

Appendix D

Hydrologic and Hydraulic Calculations



**WWHM4
PROJECT REPORT**

Project Name: Threshold (TDAs with 0.28 ac or less of new impervious surface qualify for the flow control facilities exception)
Site Name : N. Sammamish
Site Address:
City : Sammamish
Report Date : 6/8/2012
Gage : Seatac
Data Start : 1948/10/01
Data End : 1998/09/30
Precip Scale: 1.00
Version : 2011/06/21

PREDEVELOPED LAND USE

Name : TDA 11 - Unnamed Trib #2
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>Acres</u>
C, Forest, Flat	.28

<u>Impervious Land Use</u>	<u>Acres</u>
----------------------------	--------------

Element Flows To:
Surface **Interflow** **Groundwater**

MITIGATED LAND USE

Name : TDA 11 - Unnamed Trib #2
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>Acres</u>
--------------------------	--------------

<u>Impervious Land Use</u>	<u>Acres</u>
ROADS FLAT	0.28

Element Flows To:
Surface **Interflow** **Groundwater**

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.007047
5 year	0.01092
10 year	0.013018
25 year	0.015151
50 year	0.016417
100 year	0.017458

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.06993
5 year	0.085024
10 year	0.09478
25 year	0.106952
50 year	0.115956
100 year	0.124934

Perlnd and Implnd Changes

No changes have been made.

This program and accompanying documentation is provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by the user. Clear Creek Solutions, Inc. disclaims all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions, Inc. be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions, Inc. has been advised of the possibility of such damages.

MGS FLOOD PROJECT REPORT

Program Version: MGSFlood 4.26
Program License Number: 200510005
Run Date: 01/28/2013 8:18 AM

Input File Name: IT-473+00.fld
Project Name: ELST - N Sammamish
Analysis Title: Infiltration Trench Sizing
Comments: Infiltration trenches STA 473+00 to STA 483+50

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

***** Default HSPF Parameters Used (Not Modified by User) *****

***** WATERSHED DEFINITION *****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

----- Subbasin : STA 473+00 to STA 483+50 -----

	-----Area(Acres)-----
Till Forest	0.386
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000

Subbasin Total	0.386

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

----- Subbasin : STA 473+00 to STA 483+50 -----

-----Area(Acres) -----

Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.386

Subbasin Total 0.386

***** LINK DATA *****

-----SCENARIO: PREDEVELOPED

Number of Links: 0

***** LINK DATA *****

-----SCENARIO: POSTDEVELOPED

Number of Links: 1

Link Name: Infil Trench

Link Type: Infiltration Trench

Downstream Link: None

Trench Type	:	Trench on Embankment Sideslope
Trench Length (ft)	:	1050.00
Trench Width (ft)	:	2.00
Trench Depth (ft)	:	2.00
Trench Bottom Elev (ft)	:	100.00
Trench Rockfill Porosity (%)	:	30.00

Constant Infiltration Option Used

Infiltration Rate (in/hr): 0.50

*****FLOOD FREQUENCY AND DURATION STATISTICS*****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

Number of Links: 1

*****Groundwater Recharge Summary*****

Recharge is computed as input to PerInd Groundwater Plus Infiltration in Structures

Model Element	Total Predeveloped Recharge During Simulation Recharge Amount (ac-ft)
Subbasin: STA 473+00 to STA 48	66.927
Total:	66.927

Model Element	Total Post Developed Recharge During Simulation Recharge Amount (ac-ft)
Subbasin: STA 473+00 to STA 48	0.000
Link: Infiltration Trench	170.472
Total:	170.472

**Total Predevelopment Recharge is Less than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.424 ac-ft/year, Post Developed: 1.079 ac-ft/year**

*****Water Quality Facility Data*****

-----SCENARIO: PREDEVELOPED

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Links: 1

***** Link: Infiltration Trench*****

Infiltration/Filtration Statistics-----
 Total Runoff Volume (ac-ft): 170.47
 Total Runoff Infiltrated (ac-ft): 170.47, 100.00%
 Total Runoff Filtered (ac-ft): 0.00, 0.00%
 Percent Treated (Infiltrated+Filtered)/Total Volume: 100.00%

*****Compliance Point Results*****

Scenario Predeveloped Compliance Subbasin: STA 473+00 to STA 483+50

Scenario Postdeveloped Compliance Link: Infiltration Trench

*** Point of Compliance Flow Frequency Data ***

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	8.195E-03	2-Year	4.300E-06
5-Year	1.399E-02	5-Year	6.617E-06
10-Year	1.740E-02	10-Year	7.887E-06
25-Year	2.246E-02	25-Year	9.919E-06
50-Year	2.704E-02	50-Year	2.200E-02
100-Year	3.246E-02	100-Year	7.509E-02
200-Year	4.389E-02	200-Year	8.742E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

**** Flow Duration Performance ****

Excursion at Predeveloped 50%Q2 (Must be Less Than 0%):	-99.9% PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than 0%):	-99.6% PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	-40.0% PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0% PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

MGS FLOOD PROJECT REPORT

Program Version: MGSFlood 4.26
Program License Number: 200510005
Run Date: 01/28/2013 8:34 AM

