Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Co.	Date:	12-Jul-89
Project No.:	007.11.100	Time:	02:34 PM
Channel Section:	D-10	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	1.18	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.020	ft/ft
	Max. Bottom Slope:	0.030	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.49	feet
	Qn/1.49(S)1/2=	0.168	
	A(R)2/3=	0.170	
	Required Depth:	0.99	feet
	Area:	0.47	ft2
	Perimeter:	2.17	feet
	Hydraulic Radius:	0.22	feet
	Velocity:	2.51	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.45	feet
	Qn/1.49(S)1/2=	0.138	
	A(R)2/3=	0.139	
	Required Depth:	0.95	feet
	Area:	0.41	ft2
	Perimeter:	2.01	feet
	Hydraulic Radius:	0.20	feet
	Velocity:	2.91	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	2.0	%
	Max. Bottom Slope:	3.0	%
	Min Channel Depth:	0.99	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Not Needed	

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CLIENT Valley Camp
PROJECT Permit
FEATURE D-12A
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/11/89

D-12A

Total Area = 110 * 0.00175 = 0.2 ac
paved = = 0.1 ac
dist = 0.1 ac

CN	A	Q
98	0.1	1.329
90	0.1	0.723

$\bar{Q} = 1.026$ $\bar{CN} = 94.6$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 200'

$$\text{slope} = \frac{(425)(5)(100)}{43{,}560\,(.2)} = 24.4\%$$

Note
The basin geometry does not allow "HYDRO" analysis.

Calculate t_c using Alternate Method

from "Urban Storm Drainage Criteria Manual - Vol 1 by Wright McLaughlin Engineers (March 1969)

$$t_c = t_i + t_t^0$$

where t_c = time of concentration (minutes)
t_i = overland flow time (minutes)
t_t = travel time in ditch (assume negligible)

$$t_i = \frac{(1.8)(1.1 - C_{10})\sqrt{L}}{\sqrt[3]{S}}$$

where $L = 200'$
$S = 24.4\%$
$C_{10} = 0.50$

$t_c = t_i = 5.27$ minutes

$= 0.08777$ hours $\Rightarrow$ $Q_{TOT} = 0.19$ cfs

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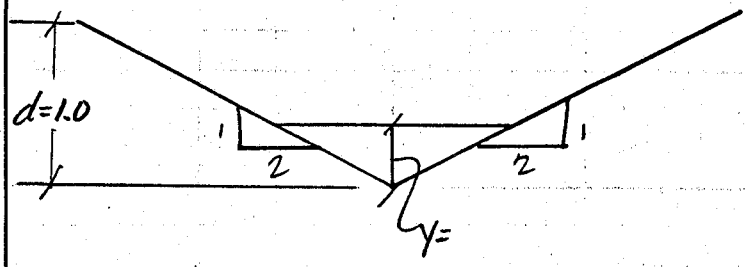
FEATURE D-12A
PROJECT NO. 007-11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/16/89

Ditch Design

try trapezoidal channel

$b=0,\ M=2,\ n=0.03$



$V=1.6$ ft/sec <5.0 ft/sec OK

∴ no lining required

PROJECT : Valley Camp Coal - D-12A Runoff Calculation

AREA= .2 ACRES
AVERAGE BASIN SLOPE= 24.4 PERCENT
CURVE NUMBER= 94.6
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 200. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR
USER INPUT TIME OF CONCENTRATION= .09 HOURS

TP= .0585 HOURS QPCFS= 2.58 CFS QPIN=12.8171 INCHES
C3= 63.1756 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
.92	.1131	.0000	.0000	.0	.00
.94	.1151	.0000	.0000	.2	.00
.95	.1172	.0000	.0000	1.3	.00
.97	.1192	.0000	.0000	2.2	.00
.98	.1212	.0000	.0000	2.6	.00
.99	.1233	.0001	.0000	2.3	.00
1.01	.1256	.0002	.0000	1.8	.00
1.02	.1281	.0003	.0001	1.3	.00
1.04	.1306	.0005	.0001	.8	.00
1.05	.1331	.0006	.0001	.5	.00
1.07	.1356	.0008	.0002	.3	.00
1.08	.1381	.0010	.0002	.2	.00
1.10	.1406	.0012	.0002	.0	.00
2.41	.8313	.3993	.0134	.0	.18
2.43	.8481	.4128	.0135	.0	.18
2.44	.8649	.4264	.0136	.0	.18
2.46	.8816	.4401	.0137	.0	.18
2.47	.8984	.4539	.0138	.0	.18
2.49	.9152	.4677	.0138	.0	.19
2.50	.9305	.4804	.0127	.0	.19
2.52	.9351	.4842	.0038	.0	.18
2.53	.9396	.4880	.0038	.0	.17
2.55	.9441	.4918	.0038	.0	.15
2.56	.9487	.4955	.0038	.0	.12
2.57	.9532	.4993	.0038	.0	.10
2.59	.9577	.5031	.0038	.0	.08

HYDROGRAPH PEAK= .19 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .02 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	16-May-89
Project No.:	007.11.100	Time:	02:13 PM
Channel Section:	Ditch D-12A	Computed:	PGH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.19	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.24	feet
	Qn/1.49(S)1/2=	0.027	
	A(R)2/3=	0.027	
	Required Depth:	0.74	feet
	Area:	0.12	ft2
	Perimeter:	1.09	feet
	Hydraulic Radius:	0.11	feet
	Velocity:	1.60	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.24	feet
	Qn/1.49(S)1/2=	0.027	
	A(R)2/3=	0.027	
	Required Depth:	0.74	feet
	Area:	0.12	ft2
	Perimeter:	1.09	feet
	Hydraulic Radius:	0.11	feet
	Velocity:	1.60	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope :	0.02	ft/ft
	Max. Bottom Slope :	0.02	ft/ft
	Min. Channel Depth:	0.74	feet
	Riprap:	Not Needed	

Comment:

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CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5/11/89

D-12B (Convenience Ditch)

TOTAL AREA = 0.86 ac 0.63 ac Disturbed
0.23 ac Paved

Area	CN	Q
0.63	90	0.723
0.23	98	1.329

$\bar{Q} = 0.885 \rightarrow CN = 92.6$

PRECIP = 1.55 in

Hyd LENGTH = 530'

$$\text{SLOPE} = \frac{(2370)\,5\,(100)}{43560\,(0.86)} = 31.6\%$$

Calculated Runoff $Q_{TOT} = 0.74$ cfs

SMALL DITCH - USE GENERAL DESIGN; $b=0$, $d=1.0$, $m=2$

PROJECT : Valley Camp Coal - D-12B Runoff Calculation

AREA= .9 ACRES
AVERAGE BASIN SLOPE= 31.6 PERCENT
CURVE NUMBER= 92.6
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 530. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0237 HOURS QPCFS= 27.42 CFS QPIN=31.6169 INCHES
C3=155.8398 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.21	.1598	.0000	.0000	.0	.00
1.23	.1638	.0000	.0000	27.4	.00
1.26	.1678	.0000	.0000	8.8	.00
1.28	.1719	.0002	.0000	1.0	.00
1.30	.1759	.0003	.0001	.0	.00
2.35	.7560	.2547	.0181	.0	.67
2.37	.7832	.2732	.0185	.0	.68
2.40	.8104	.2919	.0188	.0	.70
2.42	.8376	.3110	.0191	.0	.71
2.44	.8648	.3304	.0194	.0	.72
2.47	.8920	.3501	.0197	.0	.73
2.49	.9192	.3700	.0199	.0	.74
2.51	.9344	.3813	.0113	.0	.51
2.54	.9416	.3867	.0055	.0	.27
2.56	.9491	.3922	.0055	.0	.21
2.59	.9565	.3977	.0055	.0	.21
2.61	.9639	.4032	.0055	.0	.21
2.63	.9712	.4088	.0055	.0	.21

HYDROGRAPH PEAK= .74 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .06 Acre-Feet

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CLIENT Valley Camp
PROJECT Permit
FEATURE D-12C
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/11/89

D-12C (Convenience Ditch)

Total Area = 36 * 0.00175 = 0.1 ac

CN = 90

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 100'

$$\text{slope} = \frac{(100)(5)(100)}{43{,}560\,(.1)} = 11.5\%$$

Calculated Run-off

Basin Geometry does not provide viable solution using "HYDRO". Calculate t_c using alternate method and then re-run HYDRO. See D-12A for methodology

$$t_c = \frac{1.8(1.1 - C_{10})\sqrt{L}}{\sqrt[3]{S}}$$

where $L = 100'$
$S = 11.5\%$
$C_{10} = 0.50$

t_c = 4.78 minutes
= 0.07975 hours

Re-run "HYDRO" ⇒ $Q_{TOT} = 0.07$ cfs

No further design anticipated

PROJECT : Valley Camp Coal - D-12C Runoff Calculations

AREA= .1 ACRES
AVERAGE BASIN SLOPE= 11.5 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 100. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

PROJECT : Valley Camp Coal - D-12C Runoff Calculation

AREA= .1 ACRES
AVERAGE BASIN SLOPE= 11.5 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 100. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR
USER INPUT TIME OF CONCENTRATION= .08 HOURS

TP= .0532 HOURS QPCFS= 1.42 CFS QPIN=14.1061 INCHES
C3= 69.5288 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.54	.2215	.0000	.0000	.0	.00
1.56	.2267	.0000	.0000	.3	.00
1.58	.2319	.0000	.0000	1.1	.00
1.59	.2372	.0002	.0001	1.4	.00
1.61	.2424	.0004	.0002	1.2	.00
1.63	.2476	.0006	.0002	.8	.00
1.65	.2528	.0008	.0003	.5	.00
1.67	.2580	.0011	.0003	.2	.00
1.68	.2633	.0015	.0003	.1	.00
1.70	.2685	.0018	.0004	.0	.00
2.39	.8064	.2013	.0115	.0	.06
2.41	.8267	.2130	.0117	.0	.06
2.43	.8470	.2249	.0119	.0	.06
2.45	.8673	.2370	.0121	.0	.07
2.46	.8877	.2492	.0123	.0	.07
2.48	.9080	.2617	.0125	.0	.07
2.50	.9283	.2744	.0126	.0	.07
2.52	.9350	.2786	.0042	.0	.07
2.53	.9405	.2820	.0035	.0	.06
2.55	.9460	.2855	.0035	.0	.05
2.57	.9515	.2890	.0035	.0	.04
2.59	.9570	.2925	.0035	.0	.03
2.60	.9625	.2960	.0035	.0	.02

HYDROGRAPH PEAK= .07 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .00 Acre-Feet

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CLIENT Valley Camp
PROJECT Permit
FEATURE D-12D
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/12/89

D-12D

Total Area = 930 * 0.00175 = 1.6 ac
paved = 296 = 0.5 ac
disturbed = = 1.1 ac

CN	A	Q
98	0.5	1.329
90	1.1	0.723

$\bar{Q} = 0.912$ $\bar{CN} = 93.0$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 750'

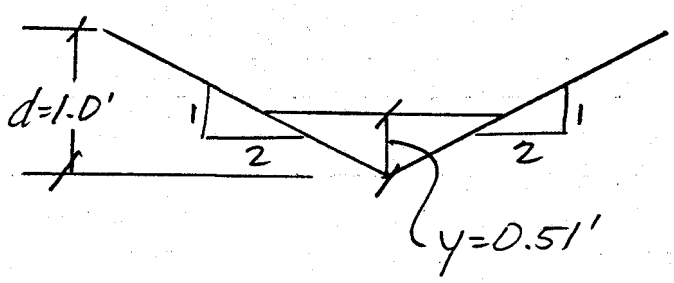
$$\text{slope} = \frac{(1150)(5)(100)}{(43{,}560)(1.6)} = 8.3\%$$

Calculated Runoff $Q_{TOT} = 1.35$ cfs

Ditch Design

$S_{min} = 2\%$ by trapezoidal Channel

$S_{max} = 2\%$ $b = 0,\ m = 2,\ n = 0.03$



$V = 2.60$ ft/sec < 5.0 ft/sec

No Lining required

PROJECT : Valley Camp Coal - D-12D Runoff Calculations

AREA= 1.6 ACRES
AVERAGE BASIN SLOPE= 8.3 PERCENT
CURVE NUMBER= 93.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 750. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0600 HOURS QPCFS= 20.17 CFS QPIN=12.5008 INCHES
C3= 61.6165 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.15	.1504	.0000	.0000	.0	.00
1.17	.1530	.0000	.0000	1.9	.00
1.18	.1555	.0000	.0000	9.9	.00
1.20	.1581	.0000	.0000	17.5	.00
1.21	.1607	.0001	.0000	20.2	.00
1.23	.1632	.0002	.0000	18.3	.00
1.24	.1658	.0003	.0000	14.2	.00
1.26	.1683	.0004	.0001	10.0	.00
1.27	.1709	.0005	.0001	6.5	.00
1.29	.1734	.0007	.0001	4.0	.00
1.30	.1760	.0008	.0002	2.3	.00
1.32	.1786	.0010	.0002	1.3	.01
1.33	.1811	.0012	.0002	.7	.01
1.35	.1837	.0014	.0002	.4	.01
1.36	.1862	.0016	.0002	.2	.02
1.38	.1888	.0018	.0002	.1	.02
1.39	.1913	.0021	.0002	.0	.02
2.41	.8325	.3242	.0124	.0	1.28
2.43	.8497	.3367	.0125	.0	1.29
2.45	.8669	.3493	.0126	.0	1.31
2.46	.8841	.3621	.0127	.0	1.32
2.48	.9013	.3749	.0128	.0	1.33
2.49	.9185	.3879	.0129	.0	1.34
2.51	.9316	.3977	.0099	.0	1.35
2.52	.9362	.4013	.0035	.0	1.32
2.54	.9409	.4048	.0035	.0	1.21
2.55	.9455	.4083	.0035	.0	1.04
2.57	.9502	.4119	.0036	.0	.86
2.58	.9548	.4155	.0036	.0	.71
2.60	.9595	.4190	.0036	.0	.59

HYDROGRAPH PEAK= 1.35 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .12 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	12-May-89
Project No.:	007.11.100	Time:	08:46 AM
Channel Section:	Ditch D-12D	Computed:	PGH

			UNITS
GENERAL CRITERIA:	Design Flow:	1.35	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.51	feet
	Qn/1.49(S)1/2=	0.193	
	A(R)2/3=	0.194	
	Required Depth:	1.01	feet
	Area:	0.52	ft2
	Perimeter:	2.28	feet
	Hydraulic Radius:	0.23	feet
	Velocity:	2.60	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.51	feet
	Qn/1.49(S)1/2=	0.193	
	A(R)2/3=	0.194	
	Required Depth:	1.01	feet
	Area:	0.52	ft2
	Perimeter:	2.28	feet
	Hydraulic Radius:	0.23	feet
	Velocity:	2.60	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope :	0.02	ft/ft
	Max. Bottom Slope :	0.02	ft/ft
	Min. Channel Depth:	1.01	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/11/89

D-12E (Convenience ditch)

Total Area = 220 * 0.00175 = 0.23 ac
paved = 98 = 0.08
disturbed = 90 = 0.15

CN	Area	Q
98	0.08	1.329
90	0.15	0.723

$\bar{Q} = 0.934$ $\bar{CN} = 93.3$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 180'

slope = $\frac{(200)(5)(100)}{43{,}560\,(0.23)} = 10.0\%$

Calculated Run-off $Q_{TOT} = 0.21$ cfs

No further design anticipated

$A_T = 0.23$ ac
.08 paved
$H_L = 180'$

DD DITCH

PROJECT : Valley Camp Coal - D-12E Runoff Calculation

AREA= .2 ACRES
AVERAGE BASIN SLOPE= 10.0 PERCENT
CURVE NUMBER= 93.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 180. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0172 HOURS QPCFS= 10.11 CFS QPIN=43.5800 INCHES
C3=214.8059 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.10	.1412	.0000	.0000	.0	.00
1.12	.1441	.0000	.0000	10.1	.00
1.14	.1470	.0000	.0000	3.3	.00
1.15	.1500	.0000	.0000	.4	.00
1.17	.1529	.0001	.0000	.0	.00
2.39	.8046	.3168	.0143	.0	.20
2.41	.8243	.3312	.0145	.0	.20
2.43	.8440	.3458	.0146	.0	.20
2.44	.8638	.3606	.0147	.0	.20
2.46	.8835	.3755	.0149	.0	.20
2.48	.9032	.3905	.0150	.0	.21
2.49	.9230	.4056	.0151	.0	.21
2.51	.9334	.4137	.0081	.0	.14
2.53	.9388	.4178	.0041	.0	.07
2.55	.9441	.4219	.0041	.0	.06
2.56	.9494	.4261	.0041	.0	.06
2.58	.9548	.4302	.0042	.0	.06
2.60	.9601	.4344	.0042	.0	.06

HYDROGRAPH PEAK= .21 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .02 Acre-Feet

D-13A

Total Area = 1150 × 0.00175 = 2.1 ac
sage/grass = 918 = 1.6 ac
disturbed = = 0.5 ac

CN	A	Q
75	1.6	0.1850
90	0.5	0.723

$\bar{Q} = 0.313$ $\bar{CN} = 80.4$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 800 feet

$$\text{slope} = \frac{(1550)(25)(100)}{43{,}560\ (2.1)} = 42.4\ \%$$

Calculated Run-off ⇒ $Q_{TOT} = 0.60$ cfs

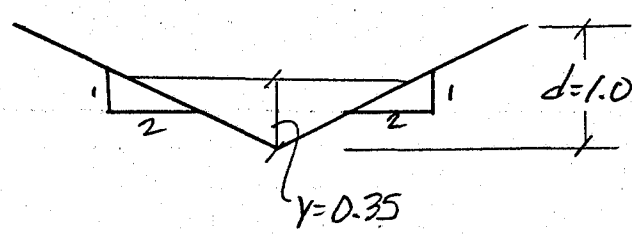
Ditch Design

$S_{min} = 3\%$

$S_{max} = 18\%$

try trapezoidal channel

$b = 0$, $M = 2$, $n = 0.03$



$V = 4.8 < 5.0$ ft/sec

∴ No lining required

PROJECT : Valley Camp Coal - D-13A Runoff Calcualation

AREA= 2.1 ACRES
AVERAGE BASIN SLOPE= 42.4 PERCENT
CURVE NUMBER= 80.1
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 800. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0452 HOURS QPCFS= 35.12 CFS QPIN=16.5868 INCHES
C3= 81.7565 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.11	.4824	.0000	.0000	.0	.00
2.12	.4997	.0000	.0000	7.1	.00
2.14	.5170	.0002	.0002	26.9	.00
2.16	.5343	.0006	.0004	35.1	.00
2.17	.5516	.0012	.0006	29.7	.02
2.19	.5689	.0020	.0008	19.7	.04
2.20	.5861	.0031	.0011	11.3	.07
2.22	.6034	.0044	.0013	5.8	.10
2.23	.6207	.0059	.0015	2.8	.13
2.25	.6380	.0076	.0017	1.3	.16
2.26	.6553	.0095	.0019	.5	.19
2.28	.6726	.0116	.0021	.2	.22
2.29	.6899	.0139	.0023	.0	.24
2.41	.8281	.0390	.0037	.0	.46
2.43	.8454	.0429	.0039	.0	.48
2.44	.8627	.0470	.0041	.0	.51
2.46	.8800	.0512	.0042	.0	.53
2.47	.8973	.0556	.0044	.0	.55
2.49	.9146	.0601	.0045	.0	.58
2.50	.9305	.0644	.0043	.0	.60
2.52	.9352	.0657	.0013	.0	.59
2.53	.9398	.0670	.0013	.0	.51
2.55	.9445	.0683	.0013	.0	.40
2.56	.9492	.0697	.0013	.0	.31
2.58	.9539	.0710	.0013	.0	.25
2.59	.9585	.0723	.0013	.0	.22

HYDROGRAPH PEAK= .60 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .05 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Co.	Date:	12-Jul-89
Project No.:	007.11.100	Time:	02:13 PM
Channel Section:	D-13A	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.60	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.030	ft/ft
	Max. Bottom Slope:	0.180	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.35	feet
	Qn/1.49(S)1/2=	0.070	
	A(R)2/3=	0.071	
	Required Depth:	0.85	feet
	Area:	0.24	ft2
	Perimeter:	1.57	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	2.45	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.25	feet
	Qn/1.49(S)1/2=	0.029	
	A(R)2/3=	0.029	
	Required Depth:	0.75	feet
	Area:	0.13	ft2
	Perimeter:	1.12	feet
	Hydraulic Radius:	0.11	feet
	Velocity:	4.80	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	3.0	%
	Max. Bottom Slope:	18.0	%
	Min Channel Depth:	0.85	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Not Needed	

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CLIENT Valley Camp
PROJECT Permit
FEATURE D-13B
PROJECT NO. 007.11-100

SHEET 1 OF
COMPUTED Paul
CHECKED
DATE 5/11/89

D-13B

Total Area = 1240 * 0.00175 = 2.2 ac
sage/grass = 1.6 ac
disturbed = 0.6 ac

CN	A	Q
75	1.6	0.185
90	0.6	0.723
		$\bar{Q}$=0.332

$\bar{CN}$ = 80.7

Precipitation = 1.55 inches (10 year, 6 hr)

hydraulic length = 870 feet

$$\text{slope} = \frac{(1675)(25)(100)}{43{,}560\,(2.2)} = 43.7\%$$

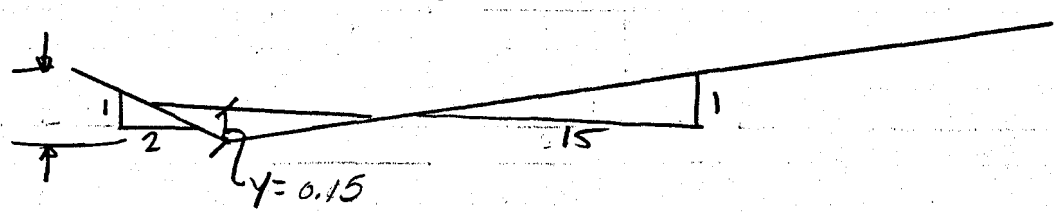
Calculated Run-off: Q_{TOT} = 0.66 cfs

Design Ditch

S_{min} = 15% try trapezoidal Channel

S_{max} = 35% b = 0, M1=2, M2=15, n=0.03

Use Roadway Design



V_{max} = 4.6 ft/sec < 5.0

∴ No lining required

PROJECT : Valley Camp Coal - D-13B Runoff Calculation

AREA= 2.2 ACRES
AVERAGE BASIN SLOPE= 43.7 PERCENT
CURVE NUMBER= 80.7
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 870. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0467 HOURS QPCFS= 35.60 CFS QPIN=16.0467 INCHES
C3= 79.0943 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.10	.4750	.0000	.0000	.0	.00
2.12	.4929	.0000	.0000	7.2	.00
2.13	.5107	.0004	.0003	27.3	.00
2.15	.5286	.0010	.0006	35.6	.02
2.17	.5465	.0019	.0009	30.1	.04
2.18	.5643	.0030	.0011	20.0	.06
2.20	.5822	.0043	.0013	11.4	.10
2.21	.6001	.0059	.0016	5.9	.13
2.23	.6180	.0077	.0018	2.8	.16
2.24	.6358	.0097	.0020	1.3	.20
2.26	.6537	.0120	.0022	.5	.23
2.27	.6716	.0144	.0025	.2	.26
2.29	.6894	.0171	.0027	.0	.29
2.41	.8324	.0457	.0042	.0	.53
2.43	.8503	.0501	.0044	.0	.55
2.45	.8681	.0546	.0046	.0	.58
2.46	.8860	.0594	.0047	.0	.61
2.48	.9039	.0643	.0049	.0	.63
2.49	.9217	.0694	.0051	.0	.66
2.51	.9326	.0725	.0032	.0	.66
2.52	.9374	.0739	.0014	.0	.62
2.54	.9423	.0754	.0014	.0	.51
2.56	.9471	.0768	.0014	.0	.40
2.57	.9519	.0783	.0015	.0	.32
2.59	.9567	.0798	.0015	.0	.26
2.60	.9616	.0812	.0015	.0	.23

HYDROGRAPH PEAK= .66 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .06 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Co.	Date:	12-Jul-89
Project No.:	007.11.100	Time:	02:18 PM
Channel Section:	D-13B	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.66	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	15.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.150	ft/ft
	Max. Bottom Slope:	0.350	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.15	feet
	Qn/1.49(S)1/2=	0.034	
	A(R)2/3=	0.034	
	Required Depth:	0.65	feet
	Area:	0.19	ft2
	Perimeter:	2.59	feet
	Hydraulic Radius:	0.07	feet
	Velocity:	3.45	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.13	feet
	Qn/1.49(S)1/2=	0.023	
	A(R)2/3=	0.023	
	Required Depth:	0.63	feet
	Area:	0.14	ft2
	Perimeter:	2.25	feet
	Hydraulic Radius:	0.06	feet
	Velocity:	4.59	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	15.0	1/m2
	Min. Bottom Slope:	15.0	%
	Max. Bottom Slope:	35.0	%
	Min Channel Depth:	0.65	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Not Needed	

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FEATURE D-15
PROJECT NO. 007.11.100

SHEET 1 OF
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CHECKED
DATE 5/11/89

D-15

Total Area = 2543 * 0.00175 = 4.45ac
Paved = = 0.2
Disturbed = = 1.5
Aspen = = 1.5
Sage/Grass = = 1.0
Reclaimed = = 0.25

CN	A	Q
85	0.25	0.484
98	0.2	1.329
90	1.5	0.723
70	1.5	0.096
75	1.0	0.185

$\overline{Q} = 0.405$ $\overline{CN} = 82.8$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 900 feet

$$\text{slope} = \frac{(2565)(25)(100)}{43{,}560\ (4.2)} = 35.0\%$$

Run-off Calculation: $Q_{TOT} = 1.57$ cfs

Ditch Design:

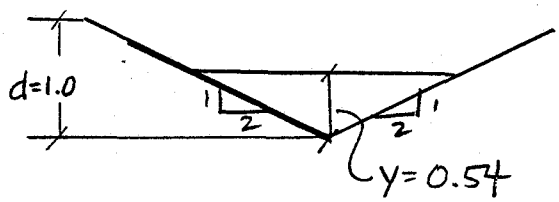
$S_{min} = 2\%$
$S_{max} = 2\%$

try trapezoidal design

$b = 0$, $M = 2$, $n = 0.03$

$V = 2.69$ ft/sec < 5.0 ft/sec OK

NO LINING NECESSARY



PROJECT : Valley Camp Coal - D-15 Runoff Calculations

AREA= 4.2 ACRES
AVERAGE BASIN SLOPE= 35.0 PERCENT
CURVE NUMBER= 82.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 900. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0501 HOURS QPCFS= 63.36 CFS QPIN=14.9611 INCHES
C3= 73.7432 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.04	.3994	.0000	.0000	.0	.00
2.05	.4186	.0000	.0000	12.8	.00
2.07	.4377	.0002	.0002	48.5	.00
2.09	.4569	.0008	.0006	63.4	.02
2.10	.4760	.0017	.0009	53.6	.05
2.12	.4952	.0029	.0012	35.7	.11
2.14	.5143	.0045	.0015	20.4	.18
2.15	.5335	.0063	.0019	10.5	.25
2.17	.5526	.0085	.0022	5.0	.33
2.19	.5718	.0109	.0024	2.3	.41
2.20	.5910	.0137	.0027	1.0	.48
2.22	.6101	.0167	.0030	.4	.56
2.24	.6293	.0200	.0033	.2	.63
2.25	.6484	.0235	.0035	.0	.70
2.40	.8208	.0662	.0056	.0	1.28
2.42	.8400	.0720	.0058	.0	1.33
2.44	.8591	.0781	.0060	.0	1.39
2.45	.8783	.0843	.0062	.0	1.44
2.47	.8974	.0908	.0064	.0	1.49
2.49	.9166	.0974	.0066	.0	1.54
2.51	.9316	.1027	.0053	.0	1.57
2.52	.9367	.1046	.0019	.0	1.50
2.54	.9419	.1064	.0019	.0	1.28
2.56	.9471	.1083	.0019	.0	1.00
2.57	.9523	.1102	.0019	.0	.78
2.59	.9574	.1121	.0019	.0	.64
2.61	.9626	.1141	.0019	.0	.56

HYDROGRAPH PEAK= 1.57 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .14 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	11-May-89
Project No.:	007.11.100	Time:	11:39 AM
Channel Section:	Ditch D-15	Computed:	PGH

			UNITS
GENERAL CRITERIA:	Design Flow:	1.57	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.54	feet
	Qn/1.49(S)1/2=	0.224	
	A(R)2/3=	0.226	
	Required Depth:	1.04	feet
	Area:	0.58	ft2
	Perimeter:	2.41	feet
	Hydraulic Radius:	0.24	feet
	Velocity:	2.69	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.54	feet
	Qn/1.49(S)1/2=	0.224	
	A(R)2/3=	0.226	
	Required Depth:	1.04	feet
	Area:	0.58	ft2
	Perimeter:	2.41	feet
	Hydraulic Radius:	0.24	feet
	Velocity:	2.69	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope :	0.02	ft/ft
	Max. Bottom Slope :	0.02	ft/ft
	Min. Channel Depth:	1.04	feet
	Riprap:	Not Needed	

Comment:

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FEATURE D-16A
PROJECT NO. 007.11-100

SHEET 1 OF
COMPUTED Paul
CHECKED
DATE 5/11/89

D-16A

Total Area = 2863 * 0.00175 = 5.1 ac
Paved = = 0.2 ac
disturbed = = 2.4 ac
Aspen = = 1.5 ac
Sage/Grass = = 1.0 ac

CN	A	Q
98	0.2	1.3294
90	2.4	0.723
70	1.5	0.096
75	1.0	0.185

$\bar{Q} = 0.457$ $\bar{CN} = 84.32$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 1415

$$\text{slope} = \frac{(2805)(25)(100)}{43{,}650\,(5.1)} = 31.6\%$$

Run-off Calculation: $Q_{TOT} = 2.13$ cfs

Ditch Design UPPER REACH

$S_{min} = 8\%$ S_{max} on upper reach ≈ 15%
$S_{max} = 37\%$ (lower reach into pond, based upon data after the 10/88 pond clean-out)

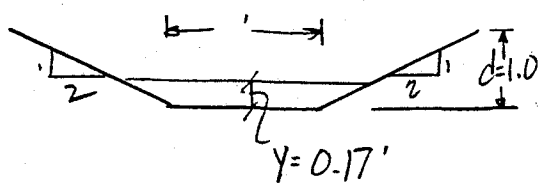
The ditch is currently lined with a conveyor belt. Because of the extreme variation in slope, it is recommended that the ditch be constructed as follows.

The upper portion of the ditch can be designed with the following parameters

b = , M = 2, n = 0.02

V = 4.75 < 5. ft/s

no lining required.



D-16A (Continued) LOWER REACH

The lower end of the channel cannot be designed practically without the use of a rip-rap pad. Therefore, the following is recommended.

Maximum Channel Slope ≈ 37% , Q = 2.13 cfs
d = 0.17 feet

Utilizing information presented in the manual "Design of Stable Channels w/ Flexible Linings", by the Federal Highway Administration. We get the following.

$$D_{50} = \frac{d_{max}\,\gamma\,S}{5}$$ where $d_{max} = 0.17$ ft, $\gamma = 62.4$, $S = 0.37$

$D_{50} = 0.8$ ft

Select $D_{50} = 1.0$ for additional safety factor and reduced maintenance.

From Table 5-1 (Urban Storm Drainage Criteria Manual Vol 2 - Wright-McLaughlin Eng. 1969)

D_{50} rock is classified as follows

TYPE L

% smaller than Given size by weight	Intermediate Rock dimen. (Inches)
70-100	15
50-70	12
35-50	9
2-10	3

The Urban Storm Drainage Criteria Manual suggests that Given the rip-rap type to be L, it is possible to use a single 12" layer of type II bedding as the underlying filter blanket.

The following cross section is proposed.

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SHEET 3 OF
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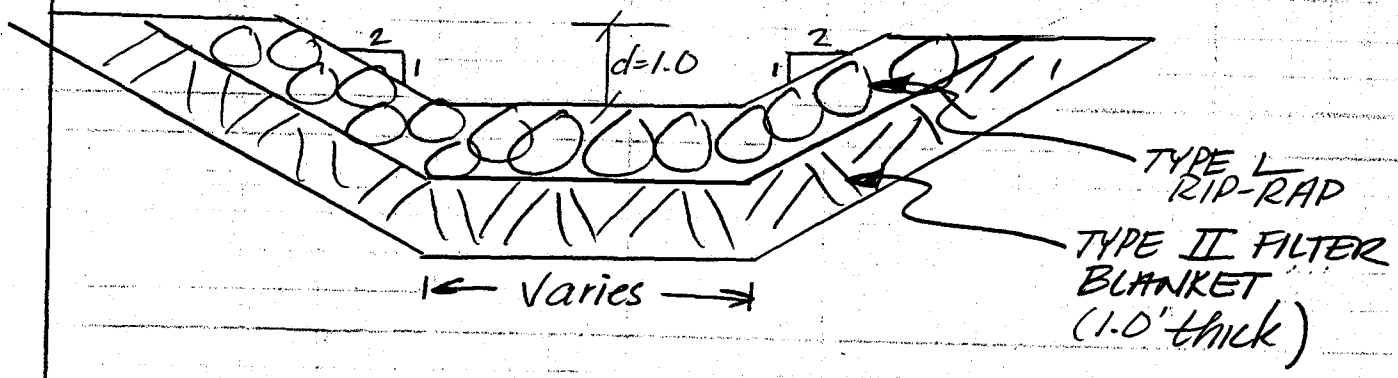
D-16A (Continued)



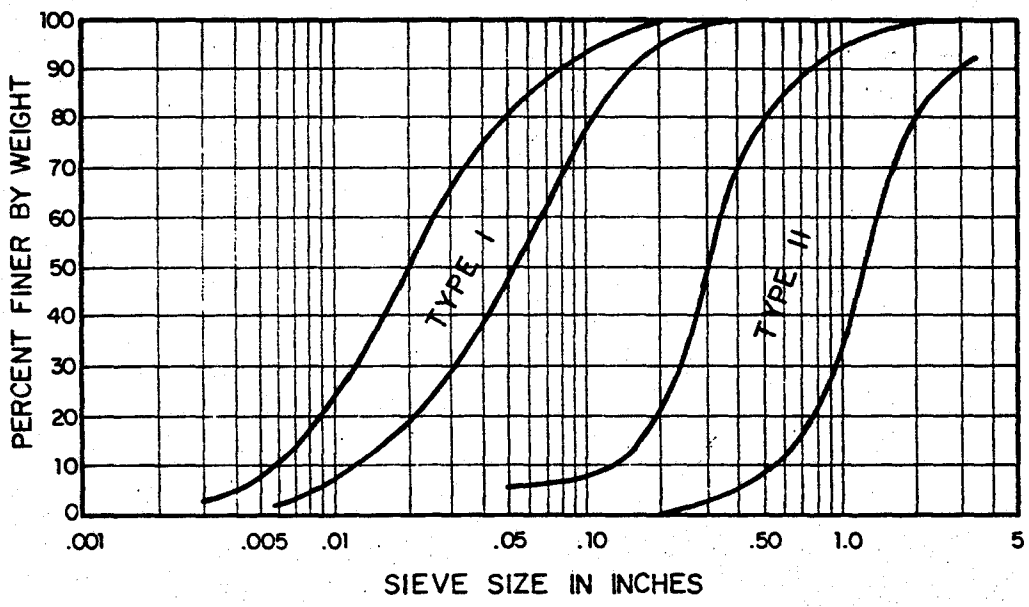


FIGURE 5-2. GRADATION CURVES FOR GRANULAR BEDDING

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FEATURE D-16A
PROJECT NO. 007-11-100

SHEET 4 OF
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CHECKED
DATE 5/12/89

D-16A (Continued)

The intent is to break up the flow and prevent unnecessary erosion from occuring within the pond.

