	6' Trap	0.70
D9	21.29	3.8	Earthen	8' Trap	0.75
D10	123.39	3.2	15" Riprap	6' Trap	1.44
D11	248.99	1.5	15" Riprap	12' Trap	1.60
D12A	94.43	12.5	12" Riprap	12' Trap	0.88
D12B	94.43	3	12" Riprap	6' Trap	1.29
D13	149.71	1.4	12" Riprap	10' Trap	1.29
D14A	47.65	19	12" Riprap	8' Trap	0.66
D14B	47.65	1.25	Earthen	6' Trap	1.39
D15	108.2	1.6	12" Riprap	8' Trap	1.24
D16A	98.66	18	21" Riprap	6' Trap	0.95
D16B	98.66	9.9	12" Riprap	8' Trap	1.07

¹ Riprap size refers to D_{50} ; see specific designs for D_{10} and D_{max} . Riprap thickness is $1.5 \cdot D_{50}$.

² Dimension is bottom width. See specific designs for top width.

³ Sideslopes are 3:1 (H:V)

Table 19-2: New Elk Post Mine Drainage					
Ditch	100-Year 24-Hour Discharge (cfs)	Slope (%)	Type ¹	Shape ^{2,3}	Depth (ft)
D17	133.27	5.7	15" Riprap	6' Trap	1.44
D18	38.34	4.11	9" Riprap	6' Trap	0.84
D19	58.63	2.3	9" Riprap	6' Trap	1.03
D20	106.8	6	15" Riprap	6' Trap	1.32
D21	56.05	6	9" Riprap	6' Trap	0.99
D22	37.48	3.5	9" Riprap	6' Trap	0.83
D23	175.75	3.7	18" Riprap	6' Trap	1.62
D30	113.04	4	12" Riprap	8' Trap	1.26
D31	15.01	18	9" Riprap	6' Trap	0.47
D32	235.4	9.6	18" Riprap	12' Trap	1.45
D33	8.54	4	Earthen	Tri	1.05
D34	16.89	9.6	6" Riprap	8' Trap	0.52
D35	22.59	6.8	6" Riprap	6' Trap	0.64
D35A	15.07	8.5	6" Riprap	6' Trap	0.54
D36	88.12	4.6	12" Riprap	6' Trap	1.25
D37	90.28	1.2	Earthen	8' Trap	1.67

¹ Riprap size refers to D_{50} ; see specific designs for D_{10} and D_{max} . Riprap thickness is $1.5 \cdot D_{50}$.

² Dimension is bottom width. See specific designs for top width.

³ Sideslopes are 3:1 (H:V)

[REDACTED] [REDACTED]

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST MINING TOPOGRAPHY, SE PORTION C20: D1 - D4

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\SEPOST10

Date: 10-14-1997

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\SEPOST10 User: CWB
 Date: 10-14-1997 Time: 15:32:58
 NEW ELK POST MINING TOPOGRAPHY, SE PORTION C20: D1 - D4
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====
 GENERAL INPUT TABLE
 =====

Detailed Between Structure Routing:

J	B	S	To #	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
2	1	1	1	1	8	570.05	1.35	3.49	0.05	0.045	0.336
3	1	1	1	1	8	600.05	1.25	3.35	0.05	0.049	0.331
4	1	1	1	1	8	140.03	2.00	4.24	0.01	0.009	0.356
4	1	2	1	1	8	440.14	2.50	4.74	0.03	0.025	0.368

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\SEPOST10 User: CWB
 Date: 10-14-1997 Time: 15:32:58
 NEW ELK POST MINING TOPOGRAPHY, SE PORTION C20: D1 - D4
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	6.77	72	M	0.111	0.124	0.353	0.0	0.42	5.66
111	2	12.13	91	M	0.114	0.000	0.000	0.0	2.00	23.06
111	3	1.15	74	S	0.101	0.000	0.000	0.0	0.08	1.08
		Type: Null	Label: UNDIS,RECLM,TRACK							
111	Structure	20.05						2.50		

111	Total IN/OUT	20.05						2.50		28.63
=====										
121	1	15.93	72	M	0.088	0.095	0.344	0.0	0.99	13.30
121	2	9.52	91	M	0.047	0.000	0.000	0.0	1.57	18.09
121	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Riprap Channel	Label: UNDIS,RECLAIM:D3							
121	Structure	25.45						2.56		

121	Total IN/OUT	25.45						2.56		29.31
=====										
211	1	3.79	91	M	0.090	0.000	0.000	0.0	0.62	7.20
211	2	0.57	74	S	0.054	0.000	0.000	0.0	0.04	0.53
211	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null	Label: RECLAIM,TRACK							
211	Structure	4.36						5.73		

211	Total IN/OUT	49.86						5.73		65.67
=====										
111 to 211 Routing					0.045	0.336				
=====										
221	1	16.45	72	M	0.073	0.071	0.342	0.0	1.03	13.74
221	2	3.50	91	F	0.070	0.000	0.000	0.0	0.58	6.65
221	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Riprap Channel	Label: UNDIST, RECLAIM: D2							
221	Structure	19.95						1.60		

221	Total IN/OUT	19.95						1.60		18.81
=====										
311	1	1.73	91	M	0.109	0.000	0.000	0.0	0.29	3.29
311	2	0.58	74	S	0.006	0.000	0.000	0.0	0.04	0.54
311	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
311	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null	Label: RECLAIM, TRACK							
311	Structure	2.31						7.66		

311 Total IN/OUT		72.12						7.66	88.32
211 to 311 Routing					0.049	0.331			
321	1	36.10	72	M	0.081	0.069	0.346	0.0	2.25
321	2	3.35	91	F	0.152	0.000	0.000	0.0	0.55
321	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00
321	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00
		Type: Riprap Channel				Label: UNDIST, RECLAIM: D1			
321 Structure		39.45							2.81
321 Total IN/OUT		39.45						2.81	33.01
411	1	0.00	74	F	0.005	0.000	0.000	0.0	0.00
		Type: Culvert				Label: C-20			
411 Structure		0.00							10.47
411 Total IN/OUT		111.57						10.47	121.33
311 to 411 Routing					0.009	0.356			
412	1	1.84	91	M	0.048	0.000	0.000	0.0	0.30
412	2	0.29	74	S	0.058	0.000	0.000	0.0	0.02
		Type: Riprap Channel				Label: D4:RECLAIM, TRACK			
412 Structure		2.13							10.79
412 Total IN/OUT		113.70						10.79	125.09
411 to 412 Routing					0.025	0.368			

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\SEPOST10 User: CWB
 Date: 10-14-1997 Time: 15:32:58
 NEW ELK POST MINING TOPOGRAPHY, SE PORTION C20: D1 - D4
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
=====												
1	1	1	1	-a	1	330.00	15.00	0.98	0.09			
				-b	7	800.00	37.00	12.24	0.02	0.111		

1	1	1	1	-1	5	445.60	16.00	4.00	0.03			
				-2	8	1394.25	1.90	4.14	0.09		0.124	0.353
=====												
1	1	1	2	-a	5	438.00	16.00	4.00	0.03			
				-b	8	1250.00	1.90	4.14	0.08	0.114		
=====												
1	1	1	3	-a	5	30.00	2.00	1.41	0.01			
				-b	5	12.00	50.00	7.07	0.00			
				-c	8	1200.00	1.35	3.49	0.10	0.101		
=====												
1	2	1	1	-a	1	198.48	35.27	1.50	0.04			
				-b	7	1570.58	28.65	10.78	0.05	0.088		

1	2	1	1	-1	5	1151.91	15.82	3.98	0.10		0.095	0.344
=====												
1	2	1	2	-a	5	309.14	42.05	6.48	0.01			
				-b	8	960.75	10.41	9.68	0.03	0.047		
=====												
2	1	1	1	-a	5	556.00	19.78	4.45	0.03			
				-b	8	703.00	1.35	3.49	0.06	0.090		
=====												
2	1	1	2	-a	5	30.00	2.00	1.41	0.01			
				-b	5	12.00	50.00	7.07	0.00			
				-c	8	600.00	1.35	3.49	0.05	0.054		
=====												
2	2	1	1	-a	1	265.24	52.78	1.84	0.04			
				-b	7	1391.00	32.33	11.45	0.03	0.073		

2	2	1	1	-1	5	248.70	36.00	6.00	0.01			
				-2	5	230.21	4.30	2.07	0.03			
				-3	5	100.50	10.00	3.16	0.01			
				-4	8	250.02	1.20	3.29	0.02		0.071	0.342
=====												
2	2	1	2	-a	5	220.00	36.00	6.00	0.01			
				-b	5	230.00	4.30	2.07	0.03			
				-c	5	100.00	10.00	3.16	0.01			
				-d	8	250.00	1.20	3.29	0.02	0.070		
=====												
3	1	1	1	-a	5	250.00	1.25	1.12	0.06			

				-b	8	570.00	1.25	3.35	0.05	0.109		
3	1	1	2	-a	5	30.00	2.00	1.41	0.01			
				-b	5	12.00	50.00	7.07	0.00	0.006		
3	2	1	1	-a	1	268.89	52.07	1.83	0.04			
				-b	7	1506.22	32.53	11.48	0.04	0.081		
3	2	1	1	-1	5	116.62	60.00	7.75	0.00			
				-2	8	800.06	1.25	3.35	0.07		0.069	0.346
3	2	1	2	-a	5	100.00	60.00	7.75	0.00			
				-b	5	600.00	1.25	1.12	0.15	0.152		
4	1	1	1	-a	8	85.00	2.00	4.24	0.01	0.005		
4	1	2	1	-a	5	300.00	3.00	1.73	0.05	0.048		
4	1	2	2	-a	7	30.00	2.00	2.85	0.00			
				-b	7	12.00	50.00	14.23	0.00			
				-c	5	220.00	3.00	1.73	0.04			
				-d	8	380.00	3.00	5.20	0.02	0.058		

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\SEPOST10 User: CWB
 Date: 10-14-1997 Time: 15:33:35
 NEW ELK POST MINING TOPOGRAPHY, SE PORTION C20: D1 - D4
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	6.77	72	M	0.111	0.124	0.353	0.0	0.90	11.77	
111	2	12.13	91	M	0.114	0.000	0.000	0.0	3.24	35.76	
111	3	1.15	74	S	0.101	0.000	0.000	0.0	0.17	2.15	
		Type: Null		Label: UNDIS, RECLM, TRACK							
111	Structure	20.05								4.32	
111 Total IN/OUT		20.05								4.32	48.07
121	1	15.93	72	M	0.088	0.095	0.344	0.0	2.13	27.69	
121	2	9.52	91	M	0.047	0.000	0.000	0.0	2.54	28.05	
121	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
		Type: Riprap Channel		Label: UNDIS, RECLAIM: D3							
121	Structure	25.45								4.67	
121 Total IN/OUT		25.45								4.67	52.89
211	1	3.79	91	M	0.090	0.000	0.000	0.0	1.01	11.17	
211	2	0.57	74	S	0.054	0.000	0.000	0.0	0.08	1.07	
211	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
		Type: Null		Label: RECLAIM, TRACK							
211	Structure	4.36								10.08	
211 Total IN/OUT		49.86								10.08	113.20
111 to 211 Routing					0.045	0.336					
221	1	16.45	72	M	0.073	0.071	0.342	0.0	2.20	28.58	
221	2	3.50	91	F	0.070	0.000	0.000	0.0	0.94	10.32	
221	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
		Type: Riprap Channel		Label: UNDIST, RECLAIM: D2							
221	Structure	19.95								3.13	
221 Total IN/OUT		19.95								3.13	36.76
311	1	1.73	91	M	0.109	0.000	0.000	0.0	0.46	5.11	
311	2	0.58	74	S	0.006	0.000	0.000	0.0	0.08	1.09	
311	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
311	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
		Type: Null		Label: RECLAIM, TRACK							
311	Structure	2.31								13.76	

311 Total IN/OUT		72.12						13.76	156.15
211 to 311 Routing					0.049	0.331			
321	1	36.10	72 M	0.081	0.069	0.346	0.0	4.82	62.73
321	2	3.35	91 F	0.152	0.000	0.000	0.0	0.90	9.82
321	3	0.00	0 M	0.000	0.000	0.000	0.0	0.00	0.00
321	4	0.00	0 M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Riprap Channel Label: UNDIST, RECLAIM: D1							
321 Structure		39.45						5.72	
321 Total IN/OUT		39.45						5.72	68.00
411	1	0.00	74 F	0.005	0.000	0.000	0.0	0.00	0.00
		Type: Culvert Label: C-20							
411 Structure		0.00						19.48	
411 Total IN/OUT		111.57						19.48	224.16
311 to 411 Routing					0.009	0.356			
412	1	1.84	91 M	0.048	0.000	0.000	0.0	0.49	5.41
412	2	0.29	74 S	0.058	0.000	0.000	0.0	0.04	0.54
		Type: Riprap Channel Label: D4:RECLAIM, TRACK							
412 Structure		2.13						20.01	
412 Total IN/OUT		113.70						20.01	230.11
411 to 412 Routing					0.025	0.368			

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST MINE TOPOGRAPHY: D1A

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	68.00 cfs	
Slope	39.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.13 ft	
with Freeboard	0.43 ft	
Top Width	6.79 ft	
with Freeboard	8.59 ft	
Velocity	80.83 fps	
Cross Sectional Area	0.84 sq ft	
Hydraulic Radius	0.12 ft	
Manning's n	0.045	
Froude Number	40.47	
Dmax	2.813 ft (33.75 in)	
D50	2.250 ft (27.00 in)	
D10	0.750 ft (9.00 in)	

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST MINE TOPOGRAPHY: D1B

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	68.00 cfs	
Slope	3.90 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.81 ft
with Freeboard	1.11 ft
Top Width	10.86 ft
with Freeboard	12.66 ft
Velocity	9.97 fps
Cross Sectional Area	6.82 sq ft
Hydraulic Radius	0.61 ft
Manning's n	0.038
Froude Number	2.22
Dmax	1.250 ft (15.00 in)
D50	1.000 ft (12.00 in)
D10	0.333 ft (4.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST MINE TOPOGRAPHY: D2A

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	36.76 cfs	
Slope	35.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.08 ft
with Freeboard	0.38 ft
Top Width	6.48 ft
with Freeboard	8.28 ft
Velocity	73.80 fps
Cross Sectional Area	0.50 sq ft
Hydraulic Radius	0.08 ft
Manning's n	0.042
Froude Number	46.90
Dmax	1.875 ft (22.50 in)
D50	1.500 ft (18.00 in)
D10	0.500 ft (6.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST MINE TOPOGRAPHY: D2B

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	36.76 cfs	
Slope	5.20 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.52 ft
with Freeboard	0.82 ft
Top Width	9.12 ft
with Freeboard	10.92 ft
Velocity	9.34 fps
Cross Sectional Area	3.94 sq ft
Hydraulic Radius	0.42 ft
Manning's n	0.035
Froude Number	2.50
Dmax	0.938 ft (11.25 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST MINE TOPOGRAPHY: D3A

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	52.89 cfs	
Slope	27.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.31 ft
with Freeboard	0.61 ft
Top Width	7.84 ft
with Freeboard	9.64 ft
Velocity	25.00 fps
Cross Sectional Area	2.12 sq ft
Hydraulic Radius	0.27 ft
Manning's n	0.042
Froude Number	8.48
Dmax	1.875 ft (22.50 in)
D50	1.500 ft (18.00 in)
D10	0.500 ft (6.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST MINE TOPOGRAPHY: D3B

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	52.89 cfs	
Slope	5.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.68 ft
with Freeboard	0.98 ft
Top Width	10.09 ft
with Freeboard	11.89 ft
Velocity	9.64 fps
Cross Sectional Area	5.49 sq ft
Hydraulic Radius	0.53 ft
Manning's n	0.037
Froude Number	2.30
Dmax	0.938 ft (11.25 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST MINE TOPOGRAPHY: D3C

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	52.89 cfs	
Slope	18.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.46 ft	
with Freeboard	0.76 ft	
Top Width	8.73 ft	
with Freeboard	10.53 ft	
Velocity	15.76 fps	
Cross Sectional Area	3.36 sq ft	
Hydraulic Radius	0.38 ft	
Manning's n	0.040	
Froude Number	4.48	
Dmax	1.563 ft (18.75 in)	
D50	1.250 ft (15.00 in)	
D10	0.417 ft (5.00 in)	

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST MINE TOPOGRAPHY: D3D

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	52.89 cfs	
Slope	5.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.68 ft
with Freeboard	0.98 ft
Top Width	10.09 ft
with Freeboard	11.89 ft
Velocity	9.64 fps
Cross Sectional Area	5.49 sq ft
Hydraulic Radius	0.53 ft
Manning's n	0.037
Froude Number	2.30
Dmax	0.938 ft (11.25 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\C5POST User: CWB
 Date: 10-14-1997 Time: 17:00:31
 NEW ELK POST MINING TOPOGRAPHY ABOVE C5: D5
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	155.81	38.51	1.57	0.03			
				-b	7	1872.52	26.70	10.40	0.06	0.091		
1	1	1	1	-1	8	1003.82	11.02	9.96	0.03		0.029	0.425
1	1	1	2	-a	1	293.81	54.46	1.87	0.05			
				-b	7	939.12	26.62	10.39	0.05			
				-c	8	1083.54	23.07	14.41	0.02	0.114		
1	1	1	2	-1	8	985.81	12.26	10.51	0.03		0.027	0.428
1	1	1	3	-a	1	200.00	37.65	1.55	0.04			
				-b	7	600.00	37.65	12.35	0.01	0.049		
1	1	1	4	-a	1	351.07	14.24	0.95	0.10			
				-b	7	1150.99	22.59	9.57	0.06			
				-c	7	442.19	15.83	8.01	0.02	0.184		
1	1	2	1	-a	5	30.00	2.00	1.41	0.01			
				-b	5	12.00	50.00	7.07	0.00			
				-c	8	400.00	1.20	3.29	0.03	0.040		
1	1	2	2	-a	5	325.81	6.14	2.48	0.04			
				-b	8	583.70	3.43	5.55	0.03	0.066		
1	2	1	1	-a	1	267.57	41.11	1.62	0.05			
				-b	7	458.99	30.50	11.12	0.01	0.059		
1	2	1	1	-1	5	792.99	5.00	2.24	0.10		0.098	0.284
1	2	1	2	-a	5	30.00	2.00	1.41	0.01			
				-b	5	12.00	50.00	7.07	0.00			
				-c	8	800.00	2.00	4.24	0.05	0.058		
1	2	1	3	-a	5	796.00	5.00	2.24	0.10	0.098		

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\C5POST User: CWB
 Date: 10-14-1997 Time: 17:00:47
 NEW ELK POST MINING TOPOGRAPHY ABOVE C5: D5
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	17.49	72	M	0.091	0.029	0.425	0.0	2.34	30.40
111	2	39.40	72	M	0.114	0.027	0.428	0.0	5.26	68.47
111	3	4.93	72	M	0.049	0.000	0.000	0.0	0.66	8.58
111	4	15.59	72	M	0.184	0.000	0.000	0.0	2.08	20.65
111	5	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
111	6	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
Type: Null					Label: UNDISTURBED					
111	Structure	77.42							10.33	

111	Total IN/OUT	77.42							10.33	125.90

112	1	0.73	74	S	0.040	0.000	0.000	0.0	0.11	1.37
112	2	3.08	91	M	0.066	0.000	0.000	0.0	0.82	9.07
112	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
112	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
Type: Riprap Channel					Label: TRACK & RECLAIMED					
112	Structure	3.81							11.26	

112	Total IN/OUT	81.23							11.26	136.34

111 to 112 Routing					0.012	0.405				

121	1	2.97	91	M	0.059	0.098	0.284	0.0	0.79	8.76
121	2	0.77	74	M	0.058	0.000	0.000	0.0	0.11	1.44
121	3	4.09	91	M	0.098	0.000	0.000	0.0	1.09	12.04
121	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
121	5	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
Type: Null					Label: UNDIS, TRACK, RECLM					
121	Structure	7.83							2.00	

121	Total IN/OUT	7.83							2.00	22.04
=====										

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST MINE TOPOGRAPHY: D4A

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	230.11 cfs	
Slope	3.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	1.45 ft	
with Freeboard	1.75 ft	
Top Width	14.67 ft	
with Freeboard	16.47 ft	
Velocity	15.40 fps	
Cross Sectional Area	14.94 sq ft	
Hydraulic Radius	0.99 ft	
Manning's n	0.043	
Froude Number	2.69	
Dmax	2.188 ft (26.25 in)	
D50	1.750 ft (21.00 in)	
D10	0.583 ft (7.00 in)	

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST MINING TOPOGRAPHY ABOVE C5: D5

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\C5POST

Date: 10-14-1997

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\C5POST User: CWB
 Date: 10-14-1997 Time: 17:00:31
 NEW ELK POST MINING TOPOGRAPHY ABOVE C5: D5
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	17.49	72	M	0.091	0.029	0.425	0.0	1.09	14.61
111	2	39.40	72	M	0.114	0.027	0.428	0.0	2.46	32.91
111	3	4.93	72	M	0.049	0.000	0.000	0.0	0.31	4.12
111	4	15.59	72	M	0.184	0.000	0.000	0.0	0.97	9.16
111	5	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
111	6	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
Type: Null					Label: UNDISTURBED					
111	Structure	77.42							4.83	
111	Total IN/OUT	77.42							4.83	59.26
112	1	0.73	74	S	0.040	0.000	0.000	0.0	0.05	0.68
112	2	3.08	91	M	0.066	0.000	0.000	0.0	0.51	5.85
112	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
112	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
Type: Riprap Channel					Label: TRACK & RECLAIMED					
112	Structure	3.81							5.39	
112	Total IN/OUT	81.23							5.39	65.80
111 to 112 Routing					0.012	0.405				
121	1	2.97	91	M	0.059	0.098	0.284	0.0	0.49	5.65
121	2	0.77	74	M	0.058	0.000	0.000	0.0	0.05	0.72
121	3	4.09	91	M	0.098	0.000	0.000	0.0	0.67	7.77
121	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
121	5	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
Type: Null					Label: UNDIS, TRACK, RECLM					
121	Structure	7.83							1.22	
121	Total IN/OUT	7.83							1.22	13.93

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\C5POST User: CWB
Date: 10-14-1997 Time: 17:00:47
NEW ELK POST MINING TOPOGRAPHY ABOVE C5: D5
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S2
TRACK & RECLAIMED

Drainage Area from J1, B1, S2, SWS(s)1-4: 3.8 acres
Total Contributing Drainage Area: 81.2 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
136.34	6.0	3.0:1	3.0:1	4.3	0.041

	Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
	1.19	11.95**	13.1	0.843	2.26
w/ Freeboard:	1.49		14.9		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

-----DMax-----	-----D50-----	-----D10-----
(ft) (in)	(ft) (in)	(ft) (in)
1.56 18.75	1.25 15.00	0.42 5.00

Runoff Volume (ac-ft)	Peak Discharge (cfs)
11.26	136.34

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST MINING TOPOGRAPHY, CENTRAL PORTION: C3: D6-D10

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D6D10

Date: 10-15-1997

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D6D10 User: CWB
 Date: 10-15-1997 Time: 14:15:42
 NEW ELK POST MINING TOPOGRAPHY, CENTRAL PORTION: C3: D6-D10
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====
 GENERAL INPUT TABLE
 =====

Detailed Between Structure Routing:

J	B	S	To #	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
2	1	1	1	1	8	523.10	1.91	4.15	0.04	0.035	0.354
3	1	1	1	1	8	850.27	2.50	4.74	0.05	0.049	0.368
4	1	1	1	1	8	80.02	2.00	4.24	0.01		
			2	2	8	200.03	1.60	3.79	0.01	0.019	0.348

211 to 311 Routing					0.049 0.368					
321	1	29.50	72	M	0.082	0.021	0.368	0.0	3.94	51.28
321	2	1.60	91	M	0.021	0.000	0.000	0.0	0.43	4.7
321	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
Type: Riprap Channel					Label: UNDIST & RECLAIM:D7					
321 Structure		31.10								4.37
321 Total IN/OUT		31.10								4.37 55.98
411	1	1.10	74	S	0.236	0.000	0.000	0.0	0.16	0.96
411	2	4.60	91	M	0.245	0.000	0.000	0.0	1.23	10.91
411	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
Type: Riprap Channel					Label: TRACKS & RECLAIM:D6					
411 Structure		5.70								28.65
411 Total IN/OUT		193.40								28.65 241.44
311 to 411 Routing					0.019 0.348					

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D6D10 User: CWB
 Date: 10-15-1997 Time: 14:15:42
 NEW ELK POST MINING TOPOGRAPHY, CENTRAL PORTION: C3: D6-D10
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	360.00	13.88	0.94	0.11			
				-b	7	2544.00	31.44	11.29	0.06	0.168		
1	1	1	1	-1	8	821.62	3.90	5.92	0.04		0.038	0.388
1	1	1	2	-a	5	1567.00	3.19	1.79	0.24	0.243		
1	2	1	1	-a	1	357.00	28.00	1.34	0.07			
				-b	7	706.00	46.50	13.73	0.01			
				-c	8	250.00	37.30	18.32	0.00	0.092		
1	2	1	1	-1	5	41.14	24.00	4.90	0.00			
				-2	8	175.13	3.80	5.85	0.01		0.010	0.384
1	2	1	2	-a	8	40.00	24.00	14.70	0.00			
				-b	8	175.00	3.80	5.85	0.01	0.009		
2	1	1	1	-a	5	8.00	1.90	1.38	0.00			
				-b	5	889.00	1.90	1.38	0.18	0.180		
2	2	1	1	-a	1	1512.92	6.61	0.65	0.69			
				-b	7	1614.15	37.17	12.27	0.04			
				-c	8	165.87	60.29	23.29	0.00	0.728		
2	2	1	1	-1	8	463.82	12.92	10.78	0.01		0.011	0.431
2	2	1	2	-a	8	460.00	12.92	10.78	0.01	0.011		
3	1	1	1	-a	1	165.00	56.00	1.89	0.02			
				-b	8	600.00	38.90	18.71	0.01	0.033		
3	1	1	1	-1	5	970.30	2.50	1.58	0.17		0.170	0.240
3	1	1	2	-a	5	970.00	2.50	1.58	0.17	0.170		
3	2	1	1	-a	1	174.37	57.35	1.92	0.03			
				-b	7	2083.58	31.20	11.24	0.06	0.082		
3	2	1	1	-1	8	375.12	2.50	4.74	0.02		0.021	0.368
3	2	1	2	-a	8	375.00	2.50	4.74	0.02	0.021		

4	1	1	1	-a	5	30.00	2.00	1.41	0.01	
				-b	5	12.00	50.00	7.07	0.00	
				-c	5	1000.00	1.60	1.26	0.22	
				-d	8	150.00	1.60	3.79	0.01	0.236

4	1	1	2	-a	5	1120.00	1.60	1.26	0.25	0.245

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D6D10 User: CWB
 Date: 10-15-1997 Time: 14:15:42
 NEW ELK POST MINING TOPOGRAPHY, CENTRAL PORTION: C3: D6-D10
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTP Civil Softwar
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D6D10 User: CWB
 Date: 10-15-1997 Time: 14:15:42
 NEW ELK POST MINING TOPOGRAPHY, CENTRAL PORTION: C3: D6-D10
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
 D10, UNDIST & RECLAM

Drainage Area from J1, B1, S1, SWS(s)1-3: 85.0 acres
 Total Contributing Drainage Area: 85.0 acres

MATERIAL: Rock Riprap
 Trapezoidal Riprap Channel
 Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
123.39	6.0	3.0:1	3.0:1	3.2	0.040

	Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
	1.14	11.52**	12.8	0.812	2.22
w/ Freeboard:	1.44		14.6		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----	----D50----	----D10----
(ft) (in)	(ft) (in)	(ft) (in)
1.56 18.75	1.25 15.00	0.42 5.00

Runoff Volume (ac-ft)	Peak Discharge (cfs)
=====	=====

IN/OUT 12.28 123.39

J1, B2, S1
D9, UNDIST & RECLAM

Drainage Area from J1, B2, S1, SWS(s)1-3: 11.8 acres
Total Contributing Drainage Area: 11.8 acres

MATERIAL: GRADED SILTS TO COBBLES COLLOIDAL
Trapezoidal Earthen Channel
Limiting Variable: Velocity = 5.500 fps
Sediment-laden Water

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
21.29	8.0	3.0:1	3.0:1	3.8	0.030

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.45	5.12	10.7	0.384	1.45
w/ Freeboard: 0.75		12.5		

Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT 1.66	21.29

J2, B2, S1
UNDIST & RECLAIM:D8

Drainage Area from J2, B2, S1, SWS(s)1-3: 49.7 acres
Total Contributing Drainage Area: 49.7 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
35.22	6.0	3.0:1	3.0:1	12.9	0.038

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.40	12.11**	8.4	0.340	3.63
w/ Freeboard: 0.70		10.2		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

-----DMax-----	-----D50-----	-----D10-----
(ft) (in)	(ft) (in)	(ft) (in)
=====	=====	=====
1.25 15.00	1.00 12.00	0.33 4.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
=====	=====	=====
IN/OUT	6.86	35.22

J3, B2, S1
UNDIST & RECLAIM:D7

Drainage Area from J3, B2, S1, SWS(s)1-3: 31.1 acres
Total Contributing Drainage Area: 31.1 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
=====	=====	=====	=====	=====	=====
55.98	6.0	3.0:1	3.0:1	2.5	0.037

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
=====	=====	=====	=====	=====
0.71	9.70**	10.3	0.550	2.28
w/ Freeboard:	1.01	12.1		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

-----DMax-----	-----D50-----	-----D10-----
(ft) (in)	(ft) (in)	(ft) (in)
=====	=====	=====
0.94 11.25	0.75 9.00	0.25 3.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
=====	=====	=====
IN/OUT	4.37	55.98

J4, B1, S1
TRACKS & RECLAIM:D6

Drainage Area from J4, B1, S1, SWS(s)1-3: 5.7 acres
Total Contributing Drainage Area: 193.4 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
241.44	6.0	3.0:1	3.0:1	1.6	0.043

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
1.47	15.81**	14.8	0.999	2.74
w/ Freeboard: 1.77		16.6		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----	----D50----	----D10----
(ft) (in)	(ft) (in)	(ft) (in)
2.19 26.25	1.75 21.00	0.58 7.00

Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT 28.65	241.44

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST MINING TOPOGRAPHY, WEST PORTAL, C27 - D11 THRU D16

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D11D16A

Date: 10-16-1997

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D11D16A User: CWB
Date: 10-16-1997 Time: 10:31:11
NEW ELK POST MINING TOPOGRAPHY, WEST PORTAL, C27 - D11 THRU D16
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
GENERAL INPUT TABLE
=====

Detailed Between Structure Routing:

J	B	S	To Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
2	1	1	1	8	876.61	1.60	3.79	0.06	0.064	0.345
3	1	1	1	8	700.05	1.43	3.59	0.05	0.054	0.339
4	1	1	1	8	40.01	2.00	4.24	0.00	0.002	0.356
4	1	2	1	8	521.06	1.49	3.66	0.04	0.039	0.341

NEW ELK POST MINING TOPOGRAPHY, WEST PORTAL, C27 - D11 THRU D16
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	2.54	91	M	0.125	0.000	0.000	0.0	0.68	7.48
111	2	0.64	72	S	0.006	0.037	0.389	0.0	0.09	1.11
111	3	0.00	0	S	0.000	0.000	0.000	0.0	0.00	0.00
111 Structure		Type: Null 3.18	Label: RECLAIM & TRACK						0.76	
111 Total IN/OUT		3.18							0.76	8.59
121	1	66.63	72	M	0.223	0.023	0.426	0.0	8.89	82.27
121	2	7.80	91	M	0.074	0.000	0.000	0.0	2.09	22.99
121	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
121 Structure		Type: Riprap Channel 74.43	Label: UNDIS, RECLAIM: D16A						10.98	
121 Total IN/OUT		74.43							10.98	98.66
211	1	0.67	74	S	0.006	0.122	0.258	0.0	0.10	1.25
211	2	3.44	91	M	0.137	0.000	0.000	0.0	0.92	9.01
211	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
211 Structure		Type: Riprap Channel 4.11	Label: D15: TRACK & RECLAIM						12.76	
211 Total IN/OUT		81.72							12.76	108.20
111 to 211 Routing						0.064	0.345			
311	1	19.28	72	M	0.093	0.032	0.409	0.0	2.57	33.51
311	2	4.80	91	F	0.080	0.000	0.000	0.0	1.28	14.14
311	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
311 Structure		Type: Riprap Channel 24.08	Label: UNDIST, RECLAIM: D14A						3.86	
311 Total IN/OUT		24.08							3.86	47.65
311	1	0.92	74	S	0.006	0.133	0.314	0.0	0.13	1.72
311	2	3.33	91	S	0.138	0.000	0.000	0.0	0.89	6.23
311	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
311	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
311 Structure		Type: Riprap Channel 4.25	Label: TRACK, RECLAIM - D13						17.64	

311 Total IN/OUT		110.05						17.64	149.71
211 to 311 Routing					0.054	0.339			
321	1	47.00	72	M	0.071	0.026	0.363	0.0	6.27
321	2	4.33	91	S	0.103	0.000	0.000	0.0	1.16
321	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00
321	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00
Type: Riprap Channel		Label: UNDIST, RECLAIM: D12A							
321 Structure		51.33						7.43	
321 Total IN/OUT		51.33						7.43	94.43
411	1	0.00	74	F	0.005	0.000	0.000	0.0	0.00
Type: Culvert		Label: C-27							
411 Structure		0.00						25.07	
411 Total IN/OUT		161.37						25.07	244.13
311 to 411 Routing					0.002	0.356			
412	1	1.45	91	S	0.034	0.000	0.000	0.0	0.39
412	2	0.31	74	S	0.058	0.000	0.000	0.0	0.05
Type: Riprap Channel		Label: D11:RCLAIM, TRACK							
412 Structure		1.76						25.51	
412 Total IN/OUT		163.13						25.51	248.99
411 to 412 Routing					0.039	0.341			

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D11D16A User: CWB
 Date: 10-16-1997 Time: 10:31:11
 NEW ELK POST MINING TOPOGRAPHY, WEST PORTAL, C27 - D11 THRU D16
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	597.89	3.35	1.83	0.11			
				-b	8	333.96	5.99	7.34	0.01	0.125		
1	1	1	2	-a	5	30.00	2.00	1.41	0.01			
				-b	5	12.00	50.00	7.07	0.00	0.006		
1	1	1	2	-1	8	800.64	4.00	6.00	0.04		0.037	0.389
1	2	1	1	-a	1	794.77	25.16	1.27	0.19			
				-b	7	965.72	41.42	12.96	0.02			
				-c	8	893.86	27.97	15.87	0.02	0.223		
1	2	1	1	-1	8	293.27	13.90	11.18	0.01			
				-2	8	537.36	9.40	9.20	0.02		0.023	0.426
1	2	1	2	-a	5	621.40	8.05	2.84	0.06			
				-b	8	450.40	8.87	8.93	0.01	0.074		
2	1	1	1	-a	5	30.00	2.00	1.41	0.01			
				-b	5	12.00	50.00	7.07	0.00	0.006		
2	1	1	1	-1	5	800.44	3.30	1.82	0.12		0.122	0.258
2	1	1	2	-a	5	900.00	3.30	1.82	0.14	0.137		
2	2	1	1	-a	1	319.63	31.29	1.42	0.06			
				-b	7	1301.00	33.83	11.71	0.03	0.093		
2	2	1	1	-1	8	328.92	15.57	11.84	0.01			
				-2	8	312.25	1.30	3.42	0.03		0.032	0.409
2	2	1	2	-a	5	243.82	16.41	4.05	0.02			
				-b	8	808.74	1.40	3.55	0.06	0.080		
3	1	1	1	-a	5	30.00	2.00	1.41	0.01			
				-b	5	12.00	50.00	7.07	0.00	0.006		
3	1	1	1	-1	5	214.93	4.66	2.16	0.03			
				-2	5	205.12	1.40	1.18	0.05			
				-3	8	736.83	1.40	3.55	0.06		0.133	0.314
3	1	1	2	-a	5	239.57	4.17	2.04	0.03			

					-b	5	192.08	1.40	1.18	0.05		
					-c	8	777.25	1.40	3.55	0.06	0.138	
3	2	1	1		-a	1	222.50	44.94	1.70	0.04		
					-b	7	527.03	56.92	15.19	0.01		
					-c	8	1250.00	21.00	13.75	0.03	0.071	
3	2	1	1		-l	8	435.00	2.30	4.55	0.03		0.026 0.363
3	2	1	2		-a	5	207.17	1.40	1.18	0.05		
					-b	8	746.10	1.60	3.79	0.05	0.103	
4	1	1	1		-a	8	85.00	2.00	4.24	0.01	0.005	
4	1	2	1		-a	8	148.95	6.71	7.77	0.01		
					-b	8	385.81	1.50	3.67	0.03	0.034	
4	1	2	2		-a	7	30.00	2.00	2.85	0.00		
					-b	7	12.00	50.00	14.23	0.00		
					-c	5	220.00	3.00	1.73	0.04		
					-d	8	380.00	3.00	5.20	0.02	0.058	

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D11D16A User: CWB
Date: 10-16-1997 Time: 10:31:11
NEW ELK POST MINING TOPOGRAPHY, WEST PORTAL, C27 - D11 THRU D16
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B2, S1
UNDIS, RECLAIM: D16A

Drainage Area from J1, B2, S1, SWS(s)1-3: 74.4 acres
Total Contributing Drainage Area: 74.4 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
98.66	6.0	3.0:1	3.0:1	18.0	0.043

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.65	19.06**	9.9	0.512	4.65
w/ Freeboard: 0.95		11.7		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----	----D50----	----D10----			
(ft)	(in)	(ft)	(in)	(ft)	(in)
2.19	26.25	1.75	21.00	0.58	7.00

Runoff Volume (ac-ft)	Peak Discharge (cfs)
10.98	98.66

J2, B1, S1
D15: TRACK & RECLAIM

Drainage Area from J2, B1, S1, SWS(s)1-3: 4.1 acres
Total Contributing Drainage Area: 81.7 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel

Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
108.20	8.0	3.0:1	3.0:1	1.6	0.039

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.94	10.70**	13.6	0.726	2.19
w/ Freeboard: 1.24		15.4		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----	----D50----	----D10----
(ft) (in)	(ft) (in)	(ft) (in)
1.25 15.00	1.00 12.00	0.33 4.00

Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT 12.76	108.20

J2, B2, S1
UNDIST, RECLAIM:D14A

Drainage Area from J2, B2, S1, SWS(s)1-3: 24.1 acres
Total Contributing Drainage Area: 24.1 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
47.65	8.0	3.0:1	3.0:1	19.0	0.039

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.36	14.40**	10.2	0.321	4.45
w/ Freeboard: 0.66		12.0		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----	----D50----	----D10----
(ft) (in)	(ft) (in)	(ft) (in)
1.25 15.00	1.00 12.00	0.33 4.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
=====		
IN/OUT	3.86	47.65

J3, B1, S1
TRACK, RECLAIM - D13

Drainage Area from J3, B1, S1, SWS(s)1-4: 4.2 acres
Total Contributing Drainage Area: 110.0 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
=====	=====	=====	=====	=====	=====
149.71	10.0	3.0:1	3.0:1	1.4	0.039

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
=====	=====	=====	=====	=====
0.99	11.71**	15.9	0.787	2.30
Freeboard: 1.29		17.7		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----	----D50----	----D10----
(ft) (in)	(ft) (in)	(ft) (in)
=====	=====	=====
1.25 15.00	1.00 12.00	0.33 4.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
=====		
IN/OUT	17.64	149.71

J3, B2, S1
UNDIST, RECLAIM: D12A

Drainage Area from J3, B2, S1, SWS(s)1-4: 51.3 acres
Total Contributing Drainage Area: 51.3 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
=====	=====	=====	=====	=====	=====

