

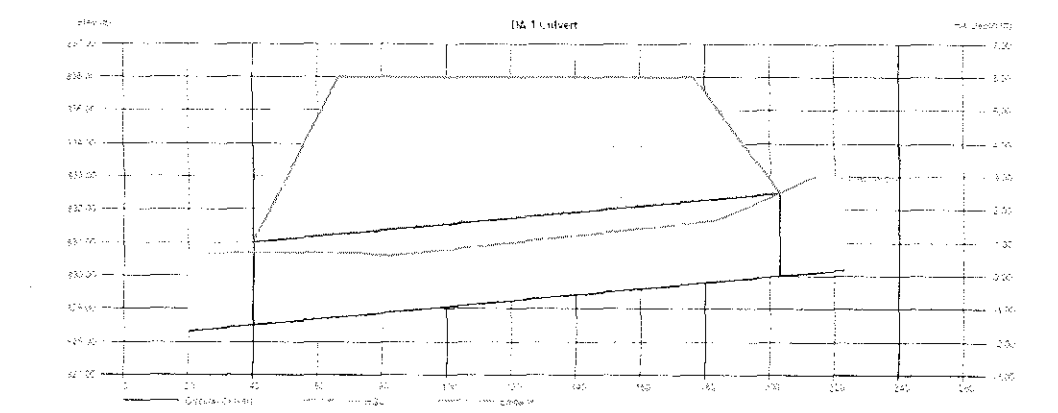
Culvert Report

Hydrow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Tuesday, Feb 7 2017

DA 1 Culvert

Invert Elev Dn (ft)	= 828.50	Calculations	
Pipe Length (ft)	= 163.03	Qmin (cfs)	= 30.76
Slope (%)	= 0.92	Qmax (cfs)	= 30.76
Invert Elev Up (ft)	= 830.00	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 30.0		
Shape	= Circular		
Span (in)	= 30.0	Highlighted	
No. Barrels	= 1	Qtotal (cfs)	= 30.76
n-Value	= 0.013	Qpipe (cfs)	= 30.76
Culvert Type	= Circular Concrete	Qovertop (cfs)	= 0.00
Culvert Entrance	= Groove end projecting (C)	Veloc Dn (ft/s)	= 5.74
Coeff. K _{M,c,Y,k}	= 0.0045, 2, 0.0317, 0.69, 0.2	Veloc Up (ft/s)	= 7.73
		HGL Dn (ft)	= 830.69
		HGL Up (ft)	= 831.89
		Hw Elev (ft)	= 832.98
		HwD (ft)	= 1.19
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 836.00		
Top Width (ft)	= 110.00		
Crest Width (ft)	= 1.00		



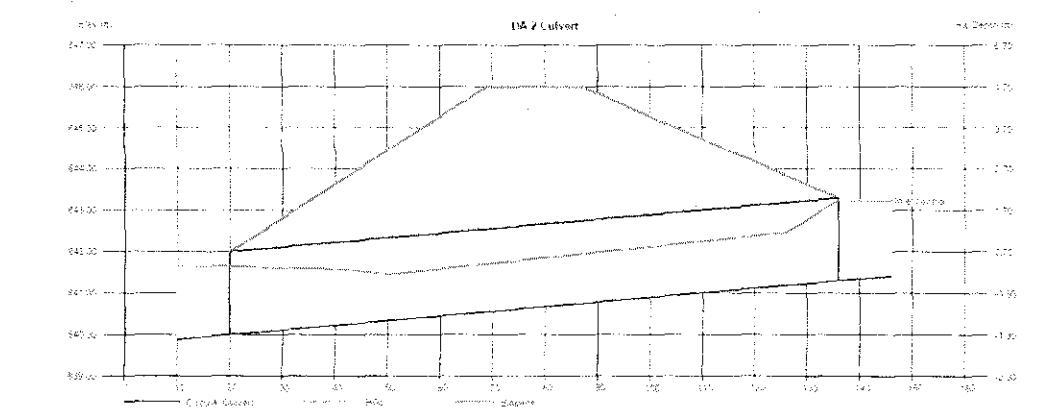
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Hydrow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Tuesday, Feb 7 2017