∴ design a transition zone and region to dissipate the stream energy prior to direct pond discharge.

The EPA has developed a methodology for a fan tailed energy dissipator, which receives flow from a culvert. (Erosion and sediment Control-Surface Mining in the Eastern U.S. - EPA technology transfer Seminar Publication.) See figure 1-15 below

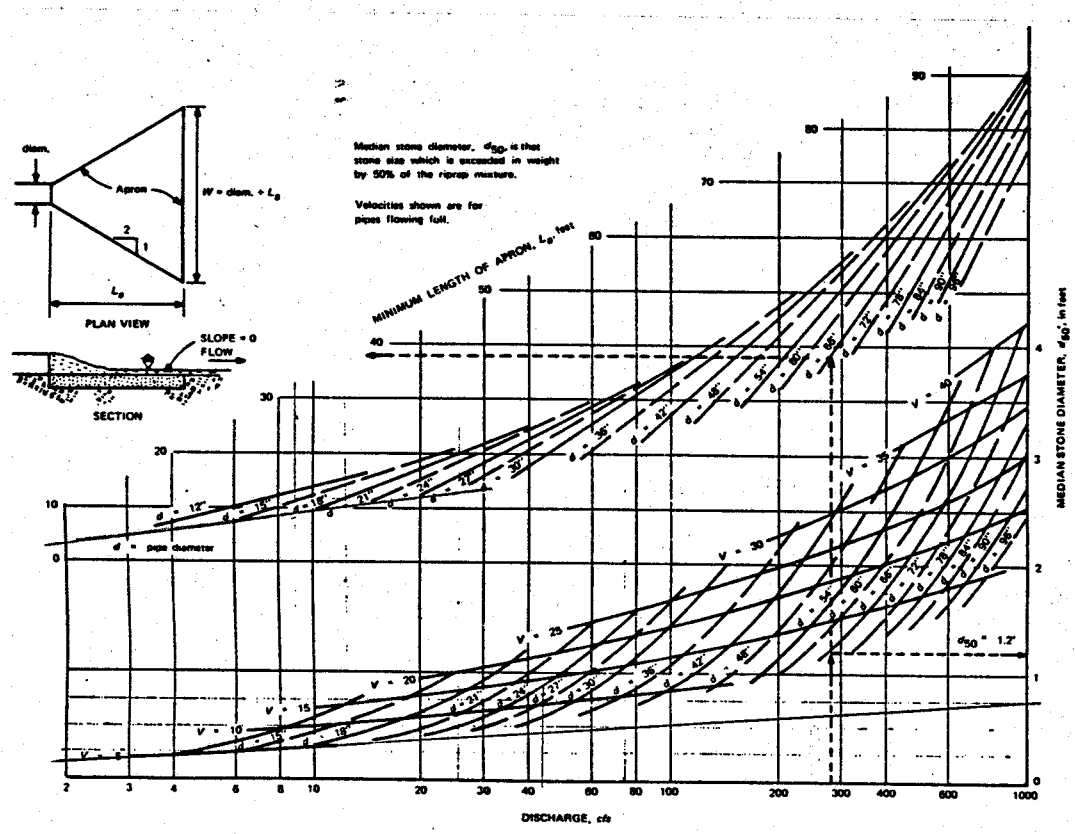

Figure I-15. Design of outlet protection — minimum tailwater condition (T_W < 0.5 diam.)[1]

Note: The Graph indicates a minimum length of 10 feet for a flow of 2-13 cfs (for all pipe diameters). As we are not on a zero % slope as for this method. It is recommended that we use 20' for a transition length.

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CLIENT Valley Camp
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FEATURE D-16A
PROJECT NO. 007-11-100

SHEET 5 OF
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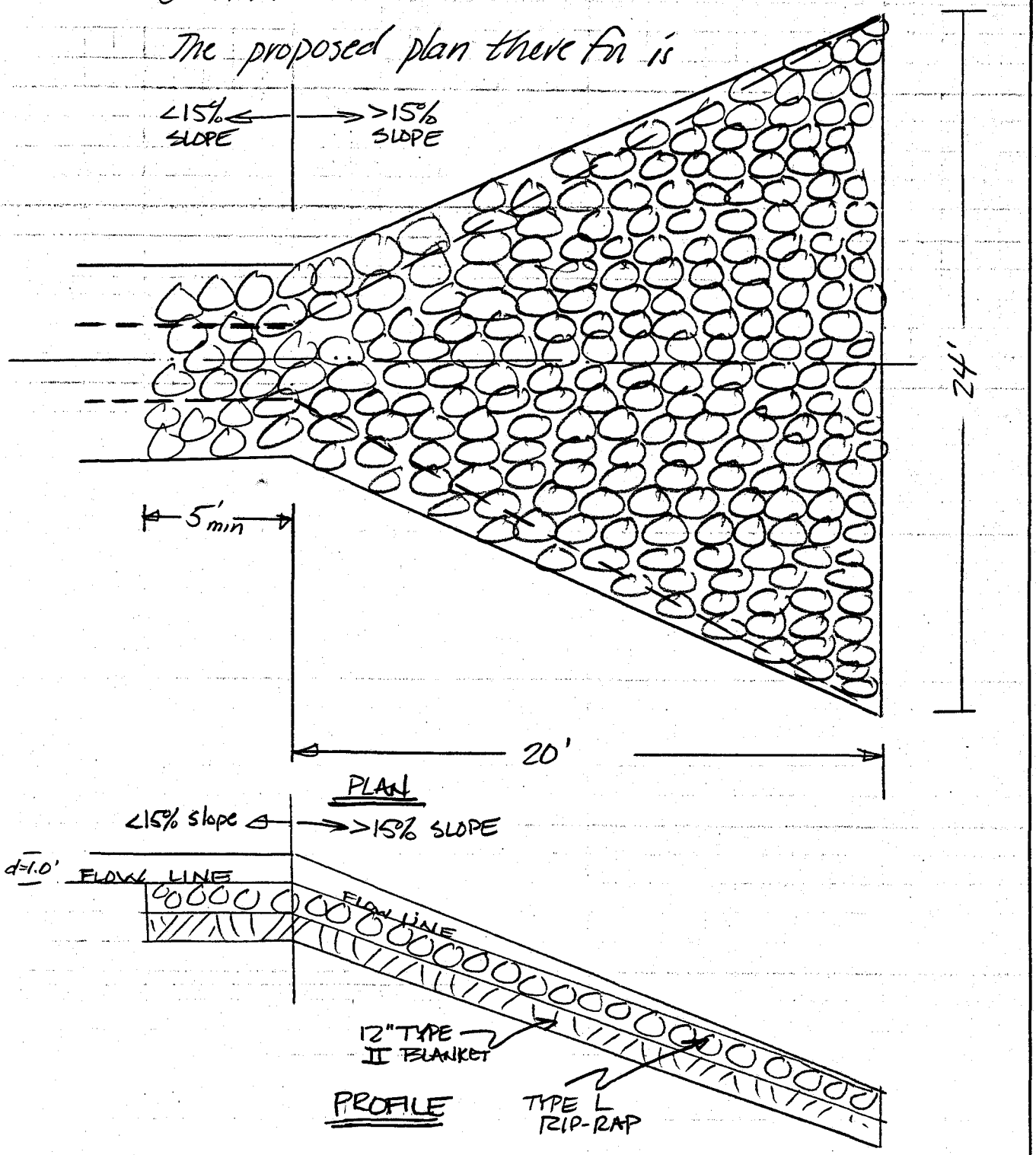
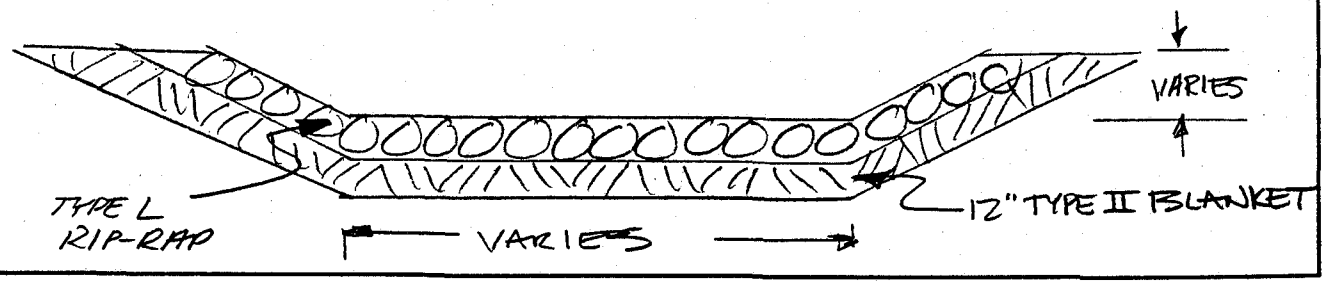
CHECKED
DATE 5/12/89

D-16A Continued

The proposed plan there fin is





PROJECT : Valley Camp Coal - D-16A Runoff Calculations

AREA= 5.1 ACRES
AVERAGE BASIN SLOPE= 31.6 PERCENT
CURVE NUMBER= 84.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1415. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0720 HOURS QPCFS= 53.55 CFS QPIN=10.4128 INCHES
C3= 51.3249 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.00	.3591	.0000	.0000	.0	.00
2.02	.3756	.0000	.0000	2.7	.00
2.03	.3921	.0002	.0002	16.6	.00
2.05	.4087	.0007	.0005	35.5	.00
2.06	.4252	.0015	.0008	49.2	.02
2.07	.4417	.0025	.0010	53.5	.04
2.09	.4582	.0038	.0013	50.2	.08
2.10	.4748	.0053	.0015	42.3	.14
2.12	.4913	.0071	.0018	33.1	.20
2.13	.5078	.0092	.0020	24.4	.27
2.15	.5243	.0114	.0023	17.2	.35
2.16	.5408	.0140	.0025	11.7	.44
2.18	.5574	.0167	.0027	7.7	.52
2.19	.5739	.0197	.0030	4.9	.61
2.20	.5904	.0228	.0032	3.1	.69
2.22	.6069	.0262	.0034	1.9	.78
2.23	.6235	.0298	.0036	1.2	.86
2.25	.6400	.0336	.0038	.7	.94
2.26	.6565	.0376	.0040	.4	1.02
2.28	.6730	.0418	.0042	.2	1.10
2.29	.6895	.0461	.0044	.1	1.17
2.30	.7061	.0507	.0045	.0	1.25
2.43	.8548	.0992	.0060	.0	1.84
2.45	.8713	.1054	.0062	.0	1.90
2.46	.8878	.1117	.0063	.0	1.96
2.48	.9043	.1181	.0065	.0	2.02
2.49	.9209	.1247	.0066	.0	2.07
2.51	.9320	.1293	.0045	.0	2.12
2.52	.9365	.1311	.0018	.0	2.13
2.54	.9409	.1329	.0018	.0	2.06
2.55	.9454	.1348	.0018	.0	1.90
2.56	.9499	.1366	.0019	.0	1.68
2.58	.9543	.1385	.0019	.0	1.46
2.59	.9588	.1404	.0019	.0	1.25

PROJECT : Valley Camp Coal - D-16A Runoff Calculations
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.61	.9633	.1423	.0019	.0	1.08

HYDROGRAPH PEAK= 2.13 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .19 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	12-May-89
Project No.:	007.11.100	Time:	10:45 AM
Channel Section:	Ditch D-16A	Computed:	PGH

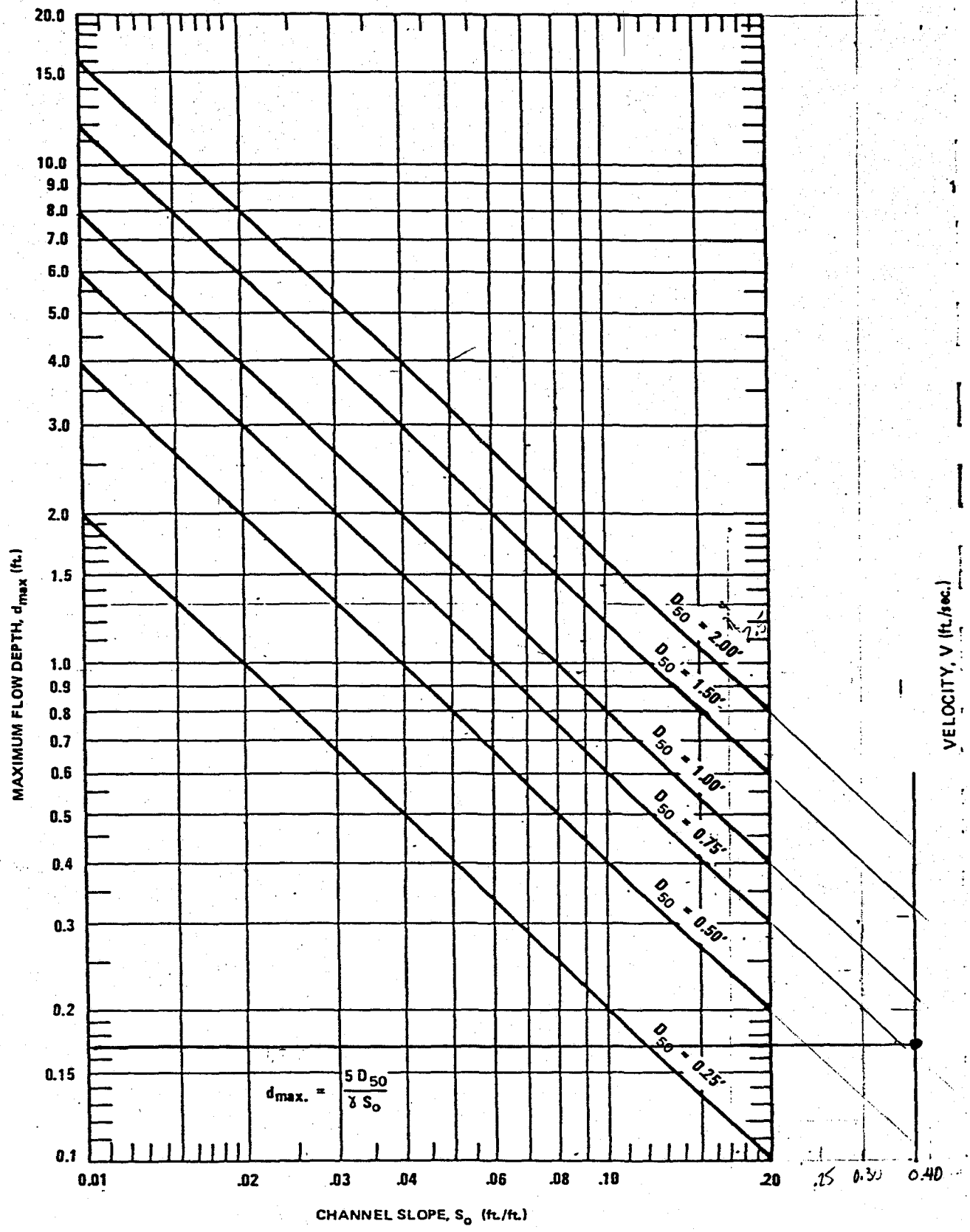
			UNITS
GENERAL CRITERIA:	Design Flow:	2.13	cfs
	Bottom Width:	3.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.08	ft/ft
	Max. Bottom Slope:	0.15	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.17	feet
	Qn/1.49(S)1/2=	0.152	
	A(R)2/3=	0.153	
	Required Depth:	0.67	feet
	Area:	0.55	ft2
	Perimeter:	3.74	feet
	Hydraulic Radius:	0.15	feet
	Velocity:	3.88	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.14	feet
	Qn/1.49(S)1/2=	0.111	
	A(R)2/3=	0.112	
	Required Depth:	0.64	feet
	Area:	0.45	ft2
	Perimeter:	3.61	feet
	Hydraulic Radius:	0.12	feet
	Velocity:	4.75	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	3.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope :	0.08	ft/ft
	Max. Bottom Slope :	0.15	ft/ft
	Min. Channel Depth:	0.67	feet
	Riprap:	Not Needed	

Comment: upper reach where S≤15%

Design of stable channels with flexible linings - Fed. Highway Administration

Chart 27



MAXIMUM PERMISSIBLE DEPTH OF FLOW (d_{max})
FOR CHANNELS LINED WITH ROCK RIPRAP

$n = .0395 D_{50}^{1/6}$

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-16B
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5/11/89

D-16B

TOTAL AREA = 415 * 0.00175 = 0.7 ac

CN = 90

PRECIPITATION = 1.55 inches (10yr, 6hr)

HYD. LENGTH = 400'

$$\text{SLOPE} = \frac{(2050)\,5(100)}{43560\,(0.7)} = 33.6\%$$

CALCULATED RUNOFF $Q_{TOT} = \underline{0.5 \text{ cfs}}$

DITCH DESIGN - UPPER SECTION TO EDGE OF POND SLOPE

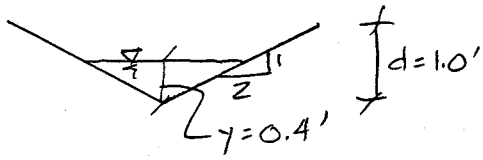
$S_{MIN} = 1\%$
$S_{MAX} = 10\%$

Try Trapezoidal Channel

$b = 0,\ m = 2,\ n = 0.03$

$V = 3.7$ fps < 5.0 ok

No LINING REQUIRED



PROJECT : Valley Camp Coal - D-16B Runoff Calculations

AREA= .7 ACRES
AVERAGE BASIN SLOPE= 33.6 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 400. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0205 HOURS QPCFS= 25.77 CFS QPIN=36.5095 INCHES
C3=179.9552 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.54	.2203	.0000	.0000	.0	.00
1.56	.2263	.0000	.0000	25.8	.00
1.58	.2324	.0000	.0000	8.4	.00
1.60	.2384	.0002	.0001	.9	.00
1.62	.2444	.0004	.0002	.0	.00
2.36	.7665	.1790	.0128	.0	.45
2.38	.7901	.1920	.0131	.0	.46
2.40	.8136	.2054	.0134	.0	.47
2.42	.8371	.2190	.0136	.0	.48
2.44	.8606	.2329	.0139	.0	.49
2.46	.8841	.2471	.0142	.0	.49
2.48	.9076	.2615	.0144	.0	.50
2.50	.9303	.2756	.0141	.0	.50
2.52	.9367	.2796	.0040	.0	.24
2.54	.9430	.2836	.0040	.0	.15
2.56	.9494	.2876	.0040	.0	.14
2.58	.9557	.2917	.0040	.0	.14
2.60	.9621	.2957	.0041	.0	.14

HYDROGRAPH PEAK= .50 cfs
TIME TO PEAK= 2.48 Hours
RUNOFF VOLUME= .04 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	12-May-89
Project No.:	007.11.100	Time:	09:53 AM
Channel Section:	Ditch D-16B	Computed:	PGH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.50	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.01	ft/ft
	Max. Bottom Slope:	0.10	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.40	feet
	Qn/1.49(S)1/2=	0.101	
	A(R)2/3=	0.102	
	Required Depth:	0.90	feet
	Area:	0.32	ft2
	Perimeter:	1.79	feet
	Hydraulic Radius:	0.18	feet
	Velocity:	1.56	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.26	feet
	Qn/1.49(S)1/2=	0.032	
	A(R)2/3=	0.032	
	Required Depth:	0.76	feet
	Area:	0.14	ft2
	Perimeter:	1.16	feet
	Hydraulic Radius:	0.12	feet
	Velocity:	3.70	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope :	0.01	ft/ft
	Max. Bottom Slope :	0.10	ft/ft
	Min. Channel Depth:	0.90	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-18A
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED Paul
CHECKED
DATE 5/10/89

D-18A

calibrate planimeter $\frac{\frac{(250\ ft)^2}{43560}}{822} = 0.00175$ Ac/#

Total Area = 1200 * 0.00175 = 2.1 Acres
dist. area = 273 = 0.5 Ac
Aspen = 724 = 1.3 Ac
Sage/grass = = 0.3 Ac

CN	Ac	Q
90	0.5	0.723
70	1.3	0.096
75	0.3	0.185

$\bar{Q} = 0.258$ $\bar{CN} = 78.1$

Precipitation = 1.55 inches (10yr, 6hr)

Hydraulic length = 750 feet

$$\text{slope} = \frac{(1575)(25)(100)}{43{,}560\ (2.1)} = 43\%$$

Run-off Calculation: Q = 0.46 cfs

Ditch Design:

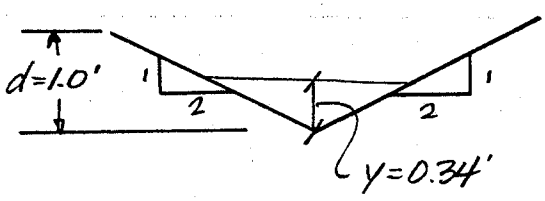
$S_{min} = 2\%$
$S_{max} = 5\%$

Try trapezoidal design

$b = 0$, $M = 2$, $n = 0.03$

$V = 2.73$ ft/sec < 5 ft/sec OK

No lining necessary



PROJECT : Valley Camp Coal - D-18A Runoff Calculation

AREA= 2.1 ACRES
AVERAGE BASIN SLOPE= 43.0 PERCENT
CURVE NUMBER= 78.1
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 750. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0453 HOURS QPCFS= 35.03 CFS QPIN=16.5406 INCHES
C3= 81.5285 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.18	.5582	.0000	.0000	.0	.00
2.19	.5755	.0000	.0000	7.1	.00
2.21	.5929	.0004	.0003	26.8	.00
2.22	.6102	.0009	.0005	35.0	.01
2.24	.6275	.0015	.0007	29.6	.03
2.25	.6448	.0024	.0009	19.7	.05
2.27	.6622	.0035	.0011	11.3	.08
2.28	.6795	.0048	.0013	5.8	.10
2.30	.6968	.0063	.0015	2.8	.13
2.31	.7142	.0080	.0017	1.3	.16
2.33	.7315	.0098	.0018	.5	.18
2.34	.7488	.0118	.0020	.2	.21
2.36	.7662	.0140	.0022	.0	.24
2.37	.7835	.0164	.0024	.0	.26
2.39	.8008	.0189	.0025	.0	.29
2.40	.8182	.0216	.0027	.0	.31
2.42	.8355	.0245	.0029	.0	.34
2.43	.8528	.0275	.0030	.0	.36
2.45	.8702	.0307	.0032	.0	.38
2.46	.8875	.0341	.0034	.0	.41
2.48	.9048	.0376	.0035	.0	.43
2.49	.9221	.0412	.0037	.0	.45
2.51	.9326	.0435	.0023	.0	.46
2.52	.9372	.0446	.0010	.0	.43
2.54	.9419	.0456	.0010	.0	.36
2.55	.9466	.0467	.0011	.0	.29
2.57	.9513	.0477	.0011	.0	.23
2.58	.9560	.0488	.0011	.0	.19
2.60	.9607	.0499	.0011	.0	.17

HYDROGRAPH PEAK= .46 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .05 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-19A
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED Paul
CHECKED
DATE 5/18/89

D-19A

Total Area = 5 * 1.401 = 7.0 Acres

CN = 75

Precip = 1.55 inches (10 yr, 6 hr)

hydraulic length = 1,200 ft

$$\text{Slope} = \frac{(900)(80)(100)}{43{,}560\,(7)} = 23.6\%$$

Calculated Runoff $Q_{TOT\,10\,yr} = 0.74$ cfs

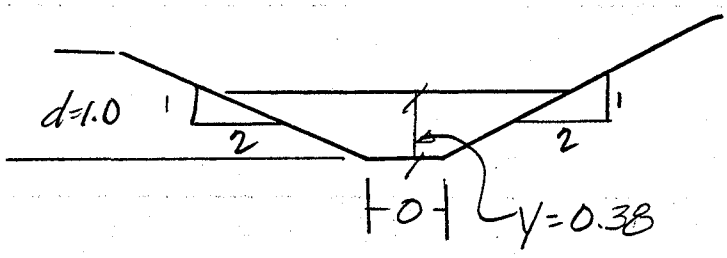
Ditch Design

$S_{min} = 3\%$

$S_{max} = 4\%$

try trapezoidal channel

$b = 0,\ m = 2,\ n = 0.03$



$V_{max} = 2.85 < 5.0$ fps ok

No Lining Required

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	10-May-89
Project No.:	007.11.100	Time:	03:00 PM
Channel Section:	Ditch D-18A	Computed:	PGH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.46	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.05	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.34	feet
	Qn/1.49(S)1/2=	0.066	
	A(R)2/3=	0.066	
	Required Depth:	0.84	feet
	Area:	0.23	ft2
	Perimeter:	1.52	feet
	Hydraulic Radius:	0.15	feet
	Velocity:	1.99	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.29	feet
	Qn/1.49(S)1/2=	0.042	
	A(R)2/3=	0.043	
	Required Depth:	0.79	feet
	Area:	0.17	ft2
	Perimeter:	1.30	feet
	Hydraulic Radius:	0.13	feet
	Velocity:	2.73	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.05	ft/ft
	Channel Depth:	0.84	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-18B
PROJECT NO. 007-11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/10/89

D-18-B (Convenience Ditch)
Tributary Area

Area D-18B = 943 * 0.00175 = 1.65 ac
sage/grass = 377 = 0.7
aspen = = 0.2
Disturbed = 286 = 0.5
Reclam = 143 = 0.25

CN	Area	Q
85	0.25	0.184
75	0.7	0.185
70	0.2	0.096
90	0.5	0.723

$\bar{Q} = 0.383$ $\bar{CN} = 82.3$

Precipitation = 1.55 inches (10yr, 6hr)

hydraulic length = 850 ft

$$\text{slope} = \frac{(850)(25)(100)}{43{,}560\ (1.4)} = 34.8$$

Run-Off Calculation: Q = 0.59 cfs

No additional design anticipated

PROJECT : Valley Camp Coal - D-18B Runoff Calculations

AREA= 1.6 ACRES
AVERAGE BASIN SLOPE= 34.8 PERCENT
CURVE NUMBER= 82.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 850. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0488 HOURS QPCFS= 25.56 CFS QPIN=15.3608 INCHES
C3= 75.7135 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.05	.4153	.0000	.0000	.0	.00
2.07	.4340	.0000	.0000	5.2	.00
2.08	.4527	.0002	.0002	19.6	.00
2.10	.4713	.0008	.0005	25.6	.00
2.12	.4900	.0016	.0008	21.6	.02
2.13	.5087	.0028	.0011	14.4	.04
2.15	.5274	.0042	.0014	8.2	.07
2.17	.5460	.0059	.0017	4.2	.09
2.18	.5647	.0079	.0020	2.0	.12
2.20	.5834	.0102	.0023	.9	.15
2.21	.6021	.0127	.0025	.4	.18
2.23	.6207	.0155	.0028	.2	.21
2.25	.6394	.0186	.0030	.0	.24
2.41	.8261	.0616	.0053	.0	.48
2.43	.8448	.0670	.0055	.0	.50
2.44	.8635	.0727	.0056	.0	.52
2.46	.8821	.0785	.0058	.0	.54
2.47	.9008	.0845	.0060	.0	.56
2.49	.9195	.0907	.0062	.0	.58
2.51	.9322	.0950	.0043	.0	.59
2.52	.9373	.0968	.0017	.0	.55
2.54	.9423	.0985	.0017	.0	.46
2.56	.9473	.1003	.0018	.0	.36
2.57	.9524	.1020	.0018	.0	.28
2.59	.9574	.1038	.0018	.0	.23
2.60	.9625	.1056	.0018	.0	.21

HYDROGRAPH PEAK= .59 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .05 Acre-Feet

PROJECT : Valley Camp Coal - D-19A Runoff Calculation

AREA= 7.0 ACRES
AVERAGE BASIN SLOPE= 23.6 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1200. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0976 HOURS QPCFS= 54.21 CFS QPIN= 7.6803 INCHES
C3= 37.8561 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.27	.6610	.0000	.0000	.0	.00
2.28	.6834	.0000	.0000	2.7	.00
2.30	.7058	.0005	.0004	16.8	.00
2.32	.7282	.0011	.0007	36.0	.01
2.34	.7506	.0021	.0009	49.8	.03
2.36	.7730	.0033	.0012	54.2	.07
2.38	.7954	.0048	.0015	50.8	.12
2.40	.8178	.0066	.0018	42.9	.18
2.42	.8402	.0086	.0020	33.5	.25
2.44	.8626	.0109	.0023	24.7	.34
2.46	.8850	.0134	.0025	17.4	.42
2.48	.9074	.0162	.0028	11.8	.51
2.50	.9298	.0193	.0030	7.8	.61
2.52	.9360	.0201	.0009	5.0	.69
2.54	.9421	.0210	.0009	3.1	.74
2.56	.9481	.0219	.0009	1.9	.74
2.58	.9542	.0228	.0009	1.2	.70
2.60	.9602	.0238	.0009	.7	.64
2.62	.9663	.0247	.0009	.4	.57
2.64	.9723	.0257	.0010	.2	.50
2.66	.9784	.0267	.0010	.1	.45
2.68	.9844	.0277	.0010	.0	.42

HYDROGRAPH PEAK= .74 cfs
TIME TO PEAK= 2.56 Hours
RUNOFF VOLUME= .11 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Co.
Project No.: 007.11.100
Channel Section: D-19A

Date: 12-Jul-89
Time: 02:31 PM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.74	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.030	ft/ft
	Max. Bottom Slope:	0.040	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.38	feet
	Qn/1.49(S)1/2=	0.086	
	A(R)2/3=	0.086	
	Required Depth:	0.88	feet
	Area:	0.28	ft2
	Perimeter:	1.68	feet
	Hydraulic Radius:	0.17	feet
	Velocity:	2.63	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.36	feet
	Qn/1.49(S)1/2=	0.075	
	A(R)2/3=	0.077	
	Required Depth:	0.86	feet
	Area:	0.26	ft2
	Perimeter:	1.61	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	2.85	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	3.0	%
	Max. Bottom Slope:	4.0	%
	Min Channel Depth:	0.88	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Not Needed	

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-19B
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/18/89

D-19B

Total Area = 530 * 0.00087 = 0.5 Acres

CN = 75

Precipitation = 1.55" (10yr, 6hr)

hydraulic length = 625'

slope = $\frac{(250)(5)(100)}{43{,}560(0.5)}$ = 5.7%

Calculated Run-off = $Q_{TOT_{100yr}}$ = 0.05 cfs

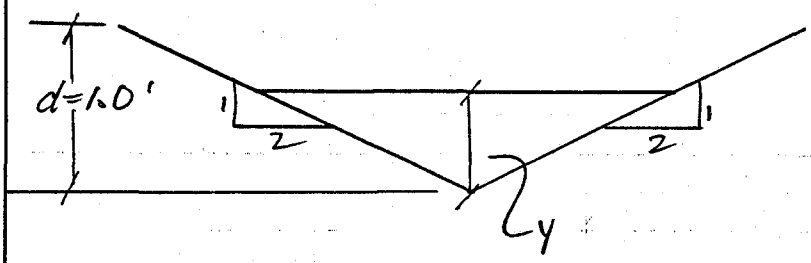
Ditch Design

S_{min} = 2%

S_{max} = 4%

try trapezoidal channel

b=0, m=2, n=0.03



FLOW IS MINIMAL
USE GENERAL DESIGN

PROJECT : Valley Camp Coal - D-19B Runoff Calculation

AREA= .5 ACRES
AVERAGE BASIN SLOPE= 5.7 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 625. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1179 HOURS QPCFS= 3.21 CFS QPIN= 6.3606 INCHES
C3= 31.3515 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.26	.6591	.0000	.0000	.0	.00
2.29	.6862	.0001	.0001	.2	.00
2.31	.7132	.0006	.0005	1.0	.00
2.33	.7403	.0016	.0009	2.1	.00
2.36	.7673	.0030	.0014	2.9	.00
2.38	.7944	.0047	.0018	3.2	.00
2.41	.8214	.0069	.0022	3.0	.00
2.43	.8485	.0094	.0025	2.5	.02
2.45	.8755	.0123	.0029	2.0	.02
2.48	.9026	.0156	.0033	1.5	.03
2.50	.9296	.0192	.0036	1.0	.04
2.52	.9372	.0203	.0011	.7	.04
2.55	.9445	.0214	.0011	.5	.05
2.57	.9518	.0225	.0011	.3	.05
2.59	.9591	.0236	.0011	.2	.05
2.62	.9664	.0247	.0011	.1	.04
2.64	.9738	.0259	.0012	.0	.04
2.66	.9811	.0271	.0012	.0	.04
2.69	.9884	.0283	.0012	.0	.03
2.71	.9957	.0296	.0012	.0	.03

