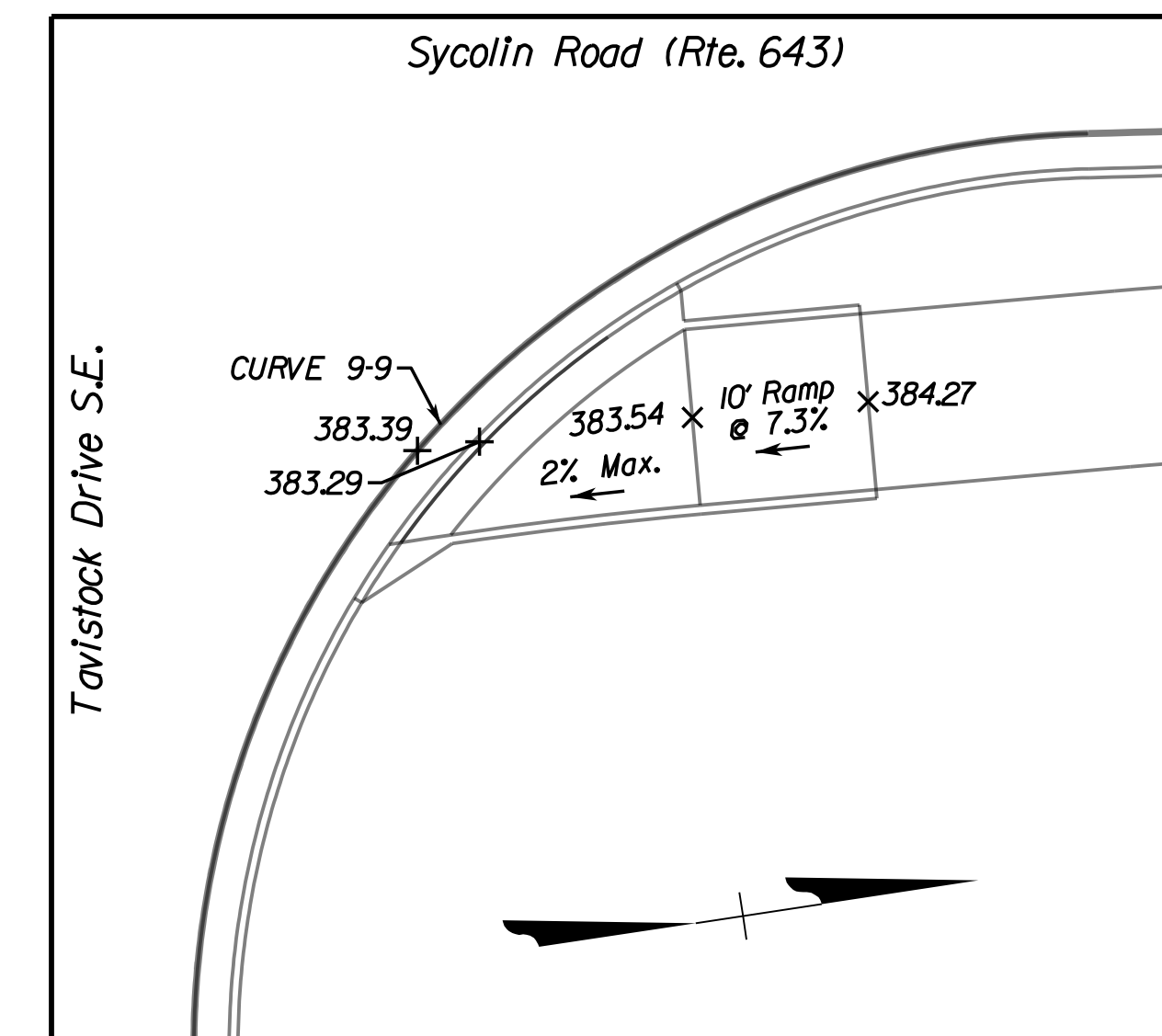
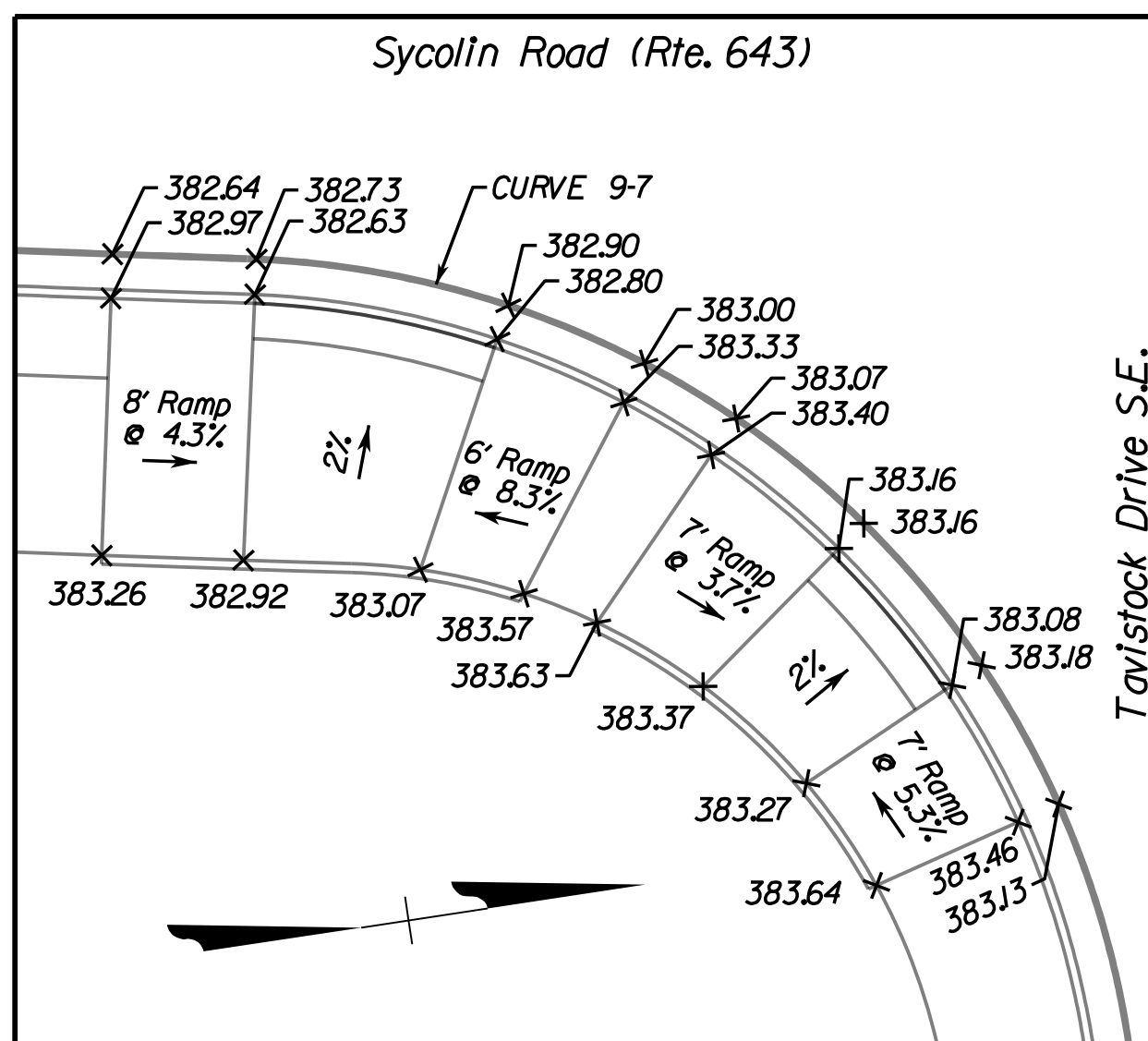
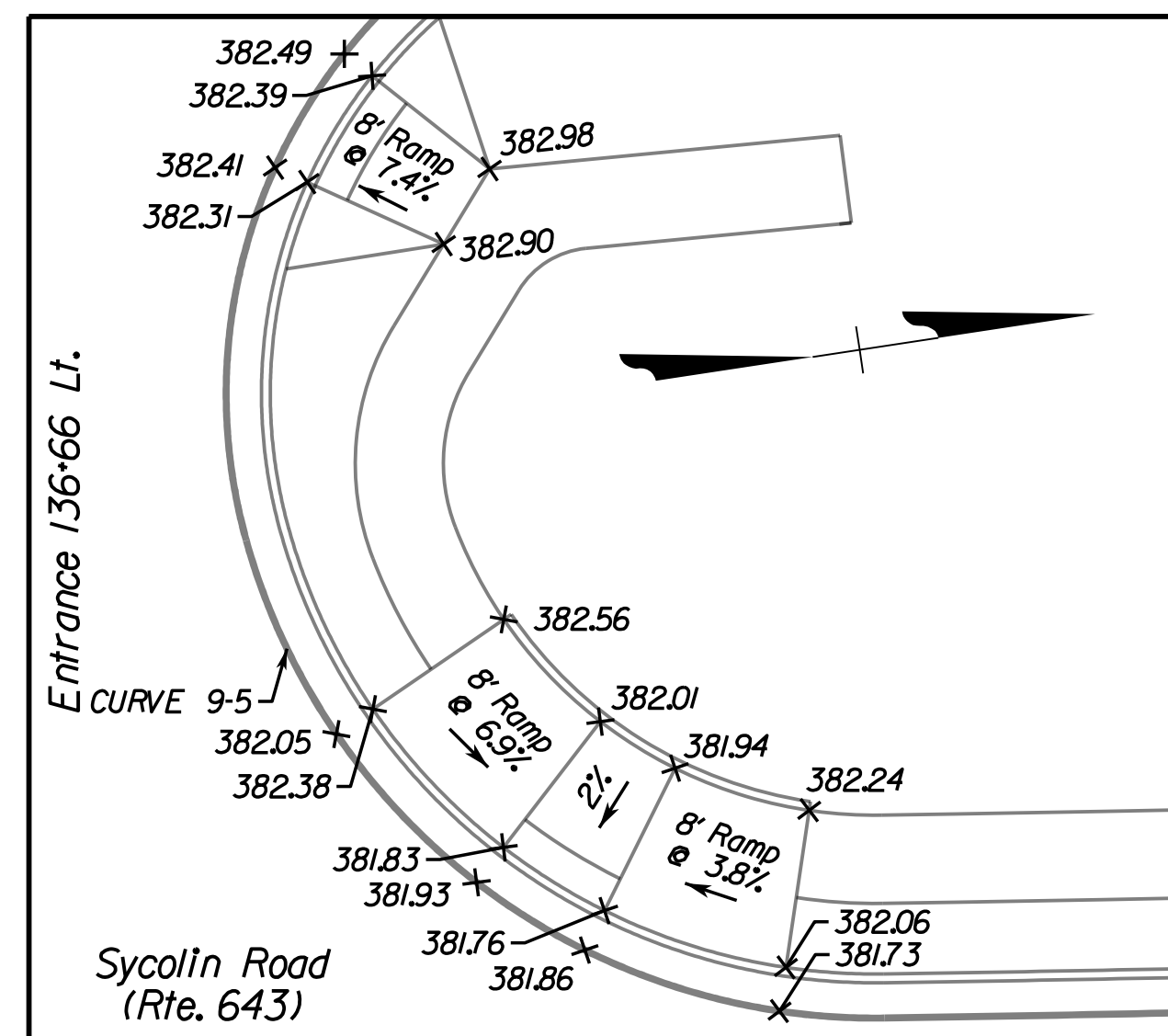
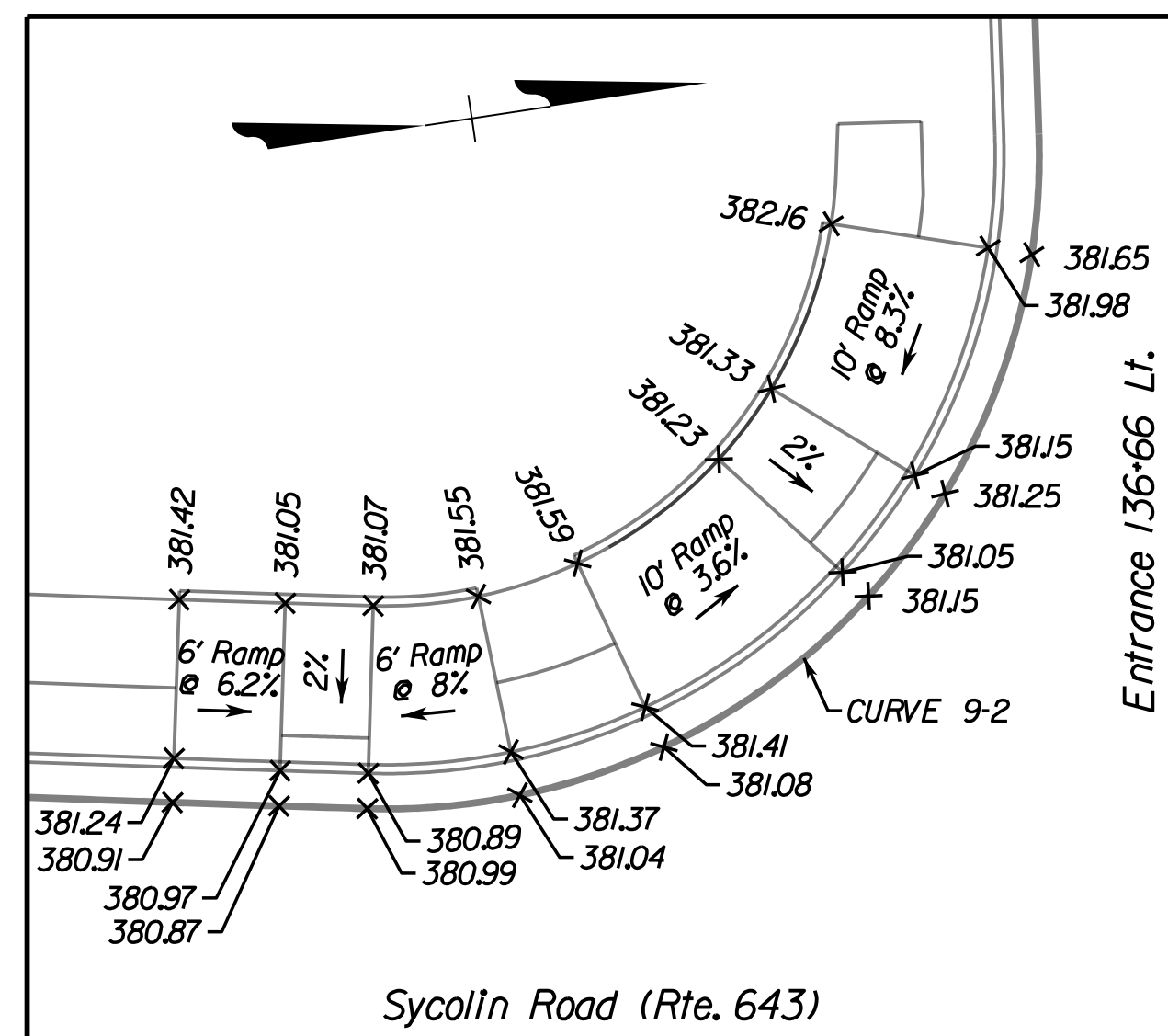
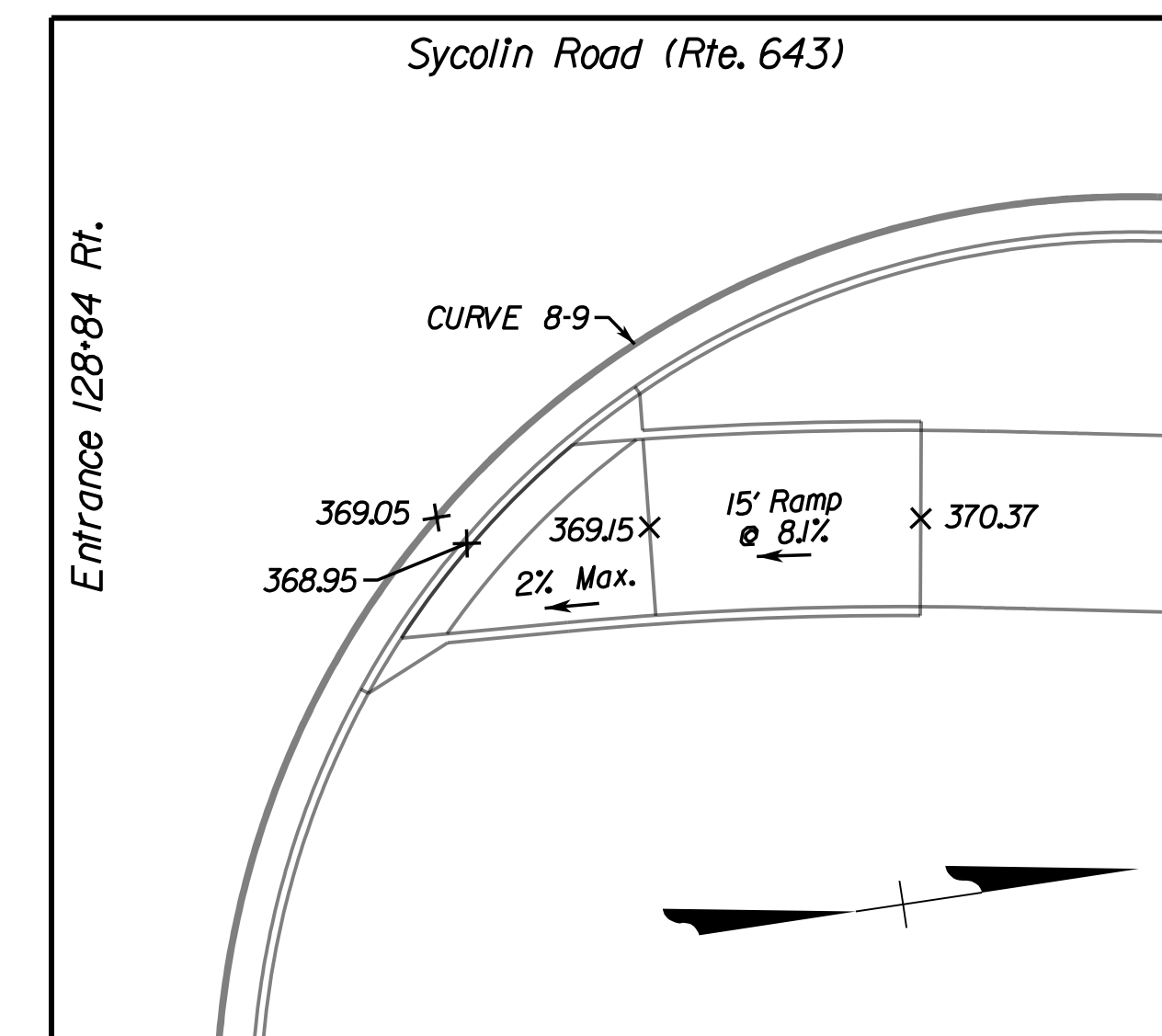
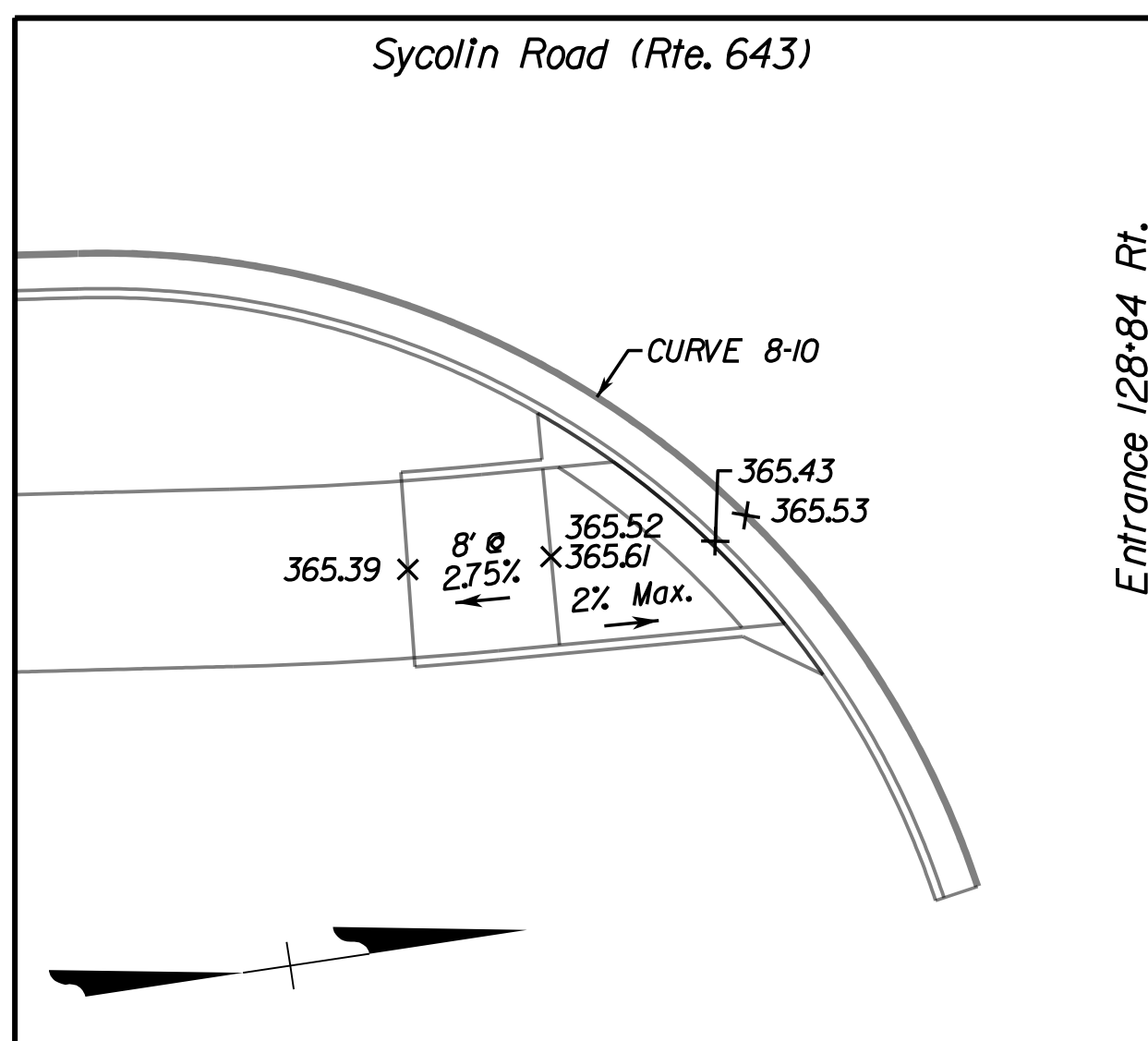
