

**DRAINAGE STUDY  
JAKL PROPERTY SOLUTIONS  
VENETA, OR 97487**



Expires: 12-31-10

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**Client:** JAKL PROPERTY SOLUTIONS, INC

**Project No.:** 09-59

**Date:** August 21, 2009

**Contents:** Summary  
Developed Stormnet Reports  
Pre-developed Stormnet Reports

## **GENERAL INFORMATION**

This preliminary storm water study is prepared to accompany the Tentative Partition Plat application being submitted by JAKL Property Solutions, Inc. The study is to address storm water drainage for Parcels 1 through 3. A final study will be performed at the time building permits are applied for in order to identify the exact impervious areas and the method and sizing of the storm water detention and treatment facility for each parcel.

## **PROJECT DESCRIPTION**

The proposed project is south of Perkins Road and west of the existing Perkins subdivision. The property is Tax Lot 100 of map 18-5W-06-23 in the City of Veneta, Lane County, Oregon. The proposed project is a single parcel being divided into three parcels. Parcel 1 has an existing residence and out buildings. This parcel will not require any detention because historically the roof area stormwater has discharged to the existing ground surfaces and found its way to existing drainage. There is not any additional runoff being proposed on Parcel 1. Runoff from Parcels 2 (labeled North Lot in StormNet) and Parcel 3 (labeled South Lot in StormNet) will be based on the future home site and driveway.

## **METHODS**

Peak flows were calculated using the SCS Urban Hydrograph Method as described in the NRCS Engineering Handbook. This method uses an equation based on land use, slope, and soil conditions. Calculations for flow, required detention, and orifice sizes were performed using the StormNET software. The rainfall used was a 4.25 inch storm based on the 10 year storm value listed in the Veneta stormwater master plan. The difference between the 10-year storm “pre-developed” flow and the “developed” flow will be detained on each parcel and released into the existing drainage way or storm drain pipe at the “pre-developed” flow rate.

## **INCLUDED AREAS**

The areas included in this report are areas within two southern parcels of the proposed three parcels just north of Irenic Avenue.

## **PRE-DEVELOPED FLOWS**

The existing drainage on site drains to the northwest into the ditch that cuts across the existing lot towards the northeast. The pre-developed curve numbers for the SCS method were based on the NRCS Engineering Handbook. The original ground cover was forest type tree density with some grass. The soil types according to the NRCS soil survey data is a mix of well drained type D soils and poorly drained C soils. The Curve number used was 79.61 a weighted average curve number for the two types of soils. The pre-developed 10 year storm has a peak discharge rate of 0.30 cfs.

## **DEVELOPED FLOWS**

The developed curve numbers for the SCS method were based on the NRCS Engineering Handbook. The Curve numbers used for the developed flows were 80 for grass cover in soil type C, 86 for grass cover in soil type D, and 98 for impervious surfaces.

The impervious areas were assumed using approximately 2,000 square feet for each house and garage and a 20 foot wide driveway to access the garages. For the northern parcel approximately 6,600 square feet was used for Parcel 2. Approximately 3,500 square feet was used for Parcel 3.

