

Appendix C – Hydraulic Calculations

- Normal Depth Calculations – Onsite
- Normal Depth Calculations – Swales

Worksheet for ON-A

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.500 %
Discharge	2.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	1.04
0+24.50	0.06
0+26.00	0.00
0+27.50	0.06
0+46.00	0.25
0+46.00	0.73
0+46.50	0.75

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 1.04)	(0+46.50, 0.75)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.20 ft
Roughness Coefficient	0.016
Elevation	0.20 ft
Elevation Range	0.00 to 1.04 ft
Flow Area	1.6 ft ²
Wetted Perimeter	19.48 ft
Hydraulic Radius	0.08 ft
Top Width	19.48 ft
Normal Depth	0.20 ft
Critical Depth	0.18 ft
Critical Slope	0.888 %
Velocity	1.24 ft/s
Velocity Head	0.02 ft
Specific Energy	0.22 ft

Worksheet for ON-A

Results

Froude Number	0.764
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

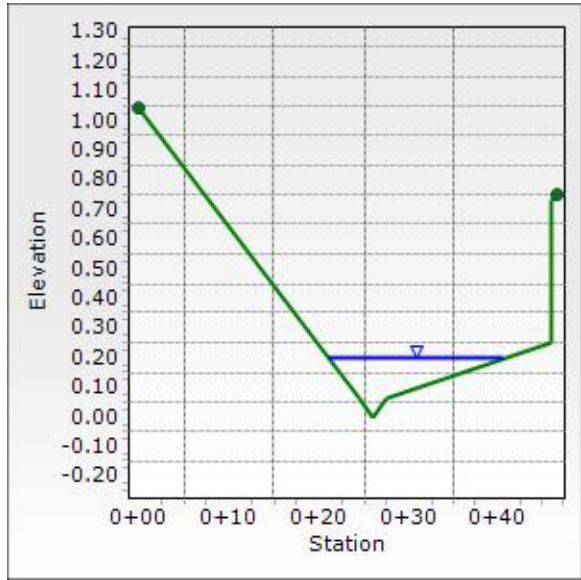
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.20 ft
Critical Depth	0.18 ft
Channel Slope	0.500 %
Critical Slope	0.888 %

Cross Section for ON-A

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.500 %
Normal Depth	0.20 ft
Discharge	2.00 cfs



Worksheet for ON-B

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.500 %
Discharge	1.00 cfs

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		0.89
	0+00.50		0.87
	0+00.50		0.39
	0+18.50		0.16
	0+43.00		0.06
	0+44.50		0.00
	0+46.00		0.06
	0+62.50		0.23
	0+62.50		0.71
	0+63.00		0.73

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.89)	(0+63.00, 0.73)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.14 ft
Roughness Coefficient	0.016
Elevation	0.14 ft
Elevation Range	0.00 to 0.89 ft
Flow Area	1.2 ft ²
Wetted Perimeter	28.48 ft
Hydraulic Radius	0.04 ft
Top Width	28.47 ft
Normal Depth	0.14 ft
Critical Depth	0.12 ft
Critical Slope	1.112 %

Worksheet for ON-B

Results

Velocity	0.81 ft/s
Velocity Head	0.01 ft
Specific Energy	0.15 ft
Froude Number	0.682
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

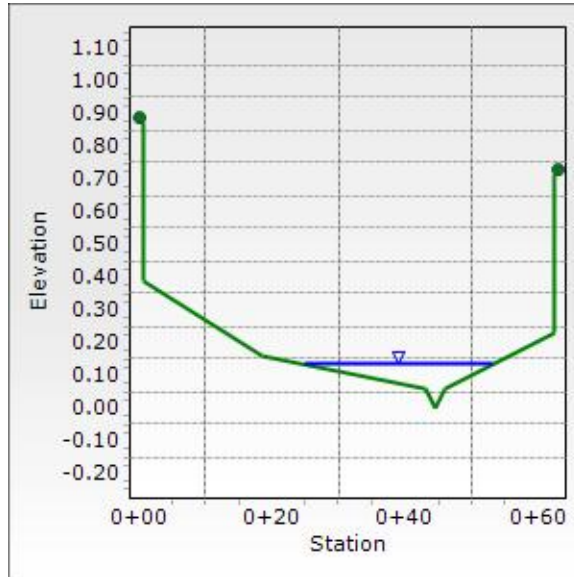
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.14 ft
Critical Depth	0.12 ft
Channel Slope	0.500 %
Critical Slope	1.112 %

Cross Section for ON-B

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.500 %
Normal Depth	0.14 ft
Discharge	1.00 cfs



Worksheet for ON-C

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.610 %
Discharge	1.00 cfs

Section Definitions

	Station (ft)	Elevation (ft)
	0+00.00	0.50
	0+00.50	0.48
	0+00.50	0.00
	0+02.00	0.13
	0+02.00	0.17
	0+24.50	0.58
	0+24.50	1.06
	0+25.00	1.08

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+25.00, 1.08)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.29 ft
Roughness Coefficient	0.016
Elevation	0.29 ft
Elevation Range	0.00 to 1.08 ft
Flow Area	0.7 ft ²
Wetted Perimeter	8.25 ft
Hydraulic Radius	0.09 ft
Top Width	7.92 ft
Normal Depth	0.29 ft
Critical Depth	0.27 ft
Critical Slope	0.901 %
Velocity	1.41 ft/s
Velocity Head	0.03 ft

Worksheet for ON-C

Results

Specific Energy	0.32 ft
Froude Number	0.833
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