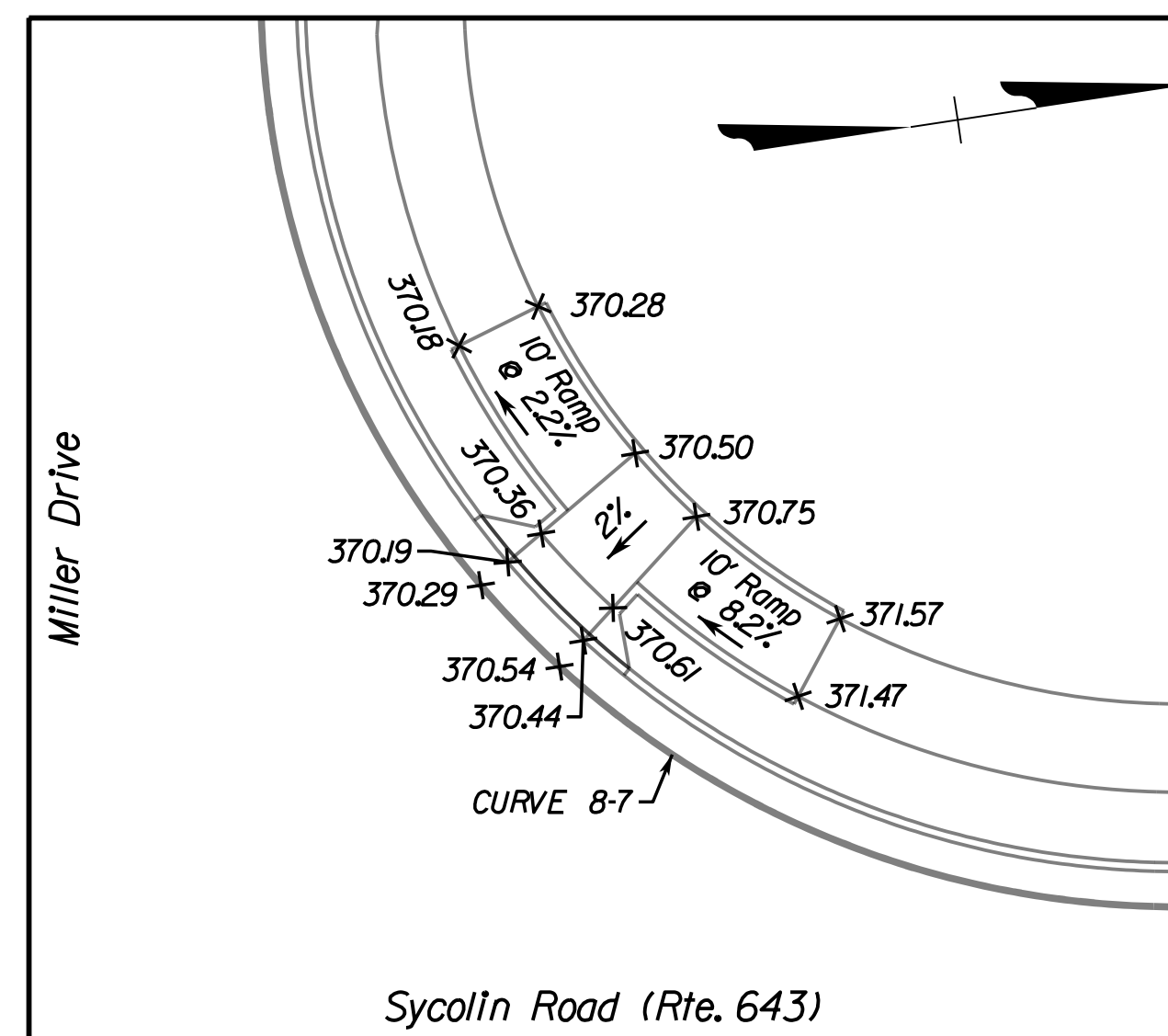
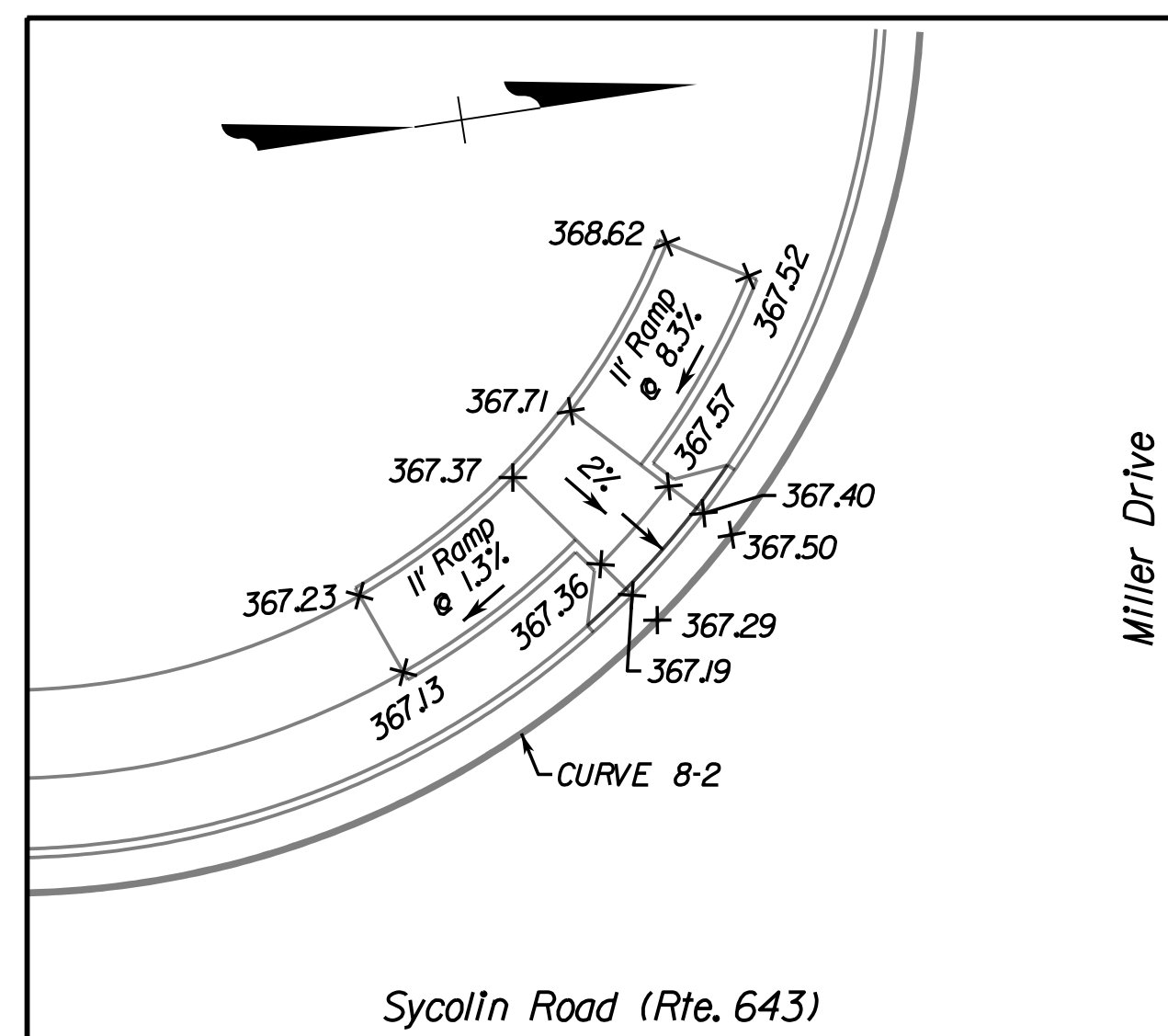
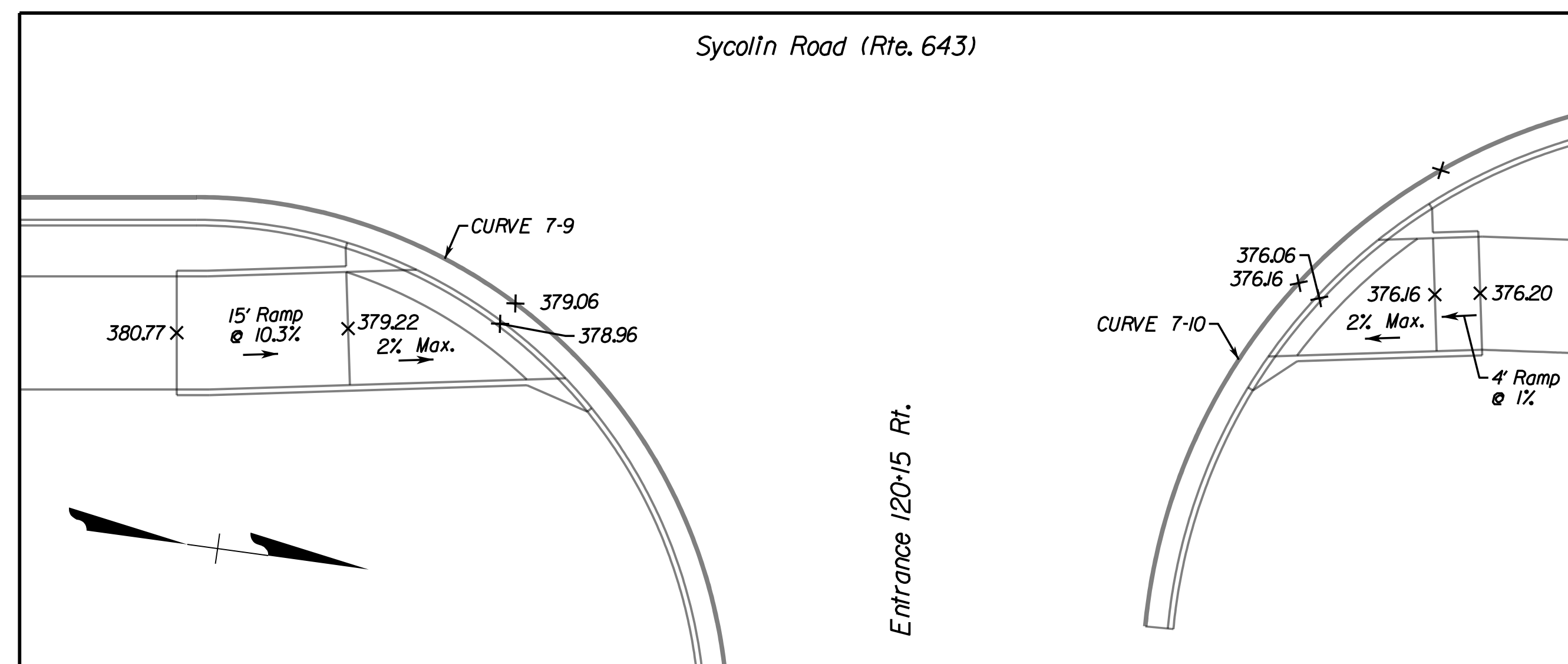
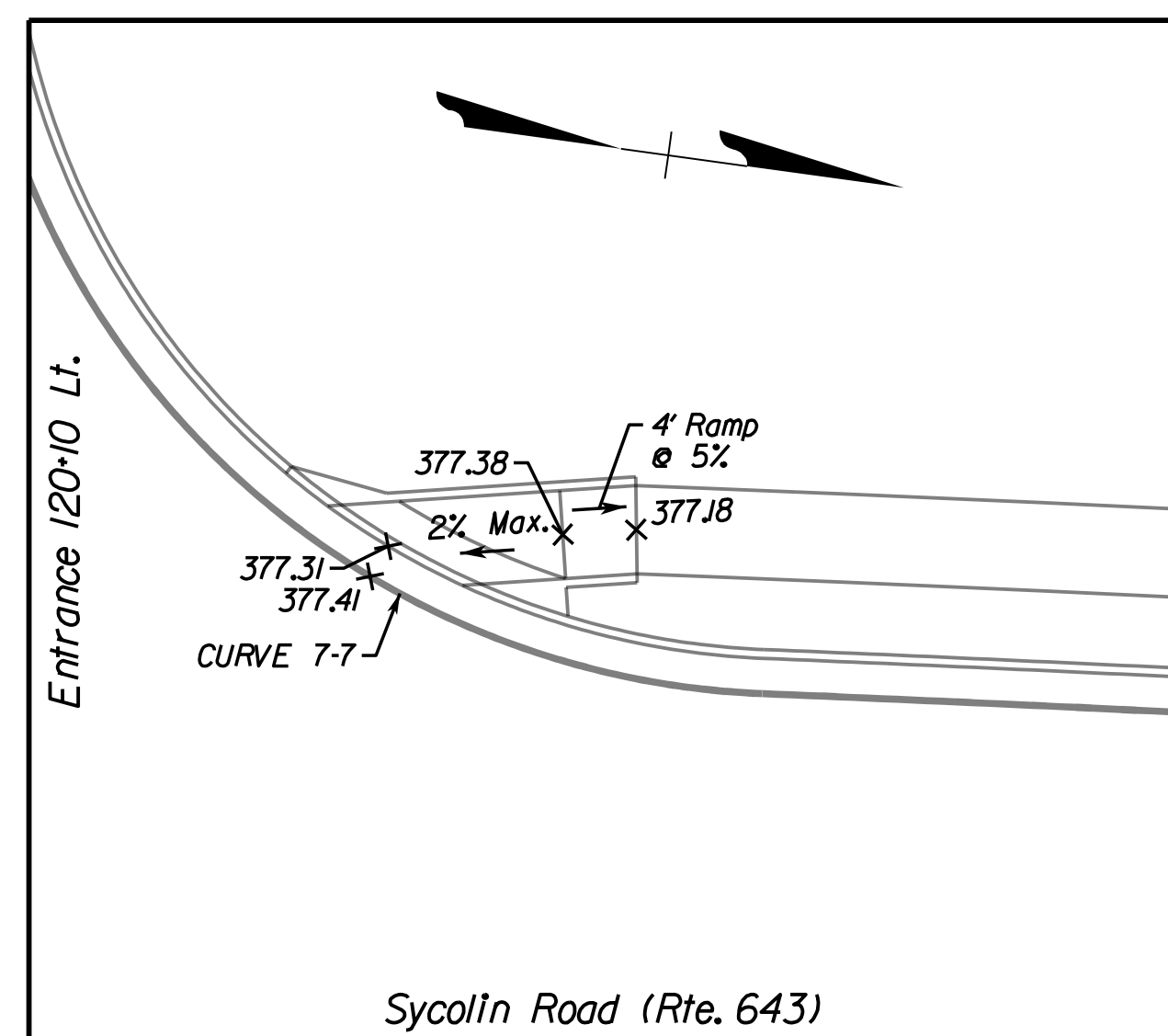
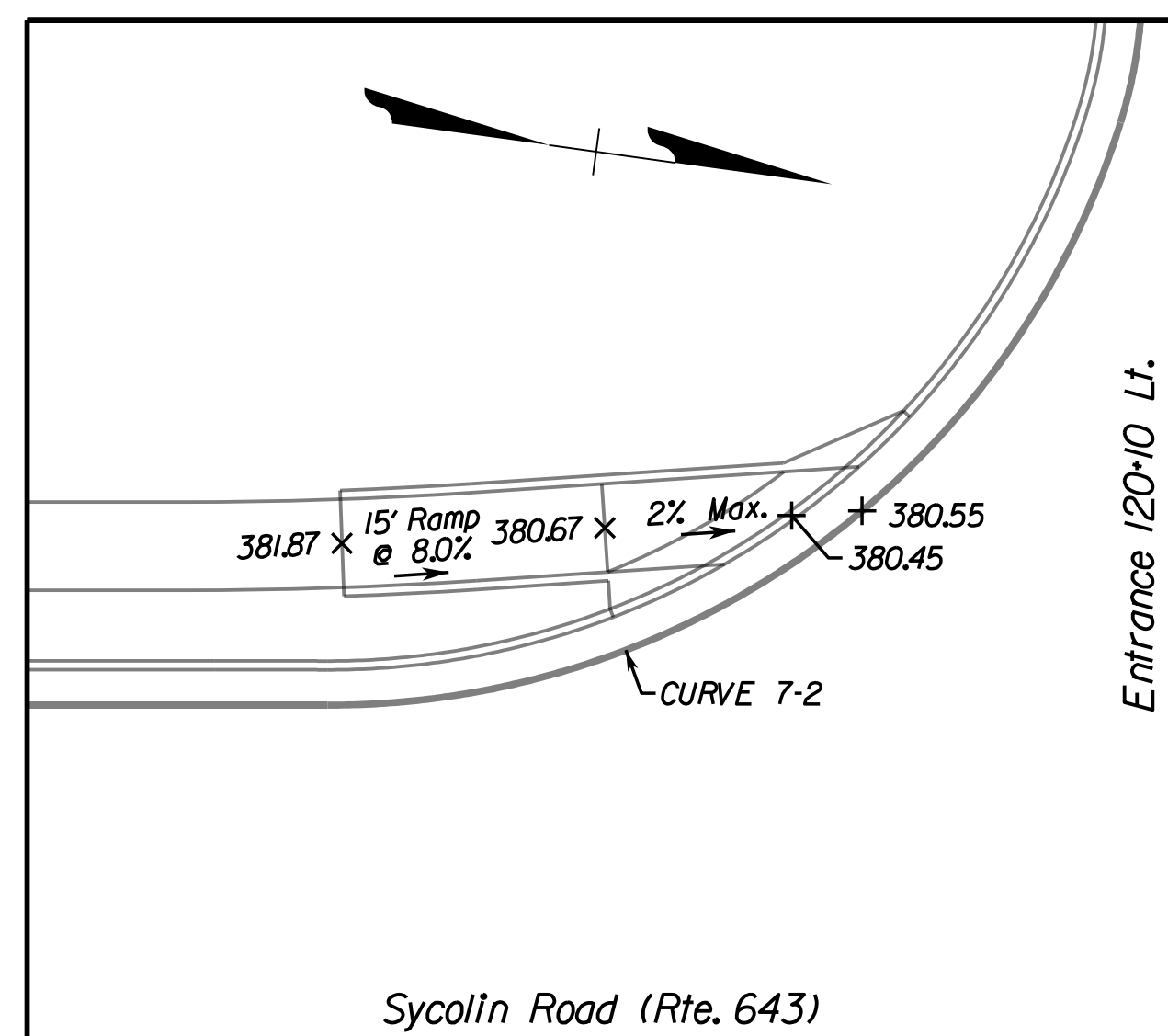