HYDROGRAPH PEAK= .05 cfs
TIME TO PEAK= 2.57 Hours
RUNOFF VOLUME= .00 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 10/30/89

D-29A

Tributary Area = 1.7ac

			Q
Undisturbed	= 0.67ac	CN = 70	0.096
Disturbed	= 1.03ac	CN = 90	0.723

$\bar{Q} = 0.476$ $\bar{CN} = 84.8$

Precipitation = 1.55 in (10yr-6hr)

Hydraulic Length = 500 ft

Slope = $\frac{(1490)\ 25(100)}{43560\ (1.7)}$ = 50.3 %

Runoff Calculation : Q_{TOT} = 0.80 cfs

DITCH LIES IN STORAGE YARD - USE GENERAL DESIGN

b = 0, m = 2, d = 1.0' max

PROJECT : Valley Camp Coal - D-29A Runoff Calculation

AREA= 1.7 ACRES
AVERAGE BASIN SLOPE= 50.3 PERCENT
CURVE NUMBER= 84.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0244 HOURS QPCFS= 52.67 CFS QPIN=30.7227 INCHES
C3=151.4323 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.99	.3536	.0000	.0000	.0	.00
2.00	.3593	.0000	.0000	25.8	.00
2.01	.3733	.0001	.0001	52.7	.00
2.03	.3873	.0005	.0003	37.1	.02
2.04	.4013	.0010	.0005	16.9	.04
2.05	.4153	.0017	.0007	6.1	.06
2.06	.4293	.0027	.0009	1.9	.09
2.08	.4433	.0038	.0011	.5	.12
2.09	.4573	.0052	.0013	.1	.15
2.10	.4713	.0067	.0015	.0	.17
2.42	.8355	.1002	.0052	.0	.71
2.43	.8495	.1056	.0053	.0	.73
2.44	.8635	.1110	.0054	.0	.74
2.45	.8775	.1165	.0055	.0	.76
2.47	.8915	.1222	.0056	.0	.77
2.48	.9055	.1279	.0057	.0	.79
2.49	.9195	.1337	.0058	.0	.80
2.50	.9309	.1386	.0048	.0	.79
2.52	.9347	.1402	.0016	.0	.66
2.53	.9385	.1418	.0016	.0	.45
2.54	.9423	.1434	.0016	.0	.32
2.55	.9461	.1451	.0016	.0	.26
2.56	.9499	.1467	.0016	.0	.24

HYDROGRAPH PEAK= .80 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .07 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 6/30/89

D-29B

Tributary Area = 1.2ac

			Q
Undisturbed Area	= 0.86ac	CN = 70	0.096
Disturbed Area	= 0.34ac	CN = 90	0.723

$\bar{Q} = 0.274$ $\overline{CN} = 78.7$

Precipitation = 1.55 inches (10yr, 6hr)

Hydraulic Length = 440 feet

$$\text{Slope} = \frac{(1400)25(100)}{43560\,(1.2)} = 66.9\%$$

Runoff Calculation: $Q_{TOT} = 0.31\,cfs$

DITCH LIES IN STORAGE YARD - USE GENERAL DESIGN

$b=0,\ m=2,\ d=1.0'$ max

PROJECT : Valley Camp Coal - D-29B Runoff Calculation

AREA= 1.2 ACRES
AVERAGE BASIN SLOPE= 66.9 PERCENT
CURVE NUMBER= 78.7
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 440. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0233 HOURS QPCFS= 38.95 CFS QPIN=32.1899 INCHES
C3=158.6639 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.14	.5202	.0000	.0000	.0	.00
2.17	.5469	.0000	.0000	39.0	.00
2.19	.5736	.0004	.0004	12.5	.01
2.21	.6003	.0013	.0009	1.4	.04
2.24	.6270	.0026	.0014	.1	.06
2.26	.6537	.0045	.0019	.0	.09
2.28	.6804	.0068	.0023	.0	.12
2.31	.7071	.0096	.0028	.0	.14
2.33	.7339	.0128	.0032	.0	.16
2.35	.7606	.0164	.0036	.0	.19
2.38	.7873	.0205	.0041	.0	.21
2.40	.8140	.0250	.0045	.0	.23
2.42	.8407	.0298	.0049	.0	.25
2.45	.8674	.0351	.0052	.0	.27
2.47	.8941	.0407	.0056	.0	.29
2.49	.9209	.0467	.0060	.0	.31
2.52	.9347	.0499	.0033	.0	.21
2.54	.9420	.0517	.0017	.0	.12
2.56	.9492	.0534	.0018	.0	.10
2.59	.9564	.0552	.0018	.0	.09
2.61	.9636	.0570	.0018	.0	.10
2.63	.9708	.0588	.0018	.0	.10

HYDROGRAPH PEAK= .31 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .03 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT: VALLEY CAMP
PROJECT: PERMIT
FEATURE: D-30
PROJECT NO.: 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

D-30

TOTAL AREA = 1748 * .00702 = 12.3 ac
UNDIST AREA = 1029 = 7.2 ac (25% OAK/ASPEN)
PAVED AREA = 122 = 0.9 ac
DIST AREA = = 4.2 ac

CN	A	Q
98	0.9	1.329
90	4.2	0.723
70	7.2	0.096
		$\bar{Q}$ = 0.401

$\overline{CN}$ = 82.8

PRECIP = 1.55'

HYD. LENGTH = 1450'

SLOPE: $\frac{1450 * 25 * 100}{12.3 * 43560}$ = 4.4:1

RUNOFF CALCULATION: Q = 4.5 cfs

DITCH DESIGN:

S_{min} = 10%
S_{max} = 12½%

} DITCH CURRENTLY LINED WITH CONCRETE GUTTER ALONG ROAD. NO EROSION POTENTIAL

NO ADD'L DESIGN CONTEMPLATED

PROJECT : Valley Camp Coal - Ditch D-30 Runoff Calculation

AREA= 12.3 ACRES
AVERAGE BASIN SLOPE= 44.1 PERCENT
CURVE NUMBER= 82.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1450. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0654 HOURS QPCFS= 142.22 CFS QPIN=11.4670 INCHES
C3= 56.5206 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.04	.4067	.0000	.0000	.0	.00
2.06	.4254	.0000	.0000	13.5	.00
2.08	.4442	.0004	.0003	69.6	.00
2.09	.4629	.0011	.0007	123.7	.04
2.11	.4817	.0020	.0010	142.2	.11
2.13	.5004	.0033	.0013	128.8	.22
2.14	.5192	.0049	.0016	100.3	.38
2.16	.5380	.0068	.0019	70.4	.56
2.17	.5567	.0090	.0022	45.8	.76
2.19	.5755	.0114	.0024	28.1	.97
2.21	.5942	.0142	.0027	16.4	1.19
2.22	.6130	.0171	.0030	9.3	1.41
2.24	.6317	.0204	.0032	5.1	1.62
2.26	.6505	.0239	.0035	2.7	1.83
2.27	.6692	.0276	.0037	1.4	2.03
2.29	.6880	.0316	.0040	.7	2.24
2.31	.7067	.0358	.0042	.4	2.43
2.32	.7255	.0403	.0044	.2	2.62
2.34	.7442	.0449	.0047	.0	2.81
2.35	.7630	.0498	.0049	.0	2.99
2.37	.7818	.0549	.0051	.0	3.17
2.39	.8005	.0602	.0053	.0	3.35
2.40	.8193	.0657	.0055	.0	3.52
2.42	.8380	.0714	.0057	.0	3.68
2.44	.8568	.0773	.0059	.0	3.84
2.45	.8755	.0834	.0061	.0	4.00
2.47	.8943	.0897	.0063	.0	4.16
2.49	.9130	.0962	.0065	.0	4.31
2.50	.9305	.1023	.0062	.0	4.45
2.52	.9355	.1041	.0018	.0	4.50
2.53	.9406	.1060	.0018	.0	4.27
2.55	.9457	.1078	.0018	.0	3.77
2.57	.9508	.1097	.0019	.0	3.17
2.58	.9558	.1115	.0019	.0	2.62
2.60	.9609	.1134	.0019	.0	2.19

PROJECT : Valley Camp Coal - Ditch D-30 Runoff Calculation
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.62	.9660	.1153	.0019	.0	1.89

HYDROGRAPH PEAK= 4.50 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .41 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-31
PROJECT NO. 007-11-100

SHEET ___ OF ___
COMPUTED paul
CHECKED ___
DATE 5/9/89

D-31 (Convenience Ditch)

Total Area = 473 * 0.00702 = 3.3 acres
disturbed area = 1.9 acres
undisturbed area = 1.4 acres (25% Oak/Aspen)

CN	area	Q
70	1.4	0.096
90	1.9	0.723
		$\bar{Q}$ = 0.457

$\bar{CN}$ = 84.3

Precipitation = 1.55 in (10 yr, 6 hr)

hydraulic length = 700 feet

$$\text{slope} = \frac{(2300)(25)(100)}{43{,}560\ (3.3)} = 40.0\%$$

Run-Off Calculation: Q_{TOT} = 1.48 cfs

Convenience Ditch - No design anticipated OK

PROJECT : Valley Camp Coal - D-31 Runoff Calculations

AREA= 3.3 ACRES
AVERAGE BASIN SLOPE= 40.0 PERCENT
CURVE NUMBER= 84.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 700. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0365 HOURS QPCFS= 68.46 CFS QPIN=20.5723 INCHES
C3=101.4008 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.01	.3626	.0000	.0000	.0	.00
2.02	.3835	.0000	.0000	33.5	.00
2.04	.4044	.0005	.0005	68.5	.02
2.06	.4253	.0015	.0009	48.3	.07
2.08	.4462	.0028	.0014	22.0	.13
2.10	.4671	.0046	.0018	7.9	.21
2.11	.4880	.0068	.0022	2.4	.28
2.13	.5089	.0093	.0026	.7	.36
2.15	.5299	.0123	.0029	.2	.43
2.17	.5508	.0156	.0033	.0	.50
2.39	.8017	.0804	.0070	.0	1.21
2.41	.8226	.0876	.0072	.0	1.25
2.42	.8435	.0951	.0075	.0	1.30
2.44	.8644	.1028	.0077	.0	1.35
2.46	.8853	.1107	.0079	.0	1.39
2.48	.9062	.1189	.0082	.0	1.43
2.50	.9271	.1273	.0084	.0	1.48
2.52	.9349	.1304	.0032	.0	1.33
2.53	.9405	.1328	.0023	.0	.97
2.55	.9462	.1351	.0023	.0	.67
2.57	.9518	.1375	.0024	.0	.51
2.59	.9575	.1398	.0024	.0	.46
2.61	.9631	.1422	.0024	.0	.44

HYDROGRAPH PEAK= 1.48 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .13 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-32A, D-32B
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/9/89

D-32A, D-32B (Convenience Ditches)

Total Area = 845 * 0.00702 = 5.9 ac
undisturbed = = 5.3 ac
disturbed = = 0.6 ac

CN	A	Q
90	0.6	0.723
70	5.3	0.096
		$\bar{Q}$ = 0.160

$\bar{CN}$ = 73.8

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 820 feet

$$\text{slope} = \frac{(5000)(25)(100)}{(43{,}560)(5.9)} = 48.6\%$$

Run-off Calculation: Q_{TOT} = 0.58 cfs

Convenience Ditches - No design contemplated

PROJECT : Valley Camp Coal - D-32A, D-32B Runoff Calculations

AREA= 5.9 ACRES
AVERAGE BASIN SLOPE= 48.6 PERCENT
CURVE NUMBER= 73.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 820. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0519 HOURS QPCFS= 85.93 CFS QPIN=14.4441 INCHES
C3= 71.1952 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.30	.7032	.0000	.0000	.0	.00
2.32	.7230	.0000	.0000	17.4	.00
2.34	.7429	.0003	.0003	65.8	.00
2.35	.7627	.0008	.0005	85.9	.03
2.37	.7826	.0015	.0007	72.6	.07
2.39	.8024	.0023	.0009	48.3	.12
2.41	.8223	.0034	.0011	27.6	.18
2.42	.8421	.0047	.0013	14.2	.25
2.44	.8620	.0062	.0015	6.8	.32
2.46	.8818	.0079	.0017	3.1	.39
2.48	.9017	.0098	.0019	1.3	.46
2.49	.9216	.0119	.0021	.5	.53
2.51	.9331	.0132	.0013	.2	.58
2.53	.9385	.0138	.0006	.0	.56
2.54	.9438	.0144	.0006	.0	.49
2.56	.9492	.0151	.0006	.0	.39
2.58	.9545	.0158	.0007	.0	.32
2.60	.9599	.0164	.0007	.0	.27
2.61	.9653	.0171	.0007	.0	.25

HYDROGRAPH PEAK= .58 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .08 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE D-33A
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 8 MAY 89

D-33A

TOTAL AREA	2037 * .00702	= 14.3 acres
PAVED AREA	189 *	= 1.3
RECLAIMED AREA	175 *	= 1.2
DISTURBED AREA	578 *	= 4.1
UNDISTURBED AREA	1095 *	= 7.7

CN	A	Q
98	1.3	1.329
90	4.1	0.723
85	1.2	0.484
70	7.7	0.096
		$\bar{Q}$ = 0.421

$\overline{CN}$ = 83.4

PRECIP = 1.55" (10YR-6HR)

HYD LENGTH = 2000'

$$\text{SLOPE} = \frac{10550 * 25 * 100}{14.3 * 43560} = 42.3\%$$

RUNOFF CALCULATION: Q = 5.36 cfs

DITCH DESIGN

Smin = 4% ? DITCH CURRENTLY LINED WITH CONCRETE
Smax = 4% GUTTER ALONG ROAD. NO EROSION POTENTIAL

NO ADDL DESIGN CONTEMPLATED

PROJECT : Valley Camp Coal - Ditch D-33A Runoff Calculation

AREA= 14.3 ACRES
AVERAGE BASIN SLOPE= 42.3 PERCENT
CURVE NUMBER= 83.4
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0847 HOURS QPCFS= 127.74 CFS QPIN= 8.8588 INCHES
C3= 43.6652 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.03	.3930	.0000	.0000	.0	.00
2.05	.4124	.0001	.0001	6.4	.00
2.07	.4318	.0006	.0005	39.7	.00
2.08	.4512	.0014	.0008	84.8	.03
2.10	.4707	.0026	.0012	117.3	.09
2.12	.4901	.0041	.0015	127.7	.19
2.13	.5095	.0059	.0018	119.7	.34
2.15	.5289	.0081	.0022	101.0	.52
2.17	.5483	.0105	.0025	79.0	.74
2.18	.5678	.0133	.0028	58.3	.97
2.20	.5872	.0164	.0031	41.1	1.22
2.22	.6066	.0198	.0034	27.9	1.48
2.23	.6260	.0234	.0036	18.4	1.74
2.25	.6454	.0273	.0039	11.8	2.00
2.27	.6649	.0315	.0042	7.4	2.26
2.29	.6843	.0360	.0044	4.6	2.51
2.30	.7037	.0407	.0047	2.8	2.76
2.32	.7231	.0456	.0049	1.7	3.00
2.34	.7425	.0508	.0052	1.0	3.23
2.35	.7620	.0562	.0054	.6	3.46
2.37	.7814	.0619	.0057	.3	3.69
2.39	.8008	.0678	.0059	.2	3.90
2.40	.8202	.0739	.0061	.1	4.12
2.42	.8396	.0802	.0063	.0	4.33
2.44	.8591	.0867	.0065	.0	4.53
2.46	.8785	.0934	.0067	.0	4.73
2.47	.8979	.1003	.0069	.0	4.92
2.49	.9173	.1074	.0071	.0	5.11
2.51	.9318	.1129	.0054	.0	5.28
2.52	.9371	.1149	.0020	.0	5.36
2.54	.9423	.1169	.0020	.0	5.23
2.56	.9476	.1189	.0020	.0	4.87
2.57	.9528	.1209	.0020	.0	4.35
2.59	.9581	.1230	.0020	.0	3.78
2.61	.9633	.1250	.0021	.0	3.26

PROJECT : Valley Camp Coal - Ditch D-33A Runoff Calculation
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.62	.9686	.1271	.0021	.0	2.82

HYDROGRAPH PEAK= 5.36 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .50 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT: VALLEY CAMP
PROJECT: PERMIT
FEATURE: D-33B
PROJECT NO.: 007.11.100

SHEET 1 OF
COMPUTED: DEH
CHECKED:
DATE: 5 MAY 89

D-33B

TRIBUTARY AREAS: D-35; D-39A-B; D-38; D-36; D-33B

AREA: CHANGE PLANIMETER SCALE TO 20
Rdg: 817 A = 5.74 ac RATIO 0.00702

TOTAL	1905 * 0.00702 = 13.4 ac		
DIST.	1336	= 7.4 ac	CN = 90
UNDIST	569	= 4.0 ac	CN = 75
RECLAIMED		2.2 ac	CN = 85

CN RATIONAL SHOWN ON D-44B SHEETS

VOL. WEIGHT CN: (P = 1.55 in)

CN	A	Q	
90	7.4	0.723	$\bar{Q}$ = 0.526
75	4.0	0.185	
85	2.2	0.484	$\overline{CN}$ = 86.0

HYD. LENGTH: (UP DITCH 37) = 1630'

$$\text{SLOPE} = \frac{10160 * 25 * 100}{13.4 * 43560} = 43.5\%$$

RUNOFF PREDICTION: Q = 6.6 cfs

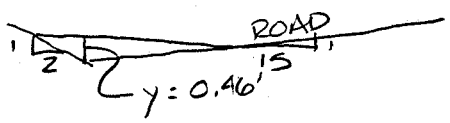
CHANNEL DESIGN: (Channel currently uses a Belt Liner)

Smin: 4%
Smax: 4%

PRELIMINARY CHECK W/ TRAP. CHANNEL SHOWS EXCESSIVE VELOCITIES.

USE ROAD TYPE CHANNEL.

b = 0	n = .03		
M_1 = 15	Q = 6.6		
M_2 = 2	S = 4%	V = 3.7 < 5 fps	NO LINING REQ'D



Id = 1.0'

PROJECT : Valley Camp Coal - Ditch D-33B Runoff Calculation

AREA= 13.4 ACRES
AVERAGE BASIN SLOPE= 43.5 PERCENT
CURVE NUMBER= 86.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1630. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0647 HOURS QPCFS= 156.51 CFS QPIN=11.5827 INCHES
C3= 57.0911 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.89	.3254	.0000	.0000	.0	.00
1.91	.3301	.0000	.0000	14.9	.00
1.93	.3349	.0000	.0000	76.7	.00
1.94	.3397	.0001	.0000	136.2	.00
1.96	.3444	.0002	.0000	156.5	.01
1.98	.3492	.0003	.0001	141.7	.03
1.99	.3540	.0005	.0001	110.3	.04
2.01	.3652	.0009	.0005	77.4	.06
2.02	.3837	.0020	.0011	50.3	.11
2.04	.4023	.0035	.0014	30.9	.22
2.06	.4209	.0053	.0018	18.1	.40
2.07	.4395	.0074	.0022	10.2	.63
2.09	.4580	.0100	.0025	5.6	.90
2.10	.4766	.0128	.0029	3.0	1.19
2.12	.4952	.0160	.0032	1.6	1.48
2.14	.5137	.0195	.0035	.8	1.77
2.15	.5323	.0233	.0038	.4	2.06
2.17	.5509	.0274	.0041	.2	2.34
2.19	.5694	.0318	.0044	.0	2.61
2.41	.8294	.1191	.0076	.0	5.68
2.43	.8480	.1269	.0078	.0	5.86
2.44	.8666	.1349	.0080	.0	6.03
2.46	.8851	.1431	.0082	.0	6.19
2.48	.9037	.1515	.0084	.0	6.36
2.49	.9223	.1600	.0085	.0	6.52
2.51	.9329	.1650	.0050	.0	6.61
2.53	.9379	.1674	.0024	.0	6.44
2.54	.9430	.1698	.0024	.0	5.86
2.56	.9480	.1721	.0024	.0	5.03
2.57	.9530	.1745	.0024	.0	4.17
2.59	.9580	.1770	.0024	.0	3.45
2.61	.9630	.1794	.0024	.0	2.91

HYDROGRAPH PEAK= 6.61 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .59 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	05-May-89
Project No.:	007.11.100	Time:	11:24 AM
Channel Section:	Ditch D-33B	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	6.60	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.04	ft/ft
	Max. Bottom Slope:	0.04	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.46	feet
	Qn/1.49(S)1/2=	0.666	
	A(R)2/3=	0.668	
	Required Depth:	0.96	feet
	Area:	1.80	ft2
	Perimeter:	7.94	feet
	Hydraulic Radius:	0.23	feet
	Velocity:	3.67	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.46	feet
	Qn/1.49(S)1/2=	0.666	
	A(R)2/3=	0.668	
	Required Depth:	0.96	feet
	Area:	1.80	ft2
	Perimeter:	7.94	feet
	Hydraulic Radius:	0.23	feet
	Velocity:	3.67	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.04	ft/ft
	Max. Bottom Slope:	0.04	ft/ft
	Channel Depth:	0.96	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE inc

CLIENT: VALLEY CAMP
PROJECT: PERMIT
FEATURE: D-34A
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

D-34A (RECLAIMED) - Small Oak Aspen Area Ignored - Calcs ∴ Conservative.

AREA: 189 * .00702 = 1.3 ac
HYD LENGTH = 450'
SLOPE = $\frac{1160' * 25 * 100}{1.3 * 43560}$ = 51.2%

CN = 85 (See D-44B design Sheets)
P = 1.55"

RUNOFF PREDICTION: Q = 0.64

CHANNEL DESIGN:

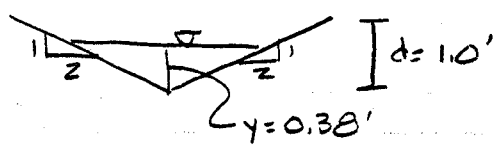
S_{min} = 2%
S_{max} = 2%

TRY TRAPEZOIDAL DESIGN

b = 0, m = 2, n = 0.03

V = 2.2 < 5 fps ok

NO LINING REQ'd



PROJECT : Valley Camp Coal - Ditch D-34A Runoff Calculation

AREA= 1.3 ACRES
AVERAGE BASIN SLOPE= 51.2 PERCENT
CURVE NUMBER= 85.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 450. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0221 HOURS QPCFS= 44.52 CFS QPIN=33.9588 INCHES
C3=167.3829 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.99	.3529	.0000	.0000	.0	.00
2.01	.3677	.0001	.0001	44.5	.00
2.03	.3930	.0009	.0008	14.3	.04
2.05	.4183	.0023	.0014	1.6	.08
2.08	.4437	.0044	.0021	.1	.12
2.10	.4690	.0072	.0027	.0	.15
2.36	.7730	.0808	.0086	.0	.51
2.39	.7983	.0897	.0090	.0	.54
2.41	.8236	.0991	.0094	.0	.56
2.43	.8490	.1088	.0097	.0	.58
2.45	.8743	.1189	.0101	.0	.60
2.47	.8996	.1293	.0104	.0	.62
2.50	.9250	.1400	.0107	.0	.64
2.52	.9355	.1446	.0046	.0	.37
2.54	.9423	.1476	.0030	.0	.22
2.56	.9492	.1506	.0030	.0	.19
2.58	.9560	.1536	.0030	.0	.18
2.61	.9629	.1567	.0031	.0	.18
2.63	.9697	.1597	.0031	.0	.19

HYDROGRAPH PEAK= .64 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .05 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: Ditch D-34A

Date: 05-May-89
Time: 10:35 AM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.64	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.38	feet
	Qn/1.49(S)1/2=	0.091	
	A(R)2/3=	0.089	
	Required Depth:	0.88	feet
	Area:	0.29	ft2
	Perimeter:	1.70	feet
	Hydraulic Radius:	0.17	feet
	Velocity:	2.22	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.38	feet
	Qn/1.49(S)1/2=	0.091	
	A(R)2/3=	0.089	
	Required Depth:	0.88	feet
	Area:	0.29	ft2
	Perimeter:	1.70	feet
	Hydraulic Radius:	0.17	feet
	Velocity:	2.22	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Channel Depth:	0.88	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-34B
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

D-34B

ALL DIST. EXCEPT FOR OAK/ASPEN AREA

TOTAL AREA = 435 * .00702 = 3.0 ac
OAK AREA = 67 * .00702 = 0.5 ac
DIST AREA = 2.5 ac

PRECIP = 1.55" (10 YR-6 HR)

VOL WEIGHTED CN.

CN	A	Q
40	0.5	0.155
90	2.5	0.723
	$\bar{Q}$ =	0.628

$\overline{CN}$ = 88.2

HYD LENGTH = 670'

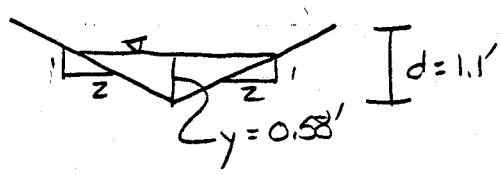
$$\text{SLOPE} = \frac{2610 * 25 * 100}{3.0 * 43560} = 50\%$$

RUNOFF CALCULATION: Q = 1.88 cfs

CHANNEL DESIGN:

Smin = 2%
Smax = 5%

TRY TRAP. CHANNEL.



NO LINING REQ'D

PROJECT : Valley Camp Coal - Ditch D-34B Runoff Calculation

AREA= 3.0 ACRES
AVERAGE BASIN SLOPE= 50.0 PERCENT
CURVE NUMBER= 88.2
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 670. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0273 HOURS QPCFS= 83.03 CFS QPIN=27.4469 INCHES
C3=135.2856 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.69	.2663	.0000	.0000	.0	.00
1.71	.2704	.0000	.0000	40.6	.00
1.72	.2744	.0000	.0000	83.0	.00
1.73	.2784	.0000	.0000	58.6	.00
1.75	.2824	.0002	.0000	26.7	.00
1.76	.2864	.0003	.0000	9.6	.01
1.78	.2905	.0004	.0001	3.0	.02
1.79	.2945	.0005	.0001	.8	.02
1.80	.2985	.0007	.0002	.2	.03
1.82	.3025	.0009	.0002	.0	.03
2.42	.8357	.1694	.0079	.0	1.71
2.43	.8514	.1774	.0080	.0	1.74
2.45	.8671	.1855	.0081	.0	1.77
2.46	.8827	.1938	.0083	.0	1.80
2.47	.8984	.2021	.0084	.0	1.82
2.49	.9141	.2106	.0085	.0	1.85
2.50	.9297	.2192	.0086	.0	1.88
2.51	.9342	.2217	.0024	.0	1.65
2.53	.9384	.2240	.0024	.0	1.14
2.54	.9426	.2264	.0024	.0	.78
2.55	.9469	.2288	.0024	.0	.61
2.57	.9511	.2311	.0024	.0	.55
2.58	.9553	.2335	.0024	.0	.54

HYDROGRAPH PEAK= 1.88 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .16 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: Ditch D-34B

Date: 05-May-89
Time: 11:08 AM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	1.88	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.05	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.58	feet
	Qn/1.49(S)1/2=	0.268	
	A(R)2/3=	0.274	
	Required Depth:	1.08	feet
	Area:	0.67	ft2
	Perimeter:	2.59	feet
	Hydraulic Radius:	0.26	feet
	Velocity:	2.79	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.48	feet
	Qn/1.49(S)1/2=	0.170	
	A(R)2/3=	0.165	
	Required Depth:	0.98	feet
	Area:	0.46	ft2
	Perimeter:	2.15	feet
	Hydraulic Radius:	0.21	feet
	Velocity:	4.08	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.05	ft/ft
	Channel Depth:	1.08	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-35
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

D-35

TRIBUTARY AREAS: D-42; D-37; D-35

AREA = 4.6 ACRES (3.9 ac disturbed, 0.7 ac reclaimed)

SLOPE = $\frac{2910 * 25 * 100}{4.6 * 43560}$ = 36.3%

HYD LENGTH = 1150'

CN = 90

P = 1.55"

CN	A	Q
90	3.9	0.723
85	0.7	0.484
		$\bar{Q}$ = 0.686

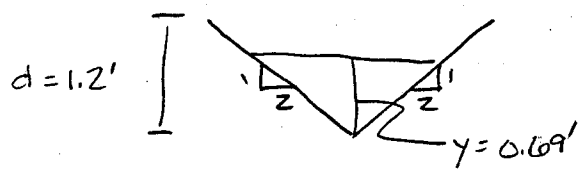
$\bar{CN}$ = 89.3

RUNOFF PREDICTION: Q = 3.0 cfs

CHANNEL DESIGN:

$S_{min} = S_{max} = 2\%$ b = 0, m = 2, n = 0.03

USE TRIANGULAR CHANNEL



v = 3.2 fps < 5 NO LINING REQ'd

PROJECT : Valley Camp Coal - Ditch D-35 Runoff Calculation

AREA= 4.6 ACRES
AVERAGE BASIN SLOPE= 36.3 PERCENT
CURVE NUMBER= 89.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1150. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0473 HOURS QPCFS= 73.51 CFS QPIN=15.8485 INCHES
C3= 78.1173 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.59	.2366	.0000	.0000	.0	.00
1.61	.2412	.0000	.0000	14.9	.00
1.62	.2459	.0000	.0000	56.3	.00
1.64	.2505	.0000	.0000	73.5	.00
1.66	.2551	.0002	.0001	62.1	.00
1.67	.2598	.0003	.0001	41.3	.01
1.69	.2644	.0005	.0002	23.7	.02
1.70	.2691	.0007	.0002	12.2	.03
1.72	.2737	.0009	.0002	5.8	.04
1.73	.2784	.0012	.0003	2.6	.05
1.75	.2830	.0015	.0003	1.1	.06
1.77	.2877	.0018	.0003	.5	.07
1.78	.2923	.0022	.0004	.2	.08
1.80	.2969	.0026	.0004	.0	.09
2.40	.8119	.1850	.0097	.0	2.71
2.41	.8300	.1949	.0099	.0	2.76
2.43	.8481	.2049	.0101	.0	2.82
2.44	.8662	.2151	.0102	.0	2.87
2.46	.8843	.2255	.0104	.0	2.92
2.48	.9023	.2360	.0105	.0	2.97
2.49	.9204	.2467	.0107	.0	3.01
2.51	.9323	.2537	.0071	.0	3.00
2.52	.9372	.2567	.0029	.0	2.77
2.54	.9421	.2596	.0029	.0	2.30
2.55	.9470	.2626	.0030	.0	1.78
2.57	.9519	.2655	.0030	.0	1.39
2.59	.9567	.2685	.0030	.0	1.14

HYDROGRAPH PEAK= 3.01 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .26 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	05-May-89
Project No.:	007.11.100	Time:	11:31 AM
Channel Section:	Ditch D-35	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	3.00	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.69	feet
	Qn/1.49(S)1/2=	0.428	
	A(R)2/3=	0.435	
	Required Depth:	1.19	feet
	Area:	0.95	ft2
	Perimeter:	3.09	feet
	Hydraulic Radius:	0.31	feet
	Velocity:	3.15	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.69	feet
	Qn/1.49(S)1/2=	0.428	
	A(R)2/3=	0.435	
	Required Depth:	1.19	feet
	Area:	0.95	ft2
	Perimeter:	3.09	feet
	Hydraulic Radius:	0.31	feet
	Velocity:	3.15	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Channel Depth:	1.19	feet
	Riprap:	Not Needed	

Comments

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-34B
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

D-34B

ALL DIST. EXCEPT FOR OAK/ASPEN AREA

TOTAL AREA = 435 * .00702 = 3.0 ac
OAK AREA = 67 * .00702 = 0.5 ac
DIST AREA = 2.5 ac

PRECIP = 1.55" (10 YR-6 HR)

VOL WEIGHTED CN.

CN	A	Q
40	0.5	0.155
90	2.5	0.723
	$\bar{Q}$ =	0.628

$\overline{CN}$ = 88.2

HYD LENGTH = 670'

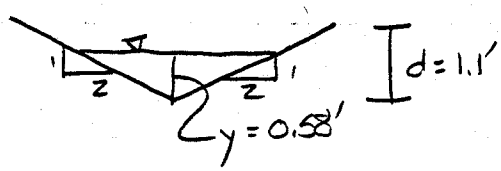
$$\text{SLOPE} = \frac{2610 * 25 * 100}{3.0 * 43560} = 50\%$$

RUNOFF CALCULATION: Q = 1.88 cfs

CHANNEL DESIGN:

Smin = 2%
Smax = 5%

TRY TRAP. CHANNEL.