94.43 12.0 3.0:1 3.0:1 12.5 0.038

	Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
	0.58	11.84**	15.5	0.509	2.91
w/ Freeboard:	0.88		17.3		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

-----DMax-----	-----D50-----	-----D10-----
(ft) (in)	(ft) (in)	(ft) (in)
1.25 15.00	1.00 12.00	0.33 4.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	7.43	94.43

J4, B1, S1
C-27

Drainage Area from J4, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 161.4 acres

Entrance Loss Coefficient	Maximum Headwater (ft)	Pipe Length (ft)	Pipe Slope (%)	Manning's n	Tailwater (ft)
0.90	6.0	85.0	2.0	0.024	0.0

Minimum Pipe Diameter Required: 96.0 inches
(See Culvert Utility Program for full performance curves)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	25.07	244.13

J4, B1, S2
D11:RCLAIM, TRACK

Drainage Area from J4, B1, S2, SWS(s)1-2: 1.8 acres
Total Contributing Drainage Area: 163.1 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n

248.99	12.0	3.0:1	3.0:1	1.5	0.041

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
1.30	12.10**	19.8	1.019	2.09
w/ Freeboard: 1.60		21.6		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----	----D50----	----D10----
(ft) (in)	(ft) (in)	(ft) (in)
1.56 18.75	1.25 15.00	0.42 5.00

Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT 25.51	248.99

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST-MINE TOPOGRAPHY: D12B

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	94.43 cfs	
Slope	3.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.99 ft	
with Freeboard	1.29 ft	
Top Width	11.94 ft	
with Freeboard	13.74 ft	
Velocity	10.64 fps	
Cross Sectional Area	8.88 sq ft	
Hydraulic Radius	0.72 ft	
Manning's n	0.039	
Froude Number	2.17	
Dmax	1.250 ft	(15.00 in)
D50	1.000 ft	(12.00 in)
D10	0.333 ft	(4.00 in)

SEDCAD+ ERODIBLE CHANNEL DESIGN

NEW ELK POST MINE TOPOGRAPHY: D14B

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	47.65 cfs	
Slope	1.25 %	
Sideslopes	3.00:1 (L)	3.00:1 (R)
Bottom Width	6.00 ft	
Manning's n	0.030	
Max. Velocity	5.50 fps	
Material	GRADED SILTS - COBBLES COLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	47.65 cfs
Depth	1.09 ft
with Freeboard	1.39 ft
Top Width	12.54 ft
with Freeboard	14.34 ft
Velocity	4.72 fps
Cross Sectional Area	10.10 sq ft
Hydraulic Radius	0.78 ft
Froude Number	0.93

SEDCAD+ RIPRAP CHANNEL DESIGN

NEW ELK POST-MINE TOPOGRAPHY: D16B

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	98.66 cfs	
Slope	9.90 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	8.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.77 ft	
with Freeboard	1.07 ft	
Top Width	12.62 ft	
with Freeboard	14.42 ft	
Velocity	12.43 fps	
Cross Sectional Area	7.94 sq ft	
Hydraulic Radius	0.62 ft	
Manning's n	0.039	
Froude Number	2.76	
Dmax	1.250 ft (15.00 in)	
D50	1.000 ft (12.00 in)	
D10	0.333 ft (4.00 in)	

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST MINE TOPOGRAPHY, W OF W PORTAL:D17-D22

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D17

Date: 10-20-1997

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D17 User: CWB
 Date: 10-20-1997 Time: 12:17:26
 NEW ELK POST MINE TOPOGRAPHY, W OF W PORTAL:D17-D22
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====
 GENERAL INPUT TABLE
 =====

Detailed Between Structure Routing:

J	B	S	To #	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
1	1	2	1	1	5	701.14	5.70	2.39	0.08	0.081	0.292
1	1	3	1	1	8	84.02	2.00	4.24	0.01	0.005	0.356
2	1	1	1	1	8	300.21	3.70	5.77	0.01	0.014	0.386

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\NELK\DI7 User: CWB

Date: 10-20-1997 Time: 12:17:26

NEW ELK POST MINE TOPOGRAPHY, W OF W PORTAL:D17-D22

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	32.25	72	M	0.115	0.012	0.398	0.0	4.31	56.05
111	2	0.87	91	M	0.012	0.000	0.000	0.0	0.23	2.58
111	3	42.54	72	M	0.228	0.000	0.000	0.0	5.68	52.11
111	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
111	5	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null			Label: D21,D19(SWS1&2),D20					
111	Structure	75.67							10.22	

111	Total IN/OUT	75.67							10.22	106.80

112	1	34.25	72	M	0.292	0.030	0.398	0.0	4.57	38.34
112	2	2.19	91	M	0.026	0.000	0.000	0.0	0.59	6.46
112	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
112	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Riprap Channel			Label: UNDIS,RECLM:D18&D17					
112	Structure	36.44							15.38	

112	Total IN/OUT	112.11							15.38	133.27

111	to 112 Routing					0.081	0.292			

113	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Culvert			Label: CULVERT					
113	Structure	0.00							15.38	

113	Total IN/OUT	112.11							15.38	133.27

112	to 113 Routing					0.005	0.356			

121	1	9.66	72	M	0.107	0.074	0.383	0.0	1.29	16.79
121	2	7.46	91	M	0.074	0.000	0.000	0.0	2.00	21.99
121	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
121	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Riprap Channel			Label: UNDIST & RECLAIM:D22					
121	Structure	17.12							3.29	

121	Total IN/OUT	17.12							3.29	37.48

211	1	1.70	91	M	0.014	0.000	0.000	0.0	0.45	5.01
211	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00

Type: Riprap Channel Label: RECLAIM:D23

211 Structure	1.70	19.12	

211 Total IN/OUT	130.93	19.12	175.75
=====			
113 to 211 Routing	0.014 0.386		
=====			

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\NELK\D17 User: CWB

Date: 10-20-1997 Time: 12:17:26

NEW ELK POST MINE TOPOGRAPHY, W OF W PORTAL:D17-D22

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	242.00	41.36	1.63	0.04			
				-b	7	937.00	37.36	12.30	0.02			
				-c	8	1521.00	17.43	12.52	0.03			
				-d	8	462.00	5.00	6.71	0.02	0.115		
1	1	1	1	-1	8	300.37	5.00	6.71	0.01		0.012	0.398
1	1	1	2	-a	8	300.00	5.00	6.71	0.01	0.012		
1	1	1	3	-a	1	472.00	10.60	0.82	0.16			
				-b	7	2732.70	29.28	10.89	0.07	0.228		
1	1	2	1	-a	1	622.45	8.03	0.72	0.24			
				-b	7	1289.97	42.64	13.14	0.03			
				-c	8	1196.94	25.06	15.02	0.02	0.292		
1	1	2	1	-1	8	725.97	5.00	6.71	0.03		0.030	0.398
1	1	2	2	-a	8	628.53	5.00	6.71	0.03	0.026		
1	2	1	1	-a	1	281.81	17.74	1.07	0.07			
				-b	7	1114.77	26.91	10.44	0.03	0.107		
1	2	1	1	-1	8	1500.92	3.50	5.61	0.07		0.074	0.383
1	2	1	2	-a	8	1500.00	3.50	5.61	0.07	0.074		
2	1	1	1	-a	8	293.74	3.30	5.45	0.01	0.014		

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D17 User: CWB

Date: 10-20-1997 Time: 12:17:26

NEW ELK POST MINE TOPOGRAPHY, W OF W PORTAL:D17-D22

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S2
 UNDIS,RECLM:D18&D17

Drainage Area from J1, B1, S2, SWS(s)1-4: 36.4 acres
 Total Contributing Drainage Area: 112.1 acres

MATERIAL: Rock Riprap
 Trapezoidal Riprap Channel
 Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
133.27	6.0	3.0:1	3.0:1	5.7	0.041

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
1.14	12.35**	12.9	0.815	2.38
w/ Freeboard: 1.44		14.7		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----		----D50----		----D10----	
(ft)	(in)	(ft)	(in)	(ft)	(in)
1.56	18.75	1.25	15.00	0.42	5.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	15.38	133.27

J1, B1, S3
 CULVERT

Drainage Area from J1, B1, S3, SWS(s)1: 0.0 acres
 Total Contributing Drainage Area: 112.1 acres

Entrance Loss	Maximum	Pipe	Pipe	Manning's

Coefficient	Headwater (ft)	Length (ft)	Slope (%)	n	Tailwater (ft)
0.90	5.5	84.0	2.0	0.024	0.0

Minimum Pipe Diameter Required: 60.0 inches
(See Culvert Utility Program for full performance curves)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	15.38	133.27

J1, B2, S1
UNDIST & RECLAIM:D22

Drainage Area from J1, B2, S1, SWS(s)1-4: 17.1 acres
Total Contributing Drainage Area: 17.1 acres

MATERIAL: Rock Riprap
Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
37.48	6.0	3.0:1	3.0:1	3.5	0.035

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.53	9.29**	9.2	0.431	2.47
w/ Freeboard: 0.83		11.0		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----	----D50----	----D10----
(ft) (in)	(ft) (in)	(ft) (in)
0.94 11.25	0.75 9.00	0.25 3.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	3.29	37.48

J2, B1, S1
RECLAIM:D23

Drainage Area from J2, B1, S1, SWS(s)1-2: 1.7 acres
Total Contributing Drainage Area: 130.9 acres

MATERIAL: Rock Riprap

Trapezoidal Riprap Channel
Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
175.75	6.0	3.0:1	3.0:1	3.7	0.042

	Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
	1.32	13.37**	13.9	0.916	2.43
w/ Freeboard:	1.62		15.7		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

-----DMax----- (ft)	(in)	-----D50----- (ft)	(in)	-----D10----- (ft)	(in)
1.88	22.50	1.50	18.00	0.50	6.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	19.12	175.75

SEDCAD+ RIPRAP CHANNEL DESIGN

D18 NEW ELK POST MINE TOPOGRAPHY

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	38.34 cfs	
Slope	4.11 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.54 ft
with Freeboard	0.84 ft
Top Width	9.24 ft
with Freeboard	11.04 ft
Velocity	9.31 fps
Cross Sectional Area	4.12 sq ft
Hydraulic Radius	0.44 ft
Manning's n	0.035
Froude Number	2.46
Dmax	0.938 ft (11.25 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

D19 NEW ELK POST MINE TOPOGRAPHY

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	58.63 cfs	
Slope	2.30 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.73 ft
with Freeboard	1.03 ft
Top Width	10.40 ft
with Freeboard	12.20 ft
Velocity	9.76 fps
Cross Sectional Area	6.01 sq ft
Hydraulic Radius	0.56 ft
Manning's n	0.037
Froude Number	2.26
Dmax	0.938 ft (11.25 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

D20 NEW ELK POST MINE TOPOGRAPHY

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	106.80 cfs	
Slope	6.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	1.02 ft	
with Freeboard	1.32 ft	
Top Width	12.10 ft	
with Freeboard	13.90 ft	
Velocity	11.60 fps	
Cross Sectional Area	9.21 sq ft	
Hydraulic Radius	0.74 ft	
Manning's n	0.040	
Froude Number	2.34	
Dmax	1.563 ft (18.75 in)	
D50	1.250 ft (15.00 in)	
D10	0.417 ft (5.00 in)	

SEDCAD+ RIPRAP CHANNEL DESIGN

D21 NEW ELK POST MINE TOPOGRAPHY

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	56.05 cfs	
Slope	6.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	6.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.69 ft
with Freeboard	0.99 ft
Top Width	10.13 ft
with Freeboard	11.93 ft
Velocity	10.08 fps
Cross Sectional Area	5.56 sq ft
Hydraulic Radius	0.54 ft
Manning's n	0.037
Froude Number	2.40
Dmax	0.938 ft (11.25 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12, D30

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D30

Date: 10-16-1997

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D30 User: CWB
Date: 10-16-1997 Time: 16:04:12
NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12, D30
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
GENERAL INPUT TABLE
=====

Detailed Between Structure Routing:

To			Seg.	Land Flow	Distance	Slope	Velocity	Segment	Muskingum	
J	B	S	#	Condition				Time	K	X
					(ft)	(%)	(fps)	(hr)	(hr)	
1	1	2	1	8	50.01	2.00	4.24	0.00	0.003	0.356
1	1	3	1	8	500.44	4.20	6.15	0.02	0.022	0.391

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D30 User: CWB
 Date: 10-16-1997 Time: 16:04:12
 NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12, D30
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	60.74	79	M	0.273	0.000	0.000	0.0	10.77	94.93	
111	2	7.85	79	M	0.101	0.000	0.000	0.0	1.39	17.35	
		Type: Null Label: UNDIST. (E/W) PJ/D									
111	Structure	68.59							12.16		

111	Total IN/OUT	68.59							12.16	102.40	
=====											
112	1	0.10	79	M	0.000	0.000	0.000	0.0	0.02	0.22	
		Type: Culvert Label: CULVERT									
112	Structure	0.10							12.18		

112	Total IN/OUT	68.69							12.18	102.62	
=====											
111 to 112 Routing					0.003	0.356					
=====											
113	1	3.54	91	F	0.086	0.000	0.000	0.0	0.95	10.42	
113	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
		Type: Riprap Channel Label: RECLAIM, D30									
113	Structure	3.54							13.12		

113	Total IN/OUT	72.23							13.12	113.04	
=====											
112 to 113 Routing					0.022	0.391					
=====											
121	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
		Type: Null Label:									
121	Structure	0.00							0.00		

121	Total IN/OUT	0.00							0.00	0.00	
=====											

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D30 User: CWB

Date: 10-16-1997 Time: 16:04:12

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12, D30

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	507.73	9.85	0.79	0.18			
				-b	7	2844.36	21.09	9.25	0.10	0.273		
1	1	1	2	-a	1	277.00	36.00	1.52	0.05			
				-b	7	750.00	25.00	10.06	0.02			
				-c	8	1157.00	13.00	10.82	0.03	0.101		
1	1	3	1	-a	5	325.00	2.00	1.41	0.06			
				-b	8	480.00	4.00	6.00	0.02	0.086		

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D30 User: CWB
 Date: 10-16-1997 Time: 16:04:12
 NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12, D30
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S2
 CULVERT

Drainage Area from J1, B1, S2, SWS(s)1: 0.1 acres
 Total Contributing Drainage Area: 68.7 acres

Entrance Loss Coefficient	Maximum Headwater (ft)	Pipe Length (ft)	Pipe Slope (%)	Manning's n	Tailwater (ft)
0.90	4.5	50.0	2.0	0.024	0.0

Minimum Pipe Diameter Required: 66.0 inches
 (See Culvert Utility Program for full performance curves)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	12.18	102.62

J1, B1, S3
 RECLAIM, D30

Drainage Area from J1, B1, S3, SWS(s)1-2: 3.5 acres
 Total Contributing Drainage Area: 72.2 acres

MATERIAL: Rock Riprap
 Trapezoidal Riprap Channel
 Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
113.04	8.0	3.0:1	3.0:1	4.0	0.039

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.96	10.83**	13.8	0.742	2.19
w/ Freeboard: 1.26		15.6		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----		----D50----		----D10----	
(ft)	(in)	(ft)	(in)	(ft)	(in)
1.25	15.00	1.00	12.00	0.33	4.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	13.12	113.04

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW EL POST MINING TOPOGRAPHY, E PORTAL, N OF HWY 12, D31

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D31

Date: 10-16-1997

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D31 User: CWB
 Date: 10-16-1997 Time: 16:42:03
 NEW EL POST MINING TOPOGRAPHY, E PORTAL, N OF HWY 12, D31
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Detailed Between Structure Routing:

J	B	S	To #	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
1	1	2	1	1	8	270.74	7.40	8.16	0.01	0.009	0.413

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\NELK\D31 User: CWB

Date: 10-16-1997 Time: 16:42:03

NEW EL POST MINING TOPOGRAPHY, E PORTAL, N OF HWY 12, D31

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	4.50	79	M	0.092	0.000	0.000	0.0	0.80	9.94
111	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Culvert				Label: UNDIST (D-PJ)				
111	Structure	4.50							0.80	

111	Total IN/OUT	4.50							0.80	9.94
=====										
112	1	1.72	91	M	0.065	0.000	0.000	0.0	0.46	5.07
112	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Riprap Channel				Label: RECLAIM(C)				
112	Structure	1.72							1.26	

112	Total IN/OUT	6.22							1.26	15.01
=====										
111 to 112 Routing					0.009	0.413				
=====										

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D31 User: CWB

Date: 10-16-1997 Time: 16:42:03

NEW EL POST MINING TOPOGRAPHY, E PORTAL, N OF HWY 12, D31

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	190.16	26.29	1.30	0.04			
				-b	7	632.35	31.63	11.32	0.02			
				-c	8	625.52	2.70	4.93	0.04	0.092		
1	1	2	1	-a	5	400.00	3.50	1.87	0.06			
				-b	8	280.00	18.00	12.73	0.01	0.065		

=====

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D31 User: CWB
 Date: 10-16-1997 Time: 16:42:03
 NEW EL POST MINING TOPOGRAPHY, E PORTAL, N OF HWY 12, D31
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
 UNDIST (D-PJ)

Drainage Area from J1, B1, S1, SWS(s)1-2: 4.5 acres
 Total Contributing Drainage Area: 4.5 acres

Entrance Loss Coefficient	Maximum Headwater (ft)	Pipe Length (ft)	Pipe Slope (%)	Manning's n	Tailwater (ft)
0.90	2.0	50.0	2.0	0.024	0.0

Minimum Pipe Diameter Required: 24.0 inches
 (See Culvert Utility Program for full performance curves)

Runoff Volume (ac-ft)	Peak Discharge (cfs)
0.80	9.94

J1, B1, S2
 RECLAIM(C)

Drainage Area from J1, B1, S2, SWS(s)1-2: 1.7 acres
 Total Contributing Drainage Area: 6.2 acres

MATERIAL: Rock Riprap
 Trapezoidal Riprap Channel
 Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
15.01	6.0	3.0:1	3.0:1	18.0	0.037

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.17	13.21**	7.0	0.160	5.79
w/ Freeboard:	0.47	8.8		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

-----DMax-----		-----D50-----		-----D10-----	
(ft)	(in)	(ft)	(in)	(ft)	(in)
0.94	11.25	0.75	9.00	0.25	3.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	1.26	15.01

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST-MINE TOPOGRAPHY, D32 BELOW RECLAIMED RDA W/O NE008

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D32

Date: 10-20-1997

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D32 User: CWB
Date: 10-20-1997 Time: 17:08:32
NEW ELK POST-MINE TOPOGRAPHY, D32 BELOW RECLAIMED RDA W/O NE008
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Detailed Between Structure Routing:

J	B	S	To Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
2	1	2	1	8	80.02	2.00	4.24	0.01	0.005	0.356

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D32 User: CWB
 Date: 10-20-1997 Time: 17:08:32
 NEW ELK POST-MINE TOPOGRAPHY, D32 BELOW RECLAIMED RDA W/O NE008
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	14.40	83	M	0.086	0.038	0.446	0.0	2.95	35.63
111	2	31.43	83	M	0.101	0.006	0.434	0.0	6.44	77.76
111	3	0.54	91	M	0.006	0.000	0.000	0.0	0.14	1.59
		Type: Null		Label: W RDA(VEG), RECL PND						
111	Structure	46.37							9.54	
111 Total IN/OUT		46.37							9.54	114.97
121	1	8.53	83	M	0.128	0.038	0.445	0.0	1.75	17.88
121	2	38.21	83	M	0.104	0.009	0.434	0.0	7.84	94.54
121	3	0.50	91	F	0.025	0.000	0.000	0.0	0.14	1.49
		Type: Null		Label: E RDA(VEG), RECL PND						
121	Structure	47.24							9.72	
121 Total IN/OUT		47.24							9.72	112.76
131	1	2.42	72	M	0.046	0.000	0.000	0.0	0.32	4.21
131	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null		Label: UPSTREAM RD DRNG-UND						
131	Structure	2.42							0.32	
131 Total IN/OUT		2.42							0.32	4.21
211	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Culvert		Label: HIGHWAY CULVERT						
211	Structure	0.00							19.58	
211 Total IN/OUT		96.03							19.58	231.94
111 to 211 Routing					0.000	0.000				
212	1	1.40	83	M	0.049	0.000	0.000	0.0	0.29	3.46
212	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Riprap Channel		Label: RECLAIM S OF RD						
212	Structure	1.40							19.87	
212 Total IN/OUT		97.43							19.87	235.40
211 to 212 Routing					0.005	0.356				

311	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
		Type: Null Label:									
311	Structure	0.00							19.87		

311	Total IN/OUT	97.43							19.87	235.4	
=====											
212	to 311 Routing					0.000	0.000				
=====											

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D32 User: CWB
 Date: 10-20-1997 Time: 17:08:32
 NEW ELK POST-MINE TOPOGRAPHY, D32 BELOW RECLAIMED RDA W/O NE008
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	3	394.00	25.36	3.53	0.03			
				-b	8	1344.00	5.00	6.71	0.06	0.086		
1	1	1	1	-1	8	2009.00	22.50	14.23	0.04		0.038	0.446
1	1	1	2	-a	3	179.00	28.00	3.70	0.01			
				-b	8	1223.00	5.00	6.71	0.05			
				-c	8	1778.00	19.23	13.16	0.04	0.101		
1	1	1	2	-1	8	275.01	14.00	11.22	0.01		0.006	0.434
			3	-a	8	275.00	14.00	11.22	0.01	0.006		
1	2	1	1	-a	1	440.00	26.14	1.29	0.09			
				-b	8	820.00	5.00	6.71	0.03	0.128		
1	2	1	1	-1	8	2008.25	21.84	14.02	0.04		0.038	0.445
1	2	1	2	-a	1	152.00	32.85	1.45	0.03			
				-b	8	800.00	5.00	6.71	0.03			
				-c	8	2114.00	21.28	13.84	0.04	0.104		
1	2	1	2	-1	8	383.71	14.00	11.22	0.01		0.009	0.434
1	2	1	3	-a	5	350.00	14.00	3.74	0.03	0.025		
1	3	1	1	-a	1	122.38	40.86	1.62	0.02			
				-b	7	400.38	37.73	12.36	0.01			
				-c	8	350.38	4.00	6.00	0.02	0.046		
2	1	2	1	-a	5	335.04	3.50	1.87	0.05	0.049		

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D32 User: CWB
 Date: 10-20-1997 Time: 17:08:32
 NEW ELK POST-MINE TOPOGRAPHY, D32 BELOW RECLAIMED RDA W/O NE008
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J2, B1, S1
 HIGHWAY CULVERT

Drainage Area from J2, B1, S1, SWS(s)1: 0.0 acres
 Total Contributing Drainage Area: 96.0 acres

Entrance Loss Coefficient	Maximum Headwater (ft)	Pipe Length (ft)	Pipe Slope (%)	Manning's n	Tailwater (ft)
0.90	6.5	80.0	2.0	0.024	0.0

Minimum Pipe Diameter Required: 84.0 inches
 (See Culvert Utility Program for full performance curves)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	19.58	231.94

J2, B1, S2
 RECLAIM S OF RD

Drainage Area from J2, B1, S2, SWS(s)1-2: 1.4 acres
 Total Contributing Drainage Area: 97.4 acres

MATERIAL: Rock Riprap
 Trapezoidal Riprap Channel
 Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
235.40	12.0	3.0:1	3.0:1	9.6	0.041

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
1.15	13.23**	18.9	0.923	2.40
w/ Freeboard: 1.45		20.7		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----		----D50----		----D10----	
(ft)	(in)	(ft)	(in)	(ft)	(in)
1.88	22.50	1.50	18.00	0.50	6.00

Runoff Volume (ac-ft)	Peak Discharge (cfs)

IN/OUT	19.87	235.40

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D33

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D33

Date: 10-17-1997

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D33 User: CWB
Date: 10-17-1997 Time: 09:24:59
NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D33
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
GENERAL INPUT TABLE
=====

Detailed Between Structure Routing:

J	B	S	To Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
1	1	2	1	8	60.01	2.00	4.24	0.00		
			2	8	320.26	4.00	6.00	0.01	0.018	0.385

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\NELK\D33 User: CWB

Date: 10-17-1997 Time: 09:24:59

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D33

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	2.40	79	M	0.062	0.000	0.000	0.0	0.43	5.30
111	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Culvert				Label: PJ, D SOILS, UNDIST				
111	Structure	2.40							0.43	
111 Total IN/OUT		2.40							0.43	5.30
112	1	1.10	91	M	0.033	0.000	0.000	0.0	0.29	3.25
112	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Earthen Channel				Label: B SOILS, RECLAIM				
112	Structure	1.10							0.72	
112 Total IN/OUT		3.50							0.72	8.54
111 to 112 Routing						0.018	0.385			

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D33 User: CWB

Date: 10-17-1997 Time: 09:24:59

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D33

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	209.00	48.00	1.75	0.03			
				-b	7	270.00	49.00	14.09	0.01			
				-c	8	350.00	1.80	4.02	0.02	0.062		
1	1	2	1	-a	5	150.00	4.00	2.00	0.02			
				-b	8	270.00	4.00	6.00	0.01	0.033		

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D33 User: CWB
 Date: 10-17-1997 Time: 09:24:59
 NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D33
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
 PJ, D SOILS, UNDIST

Drainage Area from J1, B1, S1, SWS(s)1-2: 2.4 acres
 Total Contributing Drainage Area: 2.4 acres

Entrance Loss Coefficient	Maximum Headwater (ft)	Pipe Length (ft)	Pipe Slope (%)	Manning's n	Tailwater (ft)
0.90	2.0	60.0	2.0	0.024	0.0

Minimum Pipe Diameter Required: 15.0 inches
 (See Culvert Utility Program for full performance curves)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	0.43	5.30

 D 33

J1, B1, S2
 B SOILS, RECLAIM

Drainage Area from J1, B1, S2, SWS(s)1-2: 1.1 acres
 Total Contributing Drainage Area: 3.5 acres

MATERIAL: GRADED SILTS TO COBBLES COLLOIDAL
 Triangular Earthen Channel
 Limiting Variable: Velocity = 5.500 fps
 Sediment-laden Water

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
8.54		3.0:1	3.0:1	4.0	0.030

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.75	5.01	4.5	0.358	1.44
1.05		6.3		

w/ Freeboard:

Runoff Volume (ac-ft)	Peak Discharge (cfs)

=====	=====
IN/OUT	0.72
	8.54

*****:*****

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D34

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D34

Date: 10-17-1997

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D34 User: CWB
 Date: 10-17-1997 Time: 09:32:51
 NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D34
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====
 GENERAL INPUT TABLE
 =====

Detailed Between Structure Routing:

To			Seg.	Land Flow	Distance	Slope	Velocity	Segment	Muskingum	
J	B	S	#	Condition				Time	K	X
					(ft)	(%)	(fps)	(hr)	(hr)	
1	1	2	1	8	60.01	2.00	4.24	0.00		
			2	8	301.38	9.60	9.30	0.01	0.012	0.416

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D34 User: CWB
 Date: 10-17-1997 Time: 09:32:51
 NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D34
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	6.18	79	M	0.076	0.000	0.000	0.0	1.09	13.64
111	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Culvert				Label: PJ, D SOILS, UNDIST				
111	Structure	6.18							1.09	

111	Total IN/OUT	6.18							1.09	13.64
=====										
112	1	1.10	91	M	0.031	0.000	0.000	0.0	0.29	3.25
112	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Riprap Channel				Label: B SOILS, RECLAIM				
112	Structure	1.10							1.39	

112	Total IN/OUT	7.28							1.39	16.89
=====										
111 to 112 Routing					0.012	0.416				
=====										

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D34 User: CWB

Date: 10-17-1997 Time: 09:32:51

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D34

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	200.00	75.00	2.19	0.03			
				-b	7	550.00	75.00	17.43	0.01			
				-c	8	500.00	1.20	3.29	0.04	0.076		
1	1	2	1	-a	5	220.00	9.60	3.10	0.02			
				-b	7	270.00	9.60	6.24	0.01	0.031		

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D34 User: CWB

Date: 10-17-1997 Time: 09:32:51

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D34
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
 PJ, D SOILS, UNDIST

Drainage Area from J1, B1, S1, SWS(s)1-2: 6.2 acres
 Total Contributing Drainage Area: 6.2 acres

Entrance Loss Coefficient	Maximum Headwater (ft)	Pipe Length (ft)	Pipe Slope (%)	Manning's n	Tailwater (ft)
0.90	2.5	60.0	2.5	0.024	0.0

Minimum Pipe Diameter Required: 24.0 inches
 (See Culvert Utility Program for full performance curves)

Runoff Volume (ac-ft)	Peak Discharge (cfs)
1.09	13.64

=====

IN/OUT 1.09 13.64

D 34

J1, B1, S2
 B SOILS, RECLAIM

Drainage Area from J1, B1, S2, SWS(s)1-2: 1.1 acres
 Total Contributing Drainage Area: 7.3 acres

MATERIAL: Rock Riprap
 Trapezoidal Riprap Channel
 Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
16.89	8.0	3.0:1	3.0:1	9.6	0.033

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.22	8.76**	9.3	0.205	3.40
w/ Freeboard: 0.52		11.1		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----		----D50----		----D10----	
(ft)	(in)	(ft)	(in)	(ft)	(in)
0.63	7.50	0.50	6.00	0.17	2.00

Runoff Volume (ac-ft)	Peak Discharge (cfs)

IN/OUT	1.39	16.89

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D35

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

File Name: C:\SEDCAD3\NELK\D35

Date: 10-17-1997

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D35 User: CWB
 Date: 10-17-1997 Time: 10:20:02
 NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D35
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Detailed Between Structure Routing:

J	B	S	To #	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
1	1	2	1	1	8	60.01	2.00	4.24	0.00		
			2	2	8	400.26	3.64	5.72	0.02	0.023	0.382

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D35 User: CWB
 Date: 10-17-1997 Time: 10:20:02
 NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D35
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	11.25	79	M	0.165	0.000	0.000	0.0	1.99	20.57
111	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Culvert Label: PJ, D SOILS, UNDIST								
111	Structure	11.25							1.99	

111	Total IN/OUT	11.25							1.99	20.57
=====										
112	1	1.25	91	M	0.050	0.000	0.000	0.0	0.33	3.69
112	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Riprap Channel Label: B SOILS, RECLAIM								
112	Structure	1.25							2.33	

112	Total IN/OUT	12.50							2.33	22.59
=====										
111 to 112 Routing					0.023		0.382			
=====										

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS

Filename: C:\SEDCAD3\NELK\D35 User: CWB

Date: 10-17-1997 Time: 10:20:02

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D35

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	509.80	19.62	1.12	0.14			
				-b	7	798.27	43.84	13.33	0.02			
				-c	8	249.92	3.60	5.69	0.01	0.165		
1	1	2	1	-a	5	440.00	5.90	2.43	0.05	0.050		

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D35 User: CWB
 Date: 10-17-1997 Time: 10:20:02
 NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D35
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
 PJ, D SOILS, UNDIST

Drainage Area from J1, B1, S1, SWS(s)1-2: 11.2 acres
 Total Contributing Drainage Area: 11.2 acres

Entrance Loss Coefficient	Maximum Headwater (ft)	Pipe Length (ft)	Pipe Slope (%)	Manning's n	Tailwater (ft)
0.90	3.2	60.0	2.5	0.024	0.0

Minimum Pipe Diameter Required: 24.0 inches
 (See Culvert Utility Program for full performance curves)

Runoff Volume (ac-ft)	Peak Discharge (cfs)
1.99	20.57

J1, B1, S2
 B SOILS, RECLAIM

Drainage Area from J1, B1, S2, SWS(s)1-2: 1.3 acres
 Total Contributing Drainage Area: 12.5 acres

MATERIAL: Rock Riprap
 Trapezoidal Riprap Channel
 Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
22.59	6.0	3.0:1	3.0:1	6.8	0.034

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.34	9.31**	8.1	0.297	2.99
w/ Freeboard: 0.64		9.9		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----		----D50----		----D10----	
(ft)	(in)	(ft)	(in)	(ft)	(in)
0.63	7.50	0.50	6.00	0.17	2.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	2.33	22.59

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D35A

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D35A

Date: 10-17-1997

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D35A User: CWB
Date: 10-17-1997 Time: 10:28:18
NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D35A
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Detailed Between Structure Routing:

J	B	S	To Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
1	1	2	1	8	60.01	2.00	4.24	0.00		
			2	8	301.08	8.50	8.75	0.01	0.013	0.412

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D35A User: CWB
 Date: 10-17-1997 Time: 10:28:18
 NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D35A
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	5.20	79	M	0.087	0.000	0.000	0.0	0.92	11.49
111	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Culvert Label: PJ, D SOILS, UNDIST								
111	Structure	5.20							0.92	

111	Total IN/OUT	5.20							0.92	11.49
=====										
112	1	1.22	91	M	0.055	0.000	0.000	0.0	0.33	3.58
112	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Riprap Channel Label: B SOILS, RECLAIM								
112	Structure	1.22							1.25	

112	Total IN/OUT	6.41							1.25	15.07
=====										
111 to 112 Routing					0.013	0.412				
=====										

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D35A User: CWB

Date: 10-17-1997 Time: 10:28:18

NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D35A

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	246.84	40.51	1.61	0.04			
				-b	7	605.04	41.32	12.94	0.01			
				-c	8	616.16	3.60	5.69	0.03	0.087		
1	1	2	1	-a	5	330.00	3.03	1.74	0.05			
				-b	5	50.00	20.00	4.47	0.00	0.055		

=====

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D35A User: CWB
 Date: 10-17-1997 Time: 10:28:18
 NEW ELK POST-MINING TOPOGRAPHY, E PORTAL, N OF HWY 12 D35A
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
 PJ, D SOILS, UNDIST

Drainage Area from J1, B1, S1, SWS(s)1-2: 5.2 acres
 Total Contributing Drainage Area: 5.2 acres

Entrance Loss Coefficient	Maximum Headwater (ft)	Pipe Length (ft)	Pipe Slope (%)	Manning's n	Tailwater (ft)
0.90	2.0	60.0	2.0	0.024	0.0

Minimum Pipe Diameter Required: 24.0 inches
 (See Culvert Utility Program for full performance curves)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	0.92	11.49

J1, B1, S2
 B SOILS, RECLAIM

Drainage Area from J1, B1, S2, SWS(s)1-2: 1.2 acres
 Total Contributing Drainage Area: 6.4 acres

MATERIAL: Rock Riprap
 Trapezoidal Riprap Channel
 Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
15.07	6.0	3.0:1	3.0:1	8.5	0.033

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
0.24	9.29**	7.4	0.216	3.51
0.54		9.2		

w/ Freeboard:

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----		----D50----		----D10----	
(ft)	(in)	(ft)	(in)	(ft)	(in)
0.63	7.50	0.50	6.00	0.17	2.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	1.25	15.07

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK DEV. WASTE PILE, D10, 100-YR DITCH, E SIDE, B SOILS (D36-POST)

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D36

Date: 10-17-1997

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D36 User: CWB
Date: 10-17-1997 Time: 10:53:21
NEW ELK DEV. WASTE PILE, D10, 100-YR DITCH, E SIDE, B SOILS (D36-POST)
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
GENERAL INPUT TABLE
=====

Detailed Between Structure Routing:

J	B	S	To Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
1	1	2	1	8	257.27	4.60	6.43	0.01	0.011	0.395

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D36 User: CWB
 Date: 10-17-1997 Time: 10:53:21
 NEW ELK DEV. WASTE PILE, D10, 100-YR DITCH, E SIDE, B SOILS (D36-POST)
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.92	79	S	0.172	0.003	0.269	0.0	0.16	1.15
111	2	0.34	82	M	0.168	0.000	0.000	0.0	0.07	0.69
111	3	70.35	79	S	0.181	0.000	0.000	0.0	12.47	86.17
		Type: Null		Label: FENCELINE,RD, UPLAND						
111	Structure	71.61							12.70	
111 Total IN/OUT		71.61							12.70	88.00
112	1	0.10	79	M	0.011	0.000	0.000	0.0	0.02	0.22
112	2	0.15	82	F	0.018	0.000	0.000	0.0	0.03	0.36
		Type: Riprap Channel		Label: D10:DITCH, E PILE SL						
112	Structure	0.25							12.75	
112 Total IN/OUT		71.86							12.75	88.12
111 to 112 Routing					0.011	0.395				
121	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null		Label:						
121	Structure	0.00							0.00	
121 Total IN/OUT		0.00							0.00	0.00
211	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null		Label:						
211	Structure	0.00							12.75	
211 Total IN/OUT		71.86							12.75	88.12
112 to 211 Routing					0.000	0.000				

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D36 User: CWB
 Date: 10-17-1997 Time: 10:53:21
 NEW ELK DEV. WASTE PILE, D10, 100-YR DITCH, E SIDE, B SOILS (D36-POST)
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	3	30.00	27.00	3.64	0.00			
				-b	8	820.00	0.20	1.34	0.17	0.172		
1	1	1	1	-1	3	25.08	8.00	1.98	0.00		0.003	0.269
1	1	1	2	-a	7	6.00	2.00	2.85	0.00			
				-b	8	810.00	0.20	1.34	0.17	0.168		
1	1	1	3	-a	1	244.99	40.82	1.62	0.04			
				-b	7	1089.42	41.31	12.94	0.03			
				-c	8	3347.59	10.46	9.70	0.11	0.181		
1	1	2	1	-a	3	40.37	24.77	3.48	0.00			
				-b	8	195.09	6.15	7.44	0.01	0.011		
1	1	2	2	-a	5	31.35	31.90	5.65	0.00			
				-b	8	318.32	3.77	5.82	0.02	0.018		

=====

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D36 User: CWB
 Date: 10-17-1997 Time: 10:53:21
 NEW ELK DEV. WASTE PILE, D10, 100-YR DITCH, E SIDE, B SOILS (D36-POST)
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S2
 D10:DITCH, E PILE SL

Drainage Area from J1, B1, S2, SWS(s)1-2: 0.2 acres
 Total Contributing Drainage Area: 71.9 acres

MATERIAL: Rock Riprap
 Trapezoidal Riprap Channel
 Steep Slope Design - Simons/OSM Method

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
88.12	6.0	3.0:1	3.0:1	4.6	0.039

	Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
	0.95	10.47**	11.7	0.701	2.18
w/ Freeboard:	1.25		13.5		

** Non-uniform flow - Velocity shown is $V=Q/A$ and may not be applicable

----DMax----		----D50----		----D10----	
(ft)	(in)	(ft)	(in)	(ft)	(in)
1.25	15.00	1.00	12.00	0.33	4.00

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	12.75	88.12

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NEW ELK POST MINE TOPOGRAPHY, E PORTAL, POND 004 AREA, D37

by

Name: CWB

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
File Name: C:\SEDCAD3\NELK\D37

Date: 10-17-1997

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
Filename: C:\SEDCAD3\NELK\D37 User: CWB
Date: 10-17-1997 Time: 14:27:25
NEW ELK POST MINE TOPOGRAPHY, E PORTAL, POND 004 AREA, D37
Storm: 4.20 inches, 100 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
GENERAL INPUT TABLE
=====

Detailed Between Structure Routing:

J	B	S	To Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
1	1	2	1	8	125.01	1.20	3.29	0.01	0.010	0.329
2	1	1	1	8	450.03	1.20	3.29	0.04	0.038	0.329

User: CWB

Hydrograph Convolution Interval: 0.1 hr

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	25.18	72	M	0.108	0.097	0.326	0.0	3.36	43.76	
111	2	9.55	72	M	0.108	0.020	0.398	0.0	1.27	16.60	
111	3	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
111	4	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
		Type: Culvert Label: UNDIS PJF,D, E & W									
111	Structure	34.73							4.64		
111	Total IN/OUT	34.73							4.64	55.74	
112	1	0.12	61	M	0.015	0.000	0.000	0.0	0.01	0.12	
		Type: Earthen Channel Label: GRASS, B									
112	Structure	0.12							4.65		
112	Total IN/OUT	34.85							4.65	55.86	
111 to 112 Routing						0.010	0.329				
211	1	2.20	61	S	0.251	0.033	0.329	0.0	0.17	0.81	
211	2	4.90	91	M	0.118	0.033	0.329	0.0	1.31	14.44	
211	3	1.36	91	M	0.007	0.000	0.000	0.0	0.36	3.99	
211	4	5.25	91	M	0.101	0.000	0.000	0.0	1.41	15.49	
211	5	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
211	6	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
		Type: Earthen Channel Label: RECLM(B):FEN,PILE&W									
211	Structure	13.71							7.89		
211	Total IN/OUT	48.56							7.89	90.28	
112 to 211 Routing						0.038	0.329				
311	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00	
		Type: Null Label: NULL									
311	Structure	0.00							7.89		
311	Total IN/OUT	48.56							7.89	90.28	
211 to 311 Routing						0.000	0.000				

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D37 User: CWB

Date: 10-17-1997 Time: 14:27:25

NEW ELK POST MINE TOPOGRAPHY, E PORTAL, POND 004 AREA, D37

Storm: 4.20 inches, 100 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	214.84	46.55	1.73	0.03			
				-b	7	2280.44	26.31	10.33	0.07			
				-c	8	290.93	34.37	17.59	0.01	0.108		
1	1	1	1	-1	8	475.02	1.00	3.00	0.04			
				-2	8	60.01	2.00	4.24	0.00			
				-3	8	135.01	1.10	3.15	0.01			
				-4	8	440.03	1.20	3.29	0.04		0.097	0.326
1	1	1	2	-a	1	360.93	27.71	1.33	0.08			
				-b	7	568.41	43.98	13.35	0.01			
				-c	8	481.95	5.00	6.71	0.02	0.108		
1	1	1	2	-1	8	485.14	5.00	6.71	0.02		0.020	0.398
1	1	2	1	-a	8	175.00	1.10	3.15	0.02	0.015		
2	1	1	1	-a	5	950.00	1.10	1.05	0.25	0.251		
2	1	1	1	-1	8	400.03	1.20	3.29	0.03		0.033	0.329
2	1	1	2	-a	5	161.55	50.00	7.07	0.01			
				-b	8	1918.30	2.50	4.74	0.11	0.118		
2	1	1	2	-1	8	400.03	1.20	3.29	0.03		0.033	0.329
2	1	1	3	-a	5	200.00	50.00	7.07	0.01	0.007		
2	1	1	4	-a	5	500.00	12.50	3.54	0.04			
				-b	5	370.00	2.70	1.64	0.06	0.101		

Company Name: GREYSTONE DEVELOPMENT CONSULTANTS
 Filename: C:\SEDCAD3\NELK\D37 User: CWB
 Date: 10-17-1997 Time: 14:27:25
 NEW ELK POST MINE TOPOGRAPHY, E PORTAL, POND 004 AREA, D37
 Storm: 4.20 inches, 100 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

NON-POND STRUCTURE INPUT/OUTPUT TABLE

=====

J1, B1, S1
 UNDIS PJF,D, E & W

Drainage Area from J1, B1, S1, SWS(s)1-4: 34.7 acres
 Total Contributing Drainage Area: 34.7 acres

Entrance Loss Coefficient	Maximum Headwater (ft)	Pipe Length (ft)	Pipe Slope (%)	Manning's n	Tailwater (ft)
0.90	4.0	60.0	2.0	0.024	0.0

Minimum Pipe Diameter Required: 42.0 inches
 (See Culvert Utility Program for full performance curves)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	4.64	55.74

J1, B1, S2
 GRASS, B

Drainage Area from J1, B1, S2, SWS(s)1: 0.1 acres
 Total Contributing Drainage Area: 34.9 acres

MATERIAL: UNGRADED SILTS TO COBBLES COLLOIDAL
 Trapezoidal Earthen Channel
 Limiting Variable: Velocity = 5.500 fps
 Sediment-laden Water

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
55.86	6.0	3.0:1	3.0:1	1.1	0.030

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
1.22	4.72	13.3	0.862	0.88
w/ Freeboard: 1.52		15.1		

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
=====		
IN/OUT	4.65	55.86

J2, B1, S1
RECLM(B):FEN,PILE&W

Drainage Area from J2, B1, S1, SWS(s)1-6: 13.7 acres
Total Contributing Drainage Area: 48.6 acres

MATERIAL: GRADED SILTS TO COBBLES COLLOIDAL
Trapezoidal Earthen Channel
Limiting Variable: Velocity = 5.500 fps
Sediment-laden Water

Design Discharge (cfs)	Bottom Width (ft)	ZLeft	ZRight	Slope (%)	Manning's n
=====	=====	=====	=====	=====	=====
90.28	8.0	3.0:1	3.0:1	1.2	0.030

Depth (ft)	Velocity (fps)	Top Width (ft)	Hydraulic Radius	Froude Number
=====	=====	=====	=====	=====
1.37	5.43	16.2	0.997	0.95
w/ Freeboard: 1.67		18.0		

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
=====		
IN/OUT	7.89	90.28

EXHIBIT 19

TECHNICAL REVISION 69

Refuse Disposal Area Fresh Water Diversion Ditch D-55

Contents:

SedCad Minimum Slope 2.75% Channel Cut in Sandstone – No RipRap Required

SedCad Maximum Slope 15.3% Channel Cut in Sandstone – No RipRap Required.