Input File Name: IT-511+00.fld
Project Name: ELST - N Sammamish
Analysis Title: Infiltration Trench Sizing
Comments: Infiltration trenches STA 511+00 to STA 514+74

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

***** Default HSPF Parameters Used (Not Modified by User) *****

***** WATERSHED DEFINITION *****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

----- Subbasin : STA 511+00 to STA 514+74 -----

	-----Area(Acres)-----
Till Forest	0.140
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000

Subbasin Total	0.140

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

----- Subbasin : STA 511+00 to STA 514+74 -----

-----Area(Acres) -----

Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.140

Subbasin Total 0.140

***** LINK DATA *****

-----SCENARIO: PREDEVELOPED

Number of Links: 0

***** LINK DATA *****

-----SCENARIO: POSTDEVELOPED

Number of Links: 1

Link Name: Infiltration Trench 2

Link Type: Infiltration Trench

Downstream Link: None

Trench Type	:	Trench on Embankment Sideslope
Trench Length (ft)	:	374.00
Trench Width (ft)	:	2.00
Trench Depth (ft)	:	2.10
Trench Bottom Elev (ft)	:	100.00
Trench Rockfill Porosity (%)	:	30.00

Constant Infiltration Option Used

Infiltration Rate (in/hr): 0.50

*****FLOOD FREQUENCY AND DURATION STATISTICS*****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

Number of Links: 0

-----**SCENARIO: POSTDEVELOPED**

Number of Subbasins: 1

Number of Links: 1

-----**SCENARIO: PREDEVELOPED**

Number of Links: 0

-----**SCENARIO: POSTDEVELOPED**

Number of Links: 1

***** Link: Infiltration Trench 2 *****

Infiltration/Filtration Statistics-----

Total Runoff Volume (ac-ft): 61.83

Total Runoff Infiltrated (ac-ft): 61.83, 100.00%

Total Runoff Filtered (ac-ft): 0.00, 0.00%

Percent Treated (Infiltrated+Filtered)/Total Volume: 100.00%

*******Compliance Point Results*******

Scenario Predeveloped Compliance Subbasin: STA 511+00 to STA 514+74

Scenario Postdeveloped Compliance Link: Infiltration Trench 2

*** **Point of Compliance Flow Frequency Data** ***

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	2.972E-03	2-Year	4.418E-06
5-Year	5.073E-03	5-Year	6.802E-06
10-Year	6.313E-03	10-Year	8.090E-06
25-Year	8.145E-03	25-Year	1.017E-05
50-Year	9.806E-03	50-Year	7.440E-03
100-Year	1.177E-02	100-Year	2.057E-02
200-Year	1.592E-02	200-Year	2.487E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

**** **Flow Duration Performance** ****

Excursion at Predeveloped 50%Q2 (Must be Less Than 0%):	-100.0%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than 0%):	-99.7%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	-40.0%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

MGS FLOOD PROJECT REPORT

Program Version: MGSFlood 4.26
Program License Number: 200510005
Run Date: 01/28/2013 12:29 PM

Input File Name: IT-515+47.fld
Project Name: ELST - N Sammamish
Analysis Title: Infiltration Trench Sizing
Comments: Infiltration trenches STA 515+47 to STA 521+93

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

***** Default HSPF Parameters Used (Not Modified by User) *****

***** WATERSHED DEFINITION *****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

----- Subbasin : STA 515+47 to STA 521+93 -----

	-----Area(Acres)-----
Till Forest	0.180
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000

Subbasin Total	0.180

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

----- Subbasin : STA 515+47 to STA 521+93 -----

-----Area(Acres) -----

Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.180

Subbasin Total 0.180

***** LINK DATA *****

-----SCENARIO: PREDEVELOPED

Number of Links: 0

***** LINK DATA *****

-----SCENARIO: POSTDEVELOPED

Number of Links: 1

Link Name: Infiltration Trench 2

Link Type: Infiltration Trench

Downstream Link: None

Trench Type	:	Trench on Embankment Sideslope
Trench Length (ft)	:	500.00
Trench Width (ft)	:	2.00
Trench Depth (ft)	:	2.00
Trench Bottom Elev (ft)	:	100.00
Trench Rockfill Porosity (%)	:	30.00

Constant Infiltration Option Used

Infiltration Rate (in/hr): 0.50

*****FLOOD FREQUENCY AND DURATION STATISTICS*****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

Number of Links: 1

*****Groundwater Recharge Summary*****

Recharge is computed as input to PerInd Groundwater Plus Infiltration in Structures

Model Element	Total Predeveloped Recharge During Simulation Recharge Amount (ac-ft)
Subbasin: STA 515+47 to STA 52	31.210
Total:	31.210

Model Element	Total Post Developed Recharge During Simulation Recharge Amount (ac-ft)
Subbasin: STA 515+47 to STA 52	0.000
Link: Infiltration Trench	79.495
Total:	79.495

**Total Predevelopment Recharge is Less than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.198 ac-ft/year, Post Developed: 0.503 ac-ft/year**