DA 2 Culvert

Invert Elev Dn (ft)	= 840.00	Calculations	
Pipe Length (ft)	= 115.95	Qmin (cfs)	= 13.17
Slope (%)	= 1.12	Qmax (cfs)	= 13.17
Invert Elev Up (ft)	= 841.30	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 24.0		
Shape	= Circular	Highlighted	
Span (in)	= 24.0	Qtotal (cfs)	= 13.17
No. Barrels	= 1	Qpipe (cfs)	= 13.17
n-Value	= 0.013	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 4.74
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 6.07
Coeff. K _{M,c,Y,k}	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 841.65
		HGL Up (ft)	= 842.60
		Hw Elev (ft)	= 843.24
		HwD (ft)	= 0.97
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 846.00		
Top Width (ft)	= 18.00		
Crest Width (ft)	= 1.00		



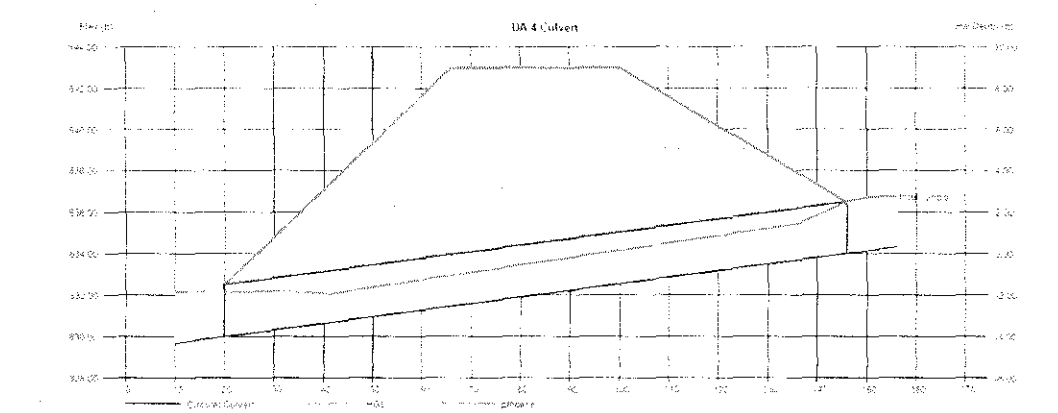
Culvert Report

Hydrow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Tuesday, Feb 7 2017

DA 4 Culvert

Invert Elev Dn (ft)	= 830.00	Calculations	
Pipe Length (ft)	= 125.95	Qmin (cfs)	= 27.94
Slope (%)	= 3.18	Qmax (cfs)	= 27.94
Invert Elev Up (ft)	= 834.00	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 30.0		
Shape	= Circular	Highlighted	
Span (in)	= 30.0	Qtotal (cfs)	= 27.94
No. Barrels	= 1	Qpipe (cfs)	= 27.94
n-Value	= 0.013	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 6.22
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 7.38
Coeff. K _{M,c,Y,k}	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 832.15
		HGL Up (ft)	= 835.80
		Hw Elev (ft)	= 836.75
		HwD (ft)	= 1.10
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 843.00		
Top Width (ft)	= 34.00		
Crest Width (ft)	= 1.00		



