Appendix E

Time of Concentration Calculations

APPENDIX E

TIME OF CONCENTRATION FLOW PATH CALCULATION

Times of concentration calculation were computed within the SedCAD 4 Program. SedCAD 4 shows the time of concentration for each watershed. When combining or accumulating watersheds for structure design, a combined hydrograph of the tributary upslope sub-watersheds is used. Since the travel time between structures is rapid, the routing analysis between the structures considers the travel time to be zero (0) and the combined hydrograph of the tributary sub-watershed is utilized.

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)
#12	1	2.170	0.045	0.000	0.000	61.000	M	0.88	0.066
	Σ	**2.170**						**0.88**	**0.066**
#11	1	11.030	0.101	0.000	0.000	61.000	S	4.48	0.335
	Σ	**11.030**						**4.48**	**0.335**
#7	1	7.120	0.270	0.000	0.000	61.000	S	0.69	0.145
	Σ	**7.120**						**0.69**	**0.145**
#8	1	4.610	0.161	0.000	0.000	61.000	S	0.59	0.095
	Σ	**11.730**						**1.24**	**0.240**
#2	1	3.920	0.165	0.000	0.000	61.000	S	0.50	0.080
	Σ	**3.920**						**0.50**	**0.080**
#1	1	2.300	0.044	0.000	0.000	61.000	M	0.93	0.070
	Σ	**2.300**						**0.93**	**0.070**
#3	1	12.160	0.174	0.000	0.000	61.000	S	1.53	0.249
	Σ	**18.380**						**2.24**	**0.399**
#4	1	1.300	0.059	0.000	0.000	61.000	M	0.53	0.039
	Σ	**19.680**						**2.49**	**0.439**
#5	1	7.880	0.228	0.000	0.000	61.000	S	0.85	0.161
	Σ	**27.560**						**3.14**	**0.599**
#6	1	5.290	0.150	0.000	0.000	61.000	S	0.68	0.109
	Σ	**32.850**						**3.82**	**0.708**
#9	1	0.590	0.022	0.000	0.000	61.000	M	0.24	0.014
	Σ	**45.170**						**5.11**	**0.962**
#10	1	1.790	0.015	0.000	0.000	61.000	M	0.73	0.054
	Σ	**60.160**						**10.04**	**1.417**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		6. Grassed waterway	3.00	12.00	400.00	2.590	0.042
#1	**1**	**Time of Concentration:** CHANNEL X					**0.044**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	6.67	10.00	150.00	2.060	0.020
		6. Grassed waterway	2.00	20.00	1,000.00	2.120	0.131
		6. Grassed waterway	10.00	25.00	250.00	4.740	0.014
#2	**1**	**Time of Concentration:**			CHANNEL W		**0.165**
#3	1	3. Short grass pasture	14.80	37.00	250.00	3.070	0.022
		6. Grassed waterway	3.10	45.00	1,450.00	2.640	0.152
#3	**1**	**Time of Concentration:**			CHANNEL Y		**0.174**
#4	1	3. Short grass pasture	7.20	18.00	250.00	2.140	0.032
		8. Large gullies, diversions, and low flowing streams	1.00	3.00	300.00	3.000	0.027
#4	**1**	**Time of Concentration:**			CHANNEL O		**0.059**
#5	1	3. Short grass pasture	4.29	15.00	350.00	1.650	0.058
		8. Large gullies, diversions, and low flowing streams	0.50	6.50	1,300.00	2.120	0.170
#5	**1**	**Time of Concentration:**			CHANNEL P		**0.228**
#6	1	3. Short grass pasture	10.00	30.00	300.00	2.520	0.033
		8. Large gullies, diversions, and low flowing streams	0.50	4.50	900.00	2.120	0.117
#6	**1**	**Time of Concentration:**			CHANNEL Q		**0.150**
#7	1	3. Short grass pasture	33.00	24.75	75.00	4.590	0.004
		6. Grassed waterway	3.00	73.50	2,450.00	2.590	0.262
		8. Large gullies, diversions, and low flowing streams	33.00	82.50	250.00	17.230	0.004
#7	**1**	**Time of Concentration:**			DS-7		**0.270**
#8	1	3. Short grass pasture	33.00	16.50	49.99	4.590	0.003
		6. Grassed waterway	3.50	56.00	1,600.00	2.800	0.158
#8	**1**	**Time of Concentration:**			CHANNEL L		**0.161**
#9	1	6. Grassed waterway	20.00	110.00	550.00	6.700	0.022
#9	**1**	**Time of Concentration:**			CHANNL N		**0.022**
#10	1	3. Short grass pasture	5.00	5.00	100.00	1.780	0.015
#10	**1**	**Time of Concentration:**			BASIN 2		**0.015**
#11	1	3. Short grass pasture	33.00	33.00	99.99	4.590	0.006
		6. Grassed waterway	3.00	25.50	850.00	2.590	0.091
		8. Large gullies, diversions, and low flowing streams	33.00	90.75	275.00	17.230	0.004
#11	**1**	**Time of Concentration:**			DS-6		**0.101**
#12	1	3. Short grass pasture	33.00	16.50	49.99	4.590	0.003
		6. Grassed waterway	12.00	96.00	800.00	5.190	0.042
#12	**1**	**Time of Concentration:**			CHANNEL M		**0.045**

TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

AREA 'A'
PRE & POST DEV.

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.800	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.20	0.00	0.00	
Land slope (%)	= 17.00	0.00	0.00	
Travel Time (min)	**= 21.97**	**+ 0.00**	**+ 0.00**	**= 21.97**
Shallow Concentrated Flow				
Flow length (ft)	= 820.00	0.00	0.00	
Watercourse slope (%)	= 24.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 7.90	0.00	0.00	
Travel Time (min)	**= 1.73**	**+ 0.00**	**+ 0.00**	**= 1.73**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... **23.70 min**

Appendix F

Runoff Curve Numbers (CN)/Weighted CN Calculations

APPENDIX F

RUNOFF CURVE NUMBER (CN) CALCULATION

Runoff curve numbers for each drainage shed were obtained from Appendix C-3 of the Lower Saucon Township Stormwater Ordinance. A copy is attached hereto. Under pre-development conditions three (3) distinct land covers exist within the area of analysis. These are woods, paved/impervious and open space.

Pre-development analysis for Basin 2 was taken from the latest approved analysis associated with the Cell 4-F Modification and as such the previously utilized CN numbers have been maintained. For Area A, which consists entirely of woods and is also underlain with soils in Hydrologic Soil Group A the resultant CN from Appendix C-3 would be 30. Based upon our engineering judgement this value is artificially low and as such we looked to Hydrologic Soil Group B Woods and utilized 55 for the Area A pre-development CN.

Post development conditions yield the same three land covers as utilized in pre-development consisting of woods, paved/impervious and open space. For each sub-area within the Basin 2 analysis a CN was utilized or a weighted CN was computed as follows:

Drainage Area ID	**CN**	**Weighted CN**
Channel X		$(0.1)(98) + (2.2)(61)/(2.3) = 63$
Channel W		$\frac{(0.01)(98) + (3.91)(61)}{(3.92)} = 61$
Channel Y		$\frac{(0.8)(98) + (11.36)(61)}{(12.16)} = 63$
Channel O	61	
Channel P	61	
Channel Q	61	
DS-7	61	

Drainage Area ID	CN	Weighted CN
Channel L		$\frac{(1.2)(98) + (3.41)(61)}{(4.61)} = 71$
Channel N		$\frac{(0.2)(98) + (.39)(61)}{(.59)} = 73$
Basin #2		$\frac{(0.2)(98) + (1.59)(61)}{(1.79)} = 65$
DS-6	61	
Channel M		$\frac{(0.8)(98) + (1.37)(61)}{(2.17)} = 75$

For post development Area "A" a CN of 55 was used as the entire area is considered woods and for the same reason as described in pre-development above.

Appendix C-3
Runoff Curve Numbers and Percent Imperviousness Values*

Cover Description		Curve numbers for hydrologic soil group**			
Land Use/Cover Type	**Average percent impervious area**	**A**	**B**	**C**	**D**
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Good condition (grass cover greater than 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
c acre or less (townhouses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
a acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Woods		30	55	70	77
Agriculture	Refer to Table 2-2b in source document (TR55) by crop type and treatment.				

* Source: Natural Resources Conservation Service Technical Release No. 55, Second Edition, June 1986.

** Hydrologic soil group based on the county soil survey, latest edition.

Appendix G

Pre-Construction Watershed Calculations

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IESI PA Bethlehem Landfill

Detention Basin 2

Pre Development

JMM

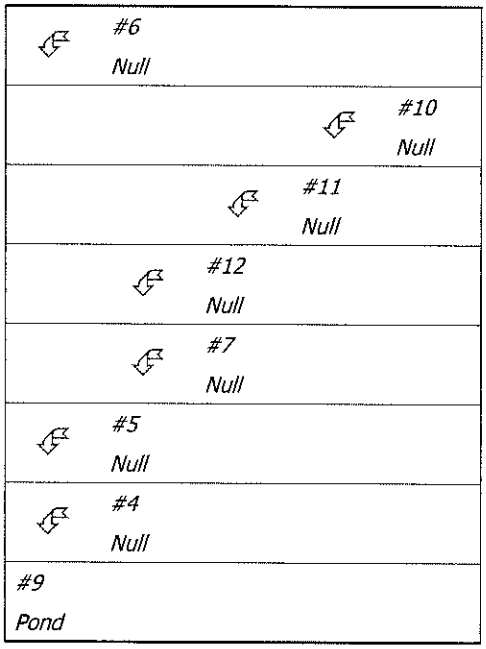
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	2 yr - 24 hr
Rainfall Depth:	3.200 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#4	==>	#9	0.000	0.000	C-101
Null	#5	==>	#9	0.000	0.000	CHANNEL N
Null	#6	==>	#9	0.000	0.000	CHANNEL L
Null	#7	==>	#5	0.000	0.000	CHANNEL M
Pond	#9	==>	End	0.000	0.000	BASIN #2
Null	#10	==>	#11	0.000	0.000	CHANNEL O
Null	#11	==>	#12	0.000	0.000	CHANNEL P
Null	#12	==>	#5	0.000	0.000	CHANNEL Q



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6		1.200	1.200	1.21	0.09
#10		11.800	11.800	14.54	1.07
#11		8.600	20.400	14.88	1.29
#12		6.400	26.800	15.13	1.45
#7		0.600	0.600	0.30	0.02
#5		8.500	35.900	19.72	1.78
#4		19.300	19.300	2.94	0.48
#9	In	2.200	58.600	23.77	2.43
	Out			0.43	1.22

Structure Detail:

Structure #6 (Null)

CHANNEL L

Structure #10 (Null)

CHANNEL O

Structure #11 (Null)

CHANNEL P

Structure #12 (Null)

CHANNEL Q

Structure #7 (Null)

CHANNEL M

Structure #5 (Null)

CHANNEL N

Structure #4 (Null)

C-101

Structure #9 (Pond)

BASIN #2

Pond Inputs:

Initial Pool Elev:	460.01 ft
Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	9

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	463.34 ft
Dewater Time:	3.53 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)	
460.00	0.000	0.000	0.000		
460.01	0.530	0.002	0.000		Low hole SPW #1
460.50	0.552	0.267	0.165	19.38*	
461.00	0.574	0.548	0.235	14.48*	
461.50	0.597	0.841	0.289	12.28*	
462.00	0.620	1.145	0.333	11.04*	
462.50	0.644	1.461	0.373	10.26*	
463.00	0.668	1.789	0.409	10.20	
463.34	0.685	2.018	0.431	7.00	Peak Stage
463.50	0.693	2.130	0.442		
464.00	0.718	2.483	0.472		
464.50	0.744	2.848	0.501		
465.00	0.770	3.227	0.528		
465.50	0.795	3.618	0.721		
466.00	0.821	4.022	0.815		
466.50	0.847	4.439	0.892		
467.00	0.873	4.869	0.959		
467.50	0.900	5.312	1.021		
468.00	0.927	5.769	1.077		
468.50	0.955	6.239	1.131		
469.00	0.983	6.724	1.181		
469.50	1.011	7.222	1.229		
470.00	1.040	7.735	1.944		
470.50	1.074	8.264	2.265		
471.00	1.110	8.810	2.520		Spillway #1
471.50	1.145	9.373	10.330		Spillway #2
472.00	1.181	9.955	32.860		
472.50	1.218	10.555	91.363		
473.00	1.255	11.173	151.823		
473.50	1.293	11.810	230.503		
474.00	1.332	12.466	325.442		
474.50	1.370	13.142	436.892		
475.00	1.410	13.837	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	1.00>0.000	0.000	0.000
460.50	0.165	0.000	0.165
461.00	0.235	0.000	0.235
461.50	0.289	0.000	0.289
462.00	0.333	0.000	0.333
462.50	0.373	0.000	0.373
463.00	0.409	0.000	0.409
463.50	0.442	0.000	0.442
464.00	0.472	0.000	0.472
464.50	0.501	0.000	0.501
465.00	1.00>0.528	0.000	0.528
465.50	0.721	0.000	0.721
466.00	0.815	0.000	0.815
466.50	0.892	0.000	0.892
467.00	0.959	0.000	0.959
467.50	1.021	0.000	1.021
468.00	1.077	0.000	1.077
468.50	1.131	0.000	1.131
469.00	1.181	0.000	1.181
469.50	2.00>1.229	0.000	1.229
470.00	1.944	0.000	1.944
470.50	2.265	0.000	2.265
471.00	2.520	0.000	2.520
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	1.200	0.095	0.000	0.000	71.000	S	1.21	0.088
	Σ	**1.200**						**1.21**	**0.088**
#10	1	11.800	0.020	0.000	0.000	75.000	M	14.54	1.074
	Σ	**11.800**						**14.54**	**1.074**
#11	1	8.600	0.340	0.000	0.000	61.000	S	0.96	0.213
	Σ	**20.400**						**14.88**	**1.288**
#12	1	6.400	0.314	0.000	0.000	61.000	S	0.75	0.159
	Σ	**26.800**						**15.13**	**1.446**
#7	1	0.600	0.027	0.000	0.000	61.000	M	0.30	0.019
	Σ	**0.600**						**0.30**	**0.019**
#5	1	8.500	0.123	0.000	0.000	61.000	S	4.29	0.314
	Σ	**35.900**						**19.72**	**1.779**
#4	1	19.300	0.205	0.000	0.000	61.000	S	2.94	0.478
	Σ	**19.300**						**2.94**	**0.478**
#9	1	2.200	0.015	0.000	0.000	61.000	M	1.11	0.081
	Σ	**58.600**						**23.77**	**2.426**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	3. Short grass pasture	8.00	20.00	250.00	2.260	0.030
		6. Grassed waterway	2.50	37.50	1,500.00	2.370	0.175
#4	**1**	**Time of Concentration:**					**0.205**
#5	1	6. Grassed waterway	9.00	180.00	1,999.99	4.500	0.123
#5	**1**	**Time of Concentration:**					**0.123**
#6	1	3. Short grass pasture	33.00	25.00	75.75	4.590	0.004
		6. Grassed waterway	3.00	25.50	850.00	2.590	0.091
#6	**1**	**Time of Concentration:**					**0.095**
#7	1	3. Short grass pasture	10.00	25.00	250.00	2.520	0.027
#7	**1**	**Time of Concentration:**					**0.027**
#9	1	3. Short grass pasture	5.00	5.00	100.00	1.780	0.015
#9	**1**	**Time of Concentration:**					**0.015**
#10	1	3. Short grass pasture	33.00	29.70	90.00	4.590	0.005

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	5.75	23.00	400.00	7.190	0.015
#10	**1**	**Time of Concentration:**					**0.020**
#11	1	6. Grassed waterway	0.50	6.50	1,300.00	1.060	0.340
#11	**1**	**Time of Concentration:**					**0.340**
#12	1	6. Grassed waterway	0.50	6.00	1,200.00	1.060	0.314
#12	**1**	**Time of Concentration:**					**0.314**

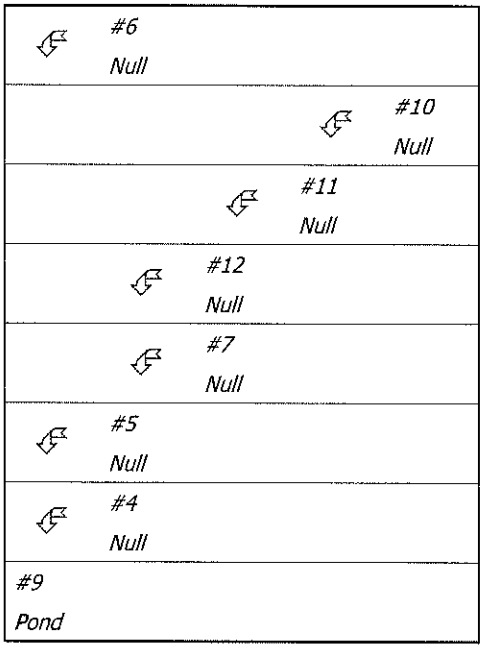
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	5 yr - 24 hr
Rainfall Depth:	3.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#4	==>	#9	0.000	0.000	C-101
Null	#5	==>	#9	0.000	0.000	CHANNEL N
Null	#6	==>	#9	0.000	0.000	CHANNEL L
Null	#7	==>	#5	0.000	0.000	CHANNEL M
Pond	#9	==>	End	0.000	0.000	BASIN #2
Null	#10	==>	#11	0.000	0.000	CHANNEL O
Null	#11	==>	#12	0.000	0.000	CHANNEL P
Null	#12	==>	#5	0.000	0.000	CHANNEL Q



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6		1.200	1.200	1.54	0.11
#10		11.800	11.800	17.99	1.35
#11		8.600	20.400	18.66	1.65
#12		6.400	26.800	19.16	1.87
#7		0.600	0.600	0.43	0.03
#5		8.500	35.900	25.69	2.33
#4		19.300	19.300	4.60	0.67
#9	In	2.200	58.600	31.89	3.23
	Out			0.49	1.43

Structure Detail:

Structure #6 (Null)

CHANNEL L

Structure #10 (Null)

CHANNEL O

Structure #11 (Null)

CHANNEL P

Structure #12 (Null)

CHANNEL Q

Structure #7 (Null)

CHANNEL M

Structure #5 (Null)

CHANNEL N

Structure #4 (Null)

C-101

Structure #9 (Pond)

BASIN #2

Pond Inputs:

Initial Pool Elev:	460.01 ft
Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	9