## **DETENTION**

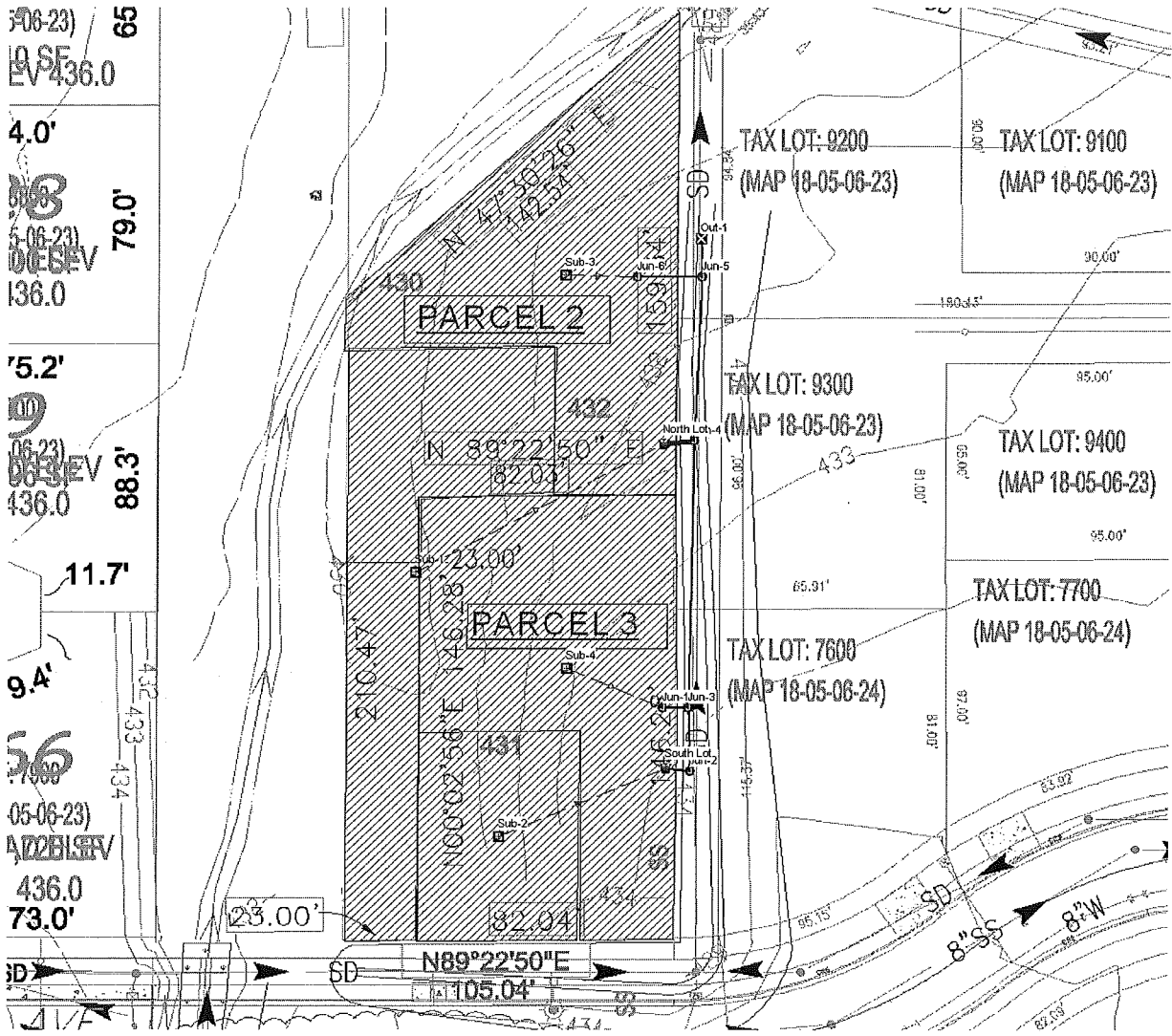
Each of the two parcels will have separate detention systems installed to limit the flow to pre-developed conditions. In the event that the detention systems fail the water will escape by either flowing to the nearby streets or escaping over the lots into the existing drainage way to the north.

A surface pond will be constructed for Parcel 2, and it will have a 1.4 inch orifice in order to limit the overall flow to the pre-developed 10 year peak flow of 0.30 cfs. Parcel 2 requires a maximum of 320 cubic feet of storage.

Parcel 3 will have a surface pond constructed with a 1.4 inch orifice. It also has the option of using an underground detention system that would consist of 75 feet of 24 inch diameter pipe with a 1.1 inch orifice rather than a surface facility. The southern lot will need a maximum of 235 cubic feet of storage. The detention will discharge either into the existing pipe that runs in the north-south direction along the east side of the property or into the existing drainage way that cuts through the existing lot.

## **CONCLUSION**

In conclusion, it is feasible for the proposed parcel to drain if developed without increasing peak discharge rates downstream. This drainage design is preliminary and will need further evaluation prior to house construction when all other design considerations are determined.



StormNet Model Layout

# Pre-Developed StormNet Reports

## Project Description

Project File Name : 09-37 Predeveloped.SPF  
 Project Description :

## Project Options

Flow Units ..... CFS  
 Elevation Type ..... Depth  
 Hydrology Method ..... SCS TR-20  
 Time of Concentration (TOC) Method ..... SCS TR-55  
 Link Routing Method ..... Kinematic Wave  
 Enable Overflow Ponding at Nodes ..... YES  
 Skip Steady State Analysis Time Periods .... NO

## Analysis Options

Start Analysis On ..... Aug 13, 2009 00:00:00  
 End Analysis On ..... Aug 15, 2009 00:00:00  
 Start Reporting On ..... Aug 13, 2009 00:00:00  
 Antecedent Dry Days ..... 0 days  
 Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss  
 Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss  
 Reporting Time Step ..... 0 00:01:00 days hh:mm:ss  
 Routing Time Step ..... 30 seconds