# CURB RAMP DETAILS



ENGINEER: **Rinker Design Associates, P.C.**  
 Engineering • Surveying • Land Planning • Transportation • Environmental Services  
 6000 Occombe Blvd., Suite 200, Manassas, Virginia 20108 on the web at [www.rinker.com](http://www.rinker.com)  
 Telephone: (703) 368-7373 Fax: (703) 368-7343  
 To Make Your Vision Reality

PROJECT NAME: **SYCOLIN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.**  
 CURB RAMP DETAILS  
 Loudoun County, Virginia

Town of Leesburg  
 SUBMISSION DATE: 02/21/2018

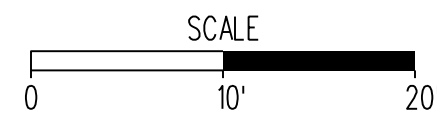
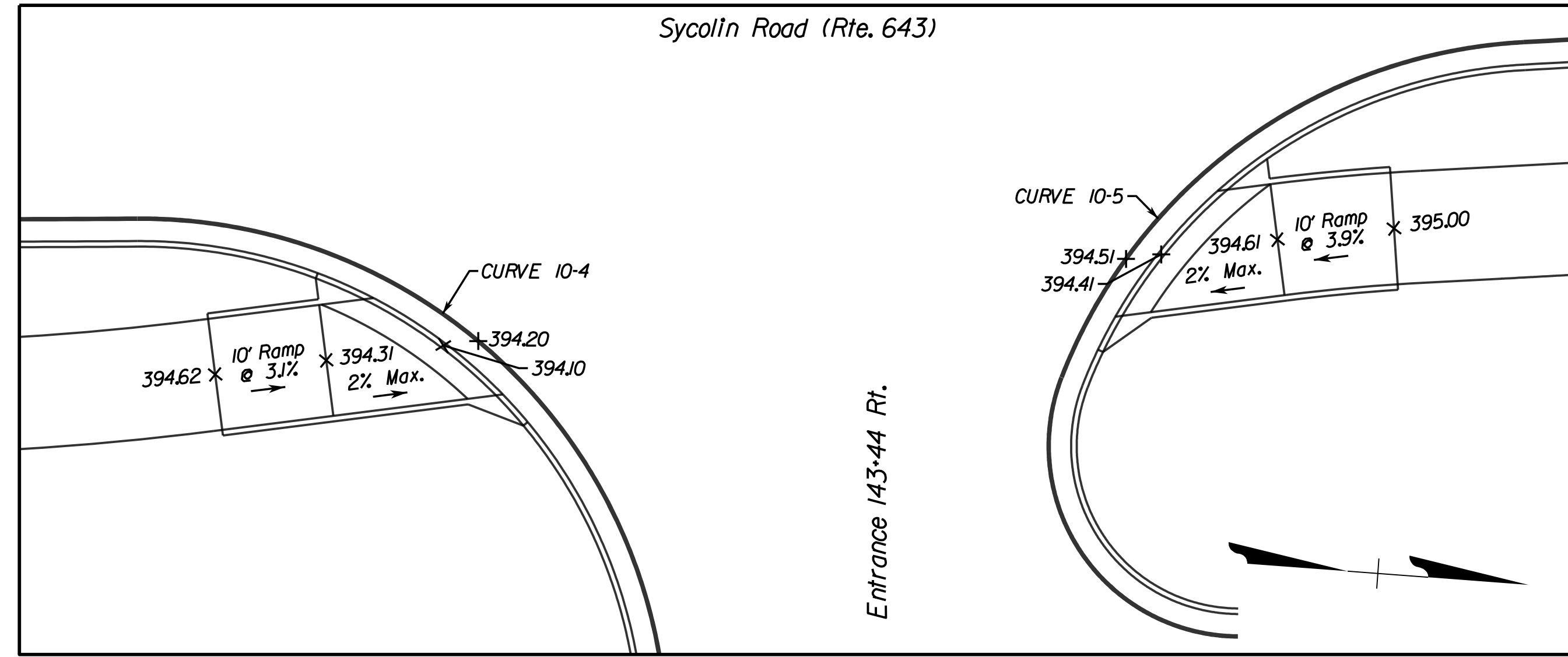
PROJECT MANAGER: MARK A. GUNN, P.E.

ASSOCIATED PLAN: **TLCI-2016-0002**  
 C.I.P. NUMBER: **U000-253-312**  
 VDOT PROJ. NO. **U000-253-312**  
 TOWN NUMBER: TBD

Sheet 2F of 20

PROJECT MANAGER *Anne Geisler*, (703) 771-2742 (Town of Leesburg)  
 SURVEYED BY *Sidney Thomas, L.S.*, (703) 368-7373 (2015)  
 SUBSURFACE UTILITY BY *Accumark*, (800) 542-2990 (2015)  
 DESIGN SUPERVISED BY *Mark A. Gunn, P.E.*, (703) 368-7373  
 DESIGNED BY *Sahab Dadir, P.E.*, (703) 368-7373

# CURB RAMP DETAILS



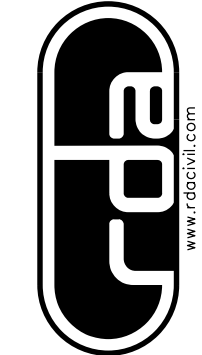
Mark A Gunn  
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ASSOCIATED PLAN	
C.I.P. NUMBER:	TLCI-2016-0002
VDOT PROJ. NO.:	U000-253-312
TOWN NUMBER:	TBD

Sheet  
 2F(1) of 20

PROJECT NAME: **SYCOLIN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.**  
**CURB RAMP DETAILS**  
 Loudoun County, Virginia  
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 SUBMISSION DATE: 02/21/2018

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PROJECT MANAGER: MARK A. GUNN, P.E.

PROJECT MANAGER *Anne Geisler, (703) 771-2742 (Town of Leesburg)*  
SURVEYED BY *Sidney Thomas, L.S., (703) 368-7373 (2015)*  
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DESIGN SUPERVISED BY *Mark A. Gunn, P.E., (703) 368-7373*  
DESIGNED BY *Sahab Qadiri, P.E., (703) 368-7373*

# EXISTING AS-BUILT INFORMATION

## EXISTING SANITARY

- (A) Ex. Sanitary M.H.  
Ex. Top-352.78  
Ex. Inv. In-345.66 (From B)  
Ex. Inv. In-345.66 (From G)  
Ex. Inv. Out-345.46
- (B) Ex. Sanitary M.H.  
Ex. Top-359.47  
Ex. Inv. In-353.72 (From C)  
Ex. Inv. In-353.62 (From E)  
Ex. Inv. Out-353.47
- (C) Ex. Sanitary M.H.  
Ex. Top-368.95  
Ex. Inv. In-355.43  
Ex. Inv. Out-355.23
- (D) Ex. Sanitary M.H.  
Ex. Top-367.93  
Ex. Inv. In-356.33 (2)  
Ex. Inv. Out-356.13
- (E) Ex. Sanitary M.H.  
Ex. Top-365.70  
Ex. Inv. In-357.93  
Ex. Inv. Out-357.83
- (F) Ex. Sanitary M.H.  
Ex. Top-371.62  
Ex. Inv. In-364.87  
Ex. Inv. Out-364.67
- (G) Ex. Sanitary M.H.  
Ex. Top-361.88  
Ex. Inv. In-354.98  
Ex. Inv. Out-354.58
- (H) Ex. Sanitary M.H.  
Ex. Top-369.70  
Ex. Inv. In-360.13 (From I)  
Ex. Inv. In-360.07 (From J)  
Ex. Inv. Out-359.93
- (I) Ex. Sanitary M.H.  
Ex. Top-372.24  
Ex. Inv. In-363.84  
Ex. Inv. In-364.24 (Lateral)  
Ex. Inv. Out-363.68
- (J) Ex. Sanitary M.H.  
Ex. Top-369.96  
Ex. Inv. In-361.31  
Ex. Inv. Out-361.21
- (K) Ex. Sanitary M.H.  
Ex. Top-374.13  
Ex. Inv. In-366.71  
Ex. Inv. Out-366.51
- (L) Ex. Sanitary M.H.  
Ex. Top-382.41  
Ex. Inv. In-367.83  
Ex. Inv. Out-367.63
- (M) Ex. Sanitary M.H.  
Ex. Top-373.35  
Ex. Inv. In-367.55  
Ex. Inv. Out-366.75
- (N) Ex. Sanitary M.H.  
Ex. Top-380.06  
Ex. Inv. In-372.76  
Ex. Inv. Out-372.66
- (O) Ex. Sanitary M.H.  
Ex. Top-384.32  
Ex. Inv. In-378.07 (From P)  
Ex. Inv. In-378.17 (From R)  
Ex. Inv. Out-377.83
- (P) Ex. Sanitary M.H.  
Ex. Top-395.05  
Ex. Inv. In-388.67  
Ex. Inv. Out-388.47
- (R) Ex. Sanitary M.H.  
Ex. Top-394.20  
Ex. Inv. In-382.02  
Ex. Inv. Out-382.00

## EXISTING STORM

- 1 Ex. End Section  
Ex. Inv.-374.74
- 2 Ex. Storm Manhole  
Ex. Top-384.79  
Ex. Inv. In-377.69  
Ex. Inv. Out-377.59  
24" Conc. Pipe
- 3 Ex. Storm Manhole  
Ex. Top-393.10  
Ex. Inv. In-382.45 (From 4)  
Ex. Inv. In-379.22 (From 6)  
Ex. Inv. Out-379.13  
24" Conc. Pipe
- 4 Ex. Storm Inlet  
Ex. Top-391.58  
Ex. Inv. In-383.46  
Ex. Inv. Out-383.38  
15" Conc. Pipe
- 5 Ex. Storm Inlet  
Ex. Top-391.57  
Ex. Inv. Out-387.92  
15" Conc. Pipe
- 6 Ex. Storm Inlet  
Ex. Top-394.21  
Ex. Inv. In-380.23  
Ex. Inv. Out-380.18  
20" Conc. Pipe
- 7 Ex. Storm Inlet  
Ex. Top-395.86  
Ex. Inv. In-389.81 (From 8)  
Ex. Inv. In-382.03 (From 9)  
Ex. Inv. Out-381.96  
20" Conc. Pipe
- 8 Ex. Storm Inlet  
Ex. Top-395.97  
Ex. Inv. Out-391.81  
15" Conc. Pipe
- 9 Ex. Storm Manhole  
Ex. Top-397.70  
Ex. Inv. In-383.67  
Ex. Inv. Out-383.61  
18" Conc. Pipe
- 10 Ex. Storm Inlet  
Ex. Top-396.81  
Ex. Inv. In-392.31 (From 11)  
Ex. Inv. In-385.08 (From 12)  
Ex. Inv. Out-385.01  
18" Conc. Pipe
- 11 Ex. Storm Inlet  
Ex. Top-397.02  
Ex. Inv. Out-392.67  
15" Conc. Pipe
- 12 Ex. Storm Inlet  
Ex. Top-395.84  
Ex. Inv. In-389.60 (From 13)  
Ex. Inv. In-388.33 (From 15)  
Ex. Inv. Out-386.26  
18" Conc. Pipe
- 13 Ex. Storm Inlet  
Ex. Top-395.68  
Ex. Inv. In-389.73  
Ex. Inv. Out-389.65  
15" Conc. Pipe
- 14 Ex. Storm Inlet  
Ex. Top-394.86  
Ex. Inv. Out-391.06  
15" Conc. Pipe
- 15 Ex. Storm Inlet  
Ex. Top-393.78  
Ex. Inv. In-388.63  
Ex. Inv. Out-388.58  
15" Conc. Pipe
- 16 Ex. Storm Inlet  
Ex. Top-393.73  
Ex. Inv. Out-389.00  
15" Conc. Pipe
- 17 Ex. Storm Pipe  
Ex. Inv.-390.38
- 18 Ex. Storm Pipe  
Ex. Inv.-390.69  
15" Conc. Pipe
- 19 Ex. End Section  
Ex. Inv.-359.88
- 20 Ex. Headwall  
Ex. Top-365.36  
Ex. Inv.-360.23  
42" Conc. Pipe
- 21 Ex. Endwall  
Ex. Top-363.38  
Ex. Inv.-358.63 (2)
- 22 Ex. Headwall  
Ex. Top-363.88  
Ex. Inv.-359.11 (2)  
5' x 3' Box Culverts
- 23 Ex. Endwall  
Ex. Top-366.58  
Ex. Inv.-360.94
- 24 Ex. Storm Inlet  
Ex. Top-371.60  
Ex. Grate-370.97  
Ex. Inv. In-364.57  
Ex. Inv. Out-364.47  
48" Conc. Pipe
- 25 Ex. Storm Grate  
Ex. Top-371.12  
Ex. Inv. In-366.22 (From 26)  
Ex. Inv. In-364.77 (From Bldg.)  
Ex. Inv. Out-364.67  
24" Conc. Pipe
- 26 Ex. Storm Grate  
Ex. Top-373.27  
Ex. Inv. In-367.42  
Ex. Inv. Out-367.39  
24" Conc. Pipe
- 27 Ex. Storm Inlet  
Ex. Top-375.84  
Ex. Inv. In-371.67 (From 28)  
Ex. Inv. In-367.79 (From 29)  
Ex. Inv. Out-367.72  
24" Conc. Pipe
- 28 Ex. Storm Inlet  
Ex. Top-380.68  
Ex. Inv. Out-374.38  
15" Conc. Pipe
- 29 Ex. Storm Inlet  
Ex. Top-376.39  
Ex. Inv. In-369.75  
Ex. Inv. Out-368.19  
24" Conc. Pipe
- 30 Ex. Storm Inlet  
Ex. Top-377.65  
Ex. Inv. In-372.15 (From 12")  
Ex. Inv. In-370.80 (From 18")  
Ex. Inv. Out-370.58  
18" Conc. Pipe
- 31 Ex. End Section  
Ex. Inv.-350.66
- 32 Ex. Storm Inlet  
Ex. Grate-363.00  
Ex. Throat-359.50  
Ex. Inv. In-352.30  
Ex. Inv. Out-352.10  
48" Conc. Pipe
- 33 Ex. End Section  
-Submerged In Pond-  
24" Conc. Pipe
- 34 Ex. End Section  
-Submerged In Pond-
- 35 Ex. Storm Inlet  
Ex. Top-369.27  
Ex. Inv. Out-363.17  
Conc. Pipe
- 36 Ex. End Section  
-Submerged In Pond-
- 37 Ex. Storm Inlet  
Ex. Top-370.29  
C/L Structure-356.86  
54" Conc. Pipe
- 38 Ex. End Section  
Ex. Inv.-362.77  
24" Conc. Pipe
- 39 Ex. End Section  
Ex. Inv.-362.93  
12" Conc. Pipe
- 40 Ex. Storm Inlet  
Ex. Top-368.86  
Ex. Inv. Out-363.60
- 41 Ex. End Section  
Ex. Inv.-369.14
- 42 Ex. Storm Manhole  
Ex. Top-373.80  
Ex. Inv. In-369.64 (From 43)  
Ex. Inv. In-369.62 (From 46)  
Ex. Inv. Out-369.30  
24" Conc. Pipe
- 43 Ex. Storm Filter  
Ex. Top-375.02  
C/L Structure-370.47  
15" Conc. Pipe
- 44 Ex. Storm Inlet  
Ex. Top-375.42  
Ex. Inv. In-371.02  
Ex. Inv. Out-370.92  
15" Conc. Pipe
- 45 Ex. Storm Inlet  
Ex. Top-379.65  
Ex. Inv. Out-375.61  
15" Conc. Pipe
- 46 Ex. Storm Manhole  
Ex. Top-383.23  
Ex. Inv. In-372.63  
Ex. Inv. Out-371.18  
24" Conc. Pipe
- 47 Ex. Storm Manhole  
Ex. Top-383.22  
Ex. Inv. In-376.72  
Ex. Inv. Out-373.52  
24" Conc. Pipe
- 48 Ex. Storm Inlet  
Ex. Top-381.44  
Ex. Inv. In-377.28  
Ex. Inv. Out-377.08  
24" Conc. Pipe
- 49 Ex. Headwall  
Ex. Top-380.12  
Ex. Inv.-377.59  
15" Conc. Pipe
- 50 Ex. End Section  
Ex. Inv.-375.60
- 51 Ex. Storm Inlet  
Ex. Top-381.14  
Ex. Inv. In-376.19 (From 52)  
Ex. Inv. In-376.09 (From 58)  
Ex. Inv. Out-375.99  
24" Conc. Pipe
- 52 Ex. Storm Inlet  
Ex. Top-381.44  
Ex. Inv. In-376.79  
Ex. Inv. Out-376.59  
24" Conc. Pipe
- 53 Ex. Storm Inlet  
Ex. Top-384.08  
Ex. Inv. In-378.72 (From 54)  
Ex. Inv. In-378.72 (From 55)  
Ex. Inv. In-278.86 (From 56)  
Ex. Inv. Out-378.21  
24" Conc. Pipe
- 54 Ex. Storm Grate  
Ex. Top-389.59  
Ex. Inv. Out-386.22  
15" Conc. Pipe
- 55 Ex. Storm Grate  
Ex. Top-382.76  
Ex. Inv. Out-380.11  
15" Conc. Pipe
- 56 Ex. Storm Inlet  
Ex. Top-384.00  
Ex. Inv. In-379.10  
Ex. Inv. Out-379.00  
15" Conc. Pipe
- 57 Ex. Storm Inlet  
Ex. Top-383.16  
Ex. Inv. Out-379.32  
15" Conc. Pipe
- 58 Ex. Storm Inlet  
Ex. Top-381.24  
Ex. Inv. In-377.04  
Ex. Inv. Out-376.94  
15" Conc. Pipe
- 59 Ex. Storm Inlet  
Ex. Top-381.33  
Ex. Inv. Out-377.41  
15" Conc. Pipe
- 60 Ex. Storm Inlet  
Ex. Top-378.00  
12" Orifice-376.29  
Ex. Inv. Out-374.58  
30" Conc. Pipe
- 61 Ex. Endwall  
Ex. Top-377.33  
Ex. Inv.-373.53
- 62 Ex. End Section  
Ex. Inv.-376.69
- 63 Ex. Storm Inlet  
Ex. Top-381.18  
Ex. Inv. In-377.23  
Ex. Inv. Out-377.13  
15" Conc. Pipe
- 64 Ex. Storm Inlet  
Ex. Top-381.90  
Ex. Inv. Out-377.90  
15" Conc. Pipe
- 65 Ex. End Section  
Ex. Inv.-374.70
- 66 Ex. Storm Inlet  
Ex. Top-383.79  
Ex. Inv. Out-381.14  
18" Conc. Pipe
- 67 Ex. End Section  
Ex. Inv.-376.42
- 68 Ex. Storm Inlet  
Ex. Top-385.61  
Ex. Inv. In-380.06  
Ex. Inv. Out-379.94  
15" Conc. Pipe
- 69 Ex. Storm Inlet  
Ex. Top-384.41  
Ex. Inv. In-380.03  
Ex. Inv. Out-379.96  
15" Conc. Pipe
- 70 Ex. Storm Inlet  
Ex. Top-385.33  
Ex. Inv. Out-381.18  
15" Conc. Pipe
- 71 Ex. Storm Inlet  
Ex. Top-393.72  
Ex. Inv. In-389.21  
Ex. Inv. Out-389.08  
15" Conc. Pipe
- 72 Ex. Storm Inlet  
Ex. Top-393.58  
C/L Structure-389.98  
-Full of Debris-  
15" Conc. Pipe
- 73 Ex. Storm Grate  
Ex. Top-359.86  
Ex. Inv. In-351.88  
Ex. Inv. Out-351.86  
48" Conc. Pipe
- 74 Ex. Endwall  
Ex. Top-386.30  
Ex. Inv.-383.69
- 75 Ex. Pond Outfall  
Structure  
Ex. Top-386.77  
Ex. 12" Orifice  
(In)-383.95  
Ex. Inv. Out-383.87  
15" Conc. Pipe
- 76 Ex. Endwall  
Ex. Top-389.20  
Ex. Inv.-386.71
- 77 Ex. Storm Inlet  
Ex. Top-392.76  
Ex. Inv. In-387.49  
Ex. Inv. Out-387.39  
88" Conc. Pipe
- 78 Ex. Storm Inlet  
Ex. Top-394.20  
Ex. Inv. In-388.50  
Ex. Inv. Out-388.33  
15" Conc. Pipe