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	464.37 ft
Dewater Time:	4.29 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)	
460.00	0.000	0.000	0.000		
460.01	0.530	0.002	0.000		Low hole SPW #1
460.50	0.552	0.267	0.165	19.38*	
461.00	0.574	0.548	0.235	14.48*	
461.50	0.597	0.841	0.289	12.28*	
462.00	0.620	1.145	0.333	11.04*	
462.50	0.644	1.461	0.373	10.26*	
463.00	0.668	1.789	0.409	9.72*	
463.50	0.693	2.130	0.442	9.33*	
464.00	0.718	2.483	0.472	9.35	
464.37	0.737	2.752	0.493	7.25	Peak Stage
464.50	0.744	2.848	0.501		
465.00	0.770	3.227	0.528		
465.50	0.795	3.618	0.721		
466.00	0.821	4.022	0.815		
466.50	0.847	4.439	0.892		
467.00	0.873	4.869	0.959		
467.50	0.900	5.312	1.021		
468.00	0.927	5.769	1.077		
468.50	0.955	6.239	1.131		
469.00	0.983	6.724	1.181		
469.50	1.011	7.222	1.229		
470.00	1.040	7.735	1.944		
470.50	1.074	8.264	2.265		
471.00	1.110	8.810	2.520		Spillway #1
471.50	1.145	9.373	10.330		Spillway #2
472.00	1.181	9.955	32.860		
472.50	1.218	10.555	91.363		
473.00	1.255	11.173	151.823		
473.50	1.293	11.810	230.503		
474.00	1.332	12.466	325.442		
474.50	1.370	13.142	436.892		
475.00	1.410	13.837	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	1.00>0.000	0.000	0.000
460.50	0.165	0.000	0.165
461.00	0.235	0.000	0.235
461.50	0.289	0.000	0.289
462.00	0.333	0.000	0.333
462.50	0.373	0.000	0.373
463.00	0.409	0.000	0.409
463.50	0.442	0.000	0.442
464.00	0.472	0.000	0.472
464.50	0.501	0.000	0.501
465.00	1.00>0.528	0.000	0.528
465.50	0.721	0.000	0.721
466.00	0.815	0.000	0.815
466.50	0.892	0.000	0.892
467.00	0.959	0.000	0.959
467.50	1.021	0.000	1.021
468.00	1.077	0.000	1.077
468.50	1.131	0.000	1.131
469.00	1.181	0.000	1.181
469.50	2.00>1.229	0.000	1.229
470.00	1.944	0.000	1.944
470.50	2.265	0.000	2.265
471.00	2.520	0.000	2.520
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	1.200	0.095	0.000	0.000	71.000	S	1.54	0.113
	Σ	**1.200**						**1.54**	**0.113**
#10	1	11.800	0.020	0.000	0.000	75.000	M	17.99	1.349
	Σ	**11.800**						**17.99**	**1.349**
#11	1	8.600	0.340	0.000	0.000	61.000	S	1.53	0.297
	Σ	**20.400**						**18.66**	**1.645**
#12	1	6.400	0.314	0.000	0.000	61.000	S	1.19	0.221
	Σ	**26.800**						**19.16**	**1.866**
#7	1	0.600	0.027	0.000	0.000	61.000	M	0.43	0.031
	Σ	**0.600**						**0.43**	**0.031**
#5	1	8.500	0.123	0.000	0.000	61.000	S	6.10	0.437
	Σ	**35.900**						**25.69**	**2.334**
#4	1	19.300	0.205	0.000	0.000	61.000	S	4.60	0.666
	Σ	**19.300**						**4.60**	**0.666**
#9	1	2.200	0.015	0.000	0.000	61.000	M	1.58	0.113
	Σ	**58.600**						**31.89**	**3.226**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	3. Short grass pasture	8.00	20.00	250.00	2.260	0.030
		6. Grassed waterway	2.50	37.50	1,500.00	2.370	0.175
#4	**1**	**Time of Concentration:**					**0.205**
#5	1	6. Grassed waterway	9.00	180.00	1,999.99	4.500	0.123
#5	**1**	**Time of Concentration:**					**0.123**
#6	1	3. Short grass pasture	33.00	25.00	75.75	4.590	0.004
		6. Grassed waterway	3.00	25.50	850.00	2.590	0.091
#6	**1**	**Time of Concentration:**					**0.095**
#7	1	3. Short grass pasture	10.00	25.00	250.00	2.520	0.027
#7	**1**	**Time of Concentration:**					**0.027**
#9	1	3. Short grass pasture	5.00	5.00	100.00	1.780	0.015
#9	**1**	**Time of Concentration:**					**0.015**
#10	1	3. Short grass pasture	33.00	29.70	90.00	4.590	0.005

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	5.75	23.00	400.00	7.190	0.015
#10	**1**	**Time of Concentration:**					**0.020**
#11	1	6. Grassed waterway	0.50	6.50	1,300.00	1.060	0.340
#11	**1**	**Time of Concentration:**					**0.340**
#12	1	6. Grassed waterway	0.50	6.00	1,200.00	1.060	0.314
#12	**1**	**Time of Concentration:**					**0.314**

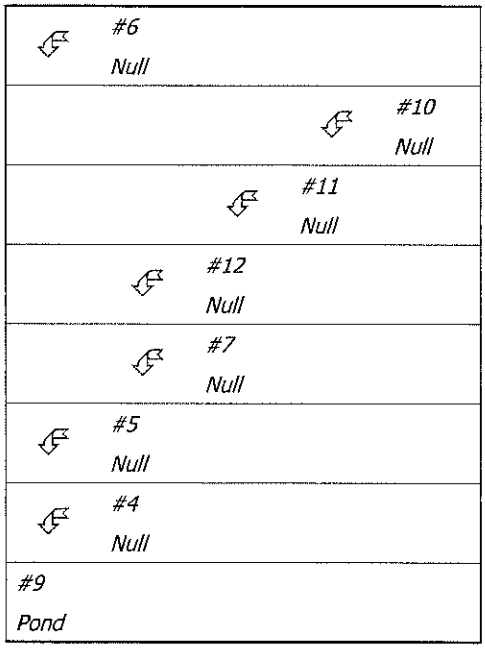
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	4.830 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#4	==>	#9	0.000	0.000	C-101
Null	#5	==>	#9	0.000	0.000	CHANNEL N
Null	#6	==>	#9	0.000	0.000	CHANNEL L
Null	#7	==>	#5	0.000	0.000	CHANNEL M
Pond	#9	==>	End	0.000	0.000	BASIN #2
Null	#10	==>	#11	0.000	0.000	CHANNEL O
Null	#11	==>	#12	0.000	0.000	CHANNEL P
Null	#12	==>	#5	0.000	0.000	CHANNEL Q



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6		1.200	1.200	2.62	0.20
#10		11.800	11.800	29.12	2.27
#11		8.600	20.400	31.38	2.88
#12		6.400	26.800	33.09	3.33
#7		0.600	0.600	0.88	0.06
#5		8.500	35.900	46.42	4.29
#4		19.300	19.300	11.02	1.37
#9	In	2.200	58.600	61.08	6.09
	Out			1.00	2.68

Structure Detail:

Structure #6 (Null)

CHANNEL L

Structure #10 (Null)

CHANNEL O

Structure #11 (Null)

CHANNEL P

Structure #12 (Null)

CHANNEL Q

Structure #7 (Null)

CHANNEL M

Structure #5 (Null)

CHANNEL N

Structure #4 (Null)

C-101

Structure #9 (Pond)

BASIN #2

Pond Inputs:

Initial Pool Elev:	460.01 ft
Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	9

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	467.35 ft
Dewater Time:	5.90 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)	
460.00	0.000	0.000	0.000		
460.01	0.530	0.002	0.000		Low hole SPW #1
460.50	0.552	0.267	0.165	19.38*	
461.00	0.574	0.548	0.235	14.48*	
461.50	0.597	0.841	0.289	12.28*	
462.00	0.620	1.145	0.333	11.04*	
462.50	0.644	1.461	0.373	10.26*	
463.00	0.668	1.789	0.409	9.72*	
463.50	0.693	2.130	0.442	9.33*	
464.00	0.718	2.483	0.472	9.04*	
464.50	0.744	2.848	0.501	8.83*	
465.00	0.770	3.227	0.528	8.67*	
465.50	0.795	3.618	0.721	6.57*	
466.00	0.821	4.022	0.815	6.35	
466.50	0.847	4.439	0.892	5.95	
467.00	0.873	4.869	0.959	5.60	
467.35	0.892	5.176	1.002	4.20	Peak Stage
467.50	0.900	5.312	1.021		
468.00	0.927	5.769	1.077		
468.50	0.955	6.239	1.131		
469.00	0.983	6.724	1.181		
469.50	1.011	7.222	1.229		
470.00	1.040	7.735	1.944		
470.50	1.074	8.264	2.265		
471.00	1.110	8.810	2.520		Spillway #1
471.50	1.145	9.373	10.330		Spillway #2
472.00	1.181	9.955	32.860		
472.50	1.218	10.555	91.363		
473.00	1.255	11.173	151.823		
473.50	1.293	11.810	230.503		
474.00	1.332	12.466	325.442		
474.50	1.370	13.142	436.892		
475.00	1.410	13.837	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	1.00>0.000	0.000	0.000
460.50	0.165	0.000	0.165
461.00	0.235	0.000	0.235
461.50	0.289	0.000	0.289
462.00	0.333	0.000	0.333
462.50	0.373	0.000	0.373
463.00	0.409	0.000	0.409
463.50	0.442	0.000	0.442
464.00	0.472	0.000	0.472
464.50	0.501	0.000	0.501
465.00	1.00>0.528	0.000	0.528
465.50	0.721	0.000	0.721
466.00	0.815	0.000	0.815
466.50	0.892	0.000	0.892
467.00	0.959	0.000	0.959
467.50	1.021	0.000	1.021
468.00	1.077	0.000	1.077
468.50	1.131	0.000	1.131
469.00	1.181	0.000	1.181
469.50	2.00>1.229	0.000	1.229
470.00	1.944	0.000	1.944
470.50	2.265	0.000	2.265
471.00	2.520	0.000	2.520
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	1.200	0.095	0.000	0.000	71.000	S	2.62	0.199
	Σ	**1.200**						**2.62**	**0.199**
#10	1	11.800	0.020	0.000	0.000	75.000	M	29.12	2.271
	Σ	**11.800**						**29.12**	**2.271**
#11	1	8.600	0.340	0.000	0.000	61.000	S	3.78	0.609
	Σ	**20.400**						**31.38**	**2.880**
#12	1	6.400	0.314	0.000	0.000	61.000	S	2.94	0.453
	Σ	**26.800**						**33.09**	**3.333**
#7	1	0.600	0.027	0.000	0.000	61.000	M	0.88	0.063
	Σ	**0.600**						**0.88**	**0.063**
#5	1	8.500	0.123	0.000	0.000	61.000	S	12.45	0.897
	Σ	**35.900**						**46.42**	**4.293**
#4	1	19.300	0.205	0.000	0.000	61.000	S	11.02	1.365
	Σ	**19.300**						**11.02**	**1.365**
#9	1	2.200	0.015	0.000	0.000	61.000	M	3.22	0.232
	Σ	**58.600**						**61.08**	**6.089**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	3. Short grass pasture	8.00	20.00	250.00	2.260	0.030
		6. Grassed waterway	2.50	37.50	1,500.00	2.370	0.175
#4	**1**	**Time of Concentration:**					**0.205**
#5	1	6. Grassed waterway	9.00	180.00	1,999.99	4.500	0.123
#5	**1**	**Time of Concentration:**					**0.123**
#6	1	3. Short grass pasture	33.00	25.00	75.75	4.590	0.004
		6. Grassed waterway	3.00	25.50	850.00	2.590	0.091
#6	**1**	**Time of Concentration:**					**0.095**
#7	1	3. Short grass pasture	10.00	25.00	250.00	2.520	0.027
#7	**1**	**Time of Concentration:**					**0.027**
#9	1	3. Short grass pasture	5.00	5.00	100.00	1.780	0.015
#9	**1**	**Time of Concentration:**					**0.015**
#10	1	3. Short grass pasture	33.00	29.70	90.00	4.590	0.005

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	5.75	23.00	400.00	7.190	0.015
#10	**1**	**Time of Concentration:**					**0.020**
#11	1	6. Grassed waterway	0.50	6.50	1,300.00	1.060	0.340
#11	**1**	**Time of Concentration:**					**0.340**
#12	1	6. Grassed waterway	0.50	6.00	1,200.00	1.060	0.314
#12	**1**	**Time of Concentration:**					**0.314**

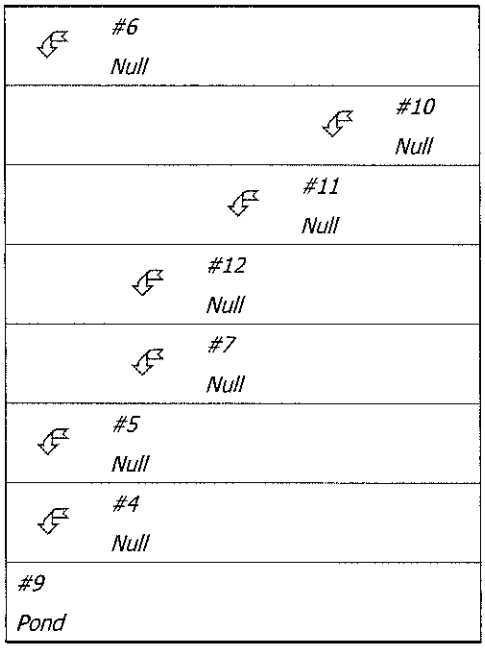
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.720 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#4	==>	#9	0.000	0.000	C-101
Null	#5	==>	#9	0.000	0.000	CHANNEL N
Null	#6	==>	#9	0.000	0.000	CHANNEL L
Null	#7	==>	#5	0.000	0.000	CHANNEL M
Pond	#9	==>	End	0.000	0.000	BASIN #2
Null	#10	==>	#11	0.000	0.000	CHANNEL O
Null	#11	==>	#12	0.000	0.000	CHANNEL P
Null	#12	==>	#5	0.000	0.000	CHANNEL Q



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6		1.200	1.200	3.44	0.27
#10		11.800	11.800	37.45	2.99
#11		8.600	20.400	41.22	3.87
#12		6.400	26.800	44.10	4.52
#7		0.600	0.600	1.24	0.09
#5		8.500	35.900	62.91	5.89
#4		19.300	19.300	16.61	1.96
#9	In	2.200	58.600	84.82	8.45
	Out			1.30	3.51

Structure Detail:

Structure #6 (Null)

CHANNEL L

Structure #10 (Null)

CHANNEL O

Structure #11 (Null)

CHANNEL P

Structure #12 (Null)

CHANNEL Q

Structure #7 (Null)

CHANNEL M

Structure #5 (Null)

CHANNEL N

Structure #4 (Null)

C-101

Structure #9 (Pond)

BASIN #2

Pond Inputs:

Initial Pool Elev:	460.01 ft
Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	9

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	469.55 ft
Dewater Time:	6.81 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)	
460.00	0.000	0.000	0.000		
460.01	0.530	0.002	0.000		Low hole SPW #1
460.50	0.552	0.267	0.165	19.38*	
461.00	0.574	0.548	0.235	14.48*	
461.50	0.597	0.841	0.289	12.28*	
462.00	0.620	1.145	0.333	11.04*	
462.50	0.644	1.461	0.373	10.26*	
463.00	0.668	1.789	0.409	9.72*	
463.50	0.693	2.130	0.442	9.33*	
464.00	0.718	2.483	0.472	9.04*	
464.50	0.744	2.848	0.501	8.83*	
465.00	0.770	3.227	0.528	8.67*	
465.50	0.795	3.618	0.721	6.57*	
466.00	0.821	4.022	0.815	6.00*	
466.50	0.847	4.439	0.892	5.66*	
467.00	0.873	4.869	0.959	5.42*	
467.50	0.900	5.312	1.021	5.26*	
468.00	0.927	5.769	1.077	5.25	
468.50	0.955	6.239	1.131	5.20	
469.00	0.983	6.724	1.181	5.05	
469.50	1.011	7.222	1.229	5.10	
469.55	1.014	7.272	1.299	0.80	Peak Stage
470.00	1.040	7.735	1.944		
470.50	1.074	8.264	2.265		
471.00	1.110	8.810	2.520		Spillway #1
471.50	1.145	9.373	10.330		Spillway #2
472.00	1.181	9.955	32.860		
472.50	1.218	10.555	91.363		
473.00	1.255	11.173	151.823		
473.50	1.293	11.810	230.503		
474.00	1.332	12.466	325.442		
474.50	1.370	13.142	436.892		
475.00	1.410	13.837	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	1.00>0.000	0.000	0.000
460.50	0.165	0.000	0.165
461.00	0.235	0.000	0.235
461.50	0.289	0.000	0.289
462.00	0.333	0.000	0.333
462.50	0.373	0.000	0.373
463.00	0.409	0.000	0.409
463.50	0.442	0.000	0.442
464.00	0.472	0.000	0.472
464.50	0.501	0.000	0.501
465.00	1.00>0.528	0.000	0.528
465.50	0.721	0.000	0.721
466.00	0.815	0.000	0.815
466.50	0.892	0.000	0.892
467.00	0.959	0.000	0.959
467.50	1.021	0.000	1.021
468.00	1.077	0.000	1.077
468.50	1.131	0.000	1.131
469.00	1.181	0.000	1.181
469.50	2.00>1.229	0.000	1.229
470.00	1.944	0.000	1.944
470.50	2.265	0.000	2.265
471.00	2.520	0.000	2.520
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	1.200	0.095	0.000	0.000	71.000	S	3.44	0.267
	Σ	**1.200**						**3.44**	**0.267**
#10	1	11.800	0.020	0.000	0.000	75.000	M	37.45	2.991
	Σ	**11.800**						**37.45**	**2.991**
#11	1	8.600	0.340	0.000	0.000	61.000	S	5.75	0.874
	Σ	**20.400**						**41.22**	**3.865**
#12	1	6.400	0.314	0.000	0.000	61.000	S	4.48	0.650
	Σ	**26.800**						**44.10**	**4.516**
#7	1	0.600	0.027	0.000	0.000	61.000	M	1.24	0.091
	Σ	**0.600**						**1.24**	**0.091**
#5	1	8.500	0.123	0.000	0.000	61.000	S	17.57	1.288
	Σ	**35.900**						**62.91**	**5.894**
#4	1	19.300	0.205	0.000	0.000	61.000	S	16.61	1.960
	Σ	**19.300**						**16.61**	**1.960**
#9	1	2.200	0.015	0.000	0.000	61.000	M	4.55	0.333
	Σ	**58.600**						**84.82**	**8.454**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	3. Short grass pasture	8.00	20.00	250.00	2.260	0.030
		6. Grassed waterway	2.50	37.50	1,500.00	2.370	0.175
#4	**1**	**Time of Concentration:**					**0.205**
#5	1	6. Grassed waterway	9.00	180.00	1,999.99	4.500	0.123
#5	**1**	**Time of Concentration:**					**0.123**
#6	1	3. Short grass pasture	33.00	25.00	75.75	4.590	0.004
		6. Grassed waterway	3.00	25.50	850.00	2.590	0.091
#6	**1**	**Time of Concentration:**					**0.095**
#7	1	3. Short grass pasture	10.00	25.00	250.00	2.520	0.027
#7	**1**	**Time of Concentration:**					**0.027**
#9	1	3. Short grass pasture	5.00	5.00	100.00	1.780	0.015
#9	**1**	**Time of Concentration:**					**0.015**
#10	1	3. Short grass pasture	33.00	29.70	90.00	4.590	0.005

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	5.75	23.00	400.00	7.190	0.015
#10	**1**	**Time of Concentration:**					**0.020**
#11	1	6. Grassed waterway	0.50	6.50	1,300.00	1.060	0.340
#11	**1**	**Time of Concentration:**					**0.340**
#12	1	6. Grassed waterway	0.50	6.00	1,200.00	1.060	0.314
#12	**1**	**Time of Concentration:**					**0.314**

