McChord Engineering Associates, Inc.
Civil Engineers and Land Planners

1 Grumman Hill Rd, Wilton, CT 06897
Tel: (203) 834-0569 Fax: (203) 834-2789

June 16, 2020

Michael Conklin
Director of Environmental Affairs
Town Hall Annex
238 Danbury Road
Wilton, CT 06897

Re: Engineering Summary
Proposed Culvert Repair
68 McFadden Drive, Wilton, CT
Map 85, Lot 13

Dear Mr. Conklin:

McChord Engineering Associates, Inc. has been commissioned to prepare a design for the repair of the culvert crossing at 68 McFadden Drive. The culvert is located within a right-of-way on 68 McFadden drive. It provides a stream crossing for a shared driveway that serves four houses at 58, 62, 64 and 66 McFadden Drive. This office has inspected the existing culvert, reviewed the contributing watershed, prepared a hydraulic analysis of the culvert pipes and created a repair plan. The following is an engineering summary of the existing conditions, proposed repair and potential impacts.

The existing culvert crossing consists of two asphalt lined corrugated pipe arches. The north pipe arch is approximately 65" wide x 40" tall and the south pipe arch is approximately 54" wide x 40" tall. Stone headwalls and wing walls support the banks on the upstream and downstream sides. The asphalt driveway is approximately 14' wide with the edges of the driveway at the headwalls. It is assumed that the culvert was constructed in the mid-1960's when this neighborhood was developed. Just downstream of the driveway culvert is another inlet from a 24" RCP that passes under McFadden Drive. The stream itself is approximately 12' wide, with a stony bottom and steep vegetated banks. The existing conditions are shown on the "Improvement Location Map, 68 McFadden Drive" prepared for JoAnne F. Pica by Stalker Land Surveying, Inc, dated July 18, 2019.

Our inspection of the driveway culvert revealed that the south pipe arch is severely degraded. The entire flow line of the culvert has rusted out the culvert has begun to settle. The settling has opened up a large pothole in the driveway and a number of cracks have formed in the stone headwalls. The north pipe arch was generally intact, but moderate deflection was

noted and the asphalt lining was very worn. Some scouring was observed on the downstream outlet but otherwise no significant erosion was noted. The attached pictures highlight the conditions of the existing culvert.

The south pipe arch is too degraded to attempt to reline. The existing conditions are also not conducive to sleeve a new pipe through the old pipes. Therefore the best option is to replace the pipe arch completely. Due to the amount of effort involved to replace the pipes, both pipes should be replaced at the same time. Two 48" diameter HDPE pipes are proposed to replace the two pipe arches. The HDPE is more readily available and easier to work with than other pipe materials, and the 48" circular pipe will have a very similar hydraulic capacity to the pipe arches being replaced. The stone headwalls will be dismantled and rebuilt.

The watershed upstream of the culvert crossing totals approximately 211 acres. It consists primarily of single family residences in the 1-acre and 2-acre zone. It also encompasses a portion of the Miller-Driscoll school campus. The watershed map is attached. Approximately 400' upstream is a culvert crossing under McFadden Drive that consists of two 42" diameter reinforced concrete pipes. Approximately 150' downstream is another driveway culvert that appears to be of the same size and configuration as the subject culvert. The stream discharges to a pond approximately 400' downstream of the culvert crossing and the pond outlets to the Norwalk River. The culvert is also within FEMA Flood Zone A, which has no base flood elevation determined.

Culvert Studio v 2.0.0.19 software was used to model the culvert under existing and proposed conditions during a 25-year and a 100-year storm event. This software uses FHWA – HDS-5 methodology to compute the hydraulic grade line for the culvert. That rational method was used to determine peak flows to the culvert crossing. The 25-year peak flow is 217.7 cfs and the 100-year peak flow is 269.6 cfs. The analysis found that the proposed headwater and tailwater conditions will be very similar to the existing conditions. Detailed calculations are attached.

The "Culvert Repair Plan" prepared for Christopher J. Silver by this office details the proposed work. The new 48" HDPE pipes and rebuilt headwalls will be in the same location as what is being removed. The existing wing walls will be reused where possible to reduce the amount of disturbance. Rip-rap inlet and outlet protection will be added to the stream bed. The driveway elevation will be raised slightly at the culvert crossing and then blended back into the existing driveway grades. The goal of the plan is to minimize site disturbance and allow the culvert to be quickly replaced.

