Post Road Surveying, Inc.

Professional Land Surveying & Consulting

The Professional Center
43 Sanford Road, Unit 3
P.O. Box 1557, Wells, Maine 04090
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February 4, 2015

Mr. Tom Ursia, Town Planner
24 Townhouse Road
East Waterboro, ME 04030

Re: Stormwater Management Plan – Revision A, dated January 22, 2015
5-Lot Subdivision of Land of the Estate of Helen M. Carpenter
Clarks Bridge Road
Waterboro, Maine
Part of Tax Map 13. Lot 30A

Dear Mr. Ursia:

For clarification purposes, the Stormwater Management Plan (including the narrative and accompanying pre & post development sketches) has been revised to reflect the lot configuration depicted on the January 8th Preliminary Plan submission. The conclusions in the revised Stormwater Management Plan remain the same.

Eight copies are enclosed for your use.

Sincerely,
For Post Road Surveying, Inc.

Frances O. LaPierre

Frances O. LaPierre, PLS

ATTAR
ENGINEERING, INC
CIVIL · STRUCTURAL · MARINE

STORMWATER MANAGEMENT PLAN

FIVE LOT SUBDIVISION
HELEN M. CARPENTER ESTATE
CLARK'S BRIDGE ROAD, WATERBORO, MAINE

Project No.: C096-15

October 23, 2014
Revision A, January 22, 2015

♦ **Revision A**
Lot sizes are revised for lots 1-4; lot 5 added.

♦ **Scope**
This stormwater management plan has been prepared for the proposed five lot subdivision located on Clark's Bridge Road in Waterboro, Maine. The project site is approximately 84 acres in area. Four of the five lots will be developed with single family dwelling units; the use of the fifth lot will be restricted as noted on the subdivision plan. All four of the lots proposed to be developed have frontage along Clark's Bridge Road; no new road construction is proposed.

Although the site is 84 acres in area, it is anticipated that construction of the four house lots will take place in an approximately 6 acre area, within 400' of Clark's Bridge Road.

The project is designed to meet the stormwater management requirements outlined in the Town Code of Waterboro, Maine.

♦ **Site and Watershed Description**
The project site is located on the north side of Clark's Bridge Road in Waterboro, Maine. A 7½ minute series U.S.G.S. map of the project area is attached. The site is undeveloped, consisting mostly of wooded areas with fields adjacent to Clark's Bridge Road.

The site is located in the watershed of Lake Arrowhead and further downstream, Little Ossipee Pond (source: USGS 7 ½ minute series, Waterboro, Mousam Lake, Limerick and Limington Quadrangles). The developed area will drain as sheet flow across on-site uplands to an on-site wetland / stream complex, then to an off-site, unnamed stream that is tributary to Lake Arrowhead.

The topography of the developed area is depicted on the project plans and consists of a downward easterly grade (from Clark's Bridge Road) with slopes from 5% to 10%. Developed area elevations (datum is NAVD 1988) range from approximately 502' to the northwest, at Clark's Bridge Road to approximately 470' at the east edge of the proposed developed area.

A portion of the site is located within a 100-Year Special Flood Hazard Area (SFHA - Zone A) as determined by the Federal Emergency Management Agency (FEMA). This area is located approximately 800' east of the proposed developed area and is depicted on the project plans. No development is proposed in the SFHA.

Proposed cuts and fills are expected to be between 0 and 6 feet, representing a normal range for construction of single family homes.

1284 State Road, Eliot, ME 03903 ◆ tel (207) 439-6023 ◆ fax (207) 439-2128

- **Soils/Hydrologic Soil Groups**

Soil types and their respective Hydrologic Soil Groups (HSG) were determined from the Soil Survey of York County, Maine. On site soils in the vicinity of the proposed construction consist of Becket fine sandy loam, Brayton/Westbury very stony fine sandy loam and Skerry fine sandy loam. All three soil types were modeled as HSG C.