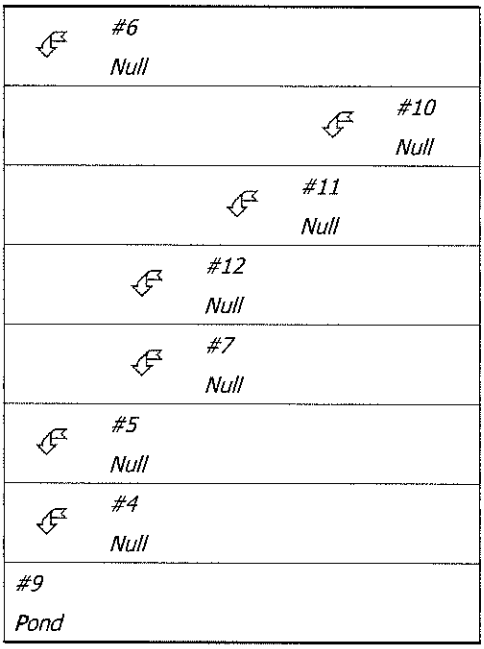
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	50 yr - 24 hr
Rainfall Depth:	6.480 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#4	==>	#9	0.000	0.000	C-101
Null	#5	==>	#9	0.000	0.000	CHANNEL N
Null	#6	==>	#9	0.000	0.000	CHANNEL L
Null	#7	==>	#5	0.000	0.000	CHANNEL M
Pond	#9	==>	End	0.000	0.000	BASIN #2
Null	#10	==>	#11	0.000	0.000	CHANNEL O
Null	#11	==>	#12	0.000	0.000	CHANNEL P
Null	#12	==>	#5	0.000	0.000	CHANNEL Q



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6		1.200	1.200	4.16	0.33
#10		11.800	11.800	44.66	3.63
#11		8.600	20.400	49.86	4.75
#12		6.400	26.800	53.84	5.58
#7		0.600	0.600	1.57	0.12
#5		8.500	35.900	77.60	7.35
#4		19.300	19.300	21.77	2.51
#9	In	2.200	58.600	106.18	10.62
	Out			2.41	5.01

Structure Detail:

Structure #6 (Null)

CHANNEL L

Structure #10 (Null)

CHANNEL O

Structure #11 (Null)

CHANNEL P

Structure #12 (Null)

CHANNEL Q

Structure #7 (Null)

CHANNEL M

Structure #5 (Null)

CHANNEL N

Structure #4 (Null)

C-101

Structure #9 (Pond)

BASIN #2

Pond Inputs:

Initial Pool Elev:	460.01 ft
Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	9

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	470.78 ft
Dewater Time:	7.13 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)	
460.00	0.000	0.000	0.000		
460.01	0.530	0.002	0.000		Low hole SPW #1
460.50	0.552	0.267	0.165	19.38*	
461.00	0.574	0.548	0.235	14.48*	
461.50	0.597	0.841	0.289	12.28*	
462.00	0.620	1.145	0.333	11.04*	
462.50	0.644	1.461	0.373	10.26*	
463.00	0.668	1.789	0.409	9.72*	
463.50	0.693	2.130	0.442	9.33*	
464.00	0.718	2.483	0.472	9.04*	
464.50	0.744	2.848	0.501	8.83*	
465.00	0.770	3.227	0.528	8.67*	
465.50	0.795	3.618	0.721	6.57*	
466.00	0.821	4.022	0.815	6.00*	
466.50	0.847	4.439	0.892	5.66*	
467.00	0.873	4.869	0.959	5.42*	
467.50	0.900	5.312	1.021	5.26*	
468.00	0.927	5.769	1.077	5.13*	
468.50	0.955	6.239	1.131	5.15	
469.00	0.983	6.724	1.181	5.05	
469.50	1.011	7.222	1.229	5.00	
470.00	1.040	7.735	1.944	4.00	
470.50	1.074	8.264	2.265	3.05	
470.78	1.094	8.573	2.410	1.90	Peak Stage
471.00	1.110	8.810	2.520		Spillway #1
471.50	1.145	9.373	10.330		Spillway #2
472.00	1.181	9.955	32.860		
472.50	1.218	10.555	91.363		
473.00	1.255	11.173	151.823		
473.50	1.293	11.810	230.503		
474.00	1.332	12.466	325.442		
474.50	1.370	13.142	436.892		
475.00	1.410	13.837	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	1.00>0.000	0.000	0.000
460.50	0.165	0.000	0.165
461.00	0.235	0.000	0.235
461.50	0.289	0.000	0.289
462.00	0.333	0.000	0.333
462.50	0.373	0.000	0.373
463.00	0.409	0.000	0.409
463.50	0.442	0.000	0.442
464.00	0.472	0.000	0.472
464.50	0.501	0.000	0.501
465.00	1.00>0.528	0.000	0.528
465.50	0.721	0.000	0.721
466.00	0.815	0.000	0.815
466.50	0.892	0.000	0.892
467.00	0.959	0.000	0.959
467.50	1.021	0.000	1.021
468.00	1.077	0.000	1.077
468.50	1.131	0.000	1.131
469.00	1.181	0.000	1.181
469.50	2.00>1.229	0.000	1.229
470.00	1.944	0.000	1.944
470.50	2.265	0.000	2.265
471.00	2.520	0.000	2.520
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	1.200	0.095	0.000	0.000	71.000	S	4.16	0.328
	Σ	**1.200**						**4.16**	**0.328**
#10	1	11.800	0.020	0.000	0.000	75.000	M	44.66	3.630
	Σ	**11.800**						**44.66**	**3.630**
#11	1	8.600	0.340	0.000	0.000	61.000	S	7.61	1.120
	Σ	**20.400**						**49.86**	**4.750**
#12	1	6.400	0.314	0.000	0.000	61.000	S	5.92	0.834
	Σ	**26.800**						**53.84**	**5.583**
#7	1	0.600	0.027	0.000	0.000	61.000	M	1.57	0.116
	Σ	**0.600**						**1.57**	**0.116**
#5	1	8.500	0.123	0.000	0.000	61.000	S	22.20	1.651
	Σ	**35.900**						**77.60**	**7.351**
#4	1	19.300	0.205	0.000	0.000	61.000	S	21.77	2.512
	Σ	**19.300**						**21.77**	**2.512**
#9	1	2.200	0.015	0.000	0.000	61.000	M	5.74	0.427
	Σ	**58.600**						**106.18**	**10.618**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	3. Short grass pasture	8.00	20.00	250.00	2.260	0.030
		6. Grassed waterway	2.50	37.50	1,500.00	2.370	0.175
#4	**1**	**Time of Concentration:**					**0.205**
#5	1	6. Grassed waterway	9.00	180.00	1,999.99	4.500	0.123
#5	**1**	**Time of Concentration:**					**0.123**
#6	1	3. Short grass pasture	33.00	25.00	75.75	4.590	0.004
		6. Grassed waterway	3.00	25.50	850.00	2.590	0.091
#6	**1**	**Time of Concentration:**					**0.095**
#7	1	3. Short grass pasture	10.00	25.00	250.00	2.520	0.027
#7	**1**	**Time of Concentration:**					**0.027**
#9	1	3. Short grass pasture	5.00	5.00	100.00	1.780	0.015
#9	**1**	**Time of Concentration:**					**0.015**
#10	1	3. Short grass pasture	33.00	29.70	90.00	4.590	0.005

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	5.75	23.00	400.00	7.190	0.015
#10	**1**	**Time of Concentration:**					**0.020**
#11	1	6. Grassed waterway	0.50	6.50	1,300.00	1.060	0.340
#11	**1**	**Time of Concentration:**					**0.340**
#12	1	6. Grassed waterway	0.50	6.00	1,200.00	1.060	0.314
#12	**1**	**Time of Concentration:**					**0.314**

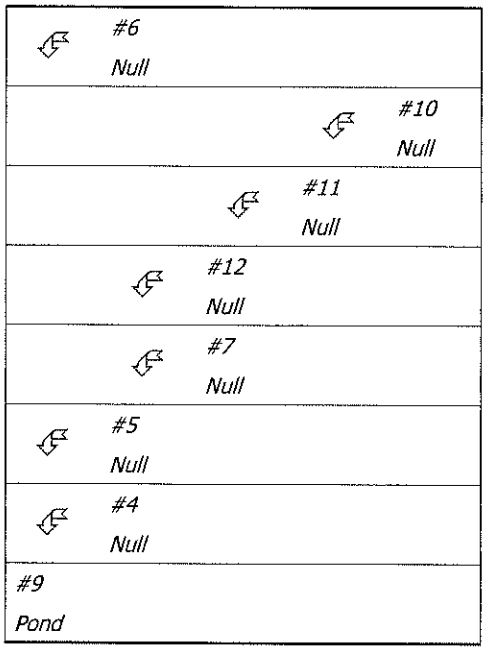
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	7.040 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#4	==>	#9	0.000	0.000	C-101
Null	#5	==>	#9	0.000	0.000	CHANNEL N
Null	#6	==>	#9	0.000	0.000	CHANNEL L
Null	#7	==>	#5	0.000	0.000	CHANNEL M
Pond	#9	==>	End	0.000	0.000	BASIN #2
Null	#10	==>	#11	0.000	0.000	CHANNEL O
Null	#11	==>	#12	0.000	0.000	CHANNEL P
Null	#12	==>	#5	0.000	0.000	CHANNEL Q



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6		1.200	1.200	4.70	0.38
#10		11.800	11.800	49.99	4.11
#11		8.600	20.400	56.33	5.42
#12		6.400	26.800	61.17	6.40
#7		0.600	0.600	1.81	0.14
#5		8.500	35.900	88.69	8.47
#4		19.300	19.300	25.75	2.94
#9	In	2.200	58.600	122.42	12.28
	Out			5.35	6.55

Structure Detail:

Structure #6 (Null)

CHANNEL L

Structure #10 (Null)

CHANNEL O

Structure #11 (Null)

CHANNEL P

Structure #12 (Null)

CHANNEL Q

Structure #7 (Null)

CHANNEL M

Structure #5 (Null)

CHANNEL N

Structure #4 (Null)

C-101

Structure #9 (Pond)

BASIN #2

Pond Inputs:

Initial Pool Elev:	460.01 ft
Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	9

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	471.18 ft
Dewater Time:	7.48 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)	
460.00	0.000	0.000	0.000		
460.01	0.530	0.002	0.000		Low hole SPW #1
460.50	0.552	0.267	0.165	19.38*	
461.00	0.574	0.548	0.235	14.48*	
461.50	0.597	0.841	0.289	12.28*	
462.00	0.620	1.145	0.333	11.04*	
462.50	0.644	1.461	0.373	10.26*	
463.00	0.668	1.789	0.409	9.72*	
463.50	0.693	2.130	0.442	9.33*	
464.00	0.718	2.483	0.472	9.04*	
464.50	0.744	2.848	0.501	8.83*	
465.00	0.770	3.227	0.528	8.67*	
465.50	0.795	3.618	0.721	6.57*	
466.00	0.821	4.022	0.815	6.00*	
466.50	0.847	4.439	0.892	5.66*	
467.00	0.873	4.869	0.959	5.42*	
467.50	0.900	5.312	1.021	5.26*	
468.00	0.927	5.769	1.077	5.13*	
468.50	0.955	6.239	1.131	5.15	
469.00	0.983	6.724	1.181	5.10	
469.50	1.011	7.222	1.229	5.00	
470.00	1.040	7.735	1.944	3.95	
470.50	1.074	8.264	2.265	3.05	
471.00	1.110	8.810	2.520	2.95	Spillway #1
471.18	1.123	9.013	5.346	7.20	Peak Stage
471.50	1.145	9.373	10.330		Spillway #2
472.00	1.181	9.955	32.860		
472.50	1.218	10.555	91.363		
473.00	1.255	11.173	151.823		
473.50	1.293	11.810	230.503		
474.00	1.332	12.466	325.442		
474.50	1.370	13.142	436.892		
475.00	1.410	13.837	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	1.00>0.000	0.000	0.000
460.50	0.165	0.000	0.165
461.00	0.235	0.000	0.235
461.50	0.289	0.000	0.289
462.00	0.333	0.000	0.333
462.50	0.373	0.000	0.373
463.00	0.409	0.000	0.409
463.50	0.442	0.000	0.442
464.00	0.472	0.000	0.472
464.50	0.501	0.000	0.501
465.00	1.00>0.528	0.000	0.528
465.50	0.721	0.000	0.721
466.00	0.815	0.000	0.815
466.50	0.892	0.000	0.892
467.00	0.959	0.000	0.959
467.50	1.021	0.000	1.021
468.00	1.077	0.000	1.077
468.50	1.131	0.000	1.131
469.00	1.181	0.000	1.181
469.50	2.00>1.229	0.000	1.229
470.00	1.944	0.000	1.944
470.50	2.265	0.000	2.265
471.00	2.520	0.000	2.520
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	1.200	0.095	0.000	0.000	71.000	S	4.70	0.375
	Σ	**1.200**						**4.70**	**0.375**
#10	1	11.800	0.020	0.000	0.000	75.000	M	49.99	4.111
	Σ	**11.800**						**49.99**	**4.111**
#11	1	8.600	0.340	0.000	0.000	61.000	S	9.04	1.311
	Σ	**20.400**						**56.33**	**5.422**
#12	1	6.400	0.314	0.000	0.000	61.000	S	7.03	0.976
	Σ	**26.800**						**61.17**	**6.398**
#7	1	0.600	0.027	0.000	0.000	61.000	M	1.81	0.136
	Σ	**0.600**						**1.81**	**0.136**
#5	1	8.500	0.123	0.000	0.000	61.000	S	25.71	1.932
	Σ	**35.900**						**88.69**	**8.466**
#4	1	19.300	0.205	0.000	0.000	61.000	S	25.75	2.940
	Σ	**19.300**						**25.75**	**2.940**
#9	1	2.200	0.015	0.000	0.000	61.000	M	6.65	0.500
	Σ	**58.600**						**122.42**	**12.281**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	3. Short grass pasture	8.00	20.00	250.00	2.260	0.030
		6. Grassed waterway	2.50	37.50	1,500.00	2.370	0.175
#4	**1**	**Time of Concentration:**					**0.205**
#5	1	6. Grassed waterway	9.00	180.00	1,999.99	4.500	0.123
#5	**1**	**Time of Concentration:**					**0.123**
#6	1	3. Short grass pasture	33.00	25.00	75.75	4.590	0.004
		6. Grassed waterway	3.00	25.50	850.00	2.590	0.091
#6	**1**	**Time of Concentration:**					**0.095**
#7	1	3. Short grass pasture	10.00	25.00	250.00	2.520	0.027
#7	**1**	**Time of Concentration:**					**0.027**
#9	1	3. Short grass pasture	5.00	5.00	100.00	1.780	0.015
#9	**1**	**Time of Concentration:**					**0.015**
#10	1	3. Short grass pasture	33.00	29.70	90.00	4.590	0.005

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	5.75	23.00	400.00	7.190	0.015
#10	**1**	**Time of Concentration:**					**0.020**
#11	1	6. Grassed waterway	0.50	6.50	1,300.00	1.060	0.340
#11	**1**	**Time of Concentration:**					**0.340**
#12	1	6. Grassed waterway	0.50	6.00	1,200.00	1.060	0.314
#12	**1**	**Time of Concentration:**					**0.314**

Bethlehem Landfill Southeast Realignment

AREA "A"

Pre-Development

JMM

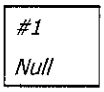
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	2 yr - 24 hr
Rainfall Depth:	3.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.370	6.370	0.23	0.08

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	6.370	0.395	0.000	0.000	55.000	M	0.23	0.083
	Σ	**6.370**						**0.23**	**0.083**

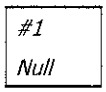
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	5 yr - 24 hr
Rainfall Depth:	3.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.370	6.370	0.79	0.16

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	6.370	0.395	0.000	0.000	55.000	M	0.79	0.161
	Σ	**6.370**						**0.79**	**0.161**

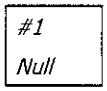
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	4.560 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.370	6.370	2.14	0.33

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	6.370	0.395	0.000	0.000	55.000	M	2.14	0.326
	Σ	**6.370**						**2.14**	**0.326**

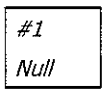
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.520 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.370	6.370	3.89	0.53

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	6.370	0.395	0.000	0.000	55.000	M	3.89	0.530
	Σ	**6.370**						**3.89**	**0.530**

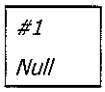
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	50 yr - 24 hr
Rainfall Depth:	6.480 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.370	6.370	5.93	0.76

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	6.370	0.395	0.000	0.000	55.000	M	5.93	0.763
	Σ	**6.370**						**5.93**	**0.763**

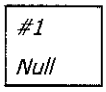
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	7.440 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.370	6.370	8.22	1.02

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	6.370	0.395	0.000	0.000	55.000	M	8.22	1.021
	Σ	**6.370**						**8.22**	**1.021**

Appendix H

Post Construction Watershed Calculations

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IESI Bethlehem Landfill
Southeastern Realignment

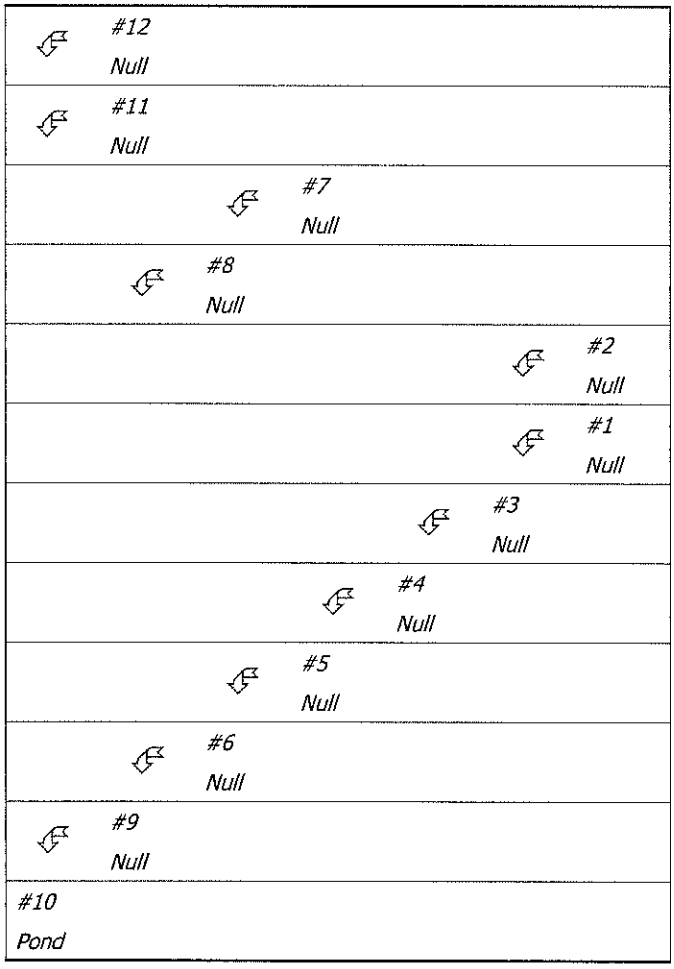
Detention Basin 2

Post Closure

JMM

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#3	0.000	0.000	Channel X
Null	#2	==>	#3	0.000	0.000	Channel W
Null	#3	==>	#4	0.000	0.000	Channel Y
Null	#4	==>	#5	0.000	0.000	Channel O
Null	#5	==>	#6	0.000	0.000	Channel P
Null	#6	==>	#9	0.000	0.000	Channel Q
Null	#7	==>	#8	0.000	0.000	DS-7
Null	#8	==>	#9	0.000	0.000	Channel L
Null	#9	==>	#10	0.000	0.000	Channel N
Pond	#10	==>	End	0.000	0.000	Basin #2
Null	#11	==>	#10	0.000	0.000	DS-6
Null	#12	==>	#10	0.000	0.000	Channel M