The "Culvert Repair Plan" shows silt fence to protect the stream and banks. It also includes a construction sequence outlining the critical steps of the repair. Work will be staged from the existing driveway which will protect the existing vegetation. It is anticipated that the material excavated can be reused for the bedding of the new culverts. Approximately 10 cubic yards of intermediated rip-rap is proposed for the inlet and outlet protection. Approximately 13

cubic yards of processed aggregate will be required to regrade the driveway. If there is any excess material, it will be removed from the site.

Construction of the project will be timed to work within good weather conditions. Temporary dewatering measures will be required to install the culverts and headwalls. Dewatering will be accomplished by installing a pump intake at the upstream end of the project and pumping to a filter sock at the downstream end. The filter sock will ensure clean water discharge. It is anticipated that the bulk of the repair can be completed within one week and will allow residents to regain vehicle access to their houses. The completed project, including paving and stabilization, is anticipated to take two weeks.

The proposed culvert repair is necessary and needs to happen quickly in order to maintain safe access to the four houses. The proposed culvert crossing will be very similar to the existing culvert crossing. There will be no negative impact to the existing flood zone or flood elevations. Proper implementation of the proposed construction sequence and erosion control measures will minimize potential impacts to the stream and downstream property owners during construction.

Sincerely,

Thomas Nelson, P.E.
Project Manager

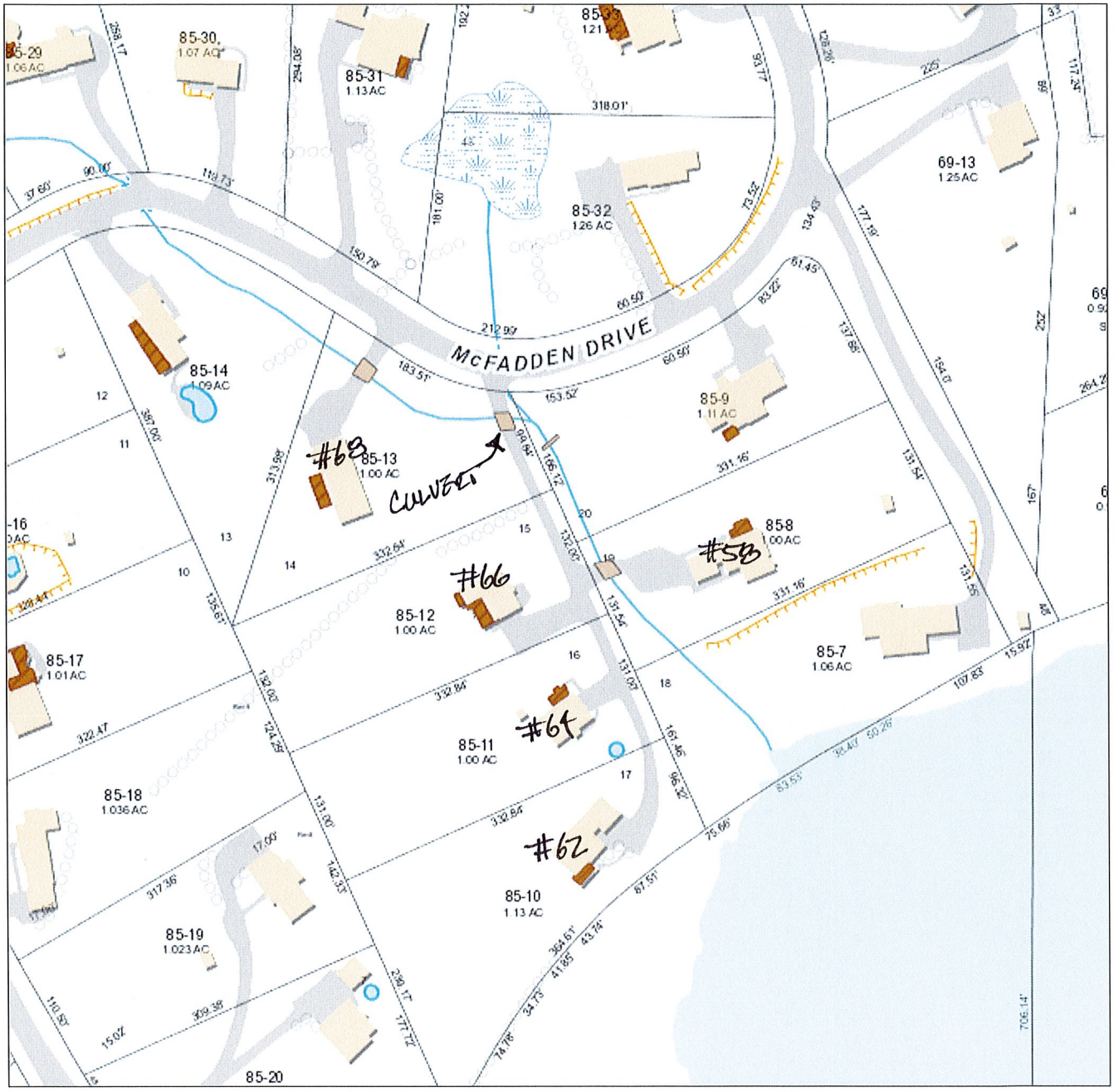
Attachements.