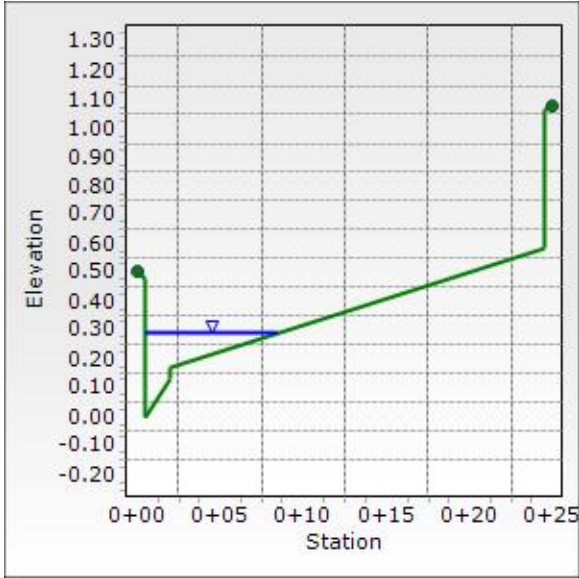
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.29 ft
Critical Depth	0.27 ft
Channel Slope	0.610 %
Critical Slope	0.901 %

Cross Section for ON-C

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 %
Normal Depth	0.29 ft
Discharge	1.00 cfs



Worksheet for ON-D

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.500 %
Discharge	1.00 cfs

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		0.86
	0+00.50		0.84
	0+00.50		0.36
	0+16.00		0.17
	0+16.00		0.13
	0+17.50		0.00
	0+17.50		0.48
	0+18.00		0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.86)	(0+18.00, 0.50)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.28 ft
Roughness Coefficient	0.016
Elevation	0.28 ft
Elevation Range	0.00 to 0.86 ft
Flow Area	0.8 ft ²
Wetted Perimeter	11.03 ft
Hydraulic Radius	0.08 ft
Top Width	10.71 ft
Normal Depth	0.28 ft
Critical Depth	0.26 ft
Critical Slope	0.938 %
Velocity	1.18 ft/s
Velocity Head	0.02 ft

Worksheet for ON-D

Results

Specific Energy	0.30 ft
Froude Number	0.741
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

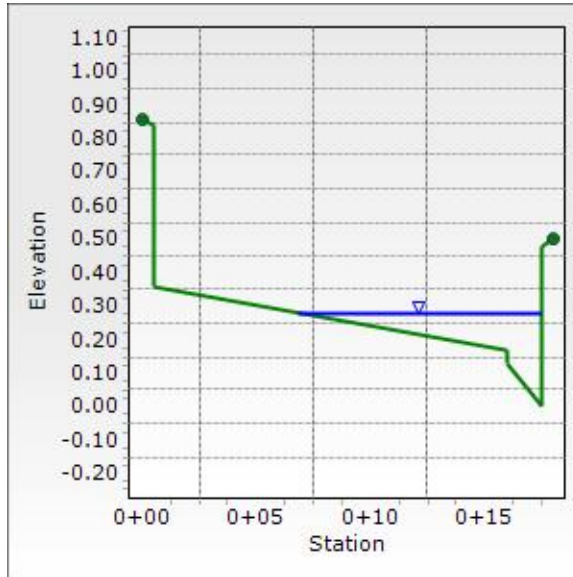
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.28 ft
Critical Depth	0.26 ft
Channel Slope	0.500 %
Critical Slope	0.938 %

Cross Section for ON-D

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.500 %
Normal Depth	0.28 ft
Discharge	1.00 cfs



Worksheet for SW1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	0.500 %
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Discharge	2.00 cfs

Results	
Normal Depth	0.61 ft
Flow Area	1.5 ft ²
Wetted Perimeter	5.05 ft
Hydraulic Radius	0.30 ft
Top Width	4.89 ft
Critical Depth	0.44 ft
Critical Slope	3.091 %
Velocity	1.34 ft/s
Velocity Head	0.03 ft
Specific Energy	0.64 ft
Froude Number	0.426
Flow Type	Subcritical

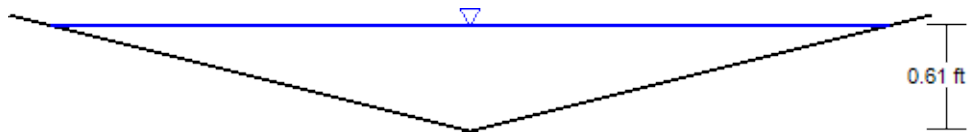
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.61 ft
Critical Depth	0.44 ft
Channel Slope	0.500 %
Critical Slope	3.091 %

Cross Section for SW1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	0.500 %
Normal Depth	0.61 ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Discharge	2.00 cfs



V: 1
H: 1

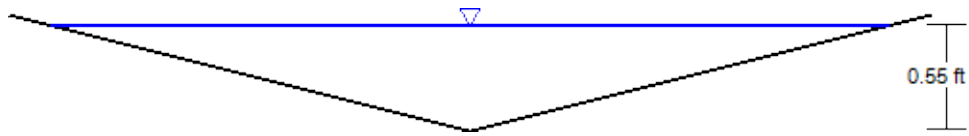
Worksheet for SW2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.035
Channel Slope	0.900 %
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Discharge	2.00 cfs
Results	
Normal Depth	0.55 ft
Flow Area	1.2 ft ²
Wetted Perimeter	4.52 ft
Hydraulic Radius	0.27 ft
Top Width	4.38 ft
Critical Depth	0.43 ft
Critical Slope	3.091 %
Velocity	1.67 ft/s
Velocity Head	0.04 ft
Specific Energy	0.59 ft
Froude Number	0.561
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.55 ft
Critical Depth	0.43 ft
Channel Slope	0.900 %
Critical Slope	3.091 %

Cross Section for SW2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	0.900 %
Normal Depth	0.55 ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Discharge	2.00 cfs



V: 1
H: 1