

Norwalk River Valley Trail: WIL-WALK (Wilton Segment)

DRAINAGE STATEMENT

Project Overview:

The proposed project consists of the design & construction of two segments of the Norwalk River Valley Multi-Purpose Recreational Trail (NRVT) totaling approximately one mile in length also known as the WIL-WALK Phase of the NRVT.

The first segment starts at the end of the proposed Norwalk portion of Wil-Walk at the Norwalk/Wilton Town Line, then running northeast to a proposed gravel parking area off Chipmunk Lane, then continuing northeast to Kent Road. The second segment starts at the commuter lot on RT #7/Wolf Pit Road running southwest to an existing pond. This latter section will be an extension of the existing NRVT that currently terminates immediately across Route 7 at the crosswalk on the northeast side of the Wolf Pit Road intersection with Route &7.

Stormwater Management:

The trail construction will have negligible impacts on existing peak flows. The linear nature of the stone dust trail routed to approximately follow parallel with the contours spreads a minimal impact over multiple drainage areas. Additionally, the layout has been configured to minimize any potential impacts by maintaining sheet flow and avoiding the concentration of runoff to the greatest extent practical.

In certain areas there are existing concentrations of runoff such as swales and intermittent watercourses. Where they could not be altogether avoided, these areas have been addressed through the installation of pipe culverts in upland areas, and the trail is entirely converted to a boardwalk in wetland/watercourse areas.

Where culverts are proposed, HDPE pipe shall be utilized. Each culvert has been analyzed using the Rational Method and designed to pass the 10-year storm without exceeding the inlet capacity of the pipe. Maps showing the delineated drainage areas to each culvert are attached. Times of concentration were computed using TR-55 methodology. Composite C-values were calculated assuming 0.9 for impervious areas and 0.3 for pervious areas. Appropriate I-values were interpolated from NOAA Atlas 14 precipitation frequency data. All pertinent maps & computations are attached.

All proposed culverts will discharge to preformed scour holes that have been designed in accordance with the State of Connecticut Department of Transportation's Drainage Manual.

Conclusion:

Minor alterations to peak flows are expected due to the installation of the stone dust trail. Due to the linear nature of the trail and the proposed stone dust surfacing, no adverse impacts to wetlands or watercourses are anticipated.