- **Methodology**

The stormwater quantity analysis was conducted using the HydroCAD Stormwater Modeling System by Applied Microcomputer Systems. The analysis was accomplished to determine the "Existing Condition" and "Developed Condition" stormwater flows. Both cases were analyzed for the 2, 10, and 25 year, 24-hour frequency storm events. The Existing Condition analyzes the site as it existed before the current development was commenced and the Developed Condition models the site with the proposed improvements described above.

- **Water Quantity Analysis and Results**

Existing Condition

The site was modeled as one subcatchment (SC) for the Existing Condition analysis. One Analysis Point (AP) was selected easterly of the developed area. The Analysis Point is located downstream of the proposed developed area and provides a convenient location to compare Existing Condition flows to Developed Condition flows.

Developed Condition

The Developed Condition analysis consists of five subcatchments. Other features such as ponds and reaches were added to account for on-site routing of stormwater. All Developed Condition flows are routed to AP 1, described above.

Tables showing Existing Condition peak flows, Developed Condition peak flows and the change in peak flow from Existing Condition to Developed Condition are presented on a separate page.

The analysis indicates increases in peak flow at AP 1 for all storm events. The increases are considered insignificant for several reasons:

- Runoff from the lots will be conveyed, as sheet flow, to an on-site, wooded buffer. Wooded buffers are a very effective treatment method, or Best Management Practice (BMP), encouraged by the Maine Department of Environmental Protection. Although, due to its small size, no MDEP permitting is required for this project, the available 800' buffer is much larger than the typical 25' to 150' buffer required by MDEP.
- Runoff from the lots will be contained on-site, due to the existing grades, for approximately 800', prior to reaching the on-site wetland / stream complex which conveys runoff off-site. Any increase in runoff due to the proposed development will most likely be imperceptible within a few hundred feet of the developed area, due to natural infiltration in the wooded buffer.

- **Drainage Easements**

30' wide drainage easements are recommended along the common property lines between the remaining estate land (approx. 8.5 acres) and Lot 1 as wells as between Lots 1/2, 2/3, and 3/4. The purpose of the easements is to ensure the natural drainage away from Clark's Bridge Road is maintained and that ponding due to lot development (filling) is prevented, particularly adjacent to Clark's Bridge Road. The drainage easements should encourage that the existing grade within the easement be maintained, however, vegetated swales with terminal level spreaders, or turnouts would be acceptable. If the easements are provided and maintained in this manner, driveway culverts at Clark's Bridge Road would be unnecessary. In the event that a driveway culvert is needed, the pipe should be have a minimum diameter of 15" with 12" minimum soil cover and outflow should be directed to the drainage easements.