D-55 Minimum Slope 2.75%, Channel Cut in Sandstone so no Riprap Required

Material: Riprap

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	2.8	0.30		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.90 cfs	
Depth:	1.24 ft	1.54 ft
Top Width:	4.97 ft	6.17 ft
Velocity:	4.51 fps	
X-Section Area:	3.08 sq ft	
Hydraulic Radius:	0.555 ft	
Froude Number:	1.01	
Manning's n:	0.0370	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	





Doc Date: 12/11/2001
EX 19

S/E "EXHIBIT 19-

Refuse Disposal Area Road Design, 9/93 //

S/E ~~EXHIBIT 11~~

~~Section 5:~~ Refuse Disposal Area Road Design 11

September 1993

Section 5: Refuse Disposal Area (RDA) Access Road Design, SEDCAD+ Documentation

Table 1

I-1

RDA Access Road - Peak Flow Calculation

Bottom of RDA Access Road, Watershed 1	PF-1
RDA Access Road, Watershed 2	PF-4
RDA Watershed 3	PF-7
RDA Access Road Below Watershed 4, Above Culvert 39	PF-10
RDA Access Road Below Watershed 5	PF-13
RDA Access Road Watershed 6, Above Culvert 40	PF-16
RDA Access Road Below Watershed 7	PF-19
Top Portion of RDA Access Road Between Elev. 7,638 and 7,602	PF-21

RDA Access Road - Ditch Designs

Bottom of RDA, Watershed 1	D-1
Ditch Below Watershed 2	D-2
Watershed 3, Bedrock Bottom	D-3
Watershed 3 Between Culverts 39 & 45, Rip-Rap Bottom	D-4
Watershed 4 Above Culvert 39	D-5
Ditch Below Watershed 5	D-6
RDA Access Road Below Watershed 6	D-7
RDA Access Road Below Watershed 7	D-8
RDA Access Road at the Top Watersheds 8 and 9	D-9

RDA Access Road - Culvert Nomographs

A	C-1
B	C-2
39	C-3
40	C-4
45	C-5

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

BOTTOM OF REFUSE DISPOSAL AREA ACCESS ROAD

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\RDA1

Date: 09-09-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDAl User: C.W. BEGEJ
 Date: 09-09-1993 Time: 13:15:17

BOTTOM OF REFUSE DISPOSAL AREA ACCESS ROAD
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.69	77	M	0.072	0.000	0.422	0.0	0.14	1.86
111	2	0.16	89	F	0.009	0.000	0.000	0.0	0.02	0.28
		Type: Null Label: RDA RD-BOTTOM- #1								
111	Structure	1.85							0.16	

111	Total IN/OUT	1.85							0.16	2.13
=====										

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDAl User: C.W. BEGEJ

Date: 09-09-1993 Time: 13:15:17

BOTTOM OF REFUSE DISPOSAL AREA ACCESS ROAD

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	200.00	17.50	1.06	0.05			
				-b	7	540.00	40.74	12.85	0.01			
				-c	8	270.00	9.60	9.30	0.01	0.072		
1	1	1	1	-1	8	10.05	9.60	9.30	0.00		0.000	0.422
1	1	1	2	-a	7	25.00	5.00	4.50	0.00			
				-b	8	270.00	9.60	9.30	0.01	0.009		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

RDA ACCESS ROAD, WATERSHED 2

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\RDA#2

Date: 09-09-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDA#2 User: C.W. BEGEJ

Date: 09-09-1993 Time: 13:26:51

RDA ACCESS ROAD, WATERSHED 2

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.81	77	M	0.052	0.000	0.433	0.0	0.15	1.99
111	2	0.18	89	F	0.009	0.000	0.000	0.0	0.03	0.33
		Type: Null Label: RDA RD WATERSHED 2								
111	Structure	1.99							0.18	

111	Total IN/OUT	1.99							0.18	2.32
=====										

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDA#2 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 13:26:51
 RDA ACCESS ROAD, WATERSHED 2
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	200.00	30.00	1.39	0.04			
				-b	7	360.00	44.44	13.42	0.01			
				-c	8	320.00	43.00	19.67	0.00	0.052		
1	1	1	1	-1	8	10.09	13.50	11.02	0.00		0.000	0.433
1	1	1	2	-a	7	25.00	5.00	4.50	0.00			
				-b	8	320.00	13.50	11.02	0.01	0.009		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

WATERSHED #3

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\RDA#3

Date: 09-09-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDA#3 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 13:37:05

WATERSHED #3

Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	2.06	77	M	0.050	0.000	0.435	0.0	0.17	2.26
111	2	0.20	89	M	0.009	0.000	0.000	0.0	0.03	0.36
		Type: Null Label: RDA ACCESS RD -WS #3								
111	Structure	2.26							0.20	

111	Total IN/OUT	2.26							0.20	2.62
=====										

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDA#3 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 13:37:05

WATERSHED #3

Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	200.00	32.50	1.44	0.04			
				-b	7	160.00	50.00	14.23	0.00			
				-c	8	350.00	14.77	11.53	0.01	0.050		
1	1	1	1	-1	8	10.11	14.77	11.53	0.00		0.000	0.435
1	1	1	2	-a	7	25.00	5.00	4.50	0.00			
				-b	8	350.00	14.77	11.53	0.01	0.009		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

RDA ACCESS RD BELOW WATERSHED 4, ABOVE CULVERT 39

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\RDARD#4

Date: 09-09-1993

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\RDARD#4 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 13:52:22
 RDA ACCESS RD BELOW WATERSHED 4, ABOVE CULVERT 39
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	4.57	77	M	0.038	0.003	0.409	0.0	0.38	5.02
111	2	0.06	89	F	0.005	0.000	0.000	0.0	0.01	0.11
		Type: Null				Label: CULVERT 39/WS 4				
111	Structure	4.63							0.39	

111	Total IN/OUT	4.63							0.39	5.13
=====										

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\RDARD#4 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 13:52:22
 RDA ACCESS RD BELOW WATERSHED 4, ABOVE CULVERT 39
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	200.00	50.00	1.79	0.03			
				-b	7	200.00	50.00	14.23	0.00			
				-c	8	105.00	6.57	7.69	0.00	0.038		
1	1	1	1	-1	8	110.24	6.57	7.69	0.00		0.003	0.409
1	1	1	2	-a	7	25.00	5.00	4.50	0.00			
				-b	8	110.00	6.50	7.65	0.00	0.005		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

RDA ACCESS RD BELOW WATERSHED 5

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\RDA#5

Date: 09-09-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDA#5 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 14:28:09
 RDA ACCESS RD BELOW WATERSHED 5
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	3.31	77	M	0.074	0.000	0.416	0.0	0.28	3.64
111	2	0.21	89	F	0.013	0.000	0.000	0.0	0.03	0.38
		Type: Null Label: RDA RD BELOW WS 5								
111	Structure	3.52							0.31	

111	Total IN/OUT	3.52							0.31	4.02
=====										

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDA#5 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 14:28:09
 RDA ACCESS RD BELOW WATERSHED 5
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	200.00	15.00	0.98	0.06			
				-b	7	270.00	27.78	10.61	0.01			
				-c	8	325.00	7.91	8.44	0.01	0.074		
1	1	1	1	-1	8	10.03	7.91	8.44	0.00		0.000	0.416
1	1	1	2	-a	7	25.00	5.00	4.50	0.00			
				-b	8	370.00	7.91	8.44	0.01	0.013		

=====

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

REFUSE DISPOSAL AREA ACCESS ROAD, WATERSHED 6 ABOVE CULVERT 40

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\RDAWS6

Date: 09-09-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDAWS6 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 14:28:11

REFUSE DISPOSAL AREA ACCESS ROAD, WATERSHED 6 ABOVE CULVERT 40
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	0.71	77	M	0.049	0.000	0.425	0.0	0.06	0.78	
111	2	0.09	89	M	0.005	0.000	0.000	0.0	0.01	0.15	
		Type: Null		Label: WATERSHED 6, CULV 40							
111	Structure	0.80								0.07	
111	Total IN/OUT	0.80								0.07	0.93

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDAWS6 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 14:28:11
 REFUSE DISPOSAL AREA ACCESS ROAD, WATERSHED 6 ABOVE CULVERT 40
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	200.00	25.00	1.26	0.04			
				-b	7	130.00	38.46	12.48	0.00			
				-c	8	100.00	10.50	9.72	0.00	0.049		
1	1	1	1	-1	8	10.05	10.50	9.72	0.00		0.000	0.425
1	1	1	2	-a	7	25.00	5.00	4.50	0.00			
				-b	8	150.00	10.50	9.72	0.00	0.005		

999 01

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

RDA ACCESS ROAD BELOW WATERSHED 7

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\RDA#7

Date: 09-09-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDA#7 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 14:28:13
 RDA ACCESS ROAD BELOW WATERSHED 7
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.26	77	M	0.052	0.000	0.389	0.0	0.02	0.29
111	2	0.03	89	F	0.003	0.000	0.000	0.0	0.00	0.05
		Type: Null Label: RDA RD BELOW WS 7								
111	Structure	0.29							0.03	

111	Total IN/OUT	0.29							0.03	0.34
=====										

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDA#7 User: C.W. BEGEJ
 Date: 09-09-1993 Time: 14:28:13
 RDA ACCESS ROAD BELOW WATERSHED 7
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	200.00	25.00	1.26	0.04			
				-b	7	230.00	32.61	11.50	0.01			
				-c	8	55.00	3.64	5.72	0.00	0.052		
1	1	1	1	-1	8	10.01	4.00	6.00	0.00		0.000	0.389
1	1	1	2	-a	7	25.00	5.00	4.50	0.00			
				-b	8	40.00	4.00	6.00	0.00	0.003		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

TOP PORTION OF RDA ACCESS ROAD BETWEEN 7638 AND 7602

by

Name: C. W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\RDATMP

Date: 09-09-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDATEMP User: C. W. BEGEJ
 Date: 09-09-1993 Time: 12:46:32
 TOP PORTION OF RDA ACCESS ROAD BETWEEN 7638 AND 7602
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	2.33	77	M	0.058	0.000	0.432	0.0	0.19	2.56	
111	2	0.27	89	F	0.015	0.000	0.000	0.0	0.04	0.48	
		Type: Null		Label: TOP OF RDA ROAD							
111	Structure	2.60								0.24	

111	Total IN/OUT	2.60								0.24	3.04
=====											

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\RDATEMP User: C. W. BEGEJ

Date: 09-09-1993 Time: 12:46:32

TOP PORTION OF RDA ACCESS ROAD BETWEEN 7638 AND 7602

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	180.00	30.56	1.40	0.04			
				-b	7	270.00	29.63	10.96	0.01			
				-c	8	470.00	7.66	8.30	0.02	0.058		
1	1	1	1	-1	8	7.76	12.99	10.81	0.00		0.000	0.432
1	1	1	2	-a	8	470.00	7.66	8.30	0.02	0.015		

SEDCAD+ ERODIBLE CHANNEL DESIGN

BOTTOM OF RDA RD - WATERSHED 1

Limiting Velocity Technique
Clear Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	2.13 cfs	
Slope	9.60 %	
Sideslopes	2.00:1 (L)	4.00:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	2.12 cfs
Depth	0.38 ft
with Freeboard	0.68 ft
Top Width	2.28 ft
with Freeboard	4.08 ft
Velocity	4.91 fps
Cross Sectional Area	0.43 sq ft
Hydraulic Radius	0.18 ft
Froude Number	1.99

SEDCAD+ RIPRAP CHANNEL DESIGN

DITCH BELOW WATERSHED 2

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	2.32 cfs	
Slope	13.50 %	
Sideslopes (L and R)	2.00:1	4.00:1
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.17 ft
with Freeboard	0.47 ft
Top Width	0.99 ft
with Freeboard	2.79 ft
Velocity	28.23 fps
Cross Sectional Area	0.08 sq ft
Hydraulic Radius	0.08 ft
Manning's n	0.039
Froude Number	17.29
Dmax	1.250 ft (15.00 in)
D50	1.000 ft (12.00 in)
D10	0.333 ft (4.00 in)

SEDCAD+ NONERODIBLE CHANNEL DESIGN

WATERSHED 3, BEDROCK BOTTOM

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	2.62 cfs	
Slope	14.80 %	
Sideslopes	2.00:1 (L)	4.00:1 (R)
Manning's n	0.038	
Material	BEDROCK	
Freeboard	.3 ft	

RESULTS:

Depth	0.41 ft
with Freeboard	0.71 ft
Top Width	2.48 ft
with Freeboard	4.28 ft
Velocity	5.10 fps
Cross Sectional Area	0.51 sq ft
Hydraulic Radius	0.20 ft
Froude Number	1.97

SEDCAD+ RIPRAP CHANNEL DESIGN

RDA ACCESS RD BETWEEN CVT 39&45 - WS-3

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	2.62 cfs	
Slope	14.80 %	
Sideslopes (L and R)	2.00:1	4.00:1
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.16 ft	
with Freeboard	0.46 ft	
Top Width	0.95 ft	
with Freeboard	2.75 ft	
Velocity	34.97 fps	
Cross Sectional Area	0.07 sq ft	
Hydraulic Radius	0.07 ft	
Manning's n	0.039	
Froude Number	21.92	
Dmax	1.250 ft	(15.00 in)
D50	1.000 ft	(12.00 in)
D10	0.333 ft	(4.00 in)

SEDCAD+ ERODIBLE CHANNEL DESIGN

RDA ACCESS RD ABOVE CVT 39/BELOW WS 4

Limiting Velocity Technique
Clear Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	5.13 cfs	
Slope	6.57 %	
Sideslopes	2.00:1 (L)	4.00:1 (R)
Manning's n	0.030	
Max. Velocity	6.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	5.13 cfs
Depth	0.57 ft
with Freeboard	0.87 ft
Top Width	3.41 ft
with Freeboard	5.21 ft
Velocity	5.31 fps
Cross Sectional Area	0.97 sq ft
Hydraulic Radius	0.27 ft
Froude Number	1.76

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH BELOW WATERSHED 5

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	4.02 cfs	
Slope	7.91 %	
Sideslopes	2.00:1 (L)	4.00:1 (R)
Manning's n	0.030	
Max. Velocity	5.50 fps	
Material	GRADED SILTS - COBBLES COLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	4.02 cfs
Depth	0.50 ft
with Freeboard	0.80 ft
Top Width	3.00 ft
with Freeboard	4.80 ft
Velocity	5.35 fps
Cross Sectional Area	0.75 sq ft
Hydraulic Radius	0.24 ft
Froude Number	1.89

SEDCAD+ ERODIBLE CHANNEL DESIGN

RDA ACCESS RD BELOW WATERSHED 6

Limiting Velocity Technique
Clear Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	0.93 cfs	
Slope	10.50 %	
Sideslopes	2.00:1 (L)	4.00:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	0.93 cfs
Depth	0.27 ft
with Freeboard	0.57 ft
Top Width	1.65 ft
with Freeboard	3.45 ft
Velocity	4.13 fps
Cross Sectional Area	0.23 sq ft
Hydraulic Radius	0.13 ft
Froude Number	1.97

SEDCAD+ ERODIBLE CHANNEL DESIGN

RDA ACCESS RD BELOW WATERSHED 7

Limiting Velocity Technique
Clear Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	0.34 cfs	
Slope	3.64 %	
Sideslopes	2.00:1 (L)	4.00:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES NONCOLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	0.34 cfs
Depth	0.23 ft
with Freeboard	0.53 ft
Top Width	1.37 ft
with Freeboard	3.17 ft
Velocity	2.16 fps
Cross Sectional Area	0.16 sq ft
Hydraulic Radius	0.11 ft
Froude Number	1.12

SEDCAD+ ERODIBLE CHANNEL DESIGN

RDA ACCESS ROAD AT THE VERY TOP - 8 & 9

Limiting Velocity Technique
Clear Water

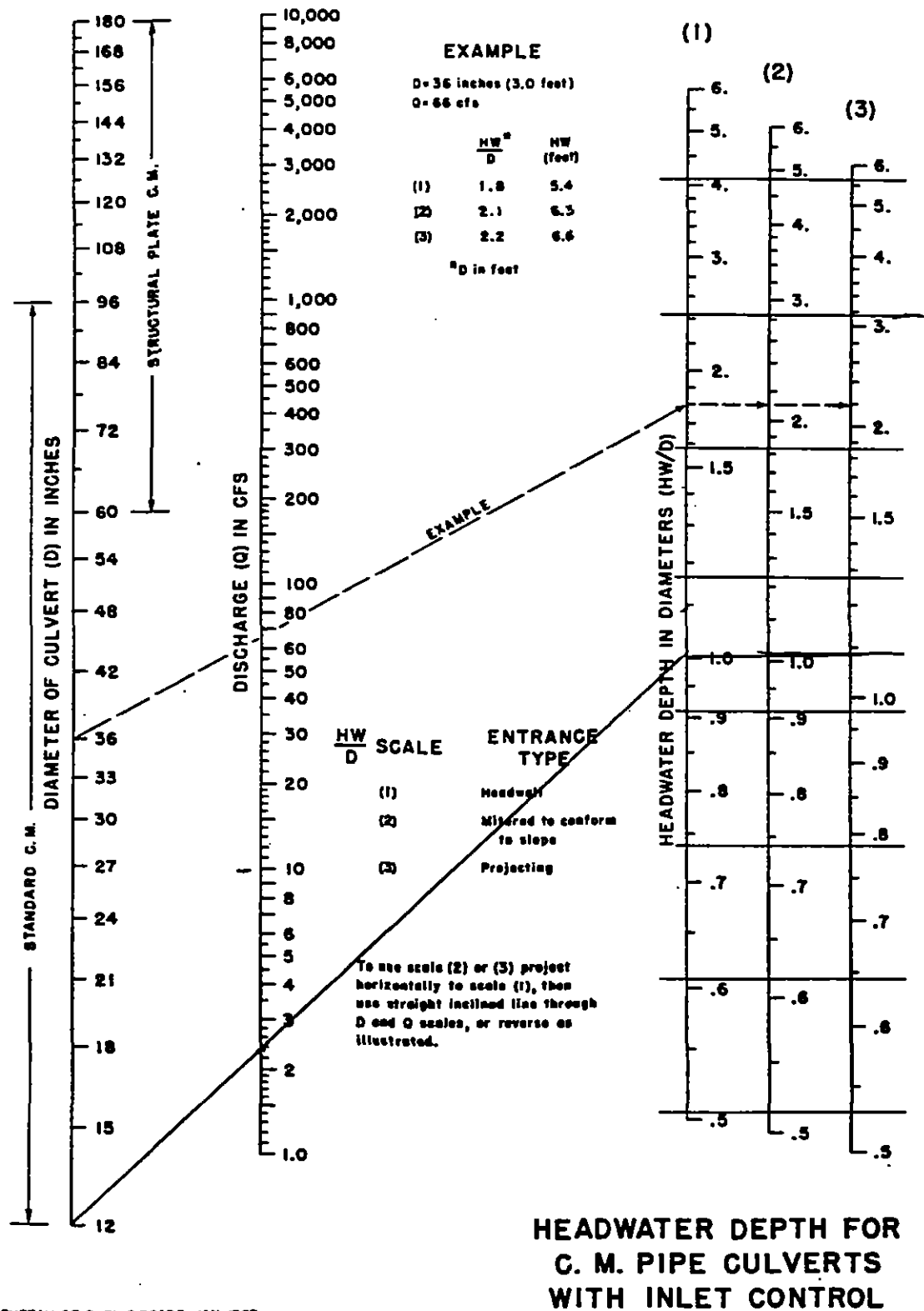
INPUT VALUES:

Shape	TRIANGULAR	
Discharge	3.04 cfs	
Slope	7.66 %	
Sideslopes	2.00:1 (L)	4.00:1 (R)
Manning's n	0.030	
Max. Velocity	5.50 fps	
Material		
Freeboard	.3 ft	

RESULTS:

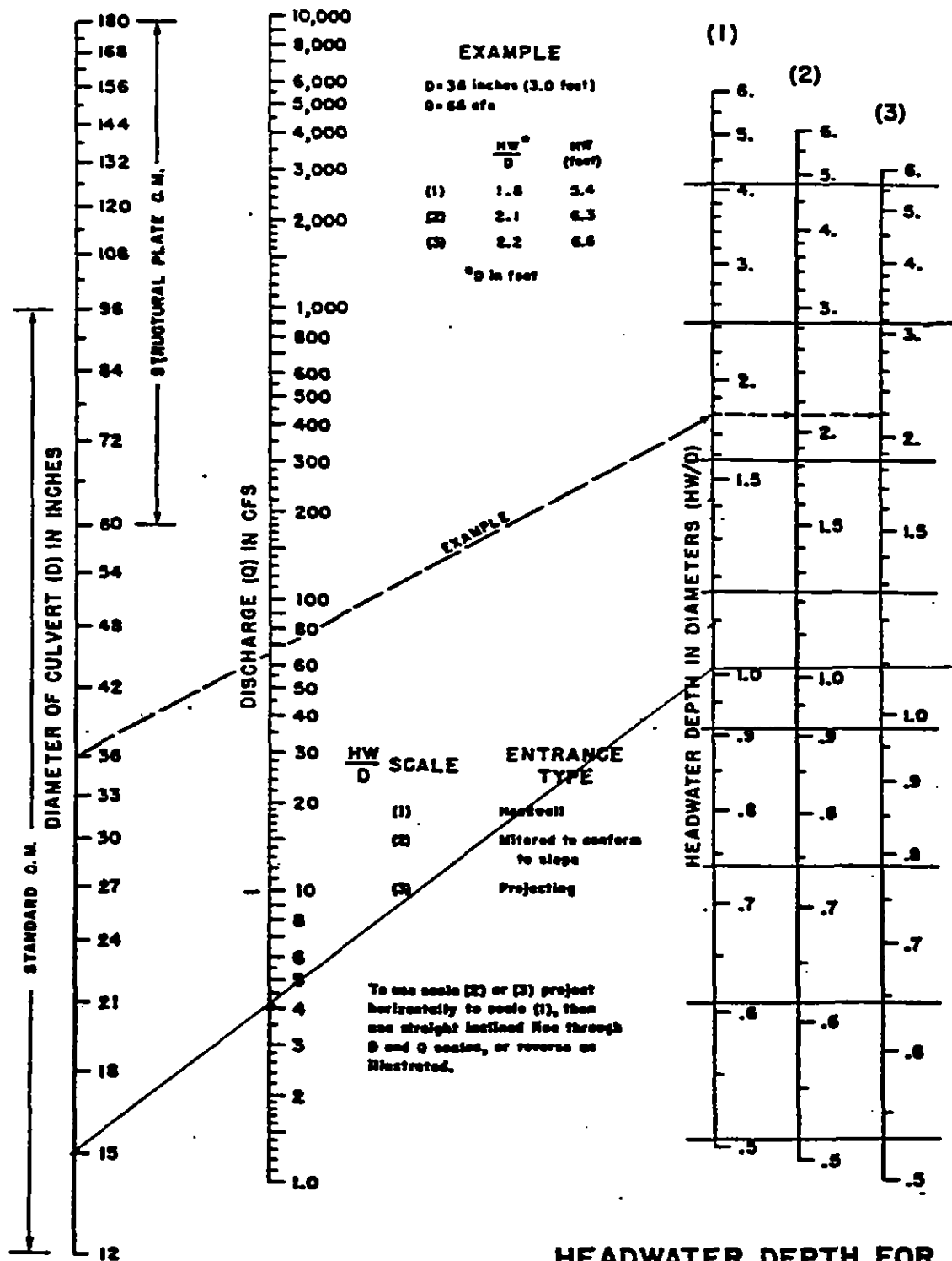
Actual Discharge	3.03 cfs
Depth	0.45 ft
with Freeboard	0.75 ft
Top Width	2.72 ft
with Freeboard	4.52 ft
Velocity	4.93 fps
Cross Sectional Area	0.62 sq ft
Hydraulic Radius	0.21 ft
Froude Number	1.83

CHART 5



BUREAU OF PUBLIC ROADS JAN. 1963

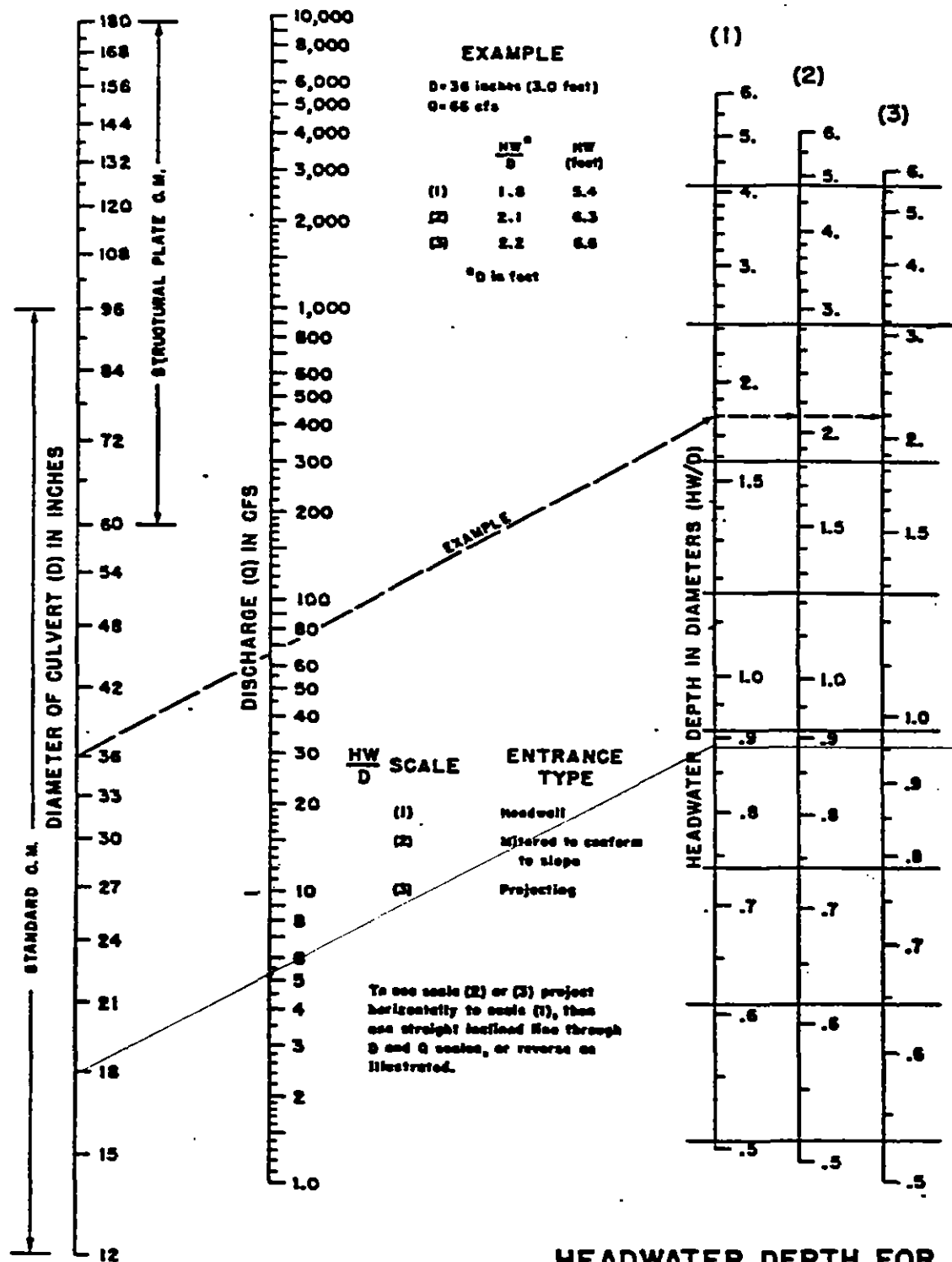
RDA CULVERT A



**HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL**

BUREAU OF PUBLIC ROADS JAN. 1963

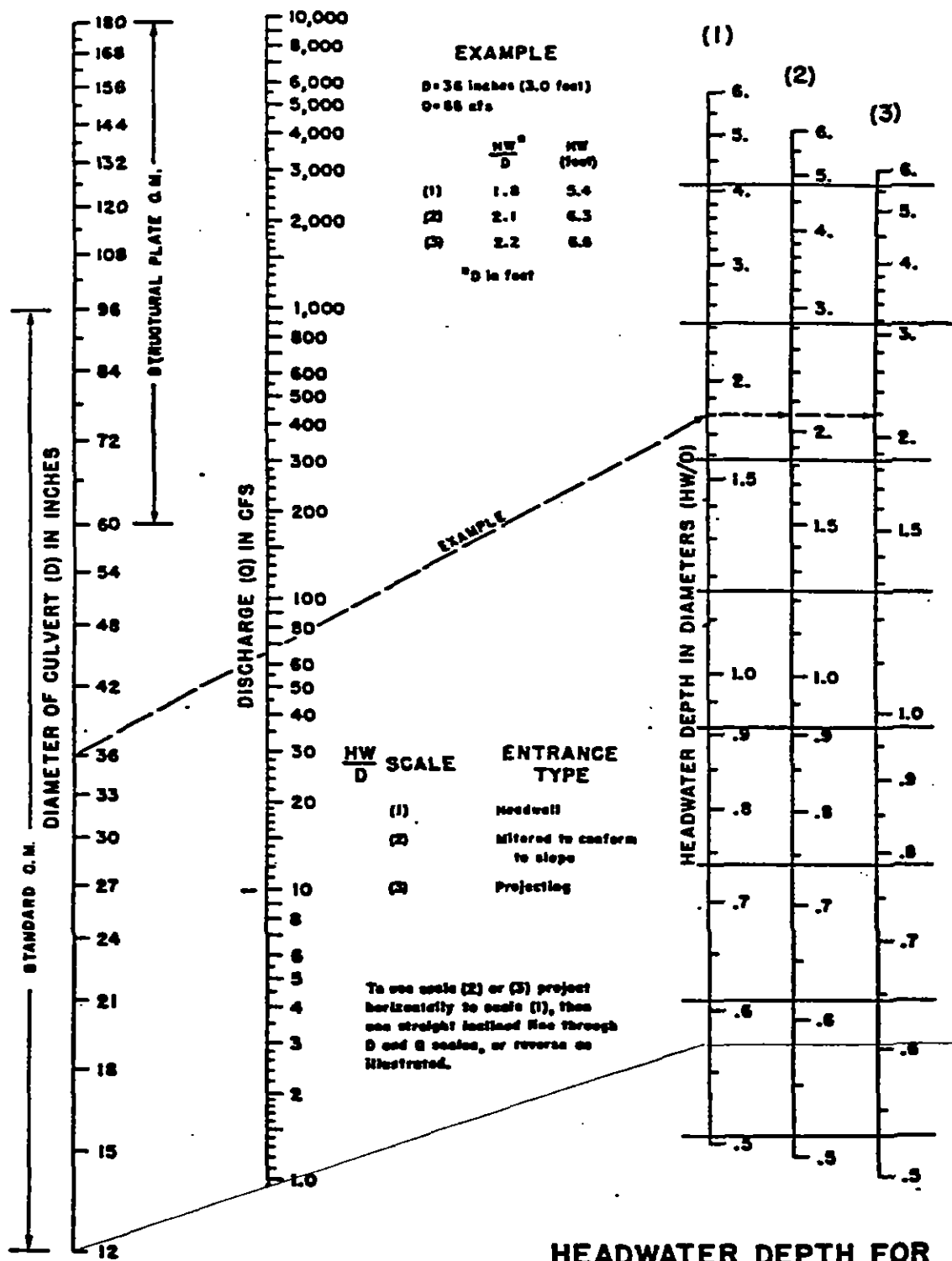
RDA CULVERT B



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1943

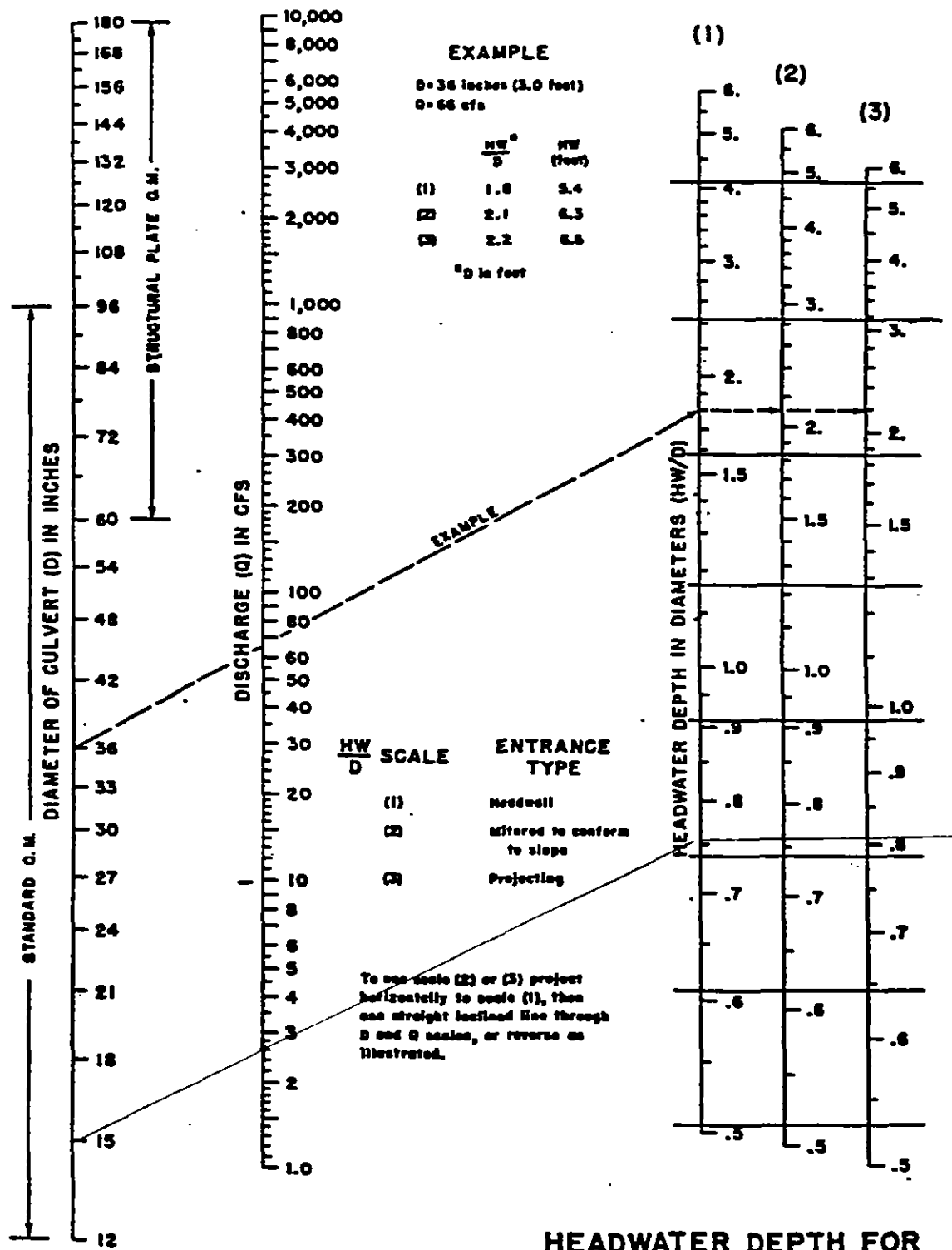
CULVERT 39



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1933

CULVERT 40



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

CULVERT 45



Doc Date: 12/11/2001

EX. 19

S/E "EXHIBIT 19-

157 Results of Required Annual Pond Survey - Ponds 006 and 007, 11/10/87 "

Wyoming Fuel Company

INTEROFFICE CORRESPONDENCE

TO: Mike Kolin *Dave* November 10, 1987
FROM: Dave Stout
IN RE: Results of Required Annual Pond Surveys - Ponds 006 & 007,
New Elk Mine, Permit C-012-81

On August 25, 1987, Steve Magnuson and I surveyed Ponds 006 and 007. The results are attached. Pond 007 requires 6.6 acre-feet of capacity above the 100% sediment level to handle a 10-year 24-hour runoff event. Currently this pond has 5.9 acre-feet of capacity. WFC needs to remove 0.7 acre feet or approximately 1,129 cubic yards. Approximately 1,111 cubic yards could be removed by cleaning an area 200 feet east of the inlet 75 feet wide and 2 feet deep.