NO LINING REQ'D

PROJECT : Valley Camp Coal - Ditch D-34B Runoff Calculation

AREA= 3.0 ACRES
AVERAGE BASIN SLOPE= 50.0 PERCENT
CURVE NUMBER= 88.2
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 670. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0273 HOURS QPCFS= 83.03 CFS QPIN=27.4469 INCHES
C3=135.2856 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.69	.2663	.0000	.0000	.0	.00
1.71	.2704	.0000	.0000	40.6	.00
1.72	.2744	.0000	.0000	83.0	.00
1.73	.2784	.0000	.0000	58.6	.00
1.75	.2824	.0002	.0000	26.7	.00
1.76	.2864	.0003	.0000	9.6	.01
1.78	.2905	.0004	.0001	3.0	.02
1.79	.2945	.0005	.0001	.8	.02
1.80	.2985	.0007	.0002	.2	.03
1.82	.3025	.0009	.0002	.0	.03
2.42	.8357	.1694	.0079	.0	1.71
2.43	.8514	.1774	.0080	.0	1.74
2.45	.8671	.1855	.0081	.0	1.77
2.46	.8827	.1938	.0083	.0	1.80
2.47	.8984	.2021	.0084	.0	1.82
2.49	.9141	.2106	.0085	.0	1.85
2.50	.9297	.2192	.0086	.0	1.88
2.51	.9342	.2217	.0024	.0	1.65
2.53	.9384	.2240	.0024	.0	1.14
2.54	.9426	.2264	.0024	.0	.78
2.55	.9469	.2288	.0024	.0	.61
2.57	.9511	.2311	.0024	.0	.55
2.58	.9553	.2335	.0024	.0	.54

HYDROGRAPH PEAK= 1.88 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .16 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: Ditch D-34B

Date: 05-May-89
Time: 11:08 AM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	1.88	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.05	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.58	feet
	Qn/1.49(S)1/2=	0.268	
	A(R)2/3=	0.274	
	Required Depth:	1.08	feet
	Area:	0.67	ft2
	Perimeter:	2.59	feet
	Hydraulic Radius:	0.26	feet
	Velocity:	2.79	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.48	feet
	Qn/1.49(S)1/2=	0.170	
	A(R)2/3=	0.165	
	Required Depth:	0.98	feet
	Area:	0.46	ft2
	Perimeter:	2.15	feet
	Hydraulic Radius:	0.21	feet
	Velocity:	4.08	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.05	ft/ft
	Channel Depth:	1.08	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE inc

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE D-35
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

D-35

TRIBUTARY AREAS: D-42; D-37; D-35

AREA = 4.6 ACRES (3.9 ac disturbed, 0.7 ac reclaimed)

SLOPE = $\frac{2910 * 25 * 100}{4.6 * 43560}$ = 36.3%

HYD LENGTH = 1150'

CN = 90

P = 1.55"

CN	A	Q
90	3.9	0.723
85	0.7	0.484
		$\bar{Q}$ = 0.686

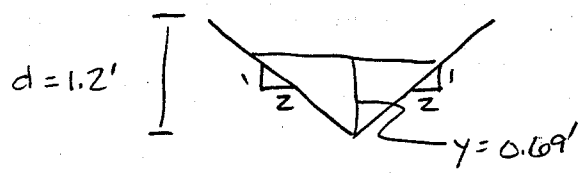
$\bar{CN}$ = 89.3

RUNOFF PREDICTION: Q = 3.0 cfs

CHANNEL DESIGN:

$S_{min} = S_{max} = 2\%$ b = 0, m = 2, n = 0.03

USE TRIANGULAR CHANNEL



v = 3.2 fps < 5 NO LINING REQ'd

PROJECT : Valley Camp Coal - Ditch D-35 Runoff Calculation

AREA= 4.6 ACRES
AVERAGE BASIN SLOPE= 36.3 PERCENT
CURVE NUMBER= 89.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1150. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0473 HOURS QPCFS= 73.51 CFS QPIN=15.8485 INCHES
C3= 78.1173 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.59	.2366	.0000	.0000	.0	.00
1.61	.2412	.0000	.0000	14.9	.00
1.62	.2459	.0000	.0000	56.3	.00
1.64	.2505	.0000	.0000	73.5	.00
1.66	.2551	.0002	.0001	62.1	.00
1.67	.2598	.0003	.0001	41.3	.01
1.69	.2644	.0005	.0002	23.7	.02
1.70	.2691	.0007	.0002	12.2	.03
1.72	.2737	.0009	.0002	5.8	.04
1.73	.2784	.0012	.0003	2.6	.05
1.75	.2830	.0015	.0003	1.1	.06
1.77	.2877	.0018	.0003	.5	.07
1.78	.2923	.0022	.0004	.2	.08
1.80	.2969	.0026	.0004	.0	.09
2.40	.8119	.1850	.0097	.0	2.71
2.41	.8300	.1949	.0099	.0	2.76
2.43	.8481	.2049	.0101	.0	2.82
2.44	.8662	.2151	.0102	.0	2.87
2.46	.8843	.2255	.0104	.0	2.92
2.48	.9023	.2360	.0105	.0	2.97
2.49	.9204	.2467	.0107	.0	3.01
2.51	.9323	.2537	.0071	.0	3.00
2.52	.9372	.2567	.0029	.0	2.77
2.54	.9421	.2596	.0029	.0	2.30
2.55	.9470	.2626	.0030	.0	1.78
2.57	.9519	.2655	.0030	.0	1.39
2.59	.9567	.2685	.0030	.0	1.14

HYDROGRAPH PEAK= 3.01 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .26 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-36
PROJECT NO. 007-11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/9/89

D-36 (Convenience Ditch)

Total Area = 517 * 0.00702 = 2.7 ac
undist. area = 310 = 1.9 ac (25% Oak/Aspen)
dist. area = = 0.8 ac

CN	A	Q
90	0.8	0.723
70	1.9	0.096
		$\bar{Q}$ = 0.282

$\bar{CN}$ = 79.0

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 550 feet

$$\text{slope} = \frac{(3{,}070)(25)(100)}{43{,}560\,(2.7)} = 65.3\ \%$$

Run-off Calculation: Q_{TOT} = 0.70 cfs

Convenience ditch - No design anticipated CK
(Small ditch)

PROJECT : Valley Camp Coal - D-36 Runoff Calculation

AREA= 2.7 ACRES
AVERAGE BASIN SLOPE= 65.3 PERCENT
CURVE NUMBER= 79.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 550. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0279 HOURS QPCFS= 73.10 CFS QPIN=26.8484 INCHES
C3=132.3358 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.15	.5266	.0000	.0000	.0	.00
2.18	.5586	.0003	.0003	73.1	.02
2.20	.5906	.0013	.0010	23.6	.08
2.23	.6226	.0030	.0017	2.6	.15
2.26	.6546	.0054	.0024	.2	.22
2.29	.6866	.0085	.0031	.0	.29
2.32	.7186	.0123	.0037	.0	.35
2.34	.7506	.0167	.0044	.0	.42
2.37	.7826	.0216	.0050	.0	.48
2.40	.8146	.0272	.0056	.0	.54
2.43	.8466	.0334	.0061	.0	.59
2.46	.8786	.0401	.0067	.0	.65
2.48	.9106	.0473	.0072	.0	.70
2.51	.9334	.0527	.0055	.0	.59
2.54	.9421	.0549	.0021	.0	.31
2.57	.9507	.0571	.0022	.0	.23
2.59	.9594	.0593	.0022	.0	.22
2.62	.9680	.0615	.0022	.0	.22
2.65	.9767	.0638	.0023	.0	.23

HYDROGRAPH PEAK= .70 cfs
TIME TO PEAK= 2.48 Hours
RUNOFF VOLUME= .06 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE D-37
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 4MAY89

D-37 DESIGN

CN DETERMINATIONS SHOWN ON D-44B SHEETS

P10 YR-6HR = 1.55 in

AREA: 124.4 * 0.0035 = 3.75 ac (ALL AREA DISTURBED) USE CN=90
60 * " 04 ac

HYD. LENGTH = 1150 ft

WATERSHED SLOPE: CONT L = 2375
CONT I = 25'

$$\frac{2375 * 25 * 100}{3.75 * 43560} = 36.3\%$$

RUNOFF PREDICTION: Q = 2.6 cfs

CHANNEL DESIGN:

S_{min} = 2%
S_{max} = 18% (Except for SHORT RIPRAP SECTION AT SWITCHBACK BY COAL PILE WHICH IS 30%)
Velocities will be higher - USE Road Ditch Design

M_1 = 15 b = 0 Q = 2.6
M_2 = 2 n = .03

Printout Shows Riprap Required on 18% GRADE IMMEDIATELY BELOW CONCRETE SETTLING BASIN. CHANGE CRITERIA AND BREAK OUT UPPER DITCH SECTION - RECALCULATE FLOW.

AREA = Tributary Area to 18% Ditch Section running between Concrete Settling Basin and road intersection near Culvert C-40-42 inlet.

Area = 390 * .0035 = 1.37 ac
HYD. LENGTH = 500'
SLOPE = $\frac{840 * 25 * 100}{1.37 * 43560}$ = 35.2%

RUNOFF PREDICTION: Q_{upper} = 0.99 cfs

CHANNEL DESIGN: USE ROAD DITCH DESIGN

S = 18%; M_1 = 15, M_2 = 2, b = 0, n = 0.03 V = 4.0 < 5 ok

LINING NOT REQ'D

PROJECT : Valley Camp Coal - Ditch D-37 Runoff Prediction

AREA= 3.8 ACRES
AVERAGE BASIN SLOPE= 36.3 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1150. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0460 HOURS QPCFS= 61.65 CFS QPIN=16.3034 INCHES
C3= 80.3596 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.53	.2190	.0000	.0000	.0	.00
1.55	.2235	.0000	.0000	12.5	.00
1.56	.2280	.0000	.0000	47.2	.00
1.58	.2325	.0000	.0000	61.6	.00
1.59	.2370	.0002	.0001	52.1	.00
1.61	.2415	.0003	.0001	34.7	.01
1.62	.2461	.0005	.0002	19.8	.02
1.64	.2506	.0007	.0002	10.2	.03
1.66	.2551	.0009	.0002	4.9	.04
1.67	.2596	.0012	.0003	2.2	.04
1.69	.2641	.0015	.0003	.9	.05
1.70	.2686	.0019	.0003	.4	.06
1.72	.2731	.0022	.0004	.2	.07
1.73	.2777	.0026	.0004	.0	.08
2.41	.8231	.2109	.0101	.0	2.38
2.42	.8407	.2212	.0103	.0	2.42
2.44	.8583	.2316	.0104	.0	2.46
2.45	.8759	.2421	.0105	.0	2.50
2.47	.8934	.2528	.0107	.0	2.54
2.48	.9110	.2636	.0108	.0	2.57
2.50	.9286	.2745	.0109	.0	2.61
2.51	.9344	.2782	.0036	.0	2.55
2.53	.9391	.2812	.0030	.0	2.22
2.54	.9439	.2842	.0030	.0	1.76
2.56	.9486	.2872	.0030	.0	1.35
2.58	.9534	.2902	.0030	.0	1.07
2.59	.9581	.2932	.0030	.0	.90

HYDROGRAPH PEAK= 2.61 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .23 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: D-37

Date: 05-May-89
Time: 08:12 AM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.60	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.18	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.37	feet
	Qn/1.49(S)1/2=	0.371	
	A(R)2/3=	0.371	
	Required Depth:	0.87	feet
	Area:	1.16	ft2
	Perimeter:	6.37	feet
	Hydraulic Radius:	0.18	feet
	Velocity:	2.25	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.25	feet
	Qn/1.49(S)1/2=	0.124	
	A(R)2/3=	0.125	
	Required Depth:	0.75	feet
	Area:	0.51	ft2
	Perimeter:	4.23	feet
	Hydraulic Radius:	0.12	feet
	Velocity:	5.10	ft/sec
	Riprap Ck (V<5?):	Required	

VEL. TOO HIGH - BREAK OUT UPPER STEEP AREA

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.18	ft/ft
	Channel Depth:	0.87	feet
	Riprap:	Required	

Comment:

PROJECT : Valley Camp Coal - Upper Section Ditch D-37 Runoff Prediction

AREA= 1.4 ACRES
AVERAGE BASIN SLOPE= 35.2 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0240 HOURS QPCFS= 43.18 CFS QPIN=31.2593 INCHES
C3=154.0771 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.54	.2197	.0000	.0000	.0	.00
1.56	.2267	.0000	.0000	43.2	.00
1.58	.2338	.0001	.0001	13.9	.00
1.61	.2409	.0003	.0002	1.5	.00
1.63	.2479	.0006	.0003	.1	.01
1.66	.2550	.0009	.0004	.0	.02
2.35	.7591	.1749	.0148	.0	.86
2.38	.7866	.1901	.0152	.0	.89
2.40	.8142	.2057	.0156	.0	.91
2.42	.8417	.2217	.0160	.0	.93
2.45	.8692	.2381	.0164	.0	.95
2.47	.8967	.2548	.0167	.0	.97
2.49	.9242	.2718	.0170	.0	.99
2.52	.9359	.2791	.0073	.0	.58
2.54	.9433	.2838	.0047	.0	.33
2.57	.9507	.2885	.0047	.0	.28
2.59	.9582	.2932	.0047	.0	.28
2.61	.9656	.2980	.0048	.0	.28
2.64	.9731	.3028	.0048	.0	.28

HYDROGRAPH PEAK= .99 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .08 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

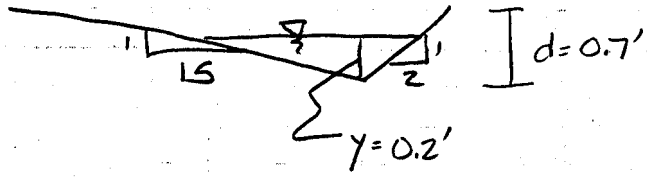
Client:	Valley Camp Coal Company	Date:	05-May-89
Project No.:	007.11.100	Time:	08:27 AM
Channel Section:	Upper D-37	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.99	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.18	ft/ft
	Max. Bottom Slope:	0.18	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.17	feet
	Qn/1.49(S)1/2=	0.047	
	A(R)2/3=	0.047	
	Required Depth:	0.67	feet
	Area:	0.25	ft2
	Perimeter:	2.94	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	4.03	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.17	feet
	Qn/1.49(S)1/2=	0.047	
	A(R)2/3=	0.047	
	Required Depth:	0.67	feet
	Area:	0.25	ft2
	Perimeter:	2.94	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	4.03	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.18	ft/ft
	Max. Bottom Slope:	0.18	ft/ft
	Channel Depth:	0.67	feet
	Riprap:	Not Needed	

Comment:

UPPER SECTION - CROSS SECTION (18% Grade)



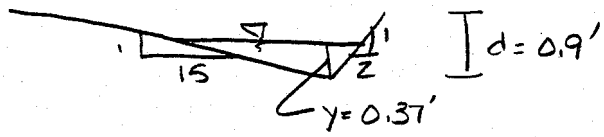
REMAINING SECTION OF DITCH (BELOW 18% GRADE)

SLOPE VARIES BETWEEN 2% AND 10% WITH 1 30% RIPRAPPED SECTION

FOR 2-10% SLOPES : Q=2.6 cfs (See Sheet 7)

$M_1=1.5$ $b=0$
$M_2=2$ $\eta=0.03$ $V=4.1<5$ ∝

NO LINING REQ'd



30% RIPRAP SECTION Q=2.6

From Sheet 8; $y=0.22'$, $V=8.1$ fps > 5.0 LINING REQ'd
$b=1.0'$

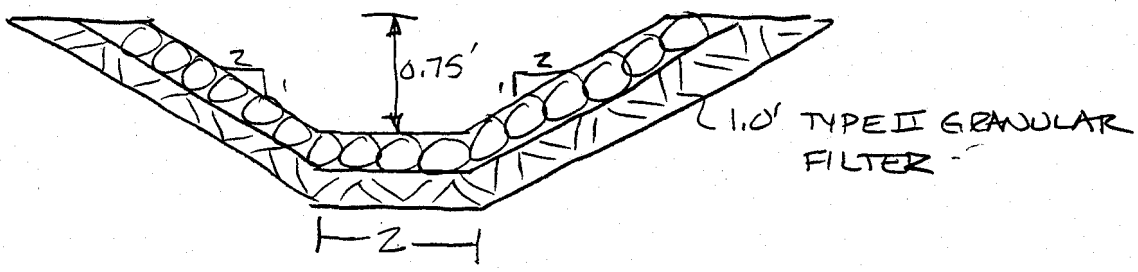
EXTRAPOLATING FROM "DESIGN OF STABLE CHANNELS WITH FLEXIBLE LININGS" FED. HIGHWAY ADM - OCT 75 - SEE SHEET 9

GIVES $D_{50} \sim 1.0'$ $\eta = .0395(D_{50})^{1/6} \sim 0.04$

IF CHANNEL IS WIDENED TO 2.0' (Sheet 10)

$y=0.19'$ AND $D_{50}=0.75'$ USE $B=2.0'$

USE 1.0' TYPE II GRANULAR FILTER AS PER "URBAN STORM DRAINAGE CRITERIA MANUAL" - VOL 2 - MARCH 1969 (T615-4)



Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: Lower D-37

Date: 05-May-89
Time: 08:33 AM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.60	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.10	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.37	feet
	Qn/1.49(S)1/2=	0.371	
	A(R)2/3=	0.371	
	Required Depth:	0.87	feet
	Area:	1.16	ft2
	Perimeter:	6.37	feet
	Hydraulic Radius:	0.18	feet
	Velocity:	2.25	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.27	feet
	Qn/1.49(S)1/2=	0.166	
	A(R)2/3=	0.166	
	Required Depth:	0.77	feet
	Area:	0.63	ft2
	Perimeter:	4.71	feet
	Hydraulic Radius:	0.13	feet
	Velocity:	4.10	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.10	ft/ft
	Channel Depth:	0.87	feet
	Riprap:	Not Needed	

Comment:

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: Lower D-37

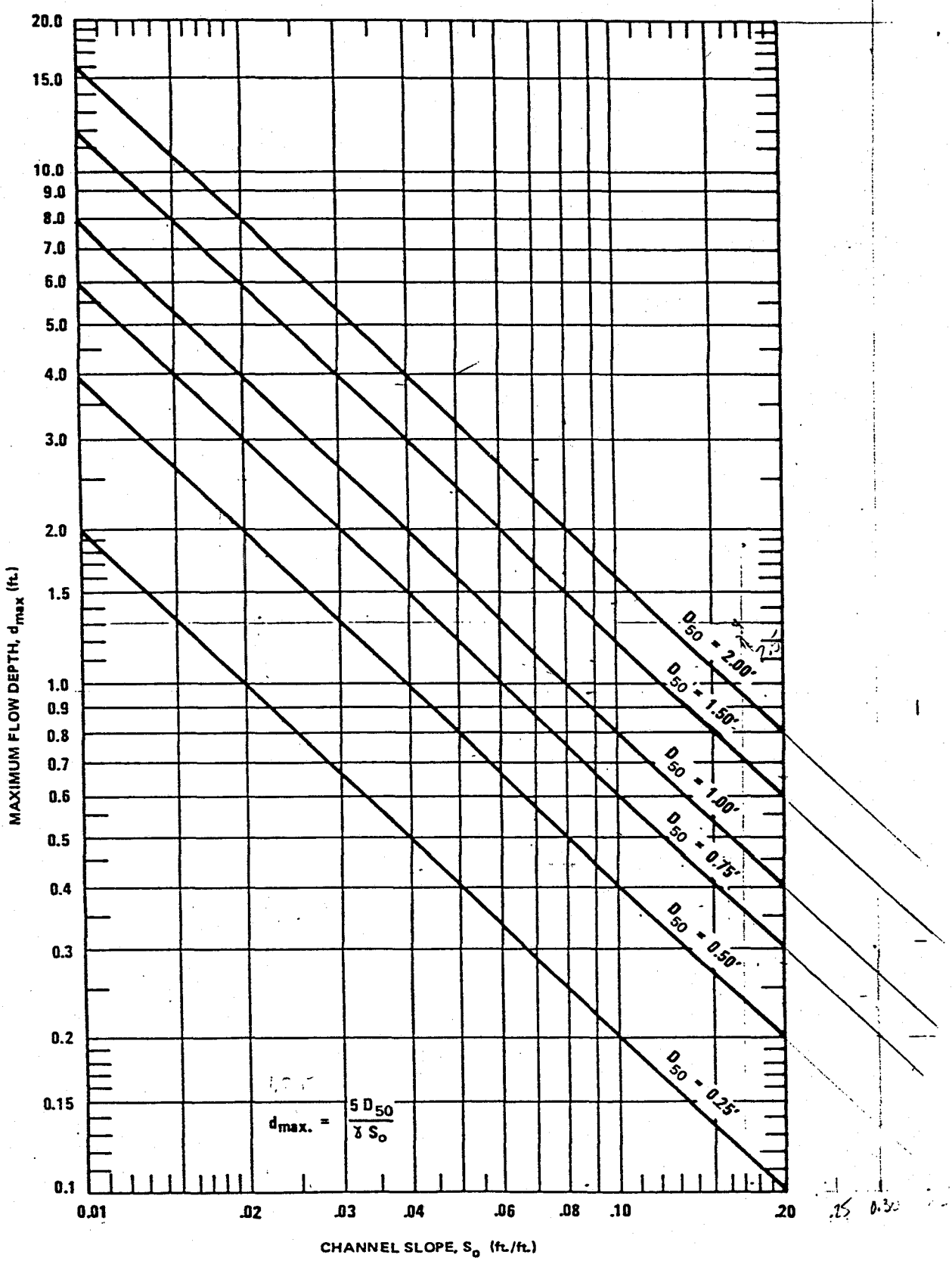
Date: 05-May-89
Time: 08:47 AM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.60	cfs
	Bottom Width:	1.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.30	ft/ft
	Max. Bottom Slope:	0.30	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.22	feet
	Qn/1.49(S)1/2=	0.096	
	A(R)2/3=	0.096	
	Required Depth:	0.72	feet
	Area:	0.32	ft2
	Perimeter:	2.00	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	8.06	ft/sec
	Riprap Ck (V<5?):	Required	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.22	feet
	Qn/1.49(S)1/2=	0.096	
	A(R)2/3=	0.096	
	Required Depth:	0.72	feet
	Area:	0.32	ft2
	Perimeter:	2.00	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	8.06	ft/sec
	Riprap Ck (V<5?):	Required	

DESIGN CRITERIA:	Bottom Width:	1.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.30	ft/ft
	Max. Bottom Slope:	0.30	ft/ft
	Channel Depth:	0.72	feet
	Riprap:	Required	

Comment:

Chart 27



MAXIMUM PERMISSIBLE DEPTH OF FLOW (d_{max})
FOR CHANNELS LINED WITH ROCK RIPRAP

$n = .0395 D_{50}^{1/6}$

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Co.	Date:	12-Jul-89
Project No.:	007.11.100	Time:	03:13 PM
Channel Section:	Lower D-37	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.60	cfs
	Bottom Width:	2.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.040	
	Min. Bottom Slope:	0.300	ft/ft
	Max. Bottom Slope:	0.300	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.19	feet
	Qn/1.49(S)1/2=	0.128	
	A(R)2/3=	0.127	
	Required Depth:	0.69	feet
	Area:	0.44	ft2
	Perimeter:	2.83	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	5.93	ft/sec
	Riprap Ck (V<5?):	Required	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.19	feet
	Qn/1.49(S)1/2=	0.128	
	A(R)2/3=	0.127	
	Required Depth:	0.69	feet
	Area:	0.44	ft2
	Perimeter:	2.83	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	5.93	ft/sec
	Riprap Ck (V<5?):	Required	

DESIGN CRITERIA:	Bottom Width:	2.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	30.0	%
	Max. Bottom Slope:	30.0	%
	Min Channel Depth:	0.69	feet
	Riprap (Min S):	Required	
	Riprap (Max S):	Required	

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-37
PROJECT NO. 007.11.100

SHEET 11 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

Riprap Gradation (From Drainage Criteria Manual) Table 5-1

Riprap Type L

Intermediate Rock Dimension (inches)	% Smaller Than Given Size By Weight
15	70-100
12	50-70
9	35-50
3	2-10

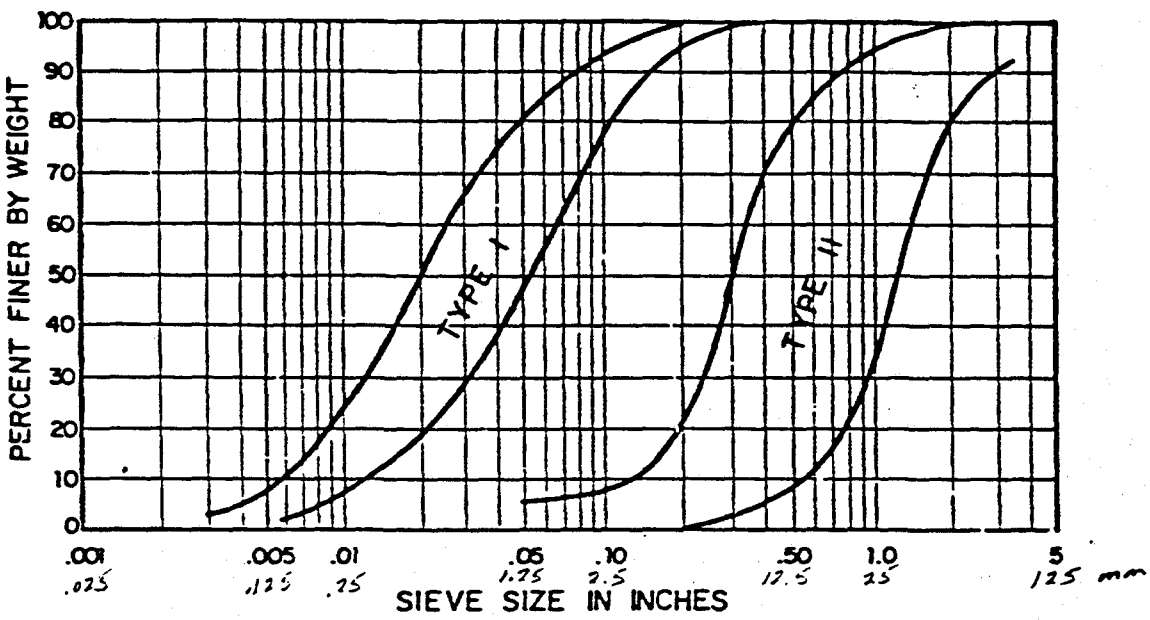


FIGURE 5-2. GRADATION CURVES FOR GRANULAR BEDDING

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 6/30/89

D-38

Total Area = 0.3 acres (Disturbed)

CN = 90

Precipitation = 1.55 inches (10yr, 6hr)

Hydraulic Length = 175 feet

$$\text{Slope} = \frac{(150)\,25(100)}{43560\,(0.3)} = 28.7\%$$

Calculated Runoff $Q_{TOT} = 0.22$ cfs

No ditch Design Anticipated. - USE GENERAL DESIGN

PROJECT : Valley Camp Coal - D-38 Runoff Calculation

AREA= .3 ACRES
AVERAGE BASIN SLOPE= 27.7 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 175. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0117 HOURS QPCFS= 19.43 CFS QPIN=64.2234 INCHES
C3=316.5573 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.54	.2199	.0000	.0000	.0	.00
1.55	.2234	.0000	.0000	19.4	.00
1.56	.2269	.0000	.0000	5.6	.00
1.57	.2305	.0000	.0000	.6	.00
1.58	.2340	.0001	.0000	.0	.00
2.42	.8428	.2224	.0081	.0	.21
2.44	.8566	.2306	.0081	.0	.21
2.45	.8704	.2388	.0082	.0	.21
2.46	.8841	.2471	.0083	.0	.21
2.47	.8979	.2555	.0084	.0	.21
2.48	.9116	.2640	.0085	.0	.22
2.50	.9254	.2725	.0086	.0	.22
2.51	.9325	.2770	.0044	.0	.14
2.52	.9362	.2793	.0023	.0	.08
2.53	.9399	.2817	.0023	.0	.06
2.54	.9436	.2840	.0023	.0	.06
2.56	.9474	.2864	.0024	.0	.06
2.57	.9511	.2887	.0024	.0	.06

HYDROGRAPH PEAK= .22 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .02 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-39A, D-39B
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/9/89

D-39A, D-39B (Convenience Ditches)

Total Area = 253 * 0.00702 = 1.8 acres

CN = 70 (25% Oak/Aspen)

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 450 feet

$$\text{slope} = \frac{(1100)(25)(100)}{(1.78)\,43{,}560} = 35.5\%$$

Run-Off Calculation: $Q_{TOT} = 0.06$ cfs

Convenience Ditches - No further design anticipated ok

PROJECT : Valley Camp Coal - D-39A, D-39B Runoff Calculations

AREA= 1.8 ACRES
AVERAGE BASIN SLOPE= 35.5 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 450. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0417 HOURS QPCFS= 32.61 CFS QPIN=17.9644 INCHES
C3= 88.5466 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.42	.8406	.0000	.0000	.0	.00
2.44	.8646	.0000	.0000	16.0	.00
2.46	.8885	.0002	.0002	32.6	.00
2.48	.9125	.0007	.0005	23.0	.01
2.51	.9317	.0013	.0006	10.5	.03
2.53	.9382	.0015	.0002	3.8	.04
2.55	.9447	.0018	.0002	1.2	.03
2.57	.9512	.0020	.0003	.3	.03
2.59	.9576	.0023	.0003	.0	.02
3.36	1.1747	.0219	.0007	.0	.06
3.38	1.1799	.0226	.0007	.0	.06
3.40	1.1851	.0233	.0007	.0	.06
3.42	1.1902	.0240	.0007	.0	.06
3.45	1.1954	.0247	.0007	.0	.06
3.47	1.2006	.0255	.0007	.0	.06
3.49	1.2058	.0262	.0007	.0	.06
3.51	1.2103	.0269	.0007	.0	.06
3.53	1.2139	.0274	.0005	.0	.06
3.55	1.2175	.0279	.0005	.0	.05
3.57	1.2210	.0285	.0005	.0	.05
3.59	1.2246	.0290	.0005	.0	.05
3.61	1.2281	.0296	.0005	.0	.05

HYDROGRAPH PEAK= .06 cfs
TIME TO PEAK= 3.49 Hours
RUNOFF VOLUME= .01 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-42
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/8/89

D-42 (Convenience Ditch)

Total Area = 99 * 0.00702 = 0.7 ac

CN = 90 (disturbed)

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 275'

$$\text{slope} = \frac{(450)(25)(100)}{43{,}560\,(0.7)} = 36.9\%$$

Run-off Calculation: $Q_{TOT} = 0.51$ cfs

Convenience Ditch - No further design anticipated

ac

PROJECT : Valley Camp Coal - D-42 Runoff Calculations

AREA= .7 ACRES
AVERAGE BASIN SLOPE= 36.9 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 275. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0145 HOURS QPCFS= 36.45 CFS QPIN=51.6334 INCHES
C3=254.5012 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.54	.2201	.0000	.0000	.0	.00
1.55	.2244	.0000	.0000	36.4	.00
1.57	.2287	.0000	.0000	11.8	.00
1.58	.2330	.0001	.0000	1.3	.00
1.60	.2372	.0002	.0000	.0	.00
2.41	.8233	.2110	.0096	.0	.47
2.42	.8400	.2207	.0097	.0	.48
2.44	.8566	.2306	.0098	.0	.49
2.45	.8732	.2405	.0100	.0	.49
2.46	.8899	.2506	.0101	.0	.50
2.48	.9065	.2608	.0102	.0	.50
2.49	.9231	.2711	.0103	.0	.51
2.51	.9326	.2771	.0060	.0	.35
2.52	.9371	.2799	.0028	.0	.19
2.54	.9416	.2827	.0028	.0	.15
2.55	.9461	.2856	.0028	.0	.14
2.57	.9506	.2884	.0029	.0	.14
2.58	.9551	.2913	.0029	.0	.14

HYDROGRAPH PEAK= .51 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .04 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE D-44A
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 4 MAY 89

D-44A DESIGN

CN determination shown on D-44B sheets $P_{10yr-6hr} = 1.55$ in

AREA: $R_{DG} = 434$ $A = 434 * 0.0035 = 1.52$ ac : TOTAL
0.53 : DISTURBED CN = 90
0.99 : UNDISTURBED CN = 70

Undist. Area is Approx 25% Oak/Aspen Complex

Area	CN	$Q_{10yr-6hr}$
0.53	90	0.723
0.99	70	0.096
1.52		$\bar{Q} = 0.315$

$\bar{CN} = 80$

HYD. LENGTH ~ 510'

WATERSHED SLOPE: $\frac{\text{Cont L} * \text{Cont Int} * 100}{\text{Area} * 43560}$

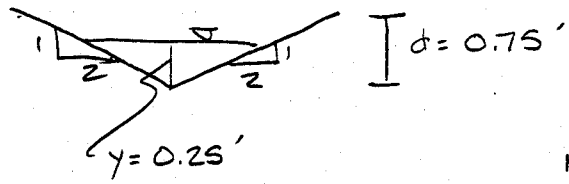
$= \frac{800 * 25 * 100}{1.52 * 43560} = 30.2\%$

RUNOFF PREDICTION:

$Q = 0.43$ cfs

CHANNEL DESIGN:

$S_{min} = 10\%$ $b = 0$
$S_{max} = 10\%$ $M_1 = M_2 = 2$



NO LINING REQ'D

PROJECT : Valley Camp Coal - Ditch D-44A Runoff Calculation

AREA= 1.5 ACRES
AVERAGE BASIN SLOPE= 30.2 PERCENT
CURVE NUMBER= 80.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 510. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0375 HOURS QPCFS= 30.66 CFS QPIN=20.0051 INCHES
C3= 98.6053 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.12	.4921	.0000	.0000	.0	.00
2.14	.5136	.0000	.0000	15.0	.00
2.16	.5351	.0005	.0004	30.7	.00
2.17	.5566	.0013	.0008	21.6	.03
2.19	.5781	.0024	.0011	9.9	.05
2.21	.5996	.0038	.0014	3.5	.08
2.23	.6211	.0056	.0018	1.1	.10
2.25	.6426	.0077	.0021	.3	.13
2.27	.6641	.0101	.0024	.0	.16
2.40	.8146	.0352	.0044	.0	.33
2.42	.8361	.0398	.0047	.0	.35
2.44	.8576	.0447	.0049	.0	.37
2.46	.8791	.0499	.0052	.0	.39
2.47	.9006	.0553	.0054	.0	.41
2.49	.9221	.0610	.0056	.0	.43
2.51	.9337	.0641	.0031	.0	.41
2.53	.9395	.0657	.0016	.0	.32
2.55	.9453	.0673	.0016	.0	.22
2.57	.9511	.0690	.0016	.0	.17
2.59	.9569	.0706	.0016	.0	.14

HYDROGRAPH PEAK= .43 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .04 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	04-May-89
Project No.:	007.11.100	Time:	04:08 PM
Channel Section:	D-44A	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.43	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.10	ft/ft
	Max. Bottom Slope:	0.10	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.25	feet
	Qn/1.49(S)1/2=	0.027	
	A(R)2/3=	0.027	
	Required Depth:	0.75	feet
	Area:	0.12	ft2
	Perimeter:	1.10	feet
	Hydraulic Radius:	0.11	feet
	Velocity:	3.58	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.25	feet
	Qn/1.49(S)1/2=	0.027	
	A(R)2/3=	0.027	
	Required Depth:	0.75	feet
	Area:	0.12	ft2
	Perimeter:	1.10	feet
	Hydraulic Radius:	0.11	feet
	Velocity:	3.58	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.10	ft/ft
	Max. Bottom Slope:	0.10	ft/ft
	Channel Depth:	0.75	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE inc

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE RUNOFF HYDROLOGY - BELINA MINE AREA
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 4 MAY 89

DITCH 44B

START W/ UPPER SMALL DITCHES TO WEST

DITCH D-44B - Includes a portion of SAE 7 plus some undisturbed area,

MAP SCALE 1:100' RDG = 40B for 1.44 ac RATIO = 0.0035

Tributary Area = 506 * .0035 = 1.8 ac
Disturbed " = 78 = 0.3 ac
Undisturbed " = 1.5 ac

USING CONSISTENT CURVE NUMBERS AS DEVELOPED IN OUR FEB 89 SED. POND REPORT.

