CULVERT C-1

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
60.00	2.00	0.0240	1.50	0.00	0.90

Culvert Results:

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

Detailed Performance Curves

Design Discharge = 5.16 cfs

Maximum Headwater = 1.50 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (15 in)	**Discharge (cfs) (18 in)**	Discharge (cfs) (21 in)
0.15	0.20	**0.20**	0.30
0.30	0.43	**0.52**	0.60
0.45	0.80	**0.96**	1.11
0.60	1.22	**1.47**	1.71
0.75	1.70	**2.04**	2.38
0.90	2.24	**2.68**	3.13
1.05	2.71	**3.38**	3.94
1.20	3.00	**4.13**	4.82
1.35	3.54	**4.93**	5.75
1.50	4.25	**5.33**	6.73
1.65	5.10	**5.68**	7.77
1.80	5.31	**6.62**	8.66
1.95	5.51	**8.15**	8.94
2.10	5.71	**8.50**	9.60
2.25	5.89	**8.81**	11.90

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KODIAK MINING
COKE MINE NO. 1
PRIMARY ROAD NO. 2
CULVERT C-1

Robert W. Usher, P.E.

General Information

Storm Information:

Storm Type:	SCS 6 HOUR
Design Storm:	10 yr - 6 hr
Rainfall Depth:	4.250 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CULVERT C-1

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	3.200	3.200	5.16	0.40

Structure Detail:

Structure #1 (Null)

CULVERT C-1

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	3.200	0.124	0.000	0.000	70.000	S	5.16	0.397
	$\sum$	**3.200**						**5.16**	**0.397**

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
60.00	2.00	0.0240	3.00	0.00	0.90

Culvert Results:

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

Detailed Performance Curves

Design Discharge = 27.10 cfs

Maximum Headwater = 3.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (30 in)	**Discharge (cfs) (36 in)**	Discharge (cfs) (42 in)
0.30	0.86	**1.04**	1.21
0.60	2.44	**2.92**	3.41
0.90	4.47	**5.36**	6.26
1.20	6.88	**8.26**	9.63
1.50	9.62	**11.54**	13.46
1.80	12.64	**15.17**	17.70
2.10	15.93	**19.12**	22.30
2.40	19.46	**23.36**	27.25
2.70	23.22	**27.87**	32.51
3.00	25.65	**32.64**	38.08
3.30	29.91	**37.66**	43.93
3.60	32.76	**42.23**	50.06
3.90	34.90	**46.39**	56.44
4.20	36.62	**50.23**	62.10
4.50	38.27	**53.79**	67.35

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KODIAK MINING

COKE MINE NO. 1

PRIMARY ROAD NO. 2

CULVERT C-2 & 3

Robert W. Usher, P.E.

General Information

Storm Information:

Storm Type:	SCS 6 HOUR
Design Storm:	10 yr - 6 hr
Rainfall Depth:	4.250 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CULVERT C-2

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	11.400	11.400	27.11	2.20

Structure Detail:

Structure #1 (Null)

CULVERT C-2

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	11.400	0.124	0.000	0.000	81.000	F	27.11	2.203
	$\sum$	**11.400**						**27.11**	**2.203**

Existing Concrete culvert in RR Fill at PR2 Culvert C-4

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
150.00	1.00	0.0150	20.00	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 60 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 350.00 cfs

Maximum Headwater = 20.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (54 in)	**Discharge (cfs) (60 in)**	Discharge (cfs) (66 in)
2.00	26.66	**29.61**	32.58
4.00	75.39	**83.76**	92.13
6.00	131.45	**151.60**	169.27
8.00	172.64	**204.88**	237.54
10.00	205.69	**247.10**	290.49
12.00	234.18	**283.13**	335.15
14.00	259.53	**315.02**	374.53
16.00	282.66	**343.99**	410.15
18.00	303.99	**370.70**	442.92
20.00	323.87	**395.60**	473.42
22.00	341.77	**419.03**	502.07
24.00	358.70	**441.23**	529.15
26.00	374.90	**462.37**	554.94
28.00	390.42	**482.57**	579.57
30.00	405.33	**501.95**	603.21

Max HW.

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KODIAK MINING
COKE MINE NO. 1
PRIMARY ROAD NO. 2
CULVERT C-4 and OLD RAILROAD FILL

Robert W. Usher, P.E.

General Information

Storm Information:

Storm Type:	SCS 6 HOUR
Design Storm:	10 yr - 6 hr
Rainfall Depth:	4.250 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CULVERT C-4

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	286.440	286.440	491.19	41.60

Structure Detail:

Structure #1 (Null)

CULVERT C-4

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	123.400	0.124	0.099	0.356	70.000	S	199.00	15.301
	2	36.400	0.120	0.099	0.356	81.000	F	86.56	7.035
	3	40.400	0.125	0.087	0.326	70.000	S	28.88	3.404
	4	83.400	0.152	0.000	0.000	81.000	F	172.25	15.624
	5	2.840	0.125	0.000	0.000	70.000	S	2.03	0.239
	$\sum$	**286.440**						**491.19**	**41.604**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	7. Paved area and small upland gullies	4.33	65.00	1,500.00	4.190	0.099
#1	**1**	**Muskingum K:**					**0.099**
#1	3	7. Paved area and small upland gullies	2.50	25.00	1,000.00	3.180	0.087
#1	**3**	**Muskingum K:**					**0.087**

Culvert C-5

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
60.00	2.00	0.0240	7.00	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 48 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 117.70 cfs

Maximum Headwater = 7.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (45 in)	**Discharge (cfs) (48 in)**	Discharge (cfs) (54 in)
0.70	4.60	**4.91**	5.52
1.40	13.01	**13.88**	15.61
2.10	23.90	**25.49**	28.67
2.80	36.79	**39.24**	44.15
3.50	51.42	**54.84**	61.70
4.20	67.59	**72.09**	81.10
4.90	81.50	**88.86**	102.20
5.60	93.58	**103.11**	121.56
6.30	104.26	**115.61**	138.40
7.00	113.92	**126.90**	153.42
7.70	122.28	**137.26**	167.11
8.40	129.54	**146.88**	179.74
9.10	136.45	**155.26**	191.56
9.80	142.99	**162.95**	202.67
10.50	149.26	**170.29**	213.20

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KODIAK MINING
COKE MINE NO. 1
Primary Road 2
Culvert C5

10 YEAR,6 HOUR EVENT

Robert W. Usher, P.E.

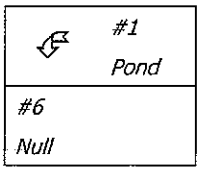
General Information

Storm Information:

Storm Type:	SCS 6 HOUR
Design Storm:	10 yr - 6 hr
Rainfall Depth:	4.250 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#6	0.160	0.329	Basin 013
Null	#6	==>	End	0.000	0.000	Culvert C-5



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	7. Paved area and small upland gullies	2.64	50.00	1,891.00	3.27	0.160
#1	**Muskingum K:**					**0.160**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	30.500	30.500	46.56	4.31
	Out			8.56	4.31
#6		55.400	85.900	117.17	14.69

Structure Detail:

Structure #1 (Pond)

Basin 013

Pond Inputs:

Initial Pool Elev:	432.65 ft
Initial Pool:	9.77 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
36.00	100.00	3.00	0.0240	432.65	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
437.00	10.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	433.87 ft
Dewater Time:	1.63 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
418.00	0.000	0.000	0.000	
418.50	0.006	0.001	0.000	
419.00	0.025	0.008	0.000	
419.50	0.056	0.028	0.000	
420.00	0.100	0.067	0.000	
420.50	0.131	0.124	0.000	
421.00	0.167	0.199	0.000	
421.50	0.206	0.292	0.000	
422.00	0.250	0.405	0.000	
422.50	0.297	0.542	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
423.00	0.350	0.704	0.000		
423.50	0.406	0.892	0.000		
424.00	0.467	1.110	0.000		
424.50	0.531	1.360	0.000		
425.00	0.600	1.642	0.000		
425.50	0.647	1.954	0.000		
426.00	0.696	2.290	0.000		
426.50	0.746	2.650	0.000		
427.00	0.799	3.036	0.000		
427.50	0.853	3.449	0.000		
428.00	0.909	3.890	0.000		
428.50	0.966	4.358	0.000		
429.00	1.026	4.856	0.000		
429.50	1.087	5.384	0.000		
430.00	1.150	5.944	0.000		
430.50	1.255	6.545	0.000		
431.00	1.365	7.200	0.000		
431.50	1.480	7.911	0.000		
432.00	1.599	8.680	0.000		
432.50	1.723	9.511	0.000		
432.65	1.761	9.772	0.000		Spillway #1
433.00	1.851	10.404	1.308	32.55	
433.50	1.984	11.363	4.930	4.25	
433.87	2.086	12.119	8.560	2.35	Peak Stage
434.00	2.121	12.389	9.856		
434.50	2.263	13.485	15.816		
435.00	2.410	14.653	22.629		
435.50	2.550	15.893	30.226		
436.00	2.694	17.204	38.516		
436.50	2.843	18.588	45.710		
437.00	2.995	20.047	52.039		Spillway #2
437.50	3.150	21.583	61.796		
438.00	3.311	23.198	116.828		
438.50	3.475	24.895	179.567		
439.00	3.642	26.674	253.430		
439.50	3.814	28.538	340.573		
440.00	3.990	30.489	441.348		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
418.00	0.000	0.000	0.000
418.50	0.000	0.000	0.000
419.00	0.000	0.000	0.000
419.50	0.000	0.000	0.000
420.00	0.000	0.000	0.000
420.50	0.000	0.000	0.000
421.00	0.000	0.000	0.000
421.50	0.000	0.000	0.000
422.00	0.000	0.000	0.000
422.50	0.000	0.000	0.000
423.00	0.000	0.000	0.000
423.50	0.000	0.000	0.000
424.00	0.000	0.000	0.000
424.50	0.000	0.000	0.000
425.00	0.000	0.000	0.000
425.50	0.000	0.000	0.000
426.00	0.000	0.000	0.000
426.50	0.000	0.000	0.000
427.00	0.000	0.000	0.000
427.50	0.000	0.000	0.000
428.00	0.000	0.000	0.000
428.50	0.000	0.000	0.000
429.00	0.000	0.000	0.000
429.50	0.000	0.000	0.000
430.00	0.000	0.000	0.000
430.50	0.000	0.000	0.000
431.00	0.000	0.000	0.000
431.50	0.000	0.000	0.000
432.00	0.000	0.000	0.000
432.50	0.000	0.000	0.000
432.65	0.000	0.000	0.000
433.00	(3)>1.308	0.000	1.308
433.50	(3)>4.930	0.000	4.930
434.00	(3)>9.856	0.000	9.856
434.50	(3)>15.816	0.000	15.816
435.00	(3)>22.629	0.000	22.629
435.50	(3)>30.226	0.000	30.226
436.00	(3)>38.516	0.000	38.516
436.50	(5)>45.710	0.000	45.710
437.00	(5)>52.039	0.000	52.039

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
437.50	(5)>57.674	4.122	61.796
438.00	(5)>62.812	54.016	116.828
438.50	(5)>67.551	112.015	179.567
439.00	(6)>70.777	182.653	253.430
439.50	(6)>73.329	267.245	340.573
440.00	(6)>75.775	365.573	441.348

Structure #6 (Null)

Culvert C-5

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	16.000	0.097	0.000	0.000	81.000	F	38.05	3.092
	2	14.500	0.125	0.000	0.000	70.000	S	10.37	1.222
	∑	**30.500**						**46.56**	**4.314**
#6	1	55.400	0.150	0.000	0.000	81.000	F	114.42	10.378
	∑	**85.900**						**117.17**	**14.692**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	7. Paved area and small upland gullies	5.24	110.00	2,100.00	4.600	0.126
#1	**1**	**Time of Concentration:**					**0.097**
#1	2	7. Paved area and small upland gullies	2.00	20.00	1,000.00	2.840	0.097
#1	**2**	**Time of Concentration:**					**0.125**