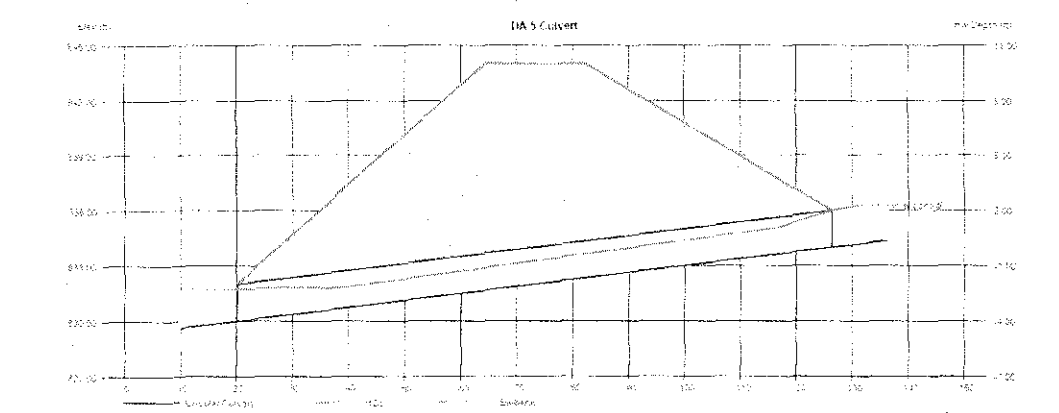
Culvert Report

Hydrow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Tuesday, Feb 7 2017

DA 5 Culvert

Invert Elev Dn (ft)	= 830.00	Calculations	
Pipe Length (ft)	= 106.37	Qmin (cfs)	= 16.98
Slope (%)	= 3.76	Qmax (cfs)	= 16.98
Invert Elev Up (ft)	= 834.00	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 24.0		
Shape	= Circular	Highlighted	
Span (in)	= 24.0	Qtotal (cfs)	= 16.98
No. Barrels	= 1	Qpipe (cfs)	= 16.98
n-Value	= 0.013	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 5.85
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 6.79
Coeff. K _{M,c,Y,k}	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 831.74
		HGL Up (ft)	= 835.48
		Hw Elev (ft)	= 836.30
		HwD (ft)	= 1.15
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 844.00		
Top Width (ft)	= 18.00		
Crest Width (ft)	= 1.00		



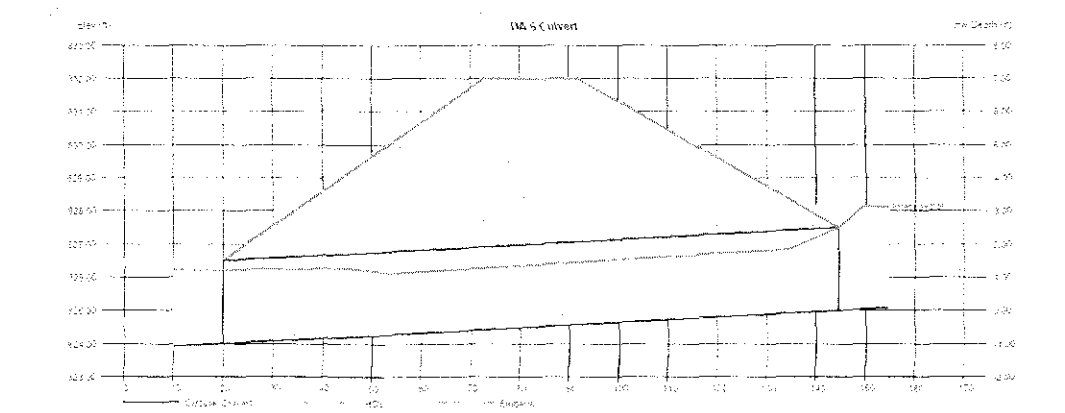
Culvert Report

Hydrow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Tuesday, Feb 7 2017

DA 6 Culvert

Invert Elev Dn (ft)	= 824.00	Calculations	
Pipe Length (ft)	= 124.59	Qmin (cfs)	= 32.75
Slope (%)	= 0.80	Qmax (cfs)	= 32.75
Invert Elev Up (ft)	= 825.00	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 30.0		
Shape	= Circular	Highlighted	
Span (in)	= 30.0	Qtotal (cfs)	= 32.75
No. Barrels	= 1	Qpipe (cfs)	= 32.75
n-Value	= 0.013	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 7.10
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 7.99
Coeff. K _{M,c,Y,k}	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 826.22
		HGL Up (ft)	= 826.95
		Hw Elev (ft)	= 828.13
		HwD (ft)	= 1.25
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 832.00		
Top Width (ft)	= 19.20		
Crest Width (ft)	= 1.00		