SAGE/GRASS AREAS, SOIL GROUP C, DENSITY 25%; CN = 75
OAK/ASPEN AREAS, SOIL GROUP C, DENSITY 25%; CN = 70
OAK/ASPEN AREAS, SOIL GROUP C, DENSITY 90%; CN = 40 *

* TAKEN FROM FIG 9.5 NEH4; PG 9.11

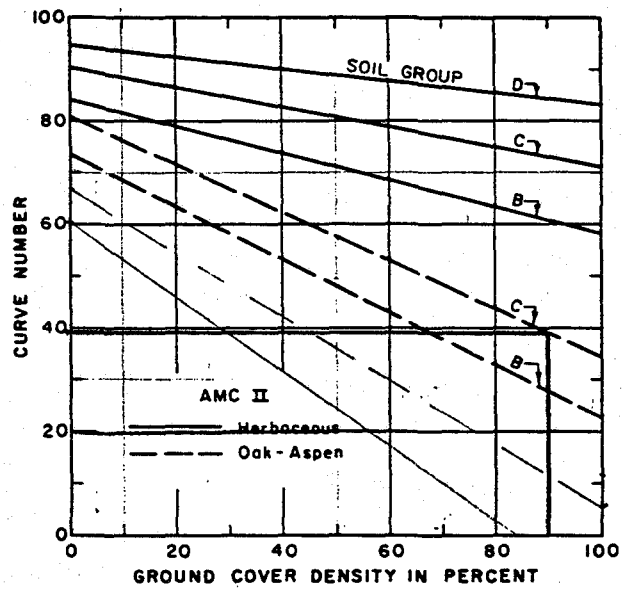


Figure 9.5.--Graph for estimating runoff curve numbers of forest-range complexes in western United States: herbaceous and oak-aspen complexes.

DISTURBED AREAS CN = 90

RECLAIMED AREAS CN = 85

PAVED AREAS CN = 98

CN	S	CN	S
98	0.204	75	3.333
90	1.111	70	4.286
85	1.765	40	15.000

DITCH D-44B

Area	CN	Runoff Depth (in) 10YR-6HR
0.3	90	0.723
1.5	40	0.155
1.8	$\bar{Q}$ = 0.25	$\overline{CN}$ = 77.8

$P_{10YR-6HR} = 1.55$ in - Hand Calc for Example of procedure

$$Q_{in} = \frac{(P-.2S)^2}{P+.8S} \quad \text{where } S = \frac{1000}{CN} - 10$$

$$P^2 - .4PS + .04S^2 = PQ + .8QS$$
$$0.04S^2 - .4S(P+2Q) - PQ + P^2 = 0 \qquad \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$b = -0.4(P+2Q) = -0.82$
$a = 0.04 = 0.04$
$c = P(P-Q) = 2.015$

$$S = [+0.82 \pm \sqrt{(-.82)^2 - 4(.04)2.015}]\,0.08 = \frac{.82 \pm .592}{.08} = 17.65;\ 2.85$$

$$CN = \frac{1000}{S+10} = \frac{1000}{12.9} = 77.8 \quad \alpha$$

Hydraulic Length: 210 ft

Avg Slope: Measured from Map $\sim \frac{(900)25(100)}{43560\,(1.8)} = 28.7\%$

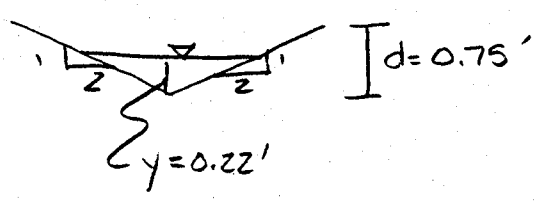
Hydro Results give Q = 0.37 cfs

Try Trap. Channel design:

$b = 0;\ m_1 = m_2 = 2;\ n = .03;\ Q = 0.4$

$S_{min} = 17\%$
$S_{max} = 21\%$ from Printout $V = 4.54 < 5 - \alpha$

NO LINING REQ'd



PROJECT : Valley Camp Coal - D-44B Runoff Calculation

AREA= 1.8 ACRES
AVERAGE BASIN SLOPE= 28.7 PERCENT
CURVE NUMBER= 77.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 710. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0536 HOURS QPCFS= 25.40 CFS QPIN=13.9920 INCHES
C3= 68.9665 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.18	.5678	.0000	.0000	.0	.00
2.20	.5831	.0000	.0000	2.4	.00
2.21	.5985	.0003	.0002	12.4	.00
2.22	.6139	.0006	.0004	22.1	.00
2.24	.6293	.0012	.0005	25.4	.01
2.25	.6446	.0019	.0007	23.0	.02
2.26	.6600	.0027	.0008	17.9	.04
2.28	.6754	.0037	.0010	12.6	.05
2.29	.6907	.0048	.0011	8.2	.07
2.30	.7061	.0061	.0013	5.0	.09
2.32	.7215	.0076	.0014	2.9	.11
2.33	.7368	.0091	.0016	1.7	.13
2.35	.7522	.0109	.0017	.9	.15
2.36	.7676	.0127	.0019	.5	.17
2.37	.7830	.0147	.0020	.3	.19
2.39	.7983	.0168	.0021	.1	.21
2.40	.8137	.0191	.0023	.0	.23
2.41	.8291	.0215	.0024	.0	.25
2.43	.8444	.0240	.0025	.0	.27
2.44	.8598	.0266	.0026	.0	.29
2.45	.8752	.0294	.0028	.0	.30
2.47	.8905	.0322	.0029	.0	.32
2.48	.9059	.0352	.0030	.0	.34
2.49	.9213	.0384	.0031	.0	.35
2.51	.9318	.0406	.0022	.0	.37
2.52	.9360	.0414	.0009	.0	.37
2.53	.9401	.0423	.0009	.0	.34
2.55	.9443	.0432	.0009	.0	.30
2.56	.9484	.0442	.0009	.0	.25
2.57	.9526	.0451	.0009	.0	.21
2.59	.9567	.0460	.0009	.0	.18
2.60	.9609	.0469	.0009	.0	.16

HYDROGRAPH PEAK= .37 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .04 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	04-May-89
Project No.:	007.11.100	Time:	03:38 PM
Channel Section:	D-44B	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.40	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.17	ft/ft
	Max. Bottom Slope:	0.21	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.22	feet
	Qn/1.49(S)1/2=	0.020	
	A(R)2/3=	0.020	
	Required Depth:	0.72	feet
	Area:	0.09	ft2
	Perimeter:	0.97	feet
	Hydraulic Radius:	0.10	feet
	Velocity:	4.25	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.21	feet
	Qn/1.49(S)1/2=	0.018	
	A(R)2/3=	0.018	
	Required Depth:	0.71	feet
	Area:	0.09	ft2
	Perimeter:	0.94	feet
	Hydraulic Radius:	0.09	feet
	Velocity:	4.54	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.17	ft/ft
	Max. Bottom Slope:	0.21	ft/ft
	Channel Depth:	0.72	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-1-32
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-1-32 (Permanent Structure)
Tributary Area → Ditch D-1

$Q_{TOT} = 3.9$ cfs (10 yr, 6 hr)

check pipe flow

32" CMP
$n = 0.024$
$S = 25\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 132.0$ cfs OK

Since $Q_{allow} >> Q_{TOT}$ pipe flow not limiting
OK

check Inlet control

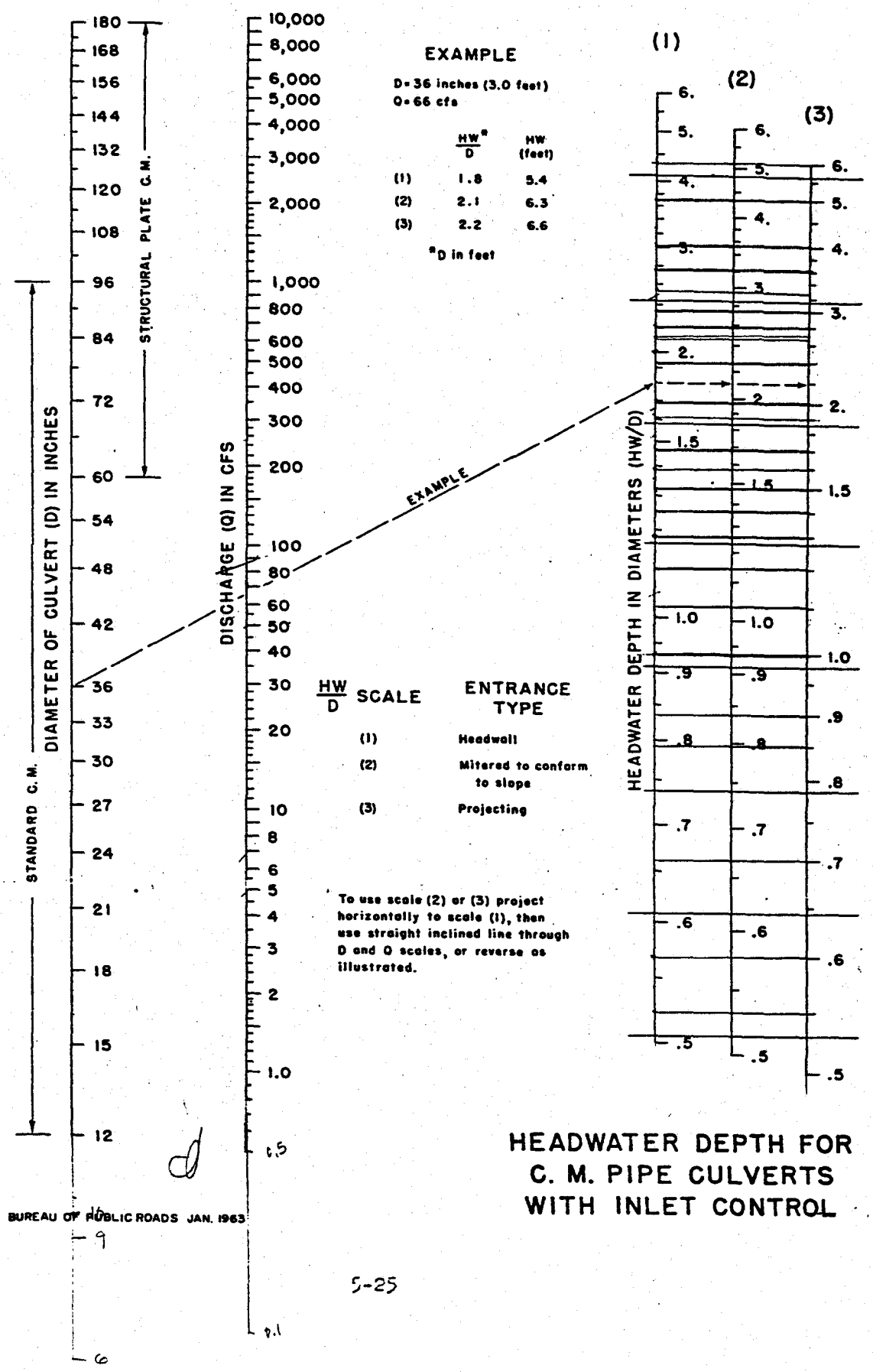
HW depth = 5.2'

$\frac{HW}{D} = 1.9$ Using Chart 5 assume projecting entrance

$Q_{HW} \approx 45.0$ cfs

Since $Q_{HW} > Q_{TOT}$ inlet control does not limit
OK

CHART 5



BUREAU OF PUBLIC ROADS JAN. 1963

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

HANSEN ALLEN & LUCE INC

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SHEET 1 OF
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C-2-18

This culvert drains very little area and is used for the draining of a small area sometimes used for storage of equipment. Since there is no identifiable tributary area, no calculations are made.

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FEATURE C-3-18
PROJECT NO. 007.11.100

SHEET ___ OF ___
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DATE 5/18/89

C-3-18

Tributary Flow - D-3

$Q_{TOT} = 2.61$ cfs

Check Pipe Flow

18" CMP
$n = 0.024$
$S = 3\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 9.86$ cfs OK

Since $Q_{allow} > Q_{TOT}$ pipe flow not limiting

Check Inlet Control

HW depth = 0.9' $\frac{HW}{D} = 2.7$

Using Chart 5 - Assume projecting entrance

$Q_{HW} = 12.5$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Redmit
FEATURE C-4-42
PROJECT NO. 087-11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/19/89

C-4-42 (Permanent structure)

Total Area = 63 * 1.401 = 88 acres
90% Cover Oak/Aspen = 69 acres CN = 40
25% Cover Sage/Grass = 19 acres CN = 75

CN	A	Q
40	69	0.04
75	19	0.51

$\overline{Q} = 0.14$ $\overline{CN} = 61.7$

Precipitation = 2.25 inches (100 yr, 6 hr)

hydraulic length = 4,000 feet

$$\text{slope} = \frac{(16{,}000)(80)(100)}{43{,}560\,(88)} = 33.4\%$$

Calculated Runoff $Q_{TOT} = 3.96$ cfs

Check Pipe Flow

- 42" CMP
- $n = 0.024$
- $S = 3\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 94.39$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe Flow not limiting

Check Inlet Control

- Hwl depth = 6.5' $\frac{HW}{D} = 1.86$

Use Chart 5 - assume projecting entrance

$Q_{HW} = 90$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

PROJECT : Valley Camp Coal - C-4-42 Runoff Calculation

AREA= 88.0 ACRES
AVERAGE BASIN SLOPE= 33.4 PERCENT
CURVE NUMBER= 61.7
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 4000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .3071 HOURS QPCFS= 216.73 CFS QPIN= 2.4424 INCHES
C3= 12.0387 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.40	1.1753	.0000	.0000	.0	.00
2.46	1.2776	.0002	.0002	10.9	.00
2.52	1.3581	.0021	.0019	67.3	.04
2.58	1.3857	.0033	.0011	143.9	.17
2.64	1.4133	.0046	.0014	199.0	.41
2.70	1.4410	.0062	.0016	216.7	.70
2.76	1.4686	.0080	.0018	203.0	1.01
2.82	1.4962	.0100	.0020	171.4	1.31
2.89	1.5239	.0123	.0022	134.0	1.62
2.95	1.5515	.0147	.0025	98.9	1.92
3.01	1.5783	.0173	.0026	69.7	2.22
3.07	1.6004	.0196	.0023	47.3	2.51
3.13	1.6225	.0220	.0024	31.2	2.77
3.19	1.6446	.0246	.0025	20.0	2.98
3.25	1.6667	.0273	.0027	12.6	3.15
3.32	1.6889	.0301	.0028	7.7	3.29
3.38	1.7110	.0330	.0029	4.7	3.43
3.44	1.7331	.0361	.0031	2.8	3.57
3.50	1.7551	.0393	.0032	1.7	3.72
3.56	1.7703	.0415	.0023	1.0	3.86
3.62	1.7855	.0438	.0023	.6	3.95
3.68	1.8007	.0462	.0024	.3	3.96
3.75	1.8159	.0487	.0024	.2	3.91
3.81	1.8311	.0511	.0025	.1	3.83
3.87	1.8463	.0537	.0026	.0	3.75
3.93	1.8615	.0563	.0026	.0	3.69
3.99	1.8767	.0590	.0027	.0	3.67
4.05	1.8907	.0615	.0025	.0	3.66

HYDROGRAPH PEAK= 3.96 cfs
TIME TO PEAK= 3.68 Hours
RUNOFF VOLUME= 1.02 Acre-Feet

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CLIENT Valley Camp
PROJECT Permit
FEATURE C-5-18
PROJECT NO. 007.11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-5-18

Tributary Flow D-5A, D-5B

$Q_{5A} + Q_{5B} = (0.43 + 2.16)$ cfs

$Q_{TOT} = 2.59$ cfs

Check pipe characteristics

- 18" cast Iron
- $n = 0.014$
- $S = 3\%$

$Q_{allow} = \frac{1.49}{n} AR^{2/3} S^{1/2}$

$Q_{allow} = 16.89$ cfs ok

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

- HW depth = 2.3'

$\frac{HW}{D} = 1.5$ assume projecting entrance or type A

Select most limiting solution using either chart 5 or 7

Chart 5 $\Rightarrow$ $Q_5 = 9.0$ cfs

Chart 7 $\Rightarrow$ $Q_7 = 10.5$ cfs

$Q_{HW} = 9.0$ cfs

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

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CLIENT Valley Camp
PROJECT Permit
FEATURE C-6-18
PROJECT NO. 007-11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-6-18

Tributary Flow (C-5-18) 2.59 cfs
(D-6) 0.82 cfs
Small Area - Negligable
3.41 cfs

Check pipe flow

- 18" CMP
- $n = 0.024$
- $S = 2.5\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 9.0$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

HW depth = 4.1 feet $\frac{HW}{D} = \frac{4.1}{1.5} = 2.7$

Use Chart 5 - Assume projecting entrance

$Q_{HW} = 13.0$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

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PROJECT Permit
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SHEET 1 OF
COMPUTED DEH
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C-7-24

Tributary Areas Ditch D-7A $Q = 0.57$
D-7B $Q = 1.27$
$Q_{TOT} = 1.84$ cfs

Check pipe flow:

- 24" CMP
- $n = 0.024$
- $S = 5\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 27.4$ cfs >> Q_{TOT} ok

Pipe Flow not limiting

Check Inlet flow

- HW = 2.8'

$\frac{HW}{D} = 1.4$

Using Chart 5 - assume projecting Inlet

$Q_{HW} = 16.5$ cfs >> Q_{TOT} ok

Inlet Control not limiting

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CLIENT Valley Camp
PROJECT Permit
FEATURE C-8-18
PROJECT NO. 007.11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-8-18

Tributary Flows

D-8 = 1.17 cfs
D-9A, 9B = 0.07
Q_{TOT} = 1.24 cfs

Check Pipe Flow

- 18" CMP
- n = 0.024
- S = 4%

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

Q_{allow} = 11.4 cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

HW depth = 2.30

$\frac{HW}{D} = 1.5$

Use Chart 5
assume projecting entrance

Q_{HW} = 9.0 cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet Control not limiting

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PROJECT Permit
FEATURE
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SHEET 1 OF
COMPUTED DEH
CHECKED
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C-9-15

Tributary Ditches D-9A, D-9B } $Q_{TOT} = 0.07$ cfs

Check Pipe Flow

- 15" CMP
- $n = 0.024$
- $S = 0.001$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 1.1$ cfs $> Q_{TOT}$ ✓

Pipe flow not limiting

Check Inlet Control

from Chart 5 - Projecting Inlet

- $HW = 1.25$

$\frac{HW}{D} = 1.0$

$Q_{HW} = 3.5$ cfs $> Q_{TOT}$ ✓

Inlet Control not limiting

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CLIENT Valley Camp
PROJECT Permit
FEATURE C-10-18
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-10-18

Tributary Area Ditch D-10

$Q_{TOT} = 1.18$ cfs

Check Pipe flow

- 18" CMP
- $n = 0.024$
- $S = 10\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 18.0$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

- HW depth = 2.3 feet

$\frac{HW}{D} = \frac{2.3}{1.5} = 1.5$ Use chart 5 - assume projecting entrance

$Q_{HW} = 9.0$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

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CLIENT Valley Camp
PROJECT Permit
FEATURE C-11-12
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-11-12

Tributary Area = 940 * .000875 = 0.8 ac
disturbed = 840 * .000875 = 0.7 ac
paved = = 0.1 ac

CN	A	Q
90	0.7	0.72
98	0.1	1.33

$\overline{Q} = 0.80$ $\overline{CN} = 91.3$

P = 1.55 inches (10 yr, 6 hr)

hydraulic length = 300'

$slope = \frac{(1425)(5)(100)}{43,560(0.8)} = 20.4\%$

Calculated Runoff $Q_{TOT} = 0.64$ cfs

Check Pipe flow

- 12" CMP
- n = 0.024
- S = 8%

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 5.5$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

HW = 16.0 ft (Seems high - Use 1.0')

$\frac{HW}{D} = 1$ $Q_{HW} = 2.0$ cfs OK

Inlet Control not limiting

PROJECT : Valley Camp Coal - C-11-12 Runoff Calculation

AREA= .8 ACRES
AVERAGE BASIN SLOPE= 20.4 PERCENT
CURVE NUMBER= 91.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 300. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0198 HOURS QPCFS= 30.51 CFS QPIN=37.8167 INCHES
C3=186.3984 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.39	.1898	.0000	.0000	.0	.00
1.41	.1932	.0000	.0000	30.5	.00
1.43	.1966	.0000	.0000	9.9	.00
1.45	.1999	.0000	.0000	1.1	.00
1.47	.2033	.0002	.0000	.0	.00
2.38	.7878	.2301	.0140	.0	.58
2.40	.8105	.2443	.0143	.0	.59
2.42	.8332	.2588	.0145	.0	.60
2.44	.8559	.2735	.0147	.0	.61
2.46	.8786	.2885	.0149	.0	.62
2.47	.9013	.3036	.0152	.0	.63
2.49	.9240	.3190	.0154	.0	.64
2.51	.9345	.3262	.0072	.0	.39
2.53	.9407	.3304	.0042	.0	.22
2.55	.9468	.3346	.0042	.0	.18
2.57	.9529	.3388	.0042	.0	.18
2.59	.9591	.3431	.0043	.0	.18
2.61	.9652	.3473	.0043	.0	.18

HYDROGRAPH PEAK= .64 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .05 Acre-Feet

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CLIENT Valley Camp
PROJECT Permit
FEATURE C-12-24
PROJECT NO. 007-11.100

SHEET ___ OF ___
COMPUTED Paul
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DATE 5/18/89

C-12-24

Tributary Area = D-12A, D-12B

$Q_{D-12A} + Q_{D-12B} = 0.19 + 0.74$

$Q_{TOT} = 0.93$ cfs

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 2\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 17.3$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

HW depth = 4.0'

$\frac{HW}{D} = 2.0$ Use Chart 5 - Assume projecting entrance

$Q_{HW} = 22.0$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

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SHEET 1 OF
COMPUTED DEH
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C-13-24

Tributary Ditch D-13A $Q_{TOT} = 0.60$ cfs

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 30\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 67.1$ cfs >> Q_{TOT} ok

Pipe Flow Not Limiting

Check Inlet Conditions

- HW = 3.0'

$\frac{HW}{D} = 1.5$

From Chart 5-
Assume projecting Inlet

$Q_{HW} = 18$ cfs >> Q_{TOT} ok

Inlet Control Not Limiting

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CLIENT Valley Camp
PROJECT Permit
FEATURE C-14-42
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/18/89

C-14-42 (Permanent structure)

Tributary Area = 173 * 1.401 = 242 Acres
90% Cover Oak/Aspen = 123 ac
25% Cover Sage/Grass = 119 ac

Ground cover taken by assuming that all North facing, and south facing slopes are characteristic.
North facing - 90% oak/Aspen CN = 40
South facing - 25% Sage/Grass CN = 75

CN	A	Q
40	123	0.04
75	119	0.51

$\bar{Q} = 0.27$ $\bar{CN} = 67.5$

Precipitation = 2.25" (100yr, 6hr)

hydraulic length = 5000 feet

$$\text{slope} = \frac{(10{,}000)(400)(100)}{43{,}560\ (242)} = 37.9\%$$

Calculated Run-Off $Q_{TOT} = 21.88$ cfs

Check Pipe Flow

- D = 42"
- n = 0.024
- S = 3% min

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 94.4$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe Flow not limiting

Check Inlet Control

HW depth = 65' $\frac{HW}{D} = 1.86$ assume proj. entrance

from Chart 5

$Q_{HW} = 90.0$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet Control not limiting

PROJECT : Valley Camp Coal - C-14-42 Runoff Calculation

AREA= 242.0 ACRES
AVERAGE BASIN SLOPE= 37.9 PERCENT
CURVE NUMBER= 67.5
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 5000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .2965 HOURS QPCFS= 617.23 CFS QPIN= 2.5294 INCHES
C3= 12.4672 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.25	.9395	.0000	.0000	.0	.00
2.31	1.0382	.0012	.0012	31.0	.04
2.37	1.1370	.0061	.0049	191.7	.37
2.43	1.2357	.0146	.0086	409.8	1.68
2.49	1.3345	.0266	.0120	566.6	4.68
2.55	1.3725	.0321	.0055	617.2	9.47
2.61	1.3992	.0362	.0041	578.2	14.64
2.67	1.4259	.0406	.0044	488.0	18.65
2.73	1.4525	.0452	.0046	381.7	20.97
2.79	1.4792	.0500	.0048	281.7	21.85
2.85	1.5059	.0550	.0050	198.5	21.88
2.91	1.5326	.0603	.0052	134.8	21.58
2.97	1.5593	.0657	.0055	88.8	21.27
3.02	1.5838	.0709	.0052	57.0	21.11
3.08	1.6051	.0756	.0047	35.8	21.08
3.14	1.6265	.0804	.0048	22.0	21.04
3.20	1.6478	.0853	.0049	13.4	20.92
3.26	1.6692	.0903	.0050	8.0	20.76
3.32	1.6905	.0955	.0052	4.7	20.63
3.38	1.7119	.1008	.0053	2.7	20.58
3.44	1.7332	.1062	.0054	1.6	20.65
3.50	1.7546	.1118	.0055	.9	20.82
3.56	1.7694	.1157	.0039	.5	21.03
3.62	1.7841	.1196	.0039	.3	21.03
3.68	1.7987	.1236	.0040	.2	20.68
3.74	1.8134	.1277	.0040	.0	20.07

HYDROGRAPH PEAK= 21.88 cfs
TIME TO PEAK= 2.85 Hours
RUNOFF VOLUME= 5.46 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-15-24
PROJECT NO. 007-11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-15-24

Tributary Flow = D-15

$Q_{TOT} = 1.57$ cfs

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 5\%$

$Q_{allow} = \frac{1.49}{n} AR^{2/3} S^{1/2}$

$Q_{allow} = 27.4$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

- HW depth = 3.2'

$\frac{HW}{D} = 1.6$

Use Chart 5 Assume projecting entrance

$Q_{HW} = 18.5$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet Control not limiting

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CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 6/30/89

C-16-24

Tributary Culvert C-15-24 $Q_{TOT} = 1.57$ cfs

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 10\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 38.7$ cfs >> Q_{TOT} ok

Pipe Flow not limiting

Check Inlet Conditions

- HW = 1.0'

$\frac{HW}{D} = 0.5$

From Chart 5
Assuming projecting Inlet

$Q_{HW} = 3.8$ cfs > Q_{TOT} ok

Inlet Conditions not limiting

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PROJECT Permit
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SHEET 1 OF
COMPUTED DEH
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C-17-21 & C-18-21

Tributary Ditches D18A, D18B } $Q_{TOT} = 0.59 + 0.47 = 1.06$ cfs

Check Pipe Flow

- 21" CMP
- $n = 0.024$
- $S = 1\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 8.6$ cfs $> Q_{TOT}$ ok

Pipe Flow not limiting

Check Inlet Conditions

- $HW = 1.75'$

$\frac{HW}{D} = 1.0$

From Chart 5
Assume projecting Inlet

$Q_{HW} = 8$ cfs $> Q_{TOT}$ ok

Inlet Conditions not limiting

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CLIENT Valley Camp
PROJECT Permit
FEATURE C-20-48, C-19-48
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/16/89

C-20-48, C-19-48

Total Area = 1060 * 1.401 = 1485 acres
90% cover Oak/Aspen = 761 acres
25% cover sage/grass = 724 acres

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 16,600 feet

$$\text{slope} = \frac{(63,500)(400)(100)}{43,560\,(1485)} = 39.3\%$$

CN	Area	Q
40	761	0.155
75	724	0.185

$\bar{Q} = 0.17$ $\qquad \bar{CN}_{10} = 74.26$

Calculated Run-off $\qquad Q_{TOT_{10yr}} = 77.0$ cfs

NOT APPLICABLE

For a 100 year, 6 hr

$P_{100} = 2.25$ inches

CN	A	Q
40	761	0.039
75	724	0.510

$\bar{Q} = 0.266$ $\qquad \bar{CN}_{100} = 67.4$

Calculated Run-off $\qquad Q_{TOT_{100yr}} = 118.8$ cfs

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-19-48
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-19-48

Culvert Analysis

$S = 6\%$
$n = 0.024$
48" CMP

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 190.6$ cfs OK

since $Q_{allow} > Q_{TOT}$ pipe flow not limiting

check Inlet Control

HW depth = 8.5'

assume projecting entrance using chart 5

$\frac{HW}{D} = \frac{8.5'}{4} = 2.1$

$Q_{HW} = 130$ cfs OK

since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

C-20-48

Culvert Analysis

$S = 4\%$
$n = 0.024$
48" CMP

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 155.6$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

HW depth = 9.0'

assume projecting entrance using chart 5

$\frac{HW}{D} = 2.25$

$Q_{HW} = 140$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

PROJECT : Valley Camp Coal - C-19-48, C-20-48 Runoff Calculation

10 yr, 6hr

AREA= 1485.0 ACRES
AVERAGE BASIN SLOPE= 39.3 PERCENT
CURVE NUMBER= 74.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 16600. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .6315 HOURS QPCFS= 1778.42 CFS QPIN= 1.1877 INCHES
C3= 5.8539 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.27	.6700	.0000	.0000	.0	.00
2.40	.8149	.0042	.0042	89.2	.38
2.53	.9380	.0164	.0121	552.4	3.42
2.65	.9772	.0218	.0054	1180.6	12.18
2.78	1.0163	.0278	.0061	1632.6	24.75
2.90	1.0555	.0346	.0068	1778.4	37.66
3.03	1.0927	.0416	.0070	1665.9	48.97
3.16	1.1240	.0480	.0064	1406.2	58.13
3.28	1.1554	.0548	.0068	1099.9	64.99
3.41	1.1867	.0619	.0072	811.6	69.92
3.54	1.2152	.0688	.0068	572.0	73.50
3.66	1.2367	.0742	.0054	388.5	75.99
3.79	1.2583	.0797	.0055	255.8	77.04
3.92	1.2798	.0854	.0057	164.2	76.67
4.04	1.3007	.0911	.0057	103.1	75.38
4.17	1.3203	.0966	.0055	63.5	73.72
4.29	1.3398	.1023	.0056	38.5	72.03
4.42	1.3594	.1080	.0058	23.0	70.53
4.55	1.3775	.1135	.0054	13.6	69.36
4.67	1.3932	.1183	.0048	7.9	68.38
4.80	1.4089	.1231	.0049	4.6	67.25
4.93	1.4245	.1281	.0050	2.6	65.84
5.05	1.4402	.1331	.0050	1.5	64.33
5.18	1.4558	.1382	.0051	.8	62.96
5.30	1.4715	.1434	.0052	.5	61.90
5.43	1.4872	.1487	.0053	.3	61.25
5.56	1.5019	.1537	.0050	.1	60.95
5.68	1.5156	.1585	.0047	.0	60.82

HYDROGRAPH PEAK= 77.04 cfs
TIME TO PEAK= 3.79 Hours
RUNOFF VOLUME= 20.80 Acre-Feet

PROJECT : Valley Camp Coal - C-19-48, C-20-48 Runoff Calculation

100 Yr, 6hr

AREA= 1485.0 ACRES
AVERAGE BASIN SLOPE= 39.3 PERCENT
CURVE NUMBER= 67.4
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 16600. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .7625 HOURS QPCFS= 1472.91 CFS QPIN= .9836 INCHES
C3= 4.8483 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.13	.7421	.0000	.0000	.0	.00
2.29	.9960	.0002	.0002	73.9	.01
2.44	1.2499	.0156	.0154	457.5	1.22
2.59	1.3916	.0342	.0186	977.8	8.60
2.74	1.4602	.0456	.0114	1352.1	24.66
2.90	1.5288	.0584	.0128	1472.9	45.45
3.05	1.5929	.0716	.0133	1379.7	66.08
3.20	1.6478	.0839	.0123	1164.6	83.77
3.35	1.7027	.0970	.0131	910.9	97.42
3.51	1.7568	.1108	.0137	672.2	107.35
3.66	1.7946	.1208	.0100	473.7	114.31
3.81	1.8323	.1312	.0104	321.7	118.05
3.96	1.8700	.1420	.0108	211.9	118.76
4.12	1.9051	.1523	.0103	136.0	117.40
4.27	1.9394	.1627	.0104	85.4	114.95
4.42	1.9738	.1733	.0107	52.6	112.21
4.57	2.0047	.1832	.0099	31.9	109.68
4.73	2.0322	.1921	.0089	19.0	107.33
4.88	2.0596	.2012	.0091	11.2	104.80
5.03	2.0871	.2105	.0093	6.5	102.06
5.18	2.1145	.2199	.0094	3.8	99.38
5.34	2.1419	.2295	.0096	2.2	97.12
5.49	2.1694	.2393	.0098	1.2	95.49
5.64	2.1936	.2480	.0088	.7	94.49
5.79	2.2177	.2568	.0088	.4	93.68
5.95	2.2417	.2657	.0089	.2	92.75
6.10	2.2417	.2657	.0000	.1	91.06
6.25	2.2417	.2657	.0000	.0	85.97

HYDROGRAPH PEAK= 118.76 cfs
TIME TO PEAK= 3.96 Hours
RUNOFF VOLUME= 32.88 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE C-21-48
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED DEH
CHECKED ___
DATE 12/14/89

C-21-48 PERMANENT STRUCTURE

FLOW TRIBUTARY

TOTAL AREA = 1479 * 1.401 = 2072 ac
90% OAK ASPEN 645 904
25% SAGE GRASS 834 1168

ASSUMING THAT NORTH & SOUTH FACING SLOPES ARE CHARACTERISTICALLY:

NORTH FACING 90% COVER OAK/ASPEN (CN = 70)
SOUTH FACING 25% COVER SAGE/GRASS (CN = 75)

CN	A	Q
70	904	0.10
75	1168	0.19
		$\bar{Q} = 0.15$

$\bar{CN} = 73$

PRECIPITATION = 1.55 inches (10 YR, 6 HR)

HYD. LENGTH = 12,000 ft

$$\text{SLOPE} = \frac{(78{,}000)(400)(100)}{43{,}560\ (2072)} = 34.6\%$$

$Q = 92.6$ cfs

CHECK PIPE FLOW

- D = 48"
- $\eta = 0.024$
- $S = 1\%$

$$Q = \frac{1.49}{\eta} AR^{2/3} S^{1/2} = 77.81 \text{ cfs} < 92.6$$ – Add Avail Head (33'-4 = 29' Available)

$$S_f = \frac{29 + 0.01(250)}{250} = 0.126$$

$$Q = \frac{1.49}{\eta} AR^{2/3} (.126)^{1/2} = 276 \text{ cfs} >> 92.6 \text{ cfs}$$

CHECK INLET FLOW (USING "HYDRAULICS CHARTS FOR THE SELECTION OF HIGHWAY CULVERTS")

PIPE LENGTH = 250 ft
HW DEPTH = 33 ft HW/D = 8.25 HW/D = 6.0 (Max Shown on Chart)

$Q = 215$ cfs – OK

L for HW/D = 6.0

PIPE IS ADEQUATE

PROJECT : Valley Camp Coal - C-21-52 Runoff Calculation

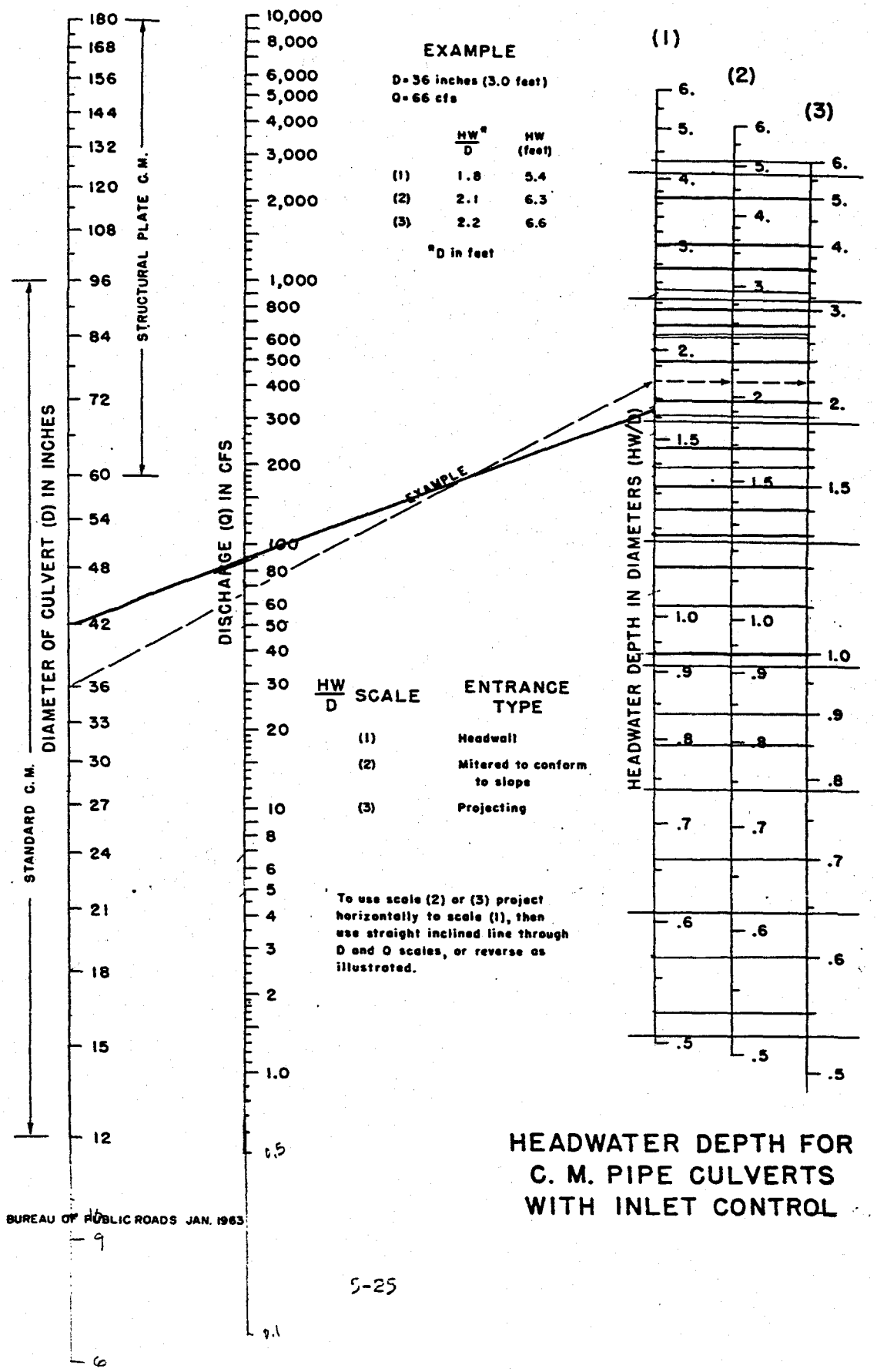
AREA= 2072.0 ACRES
AVERAGE BASIN SLOPE= 34.6 PERCENT
CURVE NUMBER= 73.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 12000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .5385 HOURS QPCFS= 2909.81 CFS QPIN= 1.3927 INCHES
C3= 6.8646 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.26	.6567	.0000	.0000	.0	.00
2.37	.7802	.0004	.0004	146.0	.06
2.48	.9038	.0070	.0065	903.8	1.35
2.58	.9563	.0120	.0050	1931.7	7.48
2.69	.9897	.0158	.0038	2671.2	18.87
2.80	1.0231	.0202	.0043	2909.8	32.51
2.91	1.0565	.0250	.0048	2725.7	45.63
3.02	1.0889	.0301	.0051	2300.8	57.15
3.12	1.1156	.0347	.0046	1799.6	66.87
3.23	1.1423	.0395	.0048	1327.9	74.59
3.34	1.1690	.0446	.0051	935.9	80.44
3.45	1.1957	.0500	.0054	635.6	84.97
3.55	1.2182	.0548	.0048	418.6	88.70
3.66	1.2366	.0588	.0040	268.7	91.43
3.77	1.2550	.0630	.0042	168.7	92.56
3.88	1.2733	.0673	.0043	103.9	92.13
3.98	1.2917	.0717	.0044	63.0	90.73
4.09	1.3086	.0758	.0042	37.6	89.06
4.20	1.3253	.0800	.0042	22.2	87.45
4.31	1.3420	.0843	.0043	12.9	86.02
4.42	1.3587	.0887	.0044	7.5	84.91
4.52	1.3747	.0930	.0043	4.3	84.21
4.63	1.3880	.0967	.0037	2.4	83.75
4.74	1.4014	.1004	.0037	1.4	83.00
4.85	1.4147	.1042	.0038	.8	81.73
4.95	1.4281	.1080	.0038	.4	80.14
5.06	1.4414	.1119	.0039	.2	78.58
5.17	1.4548	.1158	.0039	.1	77.31
5.28	1.4681	.1199	.0040	.0	76.47

HYDROGRAPH PEAK= 92.56 cfs
TIME TO PEAK= 3.77 Hours
RUNOFF VOLUME= 24.68 Acre-Feet

CHART 5



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

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-21-52
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/19/89

C-21-52 (Permanent Structure)

Flow tributary

Total Area - 1479 * 1.40 1 = 2072 Acres
90% Oak Aspen = 645 = 904
25% Sage Grass = 834 = 1168

Assuming that North and South facing slopes are characteristicly:

North Facing 90% Cover Oak/Aspen (CN = 40)
South Facing 25% Cover Sage/grass (CN = 75)

CN	A	Q
70	904	0.10
75	1168	0.19

$\overline{Q} = 0.15$ $\overline{CN} = 73.0$

Precipitation = 1.55 inches (10 year, 6 hr)

hydraulic length = 12,000 feet

$$\text{slope} = \frac{(78{,}000)(400)(100)}{43{,}560\ (2072)} = 34.6\%$$

Calculated Run-Off: $Q_{TOT} = 92.6$ cfs

Check Pipe Flow

- D = 52"
- n = 0.024
- S = 1%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 96.3$ cfs

Note: the above assume fully flowing pipe, with a $\frac{Hwd}{D}$ ratio equal to 1.0.

"Hydraulic Charts for the selection of Highway Culverts" by the US. Dept. of transportation. offers a method to calculate pipe flow under head. SEE chart 11.

Length of pipe = 250'
Hwd depth = 33.3'
assume Ke = 0.9 (Conservative)

$Q_{allow} = 280$ cfs OK

Pipe flow not limiting

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-21-52
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/19/89

Continued

Check Inlet Control

HW depth = 33.3 '

$\frac{HW}{D} = 7.7$ Using Chart 7 assume projecting entrance

Extrapolating from the chart indicates that the expected Q would be ≈ 350 cfs

A $\frac{HW}{D} = 6$ yields 300 cfs. more than adequate.

Inlet Control not limiting

PROJECT : Valley Camp Coal - C-21-52 Runoff Calculation

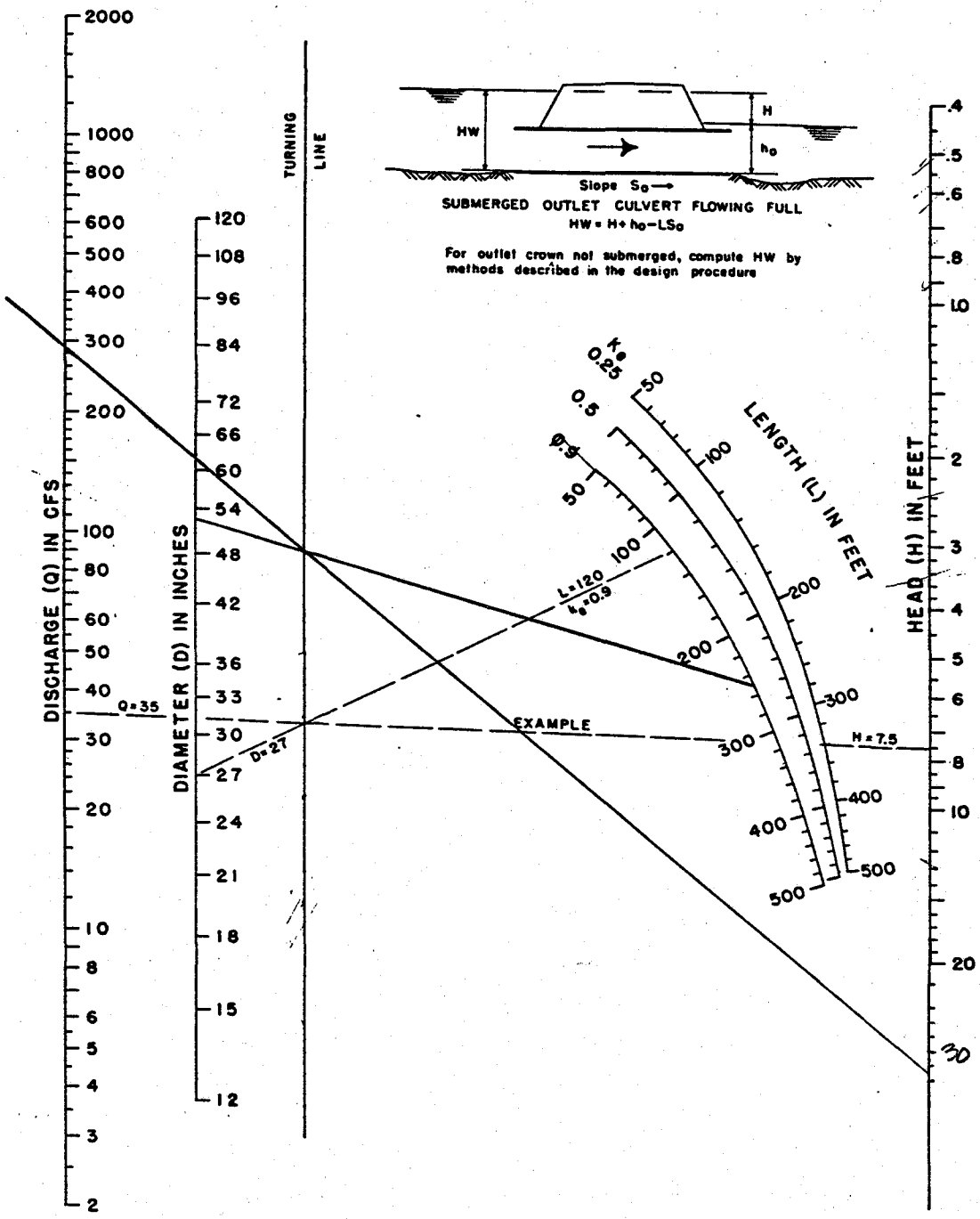
AREA= 2072.0 ACRES
AVERAGE BASIN SLOPE= 34.6 PERCENT
CURVE NUMBER= 73.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 12000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .5385 HOURS QPCFS= 2909.81 CFS QPIN= 1.3927 INCHES
C3= 6.8646 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.26	.6567	.0000	.0000	.0	.00
2.37	.7802	.0004	.0004	146.0	.06
2.48	.9038	.0070	.0065	903.8	1.35
2.58	.9563	.0120	.0050	1931.7	7.48
2.69	.9897	.0158	.0038	2671.2	18.87
2.80	1.0231	.0202	.0043	2909.8	32.51
2.91	1.0565	.0250	.0048	2725.7	45.63
3.02	1.0889	.0301	.0051	2300.8	57.15
3.12	1.1156	.0347	.0046	1799.6	66.87
3.23	1.1423	.0395	.0048	1327.9	74.59
3.34	1.1690	.0446	.0051	935.9	80.44
3.45	1.1957	.0500	.0054	635.6	84.97
3.55	1.2182	.0548	.0048	418.6	88.70
3.66	1.2366	.0588	.0040	268.7	91.43
3.77	1.2550	.0630	.0042	168.7	92.56
3.88	1.2733	.0673	.0043	103.9	92.13
3.98	1.2917	.0717	.0044	63.0	90.73
4.09	1.3086	.0758	.0042	37.6	89.06
4.20	1.3253	.0800	.0042	22.2	87.45
4.31	1.3420	.0843	.0043	12.9	86.02
4.42	1.3587	.0887	.0044	7.5	84.91
4.52	1.3747	.0930	.0043	4.3	84.21
4.63	1.3880	.0967	.0037	2.4	83.75
4.74	1.4014	.1004	.0037	1.4	83.00
4.85	1.4147	.1042	.0038	.8	81.73
4.95	1.4281	.1080	.0038	.4	80.14
5.06	1.4414	.1119	.0039	.2	78.58
5.17	1.4548	.1158	.0039	.1	77.31
5.28	1.4681	.1199	.0040	.0	76.47

HYDROGRAPH PEAK= 92.56 cfs
TIME TO PEAK= 3.77 Hours
RUNOFF VOLUME= 24.68 Acre-Feet

CHART 11



HEAD FOR STANDARD C. M. PIPE CULVERTS FLOWING FULL n = 0.024

BUREAU OF PUBLIC ROADS JAN. 1963

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-22-24
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED paul
CHECKED ___
DATE 5/19/89

C-22-24 (Permanent Structure)

Tributary Area = 16 * 1.401 = 22 acres
90% Cover Oak/Aspen CN = 70 = 20 ac
25% Cover Sage/grass CN = 75 = 2 ac

CN	A	Q
70	20	0.10
75	2	0.19
		$\bar{Q}$ = 0.10

$\bar{CN}$ = 70.5

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 2,500 ft

$$\text{slope} = \frac{(6000)(80)(100)}{43{,}560\ (22)} = 50\%$$

Calculated Run-Off = Q_{TOT} = 0.79 cfs

Check Pipe Flow

- 24" CMP
- n = 0.024
- S = 5.7%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

Q_{allow} = 29.3 cfs ok

Pipe flow not limiting

Check Inlet Control

- HW depth = 2.8'

$\frac{HW}{D}$ = 1.4 Use Chart 5 - assume proj. entrance

Q_{HW} = 17.0 cfs ok

Inlet control not limiting

PROJECT : Valley Camp Coal - C-22-24 Runoff Calculation

AREA= 22.0 ACRES
AVERAGE BASIN SLOPE= 50.0 PERCENT
CURVE NUMBER= 70.5
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1368 HOURS QPCFS= 121.60 CFS QPIN= 5.4813 INCHES
C3= 27.0175 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.41	.8246	.0000	.0000	.0	.00
2.44	.8560	.0000	.0000	6.1	.00
2.46	.8874	.0006	.0005	37.8	.00
2.49	.9187	.0016	.0010	80.7	.03
2.52	.9354	.0023	.0007	111.6	.09
2.54	.9439	.0027	.0004	121.6	.18
2.57	.9524	.0031	.0004	113.9	.25
2.60	.9609	.0036	.0005	96.1	.31
2.63	.9694	.0041	.0005	75.2	.35
2.65	.9779	.0046	.0005	55.5	.37
2.68	.9863	.0052	.0006	39.1	.39
2.71	.9948	.0057	.0006	26.6	.40
2.74	1.0033	.0064	.0006	17.5	.41
2.76	1.0118	.0070	.0007	11.2	.42
2.79	1.0203	.0077	.0007	7.0	.44
2.82	1.0288	.0084	.0007	4.3	.46
2.85	1.0372	.0092	.0007	2.6	.48
2.87	1.0457	.0099	.0008	1.6	.50
2.90	1.0542	.0107	.0008	.9	.52
2.93	1.0627	.0116	.0008	.5	.55
2.96	1.0712	.0124	.0009	.3	.57
2.98	1.0797	.0133	.0009	.2	.59
3.01	1.0875	.0142	.0009	.1	.62
3.04	1.0943	.0149	.0008	.0	.64
3.37	1.1757	.0254	.0010	.0	.71
3.39	1.1825	.0264	.0010	.0	.73
3.42	1.1893	.0274	.0010	.0	.74
3.45	1.1961	.0284	.0010	.0	.75
3.48	1.2029	.0294	.0010	.0	.77
3.50	1.2095	.0305	.0010	.0	.78
3.53	1.2141	.0312	.0007	.0	.79
3.56	1.2188	.0319	.0007	.0	.79
3.58	1.2235	.0327	.0008	.0	.78
3.61	1.2281	.0335	.0008	.0	.75

PROJECT : Valley Camp Coal - C-22-24 Runoff Calculation
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.64	1.2328	.0342	.0008	.0	.72
3.67	1.2375	.0350	.0008	.0	.70
3.69	1.2421	.0358	.0008	.0	.67

HYDROGRAPH PEAK= .79 cfs
TIME TO PEAK= 3.53 Hours
RUNOFF VOLUME= .19 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-23-24
PROJECT NO. 007.11.100

SHEET ____ OF ____
COMPUTED ____
CHECKED ____
DATE ____

C-23-24 (Permanent Structure)

Total Area = 16 + 1.401 = 22 acres
90% Cover Oak/Aspen (CN=70) = 20
25% Cover Sage/grass (CN=75) = 2

CN	A	Q
70	20	0.10
75	2	0.19
		$\bar{Q}$=0.10

$\overline{CN}$ = 70.5

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 2,500 ft

$$\text{slope} = \frac{(6{,}000)(80)(100)}{43{,}560\ (22)} = 50\%$$

Calculated Runoff: Q_{TOT} = 0.79 cfs

Check Pipe Flow

- 24" CMP
- n = 0.024
- S = 8%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

Q_{allow} = 34.66 cfs OK

Pipe flow not limiting

Check Inlet Control

HW depth = 3.5'

$\frac{HW}{D}$ = 1.75

Use Chart 5 - assume projecting entrance

Q_{HW} = 20.0 cfs OK

Inlet Control not limiting

PROJECT : Valley Camp Coal - C-23-24 Runoff Calculation

AREA= 22.0 ACRES
AVERAGE BASIN SLOPE= 50.0 PERCENT
CURVE NUMBER= 70.5
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1368 HOURS QPCFS= 121.60 CFS QPIN= 5.4813 INCHES
C3= 27.0175 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.41	.8246	.0000	.0000	.0	.00
2.44	.8560	.0000	.0000	6.1	.00
2.46	.8874	.0006	.0005	37.8	.00
2.49	.9187	.0016	.0010	80.7	.03
2.52	.9354	.0023	.0007	111.6	.09
2.54	.9439	.0027	.0004	121.6	.18
2.57	.9524	.0031	.0004	113.9	.25
2.60	.9609	.0036	.0005	96.1	.31
2.63	.9694	.0041	.0005	75.2	.35
2.65	.9779	.0046	.0005	55.5	.37
2.68	.9863	.0052	.0006	39.1	.39
2.71	.9948	.0057	.0006	26.6	.40
2.74	1.0033	.0064	.0006	17.5	.41
2.76	1.0118	.0070	.0007	11.2	.42
2.79	1.0203	.0077	.0007	7.0	.44
2.82	1.0288	.0084	.0007	4.3	.46
2.85	1.0372	.0092	.0007	2.6	.48
2.87	1.0457	.0099	.0008	1.6	.50
2.90	1.0542	.0107	.0008	.9	.52
2.93	1.0627	.0116	.0008	.5	.55
2.96	1.0712	.0124	.0009	.3	.57
2.98	1.0797	.0133	.0009	.2	.59
3.01	1.0875	.0142	.0009	.1	.62
3.04	1.0943	.0149	.0008	.0	.64
3.37	1.1757	.0254	.0010	.0	.71
3.39	1.1825	.0264	.0010	.0	.73
3.42	1.1893	.0274	.0010	.0	.74
3.45	1.1961	.0284	.0010	.0	.75
3.48	1.2029	.0294	.0010	.0	.77
3.50	1.2095	.0305	.0010	.0	.78
3.53	1.2141	.0312	.0007	.0	.79
3.56	1.2188	.0319	.0007	.0	.79
3.58	1.2235	.0327	.0008	.0	.79
3.61	1.2281	.0335	.0008	.0	.79

PROJECT : Valley Camp Coal - C-23-24 Runoff Calculation
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.64	1.2328	.0342	.0008	.0	.72
3.67	1.2375	.0350	.0008	.0	.70
3.69	1.2421	.0358	.0008	.0	.67

HYDROGRAPH PEAK= .79 cfs
TIME TO PEAK= 3.53 Hours
RUNOFF VOLUME= .19 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-24-24
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/19/89

C-24-24 (Permanent Structure)

Tributary Area = 9×1.401 = 20 acres

CN = 75 (25% Cover Sage/Grass)

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 2000 ft

$$\text{slope} = \frac{(4800)(80)(100)}{43{,}560\,(20)} = 44.1\%$$

Calculated Run-off: $Q_{TOT} \sim 2.04$ cfs

Check Pipe Flow

- 24" CMP
- n = 0.024
- S = 12%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 42.45$ cfs OK

Pipe Flow not limiting

Check Inlet Control

- HW depth = 4.2'

$\frac{HW}{D} = 2.1$ Use Chart 5 assume projecting entrance

$Q_{HW} = 22.0$ cfs OK

Inlet control not limiting

PROJECT : Valley Camp Coal - C-24-24 Runoff Calculation

AREA= 20.0 ACRES
AVERAGE BASIN SLOPE= 44.1 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1075 HOURS QPCFS= 140.71 CFS QPIN= 6.9769 INCHES
C3= 34.3891 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.26	.6517	.0000	.0000	.0	.00
2.28	.6764	.0000	.0000	7.1	.00
2.30	.7010	.0004	.0003	43.7	.00
2.32	.7257	.0010	.0007	93.4	.02
2.34	.7503	.0020	.0010	129.2	.07
2.36	.7750	.0034	.0014	140.7	.16
2.39	.7997	.0051	.0017	131.8	.30
2.41	.8243	.0071	.0020	111.3	.49
2.43	.8490	.0095	.0023	87.0	.71
2.45	.8736	.0121	.0026	64.2	.96
2.47	.8983	.0150	.0030	45.3	1.23
2.49	.9230	.0183	.0032	30.7	1.51
2.52	.9348	.0200	.0017	20.2	1.78
2.54	.9414	.0209	.0010	13.0	1.98
2.56	.9481	.0219	.0010	8.2	2.04
2.58	.9548	.0229	.0010	5.0	1.98
2.60	.9614	.0239	.0010	3.0	1.83
2.62	.9681	.0250	.0010	1.8	1.65
2.64	.9747	.0261	.0011	1.1	1.48
2.67	.9814	.0272	.0011	.6	1.33
2.69	.9881	.0283	.0011	.4	1.22
2.71	.9947	.0294	.0011	.2	1.15
2.73	1.0014	.0305	.0012	.1	1.10
2.75	1.0081	.0317	.0012	.0	1.07

HYDROGRAPH PEAK= 2.04 cfs
TIME TO PEAK= 2.56 Hours
RUNOFF VOLUME= .31 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-25-36
PROJECT NO. 007-11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/19/89

C-25-36 (Permanent Structure)

Tributary Area = 108 * 1.401 = 151 acres
90% Cover Oak/Aspen (CN=70) = 78
25% Cover Sage/grass (CN=75) = 73

CN	A	Q
70	78	0.10
75	73	0.19

$\bar{Q} = 0.14$ $\bar{CN} = 72.7$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 5,500 feet

$$\text{slope} = \frac{(6{,}500)(400)(100)}{43{,}560\ (151)} = 39.5\%$$

Calculated Run-Off: $Q_{TOT} = 17.0$ cfs

Check Pipe Flow

- 36" CMP
- n = 0.024
- S = 12%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 125.15$ cfs OK

Pipe Flow not limiting

Check Inlet Control

- HW depth = 22'

$\frac{HW}{D} = 7.33$ Use Chart 5 - assume projecting entrance

Extrapolation yields a flow of 130 cfs

Inlet control not limiting

PROJECT : Valley Camp Coal - C-25-36 Runoff Calculation

AREA= 151.0 ACRES
AVERAGE BASIN SLOPE= 39.5 PERCENT
CURVE NUMBER= 72.7
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 5000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .2523 HOURS QPCFS= 452.63 CFS QPIN= 2.9727 INCHES
C3= 14.6524 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.32	.7247	.0000	.0000	.0	.00
2.37	.7826	.0003	.0003	22.7	.00
2.42	.8405	.0021	.0018	140.6	.08
2.47	.8984	.0056	.0035	300.5	.41
2.52	.9371	.0088	.0032	415.5	1.22
2.57	.9527	.0103	.0015	452.6	2.41
2.62	.9684	.0119	.0016	424.0	3.60
2.67	.9840	.0136	.0017	357.9	4.49
2.72	.9997	.0154	.0018	279.9	5.05
2.78	1.0153	.0174	.0019	206.6	5.34
2.83	1.0309	.0194	.0020	145.6	5.49
2.88	1.0466	.0216	.0021	98.9	5.59
2.93	1.0622	.0238	.0023	65.1	5.69
2.98	1.0779	.0262	.0024	41.8	5.83
3.03	1.0918	.0284	.0022	26.2	6.01
3.08	1.1043	.0304	.0020	16.2	6.18
3.13	1.1168	.0325	.0021	9.8	6.31
3.18	1.1294	.0346	.0022	5.9	6.38
3.23	1.1419	.0368	.0022	3.5	6.42
3.28	1.1544	.0391	.0023	2.0	6.44
3.33	1.1669	.0415	.0023	1.2	6.48
3.38	1.1794	.0439	.0024	.7	6.55
3.43	1.1919	.0463	.0025	.4	6.64
3.48	1.2044	.0488	.0025	.2	6.76
3.53	1.2145	.0509	.0021	.1	6.88
3.58	1.2231	.0527	.0018	.0	6.96
3.63	1.2317	.0545	.0018	.0	6.92
3.68	1.2403	.0564	.0019	.0	6.77
3.73	1.2489	.0583	.0019	.0	6.56
3.78	1.2575	.0602	.0019	.0	6.34
3.83	1.2661	.0621	.0019	.0	6.16
3.89	1.2747	.0641	.0020	.0	6.02

HYDROGRAPH PEAK= 6.96 cfs
TIME TO PEAK= 3.58 Hours
RUNOFF VOLUME= 1.74 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-26-24
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/19/89

C-26-24 (Permanent Structure)

Tributary Area = 10. * 1.401 = 14 acres

CN = 75 (25% Sagl/Gran)

Precipitation = 1.55 inches (10 yr, 6hr)

hydraulic length = 2,000 feet

$$\text{slope} = \frac{(4{,}000)(80)(100)}{43{,}560\ (14)} = 52.5\%$$

Calculated Run-Off: $Q_{TR} = 1.48$ cfs

Check Pipe Flow

- 24" CMP
- n = 0.024
- S = 18%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 51.99$ cfs OK

Pipe Flow not limiting

Check Inlet Control

- HW depth = 4.0

$\frac{HW}{D} = 2.0$ Use Chart 5 assume projecting entrance

$Q_{HW} = 22.0$ cfs OK

Inlet control not limiting

PROJECT : Valley Camp Coal - C-26-24 Runoff Calculation

AREA= 14.0 ACRES
AVERAGE BASIN SLOPE= 52.5 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0985 HOURS QPCFS= 107.47 CFS QPIN= 7.6124 INCHES
C3= 37.5215 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.27	.6616	.0000	.0000	.0	.00
2.29	.6842	.0000	.0000	5.4	.00
2.31	.7068	.0005	.0004	33.4	.00
2.33	.7294	.0012	.0007	71.3	.02
2.34	.7520	.0021	.0010	98.7	.06
2.36	.7746	.0034	.0013	107.5	.14
2.38	.7972	.0049	.0015	100.7	.24
2.40	.8198	.0067	.0018	85.0	.37
2.42	.8424	.0088	.0021	66.5	.52
2.44	.8650	.0111	.0023	49.0	.68
2.46	.8876	.0137	.0026	34.6	.86
2.48	.9102	.0166	.0028	23.5	1.04
2.50	.9307	.0194	.0028	15.5	1.23
2.52	.9369	.0203	.0009	9.9	1.39
2.54	.9430	.0211	.0009	6.2	1.48
2.56	.9491	.0221	.0009	3.8	1.47
2.58	.9552	.0230	.0009	2.3	1.38
2.60	.9613	.0239	.0009	1.4	1.25
2.62	.9674	.0249	.0010	.8	1.12
2.64	.9735	.0259	.0010	.5	1.00
2.66	.9796	.0269	.0010	.3	.90
2.68	.9857	.0279	.0010	.2	.83
2.70	.9918	.0289	.0010	.0	.78

HYDROGRAPH PEAK= 1.48 cfs
TIME TO PEAK= 2.54 Hours
RUNOFF VOLUME= .22 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 6/30/89

C-27-24

Tributary Area: Ditch UDD-2 Q = 0.57cfs (See HA&L, 1989 Sed. Pond Report)

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 43\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 80.10$ cfs ok

Pipe flow not limiting

Check Inlet Control

- HW depth = 4.5'

$\frac{HW}{D} = 2.25$ Use Chart 5

Assume Projecting entrance

$Q_{HW} = 24$ cfs ok

Inlet Control not limiting

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 6/30/89

C-28-24

Tributary Area: UDD-2 14.7ac ← from 1989 HA&L
Tributary Area 20.3ac Report on Sed. Ponds
35.0 ac

CN	A	Q
75	33.6	0.19
70	1.4	0.10
	35.0	

$\bar{Q} = 0.18$ $\bar{CN} = \underline{74.8}$

Slope from Tributary Area = $\frac{6800(80)100}{43560(20.3)} = 61.5\%$

Avg. Slope = $\frac{61.5(20.3) + 37(14.7)}{35} = \underline{51.2\%}$

Precipitation = 1.55 inches (10yr, 6hr)

Hydraulic Length = 2350 feet

Calculated Runoff $Q_{TOT} = \underline{3.3\ cfs}$

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 30\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = \underline{67.12\ cfs}$ ✓

Pipe Flow not limiting

Check Inlet Control

- HW depth = 8.5'

Use Chart 5 - Assume Projecting Inlet

$\frac{HW}{D} = 4.25$

$Q_{HW} = 35.0\ cfs$

Inlet control not limiting

PROJECT : Valley Camp Coal - C-28-24 Runoff Calculation

AREA= 35.0 ACRES
AVERAGE BASIN SLOPE= 51.2 PERCENT
CURVE NUMBER= 74.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2350. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1142 HOURS QPCFS= 231.87 CFS QPIN= 6.5699 INCHES
C3= 32.3828 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.26	.6550	.0000	.0000	.0	.00
2.28	.6812	.0000	.0000	11.6	.00
2.31	.7074	.0003	.0003	72.0	.00
2.33	.7336	.0010	.0007	153.9	.03
2.35	.7597	.0021	.0011	212.9	.12
2.37	.7859	.0036	.0015	231.9	.28
2.40	.8121	.0055	.0018	217.2	.52
2.42	.8383	.0077	.0022	183.3	.85
2.44	.8645	.0102	.0026	143.4	1.25
2.47	.8907	.0131	.0029	105.8	1.71
2.49	.9169	.0164	.0032	74.6	2.19
2.51	.9335	.0186	.0022	50.6	2.69
2.53	.9406	.0196	.0010	33.4	3.09
2.56	.9477	.0206	.0010	21.4	3.30
2.58	.9548	.0216	.0010	13.4	3.27
2.60	.9618	.0227	.0011	8.3	3.07
2.63	.9689	.0238	.0011	5.0	2.80
2.65	.9760	.0249	.0011	3.0	2.52
2.67	.9831	.0260	.0011	1.8	2.28
2.69	.9901	.0272	.0012	1.0	2.10
2.72	.9972	.0283	.0012	.6	1.97
2.74	1.0043	.0295	.0012	.3	1.88
2.76	1.0114	.0307	.0012	.2	1.84
2.79	1.0185	.0320	.0012	.1	1.82
2.81	1.0255	.0333	.0013	.0	1.82

HYDROGRAPH PEAK= 3.30 cfs
TIME TO PEAK= 2.56 Hours
RUNOFF VOLUME= .53 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-29-16
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/9/89

C-29-16

Tributary Flow D-29A, D-29B

$Q_{TOT} = 1.14$ cfs

Check Pipe Flow

- 16" cast iron
- $n = 0.014$
- $S = 5\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 15.9$ cfs

Since $Q_{allow} > Q_{TOT}$ Culvert is acceptable OK

Check Inlet Control

HW depth = 16" $\frac{HW}{D} = 1$

Evaluate inlet based on 2 know charts from "Hydraulic Charts for the selection of Highway Culverts".

