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

****
Project Description
****
File Name ..... NAAF Stormwater Improvement Project 11_21_2014.SPF

****
Analysis Options
****
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

****
Element Count
****
Number of rain gages 1
Number of subbasins 12
Number of nodes 14
Number of links 10

****
Raingage Summary
****

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

****
Subbasin Summary
****

Subbasin ID	Total Area acres
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
Sub-16	39.16
Sub-17	30.85

****
Node Summary
****

Node	Element	Invert	Maximum	Ponded	External

ID	Type	Elevation ft	Elev. ft	Area ft²	Inflow
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	

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation ft	Inlet Rim Elevation ft	Ponded Area ft²	Initial Water Elevation ft	Grate Clogging Factor %
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

****
Roadway and Gutter Summary
****

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	

****
Link Summary
****

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-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

****
Cross Section Summary
****

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-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	52.334	3.344
Surface Runoff	0.773	0.049
Continuity Error (%)	-0.001	

********** Flow Routing Continuity **********	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	18.138	5.910
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.211	0.069
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

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

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

Subbasin Sub-16

Soil/Surface Description	Area (acres)	Soil Group	CN
-	39.16	b	65.00
Composite Area & Weighted CN	39.16		65.00

Subbasin Sub-17

Soil/Surface Description	Area (acres)	Soil Group	CN
-	30.85	b	65.00
Composite Area & Weighted CN	30.85		65.00

****
SCS TR-55 Time of Concentration Computations Report
****

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-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

=============================================================================================================
          Total TOC (minutes):                       42.81
=============================================================================================================


  ------------------
  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

  ------------------
  Subbasin Sub-16
  ------------------

          User-Defined TOC override (minutes):    416.10

  ------------------
  Subbasin Sub-17
  ------------------

          User-Defined TOC override (minutes):    316.35

  **********************
  Subbasin Runoff Summary
  **********************
```

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	hh:mm:ss
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	1.50	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
Sub-16	3.30	0.65	2.72	65.000	0	06:56:06
Sub-17	3.30	0.65	2.59	65.000	0	05:16:21

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
Out-01	0.17	0.37	249.77	0	12:06	0	0	0:00:00
Out-02	0.52	1.19	250.53	0	14:05	0	0	0:00:00
Out-03	0.09	0.46	244.07	0	12:16	0	0	0:00:00
Out-06	0.33	0.69	232.69	0	15:08	0	0	0:00:00
Out-04	0.26	1.50	256.18	1	00:34	0	0	0:00:00
Out-05	0.00	0.00	213.00	0	00:00	0	0	0:00:00
Out-07	0.32	0.68	227.68	0	15:08	0	0	0:00:00
Out-08	0.09	0.46	216.46	0	12:16	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
Out-01	JUNCTION	6.54	6.54	0	12:05	0.00		
Out-02	JUNCTION	7.28	7.56	0	14:05	0.00		
Out-03	JUNCTION	0.00	53.72	0	12:16	0.00		
Out-06	JUNCTION	0.55	13.82	0	15:03	0.00		
Out-04	OUTFALL	0.00	5.16	1	00:59	0.00		
Out-05	OUTFALL	0.00	0.00	0	00:00	0.00		
Out-07	OUTFALL	0.15	13.85	0	15:08	0.00		
Out-08	OUTFALL	0.54	15.15	0	12:16	0.00		

****
Inlet Depth Summary
****

Inlet	Max Gutter	Max Gutter	Max Gutter	Time of

ID	Spread during Peak Flow ft	Water Elev during Peak Flow ft	Water Depth during Peak Flow ft	Maximum Depth Occurrence days	hh:mm
Inlet-01	7.60	264.95	0.00	1	01:00
Inlet-02	0.00	259.57	0.00	1	00:59
Inlet-03	32.89	246.66	0.66	0	12:15
Inlet-04	211.15	246.23	4.23	0	11:57
Inlet-05	0.00	256.86	0.00	0	14:46
Inlet-06	0.00	263.06	6.18	0	13:45

****
Inlet Flow Summary
****

Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow 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	2.72	2.72	-	-	-	12.262	119
Inlet-06	2.59	2.59	-	-	-	0.000	0

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Out-04	50.38	1.47	5.16
Out-05	0.00	0.00	0.00
Out-07	54.68	11.37	13.85
Out-08	60.21	3.03	15.15
System	41.32	15.86	24.26

****
Link Flow Summary
****

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 Depth	Total Time minutes	Reported Condition
Link-04	CONDUIT	0	14:07	4.43	1.00	7.17	6.46	1.11	0.90	0	> CAPACITY
Link-05	CONDUIT	1	00:58	5.62	1.00	6.82	9.79	0.70	0.72	0	Calculated
Link-06	CONDUIT	1	00:59	3.20	1.00	5.16	5.02	1.03	0.86	0	> CAPACITY
Link-07	CONDUIT	0	12:16	47.27	1.00	53.72	18.28	2.94	0.61	0	> CAPACITY
Link-08	CHANNEL	0	00:00	0.00	1.00	0.00	2019.08	0.00	0.00	0	Calculated
Link-11	CHANNEL	0	14:10	1.71	1.00	7.65	78.55	0.10	0.18	0	Calculated
Link-12	CHANNEL	0	15:08	4.02	1.00	13.72	217.37	0.06	0.14	0	Calculated
Link-13	CHANNEL	0	12:06	2.85	1.00	6.30	252.75	0.02	0.11	0	Calculated
Link-14	CHANNEL	0	12:16	4.12	1.00	15.15	915.52	0.02	0.06	0	Calculated
Link-15	CONDUIT	0	21:51	5.53	1.00	6.19	6.51	0.95	0.62	0	Calculated

  ****
  Highest Flow Instability Indexes
  ****
  Link Link-07 (91)
  Link Link-14 (63)
  Link Link-13 (47)
  Link Link-05 (38)
  Link Link-15 (37)

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

  Analysis began on: Tue Nov 25 11:36:44 2014
  Analysis ended on: Tue Nov 25 11:36:45 2014
  Total elapsed time: 00:00:01