*****Water Quality Facility Data*****

-----SCENARIO: PREDEVELOPED

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Links: 1

***** Link: Infiltration Trench 2 *****

Infiltration/Filtration Statistics-----
 Total Runoff Volume (ac-ft): 79.49
 Total Runoff Infiltrated (ac-ft): 79.49, 100.00%
 Total Runoff Filtered (ac-ft): 0.00, 0.00%
 Percent Treated (Infiltrated+Filtered)/Total Volume: 100.00%

*****Compliance Point Results*****

Scenario Predeveloped Compliance Subbasin: STA 515+47 to STA 521+93

Scenario Postdeveloped Compliance Link: Infiltration Trench 2

*** Point of Compliance Flow Frequency Data ***

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	3.822E-03	2-Year	4.164E-06
5-Year	6.523E-03	5-Year	6.402E-06
10-Year	8.116E-03	10-Year	7.655E-06
25-Year	1.047E-02	25-Year	9.629E-06
50-Year	1.261E-02	50-Year	7.055E-03
100-Year	1.513E-02	100-Year	2.628E-02
200-Year	2.047E-02	200-Year	3.114E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

**** Flow Duration Performance ****

Excursion at Predeveloped 50%Q2 (Must be Less Than 0%):	-100.0%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than 0%):	-99.7%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	-40.0%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

MGS FLOOD PROJECT REPORT

Program Version: MGSFlood 4.26
Program License Number: 200510005
Run Date: 01/28/2013 8:47 AM

Input File Name: IT-528+22.fld
Project Name: ELST - N Sammamish
Analysis Title: Infiltration Trench Sizing
Comments: Infiltration trenches STA 528+22 to STA 531+75

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

***** Default HSPF Parameters Used (Not Modified by User) *****

***** WATERSHED DEFINITION *****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

----- Subbasin : STA 528+22 to STA 531+75 -----

	-----Area(Acres)-----
Till Forest	0.120
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000

Subbasin Total	0.120

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

----- Subbasin : STA 528+22 to STA 531+75 -----

-----Area(Acres) -----

Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.120

Subbasin Total	0.120
----------------	-------

***** LINK DATA *****

-----SCENARIO: PREDEVELOPED

Number of Links: 0

***** LINK DATA *****

-----SCENARIO: POSTDEVELOPED

Number of Links: 1

Link Name: Infil Trench 528+22 to 531+75

Link Type: Infiltration Trench

Downstream Link: None

Trench Type	:	Trench on Embankment Sideslope
Trench Length (ft)	:	317.00
Trench Width (ft)	:	2.00
Trench Depth (ft)	:	2.10
Trench Bottom Elev (ft)	:	100.00
Trench Rockfill Porosity (%)	:	30.00

Constant Infiltration Option Used

Infiltration Rate (in/hr): 0.50

*****FLOOD FREQUENCY AND DURATION STATISTICS*****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

Number of Links: 1

*****Groundwater Recharge Summary *****

Recharge is computed as input to PerInd Groundwater Plus Infiltration in Structures

Model Element	Total Predeveloped Recharge During Simulation Recharge Amount (ac-ft)
Subbasin: STA 528+22 to STA 53	20.806
Total:	20.806

Model Element	Total Post Developed Recharge During Simulation Recharge Amount (ac-ft)
Subbasin: STA 528+22 to STA 53	0.000
Link: Infiltration Trench 528+22	52.996
Total:	52.996

**Total Predevelopment Recharge is Less than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.132 ac-ft/year, Post Developed: 0.335 ac-ft/year**

*****Water Quality Facility Data *****

-----SCENARIO: PREDEVELOPED

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Links: 1

***** Link: Infiltration Trench 528+22 to 531+75 *****

Infiltration/Filtration Statistics-----
 Total Runoff Volume (ac-ft): 53.00
 Total Runoff Infiltrated (ac-ft): 53.00, 100.00%
 Total Runoff Filtered (ac-ft): 0.00, 0.00%
 Percent Treated (Infiltrated+Filtered)/Total Volume: 100.00%

*****Compliance Point Results *****

Scenario Predeveloped Compliance Subbasin: STA 528+22 to STA 531+75

Scenario Postdeveloped Compliance Link: Infiltration Trench 528+22 to 531+75

*** Point of Compliance Flow Frequency Data ***

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	2.548E-03	2-Year	4.488E-06
5-Year	4.348E-03	5-Year	6.921E-06
10-Year	5.411E-03	10-Year	8.222E-06
25-Year	6.981E-03	25-Year	1.032E-05
50-Year	8.405E-03	50-Year	5.899E-03
100-Year	1.009E-02	100-Year	2.115E-02
200-Year	1.364E-02	200-Year	2.484E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

**** Flow Duration Performance ****

Excursion at Predeveloped 50%Q2 (Must be Less Than 0%):	-99.9% PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than 0%):	-99.6% PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	-20.1% PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0% PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

Parametrix

PROJECT ELST-N, SAMM SHEET 1 OF 4
 BY C. BUETRAGO DATE 6/29/2012 CHECKED _____ DATE _____
 SUBJECT FP CULVERT SIZING JOB NO. _____ PHASE _____ TASK _____

CULVERT @ 503+35 (TRIBUTARY #0145 H)

BASIN AREA = 17.056 AC w/ R-4 ZONING

EFFECTIVE IMPERVIOUS AREA = 23.1%

LAND USE

TILL GRASS = 13.16 AC
 IMPERVIOUS = 3.940 AC

FOR ALL FLOW CALCS

USE MOSES FLOOD V4 @ 5 MIN-TIME STEP FOR CONVEYANCE FLOWS

$Q_{2yr} = 3.16$ cfs

$Q_{25yr} = 8.85$ cfs

$Q_{100yr} = 15.60$ cfs

FOR SIZING CALCS

CROSS-SECTION

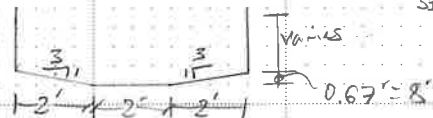


TABLE 4.4.1.B of 2009 KCSVDM

$n = 0.011$ (conc.)