Chart 7 - assume type A $\Rightarrow Q_{HW_7} = 5$ cfs

Chart 5 - assume proj. entrance $Q_{HW_5} = 4.2$ cfs ← Select lower value

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control not limiting OK

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE Culvert Calculations
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/9/89

C-30-24

Receiver flow from D-30

flow D-30 = 4.5 cfs = Q_{TOT}

Check Pipe Characteristics

- 24" CMP
- $n = 0.024$
- $S = 4\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 24.5$ cfs

since $Q_{allow} > Q_{TOT}$ Culvert is Acceptable

Check Inlet Control

HW depth = 48" $\frac{HW}{D} = 2$

assume projecting entrance - Based on Chart 5 of Federal Highway Administration

$Q_{HW_5} = 21.0$ cfs

Since $Q_{HW_5} > Q_{TOT}$ inlet control does not limit

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-31-18
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED paul
CHECKED ___
DATE 5/9/89

C-31-18

Tributary Flow - D-31 1.48 cfs

Check Pipe Flow

- 18" CMP
- $n = 0.024$
- $S' = 18\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 24.14$ cfs

Since $Q_{allow} > Q_{TOT}$ Pipe Flow not limiting OK

Check Inlet Control

- HW depth = 21.6" $\frac{HW}{D} = 1.2$

from Chart 5 assume projecting entrance

$Q_{HW_5} = 7.0$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control not limiting OK

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-32-36
PROJECT NO. 007.11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/9/89

C-32-36

Tributary Flow D-32A, D-32B

$Q_{TOT} = 0.58$ cfs

Check Pipe Flow

- 36" CMP
- $n = 0.024$
- $S = 4\%$

$$Q_{allow} = \frac{1.49}{n} AR^{2/3} S^{1/2}$$

$Q_{allow} = 72.26$ cfs

Since $Q_{allow} > Q_{TOT}$ Pipe Flow not limiting OK

Check Inlet Control

HW depth = 7.67' (drop box w/grate. Assume headwall entrance conditions to model inlet.)

$\frac{HW}{D} = 2.56$

from Chart 5 $Q_{HW_5} = 80.0$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet control not limiting OK

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE Culvert Analysis
PROJECT NO. 007.11-100

SHEET ___ OF ___
COMPUTED paul
CHECKED ___
DATE 5/9/89

C-33-24

Receives flow from D-33A, D-33B

flow D-33A = 5.36 cfs
D-33B = 6.6 cfs

Q_{TOT} = 11.96 cfs

Check Pipe Characteristics

- 24" CMP
- $n = 0.024$
- $S = 17\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

Q_{allow} = 50.5 cfs

Since $Q_{allow} > Q_{TOT}$ Culvert is Adequate OK

Check Inlet Control

HW depth = 48" $\frac{HW}{D} = 2.0$

using Chart 5 ⇒ Q_{HW_5} = 22.0 cfs
assume projecting entrance

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control does not limit OK

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE Culvert Analysis
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE

C-34-24

Receives flow from D-34A, D-34B

flow D-34A = 0.64 cfs
D-34B = 1.88 cfs

Q_{TOT} 2.52 cfs

Check Culvert Characteristics

- 24" CMP
- $n = 0.024$
- $S = 30\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 67.17$ cfs

Since $Q_{allow} > Q_{TOT}$ Culvert is adequate

Check Inlet Control

HW depth = 4.3'

$$\frac{HW}{D} = \frac{4.3}{2} = 2.15$$

using Chart 5 $\Rightarrow$ $Q_{HW_5} = 22.0$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet control does not limit

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE Culvert Analysis
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/9/89

C-35-18

Receives flow from C-36-12 and D-35

C-36-12 has 1.06 cfs
D-35 has 3.00 cfs

$Q_{TOT} = 4.06$ cfs

Check Pipe Characteristics

- 18" Cast Iron
- $n = 0.014$
- $S = 4\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 16.89$ cfs

Since $Q_{allow} > Q_{TOT}$ Culvert is acceptable

Check Inlet Control

HW depth = $\frac{HW}{D} = 1.0$

assume projecting entrance

using Chart 5 $\Rightarrow Q_{HW_5} = 5.5$ cfs

using Chart 7 $\Rightarrow Q_{HW_7} = 6.5$ cfs

select limiting value

$Q_{HW_5} = 5.5$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet control not limiting

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-36-12
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED RWL
CHECKED ___
DATE 5/9/89

C-36-12

Trib Flow D-36, C-38-6

D-36 ⇒ 0.70
C-38-6 ⇒ 0.36

1.06 cfs = Q_{TOT}

Check Pipe Flow

- 12" CMP
- $n = 0.024$
- $S = 30\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 10.57$ cfs

Since $Q_{allow} > Q_{TOT}$ Pipe Flow not limiting OK

Check Inlet Control

HW depth = 2.2 feet $\frac{HW}{D} = 2.2$

assume projecting entrance

from Chart 5 ⇒ $Q_{HW_5} = 4.0$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control not limiting

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-37-18
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/9/89

C-37-18

Receives all flow from D-37

$Q_{TOT} = 2.6$ cfs

Check Pipe Characteristics

- 18" Cast Iron
- $n = 0.014$
- $S = 2\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 16.89$ cfs

Since $Q_{allow} > Q_{TOT}$ culvert acceptable

Check Inlet Control

HW depth = $\frac{HW}{D} = 1.0$

Check Chart 5 - Assume projecting entrance

$Q_{HW_5} = 5.5$ cfs

Check Chart 7 Assume type A entrance

$Q_{HW_7} = 7.0$ cfs

Use limiting value $Q_{HW_5} = 5.5$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control not limiting

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-38-6
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/8/89

C-38-6

Area tributary = 313 * 0.00702 = 2.2 Acres

		Q		
CN = 70	A = 1.8	0.096	$\bar{Q}$ = 0.210	$\overline{CN}$ = 76.1
CN = 90	A = 0.4	0.723		

Precipitation = 1.55 inches (10 yr, 6 hr SCS)

hydraulic length = 570 feet

$$\text{Slope} = \frac{(1250)(25)(100)}{(2.2)43{,}560} = 32.6\%$$

Run-off Calculations $Q = 0.36$ cfs

Check Pipe Characteristics

- 6" CMP
- $n = 0.024$
- $S = 7\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 0.80$ cfs

since $Q_{allow} > Q_{TOT}$ culvert acceptable

Check Inlet Control

$HW = 18''$ $\frac{HW}{D} = 3.0$

based upon an extrapolation of Chart 5

$Q_{HW_5} \approx 1.3$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet control not limiting

PROJECT : Valley Camp Coal - C-38-6 Runoff Calculation

AREA= 2.2 ACRES
AVERAGE BASIN SLOPE= 32.6 PERCENT
CURVE NUMBER= 76.1
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 570. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0444 HOURS QPCFS= 37.50 CFS QPIN=16.9046 INCHES
C3= 83.3230 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.23	.6241	.0000	.0000	.0	.00
2.25	.6411	.0000	.0000	7.6	.00
2.26	.6580	.0003	.0002	28.7	.00
2.28	.6750	.0007	.0004	37.5	.01
2.29	.6919	.0013	.0006	31.7	.03
2.31	.7089	.0020	.0008	21.1	.05
2.32	.7259	.0030	.0009	12.1	.07
2.34	.7428	.0040	.0011	6.2	.09
2.35	.7598	.0053	.0013	3.0	.12
2.37	.7768	.0067	.0014	1.3	.14
2.38	.7937	.0083	.0016	.6	.17
2.40	.8107	.0100	.0017	.2	.19
2.41	.8277	.0119	.0019	.0	.22
2.43	.8446	.0140	.0020	.0	.24
2.44	.8616	.0162	.0022	.0	.26
2.46	.8786	.0185	.0023	.0	.29
2.47	.8955	.0210	.0025	.0	.31
2.48	.9125	.0236	.0026	.0	.33
2.50	.9294	.0264	.0028	.0	.35
2.51	.9344	.0272	.0008	.0	.36
2.53	.9390	.0280	.0008	.0	.32
2.54	.9436	.0288	.0008	.0	.26
2.56	.9482	.0296	.0008	.0	.20
2.57	.9528	.0304	.0008	.0	.16
2.59	.9574	.0312	.0008	.0	.14
2.60	.9619	.0321	.0008	.0	.13

HYDROGRAPH PEAK= .36 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .04 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-39-8
PROJECT NO. 007-11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/9/89

C-39-8

Tributary Flow D-39A, D-39B

$Q_{TOT} = 0.06$ cfs

Check Pipe Flow

- 8" CMP
- $n = 0.024$
- $S = 8\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 1.85$ cfs

Since $Q_{allow} > Q_{TOT}$ Pipe Flow not limiting OK

Check Inlet Control

- HW depth = 1.9 feet $\frac{HW}{D} = 2.8$

Assume projecting entrance

from Chart 5 $Q_{HW_5} = 2.0$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control not limiting OK

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-40-42
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/8/89

(Permanent Structure)

C-40-42 tributary Area + culverts C-44-24, C-41-12

Trib. Area = 20 * 2.747 = 54.9 acres

CN = 70 (25% Oak/Aspen)

Precipitation = 1.55 inches (10 yr, 6 hr SCS)

Hydraulic length = 2,000 feet

$$\text{slope} = \frac{(8{,}500)(80)(100)}{(43{,}560)(54.9)} = 28.4\%$$

Run-Off Calculation: $Q = 1.81$ cfs $Q_{TOT} = 1.81 + 2.46 + 0.99$

$Q_{TOT} = 5.26$ cfs

Check Pipe Characteristics

- 42" CMP
- $n = 0.027$
- $S = 30\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 265.33$ cfs

since $Q_{allow} >> Q$ culvert adequate

* For a 100 yr, 6 hr event

Precip = 2.25 in $\Rightarrow Q = 10.88$ cfs

$Q_{TOT} = 10.88 + 14.82 + 1.37 + 0.99 \Rightarrow Q_{TOT} = 28.06$ cfs

Note. even under the 100 yr event

$Q_{allow} > Q$ culvert still adequate

Check Inlet Control

HW depth = 15' $\frac{HW}{D} = \frac{15}{3.5} = 4.3$

assume projecting entrance

Using Chart 5 $\Rightarrow Q_{HW_5} = 140.0$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control does not limit

PROJECT : Valley Camp Coal - Culvert C-40-42 Capacity Calculations

AREA= 54.9 ACRES
AVERAGE BASIN SLOPE= 28.4 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1539 HOURS QPCFS= 269.71 CFS QPIN= 4.8720 INCHES
C3= 24.0139 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.43	.8522	.0000	.0000	.0	.00
2.46	.8875	.0002	.0002	13.5	.00
2.49	.9229	.0010	.0008	83.8	.03
2.52	.9376	.0015	.0005	179.1	.11
2.56	.9472	.0019	.0004	247.6	.24
2.59	.9567	.0023	.0004	269.7	.37
2.62	.9662	.0027	.0004	252.6	.49
2.65	.9758	.0032	.0005	213.3	.58
2.68	.9853	.0037	.0005	166.8	.65
2.71	.9949	.0043	.0006	123.1	.71
2.74	1.0044	.0049	.0006	86.7	.77
2.77	1.0140	.0055	.0006	58.9	.82
2.80	1.0235	.0062	.0007	38.8	.88
2.83	1.0331	.0069	.0007	24.9	.94
2.86	1.0426	.0077	.0008	15.6	1.01
2.89	1.0521	.0085	.0008	9.6	1.07
2.92	1.0617	.0093	.0008	5.8	1.14
2.96	1.0712	.0102	.0009	3.5	1.20
2.99	1.0808	.0111	.0009	2.1	1.27
3.02	1.0893	.0119	.0008	1.2	1.33
3.05	1.0969	.0127	.0008	.7	1.39
3.08	1.1045	.0135	.0008	.4	1.43
3.11	1.1122	.0143	.0008	.2	1.45
3.14	1.1198	.0152	.0008	.1	1.46
3.17	1.1274	.0160	.0009	.0	1.47
2.43	.8522	.0000	.0000	.0	.00
2.46	.8875	.0002	.0002	13.5	.00
2.49	.9229	.0010	.0008	83.8	.03
2.52	.9376	.0015	.0005	179.1	.11
2.56	.9472	.0019	.0004	247.6	.24
2.59	.9567	.0023	.0004	269.7	.37
2.62	.9662	.0027	.0004	252.6	.49
2.65	.9758	.0032	.0005	213.3	.58
2.68	.9853	.0037	.0005	166.8	.65
2.71	.9949	.0043	.0006	123.1	.71

PROJECT : Valley Camp Coal - Culvert C-40-42 Capacity Calculations (Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.74	1.0044	.0049	.0006	86.7	.77
2.77	1.0140	.0055	.0006	58.9	.82
2.80	1.0235	.0062	.0007	38.8	.88
2.83	1.0331	.0069	.0007	24.9	.94
2.86	1.0426	.0077	.0008	15.6	1.01
2.89	1.0521	.0085	.0008	9.6	1.07
2.92	1.0617	.0093	.0008	5.8	1.14
2.96	1.0712	.0102	.0009	3.5	1.20
2.99	1.0808	.0111	.0009	2.1	1.27
3.02	1.0893	.0119	.0008	1.2	1.33
3.05	1.0969	.0127	.0008	.7	1.39
3.08	1.1045	.0135	.0008	.4	1.43
3.11	1.1122	.0143	.0008	.2	1.45
3.14	1.1198	.0152	.0008	.1	1.46
3.17	1.1274	.0160	.0009	.0	1.47
3.20	1.1351	.0169	.0009	.0	1.48
3.23	1.1427	.0178	.0009	.0	1.49
3.26	1.1503	.0188	.0009	.0	1.51
3.29	1.1580	.0197	.0010	.0	1.54
3.33	1.1656	.0207	.0010	.0	1.57
3.36	1.1732	.0217	.0010	.0	1.60
3.39	1.1809	.0227	.0010	.0	1.63
3.42	1.1885	.0238	.0010	.0	1.67
3.45	1.1961	.0248	.0011	.0	1.71
3.48	1.2038	.0259	.0011	.0	1.75
3.51	1.2107	.0269	.0010	.0	1.79
3.54	1.2159	.0277	.0008	.0	1.81
3.57	1.2212	.0285	.0008	.0	1.81
3.60	1.2264	.0293	.0008	.0	1.78
3.63	1.2317	.0301	.0008	.0	1.72
3.66	1.2369	.0309	.0008	.0	1.66
3.69	1.2422	.0317	.0008	.0	1.60
3.73	1.2474	.0326	.0008	.0	1.56

HYDROGRAPH PEAK= 1.81 cfs
TIME TO PEAK= 3.54 Hours
RUNOFF VOLUME= .44 Acre-Feet

PROJECT : Valley Camp Coal - Culvert C-40-42 (100 yr, 6 hour SCS)

AREA= 54.9 ACRES
AVERAGE BASIN SLOPE= 28.4 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1539 HOURS QPCFS= 269.71 CFS QPIN= 4.8720 INCHES
C3= 24.0139 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.19	.8270	.0000	.0000	.0	.00
2.22	.8783	.0001	.0001	13.5	.00
2.25	.9295	.0012	.0011	83.8	.02
2.28	.9808	.0035	.0023	179.1	.14
2.31	1.0321	.0069	.0034	247.6	.46
2.34	1.0833	.0113	.0045	269.7	1.05
2.37	1.1346	.0169	.0055	252.6	1.94
2.40	1.1858	.0234	.0065	213.3	3.10
2.43	1.2371	.0309	.0075	166.8	4.49
2.46	1.2884	.0394	.0085	123.1	6.03
2.49	1.3396	.0488	.0094	86.7	7.67
2.52	1.3610	.0530	.0042	58.9	9.29
2.56	1.3749	.0558	.0028	38.8	10.46
2.59	1.3888	.0587	.0029	24.9	10.88
2.62	1.4026	.0616	.0029	15.6	10.58
2.65	1.4165	.0646	.0030	9.6	9.81
2.68	1.4303	.0676	.0030	5.8	8.88
2.71	1.4442	.0707	.0031	3.5	7.98
2.74	1.4580	.0739	.0032	2.1	7.24
2.77	1.4719	.0771	.0032	1.2	6.68
2.80	1.4857	.0804	.0033	.7	6.30
2.83	1.4996	.0838	.0033	.4	6.07
2.86	1.5134	.0872	.0034	.2	5.95
2.89	1.5273	.0906	.0035	.1	5.90
2.92	1.5412	.0941	.0035	.0	5.92

HYDROGRAPH PEAK= 10.88 cfs
TIME TO PEAK= 2.59 Hours
RUNOFF VOLUME= 1.55 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE Culverts
PROJECT NO. 007-11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/9/89

C-41-12

Mine Discharge to concrete settling Ponds.

data based on records gathered by Vaughn Hansen Assoc from 9/77 to 10/83.

Max value measured. ⇒ 9/12/83 $\underline{0.99 \text{ cfs}} = Q_{TOT}$

Assume maximum value.

Check Pipe Characteristics

- 12" CMP
- $n = 0.024$
- $S = 17\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$$\underline{Q_{allow} = 7.96 \text{ cfs}}$$

Since $Q_{allow} > Q$ Culvert is acceptable

Check Inlet Control

HW depth = 2.4' $\frac{HW}{D} = 2.4$

assume projecting entrance

Use Chart 5 ⇒ $\underline{Q_{HW_5} = 4.5 \text{ cfs}}$

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control not limiting

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-42-8
PROJECT NO. 007-11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/8/89

C-42-8

Tributary Area D-42

$Q_{TOT} = 0.51$ cfs

Check Pipe Flow

- $n = 0.024$
- 8" CMP
- $S = 5\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 1.46$ cfs

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting ok

Check Inlet Control

- HW depth = 2.67'

$$\frac{HW}{D} = \frac{2.67}{.67} = 4.0$$

assume projecting entrance

from Chart 5 ⇒ $Q_{HW_5} = 2.5$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control not limiting ok

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Mine Permit
FEATURE Culvert Analysis
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/8/89

C-43-8

Total Area = 184 * 0.00702 = 1.3 ac
Undist. Area = 57 * 0.00702 = 0.4 ac (25% oak/aspen)
Dist. Area = 130 * 0.00702 = 0.9 ac

CN	Area	Q
70	0.4	0.096
90	0.9	0.723

$\bar{Q} = 0.530$ $\bar{CN} = 86.1$

Precip = 1.55" (10 yr, 6 hr, SCS)

Hydraulic length = 325 feet

$$\text{Slope} = \frac{(350)(25)(100)}{43{,}560\,(1.3)} = 24.3\%$$

Run-Off Calculation: $Q = 0.71$ cfs

Check Pipe Characteristics

8" CMP
$n = 0.024$
$S = 30\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 3.59$ cfs

since $Q_{allow} > Q$ culvert adequate

For a 100 year, 6 hour event

$P = 2.25$ inches $\Rightarrow Q_{TOT} = 1.37$ cfs

since $Q_{allow} > Q_{TOT}$ culvert is acceptable

Check Inlet Control

HW depth = 2.17'

$$\frac{HW}{D} = \frac{2.17}{0.67} = 3.25$$

Use projecting entrance

Use Chart 5 $\Rightarrow Q_{HW_5} = 2.0$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control not limiting

PROJECT : Valley Camp Coal - Culvert C-43-8 Capacity Calculations

AREA= 1.3 ACRES
AVERAGE BASIN SLOPE= 24.3 PERCENT
CURVE NUMBER= 86.1
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 325. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0238 HOURS QPCFS= 41.38 CFS QPIN=31.5630 INCHES
C3=155.5737 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.88	.3212	.0000	.0000	.0	.00
1.90	.3282	.0000	.0000	41.4	.00
1.93	.3352	.0000	.0000	13.2	.00
1.95	.3422	.0002	.0001	1.5	.00
1.98	.3493	.0004	.0002	.1	.00
2.00	.3563	.0007	.0003	.0	.01
2.36	.7651	.0951	.0103	.0	.57
2.38	.7924	.1058	.0107	.0	.59
2.40	.8197	.1169	.0111	.0	.62
2.43	.8470	.1284	.0115	.0	.64
2.45	.8743	.1404	.0119	.0	.66
2.48	.9016	.1527	.0123	.0	.69
2.50	.9289	.1654	.0127	.0	.71
2.52	.9371	.1693	.0039	.0	.35
2.55	.9444	.1728	.0035	.0	.22
2.57	.9518	.1763	.0035	.0	.20
2.59	.9592	.1799	.0036	.0	.20
2.62	.9666	.1835	.0036	.0	.20
2.64	.9740	.1871	.0036	.0	.20

HYDROGRAPH PEAK= .71 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .06 Acre-Feet

PROJECT : Valley Camp Coal - Culvert C-43-8 (100 yr, 6 hour SCS)

AREA= 1.3 ACRES
AVERAGE BASIN SLOPE= 24.3 PERCENT
CURVE NUMBER= 86.2
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 325. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0237 HOURS QPCFS= 41.53 CFS QPIN=31.6773 INCHES
C3=156.1375 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.52	.3109	.0000	.0000	.0	.00
1.54	.3211	.0000	.0000	41.5	.00
1.56	.3312	.0000	.0000	13.3	.00
1.59	.3413	.0003	.0002	1.5	.00
1.61	.3515	.0006	.0003	.1	.02
1.64	.3616	.0010	.0004	.0	.02
2.35	1.0941	.2522	.0212	.0	1.19
2.37	1.1336	.2740	.0218	.0	1.22
2.39	1.1730	.2964	.0224	.0	1.25
2.42	1.2125	.3193	.0229	.0	1.28
2.44	1.2519	.3428	.0234	.0	1.31
2.46	1.2914	.3667	.0239	.0	1.34
2.49	1.3309	.3911	.0244	.0	1.37
2.51	1.3555	.4066	.0155	.0	1.00
2.54	1.3662	.4133	.0067	.0	.52
2.56	1.3768	.4201	.0068	.0	.40
2.58	1.3875	.4269	.0068	.0	.38
2.61	1.3982	.4338	.0068	.0	.39
2.63	1.4088	.4406	.0069	.0	.39

HYDROGRAPH PEAK= 1.37 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .11 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE Culvert Analysis
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/8/89

C-44-24

Total Area = 27+(2.747) = 74.2 Acres (25% Oak/Aspen)

CN = 70 (25% Oak/Aspen)

Precipitation = 1.55 inches (10 year, 6 hr SCS)

Hydraulic length = 2,000 feet

$$\text{slope} = \frac{(12{,}200)(80)(100)}{43{,}560\,(74.2)} = 30.2\%$$

Run-Off Calculation: $Q = 2.46$ cfs

Check Pipe Characteristics

- 24" CMP
- $n = 0.024$
- $S = 8\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 34.66$ cfs

Since $Q_{allow} > Q$ culvert adequate

* For a 100 year, 6hr event

Precip = 2.25 inches $\Rightarrow Q_{TOT} = 14.82$ cfs

$Q_{TOT} = 14.82 + 1.37$ ← From C-43-8 $Q_{TOT} = 16.19$ cfs

Note: even under the 24 hr. conditions

$Q_{allow} > Q$ ∴ culvert acceptable

Check Inlet Control

HW depth = 6.3 feet $\frac{HW}{D} = \frac{6.3}{2.0} = 3.15$

assume projecting entrance

Use Chart 5 $\Rightarrow Q_{HW_5} = 29.0$ cfs

Since $Q_{HW_5} > Q_{TOT}$ Inlet Control not limiting

PROJECT : Valley Camp Coal - Culvert C-44-24 Capacity Calculation

AREA= 74.2 ACRES
AVERAGE BASIN SLOPE= 30.2 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1493 HOURS QPCFS= 375.90 CFS QPIN= 5.0240 INCHES
C3= 24.7632 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.42	.8363	.0000	.0000	.0	.00
2.45	.8705	.0000	.0000	18.9	.00
2.48	.9048	.0005	.0005	116.8	.01
2.51	.9324	.0013	.0008	249.5	.08
2.54	.9417	.0016	.0003	345.1	.23
2.57	.9510	.0020	.0004	375.9	.42
2.60	.9602	.0024	.0004	352.1	.60
2.63	.9695	.0029	.0004	297.2	.74
2.66	.9787	.0034	.0005	232.5	.85
2.69	.9880	.0039	.0005	171.5	.93
2.72	.9972	.0044	.0006	120.9	1.00
2.75	1.0065	.0050	.0006	82.1	1.07
2.78	1.0157	.0057	.0006	54.1	1.14
2.81	1.0250	.0063	.0007	34.7	1.22
2.84	1.0343	.0070	.0007	21.8	1.30
2.87	1.0435	.0078	.0007	13.4	1.38
2.90	1.0528	.0085	.0008	8.1	1.47
2.93	1.0620	.0093	.0008	4.9	1.55
2.96	1.0713	.0102	.0008	2.9	1.64
2.99	1.0805	.0111	.0009	1.7	1.73
3.02	1.0888	.0119	.0008	1.0	1.81
3.05	1.0962	.0126	.0008	.6	1.89
3.08	1.1036	.0134	.0008	.3	1.94
3.10	1.1110	.0142	.0008	.2	1.97
3.13	1.1184	.0150	.0008	.0	1.98
3.37	1.1777	.0223	.0010	.0	2.20
3.40	1.1851	.0233	.0010	.0	2.24
3.43	1.1925	.0243	.0010	.0	2.29
3.46	1.1999	.0254	.0010	.0	2.35
3.49	1.2073	.0264	.0011	.0	2.40
3.52	1.2129	.0273	.0008	.0	2.44
3.55	1.2180	.0280	.0008	.0	2.46
3.58	1.2231	.0288	.0008	.0	2.44
3.61	1.2282	.0296	.0008	.0	2.37

PROJECT : Valley Camp Coal - Culvert C-44-24 Capacity Calculation
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.64	1.2333	.0303	.0008	.0	2.29
3.67	1.2384	.0311	.0008	.0	2.21
3.70	1.2435	.0319	.0008	.0	2.14
3.73	1.2485	.0328	.0008	.0	2.09

HYDROGRAPH PEAK= 2.46 cfs
TIME TO PEAK= 3.55 Hours
RUNOFF VOLUME= .59 Acre-Feet

PROJECT : Valley Camp Coal - Culvert C-44-24 (100 yr, 6 hour SCS)

AREA= 74.2 ACRES
AVERAGE BASIN SLOPE= 30.2 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1493 HOURS QPCFS= 375.90 CFS QPIN= 5.0240 INCHES
C3= 24.7632 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.18	.8163	.0000	.0000	.0	.00
2.21	.8660	.0000	.0000	18.9	.00
2.24	.9157	.0008	.0008	116.8	.02
2.27	.9654	.0027	.0019	249.5	.13
2.30	1.0152	.0056	.0029	345.1	.47
2.33	1.0649	.0096	.0040	375.9	1.16
2.36	1.1146	.0146	.0050	352.1	2.24
2.39	1.1643	.0205	.0060	297.2	3.69
2.42	1.2140	.0274	.0069	232.5	5.45
2.45	1.2637	.0352	.0078	171.5	7.43
2.48	1.3134	.0439	.0087	120.9	9.57
2.51	1.3535	.0515	.0076	82.1	11.76
2.54	1.3670	.0542	.0027	54.1	13.69
2.57	1.3804	.0569	.0027	34.7	14.78
2.60	1.3939	.0597	.0028	21.8	14.82
2.63	1.4073	.0626	.0029	13.4	14.02
2.66	1.4207	.0655	.0029	8.1	12.79
2.69	1.4342	.0685	.0030	4.9	11.49
2.72	1.4476	.0715	.0030	2.9	10.33
2.75	1.4610	.0746	.0031	1.7	9.42
2.78	1.4745	.0777	.0031	1.0	8.77
2.81	1.4879	.0809	.0032	.6	8.34
2.84	1.5013	.0842	.0033	.3	8.09
2.87	1.5148	.0875	.0033	.2	7.98
2.90	1.5282	.0908	.0034	.0	7.95

HYDROGRAPH PEAK= 14.82 cfs
TIME TO PEAK= 2.60 Hours
RUNOFF VOLUME= 2.10 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Hydrology - Surface Facilities
FEATURE Runoff & Peak Flow Projections - Undisturbed Area Channel
PROJECT NO.

SHEET 1 OF 17
COMPUTED [illegible]
CHECKED
DATE 1/18/89

I - Undisturbed Area Runoff Channels

A - Drainage Basin Characteristics

Channel	Basin Area (acres)	Hydraulic Length ft	Watershed Slope %
UDA-1	6.7	700	27
UDA-2	14.7	1900	37
UDA-3	8.1	1500	32
UDA-4	5.5	1250	31
UDA-5	7.2	1100	28

$$\text{Watershed Slope} = \frac{L_c * CI}{DA} * 100$$

L_c = length of Contour lines.
CI = Contour Interval in feet.
DA = Drainage Area

Channel	L_c ft	CI ft	DA ft²	Slope %
UDA-1	1000	80	291,852	27
UDA-2	11,900	20	640,332	37
UDA-3	5,600	20	352,836	32
UDA-4	3750	20	239,580	31
UDA-5	4400	20	313,632	28

B - Curve Number

Use CN = 75 for sage-grass cover
CN = 70 for Aspen or Forest Cover

See Calculations 9/18/88 for justification.

Channel	Area Sage-Grass ac	Area Aspen or Forest ac
UDA-1	6.7	0
UDA-2	1.4	13.3
UDA-3	8.1	0
UDA-4	0	5.5
UDA-5	0	7.2

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PROJECT Hydrology - Surface Facilities
FEATURE Runoff & Peak Flow Projections
PROJECT NO.

SHEET 2 OF 17
COMPUTED DMA
CHECKED
DATE 1/18/89

Weighted Curve #s based on runoff volume

Channel	Area ac	CN	10-yr 24-hr Runoff Depth in	Wt. CN based on Wt. Q
UAD-1	6.7	75	0.62	75
	0	70	0.43	
			WTQ = 0.62	
UAD-2	1.4	75	0.62	
	13.3	70	0.43	70.5 Use 71
			WTQ = 0.45	
UAD-3	8.1	75	0.62	
	0.0	70	0.43	75
			WTQ = 0.62	
UAD-4	0	75	0.62	
	5.5	70	0.43	70
			WTQ = 0.43	
UAD-5	0	75	0.62	
	7.2	70	0.43	70
			WTQ = 0.43	

10-yr 24-hr Precip = 2.45 inches

10-yr 6-hr Precip = 1.55 inches.

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Hydrology - Surface Facilities
FEATURE Runoff & Peak Flow Projections
PROJECT NO.

SHEET 3 OF 17
COMPUTED EMA
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DATE 1/18/89

C- Peak Discharge Summary

Estimated Peak Discharge for Undisturbed Area Bypass Channels from 10-year, 24-hour and 10-year, 6-hour Precipitation Events.

CHANNEL	PEAK FLOW 10-YEAR, 24-HOUR (cfs)	PEAK FLOW 10-YEAR, 6-HOUR (cfs)
UD-1	4.5	.84
UD-2	6.4	.57
UD-3	5.1	.85
UD-4	2.3	.19
UD-5	3.0	.25

See Attached Printouts for Hydrograph output data.