Town of Wilton

Geographic Information System (GIS)

LOCATION MAP
68 McFADDEN DRIVE CULVERT

Date Printed: 6/17/2020



MAP DISCLAIMER - NOTICE OF LIABILITY

This map is for assessment purposes only. It is not for legal description or conveyances. All information is subject to verification by any user. The Town of Wilton and its mapping contractors assume no legal responsibility for the information contained herein.

Zoning Effective: July 28, 2017

Planimetrics Updated: 2014

Approximate Scale: 1 inch = 150 feet

0 150 Feet

N W E S

68 McTADDEN DRIVE

CULVERT CROSSING FOR SHARES DRIVEWAY

INTERIOR OF SOUTH CULVERT

68 McFADDEN DRIVE

DOWNSTREAM HEADWALL

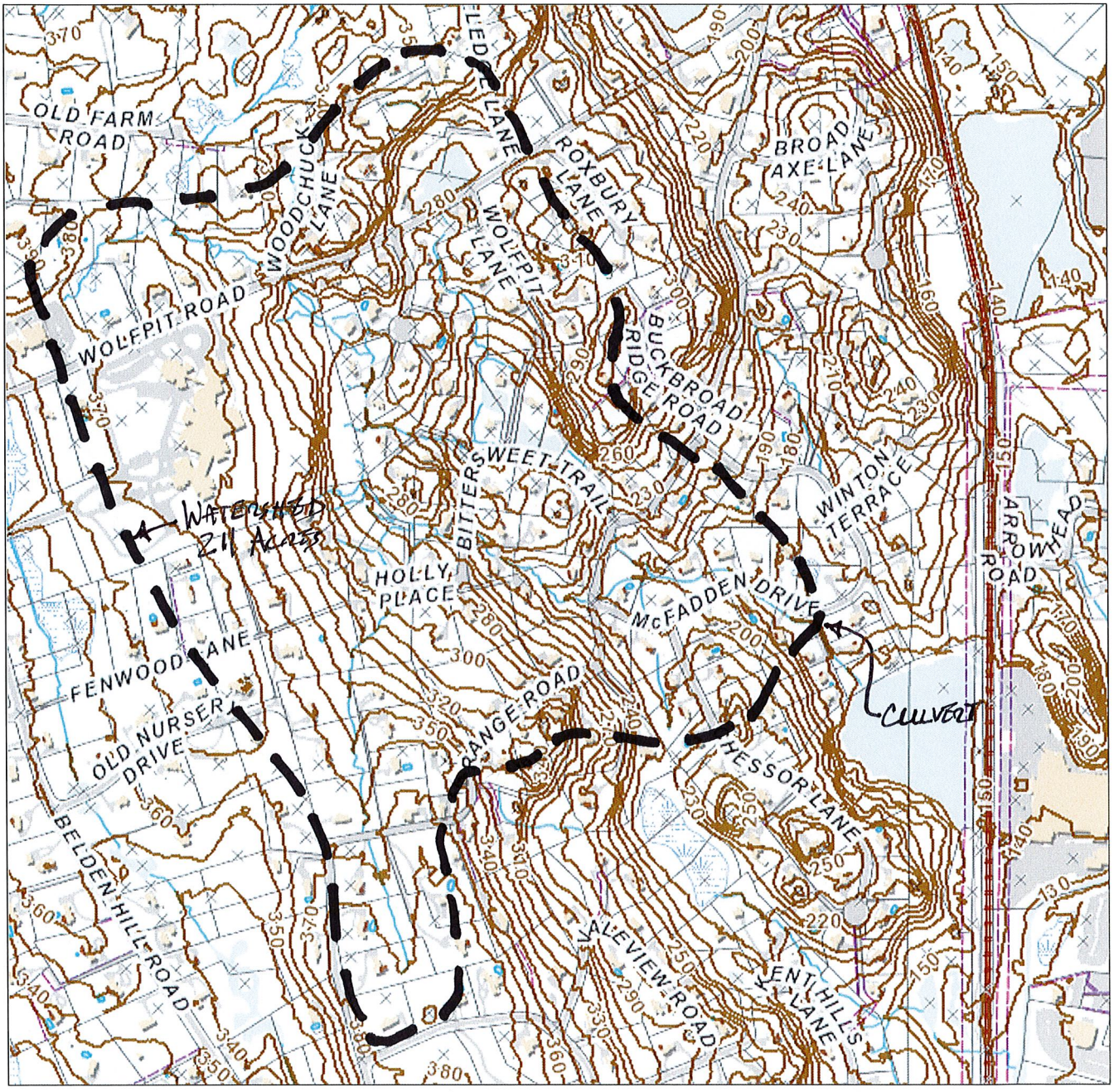
UPSTREAM HEADWALL - SOUTH CULVERT

Town of Wilton

Geographic Information System (GIS)

WATERSHED MAP
68 McFADDEN DRIVE CULVERT

Date Printed: 6/17/2020



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Zoning Effective: July 28, 2017