NOAA Atlas 14, Volume 10, Version 2
Location name: Norwalk, Connecticut, USA*
Latitude: 41.1592°, Longitude: -73.4239°
Elevation: 184.35 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orian Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.39 (3.44-5.53)	5.11 (4.01-6.44)	6.28 (4.91-7.94)	7.25 (5.64-9.23)	8.59 (6.44-11.3)	9.62 (7.06-12.9)	10.7 (7.56-14.8)	11.8 (7.99-16.9)	13.4 (8.68-19.7)	14.5 (9.19-21.8)
10-min	3.11 (2.44-3.92)	3.62 (2.84-4.56)	4.45 (3.47-5.63)	5.14 (3.99-6.53)	6.09 (4.57-8.03)	6.82 (5.00-9.17)	7.55 (5.36-10.5)	8.38 (5.66-11.9)	9.47 (6.14-14.0)	10.3 (6.51-15.5)
15-min	2.44 (1.92-3.07)	2.84 (2.22-3.58)	3.49 (2.73-4.42)	4.03 (3.13-5.12)	4.78 (3.58-6.30)	5.35 (3.92-7.20)	5.92 (4.20-8.22)	6.57 (4.44-9.37)	7.42 (4.82-10.9)	8.07 (5.11-12.1)
30-min	1.70 (1.33-2.14)	1.98 (1.55-2.49)	2.43 (1.90-3.07)	2.80 (2.18-3.56)	3.32 (2.48-4.37)	3.71 (2.72-4.98)	4.11 (2.91-5.68)	4.53 (3.06-6.45)	5.08 (3.30-7.48)	5.49 (3.48-8.25)
60-min	1.09 (0.856-1.37)	1.27 (0.993-1.60)	1.55 (1.22-1.97)	1.79 (1.39-2.28)	2.12 (1.59-2.80)	2.38 (1.74-3.18)	2.63 (1.86-3.63)	2.88 (1.95-4.11)	3.22 (2.09-4.74)	3.47 (2.20-5.22)
2-hr	0.696 (0.550-0.872)	0.822 (0.648-1.03)	1.03 (0.808-1.29)	1.20 (0.936-1.51)	1.43 (1.08-1.88)	1.61 (1.19-2.16)	1.79 (1.28-2.48)	2.01 (1.36-2.84)	2.29 (1.49-3.35)	2.50 (1.59-3.74)
3-hr	0.532 (0.422-0.663)	0.633 (0.501-0.790)	0.798 (0.629-0.999)	0.934 (0.733-1.18)	1.12 (0.851-1.47)	1.27 (0.940-1.70)	1.41 (1.01-1.96)	1.59 (1.08-2.25)	1.83 (1.20-2.68)	2.02 (1.28-3.00)
6-hr	0.336 (0.268-0.416)	0.402 (0.321-0.499)	0.511 (0.406-0.636)	0.601 (0.474-0.752)	0.725 (0.553-0.946)	0.821 (0.613-1.09)	0.916 (0.664-1.27)	1.04 (0.711-1.46)	1.21 (0.791-1.75)	1.34 (0.852-1.97)
12-hr	0.207 (0.166-0.254)	0.248 (0.199-0.306)	0.316 (0.253-0.390)	0.372 (0.296-0.462)	0.450 (0.345-0.583)	0.510 (0.383-0.675)	0.569 (0.415-0.782)	0.649 (0.444-0.905)	0.754 (0.495-1.09)	0.834 (0.534-1.22)
24-hr	0.121 (0.098-0.148)	0.147 (0.119-0.180)	0.189 (0.152-0.232)	0.224 (0.179-0.277)	0.272 (0.210-0.351)	0.310 (0.234-0.408)	0.347 (0.254-0.475)	0.398 (0.273-0.552)	0.466 (0.307-0.667)	0.517 (0.332-0.754)
2-day	0.067 (0.054-0.081)	0.083 (0.067-0.100)	0.108 (0.088-0.132)	0.130 (0.104-0.159)	0.159 (0.124-0.205)	0.182 (0.139-0.239)	0.205 (0.152-0.280)	0.238 (0.164-0.328)	0.282 (0.186-0.401)	0.315 (0.203-0.457)
3-day	0.048 (0.039-0.058)	0.059 (0.048-0.072)	0.078 (0.064-0.095)	0.094 (0.076-0.115)	0.116 (0.090-0.148)	0.132 (0.101-0.173)	0.149 (0.111-0.203)	0.173 (0.120-0.238)	0.206 (0.136-0.292)	0.230 (0.149-0.332)
4-day	0.038 (0.031-0.046)	0.047 (0.039-0.057)	0.062 (0.051-0.075)	0.075 (0.061-0.091)	0.092 (0.072-0.117)	0.105 (0.080-0.137)	0.118 (0.088-0.160)	0.137 (0.095-0.188)	0.163 (0.108-0.230)	0.182 (0.118-0.262)
7-day	0.026 (0.021-0.031)	0.032 (0.026-0.038)	0.041 (0.033-0.049)	0.049 (0.040-0.059)	0.059 (0.046-0.075)	0.067 (0.052-0.087)	0.076 (0.056-0.102)	0.087 (0.060-0.118)	0.102 (0.068-0.143)	0.113 (0.073-0.162)
10-day	0.021 (0.017-0.025)	0.025 (0.021-0.030)	0.032 (0.026-0.038)	0.038 (0.031-0.045)	0.046 (0.036-0.057)	0.052 (0.040-0.066)	0.058 (0.043-0.077)	0.065 (0.046-0.089)	0.076 (0.051-0.106)	0.084 (0.054-0.119)
20-day	0.015 (0.012-0.017)	0.017 (0.014-0.020)	0.021 (0.017-0.025)	0.024 (0.020-0.029)	0.029 (0.023-0.035)	0.032 (0.025-0.040)	0.035 (0.026-0.046)	0.039 (0.027-0.053)	0.044 (0.030-0.061)	0.048 (0.031-0.068)
30-day	0.012 (0.010-0.014)	0.014 (0.012-0.016)	0.017 (0.014-0.020)	0.019 (0.016-0.023)	0.022 (0.017-0.027)	0.025 (0.019-0.031)	0.027 (0.020-0.035)	0.029 (0.021-0.039)	0.033 (0.022-0.045)	0.035 (0.023-0.050)
45-day	0.010 (0.008-0.012)	0.011 (0.009-0.013)	0.013 (0.011-0.016)	0.015 (0.012-0.018)	0.017 (0.014-0.021)	0.019 (0.015-0.024)	0.021 (0.015-0.027)	0.022 (0.016-0.030)	0.025 (0.017-0.034)	0.026 (0.017-0.037)
60-day	0.009 (0.007-0.010)	0.010 (0.008-0.011)	0.011 (0.010-0.013)	0.013 (0.011-0.015)	0.015 (0.012-0.018)	0.016 (0.012-0.020)	0.017 (0.013-0.022)	0.019 (0.013-0.025)	0.020 (0.014-0.028)	0.021 (0.014-0.030)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
 Please refer to NOAA Atlas 14 document for more information.