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-1~~ UDD-1

AREA= 6.7 ACRES
AVERAGE BASIN SLOPE= 27.0 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 2.45 INCHES
STORM DURATION= 24.0 HOURS
HYDRAULIC LENGTH= 700. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0593 HOURS QPCFS= 85.42 CFS QPIN=12.6436 INCHES
C3= 62.3202 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.38	.6649	.0000	.0000	.0	.00
11.40	.6704	.0000	.0000	26.7	.00
11.42	.6758	.0000	.0000	78.6	.00
11.45	.6813	.0000	.0000	79.8	.00
11.47	.6868	.0001	.0000	52.5	.00
11.50	.6923	.0002	.0000	27.2	.01
11.52	.7290	.0011	.0009	12.1	.04
11.54	.7733	.0033	.0022	4.9	.14
11.57	.8177	.0065	.0032	1.8	.34
11.59	.8620	.0108	.0043	.6	.59
11.61	.9063	.0161	.0053	.2	.87
11.64	.9506	.0223	.0062	.0	1.16
11.85	1.3494	.1161	.0134	.0	3.38
11.88	1.3938	.1302	.0141	.0	3.59
11.90	1.4381	.1450	.0148	.0	3.79
11.92	1.4824	.1604	.0154	.0	3.98
11.95	1.5267	.1764	.0160	.0	4.17
11.97	1.5710	.1930	.0166	.0	4.35
12.00	1.6153	.2102	.0172	.0	4.52
12.02	1.6310	.2164	.0062	.0	4.38
12.04	1.6394	.2198	.0034	.0	3.55
12.07	1.6478	.2231	.0034	.0	2.51
12.09	1.6562	.2265	.0034	.0	1.74
12.11	1.6646	.2299	.0034	.0	1.30
12.14	1.6730	.2334	.0034	.0	1.10

HYDROGRAPH PEAK= 4.52 cfs
TIME TO PEAK= 12.00 Hours
RUNOFF VOLUME= .35 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL ~~UD-1~~ UDD-1

AREA= 6.7 ACRES
AVERAGE BASIN SLOPE= 27.0 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 700. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0593 HOURS QPCFS= 85.42 CFS QPIN=12.6436 INCHES
C3= 62.3202 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.26	.6559	.0000	.0000	.0	.00
2.28	.6832	.0000	.0000	26.7	.00
2.31	.7105	.0006	.0005	78.6	.02
2.33	.7378	.0015	.0009	79.8	.07
2.36	.7651	.0028	.0013	52.5	.15
2.38	.7924	.0046	.0017	27.2	.25
2.40	.8197	.0067	.0021	12.1	.36
2.43	.8470	.0093	.0025	4.9	.48
2.45	.8743	.0122	.0029	1.8	.59
2.48	.9016	.0155	.0033	.6	.70
2.50	.9289	.0191	.0037	.2	.81
2.52	.9371	.0203	.0012	.0	.84
2.55	.9444	.0214	.0011	.0	.71
2.57	.9518	.0225	.0011	.0	.54
2.59	.9592	.0236	.0011	.0	.42
2.62	.9666	.0248	.0012	.0	.36
2.64	.9740	.0259	.0012	.0	.34
2.67	.9813	.0271	.0012	.0	.33

HYDROGRAPH PEAK= .84 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .10 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-2~~ JDD-2

AREA= 14.7 ACRES
AVERAGE BASIN SLOPE= 37.0 PERCENT
CURVE NUMBER= 71.0
DESIGN STORM= 2.45 INCHES
STORM DURATION= 24.0 HOURS
HYDRAULIC LENGTH= 1900. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1260 HOURS QPCFS= 88.25 CFS QPIN= 5.9534 INCHES
C3= 29.3443 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.56	.8133	.0000	.0000	.0	.00
11.59	.8602	.0005	.0005	4.4	.00
11.61	.9071	.0019	.0015	27.4	.02
11.64	.9540	.0045	.0025	58.6	.08
11.67	1.0010	.0079	.0035	81.0	.21
11.69	1.0479	.0124	.0044	88.2	.42
11.72	1.0948	.0177	.0053	82.7	.72
11.74	1.1417	.0239	.0062	69.8	1.09
11.77	1.1886	.0310	.0071	54.6	1.52
11.79	1.2355	.0389	.0079	40.3	1.98
11.82	1.2824	.0476	.0087	28.4	2.46
11.84	1.3293	.0571	.0095	19.3	2.96
11.87	1.3763	.0674	.0103	12.7	3.46
11.89	1.4232	.0784	.0110	8.1	3.95
11.92	1.4701	.0901	.0117	5.1	4.43
11.94	1.5170	.1024	.0124	3.2	4.91
11.97	1.5639	.1155	.0131	1.9	5.37
11.99	1.6108	.1292	.0137	1.1	5.82
12.02	1.6307	.1352	.0060	.7	6.22
12.04	1.6396	.1379	.0027	.4	6.40
12.07	1.6485	.1407	.0027	.2	6.21
12.09	1.6573	.1434	.0028	.1	5.69
12.12	1.6662	.1462	.0028	.0	4.98
12.14	1.6751	.1490	.0028	.0	4.22
12.17	1.6840	.1518	.0028	.0	3.54
12.19	1.6929	.1547	.0029	.0	2.98

HYDROGRAPH PEAK= 6.40 cfs
TIME TO PEAK= 12.04 Hours
RUNOFF VOLUME= .57 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL ~~UD-2~~ UDD-2

AREA= 14.7 ACRES
AVERAGE BASIN SLOPE= 37.0 PERCENT
CURVE NUMBER= 71.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1900. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1260 HOURS QPCFS= 88.25 CFS QPIN= 5.9534 INCHES
C3= 29.3443 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.39	.8078	.0000	.0000	.0	.00
2.42	.8367	.0000	.0000	4.4	.00
2.44	.8656	.0006	.0005	27.4	.00
2.47	.8945	.0014	.0009	58.6	.02
2.49	.9234	.0027	.0013	81.0	.07
2.52	.9360	.0034	.0007	88.2	.14
2.54	.9438	.0038	.0005	82.7	.22
2.57	.9517	.0043	.0005	69.8	.28
2.60	.9595	.0048	.0005	54.6	.32
2.62	.9673	.0053	.0005	40.3	.33
2.65	.9751	.0059	.0006	28.4	.34
2.67	.9829	.0065	.0006	19.3	.34
2.70	.9907	.0071	.0006	12.7	.33
2.72	.9985	.0077	.0006	8.1	.33
2.75	1.0063	.0084	.0007	5.1	.33
2.77	1.0141	.0091	.0007	3.2	.34
2.80	1.0220	.0098	.0007	1.9	.35
2.82	1.0298	.0105	.0007	1.1	.36
2.85	1.0376	.0113	.0008	.7	.37
2.87	1.0454	.0121	.0008	.4	.39
2.90	1.0532	.0129	.0008	.2	.40
2.92	1.0610	.0138	.0008	.1	.42
2.95	1.0688	.0146	.0009	.0	.43
3.38	1.1783	.0294	.0010	.0	.52
3.40	1.1845	.0304	.0010	.0	.53
3.43	1.1908	.0314	.0010	.0	.54
3.45	1.1970	.0324	.0010	.0	.55
3.48	1.2033	.0334	.0010	.0	.56
3.50	1.2094	.0344	.0010	.0	.57
3.53	1.2136	.0351	.0007	.0	.57
3.55	1.2179	.0359	.0007	.0	.57
3.58	1.2222	.0366	.0007	.0	.56
3.60	1.2265	.0373	.0007	.0	.54
3.63	1.2308	.0381	.0008	.0	.52

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL ~~UD-2~~ UDD-2
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.65	1.2351	.0388	.0008	.0	.50
3.68	1.2394	.0396	.0008	.0	.48

HYDROGRAPH PEAK= .57 cfs
TIME TO PEAK= 3.53 Hours
RUNOFF VOLUME= .14 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-3~~ UDD-3

AREA= 8.1 ACRES
AVERAGE BASIN SLOPE= 32.0 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 2.45 INCHES
STORM DURATION= 24.0 HOURS
HYDRAULIC LENGTH= 1500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1002 HOURS QPCFS= 61.10 CFS QPIN= 7.4811 INCHES
C3= 36.8746 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.37	.6630	.0000	.0000	.0	.00
11.39	.6676	.0000	.0000	3.1	.00
11.41	.6722	.0000	.0000	19.0	.00
11.43	.6768	.0000	.0000	40.6	.00
11.45	.6815	.0000	.0000	56.1	.00
11.47	.6861	.0001	.0000	61.1	.00
11.49	.6907	.0002	.0000	57.2	.00
11.51	.7093	.0005	.0004	48.3	.00
11.53	.7466	.0019	.0013	37.8	.02
11.55	.7839	.0040	.0021	27.9	.06
11.57	.8213	.0069	.0029	19.7	.13
11.59	.8586	.0105	.0036	13.3	.26
11.61	.8959	.0148	.0043	8.8	.42
11.63	.9333	.0197	.0050	5.6	.63
11.65	.9706	.0254	.0057	3.5	.87
11.67	1.0079	.0317	.0063	2.2	1.12
11.69	1.0453	.0386	.0069	1.3	1.38
11.71	1.0826	.0461	.0075	.8	1.65
11.73	1.1199	.0543	.0081	.5	1.92
11.75	1.1573	.0629	.0087	.3	2.19
11.77	1.1946	.0722	.0092	.2	2.45
11.79	1.2319	.0820	.0098	.0	2.70
11.37	.6630	.0000	.0000	.0	.00
11.39	.6676	.0000	.0000	3.1	.00
11.41	.6722	.0000	.0000	19.0	.00
11.43	.6768	.0000	.0000	40.6	.00
11.45	.6815	.0000	.0000	56.1	.00
11.47	.6861	.0001	.0000	61.1	.00
11.49	.6907	.0002	.0000	57.2	.00
11.51	.7093	.0005	.0004	48.3	.00
11.53	.7466	.0019	.0013	37.8	.02
11.55	.7839	.0040	.0021	27.9	.06
11.57	.8213	.0069	.0029	19.7	.13
11.59	.8586	.0105	.0036	13.3	.26
11.61	.8959	.0148	.0043	8.8	.42

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-3~~ UDD-3
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.63	.9333	.0197	.0050	5.6	.63
11.65	.9706	.0254	.0057	3.5	.87
11.67	1.0079	.0317	.0063	2.2	1.12
11.69	1.0453	.0386	.0069	1.3	1.38
11.71	1.0826	.0461	.0075	.8	1.65
11.73	1.1199	.0543	.0081	.5	1.92
11.75	1.1573	.0629	.0087	.3	2.19
11.77	1.1946	.0722	.0092	.2	2.45
11.79	1.2319	.0820	.0098	.0	2.70
11.81	1.2693	.0923	.0103	.0	2.95
11.83	1.3066	.1031	.0108	.0	3.19
11.85	1.3439	.1144	.0113	.0	3.43
11.87	1.3813	.1262	.0118	.0	3.66
11.89	1.4186	.1384	.0122	.0	3.88
11.91	1.4559	.1511	.0127	.0	4.09
11.93	1.4933	.1642	.0131	.0	4.30
11.95	1.5306	.1778	.0136	.0	4.51
11.97	1.5679	.1918	.0140	.0	4.71
11.99	1.6053	.2062	.0144	.0	4.90
12.01	1.6278	.2151	.0089	.0	5.07
12.03	1.6349	.2179	.0028	.0	5.12
12.05	1.6420	.2208	.0028	.0	4.93
12.07	1.6490	.2236	.0028	.0	4.51
12.09	1.6561	.2265	.0029	.0	3.93
12.11	1.6632	.2293	.0029	.0	3.32
12.13	1.6702	.2322	.0029	.0	2.76
12.15	1.6773	.2351	.0029	.0	2.30

HYDROGRAPH PEAK= 5.12 cfs
TIME TO PEAK= 12.03 Hours
RUNOFF VOLUME= .42 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL ~~UD-3~~ UDD-3

AREA= 8.1 ACRES
AVERAGE BASIN SLOPE= 32.0 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1002 HOURS QPCFS= 61.10 CFS QPIN= 7.4811 INCHES
C3= 36.8746 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.27	.6612	.0000	.0000	.0	.00
2.29	.6842	.0000	.0000	3.1	.00
2.31	.7072	.0005	.0004	19.0	.00
2.33	.7301	.0012	.0007	40.6	.01
2.35	.7531	.0022	.0010	56.1	.04
2.37	.7761	.0035	.0013	61.1	.08
2.39	.7991	.0051	.0016	57.2	.14
2.41	.8221	.0069	.0019	48.3	.21
2.43	.8451	.0091	.0021	37.8	.30
2.45	.8681	.0115	.0024	27.9	.40
2.47	.8911	.0142	.0027	19.7	.50
2.49	.9141	.0171	.0029	13.3	.61
2.51	.9319	.0196	.0025	8.8	.72
2.53	.9381	.0204	.0009	5.6	.81
2.55	.9444	.0214	.0009	3.5	.85
2.57	.9506	.0223	.0009	2.2	.84
2.59	.9568	.0232	.0009	1.3	.78
2.61	.9630	.0242	.0010	.8	.71
2.63	.9692	.0252	.0010	.5	.63
2.65	.9754	.0262	.0010	.3	.57
2.67	.9816	.0272	.0010	.2	.51
2.69	.9879	.0282	.0010	.0	.48

HYDROGRAPH PEAK= .85 cfs
TIME TO PEAK= 2.55 Hours
RUNOFF VOLUME= .12 Acre-Feet

12/17

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-4~~ UDD-4

AREA= 5.5 ACRES
AVERAGE BASIN SLOPE= 31.0 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 2.45 INCHES
STORM DURATION= 24.0 HOURS
HYDRAULIC LENGTH= 1250. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1012 HOURS QPCFS= 41.12 CFS QPIN= 7.4135 INCHES
C3= 36.5410 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.57	.8296	.0000	.0000	.0	.00
11.59	.8673	.0000	.0000	2.1	.00
11.61	.9050	.0005	.0005	12.8	.00
11.63	.9426	.0017	.0011	27.3	.00
11.65	.9803	.0034	.0018	37.7	.03
11.67	1.0180	.0058	.0024	41.1	.08
11.69	1.0556	.0088	.0030	38.5	.15
11.71	1.0933	.0123	.0035	32.5	.24
11.73	1.1310	.0164	.0041	25.4	.36
11.76	1.1687	.0211	.0047	18.8	.49
11.78	1.2063	.0263	.0052	13.2	.63
11.80	1.2440	.0320	.0057	9.0	.77
11.82	1.2817	.0383	.0062	5.9	.92
11.84	1.3194	.0450	.0067	3.8	1.07
11.86	1.3570	.0522	.0072	2.4	1.22
11.88	1.3947	.0599	.0077	1.5	1.36
11.90	1.4324	.0681	.0082	.9	1.51
11.92	1.4701	.0767	.0086	.5	1.65
11.94	1.5077	.0857	.0091	.3	1.78
11.96	1.5454	.0952	.0095	.2	1.92
11.98	1.5831	.1052	.0099	.1	2.05
12.00	1.6208	.1155	.0103	.0	2.18
12.02	1.6308	.1183	.0028	.0	2.29
12.04	1.6379	.1203	.0020	.0	2.31
12.06	1.6451	.1224	.0020	.0	2.20
12.08	1.6522	.1244	.0021	.0	1.98
12.10	1.6594	.1265	.0021	.0	1.71
12.12	1.6665	.1286	.0021	.0	1.44
12.14	1.6736	.1307	.0021	.0	1.20
12.16	1.6808	.1328	.0021	.0	1.01

HYDROGRAPH PEAK= 2.31 cfs
TIME TO PEAK= 12.04 Hours
RUNOFF VOLUME= .20 Acre-Feet

PROJECT : VALLEY CAMP 10-YR 6-HR PEAK FLOW CHANNEL ~~UD-4~~ UDD-4

AREA= 5.5 ACRES
AVERAGE BASIN SLOPE= 31.0 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1250. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1012 HOURS QPCFS= 41.12 CFS QPIN= 7.4135 INCHES
C3= 36.5410 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.43	.8473	.0000	.0000	.0	.00
2.45	.8705	.0000	.0000	2.1	.00
2.47	.8937	.0003	.0003	12.8	.00
2.49	.9169	.0008	.0005	27.3	.00
2.51	.9327	.0013	.0005	37.7	.02
2.53	.9390	.0015	.0002	41.1	.03
2.55	.9453	.0018	.0002	38.5	.05
2.57	.9516	.0020	.0003	32.5	.06
2.59	.9578	.0023	.0003	25.4	.07
2.61	.9641	.0026	.0003	18.8	.07
2.63	.9704	.0029	.0003	13.2	.07
2.65	.9766	.0032	.0003	9.0	.08
2.67	.9829	.0036	.0003	5.9	.08
2.69	.9892	.0039	.0004	3.8	.08
2.71	.9955	.0043	.0004	2.4	.08
2.73	1.0017	.0047	.0004	1.5	.09
2.75	1.0080	.0051	.0004	.9	.09
2.77	1.0143	.0056	.0004	.5	.09
2.79	1.0206	.0060	.0004	.3	.10
2.81	1.0268	.0065	.0005	.2	.10
2.83	1.0331	.0069	.0005	.1	.11
2.85	1.0394	.0074	.0005	.0	.11
3.40	1.1840	.0232	.0007	.0	.17
3.42	1.1890	.0238	.0007	.0	.18
3.44	1.1940	.0245	.0007	.0	.18
3.46	1.1990	.0253	.0007	.0	.18
3.48	1.2040	.0260	.0007	.0	.18
3.50	1.2090	.0267	.0007	.0	.19
3.52	1.2125	.0272	.0005	.0	.19
3.54	1.2159	.0277	.0005	.0	.19
3.56	1.2194	.0282	.0005	.0	.18
3.58	1.2228	.0288	.0005	.0	.18
3.60	1.2263	.0293	.0005	.0	.17
3.62	1.2297	.0298	.0005	.0	.16

PROJECT : VALLEY CAMP 10-YR 6-HR PEAK FLOW CHANNEL ~~UD-4~~ UDD-4
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.64	1.2332	.0303	.0005	.0	.16

HYDROGRAPH PEAK= .19 cfs
TIME TO PEAK= 3.52 Hours
RUNOFF VOLUME= .04 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-5~~ UDO-5

AREA= 7.2 ACRES
AVERAGE BASIN SLOPE= 28.0 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 2.45 INCHES
STORM DURATION= 24.0 HOURS
HYDRAULIC LENGTH= 1100. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0961 HOURS QPCFS= 56.66 CFS QPIN= 7.8043 INCHES
C3= 38.4674 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.57	.8239	.0000	.0000	.0	.00
11.59	.8596	.0000	.0000	2.8	.00
11.61	.8954	.0003	.0003	17.6	.00
11.63	.9312	.0013	.0009	37.6	.00
11.65	.9670	.0027	.0015	52.0	.03
11.67	1.0028	.0048	.0020	56.7	.08
11.69	1.0386	.0074	.0026	53.1	.17
11.70	1.0744	.0105	.0031	44.8	.28
11.72	1.1101	.0141	.0036	35.0	.42
11.74	1.1459	.0182	.0041	25.9	.57
11.76	1.1817	.0229	.0046	18.2	.75
11.78	1.2175	.0280	.0051	12.4	.93
11.80	1.2533	.0335	.0056	8.2	1.11
11.82	1.2891	.0395	.0060	5.2	1.30
11.84	1.3249	.0460	.0065	3.3	1.48
11.86	1.3607	.0529	.0069	2.0	1.67
11.88	1.3964	.0603	.0073	1.2	1.85
11.90	1.4322	.0680	.0078	.7	2.03
11.92	1.4680	.0762	.0082	.4	2.20
11.94	1.5038	.0848	.0086	.3	2.37
11.95	1.5396	.0937	.0090	.1	2.54
11.97	1.5754	.1031	.0093	.0	2.70
11.99	1.6112	.1128	.0097	.0	2.86
12.01	1.6286	.1177	.0049	.0	3.00
12.03	1.6354	.1196	.0019	.0	3.05
12.05	1.6422	.1215	.0019	.0	2.95
12.07	1.6490	.1235	.0019	.0	2.69
12.09	1.6558	.1254	.0020	.0	2.35
12.11	1.6625	.1274	.0020	.0	1.99
12.13	1.6693	.1294	.0020	.0	1.66
12.15	1.6761	.1314	.0020	.0	1.39

HYDROGRAPH PEAK= 3.05 cfs
TIME TO PEAK= 12.03 Hours
RUNOFF VOLUME= .26 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL ~~UD-5~~ UDD-5

AREA= 7.2 ACRES
AVERAGE BASIN SLOPE= 28.0 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1100. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0961 HOURS QPCFS= 56.66 CFS QPIN= 7.8043 INCHES
C3= 38.4674 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.42	.8401	.0000	.0000	.0	.00
2.44	.8622	.0000	.0000	2.8	.00
2.46	.8842	.0002	.0002	17.6	.00
2.48	.9063	.0006	.0004	37.6	.00
2.50	.9283	.0012	.0006	52.0	.02
2.52	.9355	.0014	.0002	56.7	.03
2.54	.9415	.0016	.0002	53.1	.06
2.56	.9474	.0019	.0002	44.8	.08
2.58	.9534	.0021	.0003	35.0	.09
2.59	.9593	.0024	.0003	25.9	.09
2.61	.9653	.0027	.0003	18.2	.10
2.63	.9713	.0030	.0003	12.4	.10
2.65	.9772	.0033	.0003	8.2	.10
2.67	.9832	.0036	.0003	5.2	.10
2.69	.9891	.0039	.0003	3.3	.11
2.71	.9951	.0043	.0004	2.0	.11
2.73	1.0010	.0047	.0004	1.2	.11
2.75	1.0070	.0051	.0004	.7	.12
2.77	1.0130	.0055	.0004	.4	.12
2.79	1.0189	.0059	.0004	.3	.13
2.81	1.0249	.0063	.0004	.1	.13
2.83	1.0308	.0068	.0004	.0	.14
3.40	1.1847	.0233	.0006	.0	.23
3.42	1.1894	.0239	.0007	.0	.23
3.44	1.1942	.0246	.0007	.0	.23
3.46	1.1990	.0252	.0007	.0	.24
3.48	1.2037	.0259	.0007	.0	.24
3.50	1.2085	.0266	.0007	.0	.24
3.52	1.2119	.0271	.0005	.0	.25
3.54	1.2152	.0276	.0005	.0	.25
3.56	1.2185	.0281	.0005	.0	.24
3.57	1.2218	.0286	.0005	.0	.23
3.59	1.2250	.0291	.0005	.0	.22
3.61	1.2283	.0296	.0005	.0	.21

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL ~~UD-5~~ UDD-5
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.63	1.2316	.0301	.0005	.0	.21

HYDROGRAPH PEAK= .25 cfs
TIME TO PEAK= 3.52 Hours
RUNOFF VOLUME= .06 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT: VALLEY CAMP
PROJECT: PERMIT
FEATURE: UNDISTURBED DITCHES
PROJECT NO.:

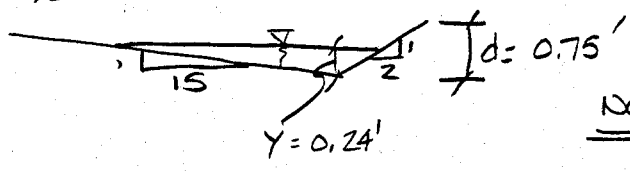
SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 2 MAY 89

UDD-1

ALL DESIGNS TO BE COMPLETED ACCORDING TO 30CFR REQUIREMENT OF A 10-YR-6HR EVENT AND AS PENDING IN NEW UTAH REG'S.

COMPUTER CALC'S SHOWN ON ATTACHED SHEETS (SHEET 2)

$S_{min} = 2\%$ $\eta = .03$ $M_1 = 15$ freeboard = 0.5'
$S_{max} = 20\%$ (field) $b = 0$ $M_2 = 2$
30% (off Map)
$Q_{design} = 0.84$ cfs



NO LINING REQ'd

UDD-2

$Q_{design} = 0.57$ cfs

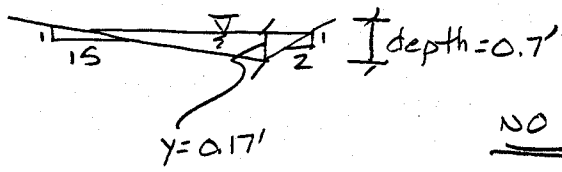
Try Triangular Section.

$b = 0$ $S_{min} = 7\%$ > from Mapping
$\eta = .03$ $S_{max} = 23\%$ >
$M_1 = M_2 = 2$ freeboard = 0.5'

Velocity Check on Sheet 3 Shows vel > 5.0'

Change to Road Style design - (SHEET 3)

$b = 0$ $\eta = .03$
$M_1 = 15$ $S_{min} = 0.07$
$M_2 = 2$ $S_{max} = 0.23$

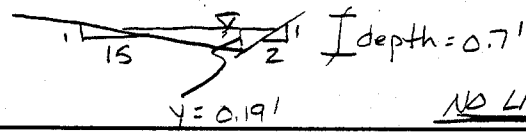


NO LINING REQ'd

UDD-3 $Q_{design} = 0.85$ cfs

$S_{min} = 7\%$ > from Mapping $b = 0$ freeboard = 0.5'
$S_{max} = 20\%$ > $M_1 = 15$
$M_2 = 2$

Use Road Style Design (SHEET 4)



NO LINING REQ'd

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	03-May-89
Project No.:	007.11.100	Time:	10:13 AM
Channel Section:	UDD-1 - Trial 1	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.84	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.30	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.24	feet
	Qn/1.49(S)1/2=	0.120	
	A(R)2/3=	0.119	
	Required Depth:	0.74	feet
	Area:	0.49	ft2
	Perimeter:	4.16	feet
	Hydraulic Radius:	0.12	feet
	Velocity:	1.70	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.15	feet
	Qn/1.49(S)1/2=	0.031	
	A(R)2/3=	0.031	
	Required Depth:	0.65	feet
	Area:	0.18	ft2
	Perimeter:	2.50	feet
	Hydraulic Radius:	0.07	feet
	Velocity:	4.70	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.30	ft/ft
	Channel Depth:	0.74	feet
	Riprap:	Not Needed	

Comment:

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: UDD-2 - Trail 2

Date: 02-May-89
Time: 02:39 PM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.57	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.07	ft/ft
	Max. Bottom Slope:	0.23	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.17	feet
	Qn/1.49(S)1/2=	0.043	
	A(R)2/3=	0.043	
	Required Depth:	0.67	feet
	Area:	0.23	ft2
	Perimeter:	2.85	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	2.46	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.13	feet
	Qn/1.49(S)1/2=	0.024	
	A(R)2/3=	0.023	
	Required Depth:	0.63	feet
	Area:	0.14	ft2
	Perimeter:	2.25	feet
	Hydraulic Radius:	0.06	feet
	Velocity:	3.97	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:

Side Slope 1:	15.0	1/m1
Side Slope 2:	2.0	1/m2
Min. Bottom Slope:	0.07	ft/ft
Max. Bottom Slope:	0.23	ft/ft
Channel Depth:	0.7	feet
Riprap:	Not Needed	

Comment: Channel Velocities < 5.0 fsp.
Design OK

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: UDD-3 - Trial 1

Date: 02-May-89
Time: 03:33 PM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.85	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.07	ft/ft
	Max. Bottom Slope:	0.20	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.19	feet
	Qn/1.49(S)1/2=	0.065	
	A(R)2/3=	0.065	
	Required Depth:	0.69	feet
	Area:	0.31	ft2
	Perimeter:	3.32	feet
	Hydraulic Radius:	0.09	feet
	Velocity:	2.71	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.16	feet
	Qn/1.49(S)1/2=	0.038	
	A(R)2/3=	0.038	
	Required Depth:	0.66	feet
	Area:	0.21	ft2
	Perimeter:	2.71	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	4.06	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.07	ft/ft
	Max. Bottom Slope:	0.20	ft/ft
	Channel Depth:	0.69	feet
	Riprap:	Not Needed	

Comment: Build channel on existing scar

HANSEN ALLEN & LUCE INC

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE UNDISTURBED DITCHES
PROJECT NO. 007.11.100

SHEET 5 OF
COMPUTED DEH
CHECKED
DATE 2 MAY 89

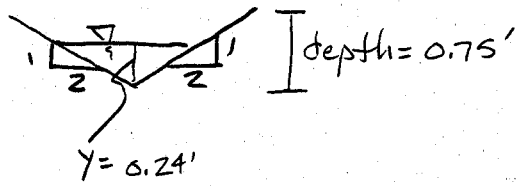
UDD-4

Qdesign = 0.19 cfs

b = 0
$M_1 = M_2 = 2$

$S_{min} = 2\%$, $S_{max} = 13\%$ } From Mapping

USE DITCH STYLE DESIGN (SHEET 6)



NO LINING REQ'd

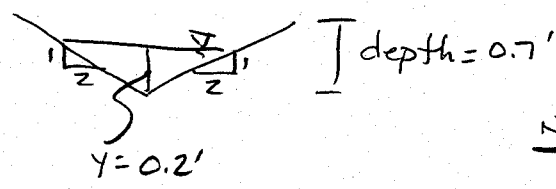
UDD-5

Qdesign = 0.25 cfs

b = 0
$M_1 = M_2 = 2$

$S_{min} = 12\%$, $S_{max} = 25\%$ } From Mapping

USE DITCH STYLE DESIGN (SHEET 7)



NO LINING REQ'd

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company — Date: 02-May-89
Project No.: 007.11.100 — Time: 03:41 PM
Channel Section: UDD-4 - Trial 1 — Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.19	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.13	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.24	feet
	Qn/1.49(S)1/2=	0.027	
	A(R)2/3=	0.027	
	Required Depth:	0.74	feet
	Area:	0.12	ft2
	Perimeter:	1.08	feet
	Hydraulic Radius:	0.11	feet
	Velocity:	1.62	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.18	feet
	Qn/1.49(S)1/2=	0.011	
	A(R)2/3=	0.011	
	Required Depth:	0.68	feet
	Area:	0.06	ft2
	Perimeter:	0.78	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	3.10	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.13	ft/ft
	Channel Depth:	0.74	feet
	Riprap:	Not Needed	

Comment:

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	02-May-89
Project No.:	007.11.100	Time:	03:56 PM
Channel Section:	UDD-5 - Trial 1	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.25	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.12	ft/ft
	Max. Bottom Slope:	0.25	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.20	feet
	Qn/1.49(S)1/2=	0.015	
	A(R)2/3=	0.015	
	Required Depth:	0.70	feet
	Area:	0.08	ft2
	Perimeter:	0.87	feet
	Hydraulic Radius:	0.09	feet
	Velocity:	3.29	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.17	feet
	Qn/1.49(S)1/2=	0.010	
	A(R)2/3=	0.010	
	Required Depth:	0.67	feet
	Area:	0.06	ft2
	Perimeter:	0.76	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	4.33	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.12	ft/ft
	Max. Bottom Slope:	0.25	ft/ft
	Channel Depth:	0.70	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit Response
FEATURE
PROJECT NO. 007.11.200

SHEET 1 OF 2
COMPUTED DEH
CHECKED
DATE 2 NOV 89

SAE's

SAE's Changed to ASCA's according to new DOGM Policy clarification.

ASCA #3 is dropped - Area has been added to Pond 3

AREA OF ASCA #3 = 0.11 ac

TOTAL AREA CONTAINED BY PONDS = 62.83 ac

POND	AREA
001A	11.53
2A	7.12
3A	7.08
4A	37.10
	62.83 ac

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

$CN = \frac{1000}{10+S}$

TRIBUTARY AREA FOR ASCA's

ASCA #	AREA Paved	Disturbed	Sage/Grass	Forest	TOTAL
1	—	1.13	—	—	1.13
2	0.11	1.00	—	—	1.11
3	0.75	0.87	—	0.5	2.12
4	—	0.19	—	—	0.19
5	—	1.16	—	—	1.16
6	—	0.95	—	—	0.95

Curve Numbers:

PAVED	= 98
DISTURBED	= 90
SAGE/GRASS	= 75
FOREST	= 70

$P_{10YR-24HR} = 2.45 in$

VOL = Q * AREA
Q = .5S Runoff Depth

ASCA #	Paved Area Q(in)	Vol(AF)	Dist. Area Q(in)	Vol(AF)	Sage/Grass Q(in)	Vol(AF)	Forest Area Q(in)	Vol(AF)	Runoff Vol (Ac-Ft)
1	2.22	—	1.49	0.14	—	—	—	—	0.14
2	2.22	0.02	1.49	0.12	—	—	—	—	0.14
3	2.22	0.14	1.49	0.11	—	—	0.43	0.02	0.27
4	2.22	—	1.49	0.02	—	—	—	—	0.02
5	2.22	—	1.49	0.14	—	—	—	—	0.14
6	2.22	—	1.49	0.12	—	—	—	—	0.12

HANSEN ALLEN & LUCE inc

CLIENT: VALLEY CAMP
PROJECT:
FEATURE:
PROJECT NO.: 007.11.200

SHEET 2 OF 2
COMPUTED: DEH
CHECKED:
DATE: 2 NOV 89

RUNOFF VOLUME INCLUDING TRIBUTARY AREAS

ASCA #	PAVED	DISTURBED	SAGE/GRASS	FOREST/ASPEN	TOTAL
1	—	1.13	—	—	1.13
2	0.60	1.00	—	—	1.60
3	0.75	0.87	—	0.50	2.12
4	—	0.19	—	0.37	0.56
5	—	1.16	—	—	1.16
6	—	0.95	1.00	1.34	3.29

ASCA #	PAVED		DISTURBED		SAGE/GRASS		FOREST/ASPEN		TOTAL RUNOFF VOLUME ac-ft
	Q (in)	Vol (ac-ft)	Q (in)	Vol (ac-ft)	Q (in)	Vol (ac-ft)	Q (in)	Vol (ac-ft)	
1	2.22	—	1.49	0.14	0.62	—	0.43	—	0.14
2	"	0.11	"	0.12	"	—	"	—	0.23
3	"	0.14	"	0.11	"	—	"	0.02	0.27
4	"	—	"	0.02	"	—	"	0.01	0.03
5	"	—	"	0.14	"	—	"	—	0.14
6	"	—	"	0.12	"	0.05	"	0.05	0.22

PERCENT AREA AS ASCA = $\frac{6.66 \text{ ac}}{62.83 \text{ ac}} * 100 = 10.6\%$

TOTAL POND RUNOFF VOLUME

POND #	10-Yr 24-Hr Volume (ac-ft)
001A	1.18
002A	0.94
003A	0.67
004A	3.15
TOTAL	5.94

ASCA Runoff Vol. as a % of Total Pond Runoff Vol = $\frac{0.83}{5.94} * 100 = 14.0\%$

PROJECT : Valley Camp Coal - D-18B Runoff Calculations

AREA= 1.6 ACRES
AVERAGE BASIN SLOPE= 34.8 PERCENT
CURVE NUMBER= 82.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 850. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0488 HOURS QPCFS= 25.56 CFS QPIN=15.3608 INCHES
C3= 75.7135 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.05	.4153	.0000	.0000	.0	.00
2.07	.4340	.0000	.0000	5.2	.00
2.08	.4527	.0002	.0002	19.6	.00
2.10	.4713	.0008	.0005	25.6	.00
2.12	.4900	.0016	.0008	21.6	.02
2.13	.5087	.0028	.0011	14.4	.04
2.15	.5274	.0042	.0014	8.2	.07
2.17	.5460	.0059	.0017	4.2	.09
2.18	.5647	.0079	.0020	2.0	.12
2.20	.5834	.0102	.0023	.9	.15
2.21	.6021	.0127	.0025	.4	.18
2.23	.6207	.0155	.0028	.2	.21
2.25	.6394	.0186	.0030	.0	.24
2.41	.8261	.0616	.0053	.0	.48
2.43	.8448	.0670	.0055	.0	.50
2.44	.8635	.0727	.0056	.0	.52
2.46	.8821	.0785	.0058	.0	.54
2.47	.9008	.0845	.0060	.0	.56
2.49	.9195	.0907	.0062	.0	.58
2.51	.9322	.0950	.0043	.0	.59
2.52	.9373	.0968	.0017	.0	.55
2.54	.9423	.0985	.0017	.0	.46
2.56	.9473	.1003	.0018	.0	.36
2.57	.9524	.1020	.0018	.0	.28
2.59	.9574	.1038	.0018	.0	.23
2.60	.9625	.1056	.0018	.0	.21

HYDROGRAPH PEAK= .59 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .05 Acre-Feet