- **Summary**

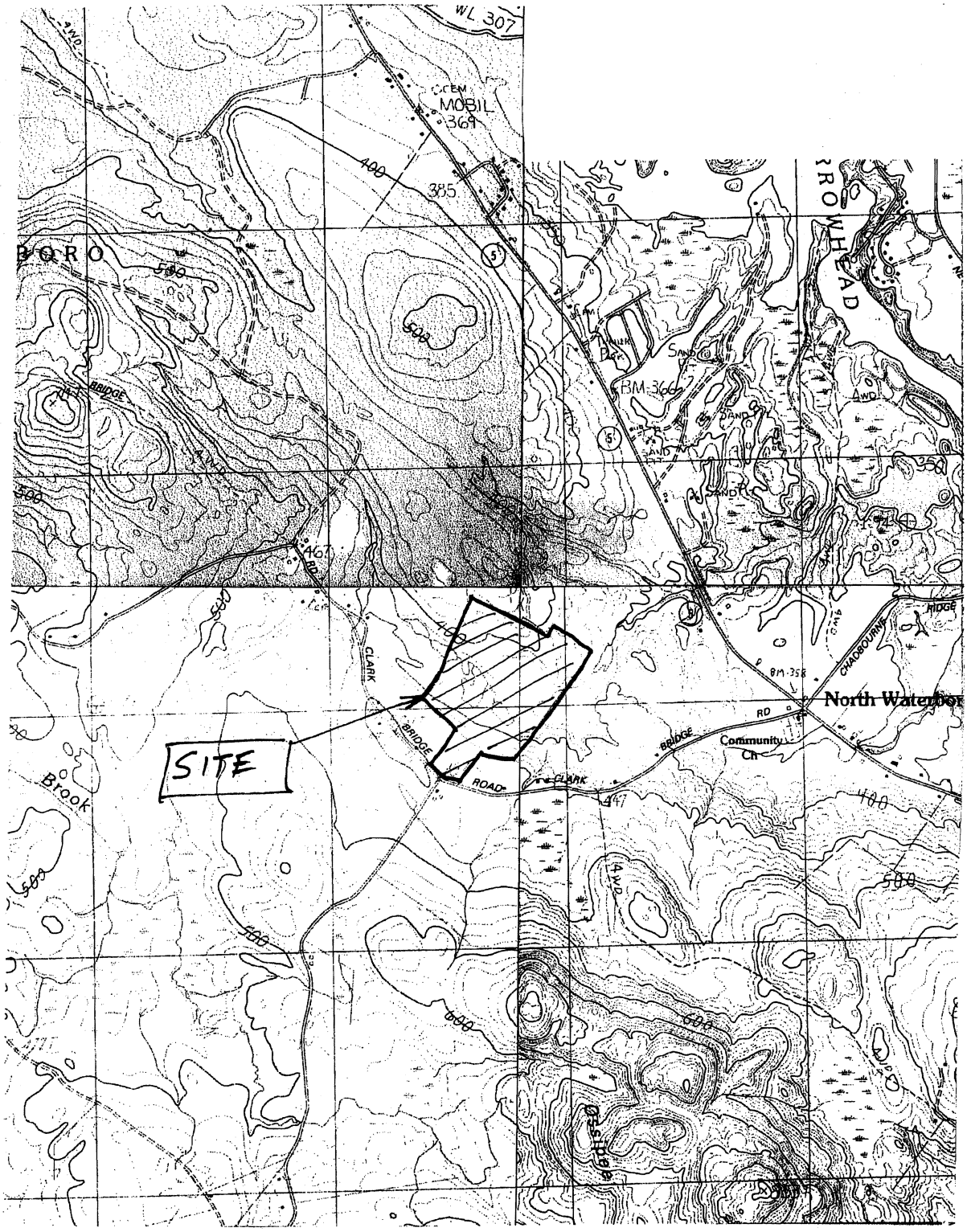
The use of buffers, level spreader and drainage easements will result in no significant impact from peak runoff quantity to abutters from the proposed residential development. No adverse effects are anticipated on any downstream properties or drainage structures for the analyzed storm events.

Sincerely;

Lewis Chamberlain, P.E.