Planimetrics Updated: 2014

Approximate Scale: 1 inch = 800 feet

0 800 Feet

N W E S

Culvert Report

Project filename: Culvert Design.cst

Culvert Studio v 2.0.0.19

06-17-2020

Existing - 68 McFadden

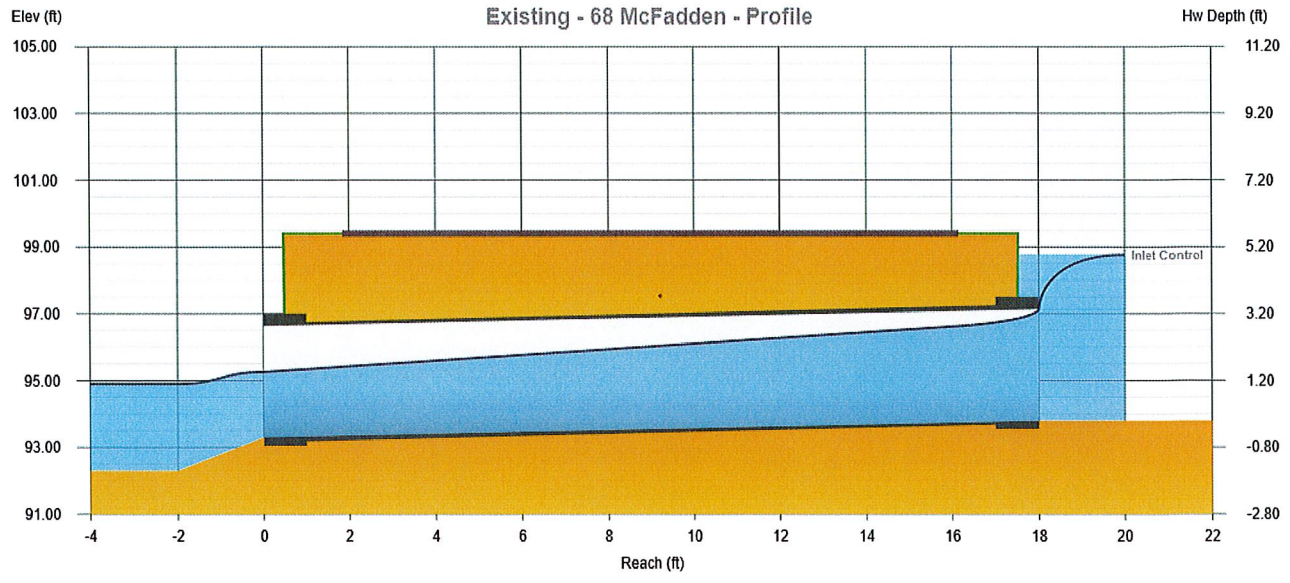
Culvert 1

CULVERT		EMBANKMENT	
Shape	= Arch Pipe	Top Width	= 16.00 ft
Inlet Edge	= Square Edge/ Hdwall	Top Elevation	= 99.40 ft
Material	= Corrugated Steel	Crest Length	= 16.00 ft
Manning's n	= 0.024		
Rise	= 40 in	**DISCHARGE**	
Span	= 59 in	Method	= Rational Method
Invert Elev. Down	= 93.30 ft	Drainage Area	= 211.00 ac
Length	= 18.00 ft	Runoff Coefficient	= 0.33
Slope	= 0.028 ft/ft	Time of Concentration	= 32.6 min
Invert Elev. Up	= 93.80 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 20 degrees	Tailwater Condition	= Channel 1

CALCULATION SAMPLE, 25 - Year Event

Discharge			Velocity		Depth		HGL @ Hw/D = 1.49		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