ASSOCIATED PLAN

C.I.P. NUMBER: **TLCI-2016-0002**  
VDOT PROJ. NO. **U000-253-312**

TOWN NUMBER: TBD

PROJECT NAME: **SYCOLIN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.**

EXISTING AS-BUILT INFORMATION

Loudoun County, Virginia

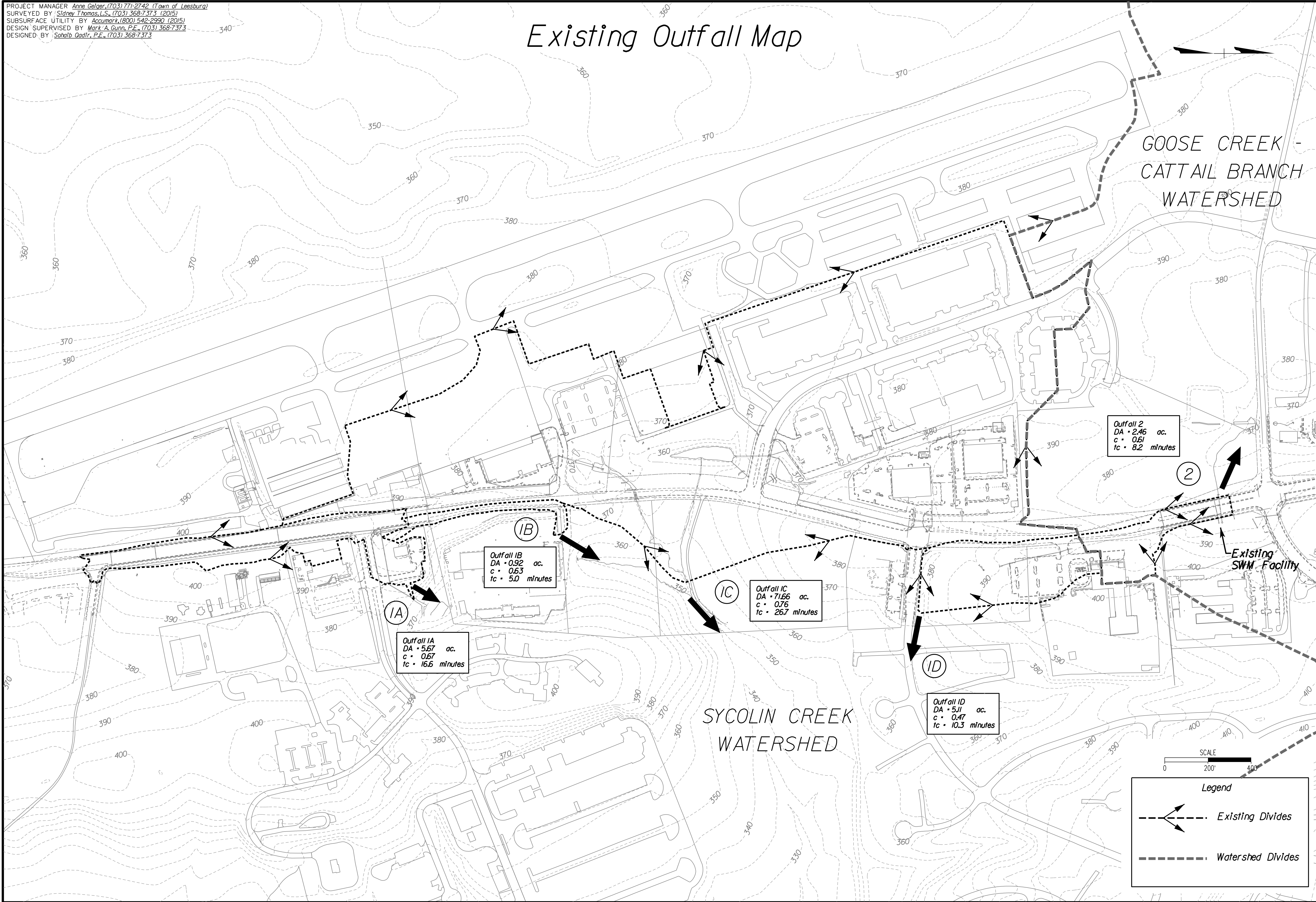
Town of Leesburg  
SUBMISSION DATE: 02/21/2018

ENGINEER:  
**Rinker Design Associates, P.C.**  
Engineering - Surveying - Land Planning - Transportation - Environmental Services  
10000 Leesburg Road, Suite 200, Leesburg, Virginia 20151  
Telephone: (703) 368-7373 Fax: (703) 370-5443  
www.rinker.com  
To Make Your Vision Reality



PROJECT MANAGER: MARK A. GUNN, P.E.

# Existing Outfall Map



**Outfall IA**  
 DA • 5.67 ac.  
 c • 0.67  
 tc • 16.6 minutes

**Outfall IB**  
 DA • 0.92 ac.  
 c • 0.63  
 tc • 5.0 minutes

**Outfall IC**  
 DA • 71.66 ac.  
 c • 0.76  
 tc • 26.7 minutes

**Outfall ID**  
 DA • 5.11 ac.  
 c • 0.47  
 tc • 10.3 minutes

**Outfall 2**  
 DA • 2.46 ac.  
 c • 0.61  
 tc • 8.2 minutes

**Legend**

- Existing Divides
- Watershed Divides

**ENGINEER:** Rinker Design Associates, P.C.  
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**PROJECT MANAGER:** MARK A. GUNN, P.E.

**Town of Leesburg**  
 Loudoun County, Virginia

**Existing Outfall Map**

**ASSOCIATED PLAN:** TLCI-2016-0002  
**C.I.P. NUMBER:** U000-253-312  
**VDOT PROJ. NO.:** U000-253-312

**PROFESSIONAL ENGINEER:** NIKHIL V. DESHPANDE  
 Lic. No. 045430

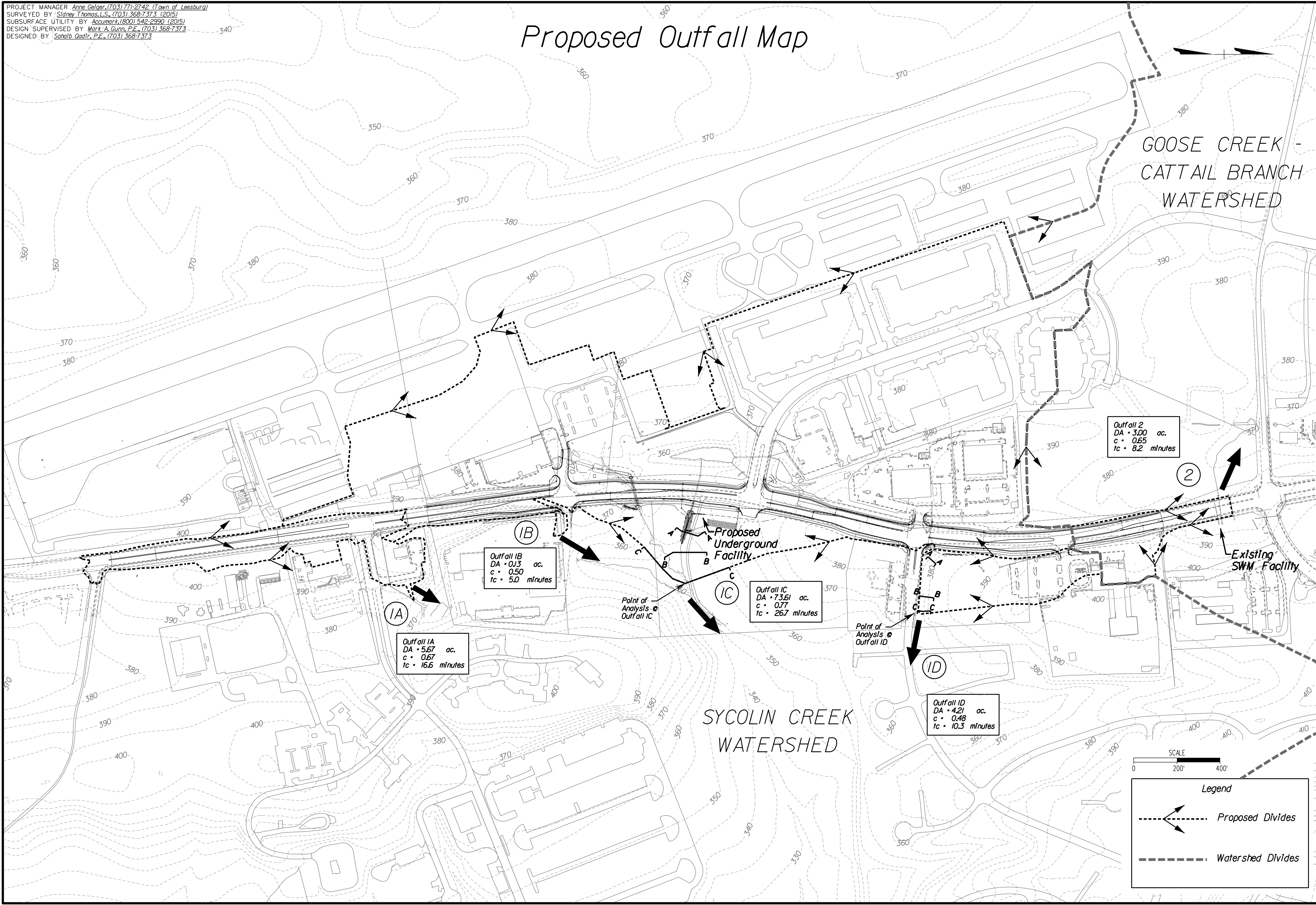
**Submission Information:**  
 Submission Date: 02/21/2018  
 Nikhil V Deshpande  
 2018.02.22 09:35:10 -05'00'

**TOWN NUMBER:** TBD

Sheet 2H of 20

PROJECT MANAGER: Anne Geisler, (703) 771-2742 (Town of Leesburg)  
 SURVEYED BY: Sidney Thomas, L.S., (703) 368-7373 (2015)  
 SUBSURFACE UTILITY BY: AccuMark, (800) 542-2990 (2015)  
 DESIGN SUPERVISED BY: Mark A. Gunn, P.E., (703) 368-7373  
 DESIGNED BY: Sahab Dadir, P.E., (703) 368-7373

# Proposed Outfall Map



**Outfall IB**  
 DA • 0.13 ac.  
 c • 0.50  
 tc • 5.0 minutes

**Outfall IA**  
 DA • 5.67 ac.  
 c • 0.67  
 tc • 16.6 minutes

**Outfall IC**  
 DA • 73.61 ac.  
 c • 0.77  
 tc • 26.7 minutes

**Outfall ID**  
 DA • 4.21 ac.  
 c • 0.48  
 tc • 10.3 minutes

**Outfall 2**  
 DA • 3.00 ac.  
 c • 0.65  
 tc • 8.2 minutes

SCALE  
 0 200' 400'

**Legend**

- Proposed Divides
- Watershed Divides

**ENGINEER:** Rinker Design Associates, P.C.  
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**PROJECT MANAGER:** MARK A. GUNN, P.E.

**Town of Leesburg**  
 Loudoun County, Virginia

**Proposed Outfall Map**

**ASSOCIATED PLAN:** TLCl-2016-0002  
**C.I.P. NUMBER:** U000-253-312  
**VDOT PROJ. NO.:** U000-253-312

**PROFESSIONAL ENGINEER:** NIKHIL V. DESHPANDE  
 Lic. No. 045430

**Submission:** 2018.02.22 09:35:32 -05'00'

**TOWN NUMBER:** TBD

Sheet 2H(1) of 20

PROJECT MANAGER Anne Gelsler, (703) 771-2742 (Town of Leesburg)  
SURVEYED BY Sidney Thomas, L.S., (703) 368-7373 (2015)  
SUBSURFACE UTILITY BY Accumark, (800) 542-2990 (2015)  
DESIGN SUPERVISED BY Mark A. Gunn, P.E., (703) 368-7373  
DESIGNED BY Sohail Qadiri, P.E., (703) 368-7373

# Outfall Narrative and Tabulation

## SYCOLIN ROAD, RTE 643

Jun-17  
Table II-1

Watershed: Sycolin Creek

Outfall	Station	Project RW	Existing Condition					Proposed Condition					Natural Channel	Manmade Channel	Pipe	Pond	AASHTO Classification	(No Lining) Depth: Allowable Velocity	Area Detention
			Drainage Area	Cw	Tc (min.)	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Drainage Area	New Impervious Area	Cw	Tc (min.)	Q <sub>2</sub> (cfs)							
1A	97+50 to 113+50 Rte 643	2.61	5.67	0.67	16.6	14.2	18.7	5.67	0.00	0.67	16.6	14.2	18.7	x			A-6	3.5	Outfalls to Existing Channel. No Increase in Drainage Area to Outfall.
1B	119+25 to 120+25 Rte 643	0.00	0.92	0.63	5.0	3.3	4.2	0.13	-0.51	0.50	5.0	0.4	0.5		x		N/A	N/A	Outfalls to Existing Inlet. Reduction in Drainage Area to Outfall.
1C	106+00 to 144+00 Rte 643	9.12	71.66	0.76	26.7	159.6	214.0	73.61	3.58	0.77	26.7	166.1	222.8	x			A-4	2.3	Outfalls to Existing Natural Channel. SWM Reduces Peak Flow to Channel.
1D	137+00 to 145+00 Rte 643	0.01	5.11	0.47	10.3	10.9	14.1	4.21	-0.22	0.48	10.3	9.2	11.9	x			A-6	3.5	Outfalls to Existing Roadside Ditch. Reduction in Drainage Area to Outfall.
<b>Total</b>		<b>11.74</b>						<b>2.85</b>											

Watershed: Goose Creek - Cattail Branch

Outfall	Station	Project RW	Existing Condition					Proposed Condition					Natural Channel	Manmade Channel	Pipe	Pond	AASHTO Classification	(No Lining) Depth: Allowable Velocity	Area Detention
			Drainage Area	Cw	Tc (min.)	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Drainage Area	New Impervious Area	Cw	Tc (min.)	Q <sub>2</sub> (cfs)							
2	143+85 to 151+40 Rte 643	1.34	2.46	0.61	8.2	7.4	9.5	3.00	0.25	0.65	8.2	9.7	12.4		x	x	N/A	N/A	Outfalls to Existing Storm Sewer System, which flows into the Sycolin Road Ph II existing pond. Pond designed to accommodate improvements to Sycolin Road in this watershed.
<b>Total</b>		<b>1.34</b>						<b>0.25</b>											

Watershed: Sycolin Creek

Outfalls	Station	Project R/W Area (ac.)	Existing Impervious (ac.)	New Impervious (ac.)	Total Impervious (ac.)	Outfall Drainage (ac.)	Pond Drainage		Site Area For BMP Calculations			Remarks
							Total Drainage Area to Facility	Impervious R/W Area Treated	Total Site Area (ac.)	Existing Impervious (ac.)	Proposed Impervious (ac.)	
1A	97+50 to 113+50 Rte 643	2.61	2.35	0.00	2.35	2.61			0.00	0.00	0.00	Outfalls to Existing Channel. No Increase in Drainage Area to Outfall.
	Offsite Upstream					0.44						
	Offsite Downstream					2.62						
<b>Total</b>		<b>2.61</b>	<b>2.35</b>	<b>0.00</b>	<b>2.35</b>	<b>5.67</b>						
<b>Sheet Flow</b>								0.07	0.00	0.00		Sheet Flow
1B	119+25 to 120+25 Rte 643	0.00	0.51	-0.51	0.00	0.00			0.02	0.01	0.01	Outfalls to Existing Inlet. Reduction in Drainage Area to Outfall.
	Offsite Downstream					0.13						
<b>Total</b>		<b>0.00</b>	<b>0.51</b>	<b>-0.51</b>	<b>0.00</b>	<b>0.13</b>						
<b>Sheet Flow</b>								0.01	0.00	0.00		Sheet Flow
1C	106+00 to 144+00 Rte 643	9.12	3.30	3.58	6.88	9.12			8.79	1.97	4.80	Outfalls to Existing Natural Channel. SWM Reduces Peak Flow to Channel.
	Offsite Upstream					58.97						
	Offsite Downstream					5.2						
<b>Total</b>		<b>9.12</b>	<b>3.30</b>	<b>3.58</b>	<b>6.88</b>	<b>73.61</b>						
<b>Underground Structure 8-23 to 8-22</b>									5.12	3.65		
<b>Sheet Flow</b>									0.06	0.02	0.03	Sheet Flow
1D	137+00 to 145+00 Rte 643	0.01	0.23	-0.22	0.01	0.02			0.14	0.03	0.04	Outfalls to Existing Roadside Ditch. Reduction in Drainage Area to Outfall.
	Offsite Downstream					4.19						
<b>Total</b>		<b>0.01</b>	<b>0.23</b>	<b>-0.22</b>	<b>0.01</b>	<b>4.21</b>						
<b>Watershed Totals:</b>		<b>11.74</b>	<b>6.39</b>	<b>2.85</b>	<b>9.24</b>	<b>83.62</b>			<b>9.09</b>	<b>2.03</b>	<b>4.88</b>	

<b>Project totals:</b>	<b>11.74</b>	<b>6.39</b>	<b>2.85</b>	<b>9.24</b>
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Watershed: Goose Creek - Cattail Branch

Outfalls	Station	Project R/W Area (ac.)	Existing Impervious (ac.)	New Impervious (ac.)	Total Impervious (ac.)	Outfall Drainage (ac.)	Pond Drainage		Site Area For BMP Calculations			Remarks
							Total Drainage Area to Facility	Impervious R/W Area Treated	Total Site Area (ac.)	Existing Impervious (ac.)	Proposed Impervious (ac.)	
2	143+85 to 151+40 Rte 643	1.34	0.75	0.25	1.00	1.34			0.89	0.25	0.50	Outfalls to Existing Storm Sewer System, which flows into the Sycolin Road Ph II existing pond. Pond designed to accommodate improvements to Sycolin Road in this watershed.
	Offsite Upstream					1.25						
	Offsite Downstream					0.41						
<b>Total</b>		<b>1.34</b>	<b>0.75</b>	<b>0.25</b>	<b>1.00</b>	<b>3.00</b>						
<b>Sheet Flow</b>									0.33	0.00	0.00	Sheet Flow
<b>Watershed Totals:</b>		<b>1.34</b>	<b>0.75</b>	<b>0.25</b>	<b>1.00</b>	<b>3.00</b>			<b>1.22</b>	<b>0.25</b>	<b>0.50</b>	

<b>Project totals:</b>	<b>1.34</b>	<b>0.75</b>	<b>0.25</b>	<b>1.00</b>
------------------------	-------------	-------------	-------------	-------------

Note: Project Right of Way Area identified in the tables above is in relation to the project Right of Way. The existing and proposed impervious area identified is within the right of way and is indicated for drainage tabulation purposes. This is not the "site area" as defined by SWPA 12.01. For BMP calculations, the "Site Area" has been calculated for each individual watershed along with the pre and post impervious area within the "Site Area". Please refer to performance based BMP calculations for additional details.

### Outfall Analysis and Narrative

The runoff from this project flows to two separate watersheds: Sycolin Creek and Goose Creek. Within the Sycolin Creek watershed, there are four secondary outfalls, and within the Goose Creek watershed, there is one secondary outfall. Please refer to the outfall tabulations on Sheets 2H(2) and 2H(3) for pre- and post-development peak runoff rates and area tabulations. These outfalls are further described as follows:

#### Sycolin Creek Watershed

Outfall 1A is the existing storm sewer system along Sycolin Road (Route 643). There is no increase in drainage area, impervious area, or peak flow from proposed improvements. The capacity of the downstream system is adequate to handle the flows with non-erosive velocities. Please refer to Inlet, storm, and HGL computations on Sheets 2J(2)-2J(8). Therefore, it is our professional opinion that Outfall 1A is an adequate outfall and the requirements of MS-19 are satisfied.