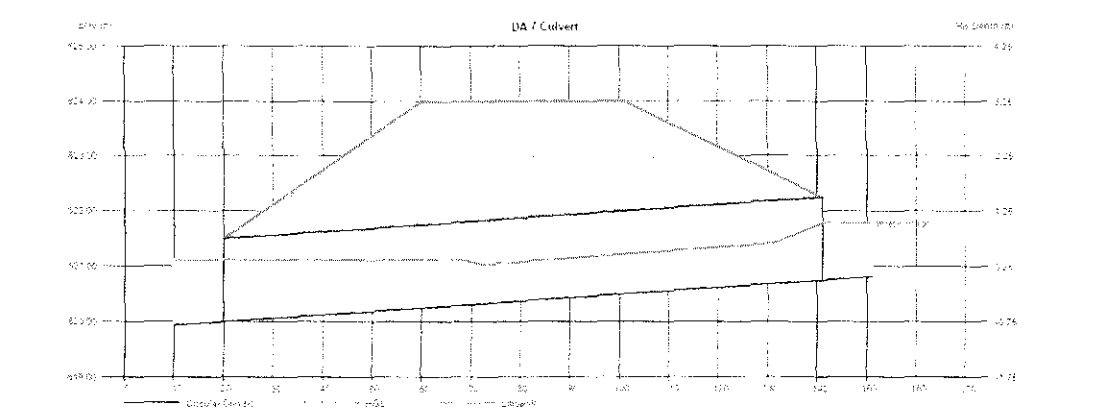
Culvert Report

Hydrow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Tuesday, Feb 14 2017

DA 7 Culvert

Invert Elev Dn (ft)	= 820.00	Calculations	
Pipe Length (ft)	= 121.15	Qmin (cfs)	= 3.73
Slope (%)	= 0.62	Qmax (cfs)	= 3.73
Invert Elev Up (ft)	= 820.75	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 18.0		
Shape	= Circular	Highlighted	
Span (in)	= 18.0	Qtotal (cfs)	= 3.73
No. Barrels	= 1	Qpipe (cfs)	= 3.73
n-Value	= 0.013	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 2.64
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 4.31
Coeff. K _{M,c,Y,k}	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 821.12
		HGL Up (ft)	= 821.49
		Hw Elev (ft)	= 821.79
		HwD (ft)	= 0.69
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 824.00		
Top Width (ft)	= 40.60		
Crest Width (ft)	= 1.00		



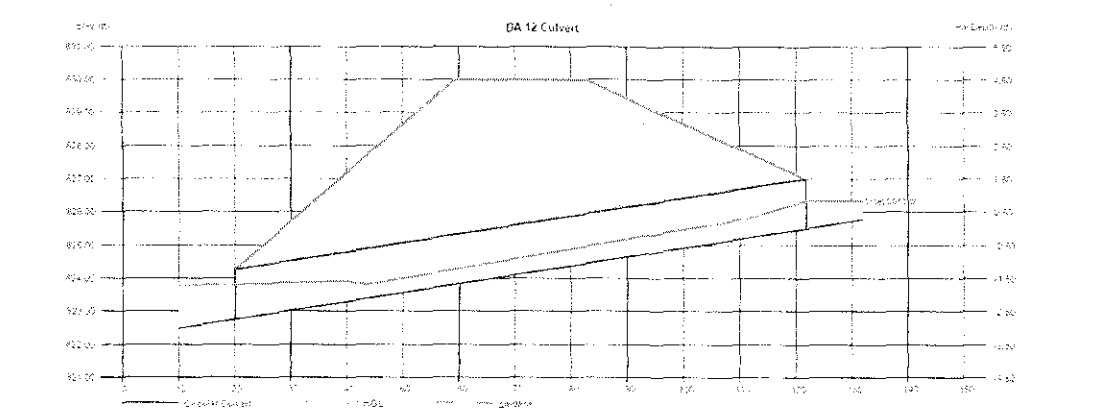
Culvert Report

Hydrow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Thursday, Dec 29 2016

DA 12 Culvert

Invert Elev Dn (ft)	= 822.75	Calculations	
Pipe Length (ft)	= 101.75	Qmin (cfs)	= 2.65
Slope (%)	= 2.70	Qmax (cfs)	= 2.65
Invert Elev Up (ft)	= 825.50	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 18.0		
Shape	= Circular	Highlighted	
Span (in)	= 18.0	Qtotal (cfs)	= 2.65
No. Barrels	= 1	Qpipe (cfs)	= 2.65
n-Value	= 0.013	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 1.99
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 3.87
Coeff. K _{M,c,Y,k}	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 823.81
		HGL Up (ft)	= 826.12
		Hw Elev (ft)	= 826.34
		HwD (ft)	= 0.58
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 830.00		
Top Width (ft)	= 23.30		
Crest Width (ft)	= 1.00		