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Culvert Report

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

Friday, Sep 13 2019

DA-3 CULVERT

Invert Elev Dn (ft) = 194.50
Pipe Length (ft) = 20.00
Slope (%) = 1.00
Invert Elev Up (ft) = 194.70
Rise (in) = 15.0
Shape = Circular
Span (in) = 15.0
No. Barrels = 1
n-Value = 0.011
Culvert Type = Circular Concrete
Culvert Entrance = Groove end projecting (C)
Coeff. K,M,c,Y,k = 0.0045, 2, 0.0317, 0.69, 0.2

Embankment

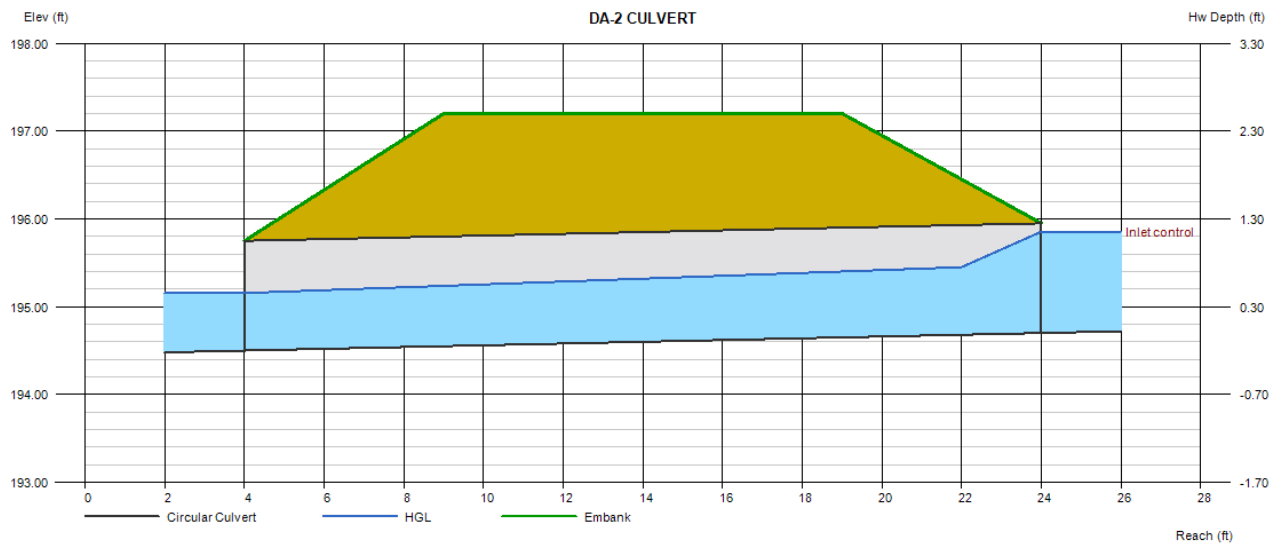
Top Elevation (ft) = 197.20
Top Width (ft) = 10.00
Crest Width (ft) = 50.00

Calculations

Qmin (cfs) = 3.76
Qmax (cfs) = 3.76
Tailwater Elev (ft) = 0.00

Highlighted

Qtotal (cfs) = 3.76
Qpipe (cfs) = 3.76
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 5.77
Veloc Up (ft/s) = 4.65
HGL Dn (ft) = 195.16
HGL Up (ft) = 195.48
Hw Elev (ft) = 195.85
Hw/D (ft) = 0.92
Flow Regime = Inlet Control