General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	2 yr - 24 hr
Rainfall Depth:	3.000 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#12		2.170	2.170	2.37	0.17
#11		11.030	11.030	4.48	0.33
#7		7.120	7.120	0.69	0.15
#8		4.610	11.730	2.31	0.34
#2		3.920	3.920	0.50	0.08
#1		2.300	2.300	1.14	0.08
#3		12.160	18.380	2.77	0.46
#4		1.300	19.680	3.11	0.50
#5		7.880	27.560	3.67	0.66
#6		5.290	32.850	4.35	0.77
#9		0.590	45.170	6.78	1.15
#10	In	1.790	60.160	13.84	1.74
	Out			0.28	0.81

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)
#12	1	2.170	0.045	0.000	0.000	75.000	M	2.37	0.173
	Σ	**2.170**						**2.37**	**0.173**
#11	1	11.030	0.101	0.000	0.000	61.000	S	4.48	0.335
	Σ	**11.030**						**4.48**	**0.335**
#7	1	7.120	0.270	0.000	0.000	61.000	S	0.69	0.145
	Σ	**7.120**						**0.69**	**0.145**
#8	1	4.610	0.161	0.000	0.000	71.000	S	1.70	0.197
	Σ	**11.730**						**2.31**	**0.342**
#2	1	3.920	0.165	0.000	0.000	61.000	S	0.50	0.080
	Σ	**3.920**						**0.50**	**0.080**
#1	1	2.300	0.044	0.000	0.000	63.000	M	1.14	0.083
	Σ	**2.300**						**1.14**	**0.083**
#3	1	12.160	0.174	0.000	0.000	63.000	S	2.02	0.295
	Σ	**18.380**						**2.77**	**0.458**
#4	1	1.300	0.059	0.000	0.000	61.000	M	0.53	0.039
	Σ	**19.680**						**3.11**	**0.498**
#5	1	7.880	0.228	0.000	0.000	61.000	S	0.85	0.161
	Σ	**27.560**						**3.67**	**0.659**
#6	1	5.290	0.150	0.000	0.000	61.000	S	0.68	0.109
	Σ	**32.850**						**4.35**	**0.767**
#9	1	0.590	0.022	0.000	0.000	73.000	M	0.58	0.042
	Σ	**45.170**						**6.78**	**1.151**
#10	1	1.790	0.015	0.000	0.000	65.000	M	1.05	0.075
	Σ	**60.160**						**13.84**	**1.735**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		6. Grassed waterway	3.00	12.00	400.00	2.590	0.042
#1	**1**	**Time of Concentration:**					**0.044**

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	5 yr - 24 hr
Rainfall Depth:	3.600 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#12		2.170	2.170	3.31	0.25
#11		11.030	11.030	7.91	0.57
#7		7.120	7.120	1.46	0.25
#8		4.610	11.730	3.97	0.54
#2		3.920	3.920	1.03	0.14
#1		2.300	2.300	1.90	0.14
#3		12.160	18.380	5.29	0.76
#4		1.300	19.680	6.22	0.82
#5		7.880	27.560	7.14	1.09
#6		5.290	32.850	8.53	1.28
#9		0.590	45.170	12.66	1.88
#10	In	1.790	60.160	24.78	2.81
	Out			0.34	1.01

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)
#12	1	2.170	0.045	0.000	0.000	75.000	M	3.31	0.248
	Σ	**2.170**						**3.31**	**0.248**
#11	1	11.030	0.101	0.000	0.000	61.000	S	7.91	0.567
	Σ	**11.030**						**7.91**	**0.567**
#7	1	7.120	0.270	0.000	0.000	61.000	S	1.46	0.246
	Σ	**7.120**						**1.46**	**0.246**
#8	1	4.610	0.161	0.000	0.000	71.000	S	2.64	0.292
	Σ	**11.730**						**3.97**	**0.538**
#2	1	3.920	0.165	0.000	0.000	61.000	S	1.03	0.136
	Σ	**3.920**						**1.03**	**0.136**
#1	1	2.300	0.044	0.000	0.000	63.000	M	1.90	0.136
	Σ	**2.300**						**1.90**	**0.136**
#3	1	12.160	0.174	0.000	0.000	63.000	S	3.79	0.483
	Σ	**18.380**						**5.29**	**0.755**
#4	1	1.300	0.059	0.000	0.000	61.000	M	0.93	0.067
	Σ	**19.680**						**6.22**	**0.822**
#5	1	7.880	0.228	0.000	0.000	61.000	S	1.78	0.272
	Σ	**27.560**						**7.14**	**1.094**
#6	1	5.290	0.150	0.000	0.000	61.000	S	1.40	0.184
	Σ	**32.850**						**8.53**	**1.278**
#9	1	0.590	0.022	0.000	0.000	73.000	M	0.83	0.061
	Σ	**45.170**						**12.66**	**1.877**
#10	1	1.790	0.015	0.000	0.000	65.000	M	1.68	0.120
	Σ	**60.160**						**24.78**	**2.813**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		6. Grassed waterway	3.00	12.00	400.00	2.590	0.042
#1	**1**	**Time of Concentration:**					**0.044**

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	4.560 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#12		2.170	2.170	4.90	0.38
#11		11.030	11.030	14.23	1.02
#7		7.120	7.120	3.04	0.44
#8		4.610	11.730	7.16	0.91
#2		3.920	3.920	2.09	0.25
#1		2.300	2.300	3.28	0.24
#3		12.160	18.380	10.79	1.33
#4		1.300	19.680	12.47	1.45
#5		7.880	27.560	14.87	1.94
#6		5.290	32.850	17.07	2.27
#9		0.590	45.170	24.14	3.27
#10	In	1.790	60.160	46.07	4.87
	Out			0.60	1.57

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)
#12	1	2.170	0.045	0.000	0.000	75.000	M	4.90	0.379
	Σ	**2.170**						**4.90**	**0.379**
#11	1	11.030	0.101	0.000	0.000	61.000	S	14.23	1.021
	Σ	**11.030**						**14.23**	**1.021**
#7	1	7.120	0.270	0.000	0.000	61.000	S	3.04	0.443
	Σ	**7.120**						**3.04**	**0.443**
#8	1	4.610	0.161	0.000	0.000	71.000	S	4.31	0.464
	Σ	**11.730**						**7.16**	**0.906**
#2	1	3.920	0.165	0.000	0.000	61.000	S	2.09	0.245
	Σ	**3.920**						**2.09**	**0.245**
#1	1	2.300	0.044	0.000	0.000	63.000	M	3.28	0.237
	Σ	**2.300**						**3.28**	**0.237**
#3	1	12.160	0.174	0.000	0.000	63.000	S	7.31	0.844
	Σ	**18.380**						**10.79**	**1.326**
#4	1	1.300	0.059	0.000	0.000	61.000	M	1.68	0.120
	Σ	**19.680**						**12.47**	**1.447**
#5	1	7.880	0.228	0.000	0.000	61.000	S	3.67	0.490
	Σ	**27.560**						**14.87**	**1.937**
#6	1	5.290	0.150	0.000	0.000	61.000	S	2.82	0.331
	Σ	**32.850**						**17.07**	**2.268**
#9	1	0.590	0.022	0.000	0.000	73.000	M	1.25	0.095
	Σ	**45.170**						**24.14**	**3.269**
#10	1	1.790	0.015	0.000	0.000	65.000	M	2.80	0.204
	Σ	**60.160**						**46.07**	**4.873**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		6. Grassed waterway	3.00	12.00	400.00	2.590	0.042
#1	**1**	**Time of Concentration:**					**0.044**

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.520 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#12		2.170	2.170	6.54	0.52
#11		11.030	11.030	21.27	1.55
#7		7.120	7.120	4.97	0.67
#8		4.610	11.730	10.88	1.33
#2		3.920	3.920	3.35	0.37
#1		2.300	2.300	4.80	0.35
#3		12.160	18.380	17.22	1.99
#4		1.300	19.680	19.72	2.17
#5		7.880	27.560	24.02	2.91
#6		5.290	32.850	27.78	3.42
#9		0.590	45.170	38.63	4.87
#10	In	1.790	60.160	70.46	7.25
	Out			1.25	2.78

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)
#12	1	2.170	0.045	0.000	0.000	75.000	M	6.54	0.520
	Σ	**2.170**						**6.54**	**0.520**
#11	1	11.030	0.101	0.000	0.000	61.000	S	21.27	1.553
	Σ	**11.030**						**21.27**	**1.553**
#7	1	7.120	0.270	0.000	0.000	61.000	S	4.97	0.673
	Σ	**7.120**						**4.97**	**0.673**
#8	1	4.610	0.161	0.000	0.000	71.000	S	6.12	0.652
	Σ	**11.730**						**10.88**	**1.325**
#2	1	3.920	0.165	0.000	0.000	61.000	S	3.35	0.373
	Σ	**3.920**						**3.35**	**0.373**
#1	1	2.300	0.044	0.000	0.000	63.000	M	4.80	0.354
	Σ	**2.300**						**4.80**	**0.354**
#3	1	12.160	0.174	0.000	0.000	63.000	S	11.36	1.260
	Σ	**18.380**						**17.22**	**1.987**
#4	1	1.300	0.059	0.000	0.000	61.000	M	2.51	0.183
	Σ	**19.680**						**19.72**	**2.170**
#5	1	7.880	0.228	0.000	0.000	61.000	S	5.98	0.745
	Σ	**27.560**						**24.02**	**2.914**
#6	1	5.290	0.150	0.000	0.000	61.000	S	4.52	0.503
	Σ	**32.850**						**27.78**	**3.417**
#9	1	0.590	0.022	0.000	0.000	73.000	M	1.69	0.132
	Σ	**45.170**						**38.63**	**4.874**
#10	1	1.790	0.015	0.000	0.000	65.000	M	4.02	0.299
	Σ	**60.160**						**70.46**	**7.246**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		6. Grassed waterway	3.00	12.00	400.00	2.590	0.042
#1	**1**	**Time of Concentration:**					**0.044**

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	50 yr - 24 hr
Rainfall Depth:	6.480 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#12		2.170	2.170	8.21	0.67
#11		11.030	11.030	28.80	2.14
#7		7.120	7.120	7.12	0.93
#8		4.610	11.730	14.90	1.78
#2		3.920	3.920	4.74	0.51
#1		2.300	2.300	6.41	0.48
#3		12.160	18.380	24.26	2.71
#4		1.300	19.680	27.66	2.97
#5		7.880	27.560	34.10	3.99
#6		5.290	32.850	39.60	4.69
#9		0.590	45.170	54.55	6.64
#10	In	1.790	60.160	96.87	9.85
	Out			2.32	4.59

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)
#12	1	2.170	0.045	0.000	0.000	75.000	M	8.21	0.667
	Σ	**2.170**						**8.21**	**0.667**
#11	1	11.030	0.101	0.000	0.000	61.000	S	28.80	2.142
	Σ	**11.030**						**28.80**	**2.142**
#7	1	7.120	0.270	0.000	0.000	61.000	S	7.12	0.928
	Σ	**7.120**						**7.12**	**0.928**
#8	1	4.610	0.161	0.000	0.000	71.000	S	8.02	0.852
	Σ	**11.730**						**14.90**	**1.781**
#2	1	3.920	0.165	0.000	0.000	61.000	S	4.74	0.514
	Σ	**3.920**						**4.74**	**0.514**
#1	1	2.300	0.044	0.000	0.000	63.000	M	6.41	0.482
	Σ	**2.300**						**6.41**	**0.482**
#3	1	12.160	0.174	0.000	0.000	63.000	S	15.78	1.717
	Σ	**18.380**						**24.26**	**2.713**
#4	1	1.300	0.059	0.000	0.000	61.000	M	3.39	0.252
	Σ	**19.680**						**27.66**	**2.966**
#5	1	7.880	0.228	0.000	0.000	61.000	S	8.52	1.027
	Σ	**27.560**						**34.10**	**3.993**
#6	1	5.290	0.150	0.000	0.000	61.000	S	6.39	0.694
	Σ	**32.850**						**39.60**	**4.687**
#9	1	0.590	0.022	0.000	0.000	73.000	M	2.14	0.171
	Σ	**45.170**						**54.55**	**6.638**
#10	1	1.790	0.015	0.000	0.000	65.000	M	5.30	0.403
	Σ	**60.160**						**96.87**	**9.851**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		6. Grassed waterway	3.00	12.00	400.00	2.590	0.042
#1	**1**	**Time of Concentration:**					**0.044**

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	7.440 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#12		2.170	2.170	9.90	0.82
#11		11.030	11.030	36.67	2.78
#7		7.120	7.120	9.43	1.20
#8		4.610	11.730	19.15	2.26
#2		3.920	3.920	6.21	0.67
#1		2.300	2.300	8.09	0.62
#3		12.160	18.380	31.76	3.49
#4		1.300	19.680	36.09	3.82
#5		7.880	27.560	44.87	5.15
#6		5.290	32.850	52.24	6.05
#9		0.590	45.170	71.53	8.52
#10	In	1.790	60.160	124.72	12.63
	Out			6.48	7.18

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)
#12	1	2.170	0.045	0.000	0.000	75.000	M	9.90	0.820
	Σ	**2.170**						**9.90**	**0.820**
#11	1	11.030	0.101	0.000	0.000	61.000	S	36.67	2.776
	Σ	**11.030**						**36.67**	**2.776**
#7	1	7.120	0.270	0.000	0.000	61.000	S	9.43	1.203
	Σ	**7.120**						**9.43**	**1.203**
#8	1	4.610	0.161	0.000	0.000	71.000	S	9.97	1.061
	Σ	**11.730**						**19.15**	**2.264**
#2	1	3.920	0.165	0.000	0.000	61.000	S	6.21	0.666
	Σ	**3.920**						**6.21**	**0.666**
#1	1	2.300	0.044	0.000	0.000	63.000	M	8.09	0.619
	Σ	**2.300**						**8.09**	**0.619**
#3	1	12.160	0.174	0.000	0.000	63.000	S	20.45	2.205
	Σ	**18.380**						**31.76**	**3.491**
#4	1	1.300	0.059	0.000	0.000	61.000	M	4.32	0.327
	Σ	**19.680**						**36.09**	**3.818**
#5	1	7.880	0.228	0.000	0.000	61.000	S	11.25	1.331
	Σ	**27.560**						**44.87**	**5.149**
#6	1	5.290	0.150	0.000	0.000	61.000	S	8.38	0.899
	Σ	**32.850**						**52.24**	**6.048**
#9	1	0.590	0.022	0.000	0.000	73.000	M	2.60	0.212
	Σ	**45.170**						**71.53**	**8.524**
#10	1	1.790	0.015	0.000	0.000	65.000	M	6.63	0.513
	Σ	**60.160**						**124.72**	**12.634**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		6. Grassed waterway	3.00	12.00	400.00	2.590	0.042
#1	**1**	**Time of Concentration:**					**0.044**

Bethlehem Landfill Southeast Realignment

AREA "A"

Post-Development

JMM

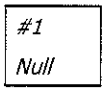
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	2 yr - 24 hr
Rainfall Depth:	3.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	5.430	5.430	0.20	0.07

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	5.430	0.395	0.000	0.000	55.000	M	0.20	0.070
	Σ	**5.430**						**0.20**	**0.070**

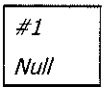
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	5 yr - 24 hr
Rainfall Depth:	3.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	5.430	5.430	0.67	0.14

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	5.430	0.395	0.000	0.000	55.000	M	0.67	0.137
	Σ	**5.430**						**0.67**	**0.137**

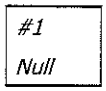
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	4.560 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	5.430	5.430	1.82	0.28

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	5.430	0.395	0.000	0.000	55.000	M	1.82	0.278
	Σ	**5.430**						**1.82**	**0.278**

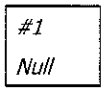
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.520 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	5.430	5.430	3.31	0.45

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	5.430	0.395	0.000	0.000	55.000	M	3.31	0.452
	Σ	**5.430**						**3.31**	**0.452**

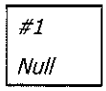
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	50 yr - 24 hr
Rainfall Depth:	6.480 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	5.430	5.430	5.05	0.65

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	5.430	0.395	0.000	0.000	55.000	M	5.05	0.651
	Σ	**5.430**						**5.05**	**0.651**

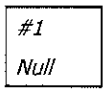
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	7.440 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pre Dev. Area A



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	5.430	5.430	7.01	0.87

Structure Detail:

Structure #1 (Null)

Pre Dev. Area A

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	5.430	0.395	0.000	0.000	55.000	M	7.01	0.870
	Σ	**5.430**						**7.01**	**0.870**

Appendix I

Stormwater Detention Basin

APPENDIX I

STORMWATER DETENTION BASIN

Stormwater detention Basin 2 has been re-designed and re-configured to allow for the increase in tributary area as well as the slight increase in impervious area as a result of the Southeastern Realignment. During construction activities the basin will serve as a sedimentation basin. Details associated with the sedimentation basin are included within the Form I document of the Solid Waste Major Permit Modification Application. Upon completion of landfill operations onsite the sediment basin will be converted to a detention basin. The permanent detention basin is the subject of this report and is what is detailed on the Post Construction Stormwater Management Plans. The detention basin will also serve to meet the water quality requirements of the Ordinance.

Based upon the routing calculations provided in Appendix H the following are peak stages within Basin 2.

Storm Event	Peak Stage
2 yr. – 24 hr.	462.97
5 yr. – 24 hr.	464.42
10 yr. – 24 hr.	466.70
25 yr. – 24 hr.	468.74
50 yr. – 24 hr.	470.53
100 yr. – 24 hr.	471.25

Printouts for the routing of each storm event are attached hereto.

In order to meet rate discharge requirements which are extremely low dewatering times increase since the bottom 7 feet of the basin is dewatered by two (2) 2.5 inch orifices. PA BMP Manual recommends a dewatering time between 24 and 72 hours from the end of the design storm. Based upon the 100 year routing at 72 hours of dewatering the water elevation would be at +/- 465.00. To ensure no overtopping of the basin berm an analysis was performed assuming a 100 year-24 hour event occurrence when the basin dewatering level reached 465 and has not completely dewatered to elevation 460. The results of the analysis yield a peak discharge rate of

18 cfs and a peak stage of 471.67. No overtopping occurred in this assumed scenario nor will the peak discharge result in any offsite/downstream impact given the established waterways. The rate of discharge increase is +/- 12 cfs and the increase in elevation is +/- 6 inches during this most severe scenario. Thus we conclude the basin is adequately designed to manage the rate of runoff from the proposed development. The printouts are provided herein for reference.