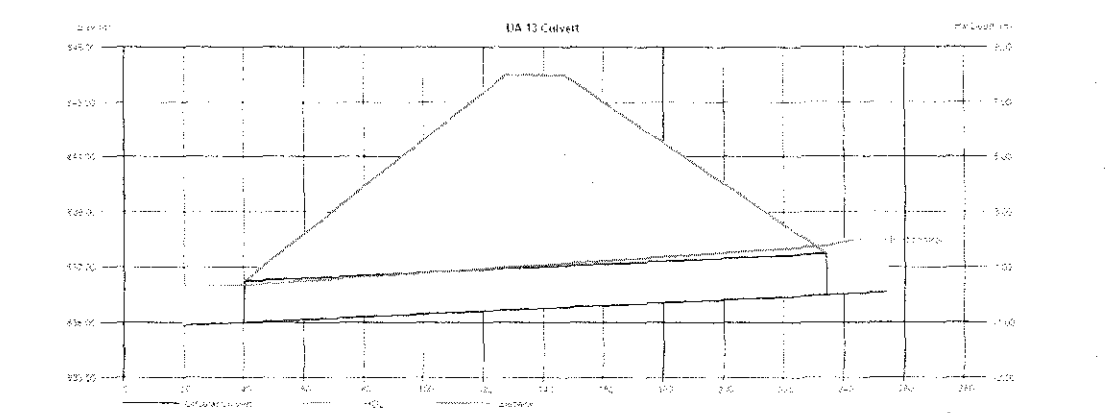
Culvert Report

Hydrow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Wednesday, Feb 22 2017

DA 13 Culvert

Invert Elev Dn (ft)	= 835.00	Calculations	
Pipe Length (ft)	= 194.20	Qmin (cfs)	= 9.87
Slope (%)	= 0.51	Qmax (cfs)	= 9.87
Invert Elev Up (ft)	= 836.00	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 18.0		
Shape	= Circular	Highlighted	
Span (in)	= 18.0	Qtotal (cfs)	= 9.87
No. Barrels	= 1	Qpipe (cfs)	= 9.87
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 5.87
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 5.59
Coeff. K _{M,c,Y,k}	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 836.36
		HGL Up (ft)	= 837.78
		Hw Elev (ft)	= 838.02
		HwD (ft)	= 1.35
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 844.00		
Top Width (ft)	= 16.90		
Crest Width (ft)	= 1.00		