NORWALK RIVER VALLEY TRAIL

Proposed Culverts

0.9 'C' FOR IMPERVIOUS AREAS

0.3 'C' FOR PERVIOUS AREAS

Flood Event	Intensity (in/hour)
	DA-3
10-year	2.60

Condition	Impervious Areas (Ac.)	Pervious Areas (Ac.)	Total Area (Ac.)	'C' Value	Time of Conc. (mins.)	10 year Intensity	10 year Flow (cfs)
DA-3	0.21	4.19	4.40	0.33	36	2.60	3.76

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Hyd. No. 3

DA-3

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>			
Sheet Flow							
Manning's n-value	= 0.240	0.400	0.011				
Flow length (ft)	= 110.0	40.0	0.0				
Two-year 24-hr precip. (in)	= 3.20	3.20	0.00				
Land slope (%)	= 1.00	1.00	0.00				
Travel Time (min)	= 20.32	+	13.61	+	0.00	=	33.94
Shallow Concentrated Flow							
Flow length (ft)	= 484.00	0.00	0.00				
Watercourse slope (%)	= 12.00	0.00	0.00				
Surface description	= Unpaved	Unpaved	Paved				
Average velocity (ft/s)	=5.59	0.00	0.00				
Travel Time (min)	= 1.44	+	0.00	+	0.00	=	1.44
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	0.0				
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00
Total Travel Time, Tc				35.38 min			

Outlet Protection Calculations

Proj. No. 192310791

DA-3

Outlet Location: 30+25, 11' LT

Preformed Scour Hole (Type 1)
Equation 11.35 CTDOT Drainage Manual

D₅₀ Sizing:

TW = Tailwater = 0.25 feet (assumed)

Rp = Pipe Diameter = 1.25 feet

Q₁₀ = 10 year design peak flow = 3.76 c.f.s.*

F = depth of riprap = 0.5Rp = 0.625 feet

$$D_{50} = \left[\frac{0.0125Rp^2}{Tw} \right] \times \left[\frac{Q_{10}}{Rp^{2.5}} \right]^{1.33}$$

D₅₀ = 0.22 feet = 2.6 inches

Use modified riprap

Dimensions:

Based on table 11-14.1
B = width = 6'
C = length = 8'

Stantec Consulting Services Inc.
55 Church Street Suite 601, New Haven CT 06510-3014
Phone: (203) 495-1645
Fax: (203) 495-1652

NRVT Wil-Walk**Wilton Segment – Inland Wetlands Application****April 8, 2020****Drainage Report Addendum**

Subsequent to the initial Wetlands Application Submission, Stantec visited the site on March 11, 2020 to flag the proposed trail route. At this site visit, two new swale areas along the trail route areas were identified as potential wetlands/watercourses. The wetlands scientist for the project (Jay Fain) visited the site to review these areas and determined that these areas were not regulated wetlands/watercourses and that culvert crossings could be installed.

This addendum to the original Drainage Report submitted on 02/04/2020 includes drainage maps and pipe sizing calculations for the two additional culverts (DA4 and DA5). The trail plan has also been revised to include these culvert crossings. Refer to the original drainage report for more detailed methodology and project overview.



REV.	DATE	REVISION DESCRIPTION	SHEET NO.



DESIGNER/DRAFTER:
M. PATE
CHECKED BY:
A. DICAMILLO
SCALE:
SCALE AS NOTED

**TOWN OF WILTON
CONNECTICUT**
Filename:

Stantec
Stantec Consulting Services Inc.
55 Church Street, Suite 601
New Haven, CT
06510
Tel. 203.495.1645
Fax. 203.495.1652
www.stantec.com

PROJECT TITLE:
**NORWALK RIVER VALLEY TRAIL
'WIL-WALK'**

CITY:
WILTON
DRAWING TITLE:
TRAIL PLAN

PROJECT NO.
DRAWING NO.
SHEET NO.
PLN-03

NORWALK RIVER VALLEY TRAIL

Proposed Culverts

0.9 'C' FOR IMPERVIOUS AREAS

0.3 'C' FOR PERVIOUS AREAS

Flood Event	Intensity (in/hour)
	DA-3
10-year	2.60

Condition	Impervious Areas (Ac.)	Pervious Areas	Total Area	'C' Value	Time of Conc.	10 year Intensity	10 year Flow
DA-4	0.02	0.29	0.31	0.30	29	2.60	0.24
DA-5	0.24	1.45	1.69	0.39	34	2.60	1.70