STATE OF MAINE
LEWIS CHAMBERLAIN
No. 9762
LICENSED
PROFESSIONAL ENGINEER

C096-15_SW_rev A.doc



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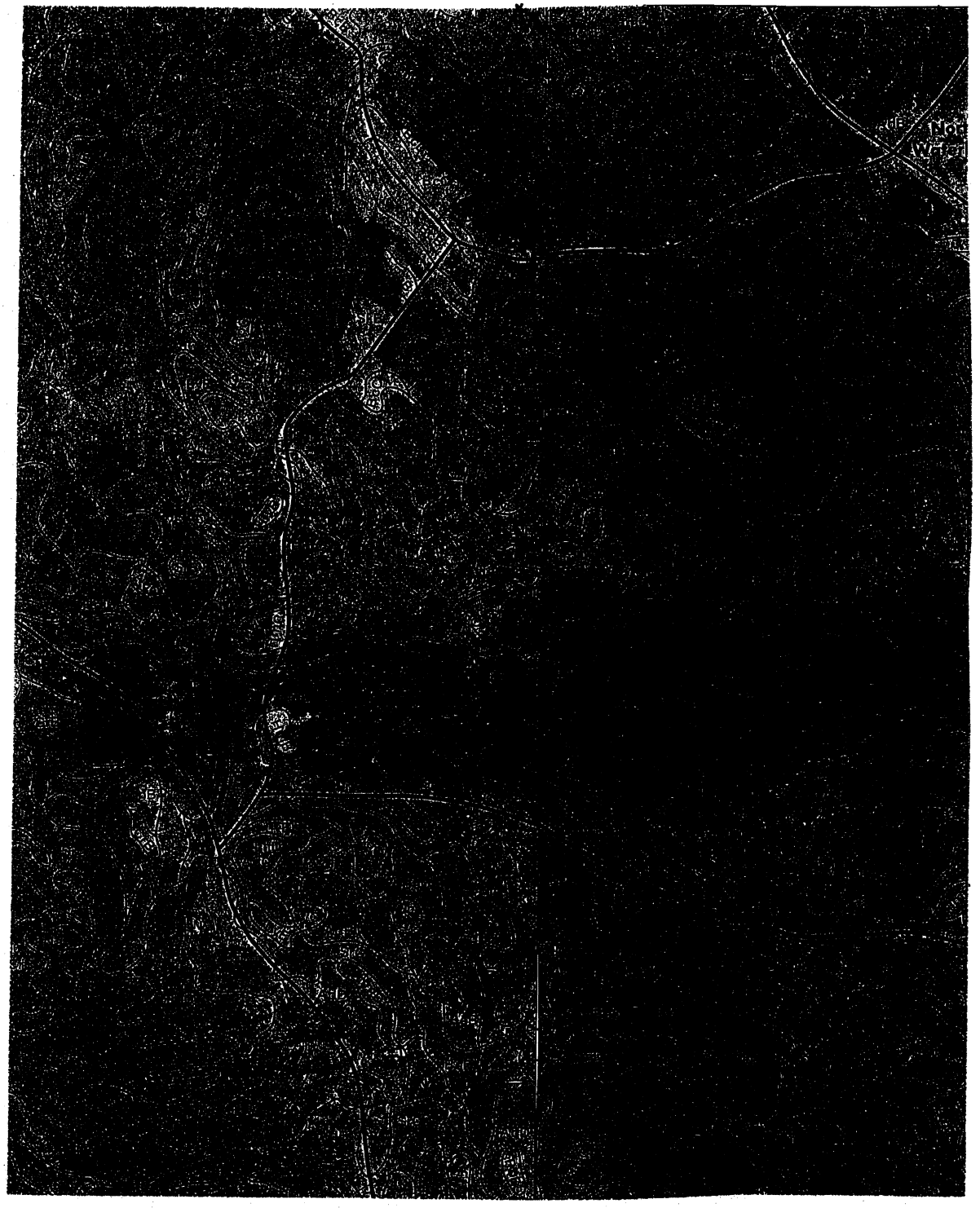
CIVIL STRUCTURAL MARINE

1284 STATE ROAD, ELIOT ME 03903

LOCATION MAP
4 LOT SUBDIVISION – HELEN M. CARPENTER ESTATE
USGS 7.5' SERIES – WATERBORO, MOUSAM LAKE, LIMERICK AND LIMINGTON QUADRANGLES
APPROX. SCALE: 1" = 2000'
PROJECT NO. C096-14



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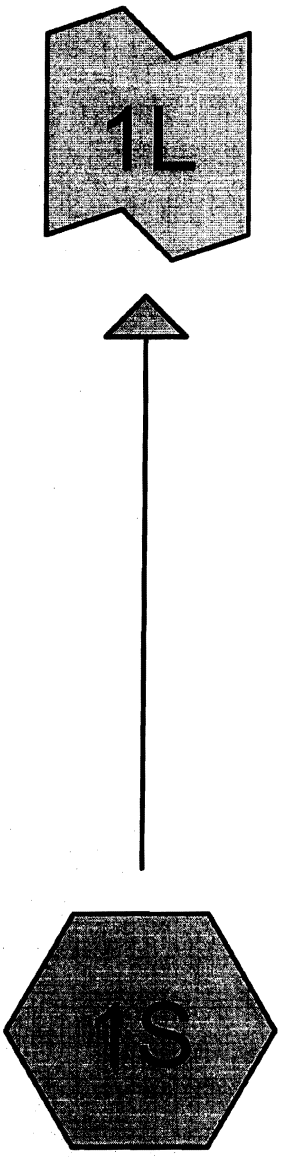
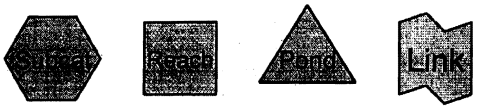
1284 STATE ROAD, ELIOT ME 03903