The total surveyed volume for Pond 006 was 3.04 acre-feet. Design volume is 3.2 acre-feet. WFC should remove 0.16 acre-feet or approximately 258 cubic yards. WFC can accomplish this by removing approximately 2 feet of sediment in an area 90 feet from the inlet and 40 feet wide. Total volume removed defined by this area will be approximately 266 cubic yards.

In addition to these cleaning efforts, WFC must also complete construction of Pond 006 as per design. Attached are the design specifications which includes the pumping system, construction of the emergency spillway and gated principal spillway.

Design criteria for Ponds 006 and 007 can be found in Exhibit 19, Volume 2 of the New Elk Permit Application.

DS/sb/61
CC: S. Magnuson

1437

Wyoming Fuel Company Pond 006 2007

Project New Elk Mine Date 10-29-87Subject 1987 Pond 006 Survey By SM Sheet 1 of 1

	Area (ft ²)	Avg. Area (ft ²)	Vol. (ft ³)	Cum. Volume (AF)
7380 0.12	1,200			
		3,100	0.07	
7381 0.50	5,000			0.07
		6,600	0.15	
7382 0.82	8,200			0.22
		9,950	0.23	
7383 1.17	11,700			0.45
		12,950	0.30	
84	14,200			0.75
		15,050	0.69	
86	15,900			1.44
		17,450	0.80	
88	19,000			2.24
		20,500	0.94	
90	22,000			3.18

Notes

1 Mud averaged 8" throughout = 0.14 AF

2 Survey date 8-25-87 SM/DS

TOTAL Volume = 3.18 AF - 0.14 = 3.04 AF

Wyoming Fuel Company

Project New Elk Mine Date 10-29-87
 Subject 1987 Pond 007 Survey By sm Sheet 2 of

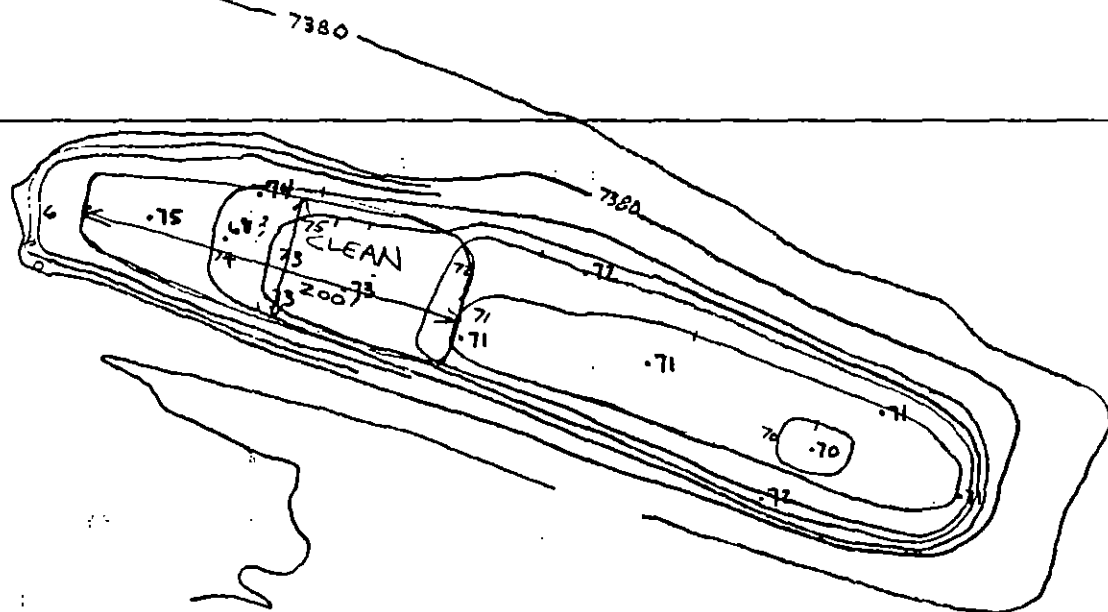
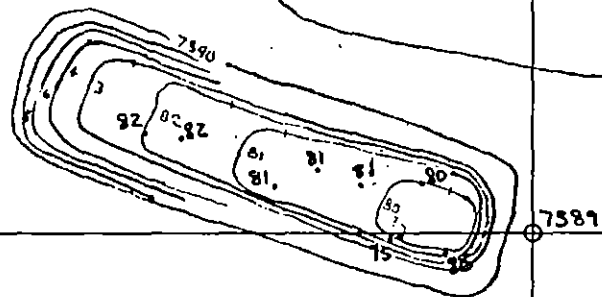
		Area (ft^2)	Avg. Area (ft^2)	Vol. (AF)	Cum. Volume (AF)
73	70	1,000			
			6,500	0.15	
71	120	12,000			0.15
			16,400	0.38	
72	208	20,800			0.53
			25,400	0.58	
73	300	30,000			1.11
			33,750	0.77	
74	375	37,500			1.88
			43,350	2.00	
76		49,200			3.88
			51,100	2.35	
78		53,000			6.23
			55,300	2.54	
80		57,600			8.77

Notes: 1. 7" of mud throughout $500' \times 50' \times \frac{7}{12}" = 0.33 \text{ AF}$
 2. Survey date 8-25-87 sm/DJ

Total Volume = $8.77 - 0.33 = \underline{8.44 \text{ AF}}$

7390

POND 006



POND 007

10-29-87
1987 POND SURVEY
SM

SCALE: 1" = 100'

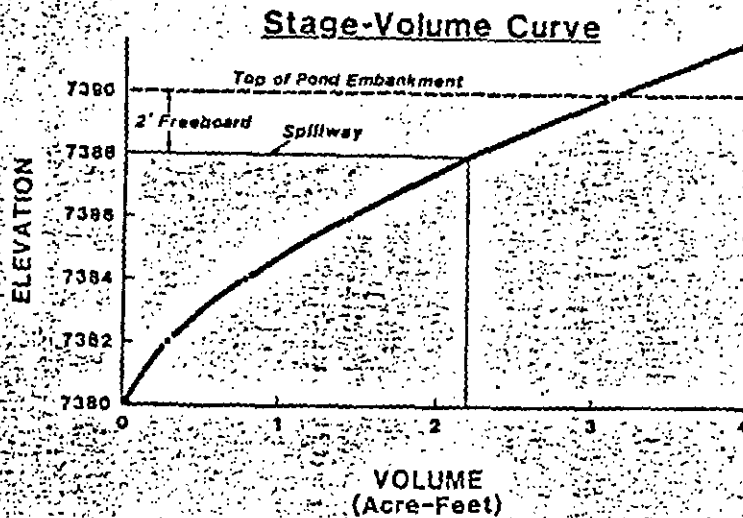
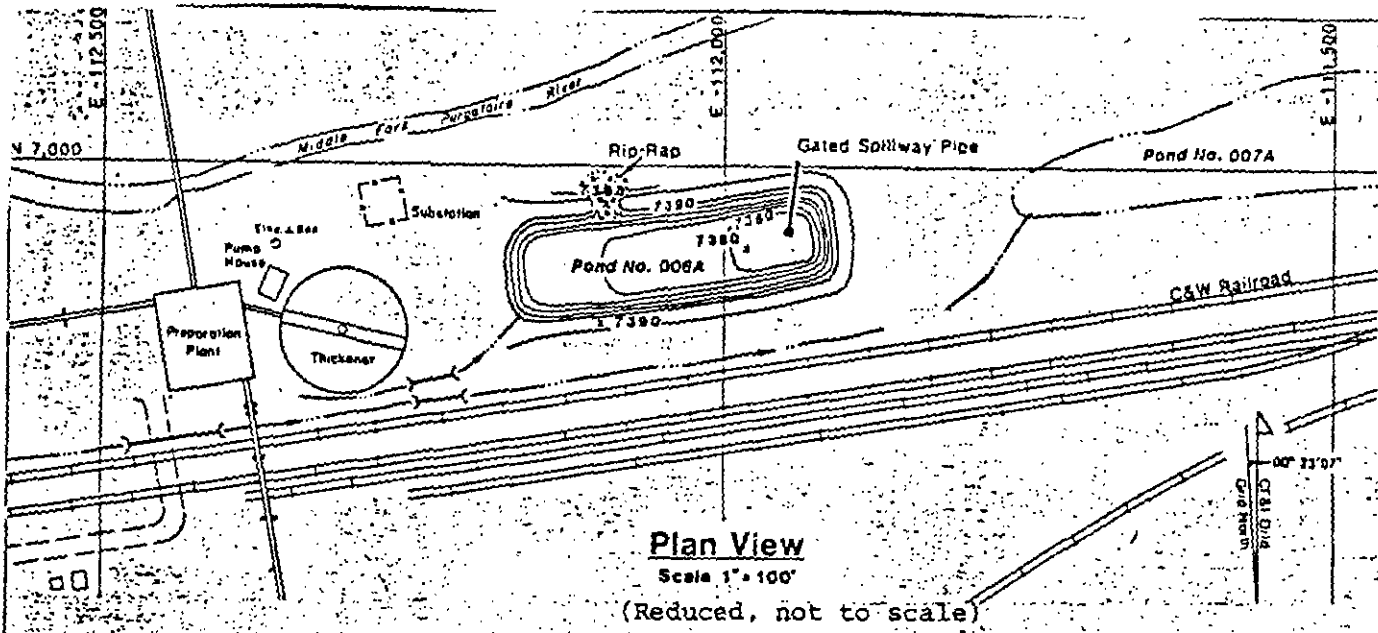
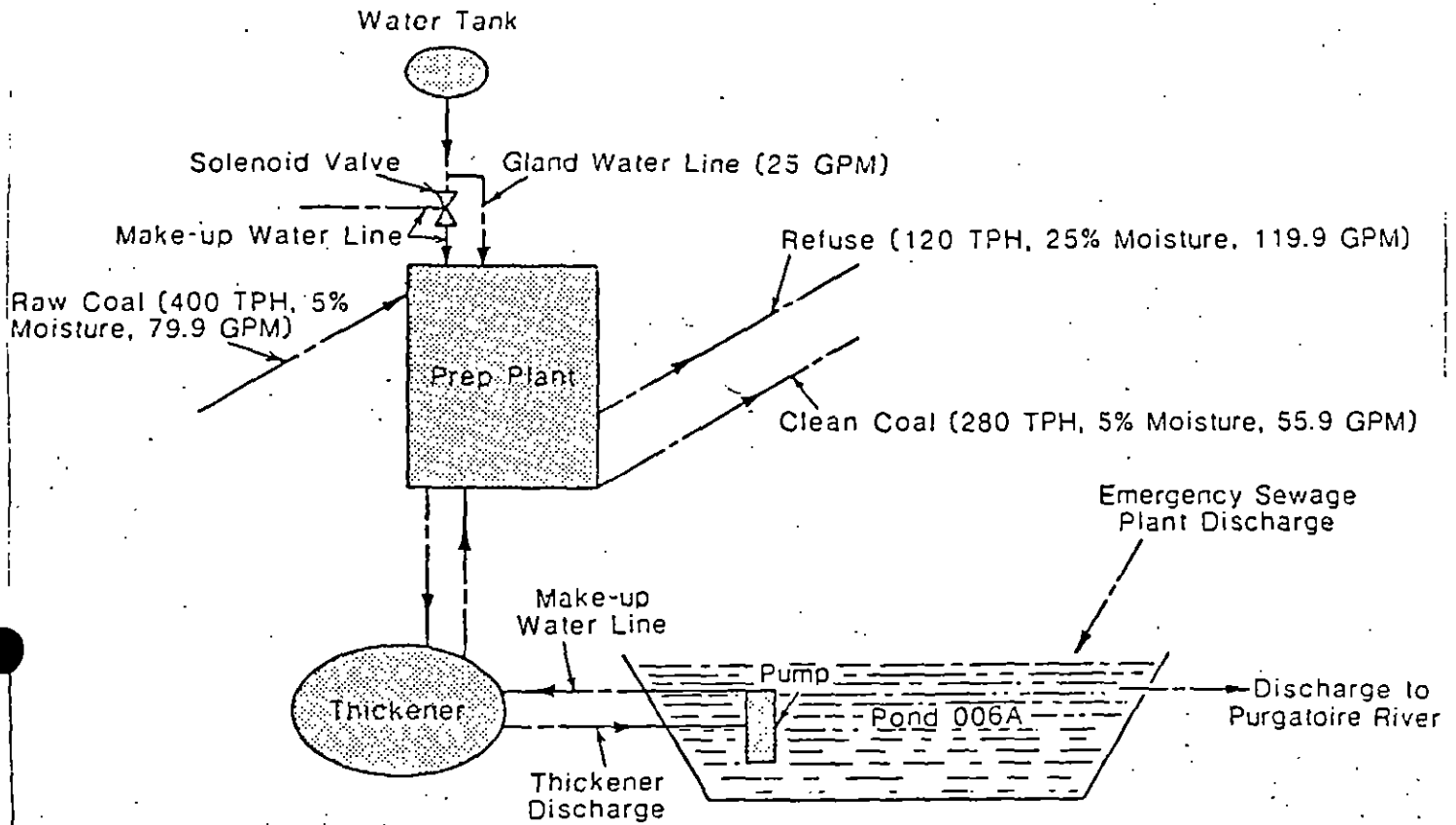


Figure 6
 Wyoming Fuel Company

Amended 10/2



Note: At 400 tons per hour feed to the plant, 70.9 gpm of make-up water is needed.

Figure 5
Wyoming Fuel Company

Amended 10/23/87

EXHIBIT 19

SEDIMENT DESIGN SPECIFICATIONS

VOLUME 2

- 1) Allen Mine Hydrologic Balance of Surface Runoff
- 2) Thickener Discharge Plan, 5/31/85 and 3/17/87
- 3) Results of Annual Pond Survey-Ponds 006 and 007, 11/10/87
- 4) Refuse Area Road Design, 9/93
- 5) Miscellaneous Drainage Supplement
 - i. West Portal Containment Areas 1 and 2, no date
 - ii. West Portal Culvert Data C21 through C-25, 3/19/97
 - iii. MR-40 Culverts 43 and 44, 1/18/92
 - iv. TR-23 SAE Demonstrations for Seven Sites
 1. West Portal Substation, 0/26/91
 2. West Portal Water Tanks, Area 1, 9/26/91
 3. West Portal Water Tanks, Area 2, 9/26/91
 4. West Portal Core House, 9/18/91
 5. East Portal Water Tanks, 5/20/91
 - v. MR-43 Ditch D-17 and D-33 Included, 3/27/1992
 - vi. TR-25 Containment Area 1, 6/11/92
 1. East of Refuse Belt, 6/20/91
 2. West of Refuse Overflow, 6/20/92
 3. Containment Area 2, 6/11/92
 4. West of Refuse Belt, 6/20/92
 - vii. TR-30 New Elk Pumphouse, West Portal Area SAE, 10/14/93
 1. Culvert 49 West of New Elk Hoist House 10/14/93
 2. D-23A, North Road Ditch, North of Hoist House 10/15/93
 3. D-23B, North Road Ditch South of Hoist House 10/15/13
 4. SAE for Contaminated Topsoil 10/15/93
 - viii. TR-31 Ditch 24 & 24A, Culverts C34, C35, C36, C46, C47, 12/3/93
 1. Culvert C-48 on Ditch D26, 12/3/93
 - ix. TR-33 D18 from Head to 960' West 10/8/93
 - x. SAE Demo, Topsoil Pile 2, NW of Plant 11/29/93
 - xi. TR-35 East Side of Dev Coal Waste Pile SAE 7/6/94
 - xii. TR-38 Refuse Area Ditch D35C and Culvert C58 3/7/95
 1. Refuse Area Ditch D-36 3/7/95
 2. Refuse Area Ditch D-35A 3/7/95
 3. Refuse Area Ditch D-365B 3/7/95
 4. Refuse Area Culvert C57 3/23/95
- 6) Ditch 17B and Culvert C50 12/2/93

VOLUME 3

- 7) TR-27 and NOV C-93-037 11/30/93
- 8) TR-39 Drainage Calculations 5/9/95
- 9) Pond 004, 1995 As-built Survey (TR-39) 9/26/95
- 10) New Elk D4, South Side of Development Waste Pile
- 11) New Elk Dev Waste Pile, D10, 100Yr Ditch 8/29/97
- 12) Post-mining Drainage Calculations 10/23/97
- 13) MR-87 Pond 001 As-built Survey 7/13/2007
- 14) TR-50 West Portal Culvert
- 15) TR-54 Sediment Design Specification-Substation Cut 11/2/10
- 16) TR-55 Bates Portal & Subsoil & Topsoil Stockpiles#1
- 17) TR-61 Small Area Exemption Located South of Pond 7
- 18) TR-60 Fourteen New Culverts
- 19) TR-62 Culverts C75 and C76 Upper RDA Diversion Ditch
- 20) SAE for Drill Sites – Silt Fence Design
- 21) Upland Diversion Ditches D18 & D26, Potable Water Tank Area
- 22) TR-65 West DWDA Design (DWDA#3
- 23) DWDA Expansion 4/20/2012
- 24) TR-66 RDA Haul Road and RDA Conveyor Area



999

Doc Date:12/11/2001

EX: 19

S/E "EXHIBIT 19-

~~2~~ Thickener Discharge Plan, 5/31/85 and 3/18/87 //

Wyoming Fuel Company

Project NEW ELK MINE & PREPARATION PLANT Date 2-31-85

Subject THICKENER DISCHARGE PLAN By KMK Sheet 1 of 3

TABLE 1 - DATA SUMMARY

RUNOFF AREAS TO BE ROUTED TO POND 007	ACRES	10YR, 24HR RUNOFF ACRE-FT	R K (75)(2)	CP	LS	SEDIMENT	
						T/Acre-yr	T/year
006-1	2.5	.20	15	.8	5.40	65	162
006-2	1.9	.29	15	.7	.25	3	5
006-3	5.4	.43	15	.8	1.08	13	70
006-4	3.8	.60	15	.7	.44	5	18
006-5	2.8	.29	15	.9	.38	5	14
Subtotals	16.4	1.81					269
007-1	7.0	1.07	15	.7	.98	10	72
007-2	21.0	2.19	15	.7	1.15	12	254
007-3	1.0	.16	15	.7	.42	4	4
007-4	3.8	.60	15	.6	.43	4	15
007-5	3.5	.55	15	.6	.34	3	11
007-6	1.3	.21	15	.6	.42	4	5
Subtotals	37.6	4.78					361
TOTALS	54.0	6.59					630

CALCULATIONS

$$\text{SEDIMENT (TONS/ACRE-YR)} = (R)(K)(CP)(LS)$$

$$\text{Assume SG of sediment} = 1.8 \quad \therefore 112 \text{ lb/cu ft}$$

$$630 \frac{\text{Tons}}{\text{year}} \times \frac{2000 \text{ lb}}{\text{Ton}} \times \frac{\text{cu ft}}{112 \text{ lb}} \times \frac{\text{acre-ft}}{43,560 \text{ cu ft}} = 3 \frac{\text{acre-ft}}{\text{year}}$$

$$\times 3 \text{ years}$$

.9 acre-ft sediment
storage required

Wyoming Fuel Company

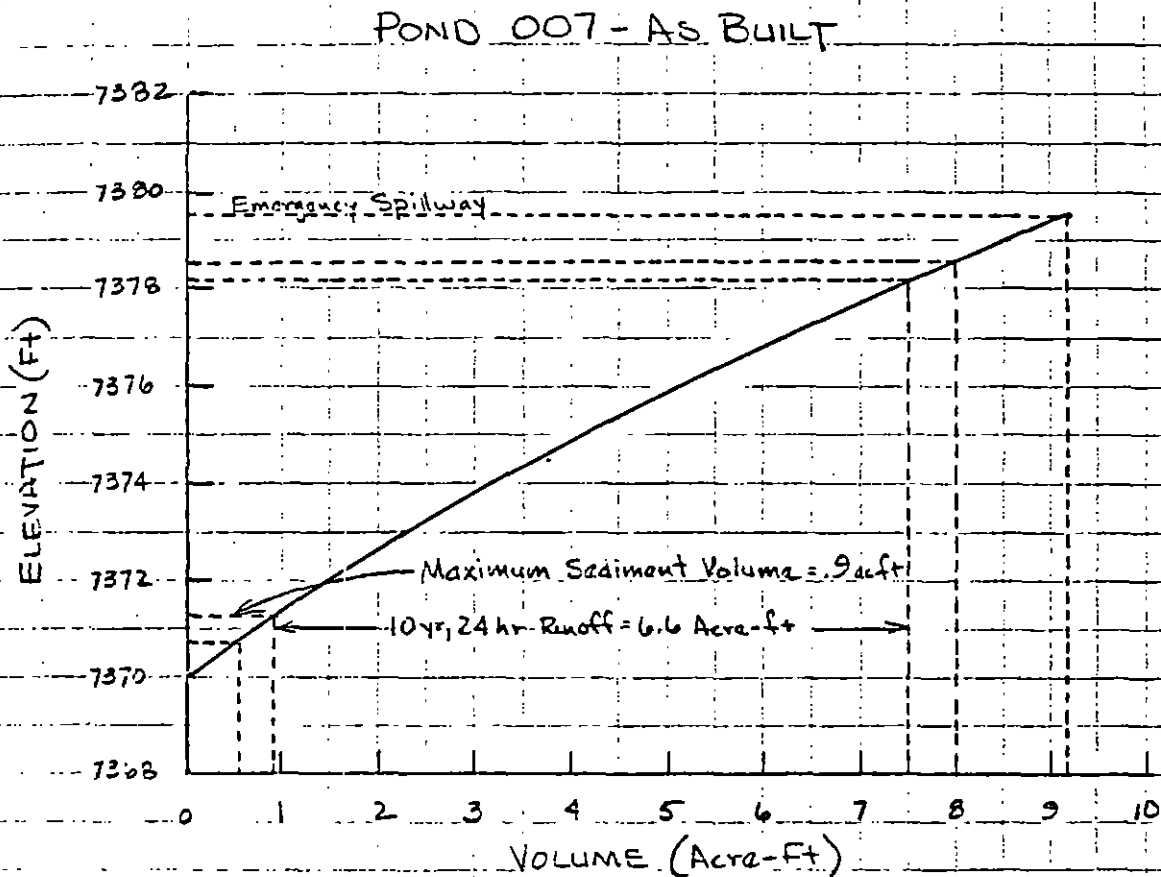
Project NEW ELK MINE & PREPARATION PLANT

Date 5-31-85

Subject THICKENER DISCHARGE PLAN

By KMK

Sheet 2 of 2



<u>STORAGE</u>	<u>CUM</u> <u>Acra-Ft</u>	<u>ELEVATION</u>
Bottom Pond	-	7370.0
60% Sediment	.54	7370.7
100% Sediment	.90	7371.3
10yr, 24hr Runoff	7.50	7378.2
1ft Below Emarg	8.00	7378.5
Emergency Spillway	9.20	7379.5

3-18-87 SDM

Summary of Emergency Spillway Design Calculations and Freeboard for Pond 006A

The following analysis was done to determine the size of Pond 006A spillway along with the vertical clearance between the bottom of the spillway and the water level after a total discharge from the thickener. The spillway was sized to handle the discharge of the thickener and discharge from the sewage plant assuming the pond is full.

The stage volume curve for Pond 006A shows that the vertical distance from the bottom of the spillway to the water level after a thickener discharge is one foot (see Map "Pond 006A Modifications").

In-flow to Pond 006:

1. Thickener	0.15 cfs ⁽¹⁾
2. Sewage Plant	0.83 cfs ⁽²⁾
Total	0.93 cfs

Determine Spillway Flowline:

Spillway dimensions:

Top width = 20'

Bottom width = 14.5'

Side Slopes = 2.5H:1V

$$Q = CLH^{3/2}$$

Q = design flow = 0.93 cfs

C = broad crested wier constant = 2.63

L = length of spillway at flowline = 14.5 ft

H = flowline depth

$$0.93 \text{ cfs} = 2.63 (14.5) (H^{3/2})$$

$$H^{3/2} = 0.02$$

$$H = 0.08 \text{ ft}$$

The spillway will flow at a depth of 0.08 ft during the design discharge. To maintain 1 foot of freeboard in the pond, construct the bottom of the spillway at an elevation of:

7390.00'	Top of pond embankment
- 1.00'	Freeboard
0.08'	Flow depth
7388.92'	Bottom of spillway

(1) field measured value

(2) From Exhibit 18, Sewage Treatment Plant



999

Doc Date:12/11/2001

EX: 19

S/E "EXHIBIT 19-

~~2~~ Thickener Discharge Plan, 5/31/85 and 3/18/87 //

Wyoming Fuel Company

Project NEW ELK MINE & PREPARATION PLANT Date 2-31-85

Subject THICKENER DISCHARGE PLAN By KMK Sheet 1 of 3

TABLE 1 - DATA SUMMARY

RUNOFF AREAS TO BE ROUTED TO POND 007	ACRES	10YR, 24HR RUNOFF ACRE-FT	R K (75)(2)	CP	LS	SEDIMENT	
						T/Acre-yr	T/year
006-1	2.5	.20	15	.8	5.40	65	162
006-2	1.9	.29	15	.7	.25	3	5
006-3	5.4	.43	15	.8	1.08	13	70
006-4	3.8	.60	15	.7	.44	5	18
006-5	2.8	.29	15	.9	.38	5	14
Subtotals	16.4	1.81					269
007-1	7.0	1.07	15	.7	.98	10	72
007-2	21.0	2.19	15	.7	1.15	12	254
007-3	1.0	.16	15	.7	.42	4	4
007-4	3.8	.60	15	.6	.43	4	15
007-5	3.5	.55	15	.6	.34	3	11
007-6	1.3	.21	15	.6	.42	4	5
Subtotals	37.6	4.78					361
TOTALS	54.0	6.59					630

CALCULATIONS

$$\text{SEDIMENT (TONS/ACRE-YR)} = (R)(K)(CP)(LS)$$

Assume SG of sediment = 1.8 $\therefore$ 112 lb/cu ft

$$630 \frac{\text{Tons}}{\text{year}} \times \frac{2000 \text{ lb}}{\text{Ton}} \times \frac{\text{cu ft}}{112 \text{ lb}} \times \frac{\text{acre-ft}}{43,560 \text{ cu ft}} = 3 \frac{\text{acre-ft}}{\text{year}}$$

x 3 years

.9 acre-ft sediment
storage required

Wyoming Fuel Company

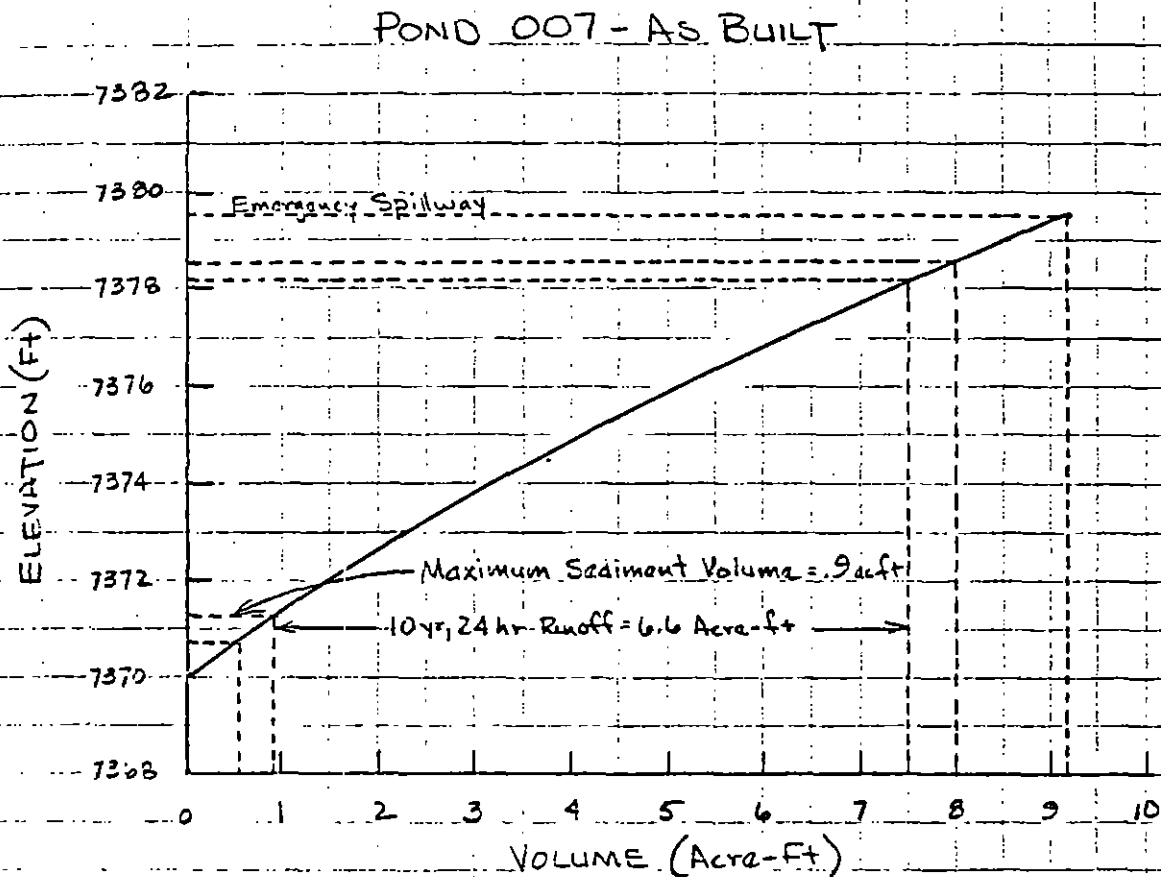
Project NEW ELK MINE & PREPARATION PLANT

Date 5-31-85

Subject THICKENER DISCHARGE PLAN

By KMK

Sheet 2 of 2



<u>STORAGE</u>	<u>CUM</u> <u>Acra-Ft</u>	<u>ELEVATION</u>
Bottom Pond	-	7370.0
60% Sediment	.54	7370.7
100% Sediment	.90	7371.3
10yr, 24hr Runoff	7.50	7378.2
1ft Below Emarg	8.00	7378.5
Emergency Spillway	9.20	7379.5

3-18-87 SDM

Summary of Emergency Spillway Design Calculations and Freeboard for Pond 006A

The following analysis was done to determine the size of Pond 006A spillway along with the vertical clearance between the bottom of the spillway and the water level after a total discharge from the thickener. The spillway was sized to handle the discharge of the thickener and discharge from the sewage plant assuming the pond is full.

The stage volume curve for Pond 006A shows that the vertical distance from the bottom of the spillway to the water level after a thickener discharge is one foot (see Map "Pond 006A Modifications").

In-flow to Pond 006:

1. Thickener	0.15 cfs ⁽¹⁾
2. Sewage Plant	0.83 cfs ⁽²⁾
Total	0.93 cfs

Determine Spillway Flowline:

Spillway dimensions:

Top width = 20'

Bottom width = 14.5'

Side Slopes = 2.5H:1V

$$Q = CLH^{3/2}$$

Q = design flow = 0.93 cfs

C = broad crested wier constant = 2.63

L = length of spillway at flowline = 14.5 ft

H = flowline depth

$$0.93 \text{ cfs} = 2.63 (14.5) (H^{3/2})$$

$$H^{3/2} = 0.02$$

$$H = 0.08 \text{ ft}$$

The spillway will flow at a depth of 0.08 ft during the design discharge. To maintain 1 foot of freeboard in the pond, construct the bottom of the spillway at an elevation of:

7390.00'	Top of pond embankment
- 1.00'	Freeboard
0.08'	Flow depth
7388.92'	Bottom of spillway

(1) field measured value

(2) From Exhibit 18, Sewage Treatment Plant

EXHIBIT 19
SEDIMENT DESIGN SPECIFICATIONS

VOLUME 2

- 1) Allen Mine Hydrologic Balance of Surface Runoff
- 2) Thickener Discharge Plan, 5/31/85 and 3/18/87
- 2) Results of Annual Pond Survey - Ponds 006 and 007, 11/10/87
- 4) Refuse Area Road Design, 9/93
- 5) Miscellaneous Drainage Supplement
 - West Portal Containment Areas 1 and 2 - no date
 - West Portal Culvert Data C21 through C25, 3/19/87
 - MR-40 Culverts 43 and 44, 1/18/92
 - TR-23 SAE Demonstrations for Seven Sites, 2/19/92
 - West Portal Substation, 9/26/91
 - West Portal Water Tanks Area 1, 9/26/91
 - West Portal Water Tanks Area 2, 9/26/91
 - West Portal Core House, 6/18/91
 - East Portal Water Tanks, 5/20/91
 - MR-43 Ditch D 17 with D 33 Included, 3/27/92
 - TR-25 Containment Area 1, 6/11/92
 - East of Refuse Belt, 6/20/92
 - West of Refuse Overflow, 6/20/92
 - Containment Area 2, 6/11/92
 - West of Refuse Belt 6/20/92
 - TR-30 New Elk Pumphouse, West Portal Area SAE, 10/14/93
 - Culvert 49 West of New Elk Hoist House, 10/14/93
 - D23A, North Road Ditch , North of Hoist House, 10/15/93
 - D23B, North Road Ditch, South of Hoist House, 10/15/93
 - SAE for Contaminated Topsoil, 10/15/93
 - TR-31 Ditch 24 & 24A, Culverts C34, C35, C36, C46, C47, 12/3/93
 - Culvert C48 on Ditch D26, 12/3/93
 - TR-33 D18 from Head to 960' West, 10/8/93
 - SAE Demo, Topsoil Pile 2, NW of Plant, 11/29/93
 - TR-35 East Side of Dev Coal Waste Pile SAE, 7/6/94
 - TR-38 Refuse Area Ditch D35C and Culvert C58, 3/7/95
 - Refuse Area Ditch D36, 3/7/95
 - Refuse Area Ditch D35D, 3/9/95
 - Refuse Area Ditch D35A, 3/9/95
 - Refuse Area Culvert C57, 3/23/95
- 6) Ditch 17B and Culvert C50, 12/2/93

VOLUME 3

- 7) TR-27 and NOV C-93-037, 11/30/93
- 8) TR-39 Drainage Calculations, 5/9/95
- 9) Pond 004, 1995 As-built Survey (TR-39), 9/26/95
- 10) New Elk D4, South Side of Dev Waste Pile, 8/29/97
- 11) New Elk Dev Waste Pile, D10, 100-Yr Ditch, 8/29/97
- 12) Postmining Drainage Calculations, 10/23/97
- 13) MR-87 Pond 001 As-built Survey, 7/13/2007
- 14) TR-50 West Portal Culvert

(Revised TR-50 2/26/09))



999

Doc Date: 12/11/2001

Vol. 3

S/E "EXHIBIT 19-

TR27 and NOV C-93-037, 11/30/93 //

GREYSTONE®

November 30, 1993

Mr. Joseph Dudash
Colorado Division of Minerals and Geology
1313 Sherman Rm. 215
Denver, CO 80203

Subject: Technical Revision 27 and NOV C-93-037, New Elk Mine,
Basin Resources, C-81-014

Dear Mr. Dudash,

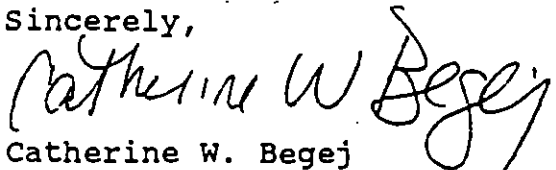
The attached submittal of SEDCAD+ documentation provides sizing for the road ditch between culverts C4 and C27. Ditch D34AA is east of D34A and C2 and Ditch D34AAA is east of C4. The B-series of ditches are named similarly. In addition, I have enclosed sizing for the berm between the ditch and the undisturbed drainages to the south.

The culvert nomograph for the culvert below the Non-Coal Waste Area has been identified as Culvert 51, and is sized to be 42". Three copies are attached.

The SAE demonstration for topsoil pile 2 has been modified to reflect a mulched and vegetated pile following discussions during field inspections between you and Mr. Lopez. This will avoid the requirements associated with impoundment regulations.

Please call if you have any questions.