IESI Bethlehem Landfill
Southeastern Realignment

Detention Basin 2

Post Closure

JMM

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	2 yr - 24 hr
Rainfall Depth:	3.000 inches

Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	1

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	462.94 ft
Dewater Time:	3.68 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)	
460.00	0.300	0.000	0.000		
460.01	0.301	0.003	0.000		Low hole SPW #1
460.50	0.365	0.166	0.115	17.16*	
461.00	0.437	0.366	0.163	14.84*	
461.50	0.515	0.604	0.200	14.36*	
462.00	0.600	0.883	0.232	14.56*	
462.50	0.624	1.189	0.259	14.30*	
462.94	0.646	1.472	0.281	13.00	Peak Stage
463.00	0.649	1.507	0.284		
463.50	0.674	1.838	0.307		
464.00	0.700	2.181	0.328		
464.50	0.749	2.544	0.348		
465.00	0.800	2.931	0.367		
465.50	0.822	3.336	0.385		
466.00	0.844	3.753	0.518		
466.50	0.867	4.181	0.582		
467.00	0.890	4.620	0.635		
467.50	0.913	5.071	0.681		
468.00	0.937	5.533	1.021		
468.50	0.961	6.008	1.183		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
469.00	0.985	6.494	1.314		
469.50	1.009	6.992	1.428		
470.00	1.034	7.503	1.531		
470.50	1.058	8.026	2.295		
471.00	1.082	8.561	2.661		Spillway #1
471.50	1.107	9.109	10.330		Spillway #2
472.00	1.132	9.668	32.860		
472.50	1.157	10.241	91.363		
473.00	1.182	10.825	151.823		
473.50	1.208	11.423	230.503		
474.00	1.234	12.033	325.442		
474.50	1.260	12.657	436.892		
475.00	1.286	13.293	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	2.50>0.000	0.000	0.000
460.50	0.115	0.000	0.115
461.00	0.163	0.000	0.163
461.50	0.200	0.000	0.200
462.00	0.232	0.000	0.232
462.50	0.259	0.000	0.259
463.00	0.284	0.000	0.284
463.50	0.307	0.000	0.307
464.00	0.328	0.000	0.328
464.50	0.348	0.000	0.348
465.00	0.367	0.000	0.367
465.50	2.50>0.385	0.000	0.385
466.00	0.518	0.000	0.518
466.50	0.582	0.000	0.582
467.00	0.635	0.000	0.635
467.50	4.00>0.681	0.000	0.681
468.00	1.021	0.000	1.021
468.50	1.183	0.000	1.183
469.00	1.314	0.000	1.314

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
469.50	1.428	0.000	1.428
470.00	6.00>1.531	0.000	1.531
470.50	2.295	0.000	2.295
471.00	2.661	0.000	2.661
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	5 yr - 24 hr
Rainfall Depth:	3.600 inches

Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	1

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	464.42 ft
Dewater Time:	5.26 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)	
460.00	0.300	0.000	0.000		
460.01	0.301	0.003	0.000		Low hole SPW #1
460.50	0.365	0.166	0.115	17.16*	
461.00	0.437	0.366	0.163	14.84*	
461.50	0.515	0.604	0.200	14.36*	
462.00	0.600	0.883	0.232	14.56*	
462.50	0.624	1.189	0.259	14.30*	
463.00	0.649	1.507	0.284	13.57*	
463.50	0.674	1.838	0.307	13.05*	
464.00	0.700	2.181	0.328	13.10	
464.42	0.743	2.483	0.344	11.25	Peak Stage
464.50	0.749	2.544	0.348		
465.00	0.800	2.931	0.367		
465.50	0.822	3.336	0.385		
466.00	0.844	3.753	0.518		
466.50	0.867	4.181	0.582		
467.00	0.890	4.620	0.635		
467.50	0.913	5.071	0.681		
468.00	0.937	5.533	1.021		
468.50	0.961	6.008	1.183		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
469.00	0.985	6.494	1.314		
469.50	1.009	6.992	1.428		
470.00	1.034	7.503	1.531		
470.50	1.058	8.026	2.295		
471.00	1.082	8.561	2.661		Spillway #1
471.50	1.107	9.109	10.330		Spillway #2
472.00	1.132	9.668	32.860		
472.50	1.157	10.241	91.363		
473.00	1.182	10.825	151.823		
473.50	1.208	11.423	230.503		
474.00	1.234	12.033	325.442		
474.50	1.260	12.657	436.892		
475.00	1.286	13.293	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	2.50>0.000	0.000	0.000
460.50	0.115	0.000	0.115
461.00	0.163	0.000	0.163
461.50	0.200	0.000	0.200
462.00	0.232	0.000	0.232
462.50	0.259	0.000	0.259
463.00	0.284	0.000	0.284
463.50	0.307	0.000	0.307
464.00	0.328	0.000	0.328
464.50	0.348	0.000	0.348
465.00	0.367	0.000	0.367
465.50	2.50>0.385	0.000	0.385
466.00	0.518	0.000	0.518
466.50	0.582	0.000	0.582
467.00	0.635	0.000	0.635
467.50	4.00>0.681	0.000	0.681
468.00	1.021	0.000	1.021
468.50	1.183	0.000	1.183
469.00	1.314	0.000	1.314

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
469.50	1.428	0.000	1.428
470.00	6.00>1.531	0.000	1.531
470.50	2.295	0.000	2.295
471.00	2.661	0.000	2.661
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	4.560 inches

Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	1

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	466.70 ft
Dewater Time:	7.39 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)	
460.00	0.300	0.000	0.000		
460.01	0.301	0.003	0.000		Low hole SPW #1
460.50	0.365	0.166	0.115	17.16*	
461.00	0.437	0.366	0.163	14.84*	
461.50	0.515	0.604	0.200	14.36*	
462.00	0.600	0.883	0.232	14.56*	
462.50	0.624	1.189	0.259	14.30*	
463.00	0.649	1.507	0.284	13.57*	
463.50	0.674	1.838	0.307	13.05*	
464.00	0.700	2.181	0.328	12.68*	
464.50	0.749	2.544	0.348	12.60*	
465.00	0.800	2.931	0.367	12.78*	
465.50	0.822	3.336	0.385	12.76*	
466.00	0.844	3.753	0.518	11.25	
466.50	0.867	4.181	0.582	9.45	
466.70	0.876	4.357	0.603	3.90	Peak Stage
467.00	0.890	4.620	0.635		
467.50	0.913	5.071	0.681		
468.00	0.937	5.533	1.021		
468.50	0.961	6.008	1.183		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
469.00	0.985	6.494	1.314		
469.50	1.009	6.992	1.428		
470.00	1.034	7.503	1.531		
470.50	1.058	8.026	2.295		
471.00	1.082	8.561	2.661		Spillway #1
471.50	1.107	9.109	10.330		Spillway #2
472.00	1.132	9.668	32.860		
472.50	1.157	10.241	91.363		
473.00	1.182	10.825	151.823		
473.50	1.208	11.423	230.503		
474.00	1.234	12.033	325.442		
474.50	1.260	12.657	436.892		
475.00	1.286	13.293	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	2.50>0.000	0.000	0.000
460.50	0.115	0.000	0.115
461.00	0.163	0.000	0.163
461.50	0.200	0.000	0.200
462.00	0.232	0.000	0.232
462.50	0.259	0.000	0.259
463.00	0.284	0.000	0.284
463.50	0.307	0.000	0.307
464.00	0.328	0.000	0.328
464.50	0.348	0.000	0.348
465.00	0.367	0.000	0.367
465.50	2.50>0.385	0.000	0.385
466.00	0.518	0.000	0.518
466.50	0.582	0.000	0.582
467.00	0.635	0.000	0.635
467.50	4.00>0.681	0.000	0.681
468.00	1.021	0.000	1.021
468.50	1.183	0.000	1.183
469.00	1.314	0.000	1.314

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
469.50	1.428	0.000	1.428
470.00	6.00>1.531	0.000	1.531
470.50	2.295	0.000	2.295
471.00	2.661	0.000	2.661
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.520 inches

Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	1

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	468.74 ft
Dewater Time:	8.44 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)	
460.00	0.300	0.000	0.000		
460.01	0.301	0.003	0.000		Low hole SPW #1
460.50	0.365	0.166	0.115	17.16*	
461.00	0.437	0.366	0.163	14.84*	
461.50	0.515	0.604	0.200	14.36*	
462.00	0.600	0.883	0.232	14.56*	
462.50	0.624	1.189	0.259	14.30*	
463.00	0.649	1.507	0.284	13.57*	
463.50	0.674	1.838	0.307	13.05*	
464.00	0.700	2.181	0.328	12.68*	
464.50	0.749	2.544	0.348	12.60*	
465.00	0.800	2.931	0.367	12.78*	
465.50	0.822	3.336	0.385	12.76*	
466.00	0.844	3.753	0.518	9.74*	
466.50	0.867	4.181	0.582	8.89*	
467.00	0.890	4.620	0.635	8.37*	
467.50	0.913	5.071	0.681	8.30	
468.00	0.937	5.533	1.021	6.65	
468.50	0.961	6.008	1.183	5.20	
468.74	0.973	6.245	1.247	2.80	Peak Stage

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
469.00	0.985	6.494	1.314		
469.50	1.009	6.992	1.428		
470.00	1.034	7.503	1.531		
470.50	1.058	8.026	2.295		
471.00	1.082	8.561	2.661		Spillway #1
471.50	1.107	9.109	10.330		Spillway #2
472.00	1.132	9.668	32.860		
472.50	1.157	10.241	91.363		
473.00	1.182	10.825	151.823		
473.50	1.208	11.423	230.503		
474.00	1.234	12.033	325.442		
474.50	1.260	12.657	436.892		
475.00	1.286	13.293	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	2.50>0.000	0.000	0.000
460.50	0.115	0.000	0.115
461.00	0.163	0.000	0.163
461.50	0.200	0.000	0.200
462.00	0.232	0.000	0.232
462.50	0.259	0.000	0.259
463.00	0.284	0.000	0.284
463.50	0.307	0.000	0.307
464.00	0.328	0.000	0.328
464.50	0.348	0.000	0.348
465.00	0.367	0.000	0.367
465.50	2.50>0.385	0.000	0.385
466.00	0.518	0.000	0.518
466.50	0.582	0.000	0.582
467.00	0.635	0.000	0.635
467.50	4.00>0.681	0.000	0.681
468.00	1.021	0.000	1.021
468.50	1.183	0.000	1.183
469.00	1.314	0.000	1.314

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
469.50	1.428	0.000	1.428
470.00	6.00>1.531	0.000	1.531
470.50	2.295	0.000	2.295
471.00	2.661	0.000	2.661
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	50 yr - 24 hr
Rainfall Depth:	6.480 inches

Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	1

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	470.53 ft
Dewater Time:	8.98 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)	
460.00	0.300	0.000	0.000		
460.01	0.301	0.003	0.000		Low hole SPW #1
460.50	0.365	0.166	0.115	17.16*	
461.00	0.437	0.366	0.163	14.84*	
461.50	0.515	0.604	0.200	14.36*	
462.00	0.600	0.883	0.232	14.56*	
462.50	0.624	1.189	0.259	14.30*	
463.00	0.649	1.507	0.284	13.57*	
463.50	0.674	1.838	0.307	13.05*	
464.00	0.700	2.181	0.328	12.68*	
464.50	0.749	2.544	0.348	12.60*	
465.00	0.800	2.931	0.367	12.78*	
465.50	0.822	3.336	0.385	12.76*	
466.00	0.844	3.753	0.518	9.74*	
466.50	0.867	4.181	0.582	8.89*	
467.00	0.890	4.620	0.635	8.37*	
467.50	0.913	5.071	0.681	8.01*	
468.00	0.937	5.533	1.021	5.48*	
468.50	0.961	6.008	1.183	5.20	
469.00	0.985	6.494	1.314	4.70	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
469.50	1.009	6.992	1.428	4.40	
470.00	1.034	7.503	1.531	4.20	
470.50	1.058	8.026	2.295	3.45	
470.53	1.060	8.059	2.317	0.40	Peak Stage
471.00	1.082	8.561	2.661		Spillway #1
471.50	1.107	9.109	10.330		Spillway #2
472.00	1.132	9.668	32.860		
472.50	1.157	10.241	91.363		
473.00	1.182	10.825	151.823		
473.50	1.208	11.423	230.503		
474.00	1.234	12.033	325.442		
474.50	1.260	12.657	436.892		
475.00	1.286	13.293	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	2.50>0.000	0.000	0.000
460.50	0.115	0.000	0.115
461.00	0.163	0.000	0.163
461.50	0.200	0.000	0.200
462.00	0.232	0.000	0.232
462.50	0.259	0.000	0.259
463.00	0.284	0.000	0.284
463.50	0.307	0.000	0.307
464.00	0.328	0.000	0.328
464.50	0.348	0.000	0.348
465.00	0.367	0.000	0.367
465.50	2.50>0.385	0.000	0.385
466.00	0.518	0.000	0.518
466.50	0.582	0.000	0.582
467.00	0.635	0.000	0.635
467.50	4.00>0.681	0.000	0.681
468.00	1.021	0.000	1.021
468.50	1.183	0.000	1.183
469.00	1.314	0.000	1.314

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
469.50	1.428	0.000	1.428
470.00	6.00>1.531	0.000	1.531
470.50	2.295	0.000	2.295
471.00	2.661	0.000	2.661
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	7.440 inches

Initial Pool:	0.00 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	1

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	471.25 ft
Dewater Time:	9.42 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)	
460.00	0.300	0.000	0.000		
460.01	0.301	0.003	0.000		Low hole SPW #1
460.50	0.365	0.166	0.115	17.16*	
461.00	0.437	0.366	0.163	14.84*	
461.50	0.515	0.604	0.200	14.36*	
462.00	0.600	0.883	0.232	14.56*	
462.50	0.624	1.189	0.259	14.30*	
463.00	0.649	1.507	0.284	13.57*	
463.50	0.674	1.838	0.307	13.05*	
464.00	0.700	2.181	0.328	12.68*	
464.50	0.749	2.544	0.348	12.60*	
465.00	0.800	2.931	0.367	12.78*	
465.50	0.822	3.336	0.385	12.76*	
466.00	0.844	3.753	0.518	9.74*	
466.50	0.867	4.181	0.582	8.89*	
467.00	0.890	4.620	0.635	8.37*	
467.50	0.913	5.071	0.681	8.01*	
468.00	0.937	5.533	1.021	5.48*	
468.50	0.961	6.008	1.183	5.20	
469.00	0.985	6.494	1.314	4.70	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
469.50	1.009	6.992	1.428	4.40	
470.00	1.034	7.503	1.531	4.20	
470.50	1.058	8.026	2.295	3.35	
471.00	1.082	8.561	2.661	2.75	Spillway #1
471.25	1.095	8.834	6.481	8.45	Peak Stage
471.50	1.107	9.109	10.330		Spillway #2
472.00	1.132	9.668	32.860		
472.50	1.157	10.241	91.363		
473.00	1.182	10.825	151.823		
473.50	1.208	11.423	230.503		
474.00	1.234	12.033	325.442		
474.50	1.260	12.657	436.892		
475.00	1.286	13.293	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	2.50>0.000	0.000	0.000
460.50	0.115	0.000	0.115
461.00	0.163	0.000	0.163
461.50	0.200	0.000	0.200
462.00	0.232	0.000	0.232
462.50	0.259	0.000	0.259
463.00	0.284	0.000	0.284
463.50	0.307	0.000	0.307
464.00	0.328	0.000	0.328
464.50	0.348	0.000	0.348
465.00	0.367	0.000	0.367
465.50	2.50>0.385	0.000	0.385
466.00	0.518	0.000	0.518
466.50	0.582	0.000	0.582
467.00	0.635	0.000	0.635
467.50	4.00>0.681	0.000	0.681
468.00	1.021	0.000	1.021
468.50	1.183	0.000	1.183
469.00	1.314	0.000	1.314

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
469.50	1.428	0.000	1.428
470.00	6.00>1.531	0.000	1.531
470.50	2.295	0.000	2.295
471.00	2.661	0.000	2.661
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

IESI Bethlehem Landfill
Southeastern Realignment

Detention Basin 2

Post Closure

BASIN PERMANENT POOL: 465.00

JMM

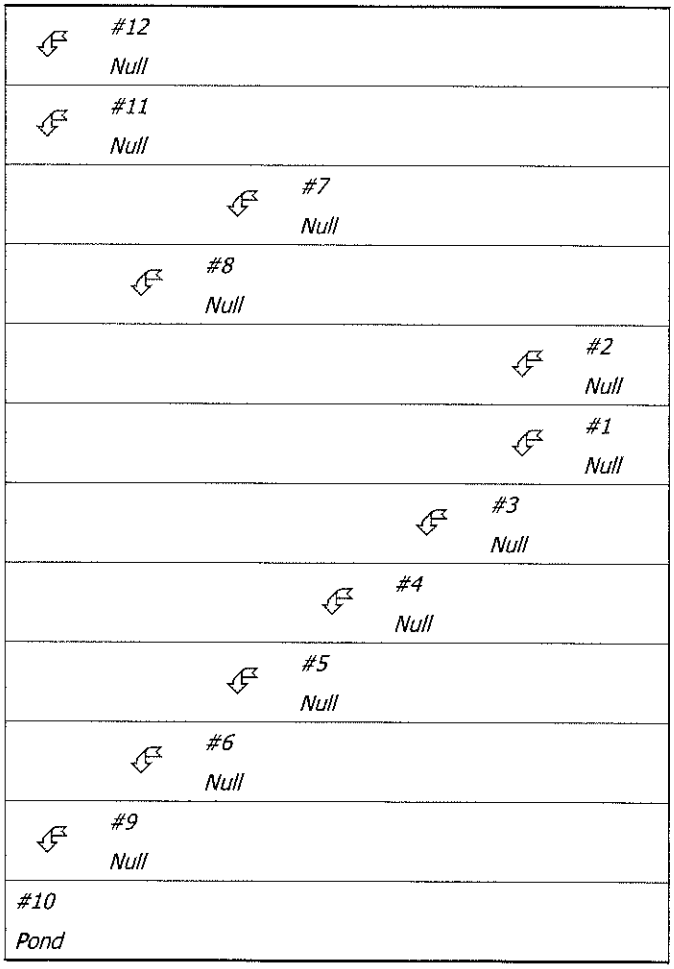
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	7.440 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#3	0.000	0.000	Channel X
Null	#2	==>	#3	0.000	0.000	Channel W
Null	#3	==>	#4	0.000	0.000	Channel Y
Null	#4	==>	#5	0.000	0.000	Channel O
Null	#5	==>	#6	0.000	0.000	Channel P
Null	#6	==>	#9	0.000	0.000	Channel Q
Null	#7	==>	#8	0.000	0.000	DS-7
Null	#8	==>	#9	0.000	0.000	Channel L
Null	#9	==>	#10	0.000	0.000	Channel N
Pond	#10	==>	End	0.000	0.000	Basin #2
Null	#11	==>	#10	0.000	0.000	DS-6
Null	#12	==>	#10	0.000	0.000	Channel M



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#12		2.170	2.170	9.90	0.82
#11		11.030	11.030	36.67	2.78
#7		7.120	7.120	9.43	1.20
#8		4.610	11.730	19.15	2.26
#2		3.920	3.920	6.21	0.67
#1		2.300	2.300	8.09	0.62
#3		12.160	18.380	31.76	3.49
#4		1.300	19.680	36.09	3.82
#5		7.880	27.560	44.87	5.15
#6		5.290	32.850	52.24	6.05
#9		0.590	45.170	71.53	8.52
#10	In	1.790	60.160	124.72	12.63
	Out			17.94	10.11

Initial Pool:	2.93 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
36.00	11.00	30.00	100.00	4.50	0.0240	471.00	1