## Number of Elements

	Qty
Rain Gages .....	1
Subbasins .....	1
Nodes.....	2
<i>Junctions</i> .....	1
<i>Outfalls</i> .....	1
<i>Flow Diversions</i> .....	0
<i>Inlets</i> .....	0
<i>Detention Ponds</i> .....	0
Links.....	1
<i>Channels</i> .....	0
<i>Pipes</i> .....	1
<i>Pumps</i> .....	0
<i>Orifices</i> .....	0
<i>Weirs</i> .....	0
<i>Outlets</i> .....	0
Pollutants .....	0
Land Uses .....	0

### Subbasin Summary

SN	Subbasin ID	Area	Weighted Curve Number	Total Rainfall	Total Runoff	Peak Runoff	Time of Concentration
		(ac)		(in)	(in)	(cfs)	(days hh:mm:ss)
1	Sub-1	0.63	79.61	4.25	2.22	0.30	0 00:22:17

Jaki Property  
10 Year Storm  
Pre-developed Conditions

**Node Summary**

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft <sup>2</sup> )	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-1	Junction	2.00	2.00	2.00	2.00	0.00	0.30	2.10	0.00	1.40	0 00:00	0.00	0.00
2	Out-1	OutFall	0.00					0.30						

### Link Summary

SN	Element ID	Element Type	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio
1	Con-1	Pipe	16.46	2.00	0.00	12.1507	18.000	0.0150	0.30	31.85	0.01	5.68	0.10	0.07

Jakl Property  
10 Year Storm  
Pre-developed Conditions

Total Time  
Surcharged

\_\_\_\_\_  
(min)  
0.00

## Subbasin Hydrology

### Subbasin : Sub-1

#### Input Data

Area (ac) ..... 0.63  
 Weighted Curve Number ..... 79.61  
 Rain Gage ID ..... Gage-1

#### Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Good	0.50	D	79.00
Woods & grass combination, Poor	0.13	C	82.00
Composite Area & Weighted CN	0.63		79.61

#### Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T<sub>c</sub> = Time of Concentration (hrs)  
 n = Manning's Roughness  
 L<sub>f</sub> = Flow Length (ft)  
 P = 2 yr, 24 hr Rainfall (inches)  
 S<sub>f</sub> = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 \* (S<sub>f</sub><sup>0.5</sup>) (unpaved surface)  
 V = 20.3282 \* (S<sub>f</sub><sup>0.5</sup>) (paved surface)  
 V = 15.0 \* (S<sub>f</sub><sup>0.5</sup>) (grassed waterway surface)  
 V = 10.0 \* (S<sub>f</sub><sup>0.5</sup>) (nearly bare & untilled surface)  
 V = 9.0 \* (S<sub>f</sub><sup>0.5</sup>) (cultivated straight rows surface)  
 V = 7.0 \* (S<sub>f</sub><sup>0.5</sup>) (short grass pasture surface)  
 V = 5.0 \* (S<sub>f</sub><sup>0.5</sup>) (woodland surface)  
 V = 2.5 \* (S<sub>f</sub><sup>0.5</sup>) (forest w/heavy litter surface)  
 T<sub>c</sub> = (L<sub>f</sub> / V) / (3600 sec/hr)

Where :

T<sub>c</sub> = Time of Concentration (hrs)  
 L<sub>f</sub> = Flow Length (ft)  
 V = Velocity (ft/sec)  
 S<sub>f</sub> = Slope (ft/ft)

Channel Flow Equation :

$$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$$

$$R = A_q / W_p$$

$$T_c = (L_f / V) / (3600 \text{ sec/hr})$$

Where :

T<sub>c</sub> = Time of Concentration (hrs)  
 L<sub>f</sub> = Flow Length (ft)  
 R = Hydraulic Radius (ft)  
 A<sub>q</sub> = Flow Area (ft<sup>2</sup>)  
 W<sub>p</sub> = Wetted Perimeter (ft)  
 V = Velocity (ft/sec)  
 S<sub>f</sub> = Slope (ft/ft)  
 n = Manning's Roughness

Jaki Property  
10 Year Storm  
Pre-developed Conditions

	Subarea A	Subarea B	Subarea C
<b>Sheet Flow Computations</b>			
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	90	0.00	0.00
Slope (%) :	2.1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.52	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	21.81	0.00	0.00
<b>Shallow Concentrated Flow Computations</b>			
Flow Length (ft) :	20	0.00	0.00
Slope (%) :	2.1	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	0.72	0.00	0.00
Computed Flow Time (min) :	0.46	0.00	0.00
Total TOC (min) .....	22.28		