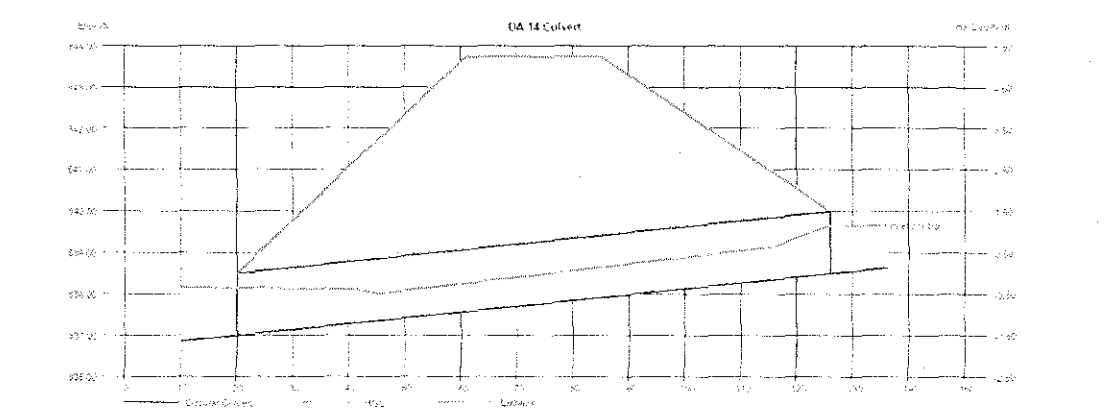
Culvert Report

Hydrow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Friday, Jul 14 2017

DA 14 Culvert

Invert Elev Dn (ft)	= 837.00	Calculations	
Pipe Length (ft)	= 105.06	Qmin (cfs)	= 4.57
Slope (%)	= 1.41	Qmax (cfs)	= 4.57
Invert Elev Up (ft)	= 838.50	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 18.0		
Shape	= Circular	Highlighted	
Span (in)	= 18.0	Qtotal (cfs)	= 4.57
No. Barrels	= 1	Qpipe (cfs)	= 4.57
n-Value	= 0.013	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 3.12
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 4.62
Coeff. K _{M,c,Y,k}	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 838.16
		HGL Up (ft)	= 839.32
		Hw Elev (ft)	= 839.67
		HwD (ft)	= 0.78
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 843.75		
Top Width (ft)	= 24.00		
Crest Width (ft)	= 1.00		



Culvert Flowrate Calculations						
Culvert #	A (ac)	TC (min)	I2 - Franklin County	I10 - Franklin County	Cover Coefficient	Q2 (cfs)
1	9.25	5.0	5.01	6.52	0.51	23.63
2	3.74	5.0	5.01	6.52	0.54	10.12
4	8.57	5.0	5.01	6.52	0.50	21.47
5	4.65	5.0	5.01	6.52	0.56	13.05
6	8.97	5.0	5.01	6.52	0.56	25.17
7	0.88	5.0	5.01	6.52	0.65	2.87
8	1.68	5.0	5.01	6.52	0.52	4.38
12	0.74	5.0	5.01	6.52	0.55	2.04
13	3.29	5.0	5.01	6.52	0.46	7.58
14	1.23	5.0	5.01	6.52	0.57	3.51
15	5.54	5.0	5.01	6.52	0.43	11.93
						15.53

PIPE OUTLET PROTECTION COMPUTATIONS													
Outfall Str #	10-YR Discharge (cfs)	Outlet Pipe D _o (in)	Required as per Std. & Spec. 3.18 (VESCH)					Provided					Remarks
			3D _o (ft)	L _a (ft)	W (ft)	D ₃₀ (ft)	3D _o (ft)	L _a (ft)	W (ft)	D ₃₀ (ft)			
1A	30.76	30	7.50	14.00	21.50	0.50	7.50	14.00	21.50	0.90		Class IA Rip-Rap, 2.0' Deep	
3A	12.34	36	9.00	20.00	29.00	0.60	9.00	20.00	29.00	0.90		Class IA Rip-Rap, 2.0' Deep	
8A	5.70	18	4.50	10.00	14.50	0.50	4.50	10.00	14.50	0.90		Class IA Rip-Rap, 2.0' Deep	
9A	0.33	18	4.50	10.00	14.50	0.50	4.50	10.00	14.50	0.90		Class IA Rip-Rap, 2.0' Deep	
10A	14.30	36	9.00	20.00	29.00	0.60	9.00	20.00	29.00	0.90		Class AI Rip-Rap, 2.0' Deep	
11A	13.56	36	9.00	20.00	29.00	0.60	9.00	20.00	29.00	0.90		Class AI Rip-Rap, 2.0' Deep	
12A	2.65	18	4.50	10.00	14.50	0.50	4.50	10.00	14.50	0.90		Class AI Rip-Rap, 2.0' Deep	
13A	9.70	18	4.50	12.00	16.50	0.50	4.50	12.00	16.50	0.90		Class AI Rip-Rap, 2.0' Deep	
14A	4.57	18	4.50	12.00	16.50	0.50	4.50	12.00	16.50	0.90		Class AI Rip-Rap, 2.0' Deep	
15A	5.30	18	4.50	12.00	16.50	0.50	4.50	12.00	16.50	0.90		Class AI Rip-Rap, 2.0' Deep	