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
471.50	20.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	471.67 ft
Dewater Time:	9.53 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)	
460.00	0.300	0.000	0.000		
460.01	0.301	0.003	0.000		Low hole SPW #1
460.50	0.365	0.166	0.115	17.16*	
461.00	0.437	0.366	0.163	14.84*	
461.50	0.515	0.604	0.200	14.36*	
462.00	0.600	0.883	0.232	14.56*	
462.50	0.624	1.189	0.259	14.30*	
463.00	0.649	1.507	0.284	13.57*	
463.50	0.674	1.838	0.307	13.05*	
464.00	0.700	2.181	0.328	12.68*	
464.50	0.749	2.544	0.348	12.60*	
465.00	0.800	2.931	0.367	12.78*	
465.50	0.822	3.336	0.385	12.76*	
466.00	0.844	3.753	0.518	9.74*	
466.50	0.867	4.181	0.582	8.89*	
467.00	0.890	4.620	0.635	8.37*	
467.50	0.913	5.071	0.681	8.01*	
468.00	0.937	5.533	1.021	5.48*	
468.50	0.961	6.008	1.183	5.20	
469.00	0.985	6.494	1.314	4.70	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
469.50	1.009	6.992	1.428	4.40	
470.00	1.034	7.503	1.531	4.20	
470.50	1.058	8.026	2.295	3.35	
471.00	1.082	8.561	2.661	2.75	Spillway #1
471.50	1.107	9.109	10.330	9.70	Spillway #2
471.67	1.115	9.298	17.936	1.35	Peak Stage
472.00	1.132	9.668	32.860		
472.50	1.157	10.241	91.363		
473.00	1.182	10.825	151.823		
473.50	1.208	11.423	230.503		
474.00	1.234	12.033	325.442		
474.50	1.260	12.657	436.892		
475.00	1.286	13.293	565.241		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
460.00	0.000	0.000	0.000
460.01	2.50>0.000	0.000	0.000
460.50	0.115	0.000	0.115
461.00	0.163	0.000	0.163
461.50	0.200	0.000	0.200
462.00	0.232	0.000	0.232
462.50	0.259	0.000	0.259
463.00	0.284	0.000	0.284
463.50	0.307	0.000	0.307
464.00	0.328	0.000	0.328
464.50	0.348	0.000	0.348
465.00	0.367	0.000	0.367
465.50	2.50>0.385	0.000	0.385
466.00	0.518	0.000	0.518
466.50	0.582	0.000	0.582
467.00	0.635	0.000	0.635
467.50	4.00>0.681	0.000	0.681
468.00	1.021	0.000	1.021
468.50	1.183	0.000	1.183
469.00	1.314	0.000	1.314

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
469.50	1.428	0.000	1.428
470.00	6.00>1.531	0.000	1.531
470.50	2.295	0.000	2.295
471.00	2.661	0.000	2.661
471.50	10.330	0.000	10.330
472.00	29.217	3.643	32.860
472.50	41.684	49.679	91.363
473.00	48.133	103.690	151.823
473.50	53.814	176.689	230.503
474.00	58.950	266.492	325.442
474.50	63.674	373.219	436.892
475.00	68.070	497.171	565.241

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)
#12	1	2.170	0.045	0.000	0.000	75.000	M	9.90	0.820
	Σ	**2.170**						**9.90**	**0.820**
#11	1	11.030	0.101	0.000	0.000	61.000	S	36.67	2.776
	Σ	**11.030**						**36.67**	**2.776**
#7	1	7.120	0.270	0.000	0.000	61.000	S	9.43	1.203
	Σ	**7.120**						**9.43**	**1.203**
#8	1	4.610	0.161	0.000	0.000	71.000	S	9.97	1.061
	Σ	**11.730**						**19.15**	**2.264**
#2	1	3.920	0.165	0.000	0.000	61.000	S	6.21	0.666
	Σ	**3.920**						**6.21**	**0.666**
#1	1	2.300	0.044	0.000	0.000	63.000	M	8.09	0.619
	Σ	**2.300**						**8.09**	**0.619**
#3	1	12.160	0.174	0.000	0.000	63.000	S	20.45	2.205
	Σ	**18.380**						**31.76**	**3.491**
#4	1	1.300	0.059	0.000	0.000	61.000	M	4.32	0.327
	Σ	**19.680**						**36.09**	**3.818**
#5	1	7.880	0.228	0.000	0.000	61.000	S	11.25	1.331
	Σ	**27.560**						**44.87**	**5.149**
#6	1	5.290	0.150	0.000	0.000	61.000	S	8.38	0.899
	Σ	**32.850**						**52.24**	**6.048**
#9	1	0.590	0.022	0.000	0.000	73.000	M	2.60	0.212
	Σ	**45.170**						**71.53**	**8.524**
#10	1	1.790	0.015	0.000	0.000	65.000	M	6.63	0.513
	Σ	**60.160**						**124.72**	**12.634**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		6. Grassed waterway	3.00	12.00	400.00	2.590	0.042
#1	**1**	**Time of Concentration:**					**0.044**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	6.67	10.00	150.00	2.060	0.020
		6. Grassed waterway	2.00	20.00	1,000.00	2.120	0.131
		6. Grassed waterway	10.00	25.00	250.00	4.740	0.014
#2	**1**	**Time of Concentration:**					**0.165**
#3	1	3. Short grass pasture	14.80	37.00	250.00	3.070	0.022
		6. Grassed waterway	3.10	45.00	1,450.00	2.640	0.152
#3	**1**	**Time of Concentration:**					**0.174**
#4	1	3. Short grass pasture	7.20	18.00	250.00	2.140	0.032
		8. Large gullies, diversions, and low flowing streams	1.00	3.00	300.00	3.000	0.027
#4	**1**	**Time of Concentration:**					**0.059**
#5	1	3. Short grass pasture	4.29	15.00	350.00	1.650	0.058
		8. Large gullies, diversions, and low flowing streams	0.50	6.50	1,300.00	2.120	0.170
#5	**1**	**Time of Concentration:**					**0.228**
#6	1	3. Short grass pasture	10.00	30.00	300.00	2.520	0.033
		8. Large gullies, diversions, and low flowing streams	0.50	4.50	900.00	2.120	0.117
#6	**1**	**Time of Concentration:**					**0.150**
#7	1	3. Short grass pasture	33.00	24.75	75.00	4.590	0.004
		6. Grassed waterway	3.00	73.50	2,450.00	2.590	0.262
		8. Large gullies, diversions, and low flowing streams	33.00	82.50	250.00	17.230	0.004
#7	**1**	**Time of Concentration:**					**0.270**
#8	1	3. Short grass pasture	33.00	16.50	49.99	4.590	0.003
		6. Grassed waterway	3.50	56.00	1,600.00	2.800	0.158
#8	**1**	**Time of Concentration:**					**0.161**
#9	1	6. Grassed waterway	20.00	110.00	550.00	6.700	0.022
#9	**1**	**Time of Concentration:**					**0.022**
#10	1	3. Short grass pasture	5.00	5.00	100.00	1.780	0.015
#10	**1**	**Time of Concentration:**					**0.015**
#11	1	3. Short grass pasture	33.00	33.00	99.99	4.590	0.006
		6. Grassed waterway	3.00	25.50	850.00	2.590	0.091
		8. Large gullies, diversions, and low flowing streams	33.00	90.75	275.00	17.230	0.004
#11	**1**	**Time of Concentration:**					**0.101**
#12	1	3. Short grass pasture	33.00	16.50	49.99	4.590	0.003
		6. Grassed waterway	12.00	96.00	800.00	5.190	0.042
#12	**1**	**Time of Concentration:**					**0.045**

Appendix J

Stormwater Channels

APPENDIX J

STORMWATER CHANNELS

CHANNEL DESIGN

All permanent channels were designed using the peak discharge from the contributing drainage area for the 25-year/24-hour storm event under post-development conditions. The channel designs are show on the SEDCAD printouts. In addition, the perimeter conveyance system to each proposed basin was designed to ensure conveyance of the 100-year/24-hour event to each basin. The existing conveyance system consists of Channels A thru C, E, G, H, K thru Q, S, Berm Swale, DIV#1 and DS-1 thru DS-4. **The Southeastern Realignment requires Channels L, M, and N to be reconfigured/redesigned Channels U, O, P and Q to be reviewed for adequacy and adds Channels V, W, X, Y, Z, DS-6 and DS-7.**

Bench Capacity

The proposed modifications do not change the design of the landfill benches.

Channel A Capacity

Existing (no changes)

Proposed Channel A lies within the Basin #4 drainage shed. The channel conveys runoff from the landfill face to Basin #4 along the access road. Channel A extends from Inlet #2 to Inlet #1 and the drainage area to Channel A was determined to be 2.2 acres. The drainage area analysis was completed within the Basin 4 design in which a 100-year peak discharge rate was determined to be 10.03 cfs. The channel was analyzed using an average slope of 5% and 2%.

Channel B Capacity

Existing (no changes)

Proposed Channel B lies within the Basin #6 drainage shed. The channel conveys runoff from the landfill face to Basin 6 along the access road. Channel B extends from Inlet #3 to Inlet #2 and the drainage area to Channel B was determined to be 0.7 acres. The drainage area analysis

was completed within the Basin 6 design in which a 100-year peak discharge rate was determined to be 3.8 cfs. The channel was analyzed using an average slope of 5.0%.

Channel C Capacity

Existing (no changes)

Channel C lies within the Basin #6 drainage shed. The channel conveys runoff from the landfill face to Basin 6 along the access road. Channel C extends from Culvert 16 to Inlet #3 and the drainage area to Channel C was determined to be 11.6 acres. The drainage area analysis was completed within the Basin 6 design in which a 100-year peak discharge rate was determined to be 52.8 cfs. The channel was analyzed using an average slope of 5% and 20%.

Channel D Capacity

Existing Channel D was eliminated during the construction of Cell 4F.

Channel E Capacity

A section of Channel E was removed during the construction of Cell 4F. (No Changes)

The remaining section will be directed to Inlet 14 / Sediment Trap A. Existing Channel E lies within the Sediment Trap A drainage shed consisting of approximately 4.0 acres. The channel conveys runoff from the landfill face to Sediment Trap A along the access road. The drainage area analysis was completed for Sediment Trap A, in which a 100-year peak discharge rate was determined to be 10.3 cfs. The channel was analyzed using an average slope of 1.5%.

Channel G Capacity

Existing (no changes)

Proposed Channel G lies within the proposed Basin #3 drainage shed. The channel conveys runoff from the landfill access road to Basin #3 along the toe of the access road berm. The drainage area to Channel G was determined to be 0.25 acres. The drainage area analysis was completed within the Basin 3 design in which a 100-year peak discharge rate was determined to be 1.24 cfs. The channel was analyzed using an average slope of 2.9%.

Channel H Capacity

Existing (no changes)

Proposed Channel H lies within the Basin #3 drainage shed. The channel conveys runoff from the landfill access road to Basin #3 along the toe of the access road berm. The drainage area to Channel H was determined to be 0.6 acres. The drainage area analysis was completed within the Basin #3 design in which a 100-year peak discharge rate was determined to be 2.98 cfs. The channel was analyzed using an average slope of 1.0%.

Channel K Capacity

Existing (no changes)

Proposed Channel K lies within the Basin 6 drainage shed. The channel conveys runoff from culvert C-2 to the Landfill discharge point at Wetland A. The total 100-year peak discharge rate is that of the combined Basin 6 & 7 discharge of 33.9 cfs. The channel was analyzed using an average slope of 4.00%.

Channel L Capacity

Southeastern Realignment Channel Redesigned

Proposed Channel L lies within the Basin #2 drainage shed. The channel conveys runoff from the north face of the landfill along the access road discharging to I-15. The drainage area to Channel L was determined to be 4.61 acres. The drainage area analysis was completed within the Basin #2 design in which a peak 100-year discharge rate was determined to be 19.15 cfs. The channel was analyzed using average slopes of 2.4% and 6.7%. The channel design is shown on the attached SEDCAD printout and on the plan sheets.

Channel M Capacity

Southeastern Realignment Channel Redesigned

Proposed Channel M lies within the Basin #2 drainage shed. The channel conveys runoff from the southern face of the landfill from I-15 to I-16 along the access drive. The drainage area to Channel M was determined to be 2.17 acres. The drainage area analysis was completed within the Basin #2 analysis in which a peak 100-year discharge rate was determined to be 9.90 cfs.

The channel was analyzed using average slopes of 3.5% and 13.1%. The channel design is shown on the attached SEDCAD printout and on the plan sheets.

Channel N Capacity

Southeastern Realignment Channel Redesigned

Proposed Channel N lies within the Basin #2 drainage shed. The channel conveys runoff from C-23 to C-25 along the MSE Wall maintenance road. The drainage to Channel N was determined to be 45.2 acres. The drainage analysis was completed within the Basin #2 analysis in which a peak 100-year discharge rate was determined to be 71.53 cfs. The channel was designed with an average slope of 18.2% and 25%. The channel design is shown on the attached SEDCAD printout and on the plan sheets.

Channel O Capacity

Southeastern Realignment Channel Re-evaluated

Proposed Channel O lies within the Basin #2 drainage shed. Channel "O" was originally designed as part of the Cell 4F Modification. The tributary area to Channel "O" is being modified and thus the values contained herein reflect these modifications. The channel conveys runoff from the landfill face to Basin #2 across the slope of the old landfill. Channel O extends from the landfill face to Channel P and is underlain with a textured HDPE liner. The drainage area to Channel O was determined to be 19.7 acres. The drainage area analysis was completed within the Basin 2 design in which a 100-year peak discharge rate was determined to be 36.09 cfs. The channel was analyzed using an average slope of 0.5%. The channel is shown on the attached SEDCAD printout and on the plan sheets.

Channel P Capacity

Southeastern Realignment Channel Re-evaluated

Proposed Channel P lies within the Basin #2 drainage shed. The channel conveys runoff from the landfill face to Basin #2 across the slope of the old landfill. Channel P extends from Channel O to Channel Q and is underlain with an HDPE liner. The drainage area to Channel P was determined to be 27.6 acres. The drainage area analysis was completed within the Basin #2 design in which a 100-year peak discharge rate was determined to be 44.87 cfs. The channel was

design in which a 100-year peak discharge rate was calculated to be 8.10 cfs. The channel was analyzed using an average slope of 6.5% and 2%. The channel is shown on the attached SEDCAD printout and on the plan sheets.

Channel Y Capacity

New Channel Southeastern Realignment

Proposed Channel Y lies within the Basin #2 drainage shed. The channel conveys runoff from Culvert 21 to Channel O. The drainage area to Channel Y was determined to be 18.40 acres. The drainage area analysis was completed within the Basin #2 design in which a 100-year peak discharge rate was calculated to be 31.76 cfs. The channel was analyzed using an average slope of 1.8% and 3.9%. The channel is shown on the attached SEDCAD printouts and plan sheets.

Channel Z Capacity

New Channel Southeastern Realignment

Proposed Channel Z lie within the Area "A" drainage shed. The channel is proposed to divert offsite run-on around the area of development. Channel Z extends from a proposed level spreader outlet approximately 500 feet. The drainage area to Channel Z was determined to be 2.5 acres (Area "A" upon development). The drainage area analysis was completed within the pre-post SEDCAD computer program included herein in which a 100-year peak discharge was calculated to be 7.01 cfs. This is a conservative value. Channels Z was analyzed using an average slope of 0.7% and 21%.

Channels DS-1 to DS-5

Existing (No Changes)

Existing Channels DS-1 to DS-5 design shall remain the same as previously approved without change except DS-3 shall be extended as depicted on the plans for the Southeastern Realignment.

Channel DS-6 Capacity

New Channel Southeastern Realignment

Proposed Channel DS-6 lies within the Basin #2 drainage shed. The channel conveys runoff from the landfill face via benches to I-16 down the slope of the landfill. The tributary area to

DS-6 was determined to be 11.03 acres. The drainage area analysis was completed within the Basin #2 design in which a peak 100-year discharge rate of 36.67 cfs was calculated. The channel was analyzed using an average slope of 28%. The channel is shown on the attached SEDCAD printouts and on the plan sheets.

Channel DS-7 Capacity

New Channel Southeastern Realignment

Proposed Channel DS-7 lies within the Basin #2 drainage shed. The channel conveys runoff from the landfill face via benches to I-15 down the slope of the landfill. The tributary area to DS-7 was determined to be 7.12 acres. The drainage area analysis was completed within the Basin #2 design in which a peak 100-year discharge rate of 9.43 cfs was calculated. The channel was analyzed using an average slope of 28%. The channel is shown on the attached SEDCAD printouts and on the plan sheets.

Channel L @ 6.7%

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	2.0:1	2.0:1	6.7	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	19.15 cfs	
Depth:	0.72 ft	1.72 ft
Top Width:	5.87 ft	9.87 ft
Velocity:	6.02 fps	
X-Section Area:	3.18 sq ft	
Hydraulic Radius:	0.512 ft	
Froude Number:	1.44	
Manning's n:	0.0410	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Channel L @ 2.4%

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	2.0:1	2.0:1	2.4	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	19.15 cfs	
Depth:	0.88 ft	1.88 ft
Top Width:	6.52 ft	10.52 ft
Velocity:	4.58 fps	
X-Section Area:	4.18 sq ft	
Hydraulic Radius:	0.603 ft	
Froude Number:	1.01	
Manning's n:	0.0360	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Channel M @ 3.5%

Material: Riprap

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	3.5	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.90 cfs	
Depth:	1.04 ft	2.04 ft
Top Width:	4.18 ft	8.18 ft
Velocity:	4.54 fps	
X-Section Area:	2.18 sq ft	
Hydraulic Radius:	0.467 ft	
Froude Number:	1.11	
Manning's n:	0.0370	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Channel M @ 13.1%

Material: Riprap

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	13.1	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.90 cfs	
Depth:	0.87 ft	1.87 ft
Top Width:	3.48 ft	7.48 ft
Velocity:	6.53 fps	
X-Section Area:	1.52 sq ft	
Hydraulic Radius:	0.389 ft	
Froude Number:	1.75	
Manning's n:	0.0440	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Channel N @ 18.2%

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	2.0:1	2.0:1	18.2	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	71.53 cfs	
Depth:	1.29 ft	2.29 ft
Top Width:	8.16 ft	12.16 ft
Velocity:	9.95 fps	
X-Section Area:	7.19 sq ft	
Hydraulic Radius:	0.820 ft	
Froude Number:	1.87	
Manning's n:	0.0560	
Dmin:	5.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

Channel N @ 25.0%

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	2.0:1	2.0:1	25.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	71.53 cfs	
Depth:	1.20 ft	2.20 ft
Top Width:	7.80 ft	11.80 ft
Velocity:	11.03 fps	
X-Section Area:	6.49 sq ft	
Hydraulic Radius:	0.775 ft	
Froude Number:	2.13	
Manning's n:	0.0570	
Dmin:	5.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

Channel O @ 0.50%

Material: Riprap

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.0:1	8.0:1	0.5	1.00		

PADER Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	36.09 cfs	
Depth:	1.51 ft	2.51 ft
Top Width:	16.60 ft	27.60 ft
Velocity:	2.88 fps	
X-Section Area:	12.53 sq ft	
Hydraulic Radius:	0.743 ft	
Froude Number:	0.58	
Manning's n:	0.0300	
Dmin:	1.00 in	
D50:	1.50 in	
Dmax:	3.00 in	

Channel P @ 0.50%

Material: Riprap

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.0:1	8.0:1	0.5	1.00		

PADER Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	44.87 cfs	
Depth:	1.62 ft	2.62 ft
Top Width:	17.79 ft	28.79 ft
Velocity:	3.12 fps	
X-Section Area:	14.38 sq ft	
Hydraulic Radius:	0.796 ft	
Froude Number:	0.61	
Manning's n:	0.0290	
Dmin:	1.00 in	
D50:	1.50 in	
Dmax:	3.00 in	

Channel Q @ 0.50%

Material: Riprap

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.0:1	8.0:1	0.5	1.00		

PADER Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	52.24 cfs	
Depth:	1.71 ft	2.71 ft
Top Width:	18.83 ft	29.83 ft
Velocity:	3.24 fps	
X-Section Area:	16.12 sq ft	
Hydraulic Radius:	0.842 ft	
Froude Number:	0.62	
Manning's n:	0.0290	
Dmin:	1.00 in	
D50:	1.50 in	
Dmax:	3.00 in	

analyzed using an average slope of 0.5%. The channel design is shown on the attached SEDCAD printout and on the plan sheets.