Outfall 1B is sheet flow over commercial entrance at station 120+8.37 into an existing inlet in the parking lot. There is a reduction in drainage area, impervious area, and peak flows to the inlet, and there are no documented issues with stormwater conveyance in the existing condition. Therefore, it is our professional opinion that Outfall 1B is an adequate outfall and the requirements of MS-19 are satisfied.

Outfall 1C is the point of confluence of two gently-meandering minor channels to the east of Sycolin Road. In the existing condition, the two channels are fed by a double 5' x 3' box culvert and a 48" end section, respectively. The proposed condition incorporates an extension of the box culvert and the addition of two 18" end sections, which receive flow from the proposed storm sewer system. The proposed roadway improvements correspond with an increase in impervious and total drainage area to the outfall. An underground detention pipe structure is proposed one pipe length upstream of the northern stormwater outlet, to limit peak inflow and offset the increased peak flow to the outfall. Cross sections of the outfall in the proposed condition on Sheet 2H(5) demonstrate adequate channel capacity and non-erosive velocity. Therefore, it is our professional opinion that Outfall 1C is an adequate outfall and the requirements of MS-19 are satisfied.

Outfall 1D is an existing roadside ditch running west to east along Tavistock Drive S.E. Proposed changes to the outfall include a reduction in drainage area and a rerouting of the upstream end of the ditch, which primarily receives the outflow from an existing detention pond. The proposed improvements reduce peak flows to the outfall. The velocities in the ditch are less than permissible velocity and the ditch capacity is adequate to contain flows from the 10-year storm. Therefore, it is our professional opinion that Outfall 1D is an adequate outfall and the requirements of MS-19 are satisfied.

#### Goose Creek Watershed

Outfall 2 is an existing storm sewer system which flows into an existing extended-detention pond at the southeastern corner of the Sycolin Road and Tolbert Lane S.E. Intersection. There is an increase in drainage area and impervious area associated with this outfall. The existing pipe system provides an adequate control of velocity and capacity to convey the design storm, and the pond is sized according to the ultimate condition, which included the proposed improvements on this plan. The pond was designed in the Sycolin Road Widening Phase II plan with future widening of Sycolin Road taken into consideration. Adequate storage is provided. Therefore, it is our professional opinion that Outfall 2 is an adequate outfall and the requirements of MS-19 are satisfied.

#### Adequate Outfall Analysis and Summary

The primary outfall for the project is the unnamed tributary to Sycolin Creek identified as Outfall 1C, which receives 73.61 acres of total drainage from the vicinity of Sycolin Road at the limit of study. The outfall limit of study is located at Station 126+00, 350' right, and is an incised natural channel. Proposed increases in volume to the channel from the site will be controlled by the proposed underground SWM facility. Pre-versus post-development flow velocity and volumetric considerations in this plan were assessed and the adequacy of the channel was verified in conformance with MS-19 regulations.

The northernmost outfall flows to Goose Creek via an existing extended-detention pond. The adequacy of proposed and existing storm sewer systems flowing to the pond was verified in compliance with MS-19. The pond, which was constructed in Phase II of the Sycolin Road Widening overall project, was designed to meet the design storm requirements of the ultimate condition. Because the proposed construction in this plan represents the ultimate condition, the pond is considered the limit of study in outfall analysis. Design calculations verifying the adequacy of the pond will be provided in compliance with MS-19.

#### Underground Detention System Inspection and Maintenance

The underground detention system will be inspected annually. Do not enter the underground facility to inspect unless Occupational Safety and Health Administration (OSHA) regulations for confined space entry are followed. If applicable, follow inspection and maintenance instructions and schedules provided by system manufacturer and installer. Properly dispose of all wastes. The following items will be inspected:

#### Inflow Point

- 1) Sediment accumulation
- 2) Trash and debris accumulation

#### Inlets

- 1) Structural condition of inlet
- 2) Sediment, trash, or debris has accumulated and/or is blocking the inlet

#### Storage Pipe

- 1) Sediment accumulation in pipe
- 2) Trash and debris accumulation in pipe

#### Other System Components

- 1) Structural deterioration is evident

#### Outlet

- 1) Outlet is in poor structural condition
- 2) Sediment, trash, or debris is blocking the outlet
- 3) Erosion is occurring around the outlet

#### Other

- 1) Evidence of ponding water on area draining to system
- 2) Evidence that water is not being conveyed through the system



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www.rinker.com  
to Make Your Vision Reality

PROJECT NAME: **SYCOLIN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.**  
PROJECT NUMBER: **TLCI-2016-0002**  
C.I.P. NUMBER: **U000-253-312**  
VDOT PROJ. NO. **U000-253-312**  
TOWN NUMBER: TBD

PROJECT MANAGER: **MARK A. GUNN, P.E.**  
Loudoun County, Virginia  
Town of Leesburg  
SUBMISSION DATE: 02/21/2018

Nikhil V Deshpande  
2018.02.22 09:35:56 -05'00'

ASSOCIATED PLAN  
Sheet 2H(2) of 20

PROJECT MANAGER: **Anne Geisler, (703) 771-2742 (Town of Leesburg)**  
 SURVEYED BY: **Sidney Thomas, L.S., (703) 368-7373 (2015)**  
 SUBSURFACE UTILITY BY: **Accumark, (800) 542-2990 (2015)**  
 DESIGN SUPERVISED BY: **Mark A. Gunn, P.E., (703) 368-7373**  
 DESIGNED BY: **Sahab Qadiri, P.E., (703) 368-7373**

# Drainage Computations and Details

Outfall 1A	Outfall 1B	Outfall 1C	Outfall 1D	Outfall 2
Drainage Area: 5.67 Ac	Drainage Area: 0.13 Ac	Drainage Area: 73.61 Ac	Drainage Area: 4.21 Ac	Drainage Area: 3.00 Ac
C Factor: 0.67	C Factor: 0.50	C Factor: 0.76	C Factor: 0.48	C Factor: 0.65
<b>TIME OF CONCENTRATION CALCULATION</b>				
<b>SHEET FLOW (VDM-APPENDIX 6D-1)</b>				
Length of flow: 13	Length of flow: 25	Length of flow: 100	Length of flow: 100	Length of flow: 97
Up Elev: 395	Up Elev: 384	Up Elev: 395	Up Elev: 401.5	Up Elev: 402
Down Elev: 394.86	Down Elev: 380	Down Elev: 380	Down Elev: 396.5	Down Elev: 401
Slope: 0.010769	Slope: 0.16	Slope: 0.05	Slope: 0.05	Slope: 0.010309
Ground Condition: Paved	Ground Condition: Short Grass Pasture	Ground Condition: Paved	Ground Condition: Paved	Ground Condition: Paved
C=: 0.9	C=: 0.4	C=: 0.9	C=: 0.9	C=: 0.9
Time of Sheet Flow: 1.7 Min	Time of Sheet Flow: 3.1 Min	Time of Sheet Flow: 3.1 Min	Time of Sheet Flow: 3.1 Min	Time of Sheet Flow: 4.1 Min
Velocity=: 0.1 fps	Velocity=: 0.1 fps	Velocity=: 0.5 fps	Velocity=: 0.5 fps	Velocity=: 0.4 fps
<b>SHALLOW FLOW</b>				
<b>KIRPICH (VDM APPENDIX 6D-5)</b>				
Length of flow: N/A	Length of flow: 180	Length of flow: 2288	Length of flow: 62	Length of flow: 162
Up Elev: N/A	Up Elev: 380	Up Elev: 380	Up Elev: 396.5	Up Elev: 401
Dn Elev: N/A	Dn Elev: 288.5	Dn Elev: 353	Dn Elev: 394	Dn Elev: 393.7
Height: N/A	Height: 113.5	Height: 27	Height: 2.5	Height: 7.3
Time of Shallow Flow: 0.0 Min	Time of Shallow Flow: 0.6 Min	Time of Shallow Flow: 16.8 Min	Time of Shallow Flow: 0.7 Min	Time of Shallow Flow: 1.4 Min
Velocity=: N/A	Velocity=: 5.4 fps	Velocity=: 2.3 fps	Velocity=: 1.5 fps	Velocity=: 1.9 fps
<b>CHANNEL FLOW</b>				
<b>KIRPICH (VDM APPENDIX 6D-5)</b>				
Length of flow: 1843	Length of flow: N/A	Length of flow: 600	Length of flow: 940	Length of flow: 400
Up Elev: 394.86	Up Elev: N/A	Up Elev: 353	Up Elev: 394	Up Elev: 393.7
Dn Elev: 374.74	Dn Elev: N/A	Dn Elev: 347.5	Dn Elev: 370	Dn Elev: 376
Height: 20.12	Height: N/A	Height: 5.5	Height: 24	Height: 17.7
Time of Shallow Flow: 14.8 Min	Time of Shallow Flow: 0.0	Time of Shallow Flow: 6.8 Min	Time of Shallow Flow: 6.5 Min	Time of Shallow Flow: 2.8 Min
Velocity=: 2.1 fps	Velocity=: N/A	Velocity=: 1.5 fps	Velocity=: 2.4 fps	Velocity=: 2.4 fps
<b>TIME OF CONCENTRATION</b> : 16.6 Min	<b>TIME OF CONCENTRATION</b> : 5.0 Min	<b>TIME OF CONCENTRATION</b> : 26.7 Min	<b>TIME OF CONCENTRATION</b> : 10.3 Min	<b>TIME OF CONCENTRATION</b> : 8.2 Min

**NOTE:**

For the design discharges associated with the outfalls, see Sheet 2H(2).  
 The computations and details on this sheet reflect only the computed times of concentration and the Town of Leesburg standards used to calculate rainfall intensity. A linear interpolation of the table in Drawing DD-4 was used to determine the peak rainfall intensity of Outfalls 1A, 1B, 1C, 1D, and 2. VDOT B, D, and E factors were not used.

Drainage systems for this project were designed in accordance with Town of Leesburg DCSM criteria and VDOT Standards where applicable.

RETURN INTERVAL (YEARS)	DURATION	RAINFALL DEPTH (INCHES)
1	24 Hours	2.6
2	24 Hours	3.1
5	24 Hours	4.0
10	24 Hours	4.7
25	24 Hours	5.9
50	24 Hours	6.9
100	24 Hours	8.0

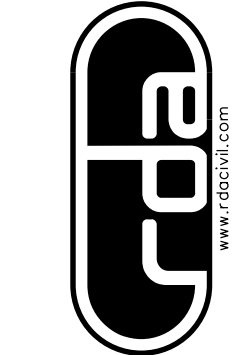
  

NO.	DATE	REVISIONS	<b>PEAK RAINFALL INTENSITIES</b>	DRAWING
1	11/2008			DD-3
				PAGE 113

DURATION (MINUTES)	RETURN INTERVAL (YEARS)				
	2	10	25	50	100
5	5.75	7.27	8.27	9.06	9.84
6	5.44	6.91	7.86	8.50	9.41
7	5.22	6.64	7.53	8.39	9.00
8	4.99	6.38	7.26	8.18	8.60
9	4.78	6.14	6.99	7.92	8.41
10	4.60	5.92	6.77	7.63	8.10
11	4.43	5.71	6.55	7.34	7.90
12	4.30	5.57	6.38	7.05	7.68
13	4.17	5.40	6.17	6.84	7.45
14	4.05	5.27	6.00	6.66	7.24
15	3.90	5.10	5.86	6.46	7.05
16	3.80	4.99	5.71	6.31	6.88
17	3.71	4.89	5.58	6.16	6.72
18	3.60	4.75	5.45	6.01	6.57
19	3.52	4.65	5.33	5.88	6.42
20	3.44	4.55	5.22	5.74	6.29
21	3.35	4.44	5.11	5.62	6.15
22	3.27	4.34	5.00	5.52	6.03
23	3.20	4.26	4.90	5.41	5.92
24	3.12	4.16	4.80	5.31	5.81
25	3.06	4.08	4.72	5.20	5.69
26	3.00	4.00	4.62	5.11	5.59
27	2.92	3.92	4.54	5.02	5.50
28	2.87	3.84	4.46	4.93	5.40
29	2.81	3.79	4.39	4.85	5.32
30	2.75	3.71	4.30	4.76	5.22
35	2.51	3.42	3.99	4.43	4.85
40	2.31	3.17	3.71	4.14	4.54
45	2.13	2.96	3.49	3.89	4.27
50	1.99	2.80	3.30	3.67	4.05
55	1.86	2.64	3.13	3.49	3.86
60	1.73	2.50	2.95	3.30	3.65
65	1.65	2.37	2.83	3.16	3.50
70	1.56	2.26	2.70	3.01	3.35
75	1.47	2.16	2.56	2.87	3.19
80	1.40	2.04	2.45	2.75	3.05
85	1.32	1.95	2.34	2.63	2.91
90	1.26	1.87	2.24	2.51	2.79
95	1.20	1.79	2.14	2.41	2.67
100	1.15	1.72	2.06	2.31	2.56
110	1.08	1.59	1.90	2.14	2.37
120	1.01	1.48	1.76	1.97	2.18

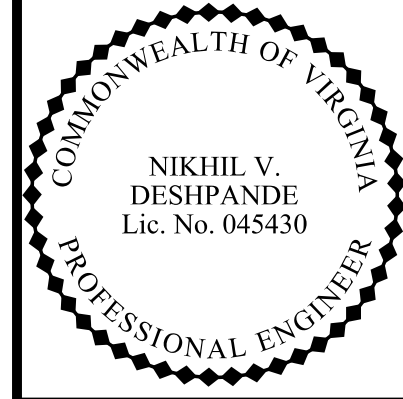
NO.	DATE	REVISIONS	<b>PEAK RAINFALL INTENSITIES</b>	DRAWING
				DD-4
				PAGE 114



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**PROJECT NAME:** SYCOLIN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.  
**PROJECT MANAGER:** MARK A. GUNN, P.E.  
**Submission DATE:** 02/21/2018  
**Town of Leesburg**  
**Loudoun County, Virginia**

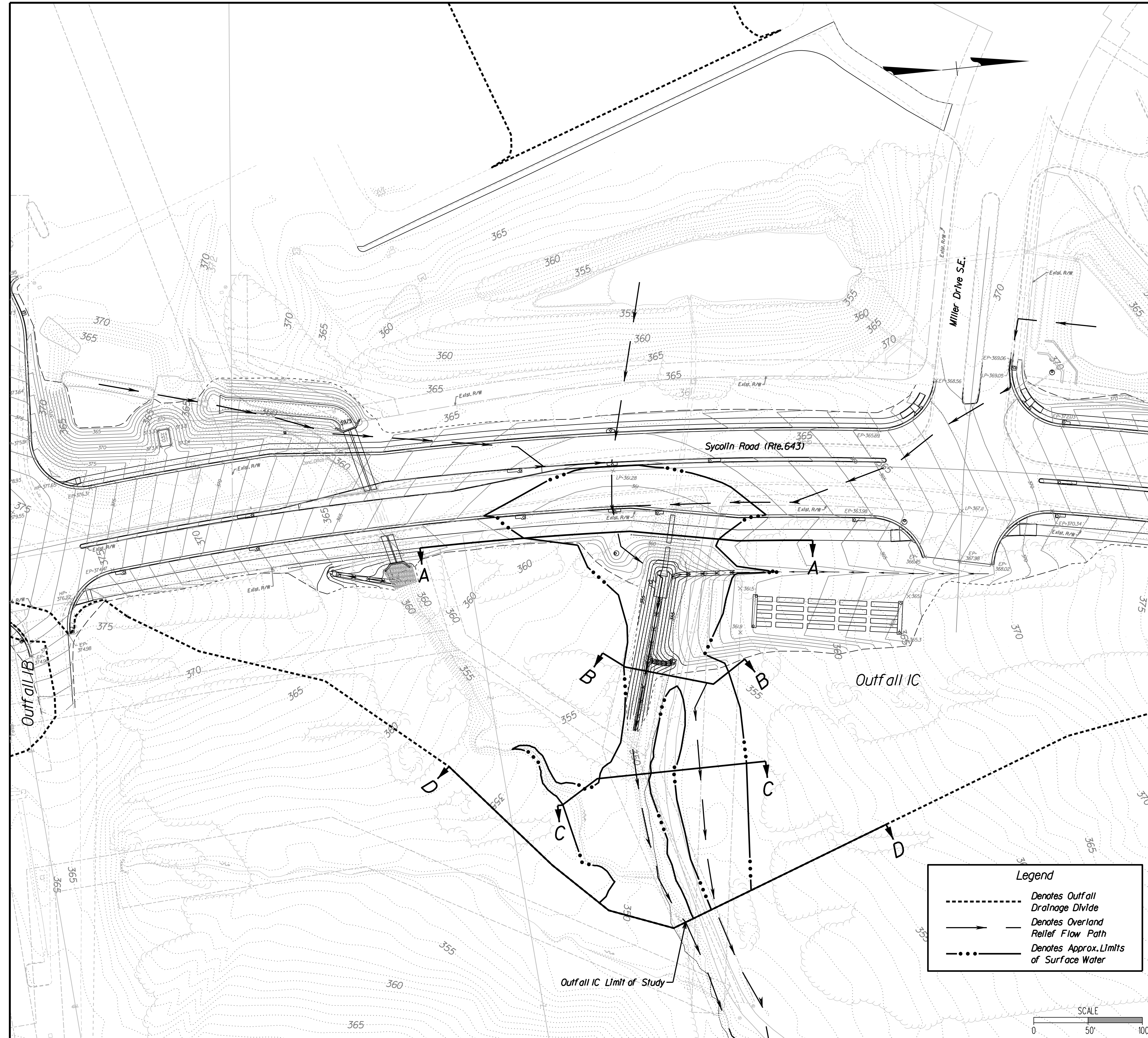


**PROFESSIONAL ENGINEER**  
 NIKHIL V. DESHPANDE  
 Lic. No. 045430

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ASSOCIATED PLAN	C.I.P. NUMBER: TLCl-2016-0002	VDOT PROJ. NO. U000-253-312
TOWN NUMBER: TBD		Sheet 2H(3) of 20

# OVERLAND RELIEF PLAN



### 100-Year Overland Relief

Based upon adjacent topographic conditions, overland relief of the 100-year storm event passes west to east at the Sycolln Road sag (station 125+50). The proposed profile closely follows existing vertical alignment which matches the existing cross drainage flow path. If the culverts are nonfunctional, median overtopping will occur about at elevation 362. Water overtopping the roadway will pond at the location of the easternmost sag to a depth of about a foot, which will entail ponding across the northbound travelway and atop the curb and shared use facility. Ponding at this location will be limited by excess water flowing over the low point of the eastern hinge and descending into the regraded portion of the outfall ditch servicing Outfall IC. No downstream developed properties are located within potential inundation areas for the flow path.

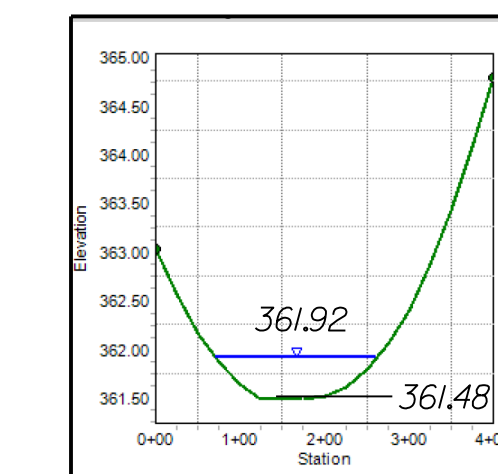
The sag location shown on this plan is the only location within project limits where open-system cross drainage occurs.

From observation of the overland relief flow path and the corresponding cross-sectional analysis, no buildings are in danger of damage from drainage of the 100-year event, and all nearby buildings have over 1 foot of freeboard to the lowest entry point.

The calculated limit-of-study flow rate for the 100-year storm event, 390.91 cfs, has been applied to all cross sections for this analysis.