217.70	217.70	0.00	12.05	8.81	23.5	35.8	95.26	96.79	98.76

Notes:IDF Curves = Atlas14-IDF.idf; Tailwater = Channel 1, Id = Sample Channel, Velocity = 7.61 ft/s, Tailwater Elev. = 94.90 ft



Culvert Report

Project filename: Culvert Design.cst

Culvert Studio v 2.0.0.19

06-17-2020

Existing - 68 McFadden

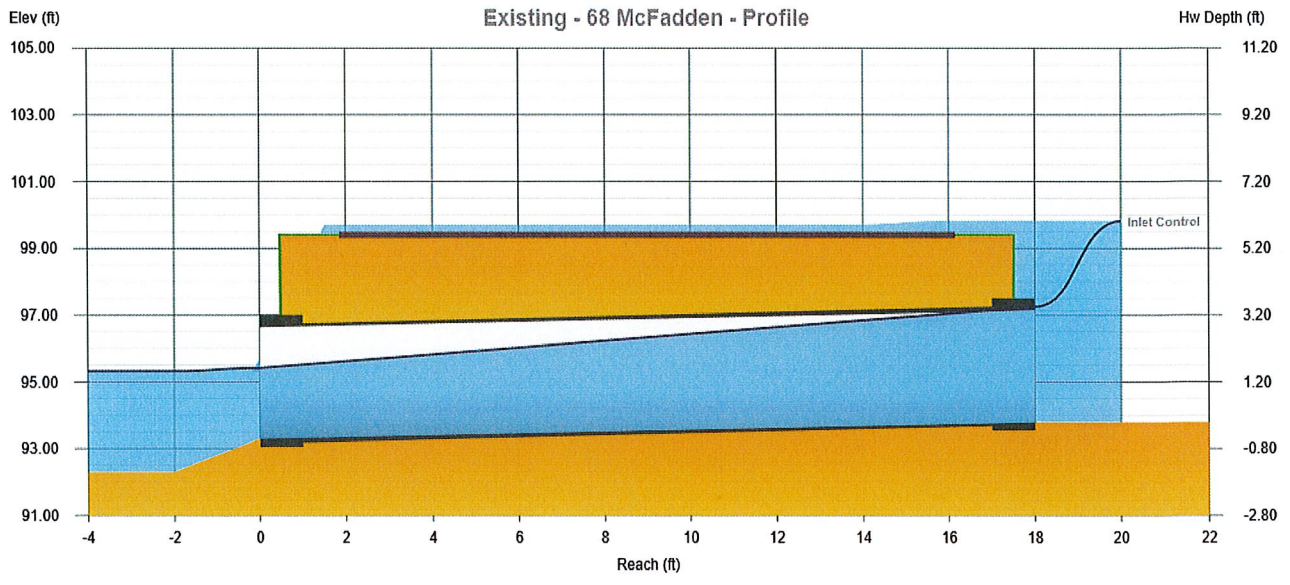
Culvert 1

CULVERT		EMBANKMENT	
Shape	= Arch Pipe	Top Width	= 16.00 ft
Inlet Edge	= Square Edge/ Hdwall	Top Elevation	= 99.40 ft
Material	= Corrugated Steel	Crest Length	= 16.00 ft
Manning's n	= 0.024		
Rise	= 40 in	**DISCHARGE**	
Span	= 59 in	Method	= Rational Method
Invert Elev. Down	= 93.30 ft	Drainage Area	= 211.00 ac
Length	= 18.00 ft	Runoff Coefficient	= 0.33
Slope	= 0.028 ft/ft	Time of Concentration	= 32.6 min
Invert Elev. Up	= 93.80 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 20 degrees	Tailwater Condition	= Channel 1