Sincerely,



Catherine W. Begej

Catherine W. Begej
Project Manager

cc Mr. Ralph Lopez
Enclosures

DITCH D34AA

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	2.07 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.025	
Max. Velocity	5.00 fps	
Material	ALLUVIAL SILTS COLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	2.07 cfs
Depth	0.51 ft
with Freeboard	0.81 ft
Top Width	2.54 ft
with Freeboard	4.04 ft
Velocity	3.21 fps
Cross Sectional Area	0.64 sq ft
Hydraulic Radius	0.24 ft
Froude Number	1.12

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D34AAA

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	1.80 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.025	
Max. Velocity	5.00 fps	
Material	ALLUVIAL SILTS COLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	1.80 cfs
Depth	0.48 ft
with Freeboard	0.78 ft
Top Width	2.41 ft
with Freeboard	3.91 ft
Velocity	3.10 fps
Cross Sectional Area	0.58 sq ft
Hydraulic Radius	0.22 ft
Froude Number	1.11

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D34BB

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	1.27 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.025	
Max. Velocity	5.00 fps	
Material	ALLUVIAL SILTS COLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	1.27 cfs
Depth	0.42 ft
with Freeboard	0.72 ft
Top Width	2.11 ft
with Freeboard	3.61 ft
Velocity	2.85 fps
Cross Sectional Area	0.45 sq ft
Hydraulic Radius	0.20 ft
Froude Number	1.09

SEDCAD+ ERODIBLE CHANNEL DESIGN

BERM SOUTH OF D34BB

Limiting Velocity Technique
Clear Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	59.10 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	1.00:1 (R)
Bottom Width	35.00 ft	
Manning's n	0.030	
Max. Velocity	4.00 fps	
Material	GRADED SILTS - COBBLES COLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	59.10 cfs
Depth	0.42 ft
with Freeboard	0.72 ft
Top Width	36.49 ft
with Freeboard	37.54 ft
Velocity	3.90 fps
Cross Sectional Area	15.17 sq ft
Hydraulic Radius	0.41 ft
Froude Number	1.06

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D34BBB

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	1.29 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.025	
Max. Velocity	5.00 fps	
Material	ALLUVIAL SILTS COLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	1.29 cfs
Depth	0.42 ft
with Freeboard	0.72 ft
Top Width	2.12 ft
with Freeboard	3.62 ft
Velocity	2.86 fps
Cross Sectional Area	0.45 sq ft
Hydraulic Radius	0.20 ft
Froude Number	1.09

SEDCAD+ ERODIBLE CHANNEL DESIGN

BERM SOUTH OF D34BBB

Limiting Velocity Technique
Clear Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	39.86 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	1.00:1 (R)
Bottom Width	25.00 ft	
Manning's n	0.030	
Max. Velocity	4.00 fps	
Material	GRADED SILTS - COBBLES COLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	39.86 cfs
Depth	0.41 ft
with Freeboard	0.71 ft
Top Width	26.43 ft
with Freeboard	27.48 ft
Velocity	3.78 fps
Cross Sectional Area	10.54 sq ft
Hydraulic Radius	0.40 ft
Froude Number	1.06

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

ROAD DITCH 34AA BETWEEN C27 AND C2

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants

File Name: C:\SCAD\DT\BASIN\NE34AA

Date: 11-29-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\NE34AA User: C.W. BEGEJ
 Date: 11-29-1993 Time: 15:12:34
 Road Ditch 34AA between C27 and C2
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS SWS	Area (ac)	CN UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	1.16	89 M	0.100	0.000	0.000	0.0	0.17	2.07
		Type: Null						
111 Structure	1.16						0.17	
111 Total IN/OUT	1.16						0.17	2.07

=====

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\NE34AA User: C.W. BEGEJ
Date: 11-29-1993 Time: 15:12:34
Road Ditch 34AA between C27 and C2
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	10.00	33.00	5.74	0.00			
				-b	8	1520.00	2.00	4.24	0.10	0.100		

=====

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

ROAD DITCH D34AAA BETWEEN C2 AND C4

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\NED34AAA

Date: 11-29-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\NED34AAA User: C.W. BEGEJ
 Date: 11-29-1993 Time: 15:12:41
 Road Ditch D34AAA between C2 and C4
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.01	89	M	0.079	0.000	0.000	0.0	0.15	1.80
		Type: Null		Label: Road Ditch D34AAA						
111	Structure	1.01							0.15	
111	Total IN/OUT	1.01							0.15	1.80

=====

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\NED34AAA User: C.W. BEGEJ
 Date: 11-29-1993 Time: 15:12:41
 Road Ditch D34AAA between C2 and C4
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	10.00	33.00	5.74	0.00			
				-b	8	1250.00	2.12	4.37	0.08	0.079		

=====

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

ROAD DITCH D-34BB BETWEEN C27 AND C2

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants

File Name: C:\SCAD\DT\BASIN\NED34BB

Date: 11-29-1993

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\NED34BB User: C.W. BEGEJ
Date: 11-29-1993 Time: 15:18:17
Road Ditch D-34BB between C27 and C2
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	0.83	89	M	0.150	0.000	0.000	0.0	0.13	1.27	
		Type: Null				Label: Ditch C2-C27					
111	Structure	0.83								0.13	
111	Total IN/OUT	0.83								0.13	1.27

=====

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\NED34BB User: C.W. BEGEJ
Date: 11-29-1993 Time: 15:18:17
Road Ditch D-34BB between C27 and C2
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	7	1544.00	2.00	2.85	0.15	0.150		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

ROAD DITCH D34BBB BETWEEN C2 AND C4

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\NED34BBB

Date: 11-29-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\NED34BBB User: C.W. BEGEJ

Date: 11-29-1993 Time: 15:12:39

Road Ditch D34BBB between C2 and C4

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	0.72	89	M	0.117	0.000	0.000	0.0	0.11	1.29
				Type: Null						
111	Structure	0.72							0.11	
111	Total IN/OUT	0.72							0.11	1.29

=====

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\NED34BBB User: C.W. BEGEJ
Date: 11-29-1993 Time: 15:12:39
Road Ditch D34BBB between C2 and C4
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	7	1200.00	2.00	2.85	0.12	0.117		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

BERM SOUTH OF DITCH D34BB

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\NEC2BERM

Date: 11-29-1993

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\NEC2BERM User: C.W. BEGEJ
Date: 11-29-1993 Time: 16:05:34

BERM SOUTH OF DITCH D34BB

Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	97.26	73	M	0.202	0.000	0.000	0.0	6.46	59.10
					Type: Null		Label: BERM			
111	Structure	97.26							6.46	
111	Total IN/OUT	97.26							6.46	59.10

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\NEC2BERM User: C.W. BEGEJ

Date: 11-29-1993 Time: 16:05:34

BERM SOUTH OF DITCH D34BB

Storm: 2.90 inches, 10 year-24 hour, SCS Type II

Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	3	2800.00	30.00	3.83	0.20	0.202		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

BERM SOUTH OF DITCH 34BBB

by

Name: C.W. BEGEJ

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\BASIN\NE34BBBM

Date: 11-29-1993

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\BASIN\NE34BBBM User: C.W. BEGEJ
 Date: 11-29-1993 Time: 16:05:37

BERM SOUTH OF DITCH 34BBB
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	60.73	73	M	0.152	0.000	0.000	0.0	4.03	39.86	
		Type: Null		Label: BERM BETWEEN C2&C4							
111	Structure	60.73								4.03	
111	Total IN/OUT	60.73								4.03	39.86

=====

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\BASIN\NE34BBBM User: C.W. BEGEJ
Date: 11-29-1993 Time: 16:05:37

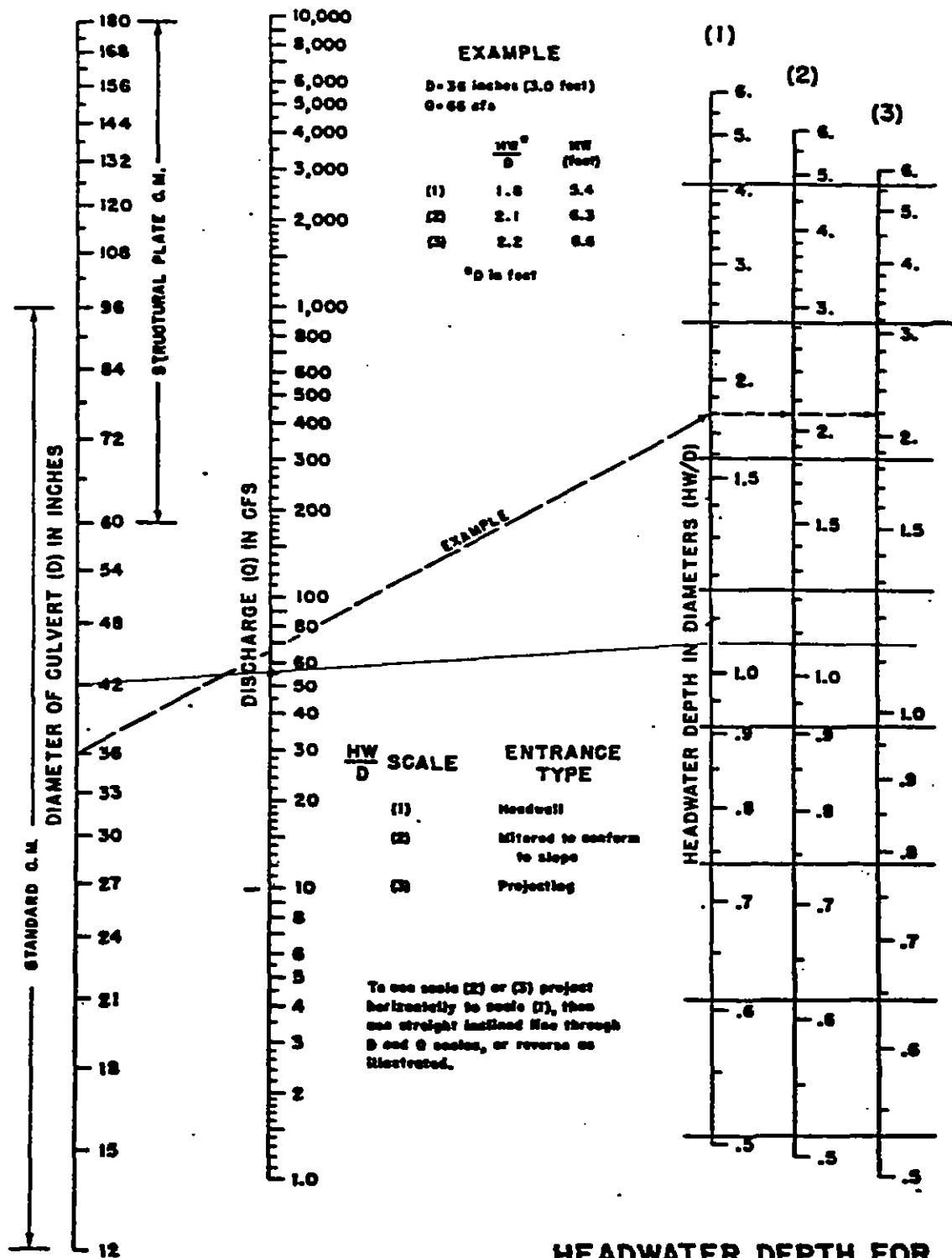
BERM SOUTH OF DITCH 34BBB
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

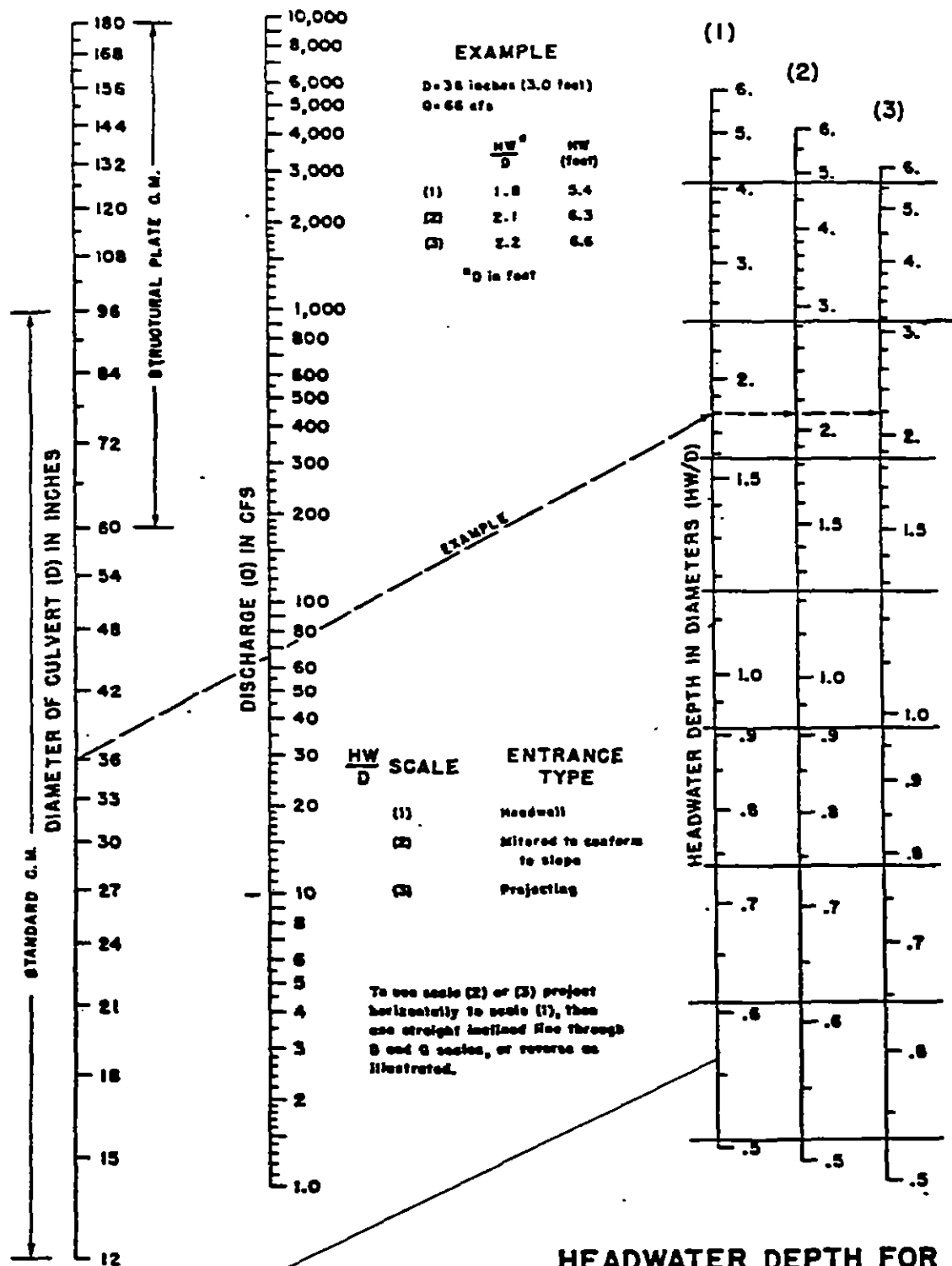
DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	3	2200.00	32.73	4.00	0.15	0.152		



BUREAU OF PUBLIC ROADS JAN. 1943



BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

DITCH RELIEF DRAINS SOUTH OF D34B
24" HALF-CULVERT CARRYING 0.5 CFS



Doc Date: 12/11/2001

Vol. 3

S/E "EXHIBIT 19-

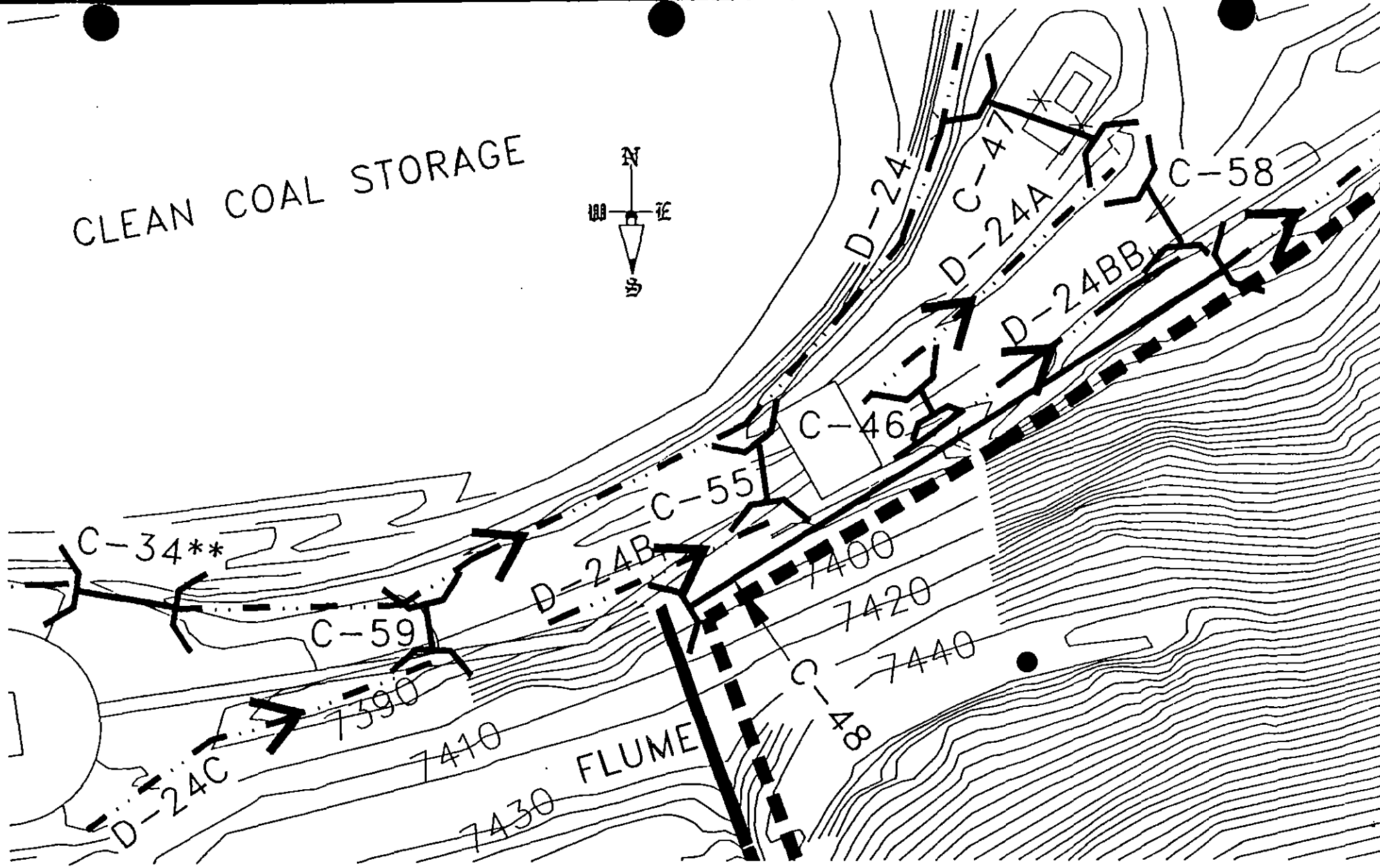
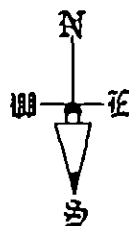
~~TR~~ TR-39 Drainage Calculations 5/9/95 //

[REDACTED]

[REDACTED]

Exhibit 19
TR-39 Drainage
Calculations

CLEAN COAL STORAGE



LEGEND

- DITCH (WITH DIRECTION OF FLOW)
- CULVERT INSTALLED AS NEEDED
- CULVERT
- BERM
- SURFACE DISTURBANCE BOUNDARY

Information presented on this map has been reviewed by me and is accurate to the best of my knowledge and information.

11/1/95
Date.

Signature



REV	BY	DATE

BASIN RESOURCES, INC.
NEW ELK MINE

SEDIMENT AND SURFACE
WATER CONTROL SILO AREA

DESIGN BY: DATE: 10/27/95
DWN BY: R.S/D.F.
SCALE: 1"=50'

FIGURE 1

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

CULVERT 1, NEW ELK MINE, NEAR EAST PORTAL WATER TANKS

by

Name: CWB

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\NEWELK\WTNKC1

Date: 05-08-1995

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\NEWELK\WTNKC1 User: CWB
 Date: 05-08-1995 Time: 10:59:36
 CULVERT 1, NEW ELK MINE, NEAR EAST PORTAL WATER TANKS
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	13.22	71	S	0.054	0.000	0.000	0.0	0.78	10.38	
					Type: Culvert	Label: C1					
111	Structure	13.22								0.78	
111	Total IN/OUT	13.22								0.78	10.38

=====

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
Filename: C:\SCAD\DT\NEWELK\WTNKC1 User: CWB
Date: 05-08-1995 Time: 10:59:36
CULVERT 1, NEW ELK MINE, NEAR EAST PORTAL WATER TANKS
Storm: 2.90 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	1	72.11	55.47	1.88	0.01			
				-b	7	1599.11	32.52	11.48	0.04	0.054		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

D23A/AA & D24SYST:C34,C35,C36,C46,C47,C55,C58,C59,C61:D24&D24A,B,BB,C,D,E

by

Name: CWB

Company Name: Greystone Development Consultants
File Name: C:\SCAD\DT\NEWELK\D24

Date: 05-09-1995

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\NEWELK\D24 User: CWB
 Date: 05-09-1995 Time: 16:12:15
 D23A/AA & D24SYST:C34,C35,C36,C46,C47,C55,C58,C59,C61:D24&D24A,B,BBCDE
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

GENERAL INPUT TABLE

=====

Detailed Between Structure Routing:

J	B	S	To #	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
1	1	2	1	1	8	175.04	2.00	4.24	0.01	0.011	0.356
1	1	3	1	1	8	182.04	2.00	4.24	0.01	0.011	0.356
1	1	4	1	1	8	222.04	2.00	4.24	0.01	0.014	0.356
2	1	1	1	1	8	250.05	2.00	4.24	0.02	0.016	0.356
2	2	2	1	1	8	85.02	2.00	4.24	0.01	0.005	0.356
3	1	1	1	1	8	320.06	2.00	4.24	0.02	0.020	0.356

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\NEWELK\D24 User: CWB
 Date: 05-09-1995 Time: 16:12:15
 D23A/AA & D24SYST:C34,C35,C36,C46,C47,C55,C58,C59,C61:D24&D24A,B,BBCDE
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

=====

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base- Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)	
111	1	0.61	85	M	0.024	0.000	0.000	0.0	0.08	0.95	
		Type: Culvert				Label: D23A, C61					
111	Structure	0.61								0.08	
111 Total IN/OUT		0.61								0.08	0.95
112	1	0.34	85	M	0.028	0.000	0.000	0.0	0.04	0.53	
		Type: Null				Label: D23AA					
112	Structure	0.34								0.12	
112 Total IN/OUT		0.95								0.12	1.48 ^{D23A}
111 to 112 Routing					0.011	0.356					
113	1	0.17	85	F	0.011	0.016	0.356	0.0	0.02	0.26 ^{D24E}	
113	2	0.30	85	F	0.011	0.000	0.000	0.0	0.04	0.47 ^{C3}	
		Type: Null				Label: D24E/C35 & D24D/C36					
113	Structure	0.47								0.18	
113 Total IN/OUT		1.42								0.18	2.21 ^{D24E} ^{C3}
112 to 113 Routing					0.011	0.356					
114	1	0.19	85	M	0.024	0.014	0.356	0.0	0.02	0.30	
114	2	0.38	85	F	0.021	0.000	0.000	0.0	0.05	0.59	
114	3	0.50	85	F	0.034	0.000	0.000	0.0	0.06	0.78	
		Type: Culvert				Label: C34/D24:W,SILO,COAL					
114	Structure	1.07								0.31	
114 Total IN/OUT		2.49								0.31	3.87 ^{C34} ^{D24E}
113 to 114 Routing					0.014	0.356					
121	1	0.73	85	F	0.066	0.000	0.000	0.0	0.09	1.14	
121	2	0.20	85	M	0.061	0.000	0.000	0.0	0.03	0.31	
		Type: Null				Label: D24C/C59:SLOPE/BASE					
121	Structure	0.93								0.12	
121 Total IN/OUT		0.93								0.12	1.45 ^{D24C} ^{C5}

211	1	0.60	85	M	0.010	0.000	0.000	0.0	0.08	0.93	D24 C5
211	2	0.05	85	M	0.030	0.000	0.000	0.0	0.01	0.08	
		Type: Null Label: D24B/C55:SLOPE/BASE									
Structure		0.65						0.51			
211 Total IN/OUT		4.07						0.51	6.33		
114 to 211 Routing					0.016		0.356				
221	1	1.40	85	F	0.045	0.000	0.000	0.0	0.18	2.18	D24 C46
221	2	0.05	85	M	0.021	0.000	0.000	0.0	0.01	0.08	
		Type: Null Label: C46:SLOPE/BASE									
221 Structure		1.45						0.18			
221 Total IN/OUT		1.45						0.18	2.26		
222	1	0.18	85	M	0.018	0.000	0.000	0.0	0.02	0.28	D24 C58
222	2	0.05	85	M	0.015	0.000	0.000	0.0	0.01	0.08	
		Type: Null Label: D24A & D24BB/C58:C47									
222 Structure		0.23						0.21			
222 Total IN/OUT		1.68						0.21	2.61		
221 to 222 Routing					0.005		0.356				
311	1	0.83	85	F	0.046	0.000	0.000	0.0	0.10	1.29	D24
311	2	0.32	85	M	0.031	0.000	0.000	0.0	0.04	0.50	
		Type: Null Label: COAL&D24:SCONTRIBC20									
Structure		1.15						0.87			
311 Total IN/OUT		6.90						0.87	10.73		
211 to 311 Routing					0.020		0.356				

Civil Software Design -- SEDCAD+ Version 3.1
 Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Greystone Development Consultants
 Filename: C:\SCAD\DT\NEWELK\D24 User: CWB
 Date: 05-09-1995 Time: 16:12:15
 D23A/AA & D24SYST:C34,C35,C36,C46,C47,C55,C58,C59,C61:D24&D24A,B,BBCDE
 Storm: 2.90 inches, 10 year-24 hour, SCS Type II
 Hydrograph Convolution Interval: 0.1 hr

=====

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

=====

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	55.00	2.00	1.41	0.01			
				-b	8	210.00	2.00	4.24	0.01	0.024		
1	1	2	1	-a	5	100.00	2.00	1.41	0.02			
				-b	8	135.00	2.00	4.24	0.01	0.028		
1	1	3	1	-a	5	70.00	43.00	6.56	0.00			
				-b	8	115.00	1.48	3.65	0.01	0.011		
1	1	3	1	-1	8	257.05	2.00	4.24	0.02		0.016	0.356
1	1	3	2	-a	5	70.00	57.00	7.55	0.00			
				-b	8	115.00	1.50	3.67	0.01	0.011		
1	1	4	1	-a	5	80.00	5.00	2.24	0.01			
				-b	8	225.00	2.00	4.24	0.01	0.024		
1	1	4	1	-1	8	216.04	2.00	4.24	0.01		0.014	0.356
1	1	4	2	-a	5	140.00	35.71	5.98	0.01			
				-b	8	225.00	2.00	4.24	0.01	0.021		
1	1	4	3	-a	5	50.00	33.00	5.74	0.00			
				-b	8	430.00	1.50	3.67	0.03	0.034		
1	2	1	1	-a	5	64.95	61.60	7.85	0.00			
				-b	5	328.40	2.00	1.41	0.06	0.066		
1	2	1	2	-a	5	314.40	2.00	1.41	0.06	0.061		
2	1	1	1	-a	8	156.00	2.00	4.24	0.01	0.010		
2	1	1	2	-a	5	155.00	2.00	1.41	0.03	0.030		
2	2	1	1	-a	3	100.38	39.85	4.42	0.01			
				-b	7	491.00	38.70	12.52	0.01			
				-c	5	86.23	69.58	8.34	0.00			
				-d	5	131.10	2.00	1.41	0.03	0.045		
2	2	1	2	-a	5	108.40	2.00	1.41	0.02	0.021		

2	2	2	1	-a	5	18.00	2.00	1.41	0.00	
				-b	8	228.84	2.00	4.24	0.01	0.018
2	2	2	2	-a	5	76.63	2.00	1.41	0.02	0.015
3	1	1	1	-a	5	94.23	33.00	5.74	0.00	
				-b	8	636.35	2.00	4.24	0.04	0.046
3	1	1	2	-a	5	160.46	2.00	1.41	0.03	0.031

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D23A

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	0.95 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	0.95 cfs
Depth	0.41 ft
with Freeboard	0.71 ft
Top Width	2.03 ft
with Freeboard	3.53 ft
Velocity	2.31 fps
Cross Sectional Area	0.41 sq ft
Hydraulic Radius	0.19 ft
Froude Number	0.90

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D23AA

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	1.48 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	1.48 cfs
Depth	0.48 ft
with Freeboard	0.78 ft
Top Width	2.40 ft
with Freeboard	3.90 ft
Velocity	2.58 fps
Cross Sectional Area	0.57 sq ft
Hydraulic Radius	0.22 ft
Froude Number	0.93

SEDCAD+ ERODIBLE CHANNEL DESIGN

D24-RECTANGULAR DITCH W/MIN 2.5' BW

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	10.73 cfs	
Slope	2.00 %	
Sideslopes	0.01:1 (L)	0.01:1 (R)
Bottom Width	2.50 ft	
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES NONCOLLOIDAL	
Freeboard	.3 ft	

RESULTS:

Actual Discharge	10.73 cfs
Depth	0.93 ft
with Freeboard	1.23 ft
Top Width	2.52 ft
with Freeboard	2.52 ft
Velocity	4.62 fps
Cross Sectional Area	2.32 sq ft
Hydraulic Radius	0.53 ft
Froude Number	0.85

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D24A

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	0.28 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	0.28 cfs
Depth	0.26 ft
with Freeboard	0.56 ft
Top Width	1.28 ft
with Freeboard	2.78 ft
Velocity	1.70 fps
Cross Sectional Area	0.16 sq ft
Hydraulic Radius	0.12 ft
Froude Number	0.84

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D24B

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR
Discharge	1.01 cfs
Slope	2.00 %
Sideslopes	2.50:1 (L) 2.50:1 (R)
Manning's n	0.030
Max. Velocity	5.00 fps
Material	GRADED LOAM - COBBLES NONCOLLOIDAL
Freeboard	.3 ft

RESULTS:

Actual Discharge	1.01 cfs
Depth	0.42 ft
with Freeboard	0.72 ft
Top Width	2.08 ft
with Freeboard	3.58 ft
Velocity	2.34 fps
Cross Sectional Area	0.43 sq ft
Hydraulic Radius	0.19 ft
Froude Number	0.91

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D24BB

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	0.10 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	0.10 cfs
Depth	0.18 ft
with Freeboard	0.48 ft
Top Width	0.88 ft
with Freeboard	2.38 ft
Velocity	1.32 fps
Cross Sectional Area	0.08 sq ft
Hydraulic Radius	0.08 ft
Froude Number	0.79

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D24C

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	1.45 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	1.46 cfs
Depth	0.48 ft
with Freeboard	0.78 ft
Top Width	2.38 ft
with Freeboard	3.88 ft
Velocity	2.57 fps
Cross Sectional Area	0.57 sq ft
Hydraulic Radius	0.22 ft
Froude Number	0.93

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D24D

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	2.21 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	2.21 cfs
Depth	0.56 ft
with Freeboard	0.86 ft
Top Width	2.78 ft
with Freeboard	4.28 ft
Velocity	2.85 fps
Cross Sectional Area	0.78 sq ft
Hydraulic Radius	0.26 ft
Froude Number	0.95

SEDCAD+ ERODIBLE CHANNEL DESIGN

DITCH D24E

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	0.26 cfs	
Slope	2.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Manning's n	0.030	
Max. Velocity	5.00 fps	
Material	GRADED LOAM - COBBLES	NONCOLLOIDAL
Freeboard	.3 ft	

RESULTS:

Actual Discharge	0.26 cfs
Depth	0.25 ft
with Freeboard	0.55 ft
Top Width	1.24 ft
with Freeboard	2.74 ft
Velocity	1.66 fps
Cross Sectional Area	0.15 sq ft
Hydraulic Radius	0.12 ft
Froude Number	0.83

SEDCAD+ CULVERT SIZING UTILITY

C35

Design Discharge	=	0.260 cfs
Entrance Loss Coefficient	=	0.9
Pipe Length	=	30.000 feet
Pipe Slope	=	2.000 %
Manning's n	=	0.024
Maximum Headwater	=	1.000 feet
Tailwater Depth	=	0.200 feet

Smallest Diameter Required to Pass Flow is 6 inches

SEDCAD+ CULVERT SIZING UTILITY

C55

Design Discharge	=	1.010 cfs
Entrance Loss Coefficient	=	0.9
Pipe Length	=	30.000 feet
Pipe Slope	=	2.000 %
Manning's n	=	0.024
Maximum Headwater	=	1.200 feet
Tailwater Depth	=	0.200 feet

Smallest Diameter Required to Pass Flow is 8 inches

SEDCAD+ CULVERT SIZING UTILITY

C59

Design Discharge	=	1.450 cfs
Entrance Loss Coefficient	=	0.9
Pipe Length	=	20.000 feet
Pipe Slope	=	2.000 %
Manning's n	=	0.024
Maximum Headwater	=	1.500 feet
Tailwater Depth	=	0.200 feet

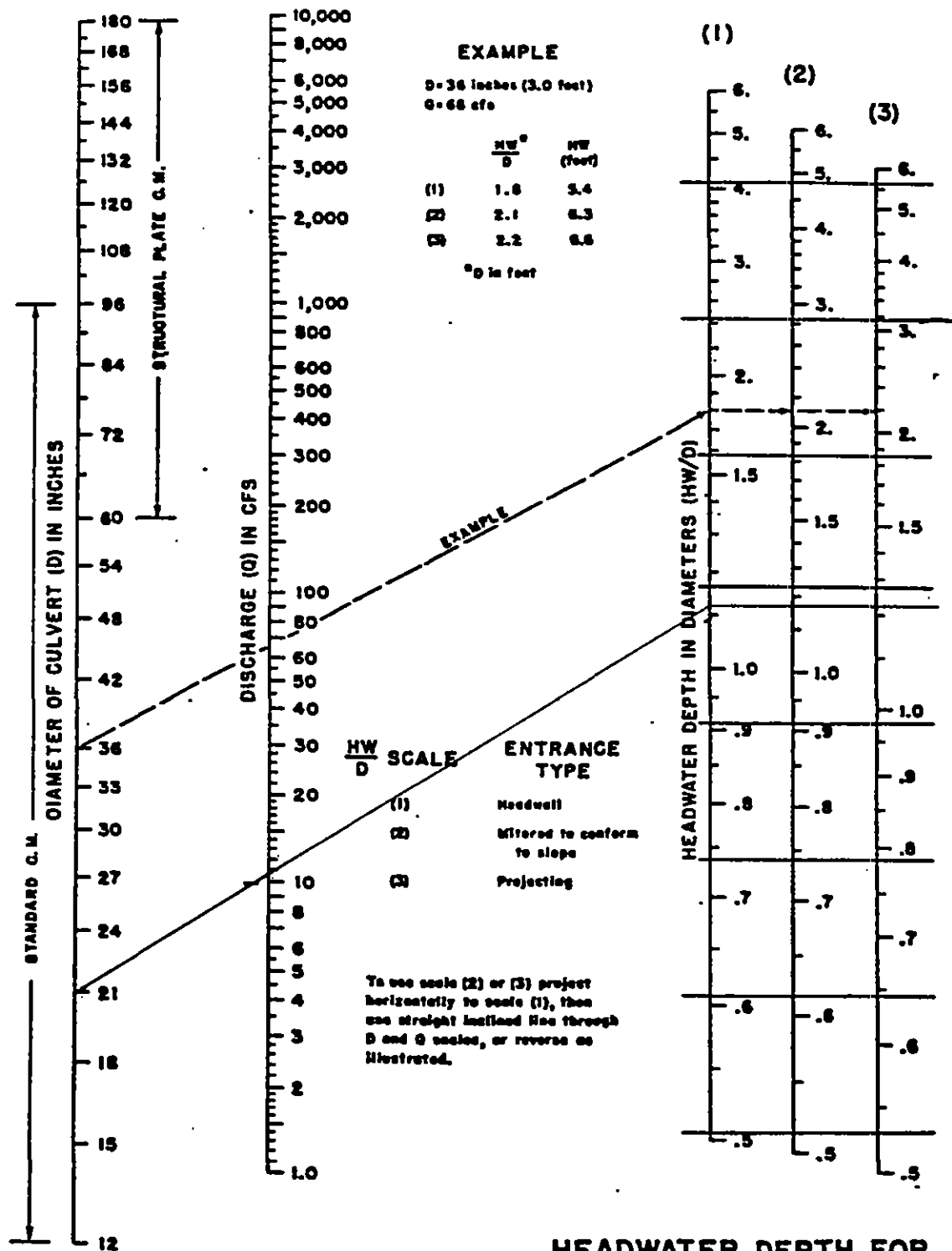
Smallest Diameter Required to Pass Flow is 9 inches

SEDCAD+ CULVERT SIZING UTILITY

C61

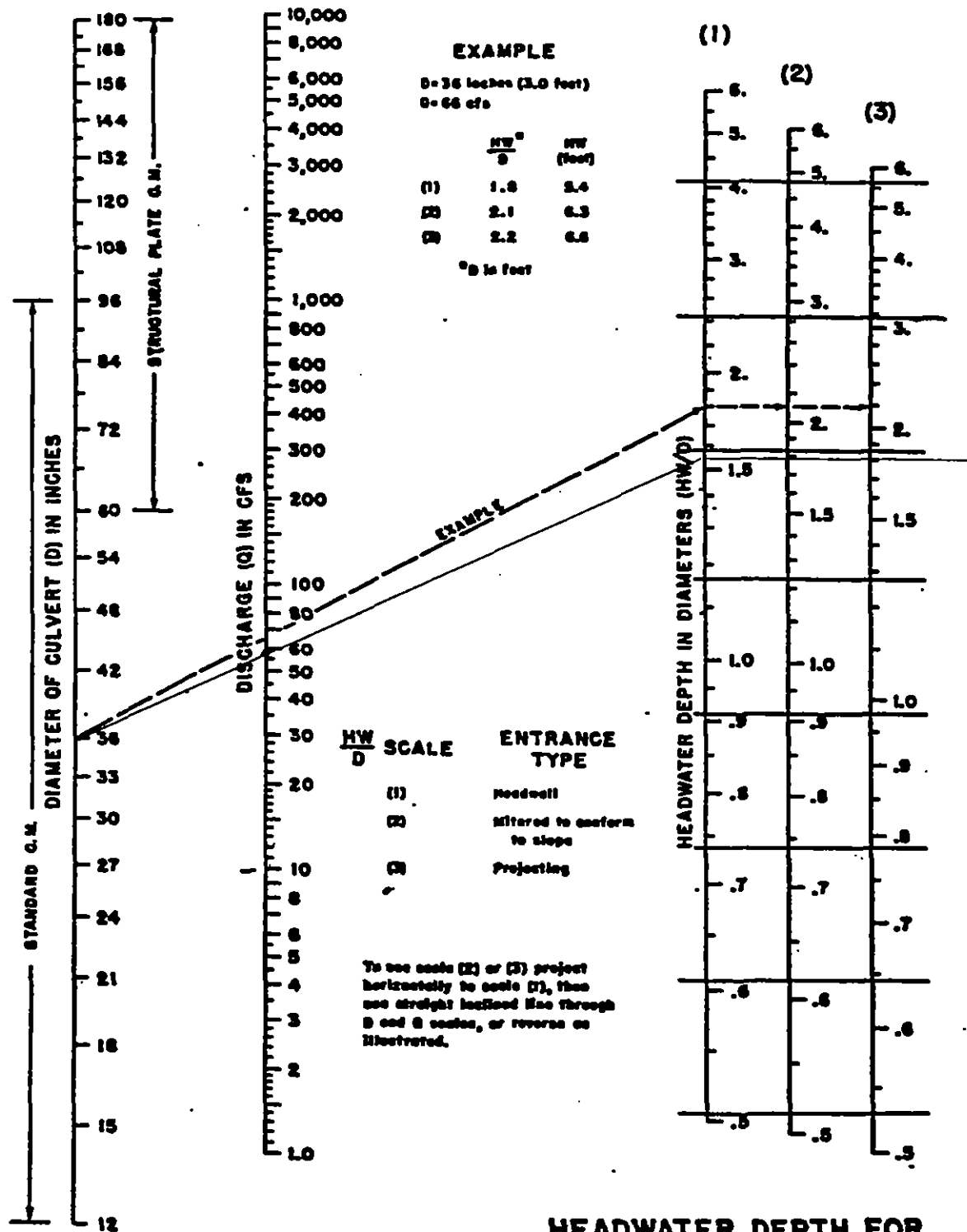
Design Discharge	=	0.950 cfs
Entrance Loss Coefficient	=	0.9
Pipe Length	=	30.000 feet
Pipe Slope	=	2.000 %
Manning's n	=	0.024
Maximum Headwater	=	1.000 feet
Tailwater Depth	=	0.200 feet