**Subbasin Runoff Results**

Total Rainfall (in) .....	4.25
Total Runoff (In) .....	2.22
Peak Runoff (cfs) .....	0.30
Weighted Curve Number .....	79.61
Time of Concentration (days hh:mm:ss) .....	0 00:22:17

### Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft <sup>2</sup> )
1	Jun-1	2.00	2.00	0.00	2.00	0.00	2.00	0.00	0.00

Jaki Property  
10 Year Storm  
Pre-developed Conditions

**Junction Results**

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	ys hh:mm	ys hh:mm	(ac-in)	(min)
1	Jun-1	0.30	0.30	2.10	0.10	0.00	1.40	2.02	0.02	0 08:07	0 00:00	0.00	0.00

### Pipe Input

SN Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1 Con-1	16.46	2.00	0.00	0.00	0.00	12.1507	Circular	18.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

### Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/Surcharged Total Depth Ratio	Total Time	Froude Number
1	Con-1	0.30	0 08:07	31.85	0.01	5.68	0.10	0.07	0.00	

# Developed StormNet Reports

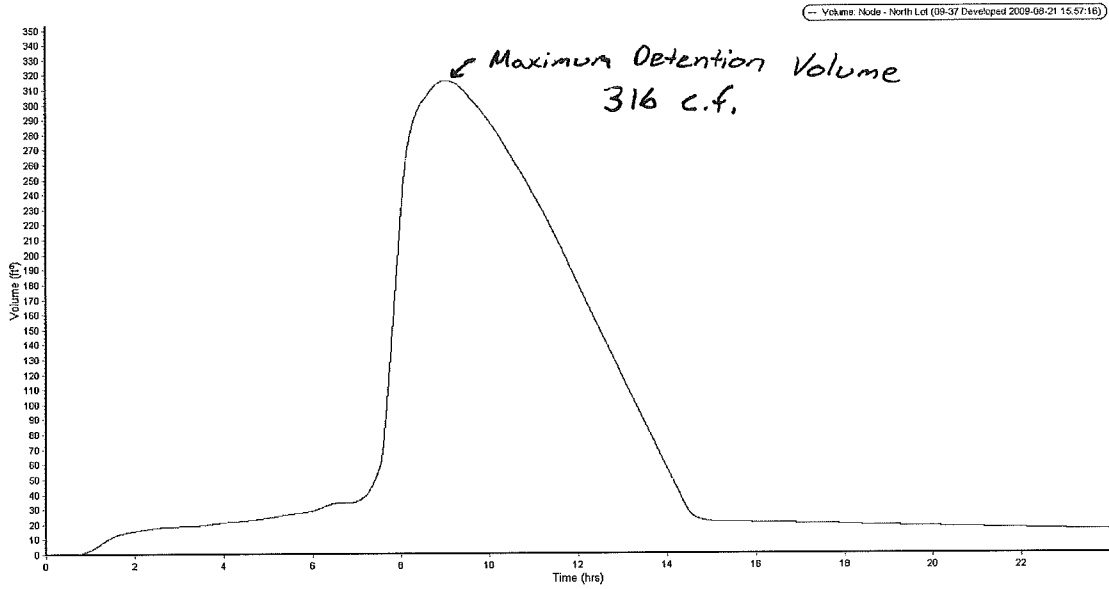


Fig.1: Parcel 2 Detention Volume Curve

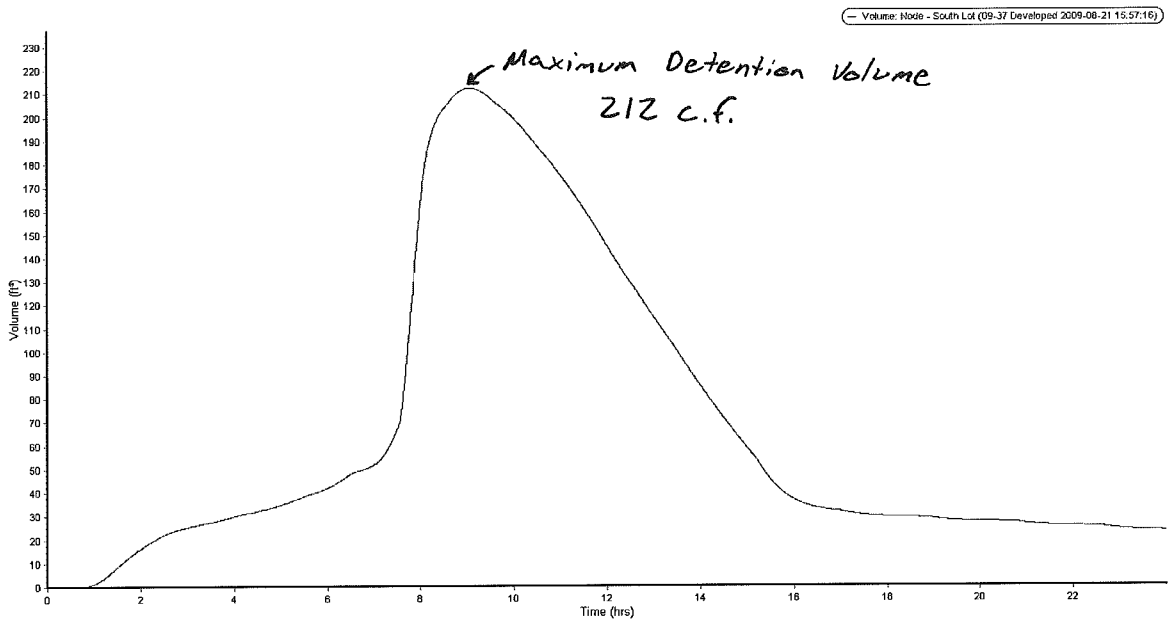


Fig.2: Parcel 3 Detention Volume Curve

## Project Description

Project File Name : 09-37 Developed.SPF  
 Project Description :

## Project Options

Flow Units ..... CFS  
 Elevation Type ..... Depth  
 Hydrology Method ..... SCS TR-20  
 Time of Concentration (TOC) Method ..... SCS TR-55  
 Link Routing Method ..... Hydrodynamic  
 Enable Overflow Ponding at Nodes ..... YES  
 Skip Steady State Analysis Time Periods .... NO

## Analysis Options

Start Analysis On ..... Aug 13, 2009 00:00:00  
 End Analysis On ..... Aug 14, 2009 00:00:00  
 Start Reporting On ..... Aug 13, 2009 00:00:00  
 Antecedent Dry Days ..... 0 days  
 Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss  
 Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss  
 Reporting Time Step ..... 0 00:00:30 days hh:mm:ss  
 Routing Time Step ..... 30 seconds

## Number of Elements

	Qty
Rain Gages .....	1
Subbasins .....	4
Nodes.....	9
<i>Junctions</i> .....	6
<i>Outfalls</i> .....	1
<i>Flow Diversions</i> .....	0
<i>Inlets</i> .....	0
<i>Detention Ponds</i> .....	2
Links.....	8
<i>Channels</i> .....	0
<i>Pipes</i> .....	8
<i>Pumps</i> .....	0
<i>Orifices</i> .....	0
<i>Weirs</i> .....	0
<i>Outlets</i> .....	0
Pollutants .....	0
Land Uses .....	0

### Subbasin Summary

SN Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1 Sub-1	0.15	98	4.25	4.01	0.16	0 00:03:04
2 Sub-2	0.08	98	4.25	4.01	0.08	0 00:05:00
3 Sub-3	0.20	86	4.25	2.77	0.13	0 00:18:11
4 Sub-4	0.19	80	4.25	2.25	0.10	0 00:18:11

StormNet Output Report  
 Jakl Properties  
 10 year Developed

**Node Summary**

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft <sup>2</sup> )	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-1	Junction	1.00	1.00	1.00	1.00	0.00	0.10	1.17	0.00	0.33	0 00:00	0.00	0.00
2	Jun-2	Junction	1.13	1.13	1.13	1.13	0.00	0.02	1.19	0.00	1.44	0 00:00	0.00	0.00
3	Jun-3	Junction	0.92	0.92	0.92	0.92	0.00	0.12	1.06	0.00	1.36	0 00:00	0.00	0.00
4	Jun-4	Junction	0.40	0.40	0.40	0.40	0.00	0.17	0.56	0.00	1.34	0 00:00	0.00	0.00
5	Jun-5	Junction	0.08	0.08	0.08	0.08	0.00	0.30	0.32	0.00	1.26	0 00:00	0.00	0.00
6	Jun-6	Junction	0.29	0.29	0.29	0.29	0.00	0.13	0.48	0.00	0.31	0 00:00	0.00	0.00
7	Out-1	OutFall	0.00					0.30						
8	North Lot	Pond	2.00	5.00	2.00		0.00	0.16	2.88				0.00	
9	South Lot	Pond	1.50	4.50	1.50		0.00	0.08	1.90				0.00	