CALCULATION SAMPLE, 100 - Year Event

Discharge			Velocity		Depth		HGL @ Hw/D = 1.81		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
269.56	256.59	12.97	13.30	9.97	25.4	40.0	95.41	97.25	99.82

Notes:IDF Curves = Atlas14-IDF.idf; Tailwater = Channel 1, Id = Sample Channel, Velocity = 8.11 ft/s, Tailwater Elev. = 95.32 ft



Culvert Report

Project filename: Culvert Design.cst

Culvert Studio v 2.0.0.19

06-17-2020

Proposed - 68 McFadden

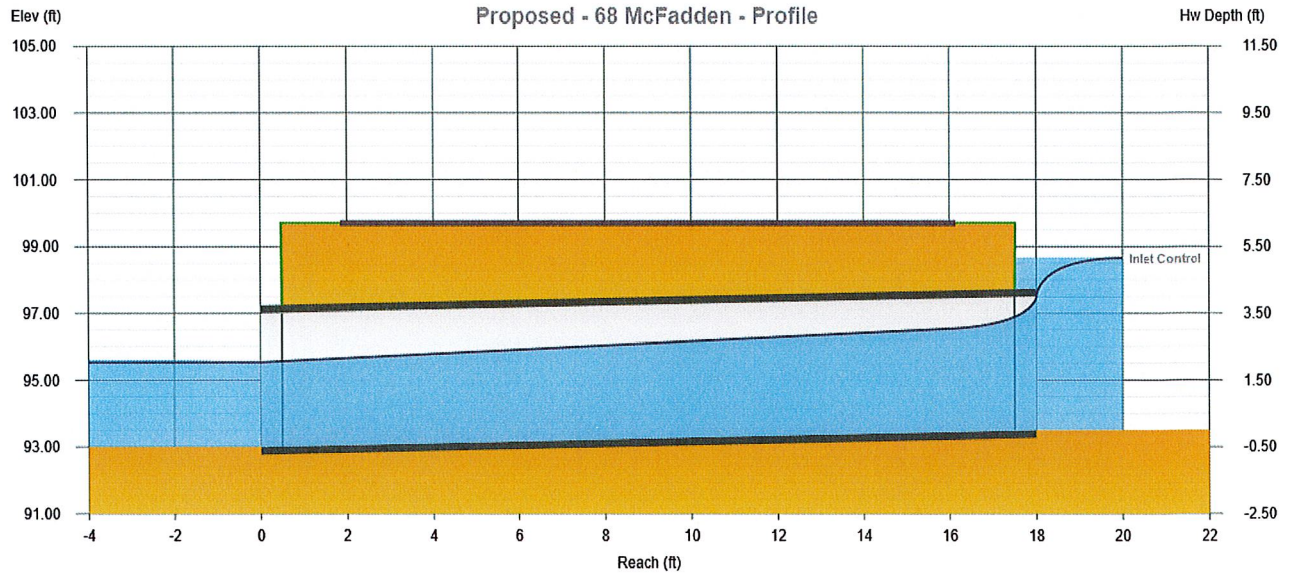
Culvert 2

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 16.00 ft
Inlet Edge	= Beveled	Top Elevation	= 99.70 ft
Material	= HDPE	Crest Length	= 16.00 ft
Manning's n	= 0.012		
Rise	= 48 in	**DISCHARGE**	
Span	= 48 in	Method	= Rational Method
Invert Elev. Down	= 93.00 ft	Drainage Area	= 211.00 ac
Length	= 18.00 ft	Runoff Coefficient	= 0.33
Slope	= 0.028 ft/ft	Time of Concentration	= 32.6 min
Invert Elev. Up	= 93.50 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 20 degrees	Tailwater Condition	= Channel 2