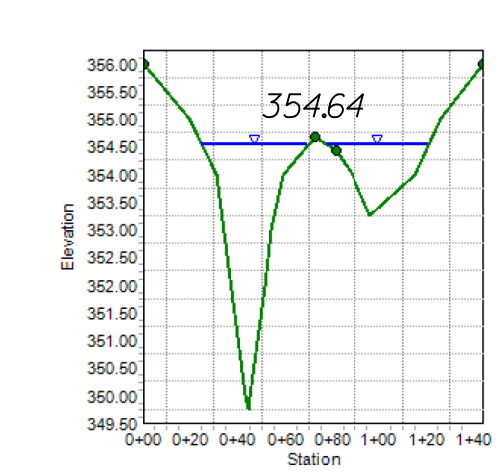
### Cross Section A-A

Channel Slope 2.00%  
 "n," Roughness Coefficient 0.013  
 W.S.E. 361.92 ft



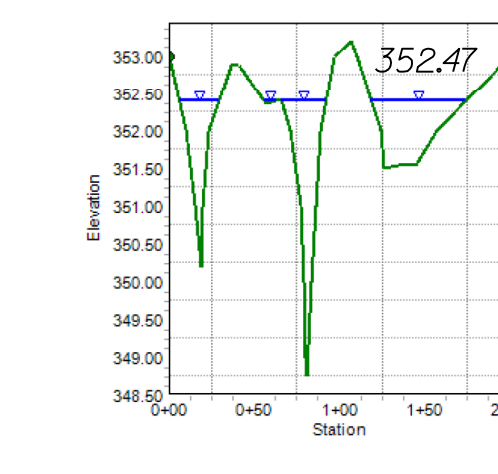
### Cross Section B-B

Channel Slope 0.50%  
 "n," Roughness Coefficient 0.034  
 W.S.E. 354.64 ft



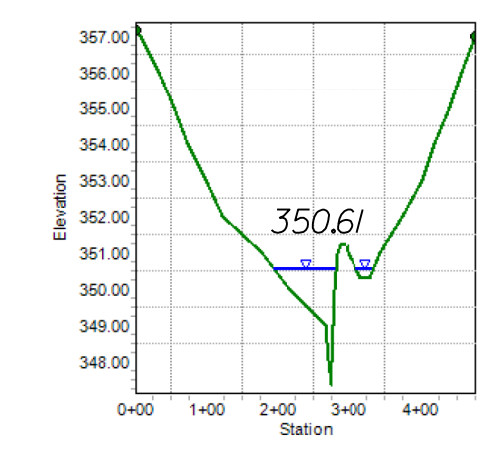
### Cross Section C-C

Channel Slope 1.67%  
 "n," Roughness Coefficient 0.035  
 W.S.E. 352.47 ft



### Cross Section D-D

Channel Slope 1.00%  
 "n," Roughness Coefficient 0.035  
 W.S.E. 350.61 ft



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 6000 DeCorney Blvd., Suite 200, Manassas, Virginia 20108 on the web @ www.rinker.com  
 Telephone: (703) 368-7373 Fax: (703) 370-5443  
 E-mail: info@rinker.com To Make Your Vision Reality

PROJECT NAME: **SYCOLLN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.**

Overland Relief Plan  
 Loudoun County, Virginia

Town of Leesburg  
 SUBMISSION DATE: 02/21/2018

ASSOCIATED PLAN NUMBER: **TLCI-2016-0002**  
 C.I.P. NUMBER: **U000-253-312**  
 VDOT PROJ. NO. **U000-253-312**

TOWN NUMBER: TBD

Sheet 2H(4) of 28



PROJECT MANAGER Anne Gelaer, (703) 771-2742 (Town of Leesburg)  
SURVEYED BY Sidney Thomas, L.S., (703) 368-7373 (2015)  
SUBSURFACE UTILITY BY Accumark, (800) 542-2990 (2015)  
DESIGN SUPERVISED BY Mark A. Gunn, P.E., (703) 368-7373  
DESIGNED BY Sahab Qadiri, P.E., (703) 368-7373

Outfall ID Cross Section A-A 2Yr  
Channel Slope: 0.02000 ft/ft  
Discharge: 9.20 cfs

Roughness Segment Definitions  
Start Station, Ending Station, Roughness Coefficient  
(0+00, 377.00), (0+18, 374.00), 0.035  
(0+18, 374.00), (0+31, 374.00), 0.050  
(0+31, 374.00), (0+50, 375.00), 0.035

Results  
Normal Depth: 0.79 ft  
Elevation Range: 373.00 to 377.00 ft  
Flow Area: 4.09 sf  
Wetted Perimeter: 10.43 ft  
Hydraulic Radius: 0.39 ft  
Top Width: 10.31 ft  
Normal Depth: 0.79 ft  
Critical Depth: 0.66 ft  
Critical Slope: 0.05357 ft/ft  
Velocity: 2.25 ft/s  
Velocity Head: 0.08 ft  
Specific Energy: 0.87 ft  
Froude Number: 0.63  
Flow Type: Subcritical

Outfall ID Cross Section B-B 2Yr  
Channel Slope: 0.02500 ft/ft  
Discharge: 9.20 cfs

Roughness Segment Definitions  
Start Station, Ending Station, Roughness Coefficient  
(0+00, 376.75), (0+12, 376.00), 0.035  
(0+12, 376.00), (0+37, 377.00), 0.050  
(0+37, 377.00), (0+70, 380.00), 0.035

Results  
Normal Depth: 0.86 ft  
Elevation Range: 373.25 to 380.00 ft  
Flow Area: 3.43 sf  
Wetted Perimeter: 7.96 ft  
Hydraulic Radius: 0.43 ft  
Top Width: 7.76 ft  
Normal Depth: 0.86 ft  
Critical Depth: 0.75 ft  
Critical Slope: 0.05201 ft/ft  
Velocity: 2.68 ft/s  
Velocity Head: 0.11 ft  
Specific Energy: 0.97 ft  
Froude Number: 0.71  
Flow Type: Subcritical

Outfall ID Cross Section C-C 2Yr  
Channel Slope: 0.04000 ft/ft  
Discharge: 9.20 cfs

Roughness Segment Definitions  
Start Station, Ending Station, Roughness Coefficient  
(0+00, 373.50), (0+12, 373.00), 0.035  
(0+12, 373.00), (0+32, 373.00), 0.080  
(0+32, 373.00), (0+60, 379.00), 0.050

Results  
Normal Depth: 0.99 ft  
Elevation Range: 369.87 to 379.00 ft  
Flow Area: 3.67 sf  
Wetted Perimeter: 6.64 ft  
Hydraulic Radius: 0.55 ft  
Top Width: 6.28 ft  
Normal Depth: 0.99 ft  
Critical Depth: 0.76 ft  
Critical Slope: 0.02900 ft/ft  
Velocity: 2.50 ft/s  
Velocity Head: 0.10 ft  
Specific Energy: 1.08 ft  
Froude Number: 0.58  
Flow Type: Subcritical

Outfall ID Cross Section A-A 10Yr  
Channel Slope: 0.02000 ft/ft  
Discharge: 11.90 cfs

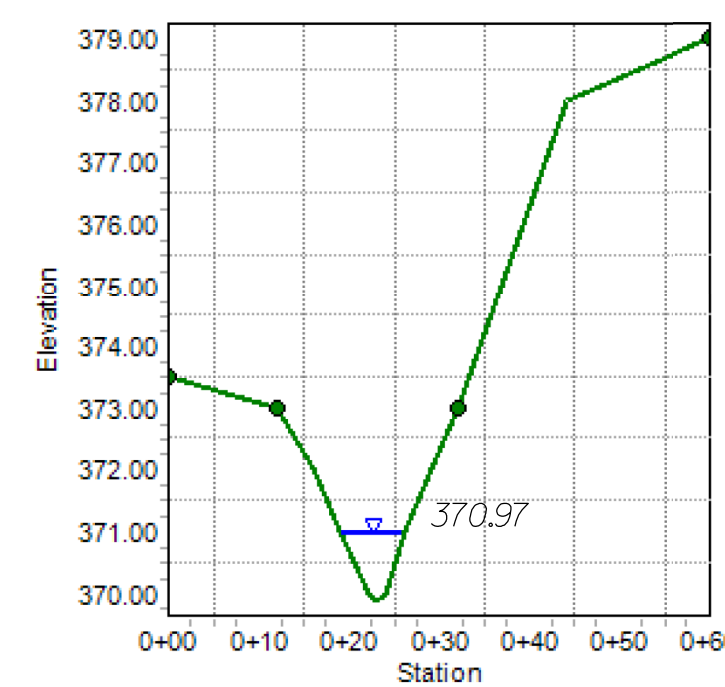
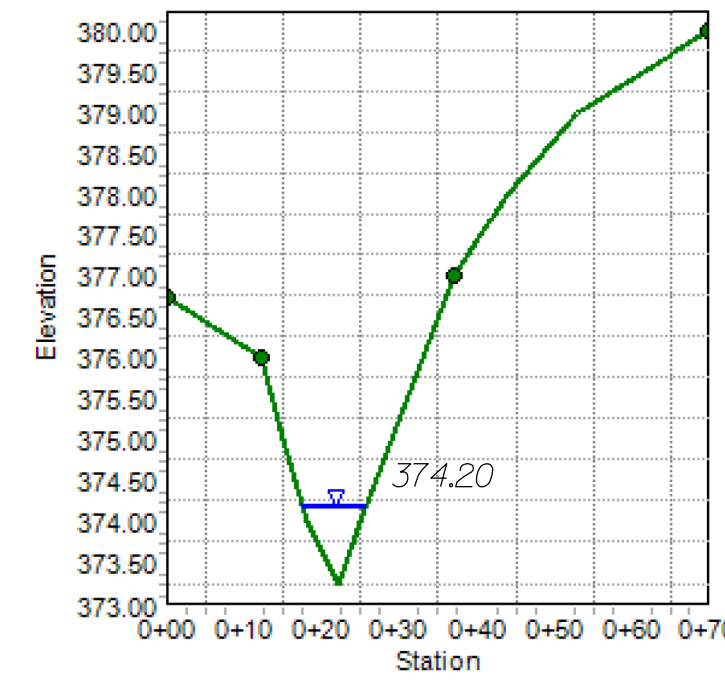
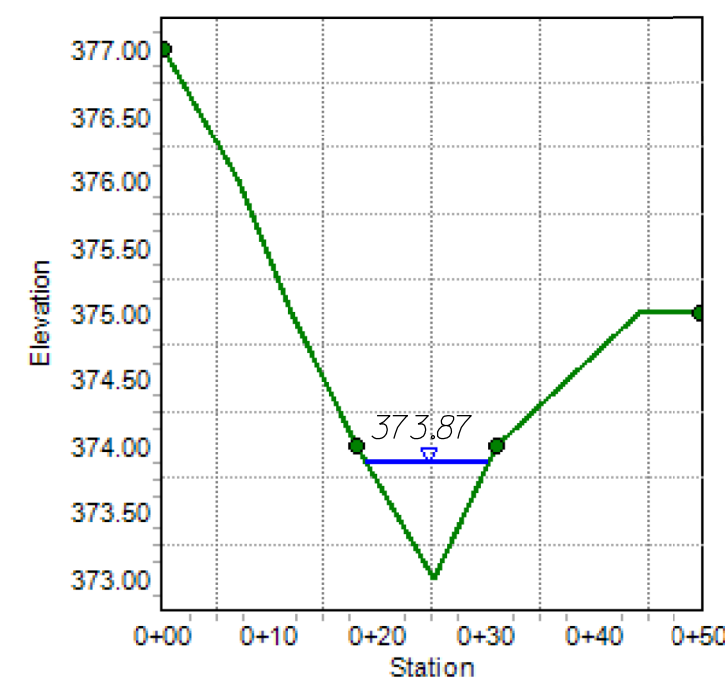
Results  
Normal Depth: 0.87 ft  
Elevation Range: 373.00 to 377.00 ft  
Flow Area: 4.96 sf  
Wetted Perimeter: 11.49 ft  
Hydraulic Radius: 0.43 ft  
Top Width: 11.35 ft  
Normal Depth: 0.87 ft  
Critical Depth: 0.73 ft  
Critical Slope: 0.05176 ft/ft  
Velocity: 2.40 ft/s  
Velocity Head: 0.09 ft  
Specific Energy: 0.96 ft  
Froude Number: 0.64  
Flow Type: Subcritical

Outfall ID Cross Section B-B 10Yr  
Channel Slope: 0.02500 ft/ft  
Discharge: 11.90 cfs

Results  
Normal Depth: 0.95 ft  
Elevation Range: 373.25 to 380.00 ft  
Flow Area: 4.13 sf  
Wetted Perimeter: 8.59 ft  
Hydraulic Radius: 0.48 ft  
Top Width: 8.37 ft  
Normal Depth: 0.95 ft  
Critical Depth: 0.83 ft  
Critical Slope: 0.05004 ft/ft  
Velocity: 2.88 ft/s  
Velocity Head: 0.13 ft  
Specific Energy: 1.07 ft  
Froude Number: 0.72  
Flow Type: Subcritical

Outfall ID Cross Section C-C 10Yr  
Channel Slope: 0.04000 ft/ft  
Discharge: 11.90 cfs

Results  
Normal Depth: 1.10 ft  
Elevation Range: 369.87 to 379.00 ft  
Flow Area: 4.45 sf  
Wetted Perimeter: 7.27 ft  
Hydraulic Radius: 0.61 ft  
Top Width: 6.87 ft  
Normal Depth: 1.10 ft  
Critical Depth: 0.86 ft  
Critical Slope: 0.02472 ft/ft  
Velocity: 2.68 ft/s  
Specific Energy: 1.21 ft  
Froude Number: 0.59  
Flow Type: Subcritical



# Outfall Computations

Outfall IC Cross Section A-A 2Yr  
Channel Slope: 0.00900 ft/ft  
Discharge: 163.90 cfs

Roughness Segment Definitions  
Start Station, Ending Station, Roughness Coefficient  
(0+00, 356.00), (0+31, 354.00), 0.080  
(0+31, 354.00), (0+59, 354.00), 0.100  
(0+59, 354.00), (0+72, 354.67), 0.035  
(0+72, 354.67), (0+81, 354.44), 0.016  
(0+81, 354.44), (0+88, 354.00), 0.035  
(0+88, 354.00), (1+15, 354.00), 0.035  
(1+15, 354.00), (1+44, 356.00), 0.035

Outfall IC Cross Section B-B 2Yr  
Channel Slope: 0.01500 ft/ft  
Discharge: 163.90 cfs

Roughness Segment Definitions  
Start Station, Ending Station, Roughness Coefficient  
(0+00, 353.00), (0+10, 352.00), 0.080  
(0+10, 352.00), (0+23, 352.00), 0.080  
(0+23, 352.00), (0+71, 352.00), 0.080  
(0+71, 352.00), (0+89, 352.00), 0.100  
(0+89, 352.00), (0+97, 353.00), 0.035  
(0+97, 353.00), (1+10, 353.00), 0.016  
(1+10, 353.00), (1+24, 352.00), 0.035  
(1+24, 352.00), (1+57, 352.00), 0.035  
(1+57, 352.00), (2+00, 353.00), 0.035

Outfall IC Cross Section C-C 2Yr  
Channel Slope: 0.01200 ft/ft  
Discharge: 163.90 cfs

Roughness Segment Definitions  
Start Station, Ending Station, Roughness Coefficient  
(0+00, 357.16), (2+65, 349.00), 0.080  
(2+65, 349.00), (2+82, 351.00), 0.100  
(2+82, 351.00), (2+96, 351.21), 0.016  
(2+96, 351.21), (3+44, 351.00), 0.035  
(3+44, 351.00), (4+58, 356.00), 0.035

Outfall IC Cross Section A-A 2Yr  
Results  
Normal Depth: 4.42 ft  
Elevation Range: 349.73 to 356.00 ft  
Flow Area: 76.34 sf  
Wetted Perimeter: 65.28 ft  
Hydraulic Radius: 1.17 ft  
Top Width: 63.90 ft  
Normal Depth: 4.42 ft  
Critical Depth: 2.78 ft  
Critical Slope: 0.07366 ft/ft  
Velocity: 2.15 ft/s  
Velocity Head: 0.07 ft  
Specific Energy: 4.49 ft  
Froude Number: 0.35  
Flow Type: Subcritical

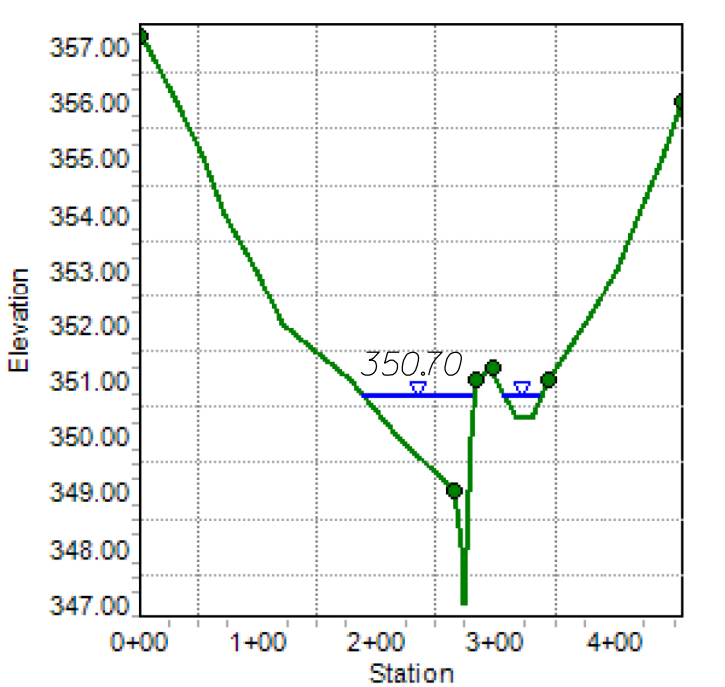
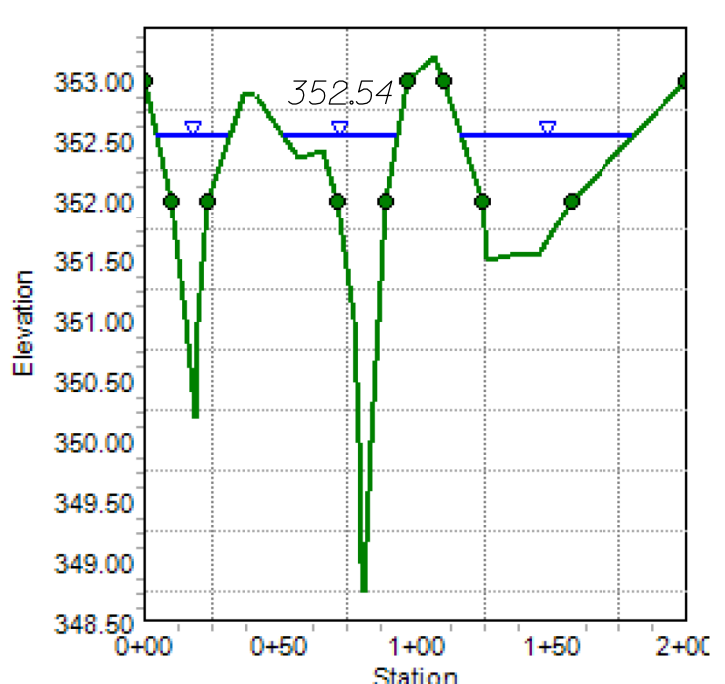
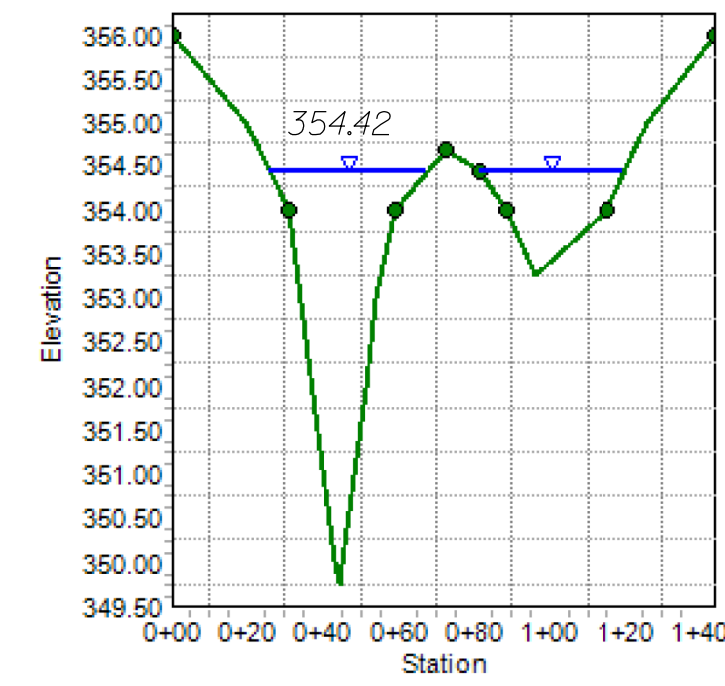
Outfall IC Cross Section B-B 2Yr  
Results  
Normal Depth: 3.57 ft  
Elevation Range: 348.75 to 353.21 ft  
Flow Area: 72.51 sf  
Wetted Perimeter: 98.81 ft  
Hydraulic Radius: 0.73 ft  
Top Width: 96.63 ft  
Normal Depth: 3.57 ft  
Critical Depth: 3.06 ft  
Critical Slope: 0.07571 ft/ft  
Velocity: 2.26 ft/s  
Velocity Head: 0.08 ft  
Specific Energy: 3.65 ft  
Froude Number: 0.46  
Flow Type: Subcritical