Culvert Report

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

Wednesday, Apr 8 2020

DA-4 CULVERT

Invert Elev Dn (ft) = 157.60
Pipe Length (ft) = 22.50
Slope (%) = 4.00
Invert Elev Up (ft) = 158.50
Rise (in) = 10.0
Shape = Circular
Span (in) = 10.0
No. Barrels = 1
n-Value = 0.011
Culvert Type = Circular Concrete
Culvert Entrance = Groove end projecting (C)
Coeff. K,M,c,Y,k = 0.0045, 2, 0.0317, 0.69, 0.2

Embankment

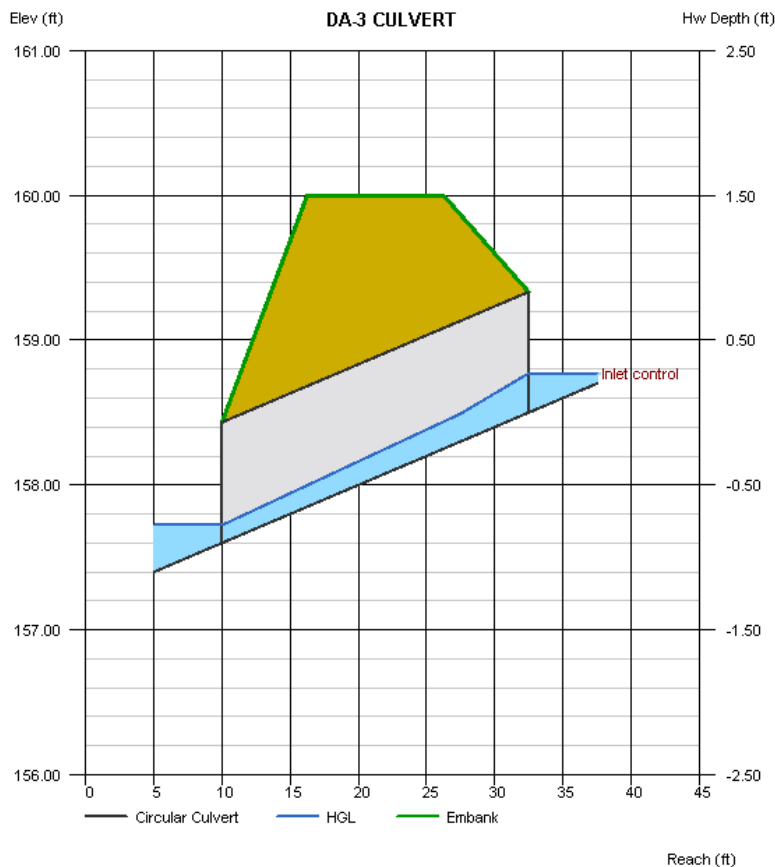
Top Elevation (ft) = 160.00
Top Width (ft) = 10.00
Crest Width (ft) = 50.00

Calculations

Qmin (cfs) = 0.24
Qmax (cfs) = 0.24
Tailwater Elev (ft) = 0.00

Highlighted

Qtotal (cfs) = 0.24
Qpipe (cfs) = 0.24
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 4.77
Veloc Up (ft/s) = 2.20
HGL Dn (ft) = 157.72
HGL Up (ft) = 158.71
Hw Elev (ft) = 158.77
Hw/D (ft) = 0.33
Flow Regime = Inlet Control



Culvert Report

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

Wednesday, Apr 8 2020

DA-5 CULVERT

Invert Elev Dn (ft) = 154.00
Pipe Length (ft) = 22.50
Slope (%) = 3.11
Invert Elev Up (ft) = 154.70
Rise (in) = 15.0
Shape = Circular
Span (in) = 15.0
No. Barrels = 1
n-Value = 0.011
Culvert Type = Circular Concrete
Culvert Entrance = Groove end projecting (C)
Coeff. K,M,c,Y,k = 0.0045, 2, 0.0317, 0.69, 0.2

