Autodesk® Storm and Sanitary Analysis 2014 - Version 8.1.62 (Build 1)

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Project Description
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File Name ..... NAAF Stormwater Improvement Project 11_11_2014.SPF

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Analysis Options
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Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date OCT-11-2014 01:00:00
Ending Date OCT-12-2014 02:00:00
Report Time Step 00:05:00

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Element Count
****
Number of rain gages 1
Number of subbasins 11
Number of nodes 15
Number of links 12

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Raingage Summary
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Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	TS-01	INTENSITY	6.00

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Subbasin Summary
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Subbasin ID	Total Area acres
Sub-01	76.06
Sub-02	4.43
Sub-03	5.59
Sub-04	1.06
Sub-05	39.00
Sub-06	24.65
Sub-08	7.88
Sub-09	4.39
Sub-10	2.70
Sub-12	11.51
Sub-14	16.59

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Node Summary
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Node ID	Element Type	Invert Elevation	Maximum Elev.	Ponded Area	External Inflow

		ft	ft	ft²
Out-01	JUNCTION	249.40	255.40	0.00
Out-02	JUNCTION	249.34	255.34	0.00
Out-03	JUNCTION	243.61	251.61	0.00
Out-06	JUNCTION	232.00	237.00	0.00
Out-04	OUTFALL	254.68	256.18	0.00
Out-05	OUTFALL	213.00	217.00	0.00
Out-07	OUTFALL	227.00	232.00	0.00
Out-08	OUTFALL	216.00	224.00	0.00
Stor-01	STORAGE	258.00	260.00	68986.00

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Inlet Summary
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Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Invert Elevation	Rim Elevation	Ponded Area	Initial Water Elevation	Grate Clogging Factor
					ft	ft	ft²	ft	%
Inlet-01	NEENAH FOUNDRY	R-3540-2	On Sag	1	260.89	264.95	10.00	260.89	0.00
Inlet-02	NEENAH FOUNDRY	R-3540-2	On Sag	1	255.10	259.57	10.00	255.10	0.00
Inlet-03	GUTTER DEPTH CAPTURE CURVE	N/A	On Sag	1	244.40	246.00	10.00	244.40	0.00
Inlet-04	GUTTER DEPTH CAPTURE CURVE	N/A	On Sag	1	241.00	242.00	10.00	241.00	0.00
Inlet-05	NEENAH FOUNDRY	R-3540-2	On Sag	1	252.46	256.86	10.00	252.46	0.00
Inlet-06	NEENAH FOUNDRY	R-3540-2	On Sag	1	252.56	256.88	10.00	252.56	0.00

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Roadway and Gutter Summary
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Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
Inlet-01	- 0.0100	0.0160	0.0100	0.01	0.00	
Inlet-02	- 0.0100	0.0160	0.0100	0.01	0.01	
Inlet-03	- 0.0200	0.0160	0.0620	2.00	2.00	
Inlet-04	- 0.0200	0.0160	0.0620	2.00	2.00	
Inlet-05	- 0.0200	0.0160	0.0620	2.00	2.00	
Inlet-06	- 0.0200	0.0160	0.0620	2.00	2.00	

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Link Summary
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Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-04	Inlet-06	Out-02	CONDUIT	639.1	0.5039	0.0150
Link-05	Inlet-01	Inlet-02	CONDUIT	501.0	1.1556	0.0150
Link-06	Inlet-02	Out-04	CONDUIT	138.3	0.3038	0.0150
Link-07	Inlet-03	Out-03	CONDUIT	19.6	4.0327	0.0150

Link-08	Inlet-04	Out-05	CHANNEL	398.0	7.2859	0.0320
Link-09	Stor-01	Inlet-05	CHANNEL	437.6	1.2659	0.0300
Link-10	Stor-01	Inlet-06	CHANNEL	342.8	1.5869	0.0300
Link-11	Out-02	Out-06	CHANNEL	766.4	2.2624	0.1000
Link-12	Out-06	Out-07	CHANNEL	281.8	1.7741	0.0320
Link-13	Out-01	Out-06	CHANNEL	725.4	2.3987	0.0320
Link-14	Out-03	Out-08	CHANNEL	1075.9	2.5662	0.0320
Link-15	Inlet-05	Out-01	CONDUIT	618.4	0.5110	0.0150

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Cross Section Summary
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Link ID	Shape	Depth/ Diameter	Width	No. of Barrels	Cross Sectional Area	Full Flow Hydraulic Radius	Design Flow Capacity
		ft	ft		ft²	ft	cfs
Link-04	CIRCULAR	1.50	1.50	1	1.77	0.38	6.46
Link-05	CIRCULAR	1.50	1.50	1	1.77	0.38	9.79
Link-06	CIRCULAR	1.50	1.50	1	1.77	0.38	5.02
Link-07	CIRCULAR	1.50	1.50	1	1.77	0.38	18.28
Link-08	RECT_OPEN	4.00	20.00	1	80.00	2.86	2019.08
Link-09	RECT_OPEN	1.00	1.00	1	1.00	0.33	2.68
Link-10	RECT_OPEN	1.00	1.00	1	1.00	0.33	3.00
Link-11	RECT_OPEN	5.00	5.00	1	25.00	1.67	78.55
Link-12	RECT_OPEN	5.00	5.00	1	25.00	1.67	217.37
Link-13	RECT_OPEN	5.00	5.00	1	25.00	1.67	252.75
Link-14	RECT_OPEN	8.00	8.00	1	64.00	2.67	915.52
Link-15	CIRCULAR	1.50	1.50	1	1.77	0.38	6.51

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	54.020	3.344
Surface Runoff	0.981	0.061
Continuity Error (%)	-0.001	

********** Flow Routing Continuity **********	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	13.000	4.236
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.093	0.030
Continuity Error (%)	-0.305	

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Composite Curve Number Computations Report
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Subbasin Sub-01

Soil/Surface Description	Area (acres)	Soil Group	CN
> 75% grass cover, Good	65.42	B	65.00
PAVEDAREAS	10.65	B	98.00
Composite Area & Weighted CN	76.06		69.62

Subbasin Sub-02

Soil/Surface Description	Area (acres)	Soil Group	CN
ROADWAY	1.33	B	98.00
GRASS	1.90	B	65.00
WOODFAIR	1.20	B	60.00
Composite Area & Weighted CN	4.43		73.55

Subbasin Sub-03

Soil/Surface Description	Area (acres)	Soil Group	CN
ROADWAY	1.40	B	98.00
GRASS	2.29	B	65.00
WOODSFAIR	1.90	B	60.00
Composite Area & Weighted CN	5.59		71.55

Subbasin Sub-04

Soil/Surface Description	Area (acres)	Soil Group	CN
GRASS	0.57	B	65.00
ROADWAY	0.49	B	98.00
Composite Area & Weighted CN	1.06		80.18

Subbasin Sub-05

Soil/Surface Description	Area (acres)	Soil Group	CN
GRASS	3.51	B	65.00
WOODSFAIR	31.59	B	60.00
DIRTROADS	3.90	B	82.00
Composite Area & Weighted CN	39.00		62.65

Subbasin Sub-06

Soil/Surface Description	Area (acres)	Soil Group	CN
ROADWAY	12.32	B	98.00
GRASS	12.32	B	65.00
Composite Area & Weighted CN	24.65		81.50

Subbasin Sub-08

Soil/Surface Description	Area (acres)	Soil Group	CN
WOODSFAIR	7.88	B	60.00
Composite Area & Weighted CN	7.88		60.00

Subbasin Sub-09

Soil/Surface Description	Area (acres)	Soil Group	CN
WOODSFAIR	4.39	B	60.00
Composite Area & Weighted CN	4.39		60.00

Subbasin Sub-10

Soil/Surface Description	Area (acres)	Soil Group	CN
WOODSFAIR	2.70	B	60.00
Composite Area & Weighted CN	2.70		60.00

Subbasin Sub-12

Soil/Surface Description	Area (acres)	Soil Group	CN
GRASS	1.61	B	65.00
WOODFAIR	9.90	B	60.00
Composite Area & Weighted CN	11.51		60.70

Subbasin Sub-14

Soil/Surface Description	Area (acres)	Soil Group	CN
-	16.59	B	60.00
Composite Area & Weighted CN	16.59		60.00

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SCS TR-55 Time of Concentration Computations Report
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Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Sub-01

User-Defined TOC override (minutes): 146.23

Subbasin Sub-02

User-Defined TOC override (minutes): 9.37

Subbasin Sub-03

User-Defined TOC override (minutes): 9.47

Subbasin Sub-04

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.01	0.00
Flow Length (ft):	57.71	28.06	0.00
Slope (%):	0.02	0.02	

0.00

2 yr, 24 hr Rainfall (in):	3.60	3.60
3.60		
Velocity (ft/sec):	0.01	0.14
0.00		
Computed Flow Time (minutes):	82.29	3.34
0.00		

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Total TOC (minutes): 42.81

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Subbasin Sub-05

User-Defined TOC override (minutes): 77.94

Subbasin Sub-06

User-Defined TOC override (minutes): 1760.31

Subbasin Sub-08

User-Defined TOC override (minutes): 449.84

Subbasin Sub-09

User-Defined TOC override (minutes): 371.48

Subbasin Sub-10

User-Defined TOC override (minutes): 306.83

Subbasin Sub-12

User-Defined TOC override (minutes): 480.78

Subbasin Sub-14

User-Defined TOC override (minutes): 706.23

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Subbasin Runoff Summary
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Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	hh:mm:ss
Sub-01	3.30	0.87	16.19	69.620	0	02:26:13
Sub-02	3.30	1.08	6.55	73.550	0	00:09:22

Sub-03	3.30	0.97	7.31	71.550	0	00:09:28
Sub-04	3.30	1.49	1.09	80.180	0	00:42:48
Sub-05	3.30	0.55	7.05	62.650	0	01:17:56
Sub-06	3.30	1.58	1.49	81.500	1	05:20:18
Sub-08	3.30	0.45	0.34	60.000	0	07:29:50
Sub-09	3.30	0.45	0.21	60.000	0	06:11:28
Sub-10	3.30	0.45	0.15	60.000	0	05:06:49
Sub-12	3.30	0.47	0.51	60.700	0	08:00:46
Sub-14	3.30	0.45	0.54	60.000	0	11:46:13

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Node Depth Summary
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Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Flooded Time minutes	Retention Time hh:mm:ss
Out-01	0.12	0.38	249.78	0	12:06	0	0	0:00:00
Out-02	0.28	0.99	250.33	0	12:08	0	0	0:00:00
Out-03	0.09	0.46	244.07	0	12:17	0	0	0:00:00
Out-06	0.21	0.63	232.63	0	12:11	0	0	0:00:00
Out-04	0.37	1.10	255.78	1	01:00	0	0	0:00:00
Out-05	0.00	0.00	213.00	0	00:00	0	0	0:00:00
Out-07	0.21	0.62	227.62	0	12:11	0	0	0:00:00
Out-08	0.09	0.45	216.45	0	12:17	0	0	0:00:00
Stor-01	1.06	2.94	260.94	0	15:59	17.98	586	0:00:00

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Node Flow Summary
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Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
Out-01	JUNCTION	6.54	6.66	0	12:05	0.00		
Out-02	JUNCTION	7.28	7.44	0	12:05	0.00		
Out-03	JUNCTION	0.00	54.97	0	12:16	0.00		
Out-06	JUNCTION	0.54	12.65	0	12:07	0.00		
Out-04	OUTFALL	0.00	4.43	1	01:00	0.00		
Out-05	OUTFALL	0.00	0.00	0	00:00	0.00		
Out-07	OUTFALL	0.15	12.02	0	12:11	0.00		
Out-08	OUTFALL	0.54	14.70	0	12:17	0.00		
Stor-01	STORAGE	16.16	16.16	0	13:40	10.34	0	13:40