CALCULATION SAMPLE, 25 - Year Event

Discharge			Velocity		Depth		HGL @ Hw/D = 1.29		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
217.70	217.70	0.00	12.98	10.22	30.4	37.9	95.53	96.66	98.66

Notes:IDF Curves = Atlas14-IDF.idf; Tailwater = Channel 2, Id = Sample Channel, Velocity = 7.61 ft/s, Tailwater Elev. = 95.60 ft



Culvert Report

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Culvert Studio v 2.0.0.19

06-17-2020

Proposed - 68 McFadden

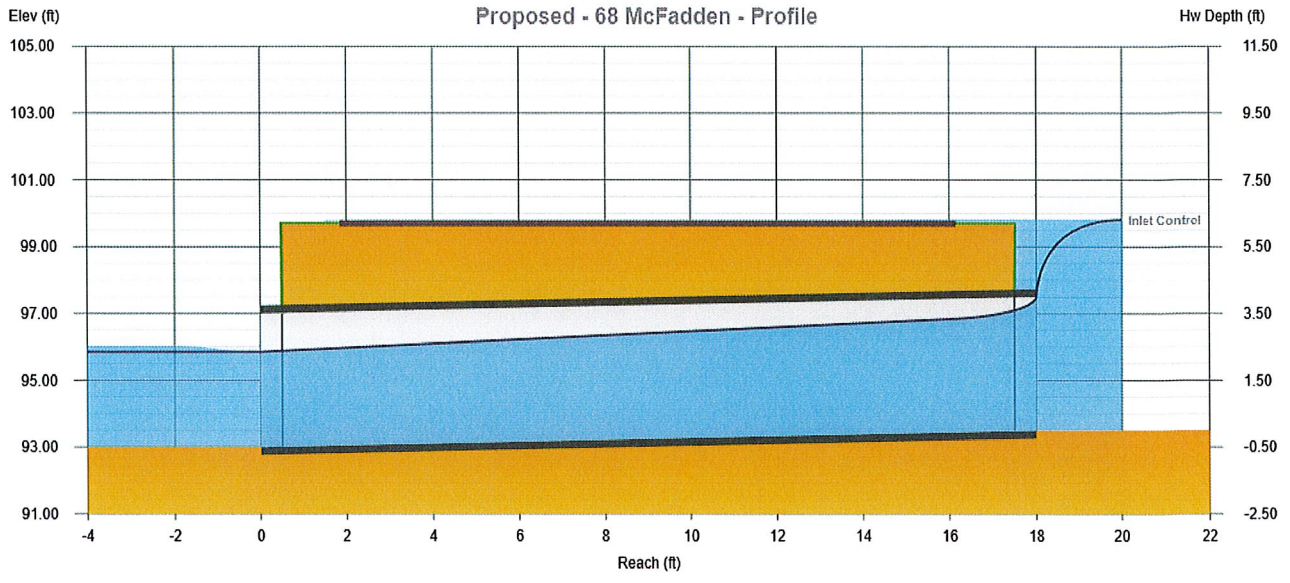
Culvert 2

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 16.00 ft
Inlet Edge	= Beveled	Top Elevation	= 99.70 ft
Material	= HDPE	Crest Length	= 16.00 ft
Manning's n	= 0.012		
Rise	= 48 in	**DISCHARGE**	
Span	= 48 in	Method	= Rational Method
Invert Elev. Down	= 93.00 ft	Drainage Area	= 211.00 ac
Length	= 18.00 ft	Runoff Coefficient	= 0.33
Slope	= 0.028 ft/ft	Time of Concentration	= 32.6 min
Invert Elev. Up	= 93.50 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 20 degrees	Tailwater Condition	= Channel 2

CALCULATION SAMPLE, 100 - Year Event

Discharge			Velocity		Depth		HGL @ Hw/D = 1.58		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
269.56	267.90	1.66	13.98	11.59	34.2	41.5	95.85	96.96	99.81

Notes:IDF Curves = Atlas14-IDF.idf; Tailwater = Channel 2, Id = Sample Channel, Velocity = 8.11 ft/s, Tailwater Elev. = 96.02 ft



MCCHORD ENGINEERING ASSOCIATES, INC.
CONSULTING CIVIL ENGINEERS
Executive Offices, Suite 202
78 Danbury Rd., Wilton, CT 06897
(203) 834-0569 FAX (203) 834-2789