Embankment

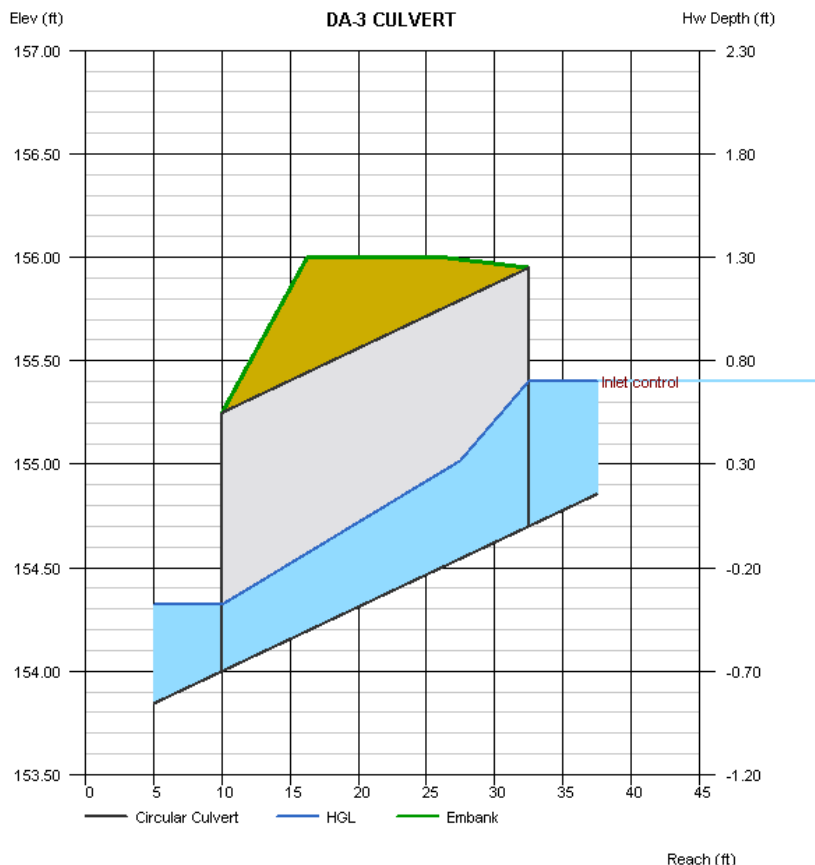
Top Elevation (ft) = 156.00
Top Width (ft) = 10.00
Crest Width (ft) = 50.00

Calculations

Qmin (cfs) = 1.70
Qmax (cfs) = 1.70
Tailwater Elev (ft) = 0.00

Highlighted

Qtotal (cfs) = 1.70
Qpipe (cfs) = 1.70
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 6.79
Veloc Up (ft/s) = 3.55
HGL Dn (ft) = 154.32
HGL Up (ft) = 155.22
Hw Elev (ft) = 155.40
Hw/D (ft) = 0.56
Flow Regime = Inlet Control



Outlet Protection Calculations

Proj. No. 192310791

DA-4

Outlet Location: 43+85, 11' LT

Preformed Scour Hole (Type 1)
Equation 11.35 CTDOT Drainage Manual

D₅₀ Sizing:

TW = Tailwater = 0.25 feet (assumed)

Rp = Pipe Diameter = 0.83 feet

Q₁₀ = 10 year design peak flow = 0.24 c.f.s.*

F = depth of riprap = 0.5Rp = 0.4165 feet

$$D_{50} = \left[\frac{0.0125Rp^2}{Tw} \right] \times \left[\frac{Q_{10}}{Rp^{2.5}} \right]^{1.33}$$

D₅₀ = 0.01 feet = 0.1 inches

Use modified riprap

Dimensions:

Based on table 11-14.1
B = width = 6'
C = length = 8'

Outlet Protection Calculations

Proj. No. 192310791

DA-5

Outlet Location: 44+85, 11' LT

Preformed Scour Hole (Type 1)
Equation 11.35 CTDOT Drainage Manual

D₅₀ Sizing:

TW = Tailwater = 0.25 feet (assumed)

Rp = Pipe Diameter = 1.25 feet

Q₁₀ = 10 year design peak flow = 1.7 c.f.s.*

F = depth of riprap = 0.5Rp = 0.625 feet

$$D_{50} = \left[\frac{0.0125Rp^2}{Tw} \right] \times \left[\frac{Q_{10}}{Rp^{2.5}} \right]^{1.33}$$

D₅₀ = 0.08 feet = 0.9 inches

Use modified riprap

Dimensions:

Based on table 11-14.1
B = width = 6'
C = length = 8'