StormNet Output Report  
 Jaki Properties  
 10 year Developed

**Link Summary**

SN	Element ID	Element Type	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio
			(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)	
1	Con-1	Pipe	9.75	2.00	0.40	16.4103	1.400	0.0150	0.05	0.04	1.13	4.31	0.12	1.00
2	Con-2	Pipe	8.15	1.00	0.92	0.9816	6.000	0.0150	0.10	0.48	0.20	1.92	0.15	0.31
3	Con-3	Pipe	7.89	1.50	1.13	4.6895	1.400	0.0150	0.02	0.02	1.12	2.86	0.09	0.74
4	Con-4	Pipe	20.89	1.13	0.92	1.0053	18.000	0.0150	0.02	9.13	0.00	0.81	0.10	0.06
5	Con-5	Pipe	88.09	0.92	0.40	0.5903	18.000	0.0150	0.12	6.99	0.02	1.34	0.15	0.10
6	Con-6	Pipe	54.20	0.40	0.08	0.5904	18.000	0.0150	0.17	7.00	0.02	1.20	0.20	0.13
7	Con-7	Pipe	12.79	0.08	0.00	0.6255	18.000	0.0150	0.30	7.20	0.04	1.82	0.22	0.15
8	Con-8	Pipe	20.55	0.29	0.08	1.0219	6.000	0.0150	0.13	0.49	0.27	1.69	0.21	0.43

StormNet Output Report  
Jakl Properties  
10 year Developed

Total Time  
Surcharged

(min)  
303.00  
0.00  
0.00  
0.00  
0.00  
0.00  
0.00  
0.00

## Subbasin Hydrology

### Subbasin : Sub-1

#### Input Data

Area (ac) ..... 0.15  
 Weighted Curve Number ..... 98.00  
 Rain Gage ID ..... Gage-1

#### Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.15	D	98.00
Composite Area & Weighted CN	0.15		98.00

#### Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

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<sup>0.5</sup>) (unpaved surface)  
 V = 20.3282 \* (Sf<sup>0.5</sup>) (paved surface)  
 V = 15.0 \* (Sf<sup>0.5</sup>) (grassed waterway surface)  
 V = 10.0 \* (Sf<sup>0.5</sup>) (nearly bare & untilled surface)  
 V = 9.0 \* (Sf<sup>0.5</sup>) (cultivated straight rows surface)  
 V = 7.0 \* (Sf<sup>0.5</sup>) (short grass pasture surface)  
 V = 5.0 \* (Sf<sup>0.5</sup>) (woodland surface)  
 V = 2.5 \* (Sf<sup>0.5</sup>) (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 :

$$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$$

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 (ft<sup>2</sup>)  
 Wp = Wetted Perimeter (ft)  
 V = Velocity (ft/sec)  
 Sf = Slope (ft/ft)  
 n = Manning's Roughness

StormNet Output Report  
 Jaki Properties  
 10 year Developed

	Subarea	Subarea	Subarea
	A	B	C
<b>Sheet Flow Computations</b>			
Manning's Roughness :	0.1	0.00	0.00
Flow Length (ft) :	20	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.52	0.00	0.00
Velocity (ft/sec) :	0.15	0.00	0.00
Computed Flow Time (min) :	2.20	0.00	0.00
	Subarea	Subarea	Subarea
	A	B	C
<b>Shallow Concentrated Flow Computations</b>			
Flow Length (ft) :	150	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	0.87	0.00	0.00
Total TOC (min) .....	3.07		

**Subbasin Runoff Results**

Total Rainfall (in) .....	4.25
Total Runoff (In) .....	4.01
Peak Runoff (cfs) .....	0.16
Weighted Curve Number .....	98.00
Time of Concentration (days hh:mm:ss) .....	0 00:03:04

**Subbasin : Sub-2**

**Input Data**

Area (ac) ..... 0.08  
 Weighted Curve Number ..... 98.00  
 Rain Gage ID ..... Gage-1

**Composite Curve Number**

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.08	D	98.00
Composite Area & Weighted CN	0.08		98.00

**Time of Concentration**

	Subarea	Subarea	Subarea
	A	B	C
<b>Sheet Flow Computations</b>			
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	50	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.52	0.00	0.00
Velocity (ft/sec) :	0.18	0.00	0.00
Computed Flow Time (min) :	4.58	0.00	0.00
<b>Shallow Concentrated Flow Computations</b>			
Flow Length (ft) :	50	0.00	0.00
Slope (%) :	1	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.03	0.00	0.00
Computed Flow Time (min) :	0.41	0.00	0.00
Total TOC (min) .....	5.00		

**Subbasin Runoff Results**

Total Rainfall (in) ..... 4.25  
 Total Runoff (in) ..... 4.01  
 Peak Runoff (cfs) ..... 0.08  
 Weighted Curve Number ..... 98.00  
 Time of Concentration (days hh:mm:ss) ..... 0 00:05:00

**Subbasin : Sub-3**

**Input Data**

Area (ac) ..... 0.20  
 Weighted Curve Number ..... 86.00  
 Rain Gage ID ..... Gage-1

**Composite Curve Number**

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
< 50% grass cover, Poor	0.20	C	86.00
Composite Area & Weighted CN	0.20		86.00

**Time of Concentration**

Sheet Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	70	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.52	0.00	0.00
Velocity (ft/sec) :	0.06	0.00	0.00
Computed Flow Time (min) :	18.19	0.00	0.00
Total TOC (min) .....	18.19		

**Subbasin Runoff Results**

Total Rainfall (in) ..... 4.25  
 Total Runoff (in) ..... 2.77  
 Peak Runoff (cfs) ..... 0.13  
 Weighted Curve Number ..... 86.00  
 Time of Concentration (days hh:mm:ss) ..... 0 00:18:11

**Subbasin : Sub-4**

**Input Data**

Area (ac) ..... 0.19  
 Weighted Curve Number ..... 80.00  
 Rain Gage ID ..... Gage-1

**Composite Curve Number**

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.19	D	80.00
Composite Area & Weighted CN	0.19		80.00

**Time of Concentration**

Sheet Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	70	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.52	0.00	0.00
Velocity (ft/sec) :	0.06	0.00	0.00
Computed Flow Time (min) :	18.19	0.00	0.00
Total TOC (min) .....	18.19		

**Subbasin Runoff Results**

Total Rainfall (in) ..... 4.25  
 Total Runoff (in) ..... 2.25  
 Peak Runoff (cfs) ..... 0.10  
 Weighted Curve Number ..... 80.00  
 Time of Concentration (days hh:mm:ss) ..... 0 00:18:11

### Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft <sup>2</sup> )
1	Jun-1	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
2	Jun-2	1.13	1.13	0.00	1.13	0.00	1.13	0.00	0.00
3	Jun-3	0.92	0.92	0.00	0.92	0.00	0.92	0.00	0.00
4	Jun-4	0.40	0.40	0.00	0.40	0.00	0.40	0.00	0.00
5	Jun-5	0.08	0.08	0.00	0.08	0.00	0.08	0.00	0.00
6	Jun-6	0.29	0.29	0.00	0.29	0.00	0.29	0.00	0.00

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**Junction Results**

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft) yys hh:mm	(ft) yys hh:mm	(ac-in)	(min)
1	Jun-1	0.10	0.10	1.17	0.17	0.00	0.33	1.07	0.07	0 08:05	0 00:00	0.00	0.00
2	Jun-2	0.02	0.00	1.19	0.06	0.00	1.44	1.18	0.05	0 09:03	0 00:00	0.00	0.00
3	Jun-3	0.12	0.00	1.06	0.14	0.00	1.36	0.99	0.07	0 08:05	0 00:00	0.00	0.00
4	Jun-4	0.17	0.00	0.56	0.16	0.00	1.34	0.50	0.10	0 08:06	0 00:00	0.00	0.00
5	Jun-5	0.30	0.00	0.32	0.24	0.00	1.26	0.20	0.12	0 08:04	0 00:00	0.00	0.00
6	Jun-6	0.13	0.13	0.48	0.19	0.00	0.31	0.36	0.07	0 08:02	0 00:00	0.00	0.00