Smallest Diameter Required to Pass Flow is 8 inches

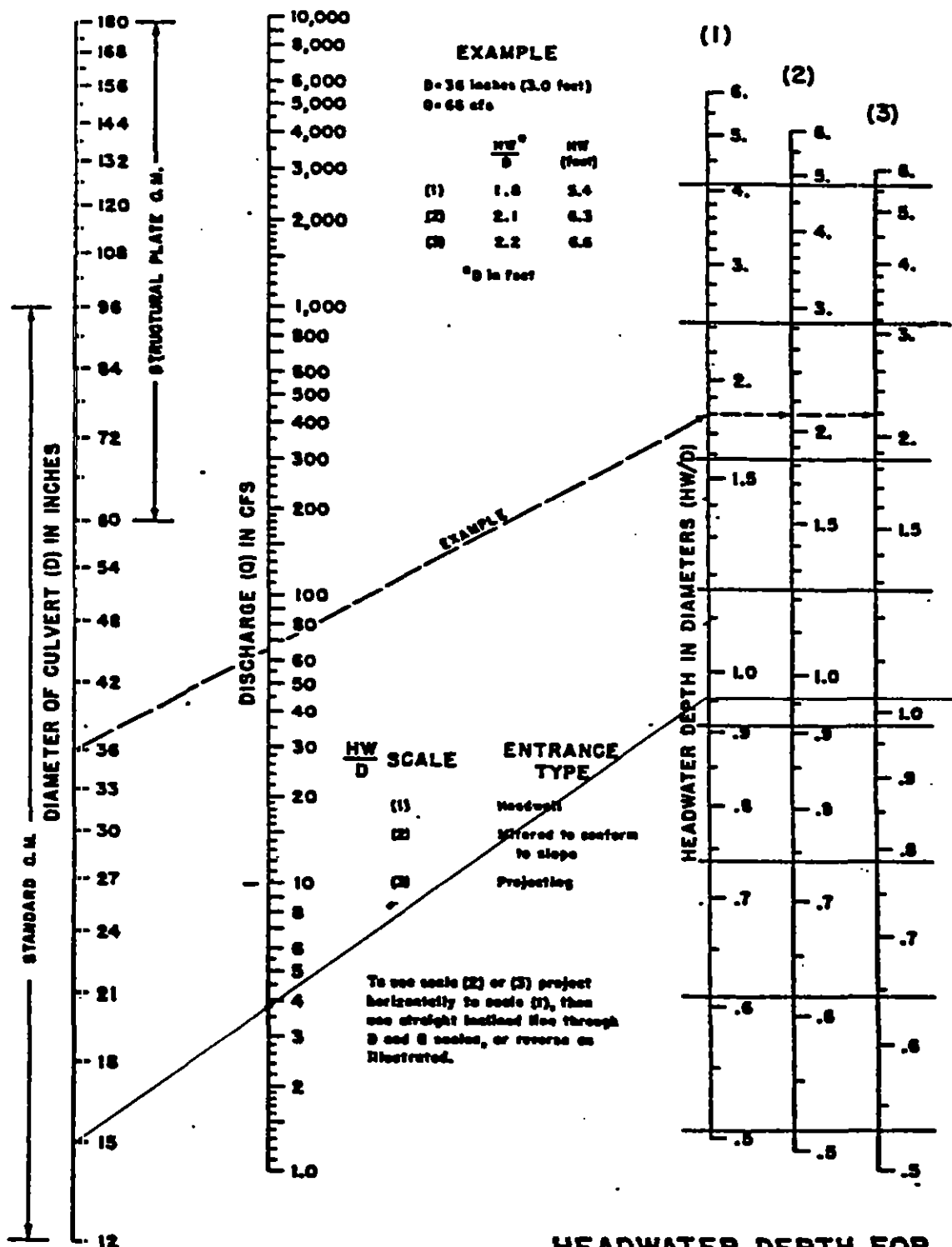


HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

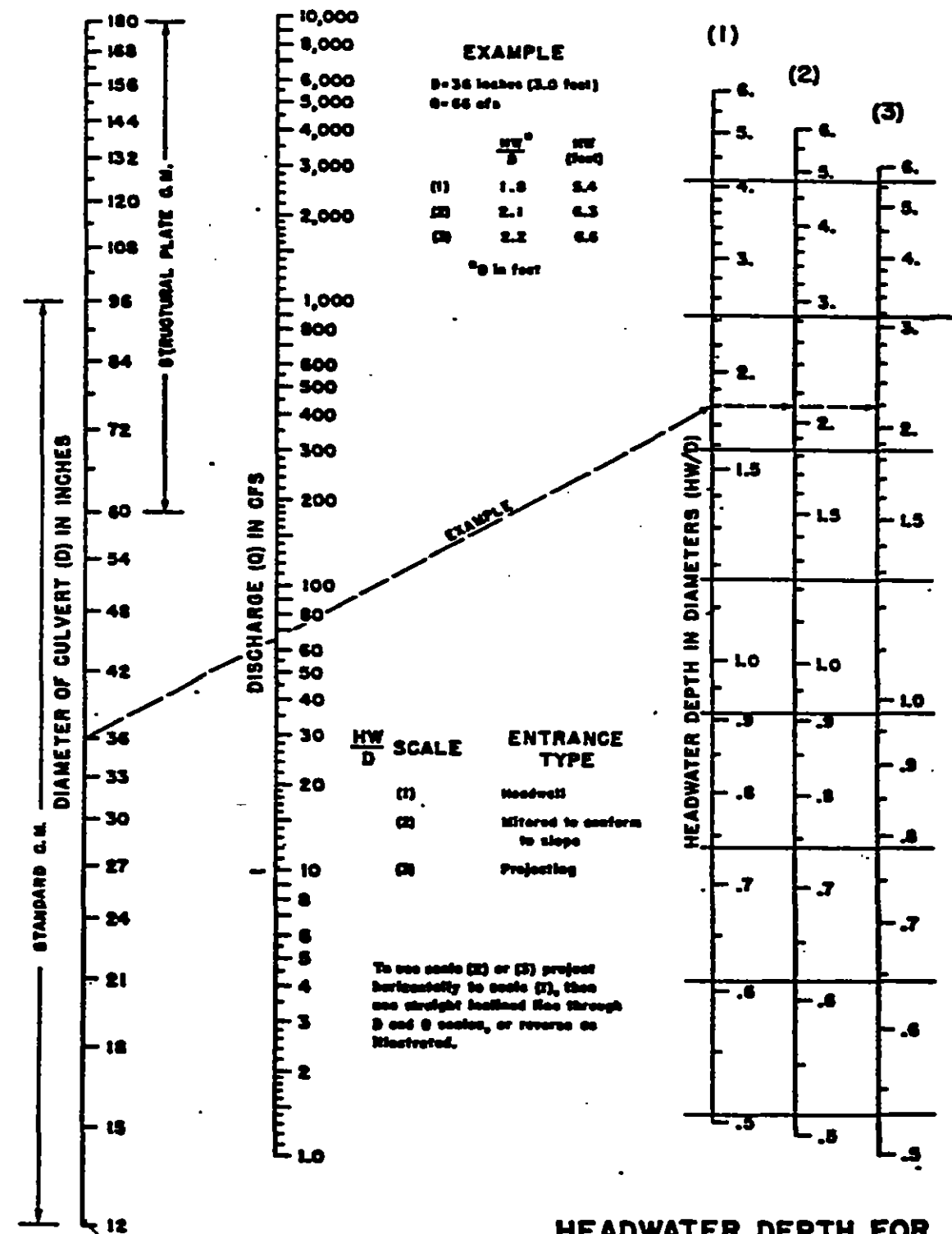
BUREAU OF PUBLIC ROADS JAN. 1963



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

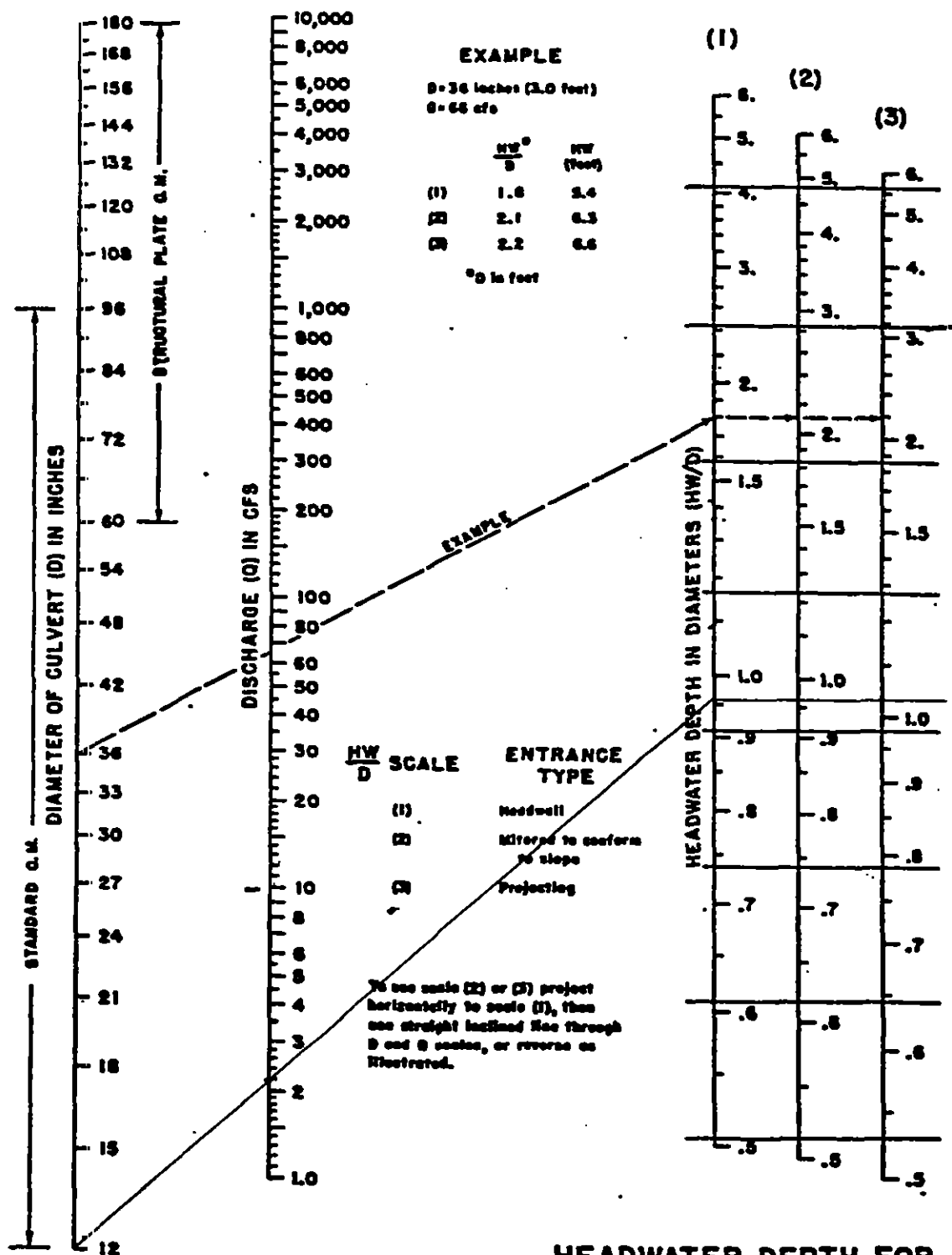


BUREAU OF PUBLIC ROADS JAN. 1923

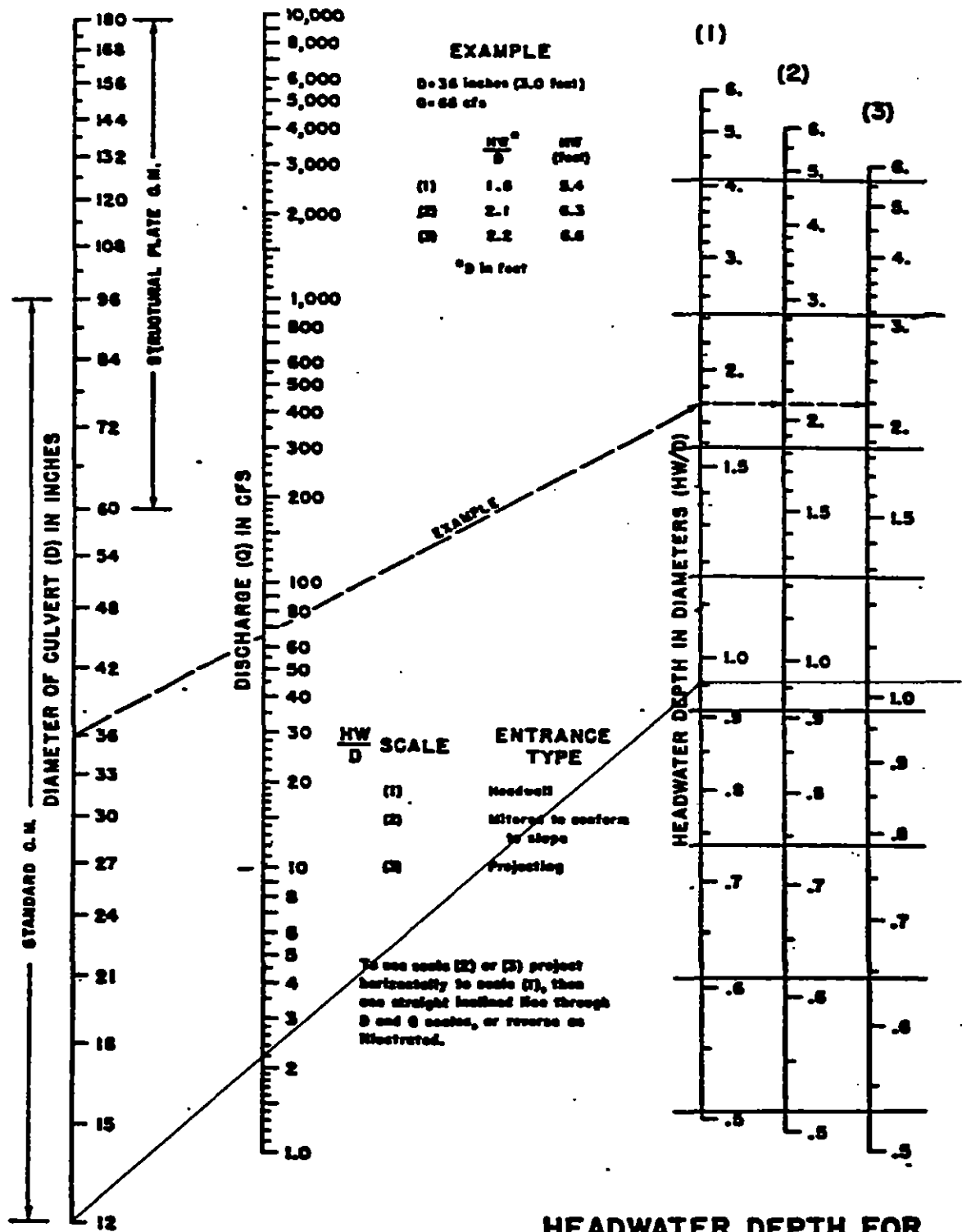
**HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL**

CULVERT C-35

Revised 4/2/95

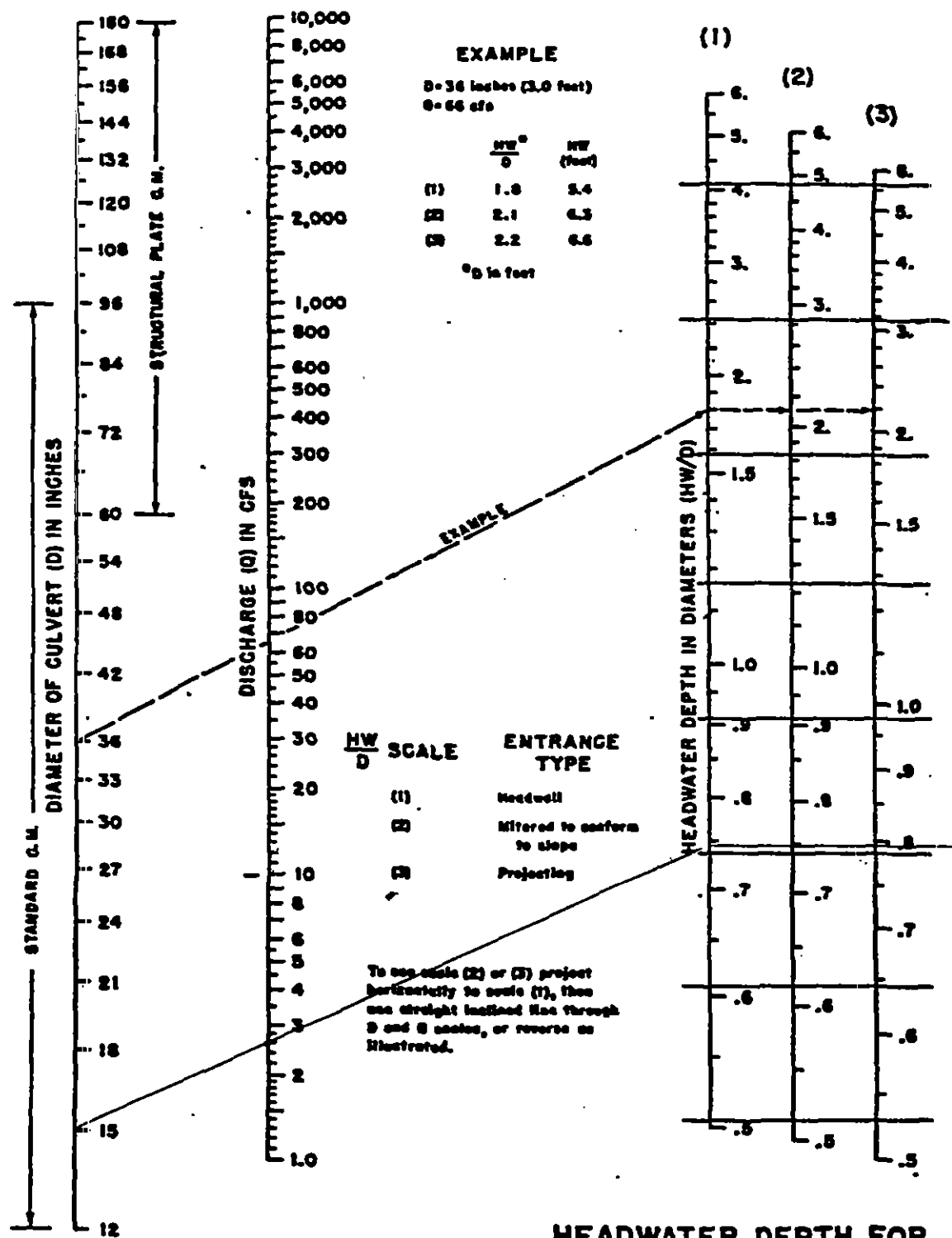


HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

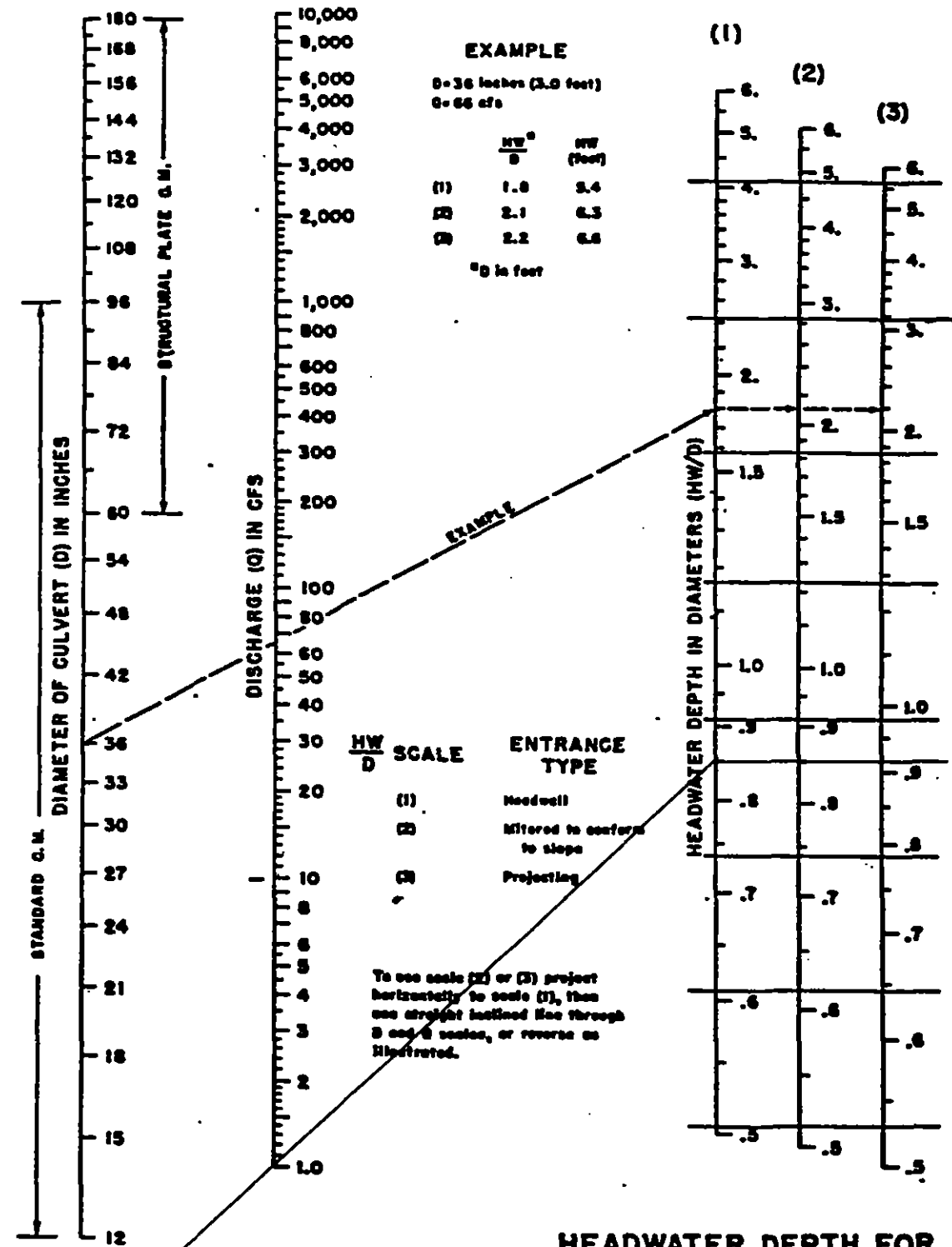


HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

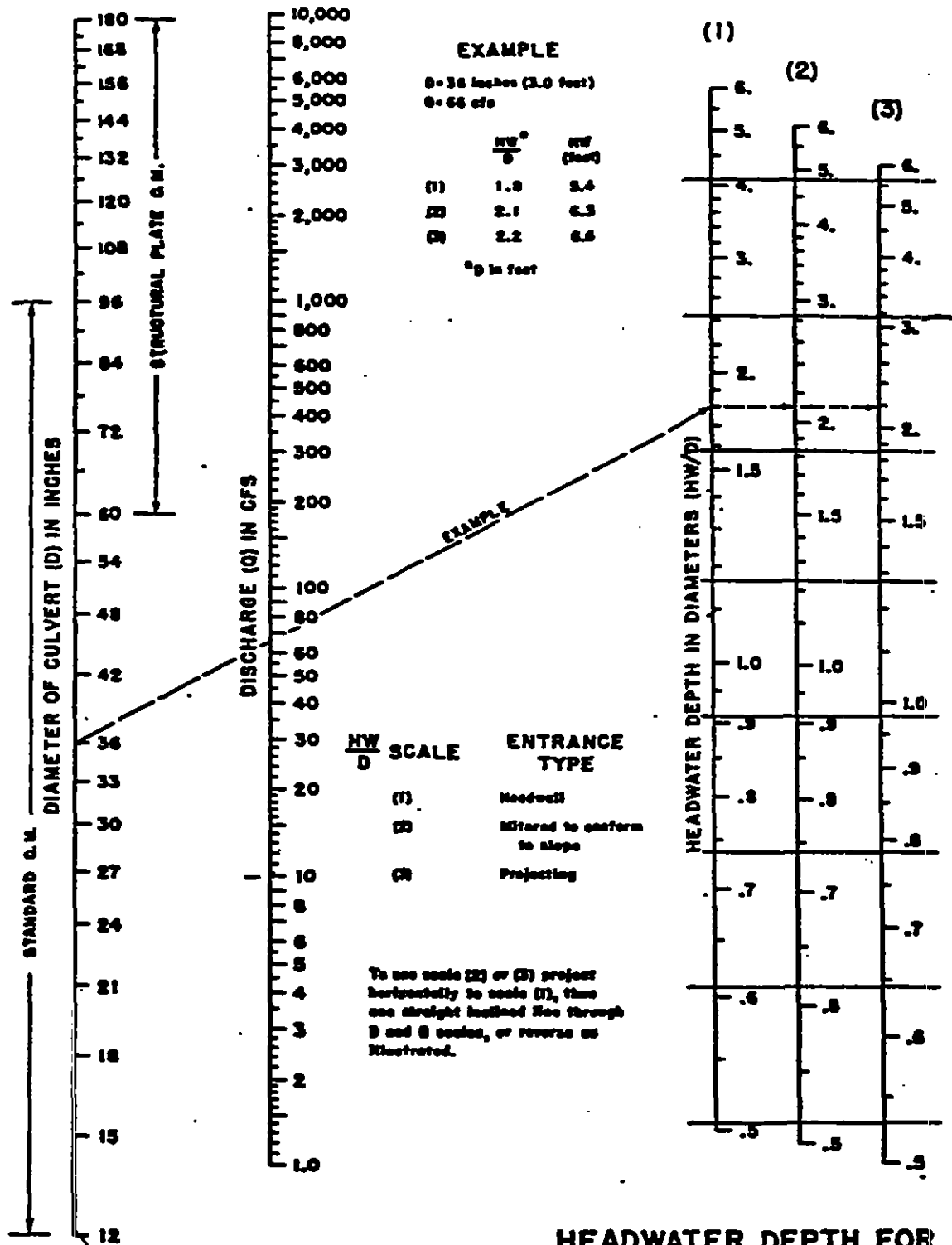
BUREAU OF PUBLIC ROADS JUL 1963



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL



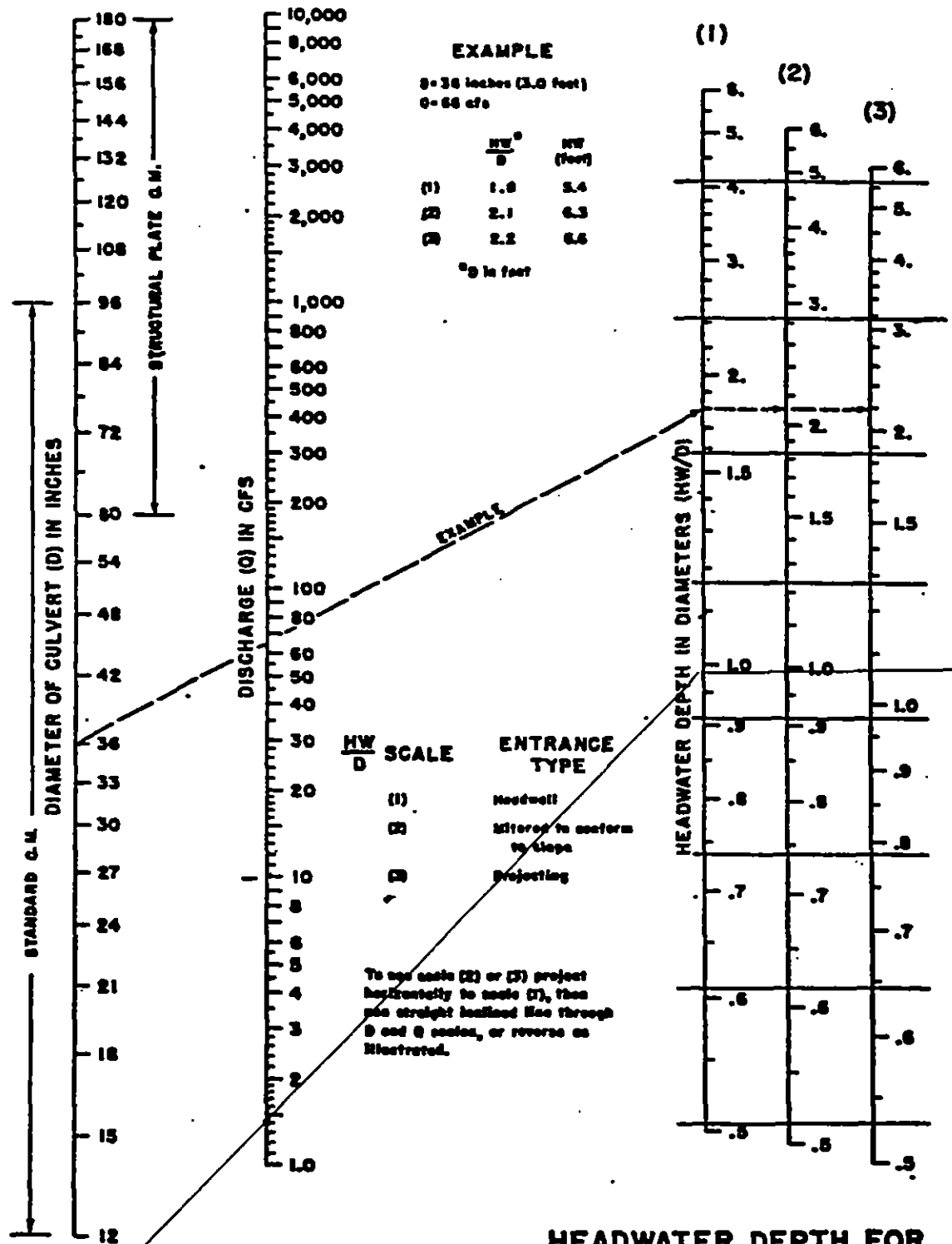
HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL



BUREAU OF PUBLIC ROADS JUL 1963

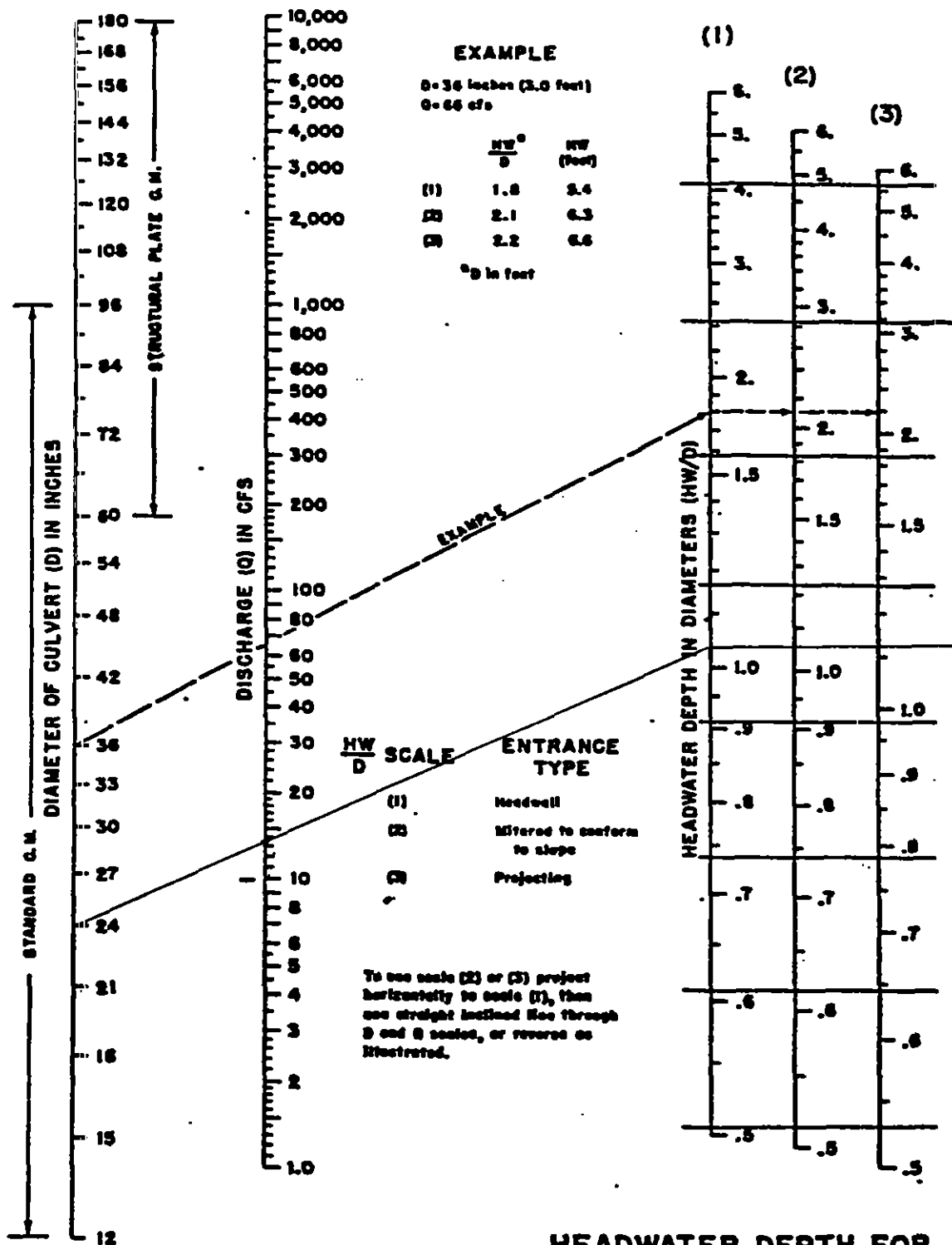
CULVERT C-58

Revised 4/2/95

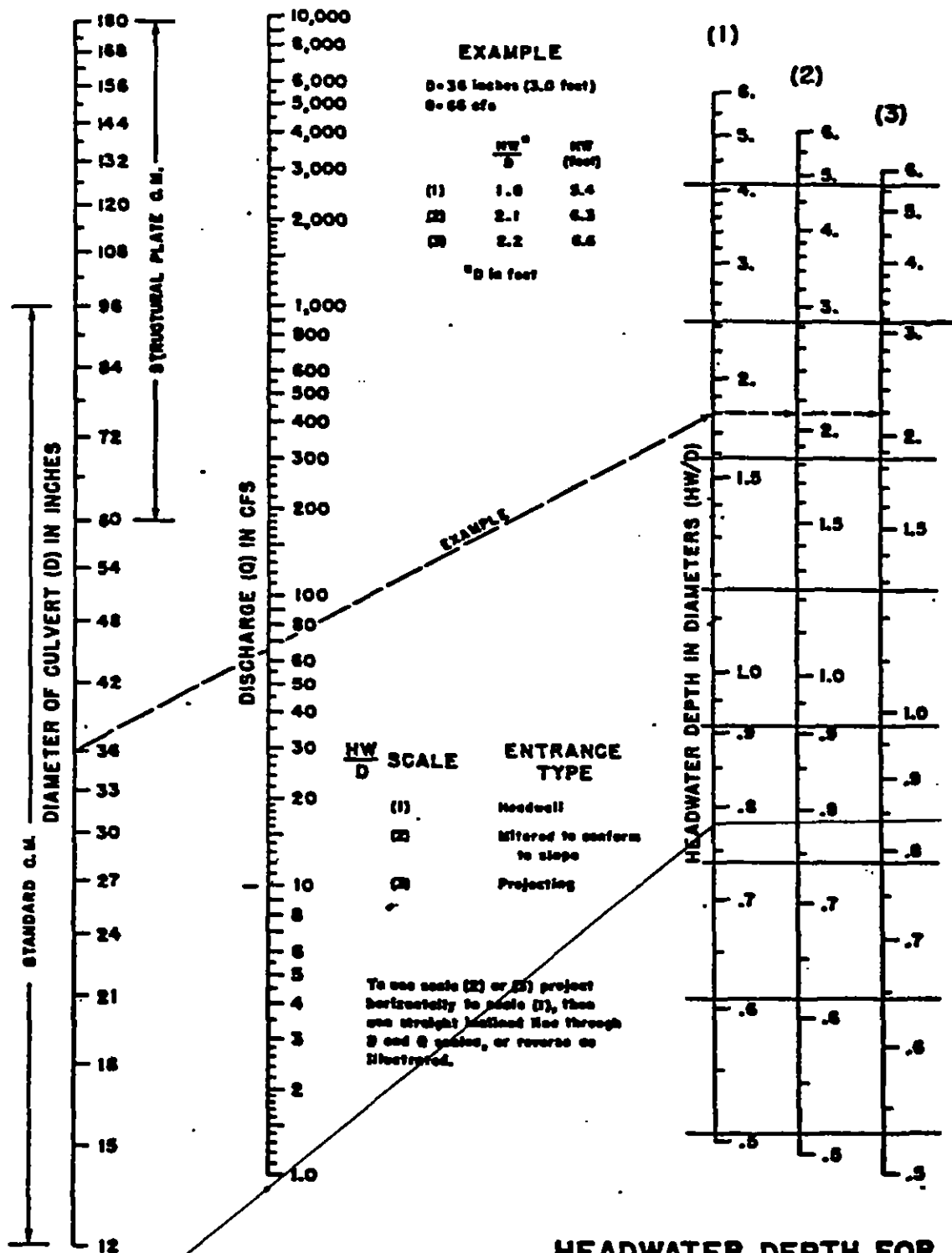


BUREAU OF PUBLIC ROADS JAN. 1943

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1945

SEDCAD+ ERODIBLE CHANNEL DESIGN

Ditch D-3; 100-year 24-hour storm

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR
Discharge	3.65 cfs
Slope	4.00 %
Sideslopes	5.00:1 (L) 2.50:1 (R)
Manning's n	0.030
Max. Velocity	5.00 fps
Material	GRADED LOAM - COBBLES NONCOLLOIDAL
Freeboard	0.5 ft

RESULTS:

Actual Discharge	3.65 cfs
Depth	0.50 ft
with Freeboard	<u>1.00 ft</u>
Top Width	<u>3.76 ft</u>
with Freeboard	<u>7.51 ft</u>
Velocity	<u>3.86 fps</u>
Cross Sectional Area	0.94 sq ft
Hydraulic Radius	0.24 ft
Froude Number	1.36

SEDCAD+ ERODIBLE CHANNEL DESIGN

Ditch D-2; 100-year 24-hour storm

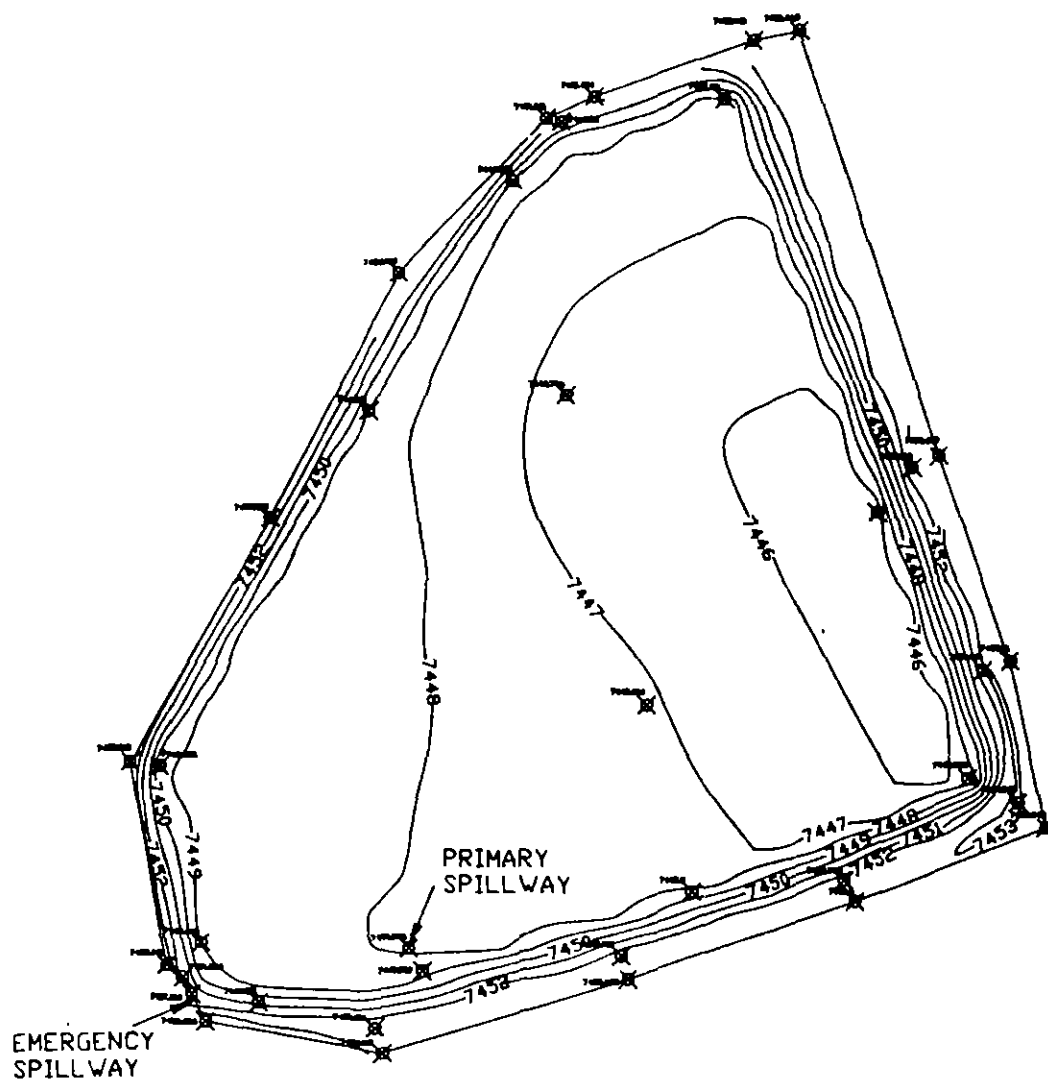
Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	13.38 cfs	
Slope	5.00 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Bottom Width	6.00 ft	
Manning's n	0.030	
Max. Velocity	5.50 fps	
Material		
Freeboard	.5 ft	

RESULTS:

Actual Discharge	13.37 cfs
Depth	0.37 ft
with Freeboard	<u>0.87 ft</u>
Top Width	7.85 ft
with Freeboard	<u>10.35 ft</u>
Velocity	<u>5.21 fps</u>
Cross Sectional Area	2.57 sq ft
Hydraulic Radius	0.32 ft
Froude Number	1.61



REV	BY	DATE
1	R.C.S.	2-95

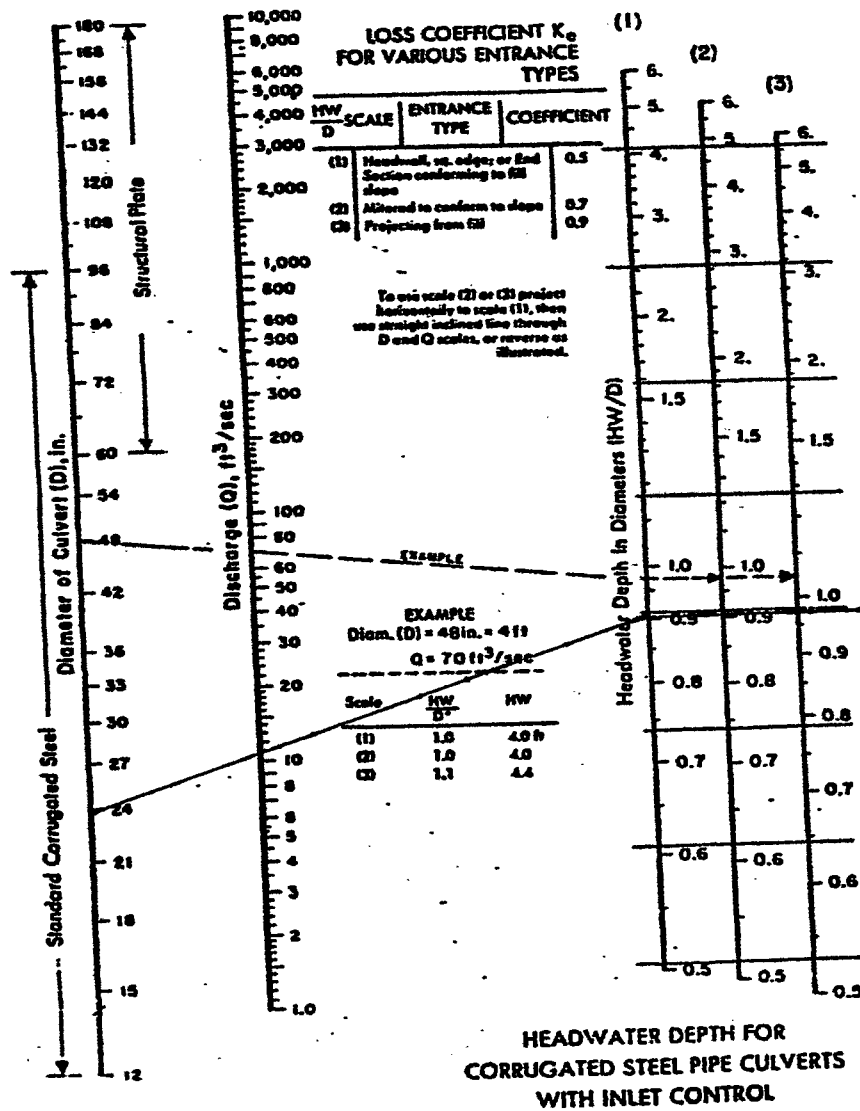
EXHIBIT 19.14

West Portal Culvert Design

TABLE 22 CULVERT SIZING NOMOGRAPH

From: "Handbook of Steel Drainage and Highway Construction Products"

CULVERT 23 at West Portal
Table 21 Peak Discharge 10 Yr.:24 Hr Storm Event = 11 CFS



FHWA HEC 5

Requires 24" Culvert @ $D = 0.95(24") = 23"$

EXHIBIT 19(15)

SEDIMENT DESIGN SPECIFICATION—SUBSTATION CUT



744 HORIZON COURT SUITE 110
GRAND JUNCTION, CO 81506

970-241-4722
970-241-8841 FAX
Email: info@rccwest.com

To: Susan Patton, Agapito Associates, Inc.
From: Marc Kenney, River City Consultants, Inc.
Date: October 20, 2010

Re: Substation Re-Grade Stormwater Calculation Summary

The purpose of this letter is to present my analysis of the 10 year 24 hour storm for the catchment draining towards the cut slope of the Substation re-grading area. This analysis included runoff modeling, ditch sizing, and culvert sizing.