JOB:	68 McFadden Drive, Wilton, CT		
BY:	TSN	DATE:	6/16/20
CHECKED:		DATE:	

WORKSHEET: COMPOSITE C VALUE

Total Area (acres): 211.0000 **Area No:** 1

COVER CONDITIONS - CULVERT WATERSHED

Cover Description	C	Area (ac)	C x A
Single Family, B-Group Soils	0.35	103.4000	36.1900
Single Family, C-Group Soils	0.40	66.3000	26.5200
Wooded, D-Group Soils	0.18	41.3000	7.4340
	Totals:	211.0000	70.1440

C(Weighted) = 0.33

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JOB:	68 McFadden Drive, Wilton, CT		
BY:	TSN	DATE:	6/16/20
CHECKED:		DATE:	
PAGE			

DRAINAGE COMPUTATIONS: RATIONAL METHOD

COMMON RUNOFF COEFFICIENTS

Type of Drainage Area	Runoff Coefficient, C
Categorized by Surface	
Forested	0.06 - 0.20
Asphalt	0.70 - 0.95
Brick	0.70 - 0.85
Concrete	0.80 - 0.95
Shingle Roof	0.70 - 0.95
Lawns, well-drained (sandy soil)	
Up to 2% slope	0.05 - 0.10
2% to 7% slope	0.10 - 0.15
Over 7% slope	0.15 - 0.20
Lawns, poorly-drained (clay soil)	
Up to 2% slope	0.13 - 0.17
2% to 7% slope	0.18 - 0.22
Over 7% slope	0.25 - 0.35
Driveways, walkways	0.75 - 0.85
Categorized by Use	
Farmland	0.05 - 0.30
Pasture	0.05 - 0.30
Unimproved	0.10 - 0.30
Parks	0.10 - 0.25
Cemeteries	0.10 - 0.25
Railroad yards	0.20 - 0.40
Playgrounds (except asphalt or concrete)	0.20 - 0.35
Business districts	
Neighborhood	0.50 - 0.70
City (downtown)	0.70 - 0.95
Residential	
Single-family	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 - 0.75
Suburban	0.25 - 0.40
Apartments, condominiums	0.50 - 0.70
Industrial	
Light areas	0.50 - 0.80
Heavy areas	0.60 - 0.90

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JOB:	68 McFadden Drive, Wilton, CT		
BY:	TSN	DATE:	6/16/20
CHECKED:		DATE:	

WORKSHEET: TIME OF CONCENTRATION (T_c)

Condition: Existing **Area No:** 1

Compute: T_c through sub-area

Sheet Flow (Applicable to T_c only)

	Segment ID	AB			
1. Surface description		lawn			
2. Manning's roughness coefficient, n		0.24			
3. Flow length, L (ft) [total <= 300 ft]		150			
4. Two-year 24-hour rainfall, P_2 (in)		3.3			
5. Land slope, s (ft/ft)		0.0190			
6. $Tt = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t (min)	19.8			19.8

Shallow Concentrated Flow

	Segment ID	BC	CD		
7. Surface description		lawn	lawn		
8. Velocity Factor, Kv (ft/s)		7.0	7.0		
9. Flow length, L (ft)		340	120		
10. Watercourse slope, s (ft/ft)		0.0240	0.1100		
11. Average velocity, V (ft/s)		1.084	2.322		
12. $Tt = \frac{L}{3600\,V}$	Compute T_t (min)	5.2	0.9		6.1

Channel Flow

	Segment ID	DE	EF	FG	
13. Cross sectional flow area, a (ft^2)		4.0000	20.0000	45.0000	
14. Wetted perimeter, pw (ft)		5.4800	13.6600	20.4800	
15. Hydraulic radius, r = a/pw (ft)		0.7299	1.4641	2.1973	
16. Channel slope, s (ft/ft)		0.1200	0.0480	0.0330	
17. Manning's roughness coefficient, n		0.060	0.050	0.050	
18. V = (1.486/n) r2/3s1/2 (ft/s)		6.955	8.396	9.125	
19. Flow length, L (ft)		650	1450	1200	
20. $Tt = \frac{L}{3600\,V}$	Compute T_t (min)	1.6	2.9	2.2	6.7

21. Watershed or sub-area T_c or T_t (add T_t in steps 6, 12, and 20) (min) **32.6**