Outfall IC Cross Section C-C 2Yr  
Results  
Normal Depth: 3.52 ft  
Elevation Range: 347.00 to 357.16 ft  
Flow Area: 88.41 sf  
Wetted Perimeter: 108.47 ft  
Hydraulic Radius: 0.82 ft  
Top Width: 107.24 ft  
Normal Depth: 3.52 ft  
Critical Depth: 2.81 ft  
Critical Slope: 0.10055 ft/ft  
Velocity: 1.85 ft/s  
Velocity Head: 0.05 ft  
Specific Energy: 3.57 ft  
Froude Number: 0.36  
Flow Type: Subcritical

Outfall IC Cross Section A-A 10Yr  
Results  
Normal Depth: 4.69 ft  
Elevation Range: 349.73 to 356.00 ft  
Flow Area: 95.89 sf  
Wetted Perimeter: 81.19 ft  
Hydraulic Radius: 1.18 ft  
Top Width: 79.78 ft  
Normal Depth: 4.69 ft  
Critical Depth: 3.14 ft  
Critical Slope: 0.06295 ft/ft  
Velocity: 2.29 ft/s  
Velocity Head: 0.08 ft  
Specific Energy: 4.78 ft  
Froude Number: 0.37  
Flow Type: Subcritical

Outfall IC Cross Section B-B 10Yr  
Results  
Normal Depth: 3.79 ft  
Elevation Range: 348.75 to 353.21 ft  
Flow Area: 97.87 sf  
Wetted Perimeter: 134.34 ft  
Hydraulic Radius: 0.73 ft  
Top Width: 132.11 ft  
Normal Depth: 3.79 ft  
Critical Depth: 3.23 ft  
Critical Slope: 0.07290 ft/ft  
Velocity: 2.25 ft/s  
Velocity Head: 0.08 ft  
Specific Energy: 3.87 ft  
Froude Number: 0.46  
Flow Type: Subcritical

Outfall IC Cross Section C-C 10Yr  
Results  
Normal Depth: 3.70 ft  
Elevation Range: 347.00 to 357.16 ft  
Flow Area: 110.13 sf  
Wetted Perimeter: 125.50 ft  
Hydraulic Radius: 0.88 ft  
Top Width: 124.23 ft  
Normal Depth: 3.70 ft  
Critical Depth: 2.98 ft  
Critical Slope: 0.09257 ft/ft  
Velocity: 2.00 ft/s  
Velocity Head: 0.06 ft  
Specific Energy: 3.77 ft  
Froude Number: 0.37  
Flow Type: Subcritical



NOTE: For outfall cross section locations, see Sheet 2H(1)

PROJECT NAME: **SYCOLIN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.**

PROJECT MANAGER: **MARK A. GUNN, P.E.**

ENGINEER: **Rinker Design Associates, P.C.**  
Engineering - Surveying - Land Planning - Transportation - Environmental Services  
6000 DeSotoe Blvd., Suite 200, Manassas, Virginia 20108 on the web @ www.rinker.com  
Telephone: (703) 368-7373 Fax: (703) 370-5443  
E-mail: info@rdainc.com

**Crda Rinker**  
Design Associates, P.C.  
Civil Engineering - Surveying - Land Planning  
Environmental - Transportation - Environmental  
Right of Way Services

ASSOCIATED PLAN NUMBER: **TLCI-2016-0002**  
C.I.P. NUMBER: **U000-253-312**  
VDOT PROJ. NO. **U000-253-312**

TOWN NUMBER: **TBD**

Sheet 2H(5) of 20

COMMONWEALTH OF VIRGINIA  
Nikhil V. Deshpande  
Lic. No. 045430  
PROFESSIONAL ENGINEER

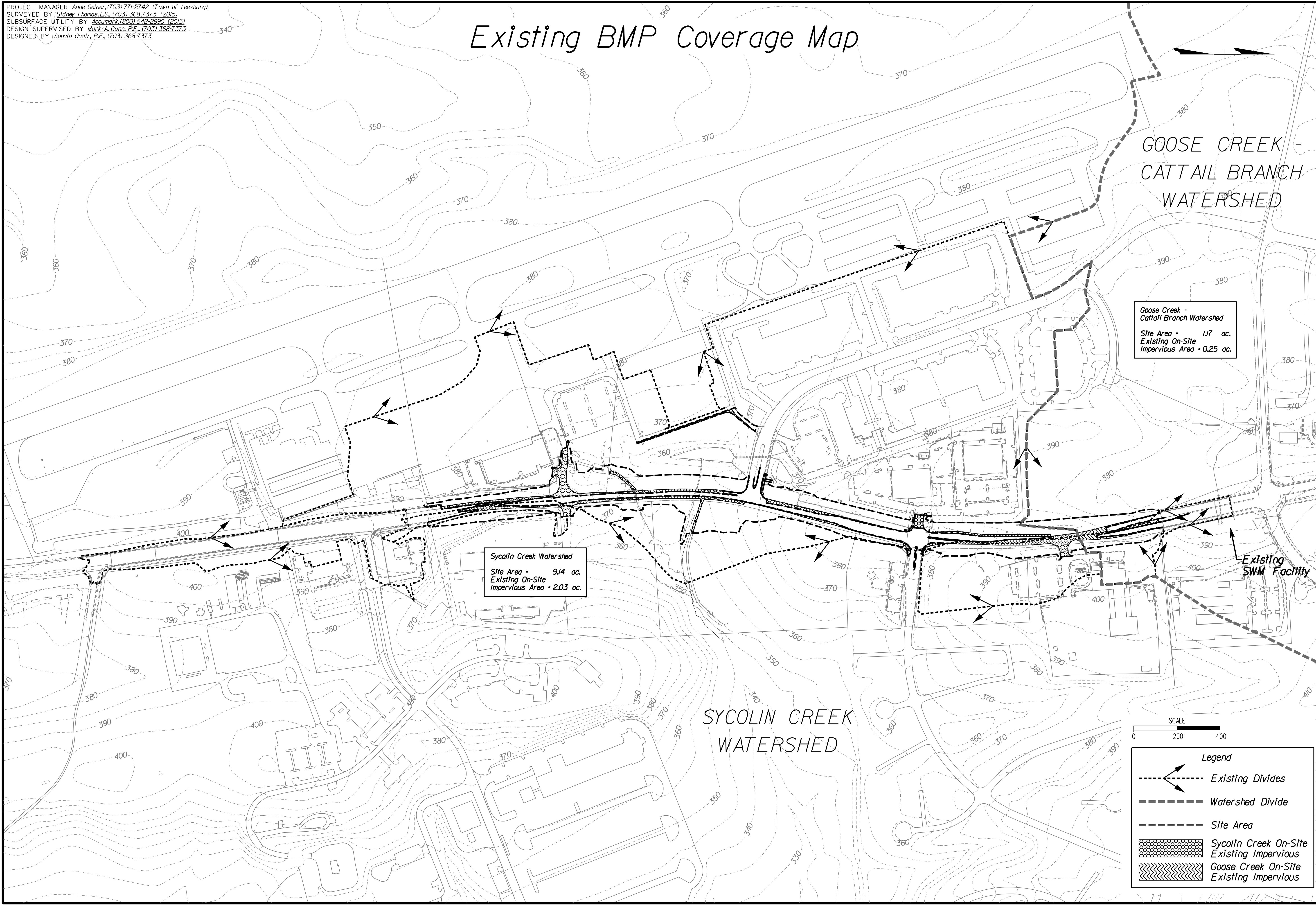
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Town of Leesburg  
Loudoun County, Virginia  
Outfall Computations



PROJECT MANAGER: Anne Gelaer, (703) 771-2742 (Town of Leesburg)  
 SURVEYED BY: Sidney Thomas, L.S., (703) 368-7373 (2015)  
 SUBSURFACE UTILITY BY: AccuMark, (800) 542-2990 (2015)  
 DESIGN SUPERVISED BY: Mark A. Gunn, P.E., (703) 368-7373  
 DESIGNED BY: Sahab Dadir, P.E., (703) 368-7373

# Existing BMP Coverage Map



**Goose Creek - Cattail Branch Watershed**  
 Site Area - 1.17 ac.  
 Existing On-Site - 0.25 ac.

**Sycolin Creek Watershed**  
 Site Area - 9.14 ac.  
 Existing On-Site - 2.03 ac.

SCALE  
 0 200' 400'

**Legend**

- Existing Divides
- Watershed Divide
- Site Area
- Sycolin Creek On-Site Existing Impervious
- Goose Creek On-Site Existing Impervious

**ENGINEER:**  
**Rinker Design Associates, P.C.**  
 Engineering • Surveying • Land Planning • Transportation • Environmental Services  
 1000 West Main Street, Leesburg, VA 20176  
 Phone: (703) 368-7373 Fax: (703) 368-7373  
 Website: www.rinker.com  
 to Make Your Vision Reality

**PROJECT NAME:** SYCOLIN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.  
**BMP Coverage Map**  
 Loudoun County, Virginia

**Town of Leesburg**  
 SUBMISSION DATE: 02/21/2018

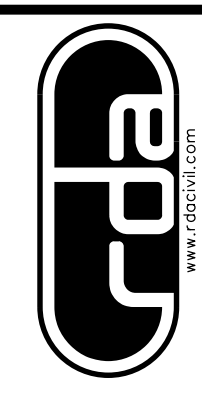
**COMMONWEALTH OF VIRGINIA**  
 NIKHIL V. DESHPANDE  
 Lic. No. 045430  
 PROFESSIONAL ENGINEER

Nikhil V Deshpande  
 2018.02.22 09:37:53 -05'00'

ASSOCIATED PLAN: TLCI-2016-0002  
 C.I.P. NUMBER: U000-253-312  
 VDOT PROJ. NO. U000-253-312

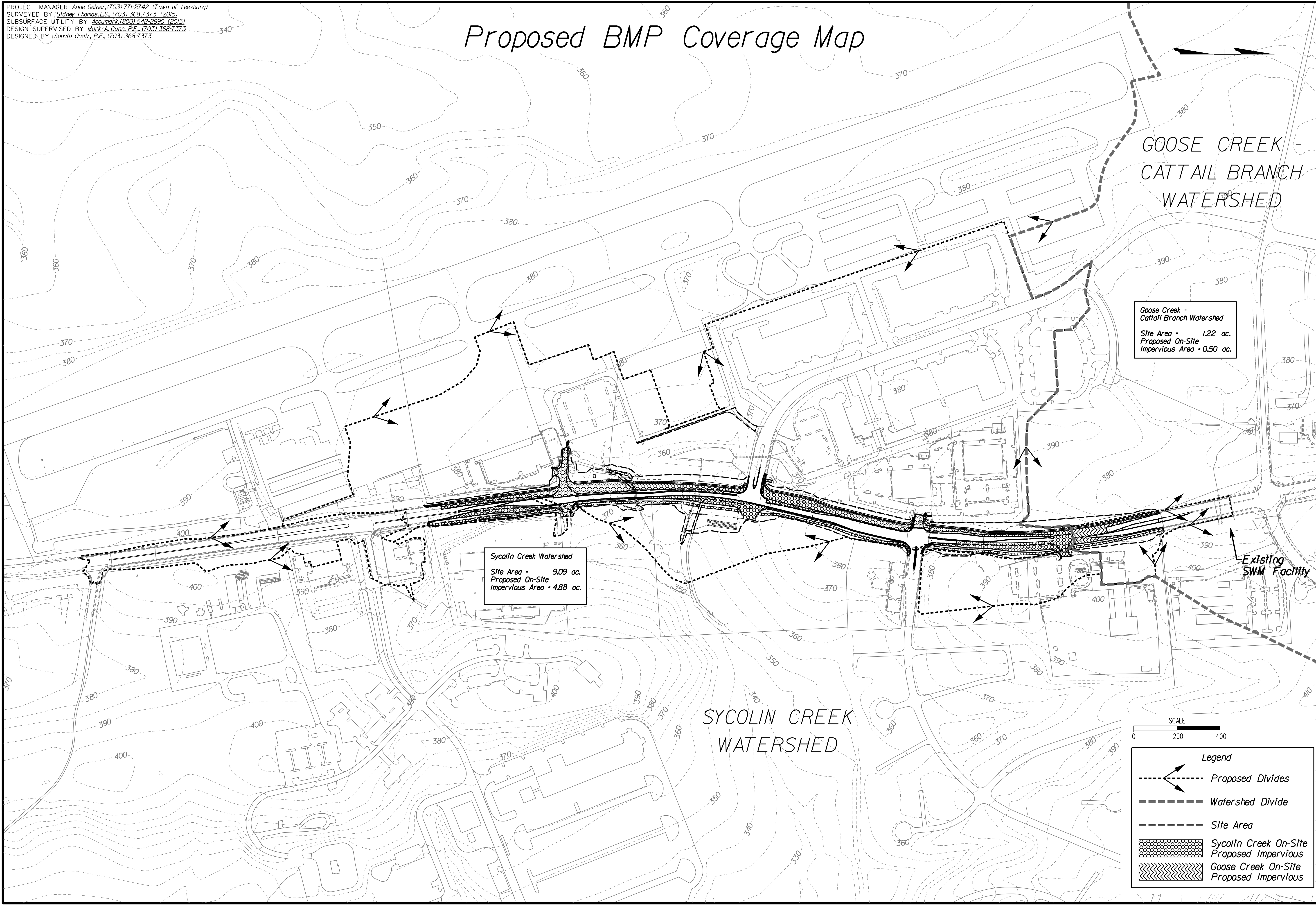
TOWN NUMBER: TBD

PROJECT MANAGER: MARK A. GUNN, P.E.



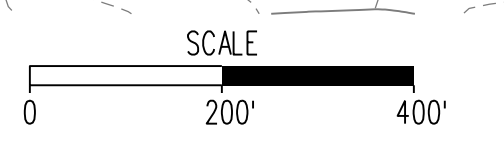
PROJECT MANAGER: Anne Gelaer, (703) 771-2742 (Town of Leesburg)  
 SURVEYED BY: Sidney Thomas, L.S., (703) 368-7373 (2015)  
 SUBSURFACE UTILITY BY: AccuMark, (800) 542-2990 (2015)  
 DESIGN SUPERVISED BY: Mark A. Gunn, P.E., (703) 368-7373  
 DESIGNED BY: Sahab Dadir, P.E., (703) 368-7373

# Proposed BMP Coverage Map



**Goose Creek - Cattail Branch Watershed**  
 Site Area • 1.22 ac.  
 Proposed On-Site Impervious Area • 0.50 ac.

**Sycolin Creek Watershed**  
 Site Area • 9.09 ac.  
 Proposed On-Site Impervious Area • 4.88 ac.



Legend	
	Proposed Divides
	Watershed Divide
	Site Area
	Sycolin Creek On-Site Proposed Impervious
	Goose Creek On-Site Proposed Impervious

ENGINEER: Rinker Design Associates, P.C.  
 Engineering • Surveying • Land Planning • Transportation • Environmental Services  
 6040 DeSoto Way, Suite 200, Manassas, VA 20108  
 Telephone: (703) 368-7373 Fax: (703) 368-7343  
 Website: www.rinker.com  
 to Make Your Vision Reality

PROJECT NAME: **SYCOLIN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.**

BMP Coverage Map

Town of Leesburg Loudoun County, Virginia

PROJECT MANAGER: MARK A. GUNN, P.E.

PROFESSIONAL ENGINEER

NIKHIL V. DESHPANDE  
 Lic. No. 045430

Nikhil V Deshpande  
 2018.02.22 09:38:17 -05'00'

ASSOCIATED PLAN

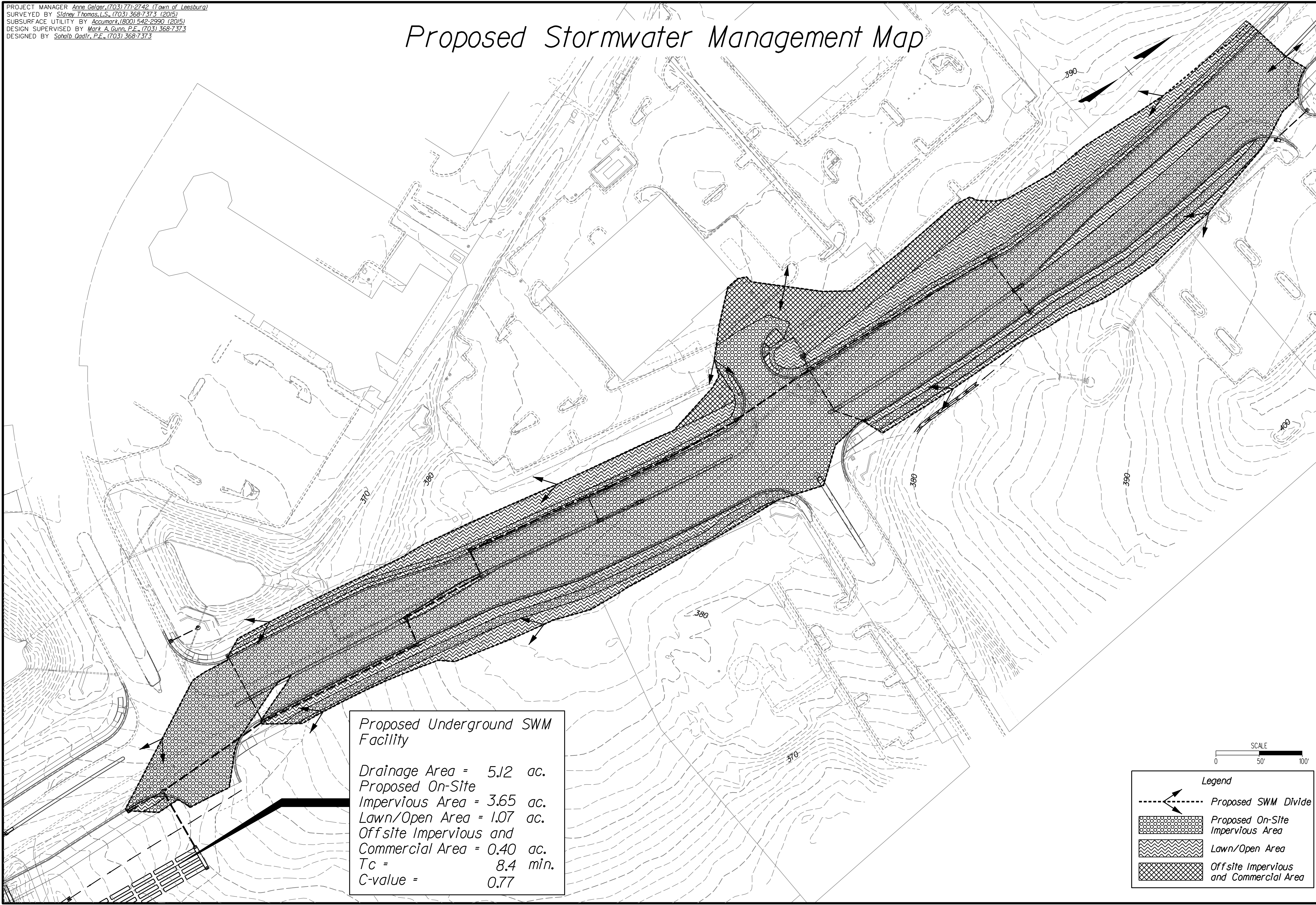
C.I.P. NUMBER: TLCl-2016-0002

VDOT PROJ. NO. U000-253-312

TOWN NUMBER: TBD

PROJECT MANAGER: Anne Gelaer, (703) 771-2742 (Town of Leesburg)  
 SURVEYED BY: Sidney Thomas, L.S., (703) 368-7373 (2015)  
 SUBSURFACE UTILITY BY: AccuMark, (800) 542-2990 (2015)  
 DESIGN SUPERVISED BY: Mark A. Gunn, P.E., (703) 368-7373  
 DESIGNED BY: Sohalb Qadir, P.E., (703) 368-7373

# Proposed Stormwater Management Map



*Proposed Underground SWM Facility*

Drainage Area = 5.12 ac.  
 Proposed On-Site Impervious Area = 3.65 ac.  
 Lawn/Open Area = 1.07 ac.  
 Offsite Impervious and Commercial Area = 0.40 ac.  
 T<sub>c</sub> = 8.4 min.  
 C-value = 0.77

SCALE  
 0 50' 100'

**Legend**

- Proposed SWM Divide
- [Cross-hatch pattern] Proposed On-Site Impervious Area
- [Wavy pattern] Lawn/Open Area
- [Grid pattern] Offsite Impervious and Commercial Area

ENGINEER:  
**Rinker Design Associates, P.C.**  
 Engineering • Surveying • Land Planning • Transportation • Environmental Services  
 10000 Woodloch Forest Drive, Suite 1000, Leesburg, Virginia 20155 on the web @ www.rinkerdca.com  
 Telephone: (703) 368-7373 Fax: (703) 368-7373  
 To Make Your Vision Reality

PROJECT MANAGER: MARK A. GUNN, P.E.