$n = 0.035$ (Smooth uniform rock) BOTTOM CHANNEL

Box Culvert

6' span x 6' rise (counter sunk)

Culv IE = 39.51' flat culv.

Culv length = 16'

Crown elev. = 39.51' + 6' rise = 45.51'

U/S Flowline Elev = 41.64'
 D/S " " " = 40.87'

$$\text{slope} = \frac{41.64 - 40.87}{16} = 0.0481$$

Use FlowMaster w/ Manning's Eqn to calculate Normal depths.

Flow	Normal Depth	Elev @ U/S Culv End	Clearance (freeboard)
Q_{2yr}	0.31'	$41.64 + 0.31 = 41.95'$	$45.51 - 41.95 = 3.56'$
Q_{25yr}	0.53'	$41.64 + 0.53 = 42.17'$	$45.51 - 42.17 = 3.34'$
Q_{100yr}	0.70'	$41.64 + 0.70 = 42.34'$	$45.51 - 42.34 = 3.17'$

Culvert Span

$$W_{culvert} = 1.2 (W_{channel}) + 2$$

From field visit,

$$W_{channel} = 3.25 \text{ ft}$$

$$W_{culvert} = 5.9 \text{ ft}, \text{ use } 6 \text{ ft span culvert}$$

Parametrix

PROJECT _____ SHEET 2 OF 4
 BY _____ DATE 6/29/2012 CHECKED _____ DATE _____
 SUBJECT _____ JOB NO. _____ PHASE _____ TASK _____

CULVERT @ S25+60 (TRIBUTARY #043 G)

BASIN AREA = 28.400 ACRE w/ R-4 ZONING
 EFFECTIVE IMPERV. AREA = 23.1%
 LAND USE
 TILL GRASS = 21,840 AC
 IMPERVIOUS = 6,560 AC

$Q_{2yr} = 5.27 \text{ cfs}$

$Q_{25yr} = 19.74 \text{ cfs}$

$Q_{100yr} = 25.97 \text{ cfs}$

Box Culvert

6' span x 5' ris (countersunk)

Culv IE = 41.28, flat culv. U/S Flowline elev = 43.28'
 Crown elev = 41.28 + 5' = 46.28 D/S " " = 42.30'
 length = 16' slope = $\frac{43.28 - 42.30}{16'} = 0.0613$

Use Flowmaster and Manning's Egn to calculate Normal depths.

Flow	Normal Depth	Elev. @ U/S Culv End	Clearance (freeboard)
Q_{2yr}	0.38'	$43.28 + 0.38 = 43.66$	$46.28 - 43.66 = 2.62'$
Q_{25yr}	0.64'	$43.28 + 0.64 = 43.92$	$46.28 - 43.92 = 2.36'$
Q_{100yr}	0.82'	$43.28 + 0.82 = 44.10$	$46.28 - 44.10 = 2.18'$

Culvert Span

From field visit, $W_{channel} = 3.5 \text{ ft}$ $W_{culv bed} = 1.2(3.25) + 2'$
 $W_{culv bed} = 5.9 \text{ ft}$, USE 6 ft span culvert

Parametrix

PROJECT _____ SHEET 3 OF 4
 BY _____ DATE 6/29/2012 CHECKED _____ DATE _____
 SUBJECT _____ JOB NO. _____ PHASE _____ TASK _____

CULVERT @ 528+12 (TRIBUTARY #0143 F)

BASIN AREA = 30.706 ACCE w/ R-4 ZONING

EFFECTIVE IMPERV. AREA = 23.1%

LAND USE

TILL GRASS = 23.815 AC
 IMPERVIOUS = 7.093 AC

$$Q_{2YR} = 5.69 \text{ cfs}$$

$$Q_{25YR} = 15.94 \text{ cfs}$$

$$Q_{100YR} = 28.08 \text{ cfs}$$

Box CULVERT

6' span x 4' rise (counter sink)

CULV. IE = 43.01' flat culv.

Crown elev = 47.01'

length = 16'

4/5 Flowline Elev = 45.01'

D/S " " = 44.12'

$$\text{slope} = \frac{45.01' - 44.12'}{16'} = 0.0556$$

USE Flow Master and Manning's Egn to calculate Normal depths

Flow	Normal Depth	Elev @ 4/5 Culv. End	Clearance
Q_{2YR}	0.41'	$45.01 + 0.41 = 45.42'$	$47.01 - 45.42 = 1.59'$
Q_{25YR}	0.68'	$45.01 + 0.68 = 45.69'$	$47.01 - 45.69 = 1.32'$
Q_{100YR}	0.87'	$45.01 + 0.87 = 45.88'$	$47.01 - 45.88 = 1.13'$

Culvert Span

From field visit, $w_{channel} = 4 \text{ ft}$

$$w_{culvert} = 1.2(4) + 2'$$

$w_{culvert} = 6.8 \text{ ft}$, use 6 ft culvert span

6' culvert span is anticipated to be adequate given the above flow calculations and the similarities to other tributaries and the short length of the culvert.

Parametrix

PROJECT _____ SHEET 4 OF 4
 BY _____ DATE 6/29/2012 CHECKED _____ DATE _____
 SUBJECT _____ JOB NO. _____ PHASE _____ TASK _____

CULVERT @ 539+10 (TRIBUTARY #0145D)

Basin Area = 66.361 Acre w/ R-4 ZONING

EFFECTIVE IMPERV. AREA = 23.1%

LAND USE:

TILL GRASS = 51.032 AC

IMPERVIOUS = 15.329 AC

$Q_{2yr} = 12.31$ cfs

$Q_{25yr} = 34.45$ cfs

$Q_{100yr} = 60.68$ cfs

Box CULVERT

6' span x 7' rise (counter sunk)

Culv IE = 38.44'

Crown elev = 45.44'

length = 16'

U/S Flowline elev = 40.66'

D/S " = 40.02'

$$\text{Slope} = \frac{40.66 - 40.02}{16} = 0.0400$$

USE Flow Master and Manning's Eqn to calculate Normal Depths

Flow	Normal Depth	Elev @ U/S culv. end	Clearance
Q_{2yr}	0.65'	$40.66' + 0.65' = 41.31'$	$45.44' - 41.31' = 4.13'$
Q_{25yr}	1.04'	$40.66' + 1.04' = 41.70'$	$45.44' - 41.70' = 3.74'$
Q_{100yr}	1.38'	$40.66' + 1.38' = 42.04'$	$45.44' - 42.04' = 3.40'$

Culvert Span

From field visit, $w_{channel} = 3.5$ ft

$$w_{culvert} = 1.2(3.5) + 2' = 6.2$$
 ft

USE 6 ft culvert span

MGS FLOOD PROJECT REPORT

Program Version: MGSFlood 4.26
Program License Number: 200510005
Run Date: 11/20/2012 1:00 PM

Input File Name: FPCulvertBasinFlows.fld
Project Name: ELST - N Sammamish
Analysis Title: Basin flows for Box Culvert Sizing
Comments: Drainage basins for Tributaries #0143H, #0143M, #0143G, #0143F, and #0143D,
#0143B, and Unnamed #6.

PRECIPITATION INPUT

Computational Time Step (Minutes): 5

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

***** Default HSPF Parameters Used (Not Modified by User) *****

***** WATERSHED DEFINITION *****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 7

----- Subbasin : Trib #0143H Basin -----
-----Area(Acres) -----
Till Forest 0.000
Till Pasture 0.000
Till Grass 13.116
Outwash Forest 0.000
Outwash Pasture 0.000
Outwash Grass 0.000
Wetland 0.000
Green Roof 0.000
User 0.000
Impervious 3.940

Subbasin Total 17.056

----- Subbasin : Trib #0143G Basin -----

	-----Area(Acres)-----
Till Forest	0.000
Till Pasture	0.000
Till Grass	21.840
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	6.560

Subbasin Total	28.400

----- Subbasin : Trib #0143F Basin -----

	-----Area(Acres)-----
Till Forest	0.000
Till Pasture	0.000
Till Grass	23.613
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	7.093

Subbasin Total	30.706

----- Subbasin : Trib #0143D Basin -----

	-----Area(Acres)-----
Till Forest	0.000
Till Pasture	0.000
Till Grass	51.032
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	15.329

Subbasin Total	66.361

----- Subbasin : Trib #0143M Basin -----

	-----Area(Acres)-----
Till Forest	0.000
Till Pasture	0.000
Till Grass	13.550

Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	4.070

Subbasin Total	17.620

----- Subbasin : Unnamed Trib #6 Basin -----

	-----Area(Acres) -----
Till Forest	0.000
Till Pasture	0.000
Till Grass	9.303
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	2.795

Subbasin Total	12.098

----- Subbasin : Trib #0143B Basin -----

	-----Area(Acres) -----
Till Forest	0.000
Till Pasture	0.000
Till Grass	86.880
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	26.098

Subbasin Total	112.978

-----**SCENARIO: POSTDEVELOPED**-----

Number of Subbasins: 7

----- Subbasin : Trib #0143H Basin -----

	-----Area(Acres) -----
Till Forest	0.000
Till Pasture	0.000
Till Grass	13.116
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000

User	0.000
Impervious	3.940

Subbasin Total	17.056

----- Subbasin : Trib #0143G Basin -----

	-----Area(Acres) -----
Till Forest	0.000
Till Pasture	0.000
Till Grass	21.840
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	6.560

Subbasin Total	28.400

----- Subbasin : Trib #0143F Basin -----

	-----Area(Acres) -----
Till Forest	0.000
Till Pasture	0.000
Till Grass	23.613
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	7.093

Subbasin Total	30.706

----- Subbasin : Trib #0143D Basin -----

	-----Area(Acres) -----
Till Forest	0.000
Till Pasture	0.000
Till Grass	51.032
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	15.329

Subbasin Total	66.361

----- Subbasin : Trib #0143M Basin -----

-----Area(Acres) -----

Till Forest	0.000
Till Pasture	0.000
Till Grass	13.550
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	4.070

Subbasin Total	17.620

----- Subbasin : Unnamed Trib #6 Basin -----
-----Area(Acres) -----

Till Forest	0.000
Till Pasture	0.000
Till Grass	9.303
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	2.795

Subbasin Total	12.098

----- Subbasin : Trib #0143B Basin -----
-----Area(Acres) -----

Till Forest	0.000
Till Pasture	0.000
Till Grass	86.880
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	26.098

Subbasin Total	112.978

***** LINK DATA *****

-----SCENARIO: PREDEVELOPED
Number of Links: 1

Link Name: New Copy Lnk1
Link Type: Copy

Downstream Link: None

***** LINK DATA *****

-----SCENARIO: POSTDEVELOPED

Number of Links: 1

Link Name: New Copy Lnk1

Link Type: Copy

Downstream Link: None

***** FLOOD FREQUENCY AND DURATION STATISTICS *****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 7

Number of Links: 1

***** Subbasin: Trib #0143H Basin *****

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)	
2-Year	3.163	
5-Year	4.994	
10-Year	6.499	
25-Year	8.854	← Conveyance Design Flow Rate
50-Year	13.104	
100-Year	15.595	
200-Year	15.901	

***** Subbasin: Trib #0143G Basin *****

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)	
2-Year	5.266	← Bypass Pipe Design Flow Rate
5-Year	8.316	
10-Year	10.821	
25-Year	14.743	← Conveyance Design Flow Rate
50-Year	21.819	
100-Year	25.966	
200-Year	26.476	

***** Subbasin: Trib #0143F Basin *****

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
----------	------------------

Tr (yrs)	Flood Peak (cfs)	
2-Year	5.694	← Bypass Pipe Design Flow Rate
5-Year	8.991	
10-Year	11.699	
25-Year	15.940	← Conveyance Design Flow Rate
50-Year	23.590	
100-Year	28.075	
200-Year	28.626	

***** Subbasin: Trib #0143D Basin *****

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)	
2-Year	12.305	← Bypass Pipe Design Flow Rate
5-Year	19.431	
10-Year	25.284	
25-Year	34.449	← Conveyance Design Flow Rate
50-Year	50.983	
100-Year	60.675	
200-Year	61.866	

***** Subbasin: Trib #0143M Basin *****

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)	
2-Year	3.267	← Bypass Pipe Design Flow Rate
5-Year	5.159	
10-Year	6.713	
25-Year	9.147	← Conveyance Design Flow Rate
50-Year	13.537	
100-Year	16.110	
200-Year	16.426	

***** Subbasin: Unnamed Trib #6 Basin *****

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)	
2-Year	2.243	← Bypass Pipe Design Flow Rate
5-Year	3.542	
10-Year	4.610	
25-Year	6.280	← Conveyance Design Flow Rate
50-Year	9.295	
100-Year	11.062	
200-Year	11.279	

***** Subbasin: Trib #0143B Basin *****

Flood Frequency Data(cfs)
 (Recurrence Interval Computed Using Gringorten Plotting Position)
 Tr (yrs) Flood Peak (cfs)

Tr (yrs)	Flood Peak (cfs)
2-Year	20.949 ← Bypass Pipe Design Flow Rate
5-Year	33.081
10-Year	43.046
25-Year	58.648
50-Year	86.797
100-Year	103.298
200-Year	105.326

***** Link: New Copy Lnk1 ***** Link Outflow 1 Frequency Stats

Flood Frequency Data(cfs)
 (Recurrence Interval Computed Using Gringorten Plotting Position)
 Tr (yrs) Flood Peak (cfs)

2-Year	52.887
5-Year	83.514
10-Year	108.672
25-Year	148.061
50-Year	219.124
100-Year	260.780
200-Year	265.900

-----**SCENARIO: POSTDEVELOPED**

Number of Subbasins: 7

Number of Links: 1

***** **Subbasin: Trib #0143H Basin** *****

Flood Frequency Data(cfs)
 (Recurrence Interval Computed Using Gringorten Plotting Position)
 Tr (yrs) Flood Peak (cfs)

2-Year	3.163
5-Year	4.994
10-Year	6.499
25-Year	8.854
50-Year	13.104
100-Year	15.595
200-Year	15.901

***** **Subbasin: Trib #0143G Basin** *****

Flood Frequency Data(cfs)
 (Recurrence Interval Computed Using Gringorten Plotting Position)
 Tr (yrs) Flood Peak (cfs)

2-Year	5.266
--------	-------

5-Year	8.316
10-Year	10.821
25-Year	14.743
50-Year	21.819
100-Year	25.966
200-Year	26.476

***** Subbasin: Trib #0143F Basin *****

Flood Frequency Data(cfs)
 (Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	5.694
5-Year	8.991
10-Year	11.699
25-Year	15.940
50-Year	23.590
100-Year	28.075
200-Year	28.626

***** Subbasin: Trib #0143D Basin *****

Flood Frequency Data(cfs)
 (Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	12.305
5-Year	19.431
10-Year	25.284
25-Year	34.449
50-Year	50.983
100-Year	60.675
200-Year	61.866

***** Subbasin: Trib #0143M Basin *****

Flood Frequency Data(cfs)
 (Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	3.267
5-Year	5.159
10-Year	6.713
25-Year	9.147
50-Year	13.537
100-Year	16.110
200-Year	16.426

***** Subbasin: Unnamed Trib #6 Basin *****

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)
Tr (yrs) Flood Peak (cfs)

=====	
2-Year	2.243
5-Year	3.542
10-Year	4.610
25-Year	6.280
50-Year	9.295
100-Year	11.062
200-Year	11.279

***** **Subbasin: Trib #0143B Basin** *****

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)
Tr (yrs) Flood Peak (cfs)

=====	
2-Year	20.949
5-Year	33.081
10-Year	43.046
25-Year	58.648
50-Year	86.797
100-Year	103.298
200-Year	105.326

***** Link: New Copy Lnk1 ***** Link Outflow 1 Frequency Stats

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)
Tr (yrs) Flood Peak (cfs)

=====	
2-Year	52.887
5-Year	83.514
10-Year	108.672
25-Year	148.061
50-Year	219.124
100-Year	260.780
200-Year	265.900

*******Groundwater Recharge Summary*******

Recharge is computed as input to PerInd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation	
Model Element	Recharge Amount (ac-ft)

Subbasin: Trib #0143H Basin	1601.799
Subbasin: Trib #0143G Basin	2667.223
Subbasin: Trib #0143F Basin	2883.752
Subbasin: Trib #0143D Basin	6232.314
Subbasin: Trib #0143M Basin	1654.802
Subbasin: Unnamed Trib #6 Basi	1136.135
Subbasin: Trib #0143B Basin	10610.270

Link: New Copy Lnk1 Not Applicable

Total: 26786.300

Total Post Developed Recharge During Simulation
Model Element Recharge Amount (ac-ft)

Subbasin: Trib #0143H Basin	1601.799
Subbasin: Trib #0143G Basin	2667.223
Subbasin: Trib #0143F Basin	2883.752
Subbasin: Trib #0143D Basin	6232.314
Subbasin: Trib #0143M Basin	1654.802
Subbasin: Unnamed Trib #6 Basi	1136.135
Subbasin: Trib #0143B Basin	10610.270
Link: New Copy Lnk1	Not Applicable

Total: 26786.300

Total Predevelopment Recharge Equals Post Developed Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 169.534 ac-ft/year, Post Developed: 169.534 ac-ft/year

*****Water Quality Facility Data *****

-----SCENARIO: PREDEVELOPED

Number of Links: 1

-----SCENARIO: POSTDEVELOPED

Number of Links: 1

*****Compliance Point Results *****

Scenario Predeveloped Compliance Link: New Copy Lnk1
Scenario Postdeveloped Compliance Link: New Copy Lnk1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	52.887	2-Year	52.887
5-Year	83.514	5-Year	83.514
10-Year	108.672	10-Year	108.672
25-Year	148.061	25-Year	148.061
50-Year	219.124	50-Year	219.124
100-Year	260.780	100-Year	260.780
200-Year	265.900	200-Year	265.900

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

**WWHM4
PROJECT REPORT**

Project Name: TDA0143Fadd (project runoff to Trib #0143F before and after project)
Site Name : ELST
Site Address: N. Sammamish
City :
Report Date : 1/28/2013
Gage : Seatac
Data Start : 1948/10/01
Data End : 1998/09/30
Precip Scale: 1.00
Version : 2011/04/14

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>Acres</u>
C, Lawn, Steep	.028

<u>Impervious Land Use</u>	<u>Acres</u>
SIDEWALKS FLAT	0.046

Element Flows To:

Surface	Interflow	Groundwater
---------	-----------	-------------

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>Acres</u>

<u>Impervious Land Use</u>	<u>Acres</u>
SIDEWALKS FLAT	0.044

Element Flows To:

Surface	Interflow	Groundwater
---------	-----------	-------------

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.01331 <-----
5 year	0.016601
10 year	0.01877
25 year	0.021518
50 year	0.023577
100 year	0.025651 <-----

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.010989 <-----
5 year	0.013361
10 year	0.014894
25 year	0.016807
50 year	0.018222
100 year	0.019633 <-----

This program and accompanying documentation is provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by the user. Clear Creek Solutions, Inc. disclaims all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions, Inc. be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions, Inc. has been advised of the possibility of such damages.

MGS FLOOD PROJECT REPORT

Program Version: MGSFlood 4.26
Program License Number: 200510005
Run Date: 01/25/2013 11:48 AM

Input File Name: ConveyanceExist.fld
Project Name: ELST - N Sammamish
Analysis Title: Conveyance flows for exist pipe at STA 561+50
Comments: TDA 30 runoff area. The flows from this analysis will be used to confirm that exist 6" pipe is adequate size for flows.

PRECIPITATION INPUT

Computational Time Step (Minutes): 5

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

***** Default HSPF Parameters Used (Not Modified by User) *****

***** WATERSHED DEFINITION *****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

----- Subbasin : TDA 30 -----
-----Area(Acres) -----
Till Forest 0.190
Till Pasture 0.000
Till Grass 0.000
Outwash Forest 0.000
Outwash Pasture 0.000
Outwash Grass 0.000
Wetland 0.000
Green Roof 0.000
User 0.000
Impervious 0.050

Subbasin Total 0.240

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

----- Subbasin : TDA 30 -----

-----Area(Acres) -----

Till Forest	0.160
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.080

Subbasin Total 0.240

***** LINK DATA *****

-----SCENARIO: PREDEVELOPED

Number of Links: 0

***** LINK DATA *****

-----SCENARIO: POSTDEVELOPED

Number of Links: 0

***** FLOOD FREQUENCY AND DURATION STATISTICS *****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

Number of Links: 0

***** Groundwater Recharge Summary *****

Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

	Total Predeveloped Recharge During Simulation
Model Element	Recharge Amount (ac-ft)

Subbasin: TDA 30	32.700
------------------	--------

Total:	32.700
--------	--------

Total Post Developed Recharge During Simulation	
Model Element	Recharge Amount (ac-ft)
Subbasin: TDA 30	27.536
Total:	27.536

**Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.207 ac-ft/year, Post Developed: 0.174 ac-ft/year**

*******Water Quality Facility Data *******

-----SCENARIO: PREDEVELOPED

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Links: 0

*******Compliance Point Results *******

Scenario Predeveloped Compliance Subbasin: TDA 30

Scenario Postdeveloped Compliance Subbasin: TDA 30

***** Point of Compliance Flow Frequency Data *****

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	2.562E-02	2-Year	3.904E-02
5-Year	3.384E-02	5-Year	5.161E-02
10-Year	3.972E-02	10-Year	6.303E-02
25-Year	5.186E-02	25-Year	7.715E-02
50-Year	6.907E-02	50-Year	0.110
100-Year	8.305E-02	100-Year	0.127
200-Year	9.697E-02	200-Year	0.131

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

STA 561+50 Exist 6" Culvert - Q25yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.10000	ft/ft
Diameter	0.50	ft
Discharge	0.08	ft ³ /s

Results

Normal Depth	0.07	ft
Flow Area	0.02	ft ²
Wetted Perimeter	0.37	ft
Hydraulic Radius	0.04	ft
Top Width	0.34	ft
Critical Depth	0.14	ft
Percent Full	13.3	%
Critical Slope	0.00506	ft/ft
Velocity	5.14	ft/s
Velocity Head	0.41	ft
Specific Energy	0.48	ft
Froude Number	4.23	
Maximum Discharge	2.26	ft ³ /s
Discharge Full	2.10	ft ³ /s
Slope Full	0.00015	ft/ft
Flow Type	SuperCritical	

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		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	13.34	%
Downstream Velocity	Infinity	ft/s

STA 561+50 Exist 6" Culvert - Q25yr

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.07	ft
Critical Depth	0.14	ft
Channel Slope	0.10000	ft/ft
Critical Slope	0.00506	ft/ft

STA 561+50 Exist 6" Culvert - Q100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.10000	ft/ft
Diameter	0.50	ft
Discharge	0.13	ft ³ /s

Results

Normal Depth	0.08	ft
Flow Area	0.02	ft ²
Wetted Perimeter	0.42	ft
Hydraulic Radius	0.05	ft
Top Width	0.37	ft
Critical Depth	0.18	ft
Percent Full	16.9	%
Critical Slope	0.00510	ft/ft
Velocity	5.94	ft/s
Velocity Head	0.55	ft
Specific Energy	0.63	ft
Froude Number	4.33	
Maximum Discharge	2.26	ft ³ /s
Discharge Full	2.10	ft ³ /s
Slope Full	0.00038	ft/ft
Flow Type	SuperCritical	

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		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	16.87	%
Downstream Velocity	Infinity	ft/s

STA 561+50 Exist 6" Culvert - Q100

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.08	ft
Critical Depth	0.18	ft
Channel Slope	0.10000	ft/ft
Critical Slope	0.00510	ft/ft

New Culvert at STA 592+23

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024	
Channel Slope	0.11230	ft/ft
Diameter	1.50	ft
Discharge	6.62	ft ³ /s

Results

Normal Depth	0.61	ft
Flow Area	0.67	ft ²
Wetted Perimeter	2.07	ft
Hydraulic Radius	0.33	ft
Top Width	1.47	ft
Critical Depth	1.00	ft
Percent Full	40.7	%
Critical Slope	0.02232	ft/ft
Velocity	9.81	ft/s
Velocity Head	1.50	ft
Specific Energy	2.11	ft
Froude Number	2.56	
Maximum Discharge	20.51	ft ³ /s
Discharge Full	19.07	ft ³ /s
Slope Full	0.01354	ft/ft
Flow Type	SuperCritical	

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		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	40.66	%
Downstream Velocity	Infinity	ft/s

New Culvert at STA 592+23

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	1.00	ft
Channel Slope	0.11230	ft/ft
Critical Slope	0.02232	ft/ft