LOCATION MAP
4 LOT SUBDIVISION – HELEN M. CARPENTER ESTATE
WATERBORO, ME
SOIL SURVEY OF YORK COUNTY, MAINE
APPROX. SCALE: 1" = 1667'
PROJECT NO. C096-14

		STORM EVENT			
		2	10	25	
EXT	**AP1**	6.64	16.9	22.64	(cfs)
DEV	**AP1**	7.12	17.68	23.55	(cfs)
CHANGE	**AP1**	0.48	0.78	0.91	(cfs)





Routing Diagram for HELEN_EXT
Prepared by Hewlett-Packard Company, Printed 1/23/2015
HydroCAD® 10.00 s/n 01988 © 2011 HydroCAD Software Solutions LLC

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=382,911 sf 1.47% Impervious Runoff Depth>0.73"
Flow Length=681' Tc=9.2 min CN=72 Runoff=6.64 cfs 0.535 af

Link 1L: Inflow=6.64 cfs 0.535 af
Primary=6.64 cfs 0.535 af

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=382,911 sf 1.47% Impervious Runoff Depth>1.74"
Flow Length=681' Tc=9.2 min CN=72 Runoff=16.90 cfs 1.277 af

Link 1L: Inflow=16.90 cfs 1.277 af
Primary=16.90 cfs 1.277 af

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=382,911 sf 1.47% Impervious Runoff Depth>2.32"
Flow Length=681' Tc=9.2 min CN=72 Runoff=22.64 cfs 1.701 af

Link 1L: Inflow=22.64 cfs 1.701 af
Primary=22.64 cfs 1.701 af

Summary for Subcatchment 1S:

Runoff = 22.64 cfs @ 12.14 hrs, Volume= 1.701 af, Depth> 2.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR STORM Rainfall=5.40"