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**Pipe Input**

SN Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate	No. of Barrels
1 Con-1	9.75	2.00	0.00	0.40	0.00	16.4103	Circular	1.400	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
2 Con-2	8.15	1.00	0.00	0.92	0.00	0.9816	Circular	6.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
3 Con-3	7.89	1.50	0.00	1.13	0.00	4.6895	Circular	1.400	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
4 Con-4	20.89	1.13	0.00	0.92	0.00	1.0053	Circular	18.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
5 Con-5	88.09	0.92	0.00	0.40	0.00	0.5903	Circular	18.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
6 Con-6	54.20	0.40	0.00	0.08	0.00	0.5904	Circular	18.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
7 Con-7	12.79	0.08	0.00	0.00	0.00	0.6255	Circular	18.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
8 Con-8	20.55	0.29	0.00	0.08	0.00	1.0219	Circular	6.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

## Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/Surcharged Total Depth Ratio	Total Time Charged	Froude Number
1	Con-1	0.05	0 09:04	0.04	1.13	4.31	0.12	1.00	303.00	
2	Con-2	0.10	0 08:05	0.48	0.20	1.92	0.15	0.31	0.00	
3	Con-3	0.02	0 09:03	0.02	1.12	2.86	0.09	0.74	0.00	
4	Con-4	0.02	0 09:03	9.13	0.00	0.81	0.10	0.08	0.00	
5	Con-5	0.12	0 08:05	6.99	0.02	1.34	0.15	0.10	0.00	
6	Con-6	0.17	0 08:06	7.00	0.02	1.20	0.20	0.13	0.00	
7	Con-7	0.30	0 08:04	7.20	0.04	1.82	0.22	0.15	0.00	
8	Con-8	0.13	0 08:02	0.49	0.27	1.69	0.21	0.43	0.00	

## Detention Ponds

### Detention Pond : North Lot

#### Input Data

Invert Elevation (ft) ..... 2.00  
Max (Rim) Elevation (ft) ..... 5.00  
Max (Rim) Offset (ft) ..... 3.00  
Initial Water Elevation ( ft) ..... 2.00  
Initial Water Depth ( ft) ..... 0.00  
Ponded Area (ft<sup>2</sup>) ..... 0.00  
Evaporation Loss ..... 0.00

#### Storage Area Volume Curves

Storage Curve : Surface Pond Shallow

Stage (ft)	Storage Area (ft <sup>2</sup> )	Storage Volume (ft <sup>3</sup> )
0	350	0.000
1	375	362.50



**Detention Pond : North Lot (continued)**

**Output Summary Results**

Peak Inflow (cfs) .....	0.16
Peak Lateral Inflow (cfs) .....	0.16
Peak Outflow (cfs) .....	0.05
Peak Exfiltration Flow Rate (cfm) .....	0.00
Max HGL Elevation Attained (ft) .....	2.88
Max HGL Depth Attained (ft) .....	0.88
Average HGL Elevation Attained (ft) .....	2.24
Average HGL Depth Attained (ft) .....	0.24
Time of Max HGL Occurrence (days hh:mm) ..	0 09:00
Total Exfiltration Volume (1000-ft <sup>3</sup> ) .....	0.00
Total Flooded Volume (ac-in) .....	0
Total Time Flooded (min) .....	0
Total Retention Time (sec) .....	0.00

### Detention Pond : South Lot

#### Input Data

Invert Elevation (ft) ..... 1.50  
Max (Rim) Elevation (ft) ..... 4.50  
Max (Rim) Offset (ft) ..... 3.00  
Initial Water Elevation ( ft) ..... 1.50  
Initial Water Depth ( ft) ..... 0.00  
Ponded Area (ft<sup>2</sup>) ..... 0.00  
Evaporation Loss ..... 0.00

#### Storage Area Volume Curves

Storage Curve : Surface Swale

Stage (ft)	Storage Area (ft <sup>2</sup> )	Storage Volume (ft <sup>3</sup> )
0	450	0.000
0.5	665	278.75

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**Detention Pond : South Lot (continued)**

**Output Summary Results**

Peak Inflow (cfs) .....	0.08
Peak Lateral Inflow (cfs) .....	0.08
Peak Outflow (cfs) .....	0.02
Peak Exfiltration Flow Rate (cfm) .....	0.00
Max HGL Elevation Attained (ft) .....	1.9
Max HGL Depth Attained (ft) .....	0.40
Average HGL Elevation Attained (ft) .....	1.66
Average HGL Depth Attained (ft) .....	0.16
Time of Max HGL Occurrence (days hh:mm) ..	0 09:03
Total Exfiltration Volume (1000-ft <sup>3</sup> ) .....	0.00
Total Flooded Volume (ac-in) .....	0
Total Time Flooded (min) .....	0
Total Retention Time (sec) .....	0.00