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Inlet Depth Summary
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Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	Time of Maximum Depth Occurrence hh:mm
Inlet-01	7.60	267.75	2.80	1	01:00
Inlet-02	0.00	259.57	0.00	1	01:00

Inlet-03	32.86	246.66	0.66	0	12:16
Inlet-04	211.10	246.23	4.23	0	11:57
Inlet-05	0.00	256.86	0.00	0	15:23
Inlet-06	0.00	256.88	0.00	0	16:20

Inlet Flow Summary

Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Intercepted by Inlet cfs	Peak Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes
Inlet-01	1.17	1.17	-	-	-	0.000	0
Inlet-02	0.00	0.00	-	-	-	0.000	0
Inlet-03	1.10	1.10	-	-	-	0.000	0
Inlet-04	7.04	7.04	-	-	-	21.306	784
Inlet-05	0.00	0.00	-	-	-	0.000	0
Inlet-06	0.00	0.00	-	-	-	0.000	0

Storage Node Summary

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded Volume (%)	Time of Max Ponded days hh:mm	Average Ponded Volume 1000 ft³	Average Ponded Volume (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Time of Max. Exfiltration Rate hh:mm:ss	Total Exfiltrated Volume 1000 ft³
Stor-01	0.002	100	0 12:42	15.347	767357	6.19	0.00	0:00:00	0.000

Outfall Loading Summary

Outfall Node ID	Flow Average	Peak

	Frequency (%)	Flow cfs	Inflow cfs
Out-04	50.38	2.53	4.43
Out-05	0.00	0.00	0.00
Out-07	54.68	5.85	12.02
Out-08	60.21	3.01	14.70
System	41.32	11.40	24.08

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Link Flow Summary
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Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow	Total Time	Reported Condition	Surcharged Depth	minutes
Link-04	CONDUIT	0 16:09	3.90	1.00	3.11	6.46	0.48	0.46	0	Calculated		
Link-05	CONDUIT	1 01:00	3.47	1.00	4.36	9.79	0.45	0.67	0	Calculated		
Link-06	CONDUIT	1 01:00	2.98	1.00	4.43	5.02	0.88	0.79	0	Calculated		
Link-07	CONDUIT	0 12:16	47.74	1.00	54.97	18.28	3.01	0.62	0	> CAPACITY		
Link-08	CHANNEL	0 00:00	0.00	1.00	0.00	2019.08	0.00	0.00	0	Calculated		
Link-09	CHANNEL	0 15:52	3.08	1.00	3.08	2.68	1.15	1.00	11	FLOODED		
Link-10	CHANNEL	0 16:07	3.48	1.00	3.11	3.00	1.04	0.90	0	> CAPACITY		
Link-11	CHANNEL	0 12:09	1.62	1.00	6.55	78.55	0.08	0.16	0	Calculated		
Link-12	CHANNEL	0 12:11	3.84	1.00	12.02	217.37	0.06	0.13	0	Calculated		
Link-13	CHANNEL	0 12:06	2.86	1.00	6.42	252.75	0.03	0.10	0	Calculated		
Link-14	CHANNEL	0 12:17	4.10	1.00	14.70	915.52	0.02	0.06	0	Calculated		
Link-15	CONDUIT	0 15:24	4.94	1.00	3.08	6.51	0.47	0.38	0	Calculated		

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Highest Flow Instability Indexes
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Link Link-07 (91)
Link Link-14 (63)
Link Link-09 (4)
Link Link-15 (2)
Link Link-06 (1)

WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Out-03.

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Analysis began on:  Wed Nov 19 14:32:20 2014
Analysis ended on:  Wed Nov 19 14:32:21 2014
Total elapsed time: 00:00:01
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