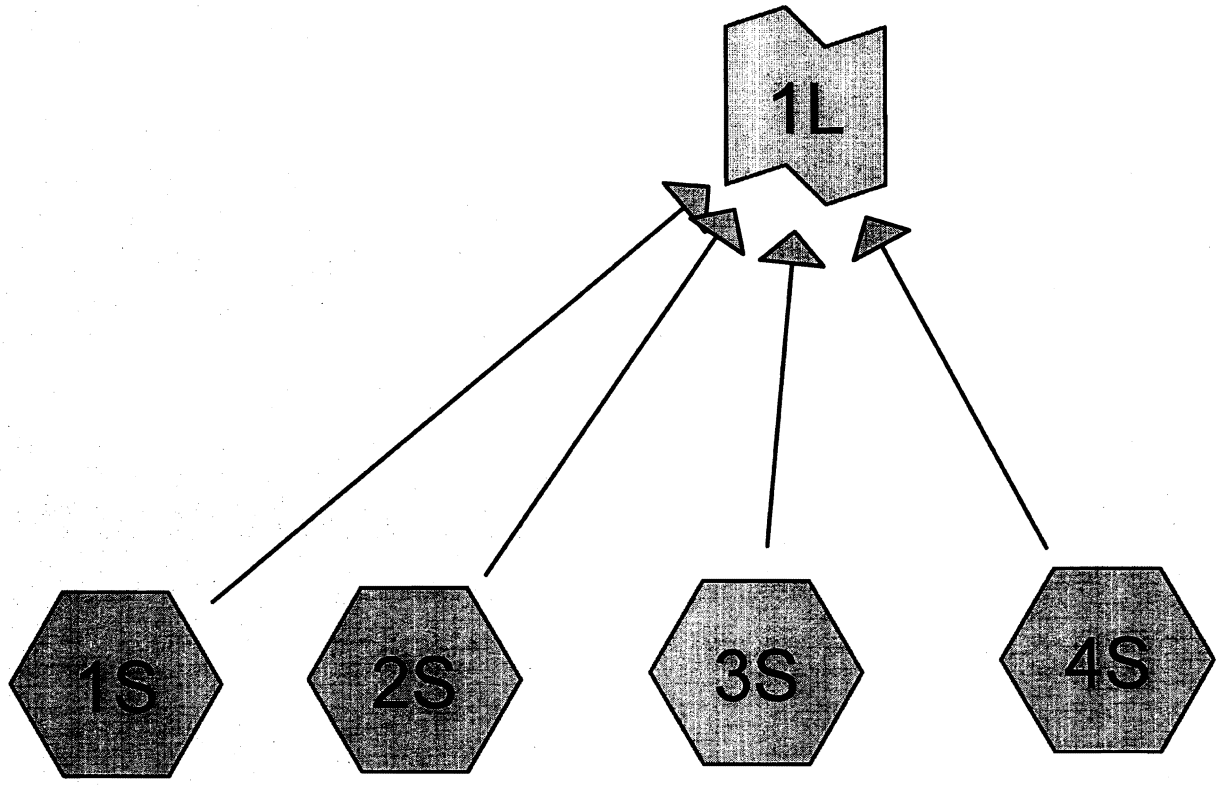
Area (sf)	CN	Description
377,265	72	Woods/grass comb., Good, HSG C
5,646	98	Unconnected pavement, HSG C
382,911	72	Weighted Average
377,265		98.53% Pervious Area
5,646		1.47% Impervious Area
5,646		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	12	0.0200	0.78		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
3.4	50	0.1000	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
5.5	619	0.0730	1.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.2	681	Total			

Summary for Link 1L:

Inflow Area = 8.790 ac, 1.47% Impervious, Inflow Depth > 2.32" for 25 YEAR STORM event
Inflow = 22.64 cfs @ 12.14 hrs, Volume= 1.701 af
Primary = 22.64 cfs @ 12.14 hrs, Volume= 1.701 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Routing Diagram for HELEN_PRP
Prepared by Hewlett-Packard Company, Printed 1/23/2015
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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=110,531 sf 6.52% Impervious Runoff Depth>0.78"
Flow Length=571' Tc=7.9 min UI Adjusted CN=73 Runoff=2.13 cfs 0.164 af

Subcatchment 2S: Runoff Area=85,931 sf 8.40% Impervious Runoff Depth>0.78"
Flow Length=611' Tc=8.5 min UI Adjusted CN=73 Runoff=1.63 cfs 0.128 af

Subcatchment 3S: Runoff Area=103,806 sf 11.27% Impervious Runoff Depth>0.78"
Flow Length=598' Tc=8.5 min UI Adjusted CN=73 Runoff=1.97 cfs 0.154 af

Subcatchment 4S: Runoff Area=82,732 sf 3.46% Impervious Runoff Depth>0.73"
Flow Length=607' Tc=9.9 min UI Adjusted CN=72 Runoff=1.41 cfs 0.115 af

Link 1L: Inflow=7.12 cfs 0.562 af
Primary=7.12 cfs 0.562 af

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=110,531 sf 6.52% Impervious Runoff Depth>1.82"
Flow Length=571' Tc=7.9 min UI Adjusted CN=73 Runoff=5.35 cfs 0.384 af

Subcatchment 2S: Runoff Area=85,931 sf 8.40% Impervious Runoff Depth>1.82"
Flow Length=611' Tc=8.5 min UI Adjusted CN=73 Runoff=4.03 cfs 0.299 af

Subcatchment 3S: Runoff Area=103,806 sf 11.27% Impervious Runoff Depth>1.82"
Flow Length=598' Tc=8.5 min UI Adjusted CN=73 Runoff=4.87 cfs 0.361 af