Channel Q Capacity

Southeastern Realignment Channel Re-evaluated

Proposed Channel Q lies within the Basin #2 drainage shed. The channel conveys runoff from the landfill face to Basin #2 across the slope of the old landfill. Channel Q extends from Channel P to Culvert 17 and is underlain with an HDPE liner. The drainage area to Channel Q was determined to be 32.8 acres. The drainage area analysis was completed within the Basin #2 design in which a 100-year peak discharge rate was determined to be 52.24 cfs. The channel was analyzed using an average slope of 0.5%. The channel is shown on the attached SEDCAD printout and on the plan sheets.

Channel R and R-1 Capacity

Existing Channels R and R-1 are to be eliminated as part of the Southeastern Realignment.

Channel S Capacity

Existing (No Changes)

MSE Berm Channels Capacity

Existing (no changes)

The Berm Channel is located along the top of the MSE Berm at the north edge of the disposal area. This channel directs runoff to Inlets 10, 11, & 12 and Channel C.

The design of the Berm Channels was based on the 100-year 24-hour storm event. The Berm Channel design is based on the largest tributary area to the Berm Channel, the calculated flow depth of the flattest channel (1%) and the velocity/lining of the steepest channel (10.8%).

Channel T Capacity

Existing Channel T is to be eliminated during construction of the Southeastern Realignment.

Channel U Capacity

Existing (no changes)

Channel U lies within the Basin #2 drainage shed. The Channel conveys runoff from the landfill face extending from Channel DS-5 to Channel O. Channel U was originally designed as part of the 2013 Grading Adjustment Modification. The Southeastern Realignment revision requires the existing Channel to be reanalyzed for adequacy. The tributary area for Channel U was determined to be 8.0 acres having a peak discharge of 14.02 cfs for the 25-year storm event.

Channel V Capacity

New Channel Southeastern Realignment

Proposed Channel V lies within the Basin #1 drainage shed. The channel conveys runoff from the landfill face to an existing perimeter channel along the access road. The drainage area to Channel V was determined to be 0.6 acres. The drainage area analysis was completed within the SEDCAD computer program in which a peak 100-year rate was determined to be 1.81 cfs. The channel was analyzed using an average slope of 1.5%. The channel and analysis is shown on the attached SEDCAD printouts and drainage mapping.

Channel W Capacity

New Channel Southeastern Realignment

Proposed Channel W lies within the Basin #2 drainage shed. The channel conveys runoff from the landfill face at the outlet of a slope bench to I-18 along an access road. The drainage area to Channel W was determined to be 3.92 acres. The drainage area analysis was completed within the Basin #2 design in which a 100-year peak discharge rate was determined to be 6.21 cfs. The channel was analyzed using an average slope of 9.0% and 12.5%. The channel is shown on the attached SEDCAD printout and plan sheets.

Channel X Capacity

New Channel Southeastern Realignment

Proposed Channel X lies within the Basin #2 drainage shed. The channel conveys runoff from the landfill face along the access road to Culvert 21. The drainage area to Channel X was determined to be 2.3 acres. The drainage area analysis was completed within the Basin #2

Chennel W @ 9.0%

Material: Riprap

Triangular Channel

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

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.21 cfs	
Depth:	0.76 ft	1.76 ft
Top Width:	3.03 ft	7.03 ft
Velocity:	5.43 fps	
X-Section Area:	1.14 sq ft	
Hydraulic Radius:	0.338 ft	
Froude Number:	1.55	
Manning's n:	0.0400	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Chennel W @ 12.5%

Material: Riprap

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	12.5	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.21 cfs	
Depth:	0.72 ft	1.72 ft
Top Width:	2.87 ft	6.87 ft
Velocity:	6.02 fps	
X-Section Area:	1.03 sq ft	
Hydraulic Radius:	0.321 ft	
Froude Number:	1.77	
Manning's n:	0.0410	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Channel X @ 6.5%

Material: Riprap

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	6.5	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	8.10 cfs	
Depth:	0.88 ft	1.88 ft
Top Width:	3.52 ft	7.52 ft
Velocity:	5.23 fps	
X-Section Area:	1.55 sq ft	
Hydraulic Radius:	0.393 ft	
Froude Number:	1.39	
Manning's n:	0.0390	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Channel X @ 2.0%

Material: Riprap

Triangular Channel

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

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	8.10 cfs	
Depth:	1.01 ft	2.01 ft
Top Width:	4.03 ft	8.03 ft
Velocity:	3.99 fps	
X-Section Area:	2.03 sq ft	
Hydraulic Radius:	0.450 ft	
Froude Number:	0.99	
Manning's n:	0.0310	
Dmin:	1.00 in	
D50:	1.50 in	
Dmax:	3.00 in	

Channel Y @ 1.8%

Material: Riprap

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	1.8	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	31.76 cfs	
Depth:	1.79 ft	2.79 ft
Top Width:	7.18 ft	11.18 ft
Velocity:	4.93 fps	
X-Section Area:	6.44 sq ft	
Hydraulic Radius:	0.802 ft	
Froude Number:	0.92	
Manning's n:	0.0350	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Channel Y @ 3.9%

Material: Riprap

Triangular Channel

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.0:1	2.0:1	3.9	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	31.76 cfs	
Depth:	1.57 ft	2.57 ft
Top Width:	6.27 ft	10.27 ft
Velocity:	6.45 fps	
X-Section Area:	4.92 sq ft	
Hydraulic Radius:	0.702 ft	
Froude Number:	1.28	
Manning's n:	0.0360	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Channel Z @ 0.70%

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	2.0:1	2.0:1	0.7	1.00		

PADER Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.01 cfs	
Depth:	0.54 ft	1.54 ft
Top Width:	6.17 ft	10.17 ft
Velocity:	2.54 fps	
X-Section Area:	2.76 sq ft	
Hydraulic Radius:	0.430 ft	
Froude Number:	0.67	
Manning's n:	0.0280	
Dmin:	1.00 in	
D50:	1.50 in	
Dmax:	3.00 in	

Channel Z @ 21%

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	2.0:1	2.0:1	21.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.01 cfs	
Depth:	0.30 ft	1.30 ft
Top Width:	5.18 ft	9.18 ft
Velocity:	5.18 fps	
X-Section Area:	1.35 sq ft	
Hydraulic Radius:	0.255 ft	
Froude Number:	1.78	
Manning's n:	0.0530	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Channel DS-6 @ 28%

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	0.0:1	0.0:1	28.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	36.67 cfs	
Depth:	0.57 ft	1.57 ft
Top Width:	8.01 ft	8.03 ft
Velocity:	8.10 fps	
X-Section Area:	4.53 sq ft	
Hydraulic Radius:	0.496 ft	
Froude Number:	1.90	
Manning's n:	0.0610	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Channel DS-7 @ 28%

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	0.0:1	0.0:1	28.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.43 cfs	
Depth:	0.27 ft	1.27 ft
Top Width:	6.01 ft	6.03 ft
Velocity:	5.72 fps	
X-Section Area:	1.65 sq ft	
Hydraulic Radius:	0.252 ft	
Froude Number:	1.92	
Manning's n:	0.0550	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Appendix K

Stormwater Culverts

APPENDIX K

STORMWATER CULVERTS

CULVERT DESIGN

All permanent culverts were designed using the peak discharge from the maximum contributing drainage area for the 100-year/24-hour storm event under post-development conditions. The culverts were designed as described below utilizing the SEDCAD computer program. In addition, the conveyance system to each proposed basin was designed to ensure conveyance of the 100-year/24-hour event to each basin. Culverts C-1 thru C-26 shall be part of the conveyance system.

Culverts C-1 thru C-10, C-13 thru C16, C-18 thru C-20 EXISTING – no change

Culvert C-17

Culvert 17 is to be reconfigured and redesigned as part of the Southeastern Realignment. Culvert C-17 will be installed to convey the discharge from Channel Q to Stormwater Manhole #10. The peak discharge from the 100-year/24-hour storm event was calculated to be 52.24 cfs or the total flow from Channel Q. One culvert will be installed to adequately pass 52.24 cfs. The SEDCAD output is attached and the sizing of the culverts is as follows:

Design Discharge	52.24 cfs
Pipe Length	655 FT
Pipe Slope	1% and 4.6%
Manning's n	0.012
Maximum Headwater	7.0 FT
Proposed Pipe Diameter	36 inches

Culvert 21 & 21A

Culvert 21 is to be reconfigured and redesigned as part of the Southeastern Realignment. Culvert 21 will be installed to convey the combined runoff from Channels X and W to Channel Y. The peak discharge from the 100-year storm event was calculated during the Basin #2 analysis for

combining Channels X and W is 14.3 cfs. One culvert will be installed to adequately pass 14.3 cfs. The output is attached and the sizing of the culvert is as follows:

Design Discharge	14.3 cfs
Pipe Length	113 FT
Pipe Slope	1.0%
Manning's n	0.012
Maximum Headwater	5.0 FT
Proposed Pipe Diameter	24 inches

Culvert C-22

Culvert C-22 is a new culvert as part of the Southeastern Realignment. Culvert C-22 will be installed to convey the discharge from I-15 to Stormwater Manhole #10. The peak discharge from the 100-year/24-hour storm event was calculated during the Basin #2 analysis by combining DS-7 and Channel L and is 28.58 cfs. One culvert will be installed to adequately pass 28.58 cfs. The SEDCAD output is attached and the sizing of the culverts is as follows:

Design Discharge	28.58 cfs
Pipe Length	26 FT
Pipe Slope	1.0 %
Manning's n	0.012
Maximum Headwater	3.0 FT
Proposed Pipe Diameter	24 inches

Culvert C-23

Culvert C-23 will be installed to convey the discharge from Stormwater Manhole #10 to Channel N. The peak discharge from the 100-year/24-hour storm event was calculated during the Basin #2 analysis for Channel "N" and is 71.53 cfs. One culvert will be installed to adequately pass 71.53 cfs. The output is attached and the sizing of the culverts is as follows:

Design Discharge	71.53 cfs
Pipe Length	90 FT

Pipe Slope	5.29% and 1.0%
Manning's n	0.012
Maximum Headwater	6.0 FT
Proposed Pipe Diameter	48 inches

Culvert C-24

Culvert C-24 will be installed to convey the discharge from Inlet #16 to Basin #2. The peak discharge from the 100-year/24-hour storm event was calculated during the Basin #2 analysis combining rates for Channel M and DS-6 and is 46.57 cfs. One culvert will be installed to adequately pass 46.57 cfs. The output is attached and the sizing of the culverts is as follows:

Design Discharge	46.57 cfs
Pipe Length	637 FT
Pipe Slope	1.06%, 3.73%, 11.88%
Manning's n	0.012
Maximum Headwater	4.0 FT
Proposed Pipe Diameter	36 inches

Culvert C-25

Culvert C-25 will be installed to convey the discharge from Channel N to Basin #2. The peak discharge from the 100-year/24-hour storm event was calculated during the Basin #2 analysis for Channel N and is 71.53 cfs. One culvert will be installed to adequately pass 71.53 cfs. The output is attached and the sizing of the culverts is as follows:

Design Discharge	71.53 cfs
Pipe Length	30 FT
Pipe Slope	1.67%
Manning's n	0.012
Maximum Headwater	5.0 FT
Proposed Pipe Diameter	48 inches

APRON DESIGN

Riprap aprons have been designed for construction within the Southeastern Realignment to dissipate energy and prevent scour problems. The aprons have been designed as outlined below for culvert outlets within the Southeastern Realignment.

Culvert C-21A Apron

The apron for Culvert C-21A has been designed for the outfall to Channel "Y". The apron was designed as follows:

The flow from Culvert C-21A for the 100-year/24-hour storm event is 14.3 cfs with a proposed diameter of 24 inches.

Using Figure 21 of Reference #2, the following design can be determined:

Length of Apron	14 FT
Width of Apron	Width to conform to Channel "Y"
D_{50} (Riprap)	R-4
Riprap Thickness	18 inches

Culvert C-23 Apron

The flow from Culvert C-23 for the 100-year/24-hour storm event is 71.53 cfs with a proposed diameter of 48 inches. The width of the outfall is designed to conform to Channel "N".

Using Figure 9.3 of Reference #2, the following design can be determined:

Length of Apron	22 FT
Width of Apron	Width to conform to Channel "N"
D_{50} (Riprap)	R-5
Riprap Thickness	27 inches

Culvert C-24 Apron

The flow from Culvert C-24 for the 100-year/24-hour storm event is 46.57 cfs with a proposed diameter of 36 inches.

Using Figure 9.3 of Reference #2, the following design can be determined:

Length of Apron	20 FT
Width of Apron	29 FT
D_{50} (Riprap)	R-5
Riprap Thickness	27 inches

Culvert C-25 Apron

The flow from Culvert C-25 for the 100-year/24-hour storm event is 71.53 cfs with a proposed diameter of 48 inches.

Using Figure 9.3 of Reference #2, the following design can be determined:

Length of Apron	26 FT
Width of Apron	38 FT
D_{50} (Riprap)	R-6
Riprap Thickness	36 inches

Culvert C-17 @ 1.0%

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
655.00	1.00	0.0120	7.00	0.00	0.50

Culvert Results:

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

Detailed Performance Curves

Design Discharge = 52.24 cfs

Maximum Headwater = 7.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (30 in)	**Discharge (cfs) (36 in)**	Discharge (cfs) (42 in)
0.70	3.07	**3.68**	4.29
1.40	8.67	**10.41**	12.14
2.10	15.93	**19.12**	22.31
2.80	24.53	**29.44**	34.34
3.50	31.83	**40.98**	47.99
4.20	37.82	**50.23**	62.17
4.90	42.99	**58.21**	73.84
5.60	47.60	**65.22**	84.01
6.30	49.97	**71.55**	93.07
7.00	51.62	**77.37**	101.32
7.70	53.18	**82.33**	108.92
8.40	54.70	**84.87**	116.07
9.10	56.17	**87.23**	122.77
9.80	57.61	**89.53**	128.34
10.50	59.01	**91.77**	132.35

Culvert C-17 @ 4.6%

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
655.00	4.60	0.0120	7.00	0.00	0.50

Culvert Results:

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

36" PROVIDED

Detailed Performance Curves

Design Discharge = 52.24 cfs

Maximum Headwater = 7.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (24 in)	**Discharge (cfs) (30 in)**	Discharge (cfs) (36 in)
0.70	2.46	**3.07**	3.68
1.40	6.94	**8.67**	10.41
2.10	12.75	**15.93**	19.12
2.80	18.22	**24.53**	29.44
3.50	22.43	**31.83**	40.98
4.20	25.95	**37.82**	50.23
4.90	29.06	**42.99**	58.21
5.60	31.87	**47.60**	65.22
6.30	34.46	**51.80**	71.55
7.00	36.85	**55.68**	77.37
7.70	39.10	**59.32**	82.78
8.40	41.23	**62.74**	87.85
9.10	43.25	**65.98**	92.65
9.80	45.19	**69.07**	97.21
10.50	47.04	**72.03**	101.56

Culvert 21 & 21A @ 1.0%

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
113.00	1.00	0.0120	5.00	0.00	0.50

Culvert Results:

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

24" PROVIDED

Detailed Performance Curves

Design Discharge = 14.30 cfs

Maximum Headwater = 5.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (15 in)	**Discharge (cfs) (18 in)**	Discharge (cfs) (21 in)
0.50	0.94	**1.12**	1.30
1.00	2.62	**3.14**	3.66
1.50	4.78	**5.77**	6.73
2.00	6.40	**8.43**	10.33
2.50	7.72	**10.47**	13.32
3.00	8.83	**12.18**	15.78
3.50	9.61	**13.67**	17.91
4.00	10.27	**15.02**	19.80
4.50	10.87	**16.25**	21.54
5.00	11.46	**17.31**	23.14
5.50	12.01	**18.18**	24.64
6.00	12.54	**19.01**	26.05
6.50	13.05	**19.80**	27.39
7.00	13.53	**20.57**	28.67
7.50	14.00	**21.31**	29.88

Culvert C-22 @ 1.0%

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
26.00	1.00	0.0120	5.00	0.00	0.50

Culvert Results:

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

Detailed Performance Curves

Design Discharge = 28.58 cfs

Maximum Headwater = 5.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (21 in)	**Discharge (cfs) (24 in)**	Discharge (cfs) (30 in)
0.50	1.30	**1.49**	1.86
1.00	3.66	**4.19**	5.24
1.50	6.73	**7.69**	9.62
2.00	10.33	**11.85**	14.81
2.50	13.32	**16.11**	20.69
3.00	15.78	**19.52**	26.85
3.50	17.91	**22.43**	31.83
4.00	19.80	**25.01**	36.21
4.50	21.54	**27.34**	40.12
5.00	23.14	**29.48**	43.68
5.50	24.64	**31.49**	46.97
6.00	26.05	**33.37**	50.04
6.50	27.39	**35.16**	52.94
7.00	28.67	**36.85**	55.69
7.50	29.88	**38.47**	58.30

Culvert C-23 @ 5.29%

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
90.00	5.29	0.0120	6.00	0.00	0.50

Culvert Results:

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

48" PROVIDED

Detailed Performance Curves

Design Discharge = 71.53 cfs

Maximum Headwater = 6.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (36 in)	**Discharge (cfs) (42 in)**	Discharge (cfs) (45 in)
0.60	2.92	**3.41**	3.65
1.20	8.26	**9.63**	10.32
1.80	15.17	**17.70**	18.96
2.40	23.36	**27.25**	29.20
3.00	32.64	**38.08**	40.80
3.60	42.25	**50.06**	53.64
4.20	50.23	**62.17**	67.59
4.80	57.14	**72.28**	79.63
5.40	63.30	**81.23**	90.29
6.00	68.91	**89.29**	99.82
6.60	74.10	**96.69**	108.52
7.20	78.95	**103.55**	116.57
7.80	83.52	**109.99**	124.10
8.40	87.85	**116.07**	131.18
9.00	91.98	**121.85**	137.91

Culvert C-24 @ 1.06%

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
637.00	1.06	0.0120	4.00	0.00	0.50

Culvert Results:

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

Detailed Performance Curves

Design Discharge = 46.57 cfs

Maximum Headwater = 4.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (30 in)	**Discharge (cfs) (36 in)**	Discharge (cfs) (42 in)
0.40	1.33	**1.59**	1.86
0.80	3.75	**4.50**	5.24
1.20	6.88	**8.26**	9.63
1.60	10.59	**12.71**	14.83
2.00	14.81	**17.77**	20.73
2.40	19.46	**23.36**	27.25
2.80	24.53	**29.43**	34.34
3.20	28.90	**35.96**	41.95
3.60	32.77	**42.27**	50.06
4.00	36.22	**47.70**	58.63
4.40	39.37	**52.64**	65.63
4.80	42.29	**57.14**	72.28
5.20	45.03	**61.31**	78.36
5.60	47.60	**65.22**	84.01
6.00	49.89	**68.92**	89.30

Culvert C-24 @ 3.73%

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
637.00	3.73	0.0120	4.00	0.00	0.50

Culvert Results:

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

Detailed Performance Curves

Design Discharge = 46.57 cfs

Maximum Headwater = 4.00 ft

(BOLD indicates design pipe size)

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

Culvert C-24 @ 11.88%

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
637.00	11.88	0.0120	4.00	0.00	0.50

Culvert Results:

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

Detailed Performance Curves

Design Discharge = 46.57 cfs

Maximum Headwater = 4.00 ft

(BOLD indicates design pipe size)

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

Culvert C-25 @ 1.67%

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
30.00	1.67	0.0120	5.00	0.00	0.50

Culvert Results:

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

48" PROVIDED

Detailed Performance Curves

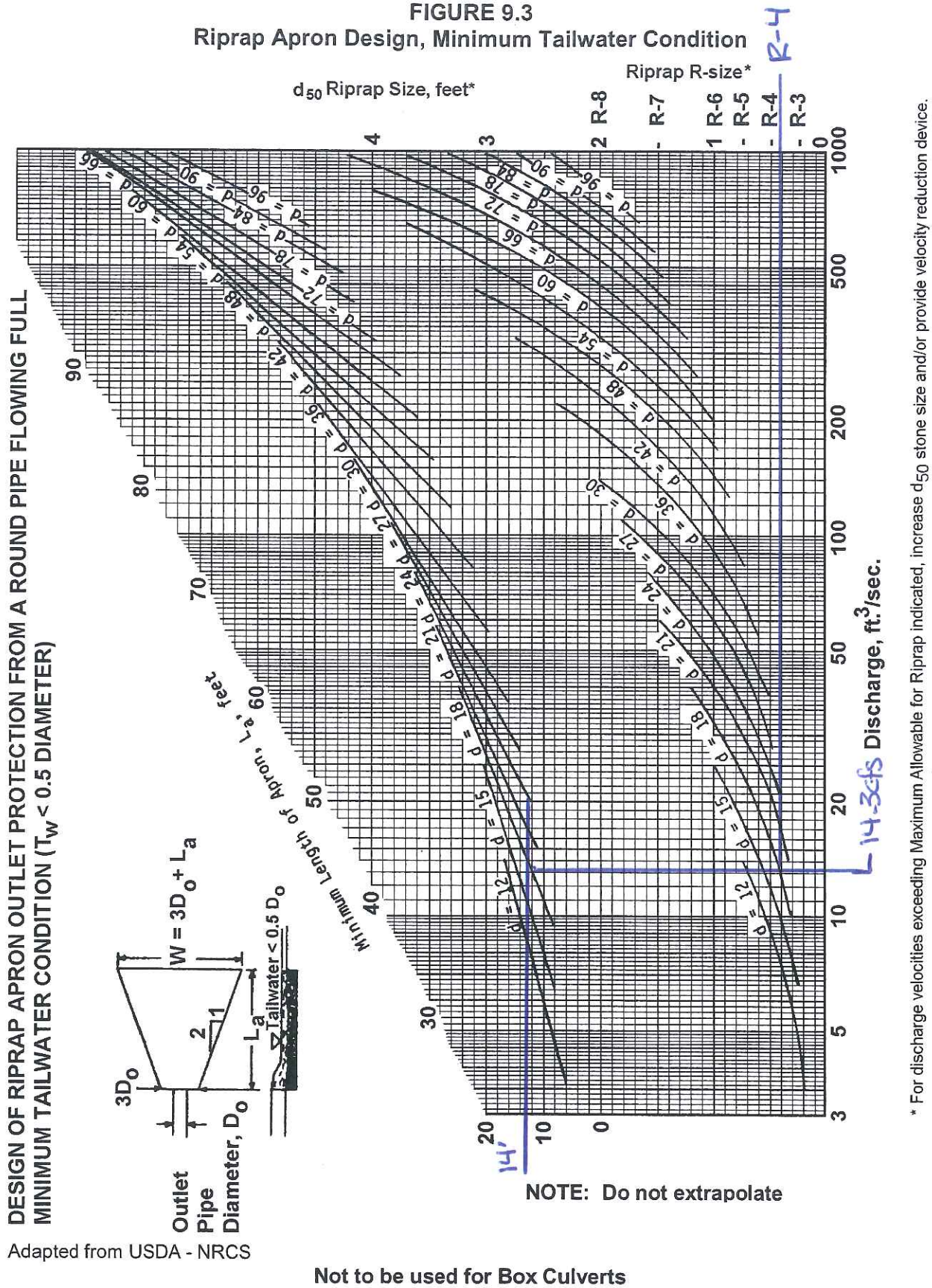
Design Discharge = 71.53 cfs

Maximum Headwater = 5.00 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (36 in)	**Discharge (cfs) (42 in)**	Discharge (cfs) (45 in)
0.50	2.22	**2.59**	2.78
1.00	6.28	**7.33**	7.85
1.50	11.54	**13.47**	14.43
2.00	17.77	**20.73**	22.21
2.50	24.83	**28.97**	31.04
3.00	32.64	**38.08**	40.80
3.50	41.13	**47.99**	51.41
4.00	47.70	**58.63**	62.82
4.50	53.79	**67.36**	74.18
5.00	59.27	**75.38**	83.34
5.50	64.27	**82.63**	91.95
6.00	68.91	**89.30**	99.82
6.50	73.27	**95.50**	107.12
7.00	77.37	**101.32**	113.95
7.50	81.27	**106.82**	120.39

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

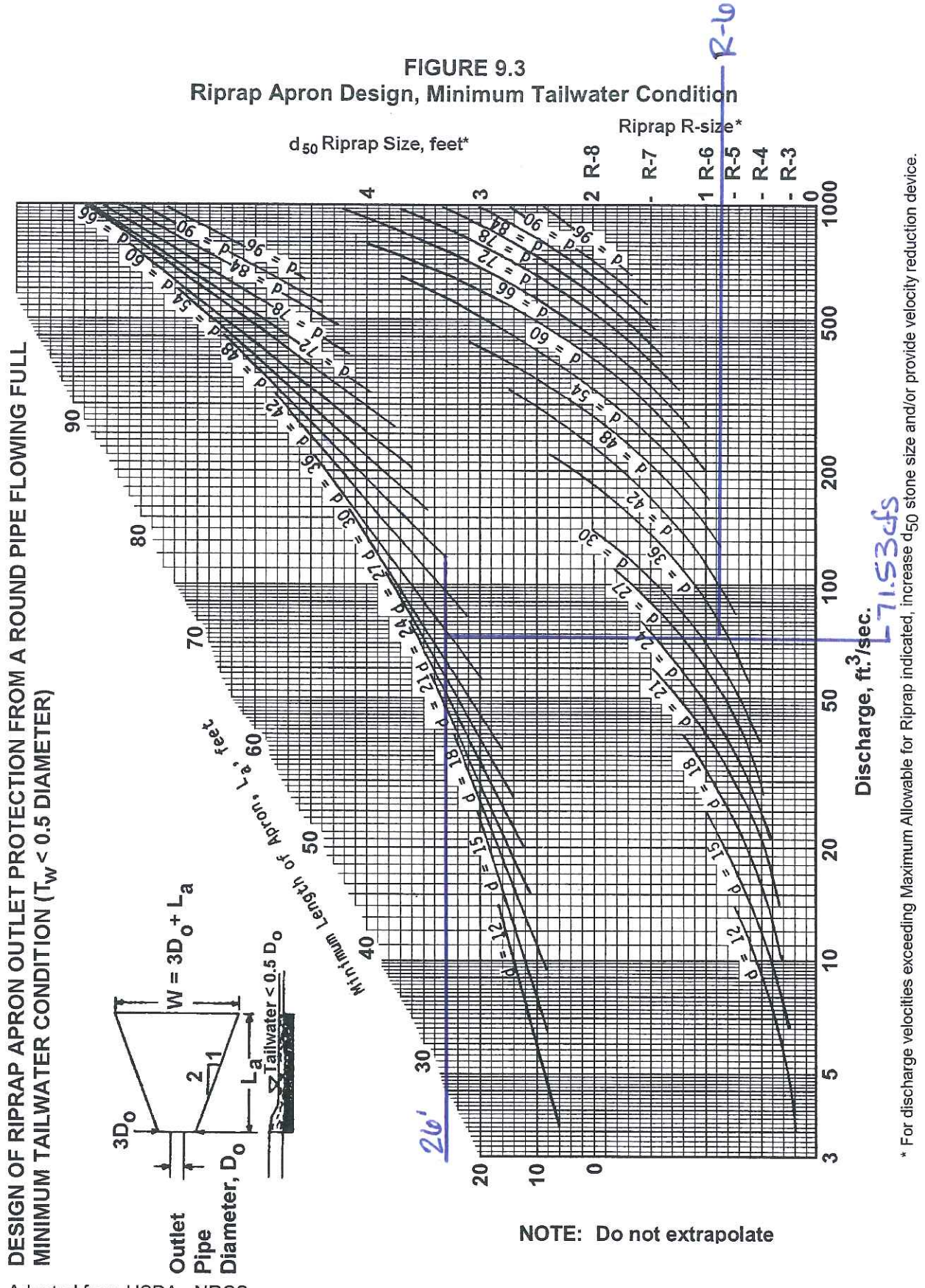


* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

CULVERT C-21A

Not to be used for Box Culverts

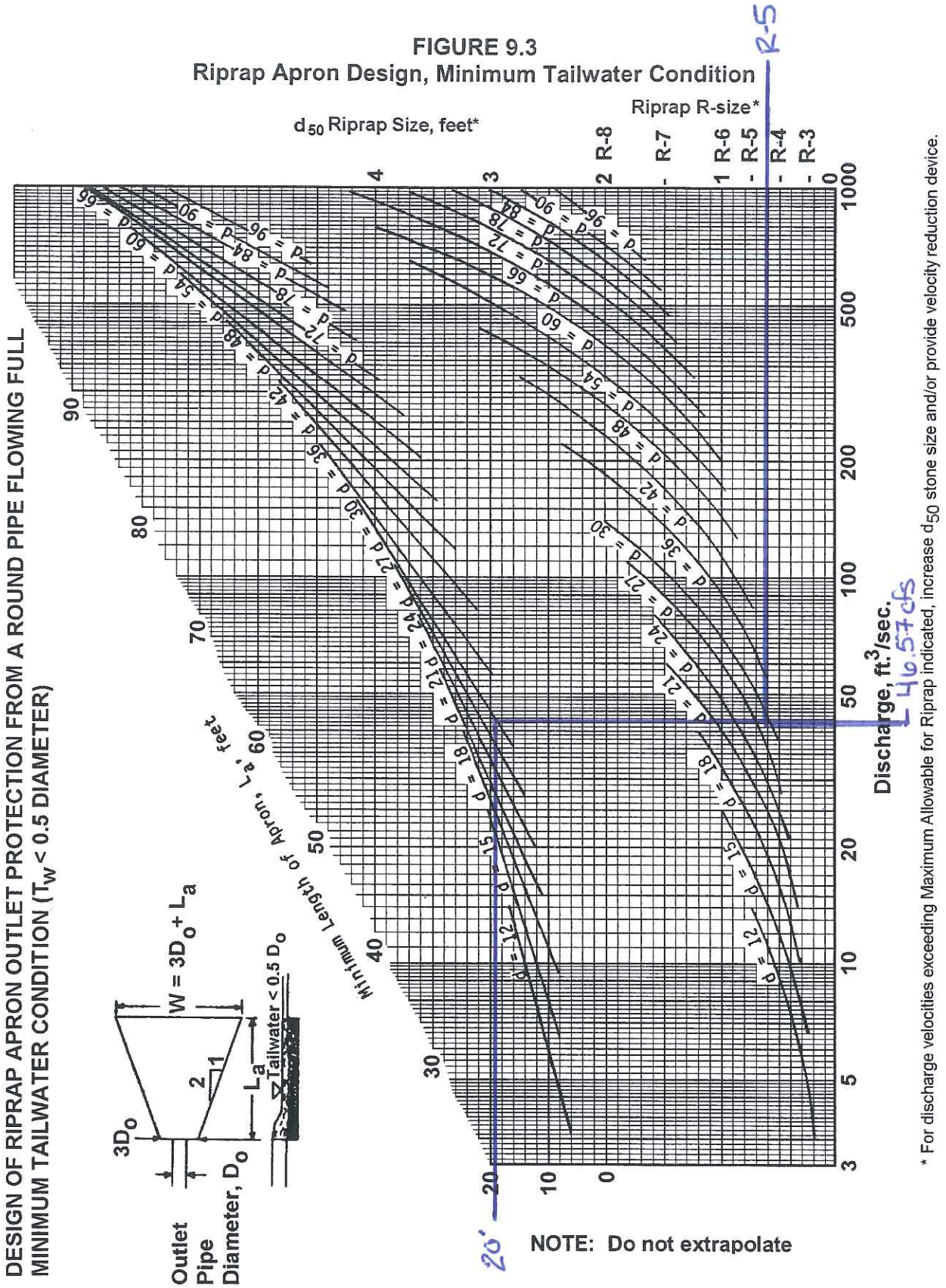
FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Not to be used for Box Culverts

* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

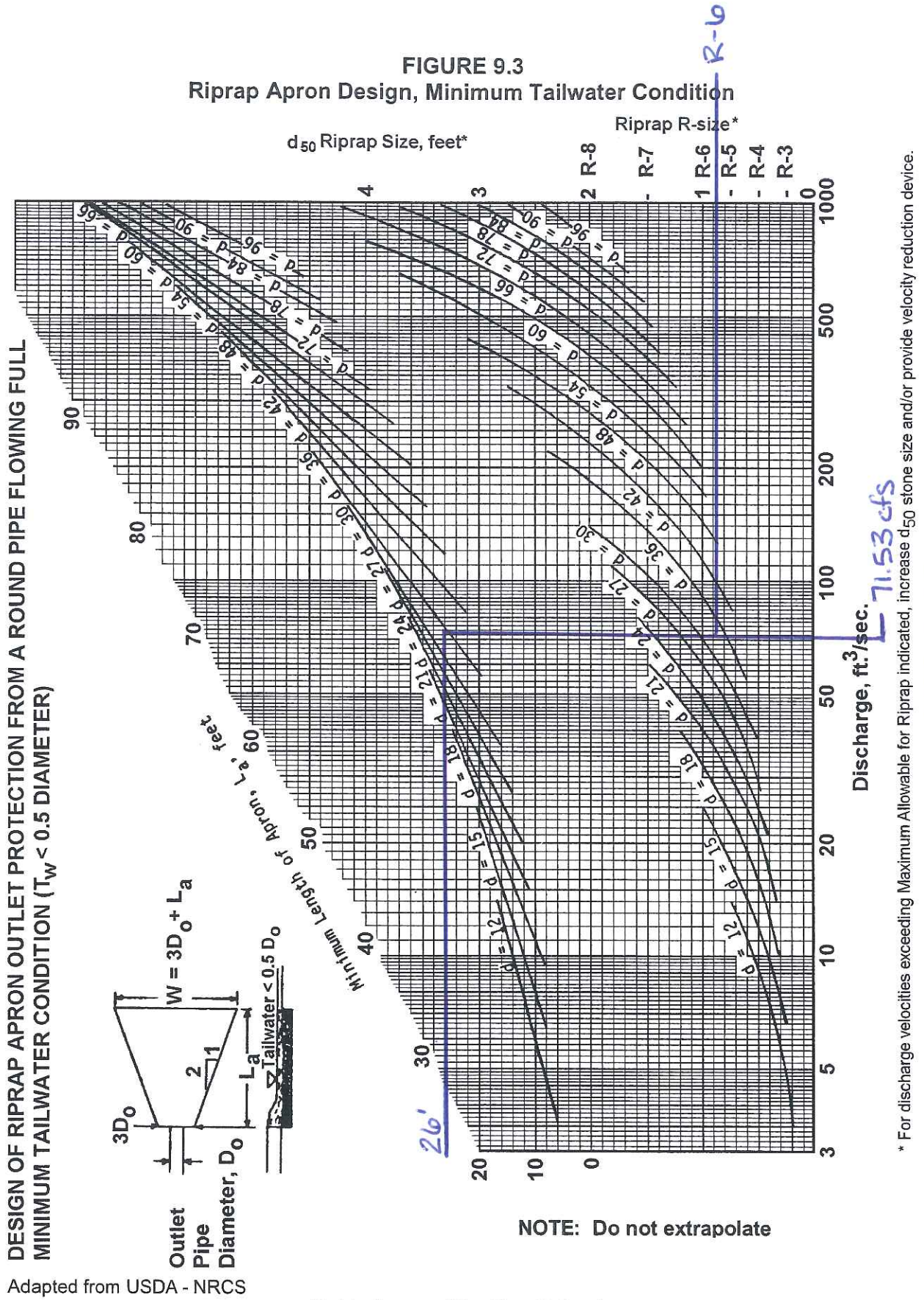


Adapted from USDA - NRCS

* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

Not to be used for Box Culverts

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

Not to be used for Box Culverts

Appendix L

Post Construction Water Quality Analysis

APPENDIX L

POST CONSTRUCTION WATER QUALITY ANALYSIS

As outlined within Section 9.0 of the Narrative the Water Quality Volume associated with the land cover change for the Southeastern Realignment is 8,338 cubic feet. Since infiltration is prohibited onsite by Ordinance. The chosen method to address the water quality volume is by the combination of vegetated swales and detention basin 2. The majority of runoff onsite is conveyed from the landfill slope via a vegetated swale (bench) to a down drain and then either piped or conveyed in a riprap swale to the detention basin. It is the combination of the vegetated bench swale having a maximum grade of 3% and the detention basin which will provide adequate treatment of the water quality volume.

The vegetated swale is listed as a BMP within the Pennsylvania Stormwater Best Management Practices Manual as a medium/high Stormwater Quality Function providing water quality treatment of 50% for TSS, 50% for TP and 20% for NO_3. All design parameters for the bench vegetated swales are met including a longitudinal slope of 1 to 6% maximum, side slopes of 3:1, and maintaining adequate freeboard. In addition the bench vegetated swale serves as a pre-treatment facility prior to the detention basin.

The detention basin in series with the bench vegetated swale is listed as a Low Water Quality BMP providing water quality treatment of 60% for TSS, 40% for TP and 20% for NO_3. Design requirements within the Pennsylvania Best Management Practices Manual for the detention basin are met including the length to width ratio maximizing the flow path from pipe inlets and combining with other BMPs (vegetated swales). Maximum dewatering times are exceeded but this is as a result of the low rate of runoff requirements. In order to meet dewatering time requirements the release rates would need to be increased which would result in offsite and downstream impacts. Additionally, a forebay is not proposed given the vegetated and even to a certain extent the riprap channels provide adequate filtering of the runoff prior to discharging to the detention basin.

In summary, the use of a vegetated swale and detention basin in series will serve to meet the water quality volume for the Southeastern Realignment. Additionally, the site including the subject detention Basin #2 is monitored under the NPDES Permitting Program to ensure water quality treatment is achieved.