The catchment of interest is located at the New Elk Coal Mine, owned by New Elk Coal Company, which is a subsidiary of Cline Mining. The New Elk Coal Mine property is located south of Highway 12 approximately 20 miles west of Trinidad, Colorado. The Substation re-grading area and associated upstream catchment are located south of the mine site on the side hill of the ridge running east-west south of the site. North of the catchment in question is the substation and various mine buildings. South of the site is a diversion ditch, an access road to the site water storage tanks, and the water storage tanks.

The area immediately adjacent to the substation is being re-graded to accommodate various mining operations. These operations include rock dust storage, improved substation access, and potential future portal access to various coal seams. The site is located towards the toe of the slope. The hillside above the area to be re-graded is undisturbed except for the diversion ditch and water storage tank access road. The diversion ditch was established to divert runoff from undisturbed catchments around mine operations and disturbed areas. This ditch was established some time ago and appears to be in need of re-design and/or repair. It is my understanding New Elk Coal Company intends to re-evaluate all diversion ditches and correct any issues in the near future. This analysis assumes this diversion ditch is functioning and can divert 100% of the 10 year 24 hour storm.

The vegetative cover for the catchment immediately upstream of the substation re-grading area is pinyon-juniper forest in good condition. Soil types are D, and it should be noted bedrock is close to the surface throughout the area. The hydrologic analysis was done using US EPA SWMM, SCS curve number, Manning's equation, and kinematic wave within Autodesk's Storm and Sanitary Analysis 2011 (formerly BOSS International's StormNET). The model was set up to represent worst case conditions such as back to back storms with saturated soils, or a runoff event occurring with frozen soils. Accordingly, the analysis

S:\PROJECTS\1134 Agapito - New Elk Mine\Design\StormNET\Substation re-grade Calc Summary.doc

assumed impervious area was 100% and the area with no depressions was 100%. NOAA Atlas 2 Volume III - Colorado was used to determine the 10 year 24 hour total precipitation (3 inches). A SCS Type II storm was used to model the 10 year 24 hour storm.

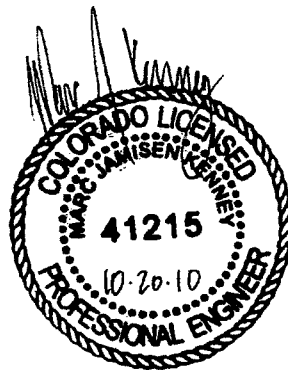
The model predicts the peak runoff to be 5.73 inches with 3 inches of runoff (zero infiltration). The required ditch size to convey that flow is a trapezoidal channel with a bottom width of 0.5 ft, a height of 1 ft, side slopes of 1:1, and a minimum slope of 3.25%. If a slope drain is used a minimum pipe diameter of 18 inches is recommended. It is likely the exposed slope will be bedrock, in which case a slope drain would not be necessary. It is also recommended that at the bottom of the slope where water is discharged be protected from erosion using D50=12 inch rip-rap over filter fabric.

Attached please find the output from the model. Please note the catchment in question is Sub-b1, the trapezoid channel is Link-05, and the pipe is Link-04.

If you have questions, concerns, or would like to discuss this further please don't hesitate to call.

Thanks,

Marc Kenney
CO PE #41215
CPSWQ #0623
CPESC #5695



mjk/

attachments

Project Description

File Name 1134-001 Grading Phase 1 (sub & hoist).SPF

Analysis Options

Flow Units cfs
 Subbasin Hydrograph Method. EPA SWMM
 Infiltration Method SCS Curve Number
 Link Routing Method Kinematic Wave
 Storage Node Exfiltration.. None
 Starting Date AUG-19-2010 00:00:00
 Ending Date AUG-21-2010 00:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:01:00
 Wet Time Step 00:01:00
 Dry Time Step 01:00:00
 Routing Time Step 30.00 sec

Element Count

Number of rain gages 1
 Number of subbasins 6
 Number of nodes 8
 Number of links 4
 Number of pollutants 1
 Number of land uses 3

Pollutant Summary

Pollutant ID	Units	Ppt. Concen.	GW Concen.	Kdecay 1/days	CoPollutant
TSS	MG/L	300.00	0.00	0.00	TSS (0.00)

Pollutant Land Types Summary

Land Type ID	Sweeping Interval days	Maximum Removal	Last Swept days
Existing Veg	0.00	0.00	0.00
Protected Disturbed	0.00	0.00	0.00
Unprotected Disturbed	0.00	0.00	0.00

Subbasin Summary

Subbasin ID	Total Area acres	Equiv. Width ft	Imperv. Area %	Average Slope %	Raingage
Sub-a1	5.41	441.11	100.00	28.6000	-

Sub-a2	2.25	121.88	100.00	20.0000	-
Sub-a3	13.78	558.10	100.00	30.9000	-
Sub-b1	1.39	120.00	100.00	20.0000	-
Sub-c	5.13	405.34	100.00	8.0000	-
Sub-d	20.68	484.97	100.00	4.5000	-

Node Summary

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
Jun-a1	JUNCTION	7541.00	7545.00	0.00	
Jun-a2	JUNCTION	7546.70	7600.00	0.00	
Jun-b3	JUNCTION	7470.00	7475.00	0.00	
Jun-b4	JUNCTION	7443.00	7448.00	0.00	
Out-a	OUTFALL	7527.00	7539.00	0.00	
Out-b	OUTFALL	7437.00	7438.00	0.00	
Out-c	OUTFALL	7635.00	7635.00	0.00	
Out-d	OUTFALL	7654.00	7654.00	0.00	

Link Summary

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Culvert h2o rd 2010 - 2	Jun-a1	Out-a	CHANNEL	69.5	5.7571	
0.0320						
Link-04	Jun-b3	Jun-b4	CONDUIT	29.2	92.4658	0.0150
Link-05	Jun-b4	Out-b	CHANNEL	184.6	3.2510	0.0250
Link-06	Jun-a2	Jun-a1	CHANNEL	626.5	0.9098	0.0320

Cross Section Summary

Link Design ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft
Culvert h2o rd 2010 - 2	TRAPEZOIDAL	2.00	5.00	1	6.00	
0.90						
Link-04	CIRCULAR	1.50	1.50	1	1.77	0.38
87.54						
Link-05	TRAPEZOIDAL	1.00	2.50	1	1.50	0.45
9.45						
Link-06	TRAPEZOIDAL	1.50	17.50	1	20.63	1.14
99.67						

Runoff Quantity Continuity

	Volume acre-ft	Depth inches
Total Precipitation	12.158	3.000
Evaporation Loss	0.000	0.000
Infiltration Loss	0.000	0.000

Surface Runoff	11.723	2.893
Final Surface Storage	0.437	0.108
Continuity Error (%)	-0.017	

```

*****
TSS
Runoff Quality Continuity
*****
Initial Buildup ..... 20570.337
Surface Buildup ..... 0.120
Wet Deposition ..... 9911.454
Sweeping Removal ..... 0.000
Infiltration Loss ..... 0.000
BMP Removal ..... 0.000
Surface Runoff ..... 9563.052
Remaining Buildup ..... 20920.195
Continuity Error (%) ..... -0.004

```

	Volume acre-ft	Volume Mgallons

Flow Routing Continuity		

Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	11.723	3.820
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	11.561	3.767
Surface Flooding	0.162	0.053
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.006	

```

*****
TSS
Quality Routing Continuity
*****
Dry Weather Inflow ..... 0.000
Wet Weather Inflow ..... 9563.051
Groundwater Inflow ..... 0.000
RDII Inflow ..... 0.000
External Inflow ..... 0.000
Internal Flooding ..... 66.217
External Outflow ..... 7169.150
Mass Reacted ..... 2327.809
Initial Stored Mass ..... 0.000
Final Stored Mass ..... 0.004
Continuity Error (%) ..... -0.001

```

Composite Curve Number Computations Report

Subbasin Sub-a1

Soil/Surface Description	Area (acres)	Soil Group	CN
Pinyon & Juniper range, Good	4.87	D	71.00
Dirt roads	0.54	D	89.00
Composite Area & Weighted CN	5.41		72.80

Subbasin Sub-a2

Soil/Surface Description	Area (acres)	Soil Group	CN
Pinyon & Juniper range, Good	2.21	D	71.00
Dirt roads	0.04	D	89.00
Composite Area & Weighted CN	2.25		71.36

Subbasin Sub-a3

Soil/Surface Description	Area (acres)	Soil Group	CN
Pinyon & Juniper range, Good	13.50	D	71.00
Dirt roads	0.28	D	89.00
Composite Area & Weighted CN	13.78		71.36

Subbasin Sub-b1

Soil/Surface Description	Area (acres)	Soil Group	CN
Pinyon & Juniper range, Good	1.39	D	71.00
Composite Area & Weighted CN	1.39		71.00

Subbasin Sub-c

Soil/Surface Description	Area (acres)	Soil Group	CN
Newly graded area	5.13	D	94.00
Composite Area & Weighted CN	5.13		94.00

Subbasin Sub-d

Soil/Surface Description	Area (acres)	Soil Group	CN
Newly graded area	20.68	D	94.00
Composite Area & Weighted CN	20.68		94.00

EPA SWMM Time of Concentration Computations Report

$$T_c = (0.94 * (L^{0.6}) * (n^{0.6})) / ((i^{0.4}) * (S^{0.3}))$$

Where:

Tc = Time of Concentration (min)
L = Flow Length (ft)
n = Manning's Roughness
i = Rainfall Intensity (in/hr)
S = Slope (ft/ft)

Subbasin Sub-a1

Flow length (ft):	534.51
Pervious Manning's Roughness:	0.60000
Impervious Manning's Roughness:	0.01000

Pervious Rainfall Intensity (in/hr):	0.12500
Impervious Rainfall Intensity (in/hr):	0.12500
Slope (%):	28.60000
Computed TOC (minutes):	8.60

=====

Subbasin Sub-a2

Flow length (ft):	804.25
Pervious Manning's Roughness:	0.60000
Impervious Manning's Roughness:	0.01000
Pervious Rainfall Intensity (in/hr):	0.12500
Impervious Rainfall Intensity (in/hr):	0.12500
Slope (%):	20.00000
Computed TOC (minutes):	12.23

Subbasin Sub-a3

=====

Flow length (ft):	1075.26
Pervious Manning's Roughness:	0.60000
Impervious Manning's Roughness:	0.01000
Pervious Rainfall Intensity (in/hr):	0.12500
Impervious Rainfall Intensity (in/hr):	0.12500
Slope (%):	30.90000
Computed TOC (minutes):	12.78

Subbasin Sub-b1

Flow length (ft):	505.11
Pervious Manning's Roughness:	0.60000
Impervious Manning's Roughness:	0.01000
Pervious Rainfall Intensity (in/hr):	0.12500
Impervious Rainfall Intensity (in/hr):	0.12500
Slope (%):	20.00000
Computed TOC (minutes):	9.25

Subbasin Sub-c

Flow length (ft):	550.79
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.10000
Pervious Rainfall Intensity (in/hr):	0.12500
Impervious Rainfall Intensity (in/hr):	0.12500
Slope (%):	8.00000
Computed TOC (minutes):	51.08

=====

Subbasin Sub-d

Flow length (ft):	1857.14
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01000
Pervious Rainfall Intensity (in/hr):	0.12500
Impervious Rainfall Intensity (in/hr):	0.12500
Slope (%):	4.50000
Computed TOC (minutes):	31.61

Subbasin Runoff Summary

Subbasin Time of ID Concentration hh:mm:ss	Total Rainfall in	Total Runon in	Total Evap. in	Total Infil. in	Total Runoff in	Peak Runoff cfs	Runoff Coefficient days
Sub-a1 00:08:35	3.000	0.000	0.000	0.000	3.001	22.33	1.000 0
Sub-a2 00:12:13	3.000	0.000	0.000	0.000	3.001	9.14	1.000 0
Sub-a3 00:12:46	3.000	0.000	0.000	0.000	3.001	55.74	1.000 0
Sub-b1 00:09:15	3.000	0.000	0.000	0.000	3.001	5.73	1.000 0
Sub-c 00:51:04	3.000	0.000	0.000	0.000	2.887	13.87	0.962 0
Sub-d 00:31:36	3.000	0.000	0.000	0.000	2.775	68.17	0.925 0
System	3.000	0.000	0.000	0.000	2.893	174.14	0.964

Subbasin Washoff Summary

Subbasin ID	TSS lbs
Sub-a1	1103.793
Sub-a2	458.831
Sub-a3	2809.148
Sub-b1	283.640
Sub-c	1006.034
Sub-d	3901.606
System	9563.052

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
Jun-a1	0.17	4.00	7545.00	0 11:56	0	0	0:00:00
Jun-a2	0.06	1.09	7547.79	0 12:00	0	0	0:00:00
Jun-b3	0.02	0.26	7470.26	0 12:00	0	0	0:00:00
Jun-b4	0.05	0.79	7443.79	0 12:00	0	0	0:00:00
Out-a	10.17	12.00	7539.00	0 11:56	0	0	0:00:00
Out-b	0.05	0.79	7437.79	0 12:00	0	0	0:00:00

Out-c	0.00	0.00	7635.00	0	00:00	0	0	0:00:00
Out-d	0.00	0.00	7654.00	0	00:00	0	0	0:00:00

Node Flow Summary

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days hh:mm
Jun-a1	JUNCTION	31.47	84.32	0 12:00	21.78	0 12:00
Jun-a2	JUNCTION	55.74	55.74	0 12:00	0.00	
Jun-b3	JUNCTION	5.73	5.73	0 12:00	0.00	
Jun-b4	JUNCTION	0.00	5.72	0 12:00	0.00	
Out-a	OUTFALL	0.00	62.38	0 11:56	0.00	
Out-b	OUTFALL	0.00	5.71	0 12:00	0.00	
Out-c	OUTFALL	13.87	13.87	0 12:06	0.00	
Out-d	OUTFALL	68.17	68.17	0 12:00	0.00	

Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs	Total TSS lbs
Out-a	66.72	1.96	62.38	2119.614
Out-b	52.98	0.17	5.71	141.747
Out-c	80.49	0.39	13.87	1005.668
Out-d	85.30	1.41	68.17	3901.291
System	71.37	3.93	149.30	7168.319

Link Flow Summary

Link ID	Ratio of	Total Time	Element Reported Type Condition	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum Flow /Design Flow
Culvert h2o rd 2010 - 2 CHANNEL	1.00	1.00	10 FLOODED	0 11:56	10.40	1.00	62.38	62.38	
Link-04		0	Calculated CONDUIT	0 12:00	27.83	1.00	5.72	87.54	0.07
Link-05		0	Calculated CHANNEL	0 12:00	5.66	1.00	5.71	9.45	0.60
Link-06		0	Calculated CHANNEL	0 12:01	4.19	1.00	55.01	99.67	0.55
0.71		0	Calculated						

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.03

Analysis began on: Wed Oct 20 08:38:55 2010
Analysis ended on: Wed Oct 20 08:38:58 2010
Total elapsed time: 00:00:03

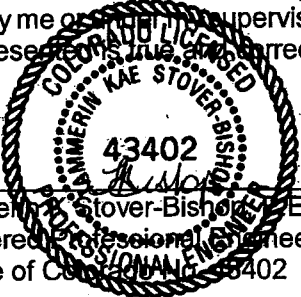
Exhibit 19 (16)
PROTECTION OF THE HYDROLOGIC BALANCE
BATES PORTAL & SUBSOIL & TOPSOIL STOCKPILES #1

Notes for Calculations:

1. Pages 2 through 4 present a spread sheet calculation of the incremental increase in the runoff volume for the Bates Portal based on the 10 year-24 hour event. It is assumed the flow from the Bates Portal area (prior to disturbance) was accounted for in the sizing of Pond 007. Therefore, the disturbance and resulting flow created by TR-55 is an incremental flow increase. The calculation is based on the difference between the flow from the undisturbed and the disturbed area applied to the increase is disturbed area (1.57 acres).
2. At the Bates Portal and SAE for Subsoil Stockpile #1, for continuity, curve numbers of 94 for newly graded areas and 89 for disturbed areas were used based on Exhibit 19(15) unless otherwise noted.
3. Design Points for the Bates Portal are shown on Map 13-A and discussed in Section 2.05.3(4).
4. Peak flow for ditches and culverts were calculated with SedCad 4.0. All new ditches have minimum freeboard of 0.3 feet. It is assumed all ditches, except D-24C and D-24-C4, are cut into bedrock and therefore rip rap has not been evaluated.
5. Sediment yield (incremental volume) was calculated using the Universal Soil Loss Equation (USLE), as shown on page 4 for the Bates Portal.
6. The design for Ditch 26 is based on vegetation and soils data as found in Exhibits 15 and 14 respectively. Curve number is based on Table 2-2d - Runoff curve numbers for arid and semi-arid rangelands. The soil type is D, and cover type is Pinon-Juniper with a 'Good' hydrologic condition, yielding a curve number equal to 71. Runoff is calculated based on the 10-year 24-hour event, precipitation equal to 3.0". A design is included for the dirt portion of the channel, and the concrete box portion of the channel.
7. The increased runoff from the Bates Portal disturbance has been added to pond 007 and pond 007 has adequate capacity for the increased runoff. However, downstream culverts and ditches have not been evaluated for capacity.
8. The SAE for Subsoil Stockpile and Topsoil Stockpile #1 requires the construction of a 2.5 foot high berm around the area and installing silt fences in the low points. The SAE demonstration on pages Exh.19(16)-25 through 31 shows that 26 feet of silt fence will result run-off from the area with a peak settleable concentration of less than 0.5 ml/l. The SAE is shown on Maps 11 & 12.

ENGINEER'S CERTIFICATION

The calculations and information presented on pages Exh.19(16)-2 through 31 with a date of and 03/11 were prepared by me or under my supervision during the months of January and March 2011, and the information presented is true and correct to the best of my knowledge and belief.


Tammie K. Stover-Bishop, P.E.
Registered Professional Engineer
State of Colorado License 43402

3/25/11
Date

EXHIBIT 19 (16)

PROTECTION OF THE HYDROLOGIC BALANCE

BATES PORTAL

EXHIBIT 19 (16)

PORTAL AREA

PROTECTION OF THE HYDROLOGIC BALANCE

STORM EVENTS

10 YEAR 24 HOUR EVENT

3.0 INCHES

The intent of this PHC is to determine the incremental flow increase into Pond 007. It is assumed the flow from Bates Portal area (prior to disturbance) was accounted for the sizing of Pond 007. Therefore, the disturbance and resulting flow created by TR-55 is an incremental flow increase. The calculation below is based on the difference in flow between the undisturbed and disturbed area, applied to the increase in disturbed area (1.57 Acres).

Curve numbers are developed based upon vegetation and soil types. Vegetation data are shown on Map 10 and presented in Exhibit 15. Soils data are shown Map 9 and presented in Exhibit 14. Ditches, culverts and drainage plans are shown on Map 13-A, and discussed in Section 2.05.3(4).

CURVE NUMBERS

Disturbed

Table 2-2b-Runoff curve numbers for cultivated and agricultural lands

Cover Type - Fallow - Bare Soil

Hydrologic Condition

Poor

Soil Type - Dargol-Fuera-Vamer

D

Curve Number

94

Undisturbed

Table 2-2d-Runoff curve numbers for arid and semiarid rangelands

Cover Type - Pinyon Juniper (Ponderosa-Pine-Oak)

Hydrologic Condition

Good

Soil Type - Dargol-Fuera-Vamer

D

Curve Number

71

RUN-OFF VOLUME - - Pond 7

Area	Acres	Curve #	10-Year Precip Amount	Direct Run-off	Run-off Vol A-F
Disturbed	1.57	94	3.0	2.35	0.31
Undisturbed	1.57	71	3.0	0.76	0.10
DIFFERENCE					0.21

SEDIMENT VOLUME - Pond 1

Use the universal soil loss equation.

$$A = R K L S C P$$

R = rainfall factor	70.00
K = soil erodibility factor - loam	0.37
LS = combined length slope factor	0.24
Use Area D-24C1 180 ft & 2%	
C = cropping management factor - Figure 7	1.00
P = erosion control practice factor	1.00
A = sediment, tons/acre/year	6.22

THREE YEAR SEDIMENT VOLUME - CUBIC FEET

1.57 ACRES - 115 #/CF 0.01

REQUIRED INCREASE IN CAPACITY -- Acre Feet - Pond 7 0.22

New Elk Mine

Bates Portal

Tamme Bishop

JE Stover & Associates, Inc.
2352 N. 7th Street, Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: tamme.jestover@bresnan.net

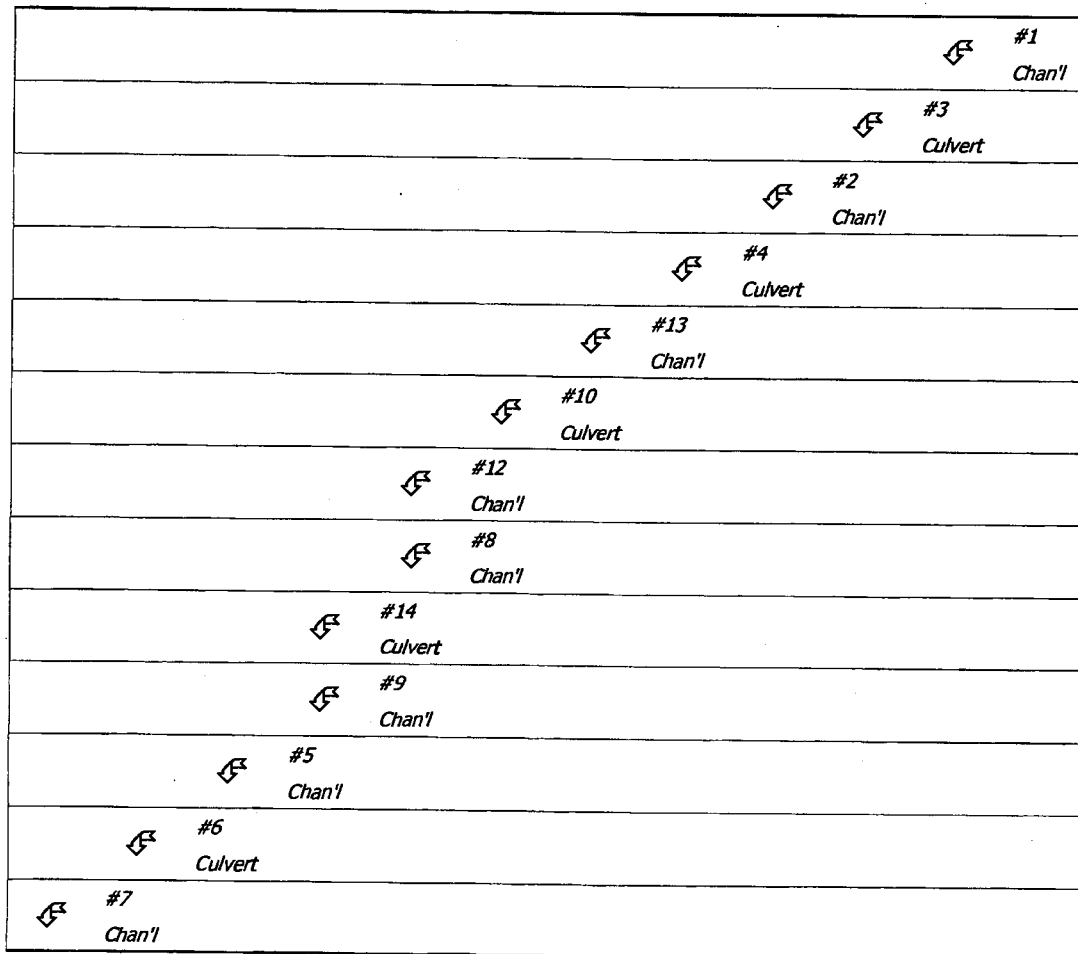
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.000	0.000	D-24-C1
Channel	#2	==>	#4	0.000	0.000	D-24-C2
Culvert	#3	==>	#2	0.000	0.000	Culvert 66
Culvert	#4	==>	#13	0.000	0.000	Culvert 67
Channel	#5	==>	#6	0.000	0.000	D-24C
Culvert	#6	==>	#7	0.000	0.000	Culvert 59
Channel	#7	==>	#11	0.000	0.000	D-24
Channel	#8	==>	#14	0.000	0.000	D-24C3
Channel	#9	==>	#5	0.000	0.000	D-24C4
Culvert	#10	==>	#12	0.000	0.000	C-68
Null	#11	==>	End	0.000	0.000	C-C20
Channel	#12	==>	#14	0.000	0.000	D-24C5
Channel	#13	==>	#10	0.000	0.000	D-24C6
Culvert	#14	==>	#5	0.000	0.000	C69



#11

Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
Ditch 24-C1	0.200	0.200	0.43	0.03
Culvert C-66	0.000	0.200	0.43	0.03
Ditch 24-C2	0.890	1.090	2.23	0.19
Culvert C-67	0.000	1.090	2.23	0.19
Ditch 24-C6	0.210	1.300	2.67	0.22
Culvert C-68	0.000	1.300	2.67	0.22
Ditch 24-C5	0.180	1.480	3.06	0.25
Ditch 24-C3	0.330	0.330	0.71	0.06
Culvert C-69	0.000	1.810	3.76	0.31
Ditch 24-C4	0.400	0.400	0.86	0.08
Ditch 24-C	0.090	2.300	4.81	0.40
Culvert C-59	0.000	2.300	4.81	0.40
Ditch 24*			15.8	
Culvert C-20*			63.0	

*Structures in Existence Prior to TR-55. Peak discharge equal to TR-55 flow added to flow prior to TR-55

Subwatershed Hydrology Detail:

	Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
Ditch 24-C3	#1	1	0.200	0.033	0.000	0.000	94.000	TR55	0.43	0.034
	Σ		0.200						0.43	0.034
Culvert 66	#3	Σ	0.200						0.43	0.034
Ditch 24-C2	#2	1	0.500	0.025	0.000	0.000	94.000	TR55	1.07	0.096
		2	0.390	0.008	0.000	0.000	89.000	TR55	0.74	0.061
	Σ		1.090						2.23	0.191
Ditch 24-C3	#4	Σ	1.090						2.23	0.191
Ditch 24-C6	#13	1	0.160	0.003	0.000	0.000	94.000	TR55	0.34	0.026
		2	0.050	0.002	0.000	0.000	89.000	TR55	0.09	0.004
	Σ		1.300						2.67	0.221
Culvert 68	#10	Σ	1.300						2.67	0.221
Ditch 24-C5	#12	1	0.180	0.009	0.000	0.000	94.000	TR55	0.39	0.030
	Σ		1.480						3.06	0.251
Ditch 24-C3	#8	1	0.330	0.018	0.000	0.000	94.000	TR55	0.71	0.063
	Σ		0.330						0.71	0.063
Culvert 69	#14	Σ	1.810						3.76	0.314
Ditch 24-C4	#9	1	0.400	0.038	0.000	0.000	94.000	TR55	0.86	0.077
	Σ		0.400						0.86	0.077
Ditch 24-C	#5	1	0.090	0.018	0.000	0.000	94.000	TR55	0.19	0.012
	Σ		2.300						4.81	0.403
Culvert 59	#6	Σ	2.300						4.81	0.403
Ditch 24	#7	Σ	2.300						4.81	0.403
Culvert 20	#11	Σ	2.300						4.81	0.403

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.21	4.00	181.00	1.480	0.033
#1	1	Time of Concentration:					0.033
#2	1	5. Nearly bare and untilled, and alluvial valley fans	10.03	28.60	285.00	3.160	0.025

SEDCAD 4 for Windows

Copyright 1998-2007 Pamela I. Schwab

2

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	Time of Concentration:					0.025
#2	2	5. Nearly bare and untilled, and alluvial valley fans	22.76	33.00	145.00	4.770	0.008
#2	2	Time of Concentration:					0.008
#5	1	5. Nearly bare and untilled, and alluvial valley fans	5.86	9.55	163.00	2.420	0.018
#5	1	Time of Concentration:					0.018
#8	1	5. Nearly bare and untilled, and alluvial valley fans	2.75	3.00	109.00	1.650	0.018
#8	1	Time of Concentration:					0.018
#9	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	3.94	197.00	1.410	0.038
#9	1	Time of Concentration:					0.038
#12	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	1.00	50.00	1.410	0.009
#12	1	Time of Concentration:					0.009
#13	1	5. Nearly bare and untilled, and alluvial valley fans	12.00	5.40	45.00	3.460	0.003
#13	1	Time of Concentration:					0.003
#13	2	5. Nearly bare and untilled, and alluvial valley fans	28.85	15.00	52.00	5.370	0.002
#13	2	Time of Concentration:					0.002

Structure Detail:

Structure #5 (Erodible Channel)

D-24C

Triangular Erodible Channel Inputs:

Material: Shales and hardpans

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	2.8	0.0250	0.35			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.81 cfs	
Depth:	0.72 ft	1.07 ft
Top Width:	2.88 ft	4.28 ft
Velocity:	4.64 fps	
X-Section Area:	1.04 sq ft	
Hydraulic Radius:	0.322 ft	
Froude Number:	1.36	

Structure Detail:

Structure #1 (Nonerodible Channel)

D-24-C1

Triangular Nonerodible Channel Inputs:

Material: Shotcrete

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	2.2	0.0170	0.75		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.43 cfs	
Depth:	0.26 ft	1.01 ft
Top Width:	1.04 ft	4.04 ft
Velocity:	3.11 fps	
X-Section Area:	0.14 sq ft	
Hydraulic Radius:	0.117 ft	
Froude Number:	1.51	

Structure Detail:

Structure #2 (Nonerodible Channel)

D-24-C2

Triangular Nonerodible Channel Inputs:

Material: Shotcrete

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult: x (VxD)
2.0:1	2.0:1	10.0	0.0170	0.65		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.23 cfs	
Depth:	0.37 ft	1.02 ft
Top Width:	1.47 ft	4.07 ft
Velocity:	8.32 fps	
X-Section Area:	0.27 sq ft	
Hydraulic Radius:	0.164 ft	
Froude Number:	3.42	

Structure Detail:

Structure #8 (Nonerodible Channel)

D-24C3

Triangular Nonerodible Channel Inputs:

Material: Shotcrete

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	1.0	0.0170	0.65		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.71 cfs	
Depth:	0.37 ft	1.02 ft
Top Width:	1.47 ft	4.07 ft
Velocity:	2.63 fps	
X-Section Area:	0.27 sq ft	
Hydraulic Radius:	0.164 ft	
Froude Number:	1.08	

Structure Detail:

Structure #9 (Erodible Channel)

D-24C4

Triangular Erodible Channel Inputs:

Material: Shales and hardpans

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	2.0	0.0250	0.60			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.86 cfs	
Depth:	0.40 ft	1.00 ft
Top Width:	1.60 ft	4.00 ft
Velocity:	2.67 fps	
X-Section Area:	0.32 sq ft	
Hydraulic Radius:	0.178 ft	
Froude Number:	1.05	

Structure Detail:

Structure #12 (Nonerodible Channel)

D-24C5

Triangular Nonerodible Channel Inputs:

Material: Shotcrete

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	2.0	0.0170	0.45		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.06 cfs	
Depth:	0.56 ft	1.01 ft
Top Width:	2.23 ft	4.03 ft
Velocity:	4.91 fps	
X-Section Area:	0.62 sq ft	
Hydraulic Radius:	0.249 ft	
Froude Number:	1.64	

Structure Detail:

Structure #13 (Nonerodible Channel)

D-24C6

Triangular Nonerodible Channel Inputs:

Material: Shotcrete

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	12.0	0.0170	0.65		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.67 cfs	
Depth:	0.38 ft	1.03 ft
Top Width:	1.52 ft	4.12 ft
Velocity:	9.32 fps	
X-Section Area:	0.29 sq ft	
Hydraulic Radius:	0.170 ft	
Froude Number:	3.77	

Bates Portal

Ditch 26

Upland Diversion Ditch

Tamme Bishop

JE Stover & Associates, Inc.
2352 N. 7th Street, Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: tamme.jestover@bresnan.net

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	52.700	52.700	32.38	3.33
#2	0.000	52.700	32.38	3.33

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	52.700	0.337	0.000	0.000	71.000	TR55	32.38	3.334
Σ		52.700						32.38	3.334

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	39.02	750.00	1,922.00	1.580	0.337
#1	1	Time of Concentration:					0.337

Ditch 26-Soil

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
0.50	2.0:1	5.0:1	5.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	32.38 cfs	
Depth:	1.14 ft	2.14 ft
Top Width:	8.51 ft	15.51 ft
Velocity:	6.29 fps	
X-Section Area:	5.15 sq ft	
Hydraulic Radius:	0.583 ft	
Froude Number:	1.42	
Manning's n:	0.0370	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Ditch D-26 - ConcreteMaterial: Concrete*Rectangular Channel*

Bottom Width (ft)	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	5.0	0.0150	0.30		

	w/o Freeboard	w/ Freeboard
Design Discharge:	32.38 cfs	
Depth:	0.76 ft	1.06 ft
Top Width:	3.00 ft	3.00 ft
Velocity:	14.11 fps	
X-Section Area:	2.29 sq ft	
Hydraulic Radius:	0.507 ft	
Froude Number:	2.84	

SAE Topsoil Stockpile #1
Subsoil Stockpile #1

Jim Stover

J. E. Stover & Associates, Inc.
2352 N 7th St Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: jestover@bresnan.net

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Particle Size Distribution:

Size (mm)	Cl
4.7600	100.000%
2.0000	100.000%
1.0000	90.000%
0.5000	88.000%
0.2500	85.000%
0.1250	82.000%
0.0630	74.000%
0.0160	56.000%
0.0040	38.000%
0.0010	1.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk K (hrs)	Musk X	Description
Silt Fence	#1	==>	End	0.000	0.000	

#1
Silt
Fence

SEDCAD 4 for Windows

Copyright 1998-2002 Pamela I. Schuch

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1 In	1.300	1.300	2.78	0.25	10.3	52,471	20.64	11.50
Out			2.66	0.25	4.4	25,404	0.49	0.24

Particle Size Distribution(s) at Each Structure***Structure #1:***

Size (mm)	In	Out
4.7600	100.000%	100.000%
2.0000	100.000%	100.000%
1.0000	90.000%	100.000%
0.5000	88.000%	100.000%
0.2500	85.000%	100.000%
0.1250	82.000%	100.000%
0.0630	74.000%	100.000%
0.0160	56.000%	100.000%
0.0040	38.000%	89.669%
0.0010	1.000%	2.360%

Structure Detail:

Structure #1 (Silt Fence)

Silt Fence Inputs:

Fence Flow Rate (gpm/sq ft)	Width along contour (ft)	Height (ft)	Land Slope (%)	Tie-back distance (ft)
10.0	26.0	2.5	2.00	125.0

*Sediment Storage: 0.00 ac-ft

*No sediment capacity defined

Silt Fence Results:

Peak Fence Stage:	1.31 ft
Peak Water Stage:	1.31 ft
Dewater Time:	0.50 days
Trap Efficiency:	57.62 %

Dewatering time is calculated from peak stage to lowest spillway

Stage-Capacity-Discharge Table

Fence Stage (ft)	Water Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
0.00	0.00	0.000	0.000	0.000	Top of Sediment
0.10	0.10	0.003	0.000	0.069	6.40
0.20	0.20	0.006	0.001	0.160	3.90
0.30	0.30	0.009	0.001	0.274	0.70
0.40	0.40	0.012	0.002	0.410	0.40
0.50	0.50	0.015	0.004	0.568	0.10
0.60	0.60	0.018	0.005	0.749	0.20
0.70	0.70	0.021	0.007	0.951	0.10
0.80	0.80	0.024	0.009	1.176	0.05
0.90	0.90	0.027	0.012	1.424	0.05
1.00	1.00	0.030	0.015	1.693	
1.10	1.10	0.033	0.018	1.985	0.05
1.20	1.20	0.036	0.021	2.299	
1.30	1.30	0.039	0.025	2.636	
1.31	1.31	0.039	0.025	2.655	0.00 Peak Stage
1.40	1.40	0.042	0.029	2.995	
1.50	1.50	0.045	0.034	3.376	
1.60	1.60	0.048	0.038	3.779	
1.70	1.70	0.051	0.043	4.205	

SEDCAD 4 for Windows

Copyright 1998-2002 Pamela I. Schuch

Fence Stage (ft)	Water Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
1.80	1.80	0.054	0.048	4.652	
1.90	1.90	0.057	0.054	5.123	
2.00	2.00	0.060	0.060	5.615	
2.10	2.10	0.063	0.066	6.130	
2.20	2.20	0.066	0.072	6.667	
2.30	2.30	0.069	0.079	7.226	
2.40	2.40	0.072	0.086	7.807	
2.50	2.50	0.075	0.093	8.411	

SEDCAD 4 for Windows

Copyright 1998-2007 Demeco I. Schwab

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	1.300	0.089	0.000	0.000	94.000	TR55	2.78	0.254
Σ		1.300						2.78	0.254

Subwatershed Sedimentology Detail:

Stru #	SWS #	Sol. K	L (ft)	S (%)	G	P	PS #	Sediment Conc (tons)	Peak Sediment Conc (mg/l)	Peak Settleable Conc (mg/l)	24W (ml/l)
#1	1	0.320	520.00	2.00	1.0000	1.0000	1	10.3	52,471	20.64	11.50
Σ								10.3	52,471	20.64	11.50

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.67	14.00	525.00	1.630	0.089
#1	1	Time of Concentration:					0.089

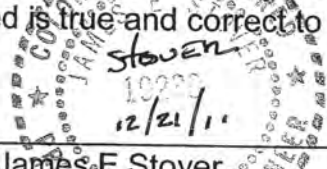
Exhibit 19(17)
SMALL AREA EXEMPTION - TR-61
LOCATED SOUTH OF POND 7

Notes for Calculations:

1. A curve number of 94 was used for newly graded areas.
2. The 1.8 acre small area exemption (SAE) is shown on Map 11, Sheets 1, 2 & 3.
3. The attached Figure 1 provides an up close view of the drainage patterns.
4. The SAE will be surrounded on the south and east sides by berms and or silt fences.
5. Flow to the SAE generally enters from the west.
6. Berms shall be at least 1.5 feet high.
7. A 40 foot long silt fence will be located at the low point in the small area exemption.
8. A berm will be constructed across the roads to direct the run-off to the silt fence. The silt fence is located between the roads and east of all activity. The berms across the road can be tapered to allow smooth traffic flow. Alternatively, a ditch could be constructed across the roads to direct run-off to the silt fence.

ENGINEER'S CERTIFICATION

The calculations and information presented on pages EXH. 19(17)-1 through 19(17)-10 with a date of 12/21/11 were prepared by me during the month of December 2011, and the information presented is true and correct to the best of my knowledge and belief.



James E. Stover
Registered Professional Engineer
State of Colorado No. 19230

Date

SAE South of Pond 7

Material Storage Area Associated Activities

Jim Stover

J. E. Stover & Associates, Inc.
2352 N 7th St Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: jestover@bresnan.net

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Particle Size Distribution:

Size (mm)	DFV-Top
2.0000	100.000%
1.0000	75.000%
0.5000	64.000%
0.2500	60.000%
0.1250	53.000%
0.0630	44.000%
0.0160	30.000%
0.0040	17.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Silt Fence	#1	==>	End	0.000	0.000	

#1
Silt
Fence

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1 In	1.800	1.800	3.85	0.35	14.6	53,886	31.59	17.59
Out			2.73	0.35	2.9	12,142	0.41	0.21

Particle Size Distribution(s) at Each Structure***Structure #1:***

Size (mm)	In	Out
2.0000	100.000%	100.000%
1.0000	75.000%	100.000%
0.5000	64.000%	100.000%
0.2500	60.000%	100.000%
0.1250	53.000%	100.000%
0.0630	44.000%	100.000%
0.0160	30.000%	100.000%
0.0040	17.000%	84.484%

Structure Detail:

Structure #1 (Silt Fence)

Silt Fence Inputs:

Fence Flow Rate (gpm/sq ft)	Width along contour (ft)	Height (ft)	Land Slope (%)	Tie-back distance (ft)
5.0	40.0	2.5	2.00	125.0

**Sediment Storage: 0.00 ac-ft*

**No sediment capacity defined*

Silt Fence Results:

Peak Fence Stage:	1.85 ft
Peak Water Stage:	1.85 ft
Dewater Time:	0.50 days
Trap Efficiency:	79.88 %

Dewatering time is calculated from peak stage to lowest spillway

Stage-Capacity-Discharge Table

Fence Stage (ft)	Water Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
0.00	0.00	0.000	0.000	0.000	Top of Sediment
0.10	0.10	0.005	0.000	0.050	0.05
0.20	0.20	0.009	0.001	0.111	6.90
0.30	0.30	0.014	0.002	0.184	2.50
0.40	0.40	0.018	0.004	0.267	0.85
0.50	0.50	0.023	0.006	0.362	0.35
0.60	0.60	0.028	0.008	0.468	0.25
0.70	0.70	0.032	0.011	0.585	0.15
0.80	0.80	0.037	0.015	0.713	0.15
0.90	0.90	0.041	0.018	0.852	0.10
1.00	1.00	0.046	0.023	1.003	0.10
1.10	1.10	0.051	0.028	1.164	0.10
1.20	1.20	0.055	0.033	1.337	0.05
1.30	1.30	0.060	0.039	1.521	0.10
1.40	1.40	0.064	0.045	1.716	0.10
1.50	1.50	0.069	0.052	1.922	0.10
1.60	1.60	0.073	0.059	2.139	0.05
1.70	1.70	0.078	0.066	2.367	0.05
1.80	1.80	0.083	0.074	2.607	0.05

SEDCAD 4 for Windows

Copyright 1998-2002 Pamela I. Schwab

Fence Stage (ft)	Water Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
1.85	1.85	0.085	0.078	2.729	0.02 Peak Stage
1.90	1.90	0.087	0.083	2.858	
2.00	2.00	0.092	0.092	3.119	
2.10	2.10	0.096	0.101	3.392	
2.20	2.20	0.101	0.111	3.676	
2.30	2.30	0.106	0.121	3.972	
2.40	2.40	0.110	0.132	4.278	
2.50	2.50	0.115	0.143	4.596	

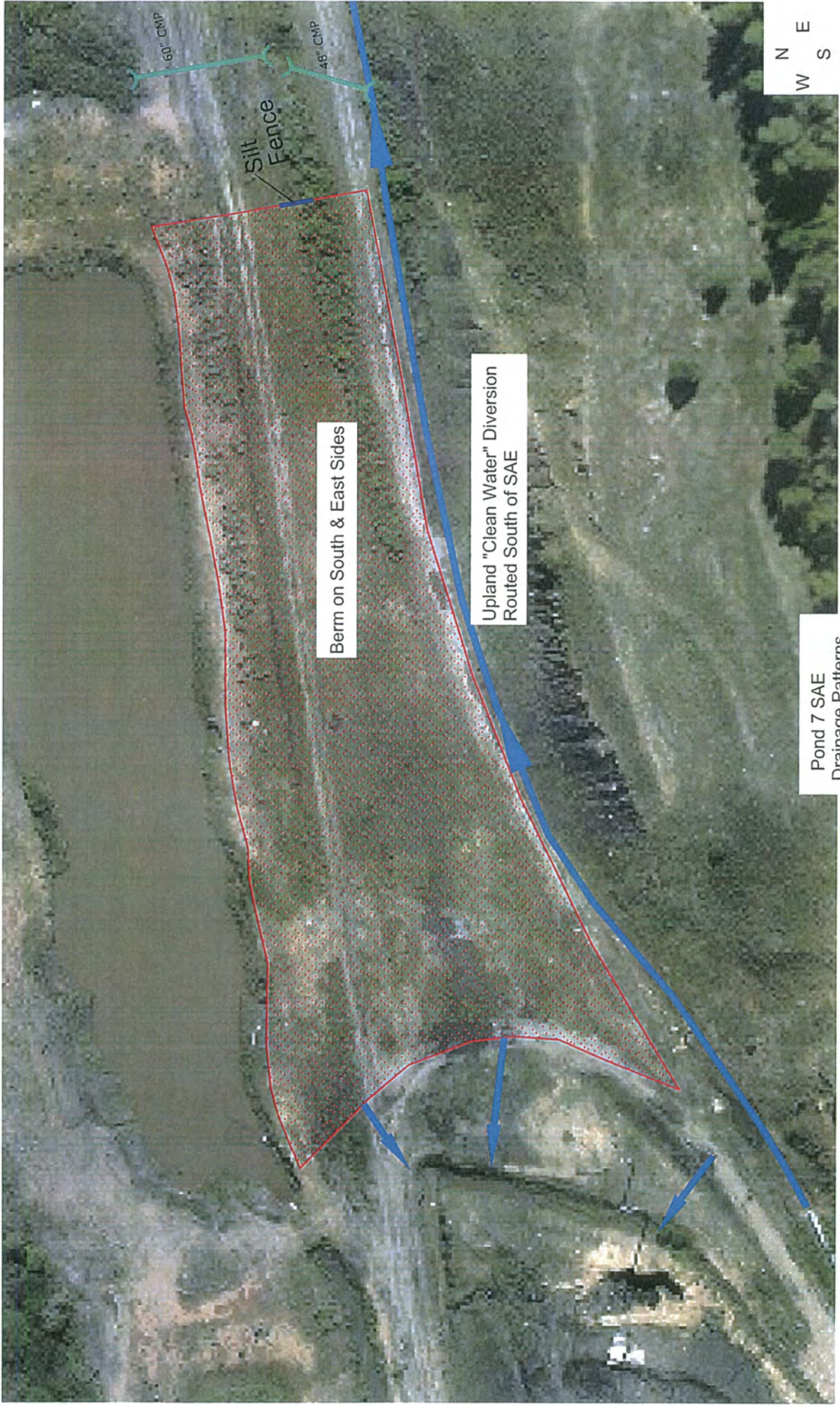
Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	1.800	0.100	0.000	0.000	94.000	TR55	3.85	0.352
Σ		1.800						3.85	0.352

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.320	500.00	2.00	1.0000	1.0000	1	14.6	53,886	31.59	17.59
Σ								14.6	53,886	31.59	17.59

Figure 1



Pond 7 SAE
Drainage Patterns
TR-61 Adequacy #1

Exhibit 19(18)
Fourteen New Culverts - TR-60
Three West of Development Waste Disposal Area C14A, C70 & C71
Three Culverts South of Truck Scales C72, C73 & C74 in Ditch D15
Four Culverts north of industrial building C16A, B, C & D in Ditch D16
One Culvert south of preparation plant C12A in Ditch 23
Two Culverts west of preparation plant C17A & C17 B in Ditch D22
New Culvert C28A
Resize Culverts C28 & C29
Check Size of Single C8 Culvert

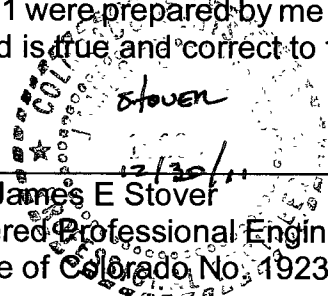
Notes for Calculations:

1. Culvert C70 is located down gradient of the refuse disposal area. The refuse disposal area sediment pond contains the run off from most of the drainage area above this culvert.
2. The drainage area between the refuse disposal area sediment pond embankment and culvert C70 is approximately 2.1 acres.
3. A curve number of 94 was used for this drainage area.
4. The following SEDCAD calculations show that culvert C70 will see a peak flow of 4.30 cfs and will need to be 18 inches in diameter. (Pages 2 - 7)
5. Culvert C14A is immediately downstream of culvert C14. Therefore culvert C14A will be sized the same as culvert C14. The peak flow is 44.4 cfs. Culvert C14 is 36 inches in diameter (Table 21). Calculations confirming the diameter of C14A are shown on page 8.
6. Culvert C71 is immediately upstream of containment area no. 4. The calculations for sizing containment no. 4 show a 10-year event of 1.03 cfs and a 25 year event of 1.29 cfs (Exhibit 19). A 12-inch diameter culvert is suitable at this location. Calculations confirming the diameter of C71 are shown on page 9.
7. 24 " Diameter culverts C72, C73 and C74 are all located in Ditch D15. Ditch D15 has a flow of 8.75 cfs (Table 20). Culvert design for C72, C73 and C74 are shown on Page 10.
8. 24" Diameter culverts C16A, C16B, 16C & 16D are located in Ditch 16 which has a flow of 11.35 cfs (Table 20). The design flow for culvert 16 shown in Table 21 is 11.96. Therefore culverts C16A, C16B, 16C & 16C will be designed for the higher flow. Culvert design for C16A, C16B, 16C & 16D are shown on Page 11.
9. Culvert 12A is located in ditch D23 which has a flow of 47.2 cfs (Table 20). Culvert design for C12A is shown on page 12.
10. Culverts 17A and 17B are located in ditch D22 which has a flow of 21.51 cfs (Table 20). The design flow for culvert 17 shown in Table 21 is 26.7. Therefore culverts C17A and C17B will be designed for the higher flow. Culvert designs for C17A and C17B are shown on page 13.
11. Culverts 28, 29 and new culvert 28A are optional culverts located in ditch D12. Ditch D12 has a flow of 8.75 cfs (Table 20). Culvert designs C28, C28A and C29 are shown on page 14.

12. Culvert C8 receives flow from ditches D5 (1.75 cfs), D10A (0.19 cfs), and possibly D4 (1.83 cfs) for a total flow of 3.77 cfs (Table 20). Culvert design for C8 is shown on page 15.

ENGINEER'S CERTIFICATION

The calculations and information presented on pages EXH. 19(18)-2 through 19(18)-15 with a date of 12/30/11 were prepared by me during the month of December 2011, and the information presented is true and correct to the best of my knowledge and belief.

The seal is circular with a star in the center. The text around the star reads "JAMES E. STOVER", "12/30/11", "REGISTERED PROFESSIONAL ENGINEER", and "STATE OF COLORADO NO. 19230". The name "Stover" is handwritten across the seal.

James E Stover
Registered Professional Engineer
State of Colorado No. 19230

Date

TR-60

Fourteen New Culverts

Three West of Development Waste Disposal Area C14A, C70 & C71

Three Culverts South of Truck Scales C72, C73 & C74 in Ditch D15

Four Culverts north of industrial building C16A, B, C & D in Ditch D16

One Culvert south of preparation plant C12A in Ditch 23

Two Culverts west of preparation plant C17A & C17 B in Ditch D22

New Culvert C28A

Re-size Culverts C28 & C29

Check Size of Single Culvert C8

Jim Stover

J. E. Stover & Associates, Inc.
2352 N 7th St Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: jestover@bresnan.net

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Culvert C70

#1
Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	2.100	2.100	4.30	0.38

Structure Detail:***Structure #1 (Culvert)****Culvert C70***Culvert Inputs:**

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
68.00	6.00	0.0240	1.25	0.00	0.90

Culvert Results:

Design Discharge = 4.30 cfs

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	2.100	0.019	0.000	0.000	92.000	TR55	4.30	0.378
Σ		2.100						4.30	0.378

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	16.55	48.00	290.00	4.060	0.019
#1	1	Time of Concentration:					0.019

Culvert C14A downstream of Culvert C14

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
82.00	5.00	0.0240	3.80	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 36 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 44.40 cfs

Maximum Headwater = 3.80 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (30 in)	Discharge (cfs) (36 in)	Discharge (cfs) (42 in)
0.38	1.23	1.48	1.72
0.76	3.47	4.16	4.86
1.14	6.37	7.65	8.92
1.52	9.81	11.77	13.74
1.90	13.71	16.45	19.19
2.28	18.02	21.63	25.23
2.66	22.71	27.25	31.79
3.04	27.20	33.29	38.85
3.42	31.08	39.73	46.35
3.80	34.54	45.03	54.29
4.18	37.68	49.98	61.79
4.56	40.57	54.48	68.37
4.94	43.27	58.63	74.46
5.32	45.82	62.51	80.10
5.70	48.23	66.17	85.36

Culvert C71

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
54.00	2.00	0.0240	0.70	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 1.03 cfs

Maximum Headwater = 0.70 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (10 in)	Discharge (cfs) (12 in)	Discharge (cfs) (15 in)
0.07	0.64	0.28	0.19
0.14	0.67	0.29	0.20
0.21	0.69	0.29	0.25
0.28	0.72	0.31	0.39
0.35	0.74	0.43	0.54
0.42	0.76	0.57	0.71
0.49	0.78	0.72	0.90
0.56	0.81	0.88	1.10
0.63	0.85	1.27	1.31
0.70	0.89	1.30	1.54
0.77	1.00	1.34	1.77
0.84	1.17	1.38	2.02
0.91	1.35	1.53	2.28
0.98	1.45	1.74	2.47
1.05	1.53	1.96	2.60

Culvert design C72, C73 and C74 all convey the 8.75 cfs flow in Ditch D15

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
190.00	2.00	0.0240	1.90	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 24 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 8.75 cfs

Maximum Headwater = 1.90 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (21 in)	Discharge (cfs) (24 in)	Discharge (cfs) (30 in)
0.19	0.30	0.35	0.43
0.38	0.87	0.98	1.23
0.57	1.58	1.81	2.26
0.76	2.43	2.78	3.47
0.95	3.39	3.88	4.85
1.14	4.46	5.10	6.37
1.33	5.62	6.42	8.03
1.52	6.87	7.85	9.81
1.71	8.19	9.36	11.71
1.90	8.77	10.97	13.71
2.09	9.52	12.65	15.82
2.28	12.03	13.25	18.02
2.47	12.41	13.93	20.32
2.66	12.68	17.26	22.71
2.85	12.92	17.78	25.19

Culverts C16A, B, C & D in Ditch D16

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
230.00	2.00	0.0240	2.10	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 24 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 11.96 cfs

Maximum Headwater = 2.10 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (21 in)	Discharge (cfs) (24 in)	Discharge (cfs) (30 in)
0.21	0.35	0.40	0.52
0.42	1.00	1.15	1.43
0.63	1.84	2.10	2.62
0.84	2.82	3.23	4.03
1.05	3.94	4.51	5.63
1.26	5.18	5.92	7.40
1.47	6.53	7.46	9.33
1.68	7.98	9.12	11.40
1.89	8.68	10.88	13.60
2.10	9.60	12.74	15.93
2.31	12.04	13.63	18.38
2.52	12.45	14.43	20.94
2.73	12.68	17.49	23.61
2.94	12.91	17.85	26.23
3.15	13.13	18.18	28.37

Culvert C12A located in Ditch D23

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
160.00	2.00	0.0240	4.00	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 36 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 47.20 cfs

Maximum Headwater = 4.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (30 in)	Discharge (cfs) (36 in)	Discharge (cfs) (42 in)
0.40	1.33	1.59	1.86
0.80	3.75	4.50	5.24
1.20	6.88	8.26	9.63
1.60	10.59	12.71	14.83
2.00	14.81	17.77	20.73
2.40	19.46	23.36	27.25
2.80	24.53	29.43	34.34
3.20	26.46	35.96	41.95
3.60	32.23	42.27	50.06
4.00	33.70	47.70	58.63
4.40	35.00	52.64	65.63
4.80	36.26	54.76	72.28
5.20	37.47	56.74	78.36
5.60	38.65	58.65	82.40
6.00	39.78	60.49	85.18

Culverts C17A & C17B in ditch D22

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
75.00	2.00	0.0240	3.00	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 36 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 26.70 cfs

Maximum Headwater = 3.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (30 in)	Discharge (cfs) (36 in)	Discharge (cfs) (42 in)
0.30	0.86	1.04	1.21
0.60	2.44	2.92	3.41
0.90	4.47	5.36	6.26
1.20	6.88	8.26	9.63
1.50	9.62	11.54	13.46
1.80	12.64	15.17	17.70
2.10	15.93	19.12	22.30
2.40	19.46	23.36	27.25
2.70	23.22	27.87	32.51
3.00	25.65	32.64	38.08
3.30	29.91	37.66	43.93
3.60	32.72	42.23	50.06
3.90	34.54	46.39	56.44
4.20	36.08	50.23	62.10
4.50	37.57	53.79	67.35

Culverts C28 C28A & C29 Located in Ditch D12

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
50.00	1.00	0.0240	2.00	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 21 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 8.75 cfs

Maximum Headwater = 2.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (18 in)	Discharge (cfs) (21 in)	Discharge (cfs) (24 in)
0.20	1.53	2.00	2.47
0.40	1.94	2.59	3.26
0.60	2.29	3.11	3.98
0.80	2.62	3.58	4.64
1.00	2.92	4.02	5.24
1.20	3.56	4.43	5.80
1.40	4.61	5.23	6.33
1.60	5.66	6.56	7.27
1.80	6.42	7.92	8.92
2.00	7.01	9.24	10.60
2.20	7.56	10.09	12.28
2.40	8.08	10.90	13.78
2.60	8.56	11.64	14.88
2.80	9.02	12.34	15.91
3.00	9.45	13.01	16.87

Culvert C8 Size Check

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	2.00	0.0240	1.35	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 3.77 cfs

Maximum Headwater = 1.35 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (15 in)	Discharge (cfs) (18 in)	Discharge (cfs) (21 in)
0.14	0.20	0.20	0.30
0.27	0.37	0.44	0.51
0.41	0.68	0.82	0.96
0.54	1.05	1.25	1.46
0.68	1.46	1.74	2.04
0.81	1.91	2.29	2.67
0.94	2.41	2.89	3.37
1.08	2.82	3.53	4.11
1.22	3.08	4.21	4.91
1.35	3.54	4.78	5.75
1.49	4.18	5.04	6.63
1.62	4.78	5.50	7.56
1.75	5.19	6.34	8.28
1.89	5.34	7.20	8.53
2.03	5.49	8.29	9.01

Exhibit 19(20)
UPLAND DIVERSION DITCHES
D18 and D26
Potable Water Tank Area

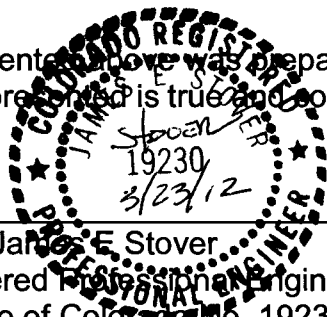
Installation of the potable water tank interfered with ditch D18. About 575 feet of D18 east of the potable water tank is no longer functional. To minimize the drainage area flowing to Pond 7, D26 will be extended about 425 feet to the west to intercept most of the drainage that was flowing to the affected section of D18 as shown on Map 13 Sheet 1. The extension of D26 to the west increases its drainage area by 1.26 acres. Reclamation of 575 feet of D18 will add 0.47 acres to the drainage area for Pond 7. The drainage area for D18 will be reduced by 1.73 acres. The following notes show that these drainage modifications are not significant.

Notes:

1. Reclaimed drainage ditch D18 will have a curve number of 87.
2. The run-off from the 0.47 additional acres flowing to Pond 7 with a curve number of 87 and a storm event of 3 inches is 0.07 AF.
3. Pond 7 has a capacity of 9.2 acre feet (PAP Section 2.05.3(4)) so the addition of 0.07 AF is not significant.
4. A berm will be constructed along west side of the potable water tank to direct drainage from the tank to Pond 7.
5. The drainage area for D26 increases by 1.26 acres as a result of this change.
6. D26 has a drainage area of 52.7 acres (Table 20).
7. The 1.26 acres of addition drainage area for D26 is not considered significant.
8. The 1.73 acre reduction in the drainage area for D18 is positive.

ENGINEER'S CERTIFICATION

The information presented above was prepared by me during the month of March 2012, and the information presented is true and correct to the best of my knowledge and belief.



James E. Stover
Registered Professional Engineer
State of Colorado No. 19230

Date

SAE Drill Sites **During Drilling**

Nominal 50 to 75 X100' Drill Pad
3H:1V or Flatter Slopes
Utilizing Existing Road for Part of Pad

Jim Stover

J. E. Stover & Associates, Inc.
2352 N 7th St Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: jestover@bresnan.net

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Particle Size Distribution:

Size (mm)	DFV-Top
2.0000	100.000%
1.0000	75.000%
0.5000	64.000%
0.2500	60.000%
0.1250	53.000%
0.0630	44.000%
0.0160	30.000%
0.0040	17.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Silt Fence	#1	==>	End	0.000	0.000	

#1
Silt
Fence

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1 In	0.500	0.500	1.07	0.10	2.4	32,545	19.08	10.72
Out			0.95	0.10	0.5	7,392	0.19	0.09

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
2.0000	100.000%	100.000%
1.0000	75.000%	100.000%
0.5000	64.000%	100.000%
0.2500	60.000%	100.000%
0.1250	53.000%	100.000%
0.0630	44.000%	100.000%
0.0160	30.000%	100.000%
0.0040	17.000%	87.210%

Structure Detail:

Structure #1 (Silt Fence)

Silt Fence Inputs:

Fence Flow Rate (gpm/sq ft)	Width along contour (ft)	Height (ft)	Land Slope (%)	Tie-back distance (ft)
5.0	20.0	2.5	2.00	125.0

*Sediment Storage: 0.00 ac-ft

*No sediment capacity defined

Silt Fence Results:

Peak Fence Stage:	1.12 ft
Peak Water Stage:	1.12 ft
Dewater Time:	0.50 days
Trap Efficiency:	80.51 %

Dewatering time is calculated from peak stage to lowest spillway

Stage-Capacity-Discharge Table

Fence Stage (ft)	Water Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
0.00	0.00	0.000	0.000	0.000		Top of Sediment
0.10	0.10	0.002	0.000	0.028	6.45	
0.20	0.20	0.005	0.000	0.067	3.90	
0.30	0.30	0.007	0.001	0.117	0.70	
0.40	0.40	0.009	0.002	0.178	0.30	
0.50	0.50	0.011	0.003	0.251	0.15	
0.60	0.60	0.014	0.004	0.334	0.15	
0.70	0.70	0.016	0.006	0.429	0.10	
0.80	0.80	0.018	0.007	0.535	0.10	
0.90	0.90	0.021	0.009	0.652	0.05	
1.00	1.00	0.023	0.011	0.780	0.05	
1.10	1.10	0.025	0.014	0.919		
1.12	1.12	0.026	0.014	0.948	0.01	Peak Stage
1.20	1.20	0.028	0.016	1.070		
1.30	1.30	0.030	0.019	1.231		
1.40	1.40	0.032	0.022	1.404		
1.50	1.50	0.034	0.026	1.588		
1.60	1.60	0.037	0.029	1.783		
1.70	1.70	0.039	0.033	1.989		
1.80	1.80	0.041	0.037	2.206		
1.90	1.90	0.044	0.041	2.434		

SEDCAD 4 for Windows

Copyright 1998-2002 Pamela L. Schwab

7

Fence Stage (ft)	Water Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
2.00	2.00	0.046	0.046	2.674	
2.10	2.10	0.048	0.051	2.924	
2.20	2.20	0.051	0.055	3.186	
2.30	2.30	0.053	0.061	3.459	
2.40	2.40	0.055	0.066	3.743	
2.50	2.50	0.057	0.072	4.039	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.500	0.100	0.000	0.000	94.000	TR55	1.07	0.096
Σ		0.500						1.07	0.096

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.320	150.00	2.00	1.0000	1.0000	1	2.4	32,545	19.08	10.72
Σ								2.4	32,545	19.08	10.72

SAE Drill Sites **Post Reclamation**

Nominal 50 to 75 X100' Drill Pad
3H:1V or Flatter Slopes
Utilizing Existing Road for Part of Pad

Jim Stover

J. E. Stover & Associates, Inc.
2352 N 7th St Unit B
Grand Junction, CO 81501

Phone: 970-245-4101
Email: jestover@bresnan.net

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	3.000 inches

Particle Size Distribution:

Size (mm)	DFV-Top
2.0000	100.000%
1.0000	75.000%
0.5000	64.000%
0.2500	60.000%
0.1250	53.000%
0.0630	44.000%
0.0160	30.000%
0.0040	17.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Silt Fence	#1	==>	End	0.000	0.000	

#1
Silt
Fence

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1 In	0.500	0.500	1.07	0.10	21.9	266,524	156.24	89.58
Out			0.88	0.10	3.9	61,712	0.42	0.20

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
2.0000	100.000%	100.000%
1.0000	75.000%	100.000%
0.5000	64.000%	100.000%
0.2500	60.000%	100.000%
0.1250	53.000%	100.000%
0.0630	44.000%	100.000%
0.0160	30.000%	100.000%
0.0040	17.000%	95.929%

Structure Detail:

Structure #1 (Silt Fence)

Silt Fence Inputs:

Fence Flow Rate (gpm/sq ft)	Width along contour (ft)	Height (ft)	Land Slope (%)	Tie-back distance (ft)
5.0	30.0	2.5	2.00	125.0

*Sediment Storage: 0.00 ac-ft

*No sediment capacity defined

Silt Fence Results:

Peak Fence Stage:	0.99 ft
Peak Water Stage:	0.99 ft
Dewater Time:	0.50 days
Trap Efficiency:	82.28 %

Dewatering time is calculated from peak stage to lowest spillway

Stage-Capacity-Discharge Table

Fence Stage (ft)	Water Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
0.00	0.00	0.000	0.000	0.000	Top of Sediment
0.10	0.10	0.003	0.000	0.039	8.45
0.20	0.20	0.007	0.001	0.089	2.35
0.30	0.30	0.010	0.001	0.150	0.40
0.40	0.40	0.014	0.003	0.223	0.20
0.50	0.50	0.017	0.004	0.306	0.10
0.60	0.60	0.021	0.006	0.401	0.15
0.70	0.70	0.024	0.008	0.507	0.10
0.80	0.80	0.028	0.011	0.624	0.10
0.90	0.90	0.031	0.014	0.752	0.10
0.99	0.99	0.034	0.017	0.878	0.04 Peak Stage
1.00	1.00	0.034	0.017	0.891	
1.10	1.10	0.038	0.021	1.042	
1.20	1.20	0.041	0.025	1.203	
1.30	1.30	0.045	0.029	1.376	
1.40	1.40	0.048	0.034	1.560	
1.50	1.50	0.052	0.039	1.755	
1.60	1.60	0.055	0.044	1.961	
1.70	1.70	0.059	0.050	2.178	

SEDCAD 4 for Windows

Copyright 1998-2002 Pamela I. Schwab

7

Fence Stage (ft)	Water Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
1.80	1.80	0.062	0.056	2.406	
1.90	1.90	0.065	0.062	2.646	
2.00	2.00	0.069	0.069	2.897	
2.10	2.10	0.072	0.076	3.158	
2.20	2.20	0.076	0.083	3.431	
2.30	2.30	0.079	0.091	3.715	
2.40	2.40	0.083	0.099	4.011	
2.50	2.50	0.086	0.108	4.317	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.500	0.100	0.000	0.000	94.000	TR55	1.07	0.096
Σ		0.500						1.07	0.096

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	1	0.320	25.00	33.00	1.0000	1.0000	1	21.9	266,524	156.24	89.58
Σ								21.9	266,524	156.24	89.58

East Outfall System (D55-E)

Colleen Koenig

Arcadis

Highlands Ranch CO

Phone: 7203694477

Email: colleen.koenig@arcadis.com

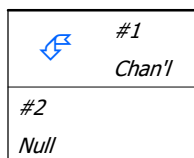
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	2.380 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	D55-E
Null	#2	==>	End	0.000	0.000	EAST OUTFALL



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	15.100	15.100	14.31	1.22
#2	0.000	15.100	14.31	1.22

Structure Detail:

Structure #1 (Riprap Channel)

D55-E

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	2.0	0.50		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	14.31 cfs	
Depth:	0.46 ft	0.96 ft
Top Width:	10.75 ft	13.75 ft
Velocity:	3.33 fps	
X-Section Area:	4.29 sq ft	
Hydraulic Radius:	0.394 ft	
Froude Number:	0.93	
Manning's n:	0.0340	
Dmin:	1.00 in	
D50:	1.50 in	
Dmax:	3.00 in	

Structure #2 (Null)

EAST OUTFALL

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	15.100	0.150	0.000	0.000	82.820	TR55	14.31	1.222
	Σ	15.100						14.31	1.222
#2	Σ	15.100						14.31	1.222

West Outfall to Pond 8 System

Colleen Koenig

Arcadis

Highlands Ranch CO

Phone: 7203694477

Email: colleen.koenig@arcadis.com

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	2.380 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	D55-W-1
Channel	#2	==>	#3	0.000	0.000	D55-W-2 D55-W-2
Channel	#3	==>	#4	0.000	0.000	D55-W-3 D55-W-3
Culvert	#4	==>	#5	0.000	0.000	Culvert 2023 RDA #1
Channel	#5	==>	#9	0.000	0.000	D-55-W-4 D-55-W-4
Channel	#6	==>	#7	0.000	0.000	D55-INT-1
Channel	#7	==>	#8	0.000	0.000	D55-INT-2 D55-INT-2
Culvert	#8	==>	#9	0.000	0.000	Existing C81
Channel	#9	==>	#10	0.000	0.000	D55-OUT-1 D55-OUT-1
Null	#10	==>	End	0.000	0.000	Pond 8 Outfall



#10

Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6	2.350	2.350	3.00	0.24
#7	4.580	6.930	8.84	0.70
#8	0.000	6.930	8.84	0.70
#1	10.200	10.200	10.75	0.81
#2	0.000	10.200	10.75	0.81
#3	0.000	10.200	10.75	0.81
#4	0.000	10.200	10.75	0.81
#5	0.000	10.200	10.75	0.81
#9	0.000	17.130	19.59	1.51
#10	0.000	17.130	19.59	1.51

Structure Detail:

Structure #6 (Riprap Channel)

D55-INT-1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	5.0	0.50		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.00 cfs	
Depth:	0.23 ft	0.73 ft
Top Width:	5.39 ft	8.39 ft
Velocity:	2.77 fps	
X-Section Area:	1.08 sq ft	
Hydraulic Radius:	0.199 ft	
Froude Number:	1.09	
Manning's n:	0.0410	
Dmin:	1.00 in	
D50:	1.50 in	
Dmax:	3.00 in	

Structure #7 (Riprap Channel)

D55-INT-2

D55-INT-2

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	2.0:1	2.0:1	5.0	0.50		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	8.84 cfs	
Depth:	0.49 ft	0.99 ft
Top Width:	4.95 ft	6.95 ft
Velocity:	4.56 fps	
X-Section Area:	1.94 sq ft	
Hydraulic Radius:	0.374 ft	
Froude Number:	1.28	
Manning's n:	0.0380	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure #8 (Culvert)

Existing C81

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
95.00	10.00	0.0240	2.00	0.00	0.90

Culvert Results:

Design Discharge = 8.84 cfs

Minimum pipe diameter: 1 - 21 inch pipe(s) required

Structure #1 (Riprap Channel)

D55-W-1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	2.0	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.75 cfs	
Depth:	0.39 ft	1.39 ft

	w/o Freeboard	w/ Freeboard
Top Width:	10.37 ft	16.37 ft
Velocity:	2.96 fps	
X-Section Area:	3.63 sq ft	
Hydraulic Radius:	0.345 ft	
Froude Number:	0.88	
Manning's n:	0.0350	
Dmin:	1.00 in	
D50:	1.50 in	
Dmax:	3.00 in	

Structure #2 (Riprap Channel)

D55-W-2

D55-W-2

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	11.0	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.75 cfs	
Depth:	0.27 ft	1.27 ft
Top Width:	9.62 ft	15.62 ft
Velocity:	4.51 fps	
X-Section Area:	2.38 sq ft	
Hydraulic Radius:	0.246 ft	
Froude Number:	1.60	
Manning's n:	0.0430	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure #3 (Riprap Channel)

D55-W-3

D55-W-3

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	13.0	0.50		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.75 cfs	
Depth:	0.40 ft	0.90 ft
Top Width:	6.39 ft	9.39 ft
Velocity:	5.20 fps	
X-Section Area:	2.07 sq ft	
Hydraulic Radius:	0.317 ft	
Froude Number:	1.61	
Manning's n:	0.0480	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure #4 (Culvert)

Culvert 2023 RDA #1

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
50.00	20.00	0.0120	2.00	0.00	0.90

Culvert Results:

Design Discharge = 10.75 cfs

Minimum pipe diameter: 1 - 24 inch pipe(s) required

Structure #5 (Riprap Channel)

D-55-W-4

D-55-W-4

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	34.0	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.75 cfs	
Depth:	0.23 ft	1.23 ft
Top Width:	9.40 ft	15.40 ft
Velocity:	5.28 fps	
X-Section Area:	2.04 sq ft	
Hydraulic Radius:	0.215 ft	
Froude Number:	2.00	
Manning's n:	0.0590	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure #9 (Riprap Channel)

D55-OUT-1

D55-OUT-1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	2.0:1	2.0:1	30.0	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	19.59 cfs	
Depth:	0.59 ft	1.59 ft
Top Width:	5.38 ft	9.38 ft
Velocity:	7.87 fps	
X-Section Area:	2.49 sq ft	
Hydraulic Radius:	0.440 ft	

	w/o Freeboard	w/ Freeboard
Froude Number:	2.04	
Manning's n:	0.0600	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Structure #10 (Null)

Pond 8 Outfall

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	2.350	0.083	0.000	0.000	87.000	TR55	3.00	0.237
	Σ	2.350						3.00	0.237
#7	1	4.580	0.083	0.000	0.000	87.000	TR55	5.84	0.462
	Σ	6.930						8.84	0.698
#8	Σ	6.930						8.84	0.698
#1	1	10.200	0.100	0.000	0.000	82.830	TR55	10.75	0.812
	Σ	10.200						10.75	0.812
#2	Σ	10.200						10.75	0.812
#3	Σ	10.200						10.75	0.812
#4	Σ	10.200						10.75	0.812
#5	Σ	10.200						10.75	0.812
#9	Σ	17.130						19.59	1.511
#10	Σ	17.130						19.59	1.511