PROJECT NAME: **SYCOLIN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.**

Proposed Stormwater Management Map  
 Loudoun County, Virginia

Town of Leesburg  
 SUBMISSION DATE: 02/21/2018

COMMONWEALTH OF VIRGINIA  
 NIKHIL V. DESHPANDE  
 Lic. No. 045430  
 PROFESSIONAL ENGINEER

Nikhil V Deshpande  
 2018.02.22 09:38:45 -05'00'

ASSOCIATED PLAN  
 C.I.P. NUMBER: **TLCI-2016-0002**  
 VDOT PROJ. NO. **U000-253-312**

TOWN NUMBER: TBD

Sheet  
 2i(1) of 20





PROJECT MANAGER: *Anne Gelaer, (703) 771-2742* (Town of Leesburg)  
 SURVEYED BY: *Sidney Thomas, L.S., (703) 368-7373* (2015)  
 SUBSURFACE UTILITY BY: *Accumark, (800) 542-2990* (2015)  
 DESIGN SUPERVISED BY: *Mark A. Gunn, P.E., (703) 368-7373*  
 DESIGNED BY: *Sahab Qadiri, P.E., (703) 368-7373*

## DITCH COMPUTATIONS

FORM LD-288

ROUTE: *Sycolln Rd.*

PROJECT NUMBER: *102895*

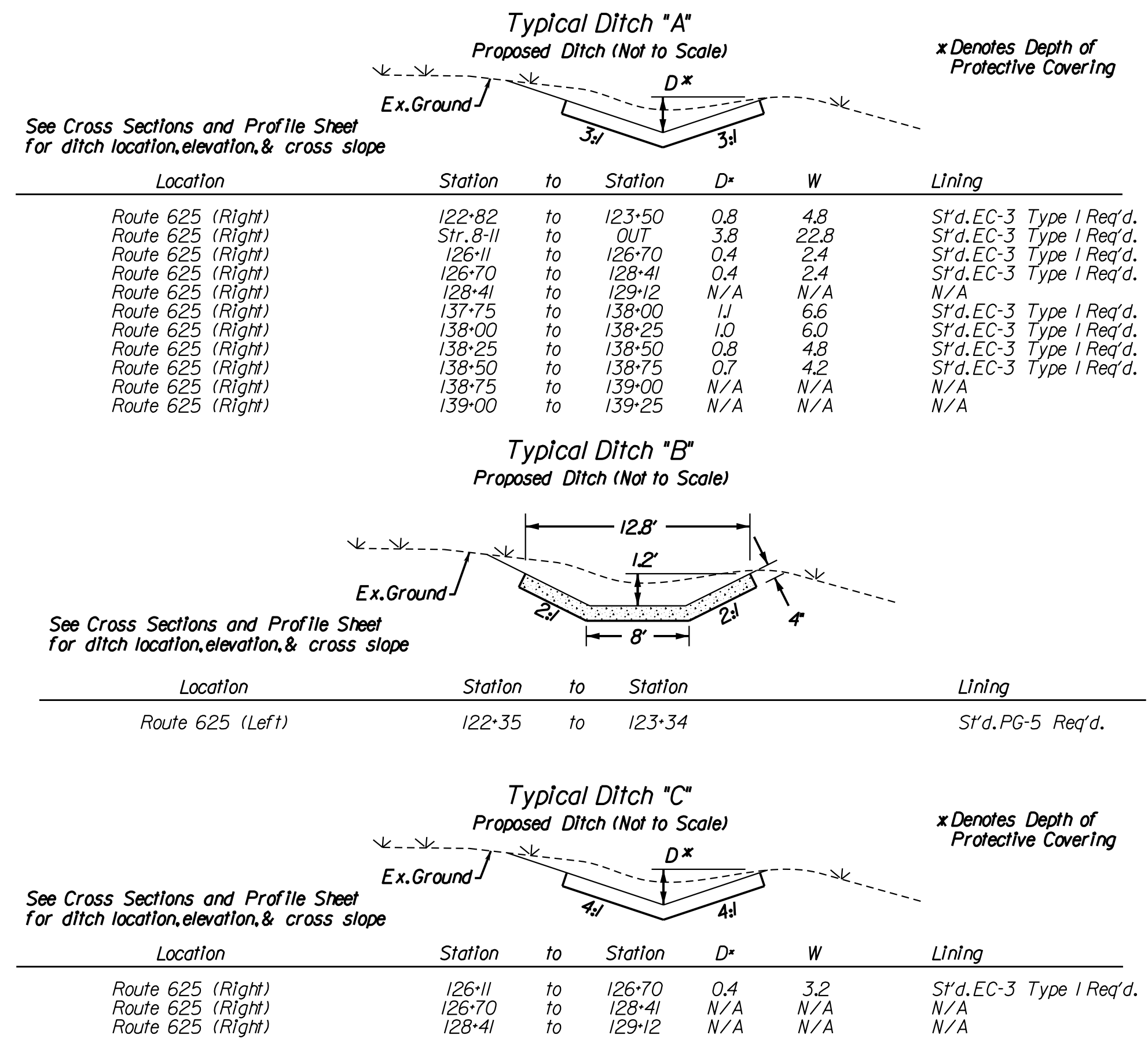
DESIGNED BY: *RDA* DATE: *11/1/2017*

CHECKED BY: *SCT* UNITS: *ENGLISH*

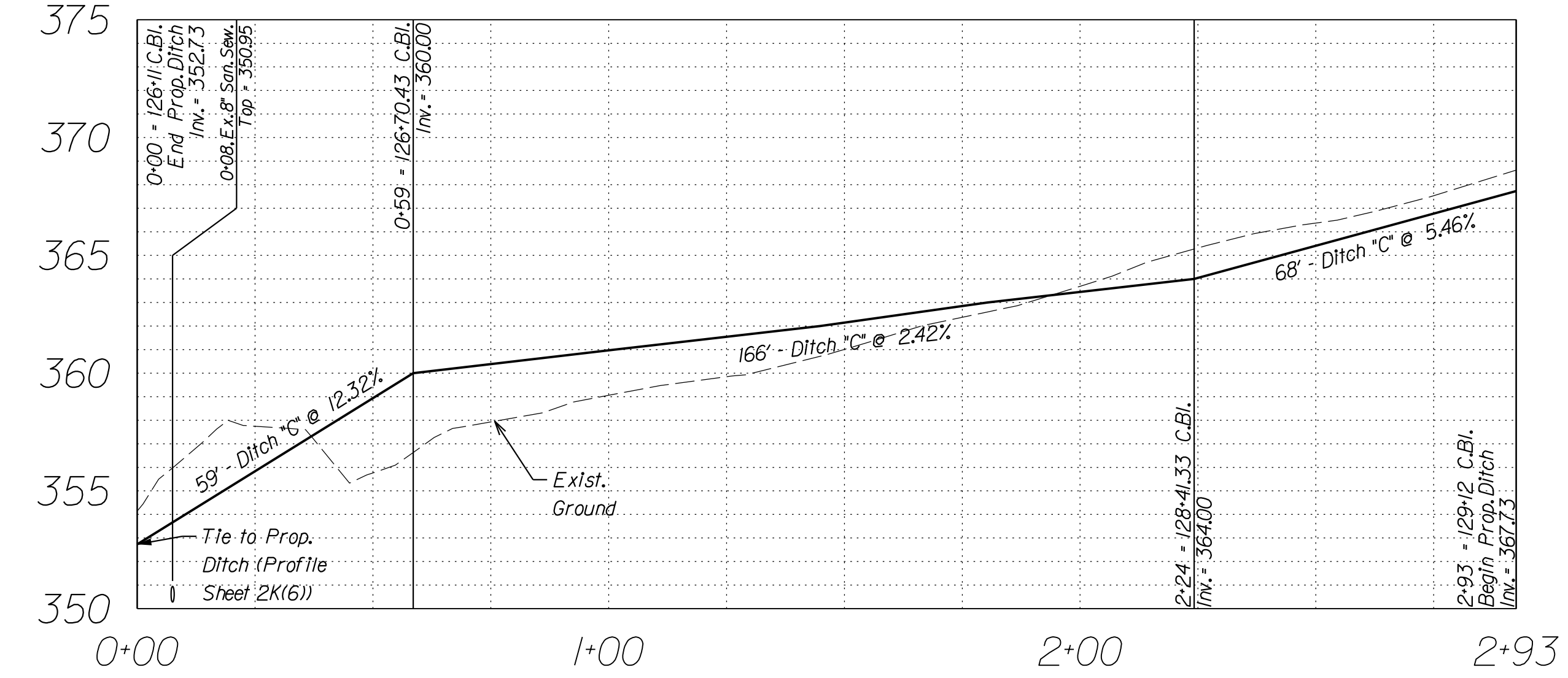
# Ditch Computations and Typical

Sta. to Sta.	Flow	Area (Acres)	C-value	CA		Tc	I (2yr)	O (2yr)	C or F	Slope Ft/Ft	Allow Vel.	Protective Lining						Available Depth	Remarks						
				Incr.	Acc.							n=0.3	n=.05		n=.013 (PG-2) n=.035 (PG-3)		I (10yr)			O (10yr)	Depth				
Route 625																									
Left Side																									
122+35	123+34	▼	31.66	0.80	25.33	25.33	26	3.00	75.98	C	0.0033	2.3	3.5						75.98	1.2	4.00	101.31	1.4	3.0	S'd.PG-5 Req'd.
Route 625																									
Right Side																									
End Section 7-8																									
122+82	123+50	▼	0.09	0.30	0.03	0.03	10	4.54	5.85	C	0.0412	2.3	4.6	5.97	3.2	0.8			6.09	7.85	6.09	8.01	0.9	1.5	S'd.EC-3 Type I Req'd.
End Section 8-11																									
End Section 8-1																									
End Section 8-25																									
Ditch Terminus 126+02																									
8-11 OUT																									
		▼	0.63	0.30	0.19	0.19	6	5.54	138.68	C	0.0055	2.3	4.8	138.68	3.2	3.8			7.03	179.37	7.03	179.37	4.2	5.0	S'd.EC-3 Type I Req'd.
126+11	126+70	▲	0.12	0.30	0.04	0.21		5.65	1.19	C	0.1232	2.3	4.4	1.19	3.0	0.3			7.17	1.51	7.17	1.51	0.4	1.5	S'd.EC-3 Type I Req'd.
126+70	128+41	▲	0.13	0.30	0.04	0.17		5.75	1.00	C	0.0242	3.5	2.3						7.27	1.26	7.27	1.26	0.4	1.0	Design Velocity < Allowable Velocity
128+41	129+12	▲	0.45	0.30	0.14	0.14	5	5.75	0.78	C	0.0546	3.5	2.9						7.27	0.98	7.27	0.98	0.3	1.0	Design Velocity < Allowable Velocity
137+75																									
138+00	138+25	▲	0.46	0.53	0.24	1.24	4.89	6.06	C	0.0140	3.5	3.1	6.06	2.1	1.0				6.28	7.79	6.28	7.79	1.1	1.4	S'd.EC-3 Type I Req'd.
138+25	138+50	▲	0.47	0.53	0.25	1.00	4.99	4.97	C	0.0240	3.5	3.6	4.97	2.5	0.8				6.38	6.36	6.38	6.36	0.9	1.4	S'd.EC-3 Type I Req'd.
138+50	138+75	▲	0.47	0.53	0.25	0.75	4.99	3.73	C	0.0320	3.5	3.7	3.73	2.6	0.7				6.38	4.77	6.38	4.77	0.8	1.4	S'd.EC-3 Type I Req'd.
138+75	139+00	▲	0.47	0.53	0.25	0.50	4.99	2.49	C	0.0320	3.5	3.4							6.38	3.18	6.38	3.18	0.5	1.4	Design Velocity < Allowable Velocity
139+00	139+25	▲	0.47	0.53	0.25	0.25	8	4.99	1.24	C	0.0440	3.5	3.2						6.38	1.59	6.38	1.59	0.4	1.4	Design Velocity < Allowable Velocity

## Ditch Typicals



## Ditch Profile 129+12 to 126+11 RT



100% PLANS

**Design Associates, P.C.**

ENGINEER: **Rinker Design Associates, P.C.**  
 Engineering - Surveying - Land Planning - Transportation - Environmental Services  
 9000 Democracy Blvd., Suite 200, Manassas, VA 20108 | www.rinker.com  
 Telephone: (703) 986-2373 | Fax: (703) 986-5443  
 To Make Your Vision Reality

PROJECT NAME: **SYCOLIN ROAD WIDENING PHASE IV FROM CLAUDIA DRIVE TO TOLBERT LANE S.E.**

DITCH COMPUTATIONS AND TYPICALS

Loudoun County, Virginia

Town of Leesburg

PROFESSIONAL ENGINEER: **NIKHIL V. DESHPANDE**  
 Lic. No. 045430

Nikhil V. Deshpande  
 2018.02.22 09:45:17 -05'00'

ASSOCIATED PLAN  
 C.I.P. NUMBER: **TLCI-2016-0002**  
 VDOT PROJ. NO. **U000-253-312**

TOWN NUMBER: **TBD**

PROJECT MANAGER: **MARK A. GUNN, P.E.**

SUBMISSION DATE: **02/21/2018**

Sheet  
 21 of 20



PROJECT MANAGER: Anne Geller, (703) 771-2742 (Town of Leesburg)  
 SURVEYED BY: Sidney Thomas, L.S., (703) 368-7373 (2015)  
 SUBSURFACE UTILITY BY: AccuMark, (800) 542-2990 (2015)  
 DESIGN SUPERVISED BY: Mark A. Gunn, P.E., (703) 368-7373  
 DESIGNED BY: Sohaib Qadiri, P.E., (703) 368-7373

PROJECT		Sycolin Rd	COUNTY		Loudoun	SHEET		OF	CULVERT DESIGN FORM LD-269										
ROAD		Sycolin Road			VA	UNITS		ENGLISH	DESIGNER:	RDA	DATE:	5/20/2016							
CULVERT		7-9							REVIEWER:	SCT	DATE:	5/20/2016							
123+50																			
HYDROLOGICAL DATA																			
Method:		RATIONAL			Roadway Width	72	ft	ROADWAY ELEVATION		364.06	ft	Road Length	1000						
Drainage Area:		17.36	Acres				Freeboard=		2.29	ft		Surface Type		PAVED					
Time of Concentration		17.1	Minutes		Shldr. Elev. Lt. =		366.09	ft		Shldr. Elev. Rt. =		364.25	ft						
DESIGN FLOWS																			
R.I. (years)	FLOW (cfs)																		
25	Design	93.76																	
2	Check	51.52																	
100	Max.	145.83																	
CULVERT DESCRIPTION:																			
TYPE:		Single/Multiple Conforming																	
Inlet Edge Description:																			
10 deg - 45 deg Skewed HW Bevelled Edges			TOTAL FLOW	FLOW PER BARREL	HEADWATER CALCULATIONS										CONTROL HEADWATER ELEV.	MINIMUM SHOULDER ELEV.	COMMENTS		
Single / Multiple Conforming / Broken Back Culverts			Q	Q/N	INLET CONTROL					OUTLET CONTROL					OUTLET VEL.				
MATERIAL	SHAPE	Size (in)	N	Mannings n	HW/D	HWi	FALL	ELHWi	TW	dc	(dc+D)/2	ho	ke	H	ELHWo				
Concrete	Box	36 X 60	2	0.013	cfs	cfs	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	
					93.76	46.9	0.74	2.21	0.00	361.96	1.48	1.40	2.20	2.20	0.50	0.33	360.87	361.96	9.46
					51.52	25.8	0.50	1.49	0.00	361.24	1.08	0.94	1.97	1.97	0.50	0.10	360.41	361.24	7.75
					145.83	72.9	0.99	2.97	0.00	362.72	1.87	1.88	2.44	2.44	0.50	0.81	361.58	362.72	10.87
Broken Back Culvert		TAILWATER DATA:			TAILWATER RESULTS:					ROADWAY DATA:			ROADWAY OVERTOPPING:						
LENGTH	Elev.	SKEW °		Channel Shape	Irregular		Discharge			Elevation	Flow depth	Velocity	Shear force	Roadway Width, ft	72	Discharge	Overtopping Discharge	Overtopping Elevation	
				Bottom Width, ft	0.00	"n" =	0.035	cfs	ft	ft	ft	PSF	Surface Type	PAVED		cfs	cfs	ft	
				Side Slope Lt: (H:1V)	0.00			Design	358.48	1.48	7.02	1.23	Top of Road Elevation, ft	364.06	Design	0	0.00		
				Side Slope Rt: (H:1V)	0.00			Check	358.08	1.08	5.85	0.94	Length of Road, ft	1000	Check	0	0.00		
				Channel Slope, f/ft	0.0188			Max.	358.87	1.87	7.99	1.50			Max.	0	0.00		
		Distance	0.00	12.15	19.25	24.00	29.76	32.68	40.92	52.87									
		Elevation	361.50	361.00	360.00	357.00	357.00	358.00	362.00	363.00									
		"n" =	0.050	0.050	0.030	0.030	0.030	0.030	0.050										
TECHNICAL FOOTNOTES:																			
(1) USE Q/NB FOR BOX CULVERTS				(4) EL <sub>hi</sub> = HW <sub>i</sub> + EL <sub>i</sub> (INVERT OF INLET CONTROL SECTION)					(6) ho = TW or (dc + D/2) (WHICHEVER IS GREATER)										
(2) HW <sub>i</sub> /D = HW/D OR HW <sub>i</sub> /D FROM DESIGN CHARTS				(5) TW BASED ON DOWNSTREAM CONTROL OR FLOW					(7) H = [1 + ke + (29n <sup>2</sup> L)/R <sup>1.33</sup> ]v <sup>2</sup> /2g										
(3) FALL = HW <sub>i</sub> - (ELHW <sub>d</sub> - EL <sub>s</sub> ); FALL IS ZERO FOR CULVERTS ON GRADE				DEPTH IN CHANNEL															
SUBSCRIPT DEFINITIONS:		COMMENTS / DISCUSSION:			CULVERT BARREL SELECTED														
HW <sub>d</sub>	DESIGN HEADWATER	i	INLET	SIZE: _____ n: _____															
HW <sub>i</sub>	HW IN INLET CONTROL	o	OUTLET	SHAPE: _____ MATERIAL: _____															
HW <sub>o</sub>	HW IN OUTLET CONTROL	sf	Streambed @ culvert face	ENTRANCE: _____															
CULVERTSOF2 by ENSOFTEC, INC.																			