Subcatchment 4S: Runoff Area=82,732 sf 3.46% Impervious Runoff Depth>1.74"
Flow Length=607' Tc=9.9 min UI Adjusted CN=72 Runoff=3.59 cfs 0.276 af

Link 1L: Inflow=17.68 cfs 1.320 af
Primary=17.68 cfs 1.320 af

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=110,531 sf 6.52% Impervious Runoff Depth>2.41"
Flow Length=571' Tc=7.9 min UI Adjusted CN=73 Runoff=7.11 cfs 0.509 af

Subcatchment 2S: Runoff Area=85,931 sf 8.40% Impervious Runoff Depth>2.41"
Flow Length=611' Tc=8.5 min UI Adjusted CN=73 Runoff=5.41 cfs 0.396 af

Subcatchment 3S: Runoff Area=103,806 sf 11.27% Impervious Runoff Depth>2.41"
Flow Length=598' Tc=8.5 min UI Adjusted CN=73 Runoff=6.54 cfs 0.478 af

Subcatchment 4S: Runoff Area=82,732 sf 3.46% Impervious Runoff Depth>2.32"
Flow Length=607' Tc=9.9 min UI Adjusted CN=72 Runoff=4.81 cfs 0.367 af

Link 1L: Inflow=23.55 cfs 1.750 af
Primary=23.55 cfs 1.750 af

Summary for Subcatchment 1S:

Runoff = 7.11 cfs @ 12.12 hrs, Volume= 0.509 af, Depth> 2.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR STORM Rainfall=5.40"

Area (sf)	CN	Description
103,326	72	Woods/grass comb., Good, HSG C
7,205	98	Unconnected pavement, HSG C
110,531	74	Weighted Average, UI Adjusted CN = 73
103,326		93.48% Pervious Area
7,205		6.52% Impervious Area
7,205		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	12	0.0200	0.78		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
3.7	50	0.0800	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
3.9	509	0.0980	2.19		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.9	571	Total			

Summary for Subcatchment 2S:

Runoff = 5.41 cfs @ 12.12 hrs, Volume= 0.396 af, Depth> 2.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR STORM Rainfall=5.40"

Area (sf)	CN	Description
78,710	72	Woods/grass comb., Good, HSG C
7,221	98	Unconnected pavement, HSG C
85,931	74	Weighted Average, UI Adjusted CN = 73
78,710		91.60% Pervious Area
7,221		8.40% Impervious Area
7,221		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	12	0.0200	0.78		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
3.7	50	0.0840	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
4.5	549	0.0840	2.03		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.5	611	Total			

Summary for Subcatchment 3S:

Runoff = 6.54 cfs @ 12.12 hrs, Volume= 0.478 af, Depth> 2.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR STORM Rainfall=5.40"

Area (sf)	CN	Description
11,697	98	Unconnected pavement, HSG C
92,109	72	Woods/grass comb., Good, HSG C
103,806	75	Weighted Average, UI Adjusted CN = 73
92,109		88.73% Pervious Area
11,697		11.27% Impervious Area
11,697		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	12	0.0200	0.78		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
3.4	50	0.1000	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
4.8	536	0.0710	1.87		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.5	598	Total			

Summary for Subcatchment 4S:

Runoff = 4.81 cfs @ 12.15 hrs, Volume= 0.367 af, Depth> 2.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR STORM Rainfall=5.40"

Area (sf)	CN	Description
2,859	98	Unconnected pavement, HSG C
79,873	72	Woods/grass comb., Good, HSG C
82,732	73	Weighted Average, UI Adjusted CN = 72
79,873		96.54% Pervious Area
2,859		3.46% Impervious Area
2,859		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	12	0.0200	0.78		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
4.2	50	0.0600	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
5.4	545	0.0570	1.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.9	607	Total			

Summary for Link 1L:

Inflow Area =	8.792 ac,	7.57% Impervious,	Inflow Depth >	2.39"	for	25 YEAR STORM event
Inflow =	23.55 cfs @	12.13 hrs,	Volume=	1.750 af		
Primary =	23.55 cfs @	12.13 hrs,	Volume=	1.750 af,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs