

August 16, 2010
W-P Project No. 12104A

Mr. Greg Hogan, P.E., LEED-AP
Bates College
147 Russell Street
Cutten Maintenance Center
Lewiston, Maine 04240

RE: Evaluation of Existing Drainage to Lake Andrews

Dear Greg

Wright-Pierce is please to provide you with the following summary and discussion of results related to the evaluation of stormwater discharges to Lake Andrews, including the hydrologic modeling of stormwater flow, peak runoff conditions and treatment provided by Lake Andrews. The following summarizes the Lake Andrews evaluation.

Background

Lake Andrews is a man made Lake located within the Bates College Campus the intersection of Russell Street and College Street. Lake Andrews is a shallow Lake with an average depth of 5-feet and encompasses an area of 2.13 acres, which includes open water surface and planted wetlands for phosphorous treatment. The Lake was designed as a wet pond to address storage volume and sediment removal; and was constructed around 1958 in conjunction with a new parking area and doubled as an outdoor skating rink. As the campus expanded, additional stormwater was directed to the lake which caused shore erosion, along with higher water temperatures and nutrient loading that promoted algal blooms. In 1993 and 1995 restoration studies were conducted to assess the existing water quality and what measures could be instituted to improve water quality and aesthetics of Lake Andrews. In 1998 the College contracted to have the lake improvements completed. Lake Andrews was dredged resulting in the removal of over 5,000 cubic yards of sediments that accumulated over the lakes 40-year operation as a detention pond/skating rink. Additional modifications at this time included shoreline stabilization measures, installation of wetland plants for phosphorus uptake and the installation of a perimeter subsurface drain to address water temperature. Each of these measures has helped improve water quality associated with the lake.

The Lake receives runoff from a portion of campus within the Russell Street/College Avenue/Center Street/Campus Avenue block (identified as Lot 173-011), as well as runoff from Central Avenue and a small portion of the campus west of the Merrill Gym (within the Lot 173-012) . An outlet control structure on the northwest corner of the Lake controls discharge, which is directed to the City of Lewiston's stormwater system along Russell Street.



Lake Andrews Hydrologic Model

The Lake Andrews Hydrologic Model was prepared to evaluate and model stormwater discharges to the Lake and subsequently the City of Lewiston's Russell Street Storm Drain System. The stormwater runoff was modeled using HydroCAD Stormwater Modeling System software and based on the TR-20 methodology. Modeling was completed for the 2-year, 10-year, 25-year, 50-year and 100-year storm events.

The study point used for the evaluation was the 24-inch PVC pipe that discharges from the catch basin located to the northeast of Lake Andrews and provides a direct connection to the existing 48-inch RCP line within Russell Street, owned by the City of Lewiston. In addition, Lake Andrews itself was modeled to accurately gauge the quantity and peak flows entering and discharging from the Lake.

Currently, 32.8 acres of the college campus is directed to Lake Andrews via a series of subsurface drainage infrastructure and direct overland discharges to the Lake. A small 3 acre portion of the campus located at the intersection of Russell Street and College Street are directed directly into the catch basin/24-inch SD connection and piped directly to Russell Street. Subcatchments associated with this drainage are were broken down to accurately represent major drainage patterns within the site, main storm drain lines that discharge to the Lake, and account for Rainstore Detention Systems installed as part of the Bates Walk and Bates Dining Hall construction.

The results of the stormwater model show that that Lake Andrews is providing significant storage and mitigation of stormwater entering the City's Russell Street Storm Drain System under each of the stormwater events modeled. Table 1 below summarizes the flow entering Lake Andrews, discharge from the Lake and discharge into the City's System under each of the storm events.

Table 1: Results of Lake Andrews Hydrological Model 1

	Peak Flow to Lake Andrews	Peak Flow Discharging from Lake Andrews	Peak Flow to City's System
2-year	40.5 cfs	9.2 cfs	9.7 cfs
10-year	74.2 cfs	14.7 cfs	18.9 cfs
25-year	89.2 cfs	15.4 cfs	22.6 cfs
50-year	100.5 cfs	15.9 cfs	24.5 cfs
100-year	110.0 cfs	16.2 cfs	26.0 cfs

To full evaluate the mitigation provided Lake Andrews, additional models were evaluated to look at the effect that the Bates College Development would have on the Russell Street stormwater system if the Lake were not available to provide mitigation (Model 2), as well as the peak flows generated if the college campus had not been developed and remained in a natural vegetative state (Model 3).

Model 2 was prepared with the same drainage areas provided as in the original model. The only modification to this was removing Lake Andrews and running the model to see what flows would discharge directly to the Russell Street System. A copy of this model is included as Appendix B.



	Model 2 Peak Runoff to City's System
2-year	43.3 cfs
10-year	80.8 cfs
25-year	97.8 cfs
50-year	110.8 cfs
100-year	121.6 cfs

As previously discussed, this drainage area discharges into the City of Lewiston's 48-inch RCP storm drain system within Russell Street. Assuming this system was constructed at a 0.005 ft/ft slope, we would expect this system to have an approximate capacity of 100 cfs. Based on the results of the modeling, the without Lake Andrews, a substantial portion of the capacity of this 48-inch line would be required to address flows from Bates College.

Model 3 was prepared to determine the peak runoff conditions associated with the Bates College drainage area if there were no development within the footprint of the site. The HydroCAD model is provided as Appendix C. Assumptions for this model included modeling the site as wood/grassed combination discharging to the 24-inch storm drain which ultimately discharges to the City of Lewiston's Russell Street storm drain system.

	Model 3 Peak Runoff to City's System
2-year	13.8 cfs
10-year	35.2 cfs
25-year	47.2 cfs
50-year	56.6 cfs
100-year	64.6 cfs

As noted by these results, Lake Andrews is limiting the discharge from the existing Bates Campus Development during modeled storm events to quantities that would be expected from a 2-year storm event should the drainage area be undeveloped.

Stormwater Assessment - Water Quality

While Lake Andrews is a focal point within the campus itself, it also provide stormwater treatment for the campus in the form of sediment removal, nutrient uptake and removal, in combination with mitigation of peak stormwater flows. As previously noted, the lake was constructed around 1958 as a wet pond/detention pond, being utilized during the winter months as a skating rink. Modifications to the Lake were made in 1998 including removal of over 5,000 cubic yards of sediments that accumulated, shoreline stabilization measures, installation of wetland plants for phosphorus uptake and the installation of a perimeter subsurface drain to address water temperature. On-going maintenance of the pond is conducted regularly, as needed, and includes cut back of wetland vegetation during the winter season to help promote future nutrient uptake.

The current construction of Lake Andrews still maintains the basic requirements associated with a wet pond, including a permanent pool volume and channel protection volume. The outlet control structure provided stormwater from the pond to be released over an extended period of time, mitigating discharge to downstream receiving facilities.

Mr. Greg Hogan
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We are in hopes we have provided sufficient information for your discussions with the City of Lewiston in regards to the Stormwater Utility Fee. Should you require additional information or discussion, please do not hesitate to contact us.

Very Truly Yours,

WRIGHT-PIERCE

Stephanie A. Hubbard, P.E.
Project Engineer

Douglas A. Rice, P.E.
Senior Project Manager

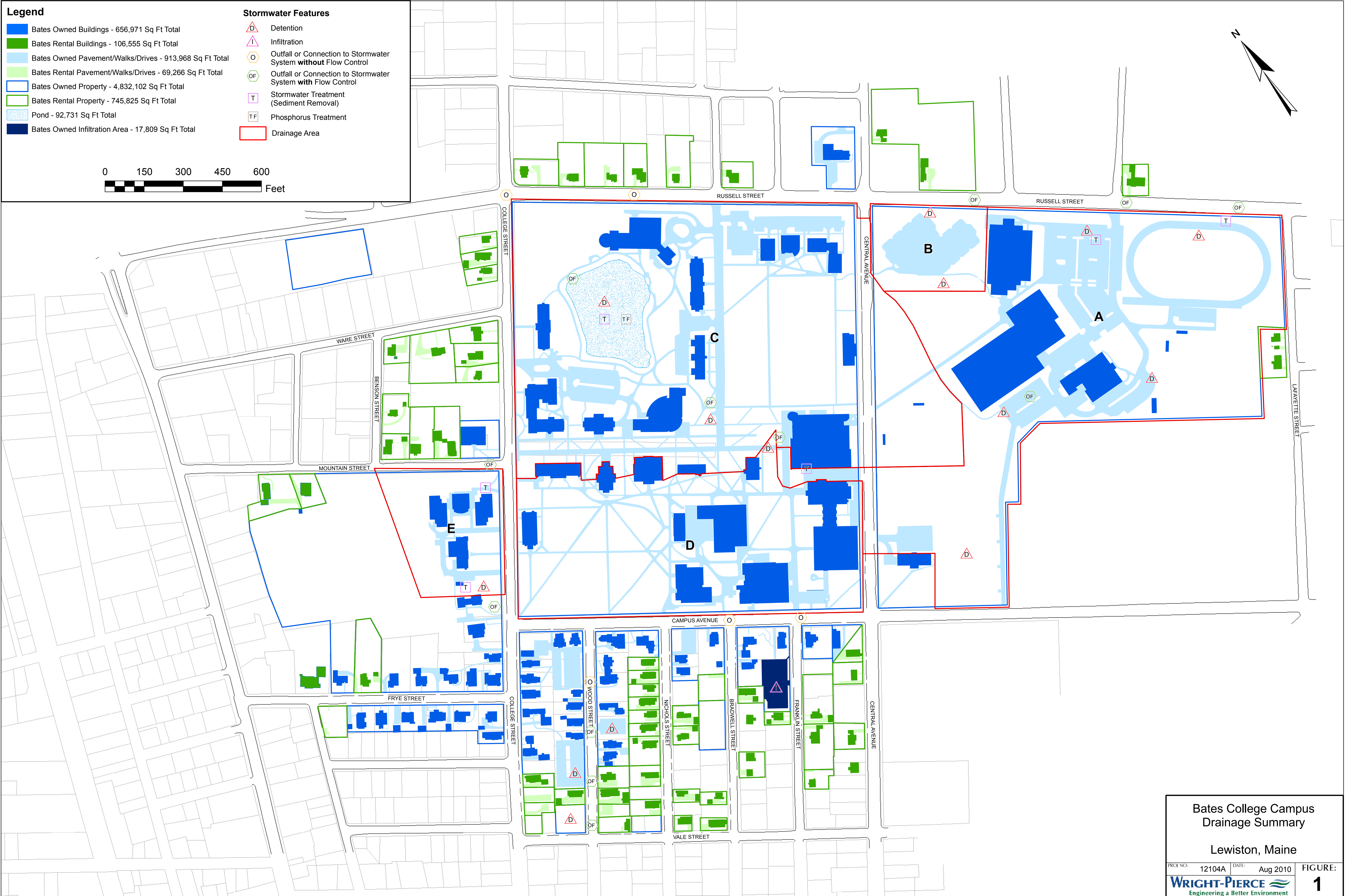
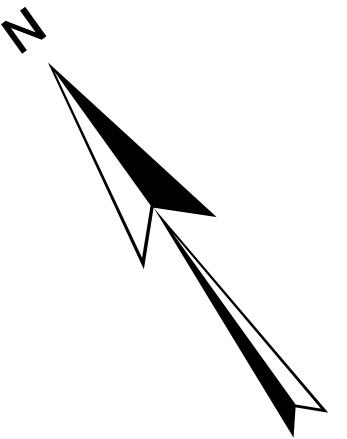
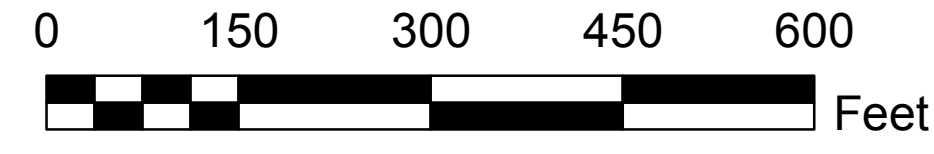
FIGURES

Legend

- Bates Owned Buildings - 656,971 Sq Ft Total
- Bates Rental Buildings - 106,555 Sq Ft Total
- Bates Owned Pavement/Walks/Drives - 913,968 Sq Ft Total
- Bates Rental Pavement/Walks/Drives - 69,266 Sq Ft Total
- Bates Owned Property - 4,832,102 Sq Ft Total
- Bates Rental Property - 745,825 Sq Ft Total
- Pond - 92,731 Sq Ft Total
- Bates Owned Infiltration Area - 17,809 Sq Ft Total

Stormwater Features

- Detention
- Infiltration
- Outfall or Connection to Stormwater System **without** Flow Control
- Outfall or Connection to Stormwater System **with** Flow Control
- Stormwater Treatment (Sediment Removal)
- Phosphorus Treatment
- Drainage Area



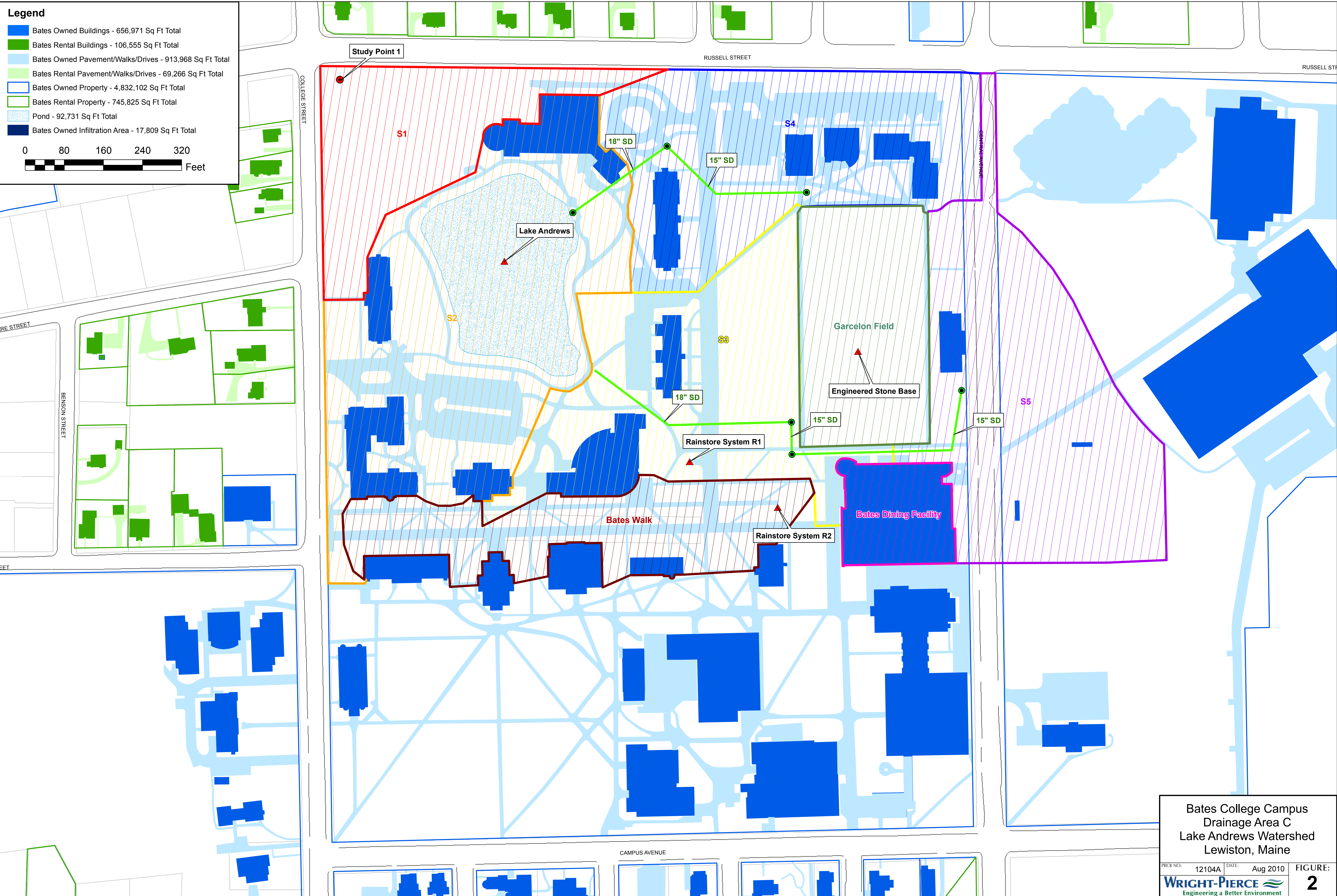
Bates College Campus Drainage Summary		
Lewiston, Maine		
PROJ NO: 12104A	DATE: Aug 2010	FIGURE: 1
 WRIGHT-PIERCE <small>Engineering a Better Environment</small>		

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Legend

- Bates Owned Buildings - 656,971 Sq Ft Total
- Bates Rental Buildings - 106,555 Sq Ft Total
- Bates Owned Pavement/Walks/Drives - 913,968 Sq Ft Total
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- Pond - 92,731 Sq Ft Total
- Bates Owned Infiltration Area - 17,809 Sq Ft Total

0 80 160 240 320 Feet



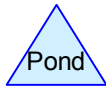
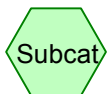
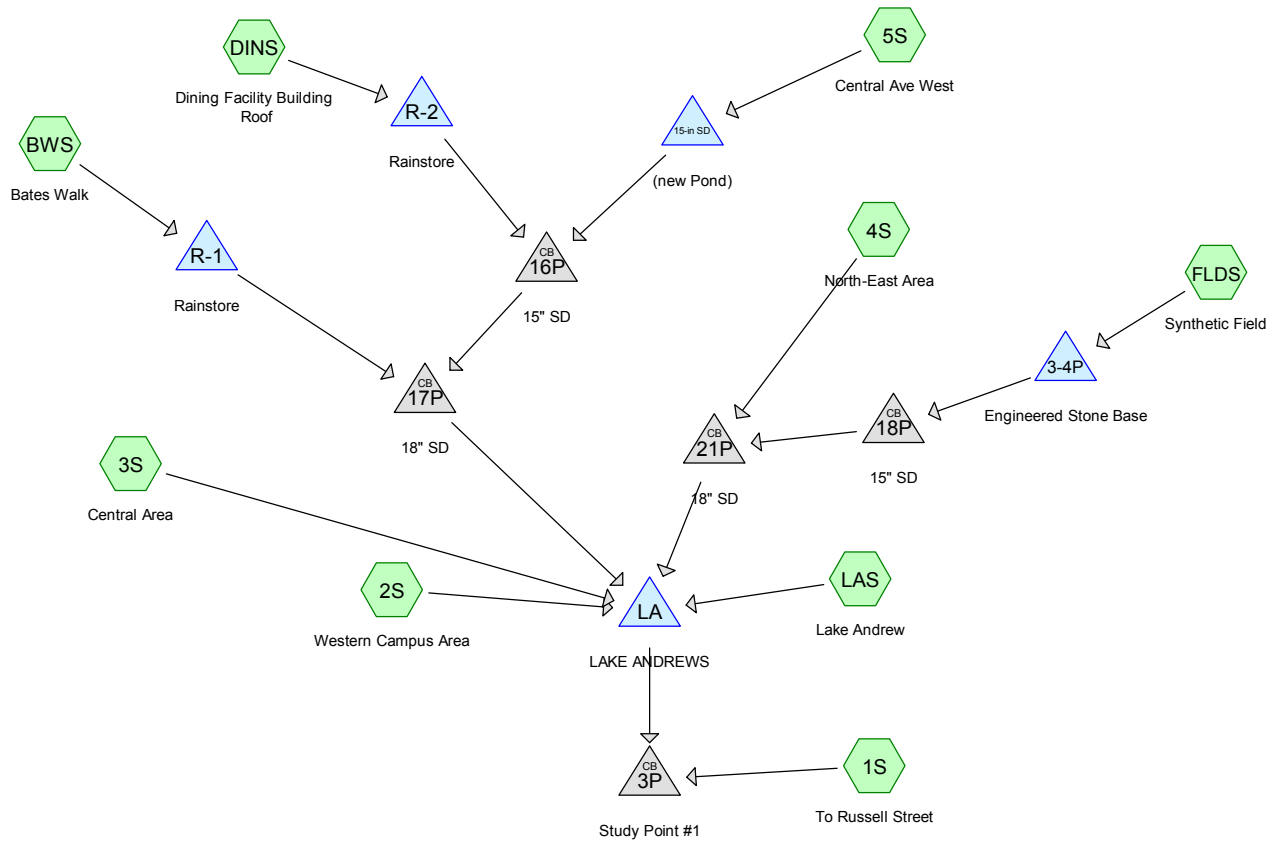
Bates College Campus
Drainage Area C
Lake Andrews Watershed
Lewiston, Maine

PROJ NO: 12104A DATE: Aug 2010 FIGURE: 2

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APPENDIX 1
LAKE ANDREWS HYDROLOGIC MODEL 1



Drainage Diagram for FINAL Bates College - Drainage Area C

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FINAL Bates College - Drainage Area C

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Russell Street	Runoff Area=3.010 ac 2.82% Impervious Runoff Depth>2.58" Flow Length=380' Slope=0.0400 '/' Tc=9.1 min CN=75 Runoff=8.6 cfs 0.647 af
Subcatchment 2S: Western Campus Area	Runoff Area=5.380 ac 47.03% Impervious Runoff Depth>3.52" Flow Length=280' Tc=9.3 min CN=85 Runoff=20.4 cfs 1.576 af
Subcatchment 3S: Central Area	Runoff Area=5.390 ac 36.18% Impervious Runoff Depth>3.32" Flow Length=405' Tc=9.7 min CN=83 Runoff=19.3 cfs 1.490 af
Subcatchment 4S: North-East Area	Runoff Area=5.540 ac 51.08% Impervious Runoff Depth>3.61" Flow Length=400' Tc=11.4 min CN=86 Runoff=20.4 cfs 1.668 af
Subcatchment 5S: Central Ave West	Runoff Area=6.720 ac 23.07% Impervious Runoff Depth>2.93" Flow Length=230' Tc=24.0 min CN=79 Runoff=15.4 cfs 1.638 af
Subcatchment BWS: Bates Walk	Runoff Area=2.824 ac 35.20% Impervious Runoff Depth>3.82" Flow Length=200' Tc=6.1 min CN=88 Runoff=12.7 cfs 0.900 af
Subcatchment DINS: Dining Facility Building	Runoff Area=1.049 ac 100.00% Impervious Runoff Depth>4.93" Tc=5.0 min CN=98 Runoff=5.6 cfs 0.431 af
Subcatchment FLDS: Synthetic Field	Runoff Area=2.900 ac 6.90% Impervious Runoff Depth>2.67" Flow Length=350' Slope=0.0050 '/' Tc=5.9 min CN=76 Runoff=9.6 cfs 0.645 af
Subcatchment LAS: Lake Andrew	Runoff Area=2.960 ac 81.08% Impervious Runoff Depth>4.36" Tc=5.0 min CN=93 Runoff=15.0 cfs 1.075 af
Pond 3-4P: Engineered Stone Base	Peak Elev=250.43' Storage=2,823 cf Inflow=9.6 cfs 0.645 af Discarded=0.4 cfs 0.061 af Primary=4.3 cfs 0.584 af Outflow=4.8 cfs 0.645 af
Pond 3P: Study Point #1	Peak Elev=229.88' Inflow=22.6 cfs 8.812 af 24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/' Outflow=22.6 cfs 8.812 af
Pond 15-in SD: (new Pond)	Peak Elev=249.94' Storage=8,038 cf Inflow=15.4 cfs 1.638 af 15.0" Round Culvert n=0.011 L=375.0' S=0.0053 '/' Outflow=9.0 cfs 1.573 af
Pond 16P: 15" SD	Peak Elev=247.25' Inflow=10.3 cfs 1.988 af 15.0" Round Culvert n=0.011 L=20.0' S=0.0100 '/' Outflow=10.3 cfs 1.988 af
Pond 17P: 18" SD	Peak Elev=238.81' Inflow=15.7 cfs 2.877 af 18.0" Round Culvert n=0.011 L=280.0' S=0.0129 '/' Outflow=15.7 cfs 2.877 af
Pond 18P: 15" SD	Peak Elev=241.59' Inflow=4.3 cfs 0.584 af 15.0" Round Culvert n=0.011 L=300.0' S=0.0050 '/' Outflow=4.3 cfs 0.584 af
Pond 21P: 18" SD	Peak Elev=252.80' Inflow=24.7 cfs 2.252 af 18.0" Round Culvert n=0.011 L=260.0' S=0.0365 '/' Outflow=24.7 cfs 2.252 af

FINAL Bates College - Drainage Area C

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Pond LA: LAKE ANDREWS

Peak Elev=231.77' Storage=198,132 cf Inflow=89.2 cfs 9.271 af
Outflow=15.4 cfs 8.165 af

Pond R-1: Rainstore

Peak Elev=237.73' Storage=8,549 cf Inflow=12.7 cfs 0.900 af
Outflow=5.7 cfs 0.889 af

Pond R-2: Rainstore

Peak Elev=247.30' Storage=7,373 cf Inflow=5.6 cfs 0.431 af
Outflow=1.4 cfs 0.415 af

Total Runoff Area = 35.773 ac Runoff Volume = 10.071 af Average Runoff Depth = 3.38"
62.02% Pervious = 22.185 ac 37.98% Impervious = 13.588 ac

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Summary for Subcatchment 1S: To Russell Street

Runoff = 8.6 cfs @ 12.13 hrs, Volume= 0.647 af, Depth> 2.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
0.085	98	Paved parking, HSG C
2.925	74	>75% Grass cover, Good, HSG C
3.010	75	Weighted Average
2.925		97.18% Pervious Area
0.085		2.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.0400	0.22		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
1.4	280	0.0400	3.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.1	380	Total			

Summary for Subcatchment 2S: Western Campus Area

Runoff = 20.4 cfs @ 12.13 hrs, Volume= 1.576 af, Depth> 3.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 2.530	98	Paved Parking & Roofs
2.850	74	>75% Grass cover, Good, HSG C
5.380	85	Weighted Average
2.850		52.97% Pervious Area
2.530		47.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	100	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
0.3	80	0.0400	4.06		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	100	0.0600	3.94		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.3	280	Total			

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Summary for Subcatchment 3S: Central Area

Runoff = 19.3 cfs @ 12.14 hrs, Volume= 1.490 af, Depth> 3.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 1.950	98	Paved Parking & Roofs
3.440	74	>75% Grass cover, Good, HSG C
5.390	83	Weighted Average
3.440		63.82% Pervious Area
1.950		36.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	100	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
0.8	200	0.0400	4.06		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.3	105	0.1000	5.09		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.7	405	Total			

Summary for Subcatchment 4S: North-East Area

Runoff = 20.4 cfs @ 12.16 hrs, Volume= 1.668 af, Depth> 3.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 2.830	98	Paved Parking & Roofs
2.710	74	>75% Grass cover, Good, HSG C
5.540	86	Weighted Average
2.710		48.92% Pervious Area
2.830		51.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	100	0.0200	0.16		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
1.3	300	0.0050	3.79	2.98	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
11.4	400	Total			

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Summary for Subcatchment 5S: Central Ave West

Runoff = 15.4 cfs @ 12.33 hrs, Volume= 1.638 af, Depth> 2.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 1.550	98	Paved Parking & Roofs
4.520	74	>75% Grass cover, Good, HSG C
0.650	70	Woods, Good, HSG C
6.720	79	Weighted Average
5.170		76.93% Pervious Area
1.550		23.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.2	100	0.0200	0.08		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
1.8	130	0.0300	1.21		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
24.0	230	Total			

Summary for Subcatchment BWS: Bates Walk

Runoff = 12.7 cfs @ 12.09 hrs, Volume= 0.900 af, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 0.994	98	Paved Parking & Roofs
0.821	74	>75% Grass cover, Good, HSG C
1.009	89	Gravel roads, HSG C
2.824	88	Weighted Average
1.830		64.80% Pervious Area
0.994		35.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	70	0.0500	0.22		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
0.8	130	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.1	200	Total			

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Summary for Subcatchment DINS: Dining Facility Building Roof

Runoff = 5.6 cfs @ 12.07 hrs, Volume= 0.431 af, Depth> 4.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 1.049	98	Paved Parking & Roofs
1.049		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Minimum Tc Used

Summary for Subcatchment FLDS: Synthetic Field

Runoff = 9.6 cfs @ 12.09 hrs, Volume= 0.645 af, Depth> 2.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
2.060	74	>75% Grass cover, Good, HSG C
0.200	98	Paved parking, HSG C
0.640	74	>75% Grass cover, Good, HSG C
2.900	76	Weighted Average
2.700		93.10% Pervious Area
0.200		6.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	100	0.0050	0.76		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.00"
3.7	250	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
5.9	350	Total			

Summary for Subcatchment LAS: Lake Andrew

Runoff = 15.0 cfs @ 12.07 hrs, Volume= 1.075 af, Depth> 4.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

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 Type III 24-hr 25-Year Rainfall=5.40"

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Area (ac)	CN	Description
2.130	98	Water Surface, HSG C
* 0.270	98	Paved Parking & Roofs
0.560	74	>75% Grass cover, Good, HSG C
2.960	93	Weighted Average
0.560		18.92% Pervious Area
2.400		81.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Pond 3-4P: Engineered Stone Base

Inflow Area = 2.900 ac, 6.90% Impervious, Inflow Depth > 2.67" for 25-Year event
 Inflow = 9.6 cfs @ 12.09 hrs, Volume= 0.645 af
 Outflow = 4.8 cfs @ 12.26 hrs, Volume= 0.645 af, Atten= 50%, Lag= 10.2 min
 Discarded = 0.4 cfs @ 12.00 hrs, Volume= 0.061 af
 Primary = 4.3 cfs @ 12.26 hrs, Volume= 0.584 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 250.43' @ 12.26 hrs Surf.Area= 89,856 sf Storage= 2,823 cf

Plug-Flow detention time= 3.4 min calculated for 0.643 af (100% of inflow)
 Center-of-Mass det. time= 3.2 min (795.8 - 792.6)

Volume	Invert	Avail.Storage	Storage Description
#1	250.35'	35,942 cf	234.00'W x 384.00'L x 1.00'H Prismatic 89,856 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	247.40'	12.0" Round Culvert L= 180.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 246.20' S= 0.0067 ' S= 0.0067 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior
#2	Primary	250.35'	Custom Weir/Orifice X 14.00, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 Width (feet) 0.08 1.00
#3	Discarded	250.35'	0.213 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.4 cfs @ 12.00 hrs HW=250.36' (Free Discharge)
 ↳ **3=Exfiltration** (Exfiltration Controls 0.4 cfs)

Primary OutFlow Max=4.3 cfs @ 12.26 hrs HW=250.43' (Free Discharge)
 ↳ **1=Culvert** (Barrel Controls 4.2 cfs @ 5.39 fps)
 ↳ **2=Custom Weir/Orifice** (Weir Controls 0.1 cfs @ 0.86 fps)

FINAL Bates College - Drainage Area C

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Type III 24-hr 25-Year Rainfall=5.40"

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Summary for Pond 3P: Study Point #1

Inflow Area = 35.773 ac, 37.98% Impervious, Inflow Depth > 2.96" for 25-Year event
 Inflow = 22.6 cfs @ 12.15 hrs, Volume= 8.812 af
 Outflow = 22.6 cfs @ 12.15 hrs, Volume= 8.812 af, Atten= 0%, Lag= 0.0 min
 Primary = 22.6 cfs @ 12.15 hrs, Volume= 8.812 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 229.88' @ 12.15 hrs

Flood Elev= 231.12'

Device	Routing	Invert	Outlet Devices
#1	Primary	225.30'	24.0" Round Culvert L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 225.20' S= 0.0010 '/' Cc= 0.900 n= 0.010 PVC, smooth interior

Primary OutFlow Max=22.5 cfs @ 12.15 hrs HW=229.86' (Free Discharge)↑**1=Culvert** (Inlet Controls 22.5 cfs @ 7.18 fps)**Summary for Pond 15-in SD: (new Pond)**

Inflow Area = 6.720 ac, 23.07% Impervious, Inflow Depth > 2.93" for 25-Year event
 Inflow = 15.4 cfs @ 12.33 hrs, Volume= 1.638 af
 Outflow = 9.0 cfs @ 12.65 hrs, Volume= 1.573 af, Atten= 41%, Lag= 18.9 min
 Primary = 9.0 cfs @ 12.65 hrs, Volume= 1.573 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs / 2

Peak Elev= 249.94' @ 12.65 hrs Surf.Area= 7,781 sf Storage= 8,038 cf

Plug-Flow detention time= 18.6 min calculated for 1.569 af (96% of inflow)

Center-of-Mass det. time= 4.3 min (805.0 - 800.7)

Volume	Invert	Avail.Storage	Storage Description
#1	248.00'	17,500 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
248.00	500	0	0
250.00	8,000	8,500	8,500
251.00	10,000	9,000	17,500

Device	Routing	Invert	Outlet Devices
#1	Primary	243.80'	15.0" Round Culvert L= 375.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 241.80' S= 0.0053 '/' Cc= 0.900 n= 0.011

Primary OutFlow Max=9.0 cfs @ 12.65 hrs HW=249.94' (Free Discharge)↑**1=Culvert** (Barrel Controls 9.0 cfs @ 7.37 fps)

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Summary for Pond 16P: 15" SD

Inflow Area = 7.769 ac, 33.45% Impervious, Inflow Depth > 3.07" for 25-Year event
 Inflow = 10.3 cfs @ 12.53 hrs, Volume= 1.988 af
 Outflow = 10.3 cfs @ 12.53 hrs, Volume= 1.988 af, Atten= 0%, Lag= 0.0 min
 Primary = 10.3 cfs @ 12.53 hrs, Volume= 1.988 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 247.25' @ 12.53 hrs

Flood Elev= 250.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	241.70'	15.0" Round Culvert L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 241.50' S= 0.0100 1/ S= 0.0100 1/ Cc= 0.900 n= 0.011

Primary OutFlow Max=10.3 cfs @ 12.53 hrs HW=247.24' (Free Discharge)↑**1=Culvert** (Inlet Controls 10.3 cfs @ 8.43 fps)**Summary for Pond 17P: 18" SD**

Inflow Area = 10.593 ac, 33.92% Impervious, Inflow Depth > 3.26" for 25-Year event
 Inflow = 15.7 cfs @ 12.38 hrs, Volume= 2.877 af
 Outflow = 15.7 cfs @ 12.38 hrs, Volume= 2.877 af, Atten= 0%, Lag= 0.0 min
 Primary = 15.7 cfs @ 12.38 hrs, Volume= 2.877 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 238.81' @ 12.38 hrs

Flood Elev= 249.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	232.60'	18.0" Round Culvert L= 280.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 229.00' S= 0.0129 1/ S= 0.0129 1/ Cc= 0.900 n= 0.011

Primary OutFlow Max=15.7 cfs @ 12.38 hrs HW=238.80' (Free Discharge)↑**1=Culvert** (Inlet Controls 15.7 cfs @ 8.88 fps)**Summary for Pond 18P: 15" SD**

Inflow Area = 2.900 ac, 6.90% Impervious, Inflow Depth > 2.42" for 25-Year event
 Inflow = 4.3 cfs @ 12.26 hrs, Volume= 0.584 af
 Outflow = 4.3 cfs @ 12.26 hrs, Volume= 0.584 af, Atten= 0%, Lag= 0.0 min
 Primary = 4.3 cfs @ 12.26 hrs, Volume= 0.584 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 241.59' @ 12.26 hrs

Flood Elev= 250.45'

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Device	Routing	Invert	Outlet Devices
#1	Primary	240.10'	15.0" Round Culvert L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 238.60' S= 0.0050 '/' Cc= 0.900 n= 0.011

Primary OutFlow Max=4.3 cfs @ 12.26 hrs HW=241.59' (Free Discharge)

↑**1=Culvert** (Inlet Controls 4.3 cfs @ 3.54 fps)

Summary for Pond 21P: 18" SD

Inflow Area = 8.440 ac, 35.90% Impervious, Inflow Depth > 3.20" for 25-Year event
 Inflow = 24.7 cfs @ 12.16 hrs, Volume= 2.252 af
 Outflow = 24.7 cfs @ 12.16 hrs, Volume= 2.252 af, Atten= 0%, Lag= 0.0 min
 Primary = 24.7 cfs @ 12.16 hrs, Volume= 2.252 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 252.80' @ 12.16 hrs
 Flood Elev= 250.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.50'	18.0" Round Culvert L= 260.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 229.00' S= 0.0365 '/' Cc= 0.900 n= 0.011

Primary OutFlow Max=24.5 cfs @ 12.16 hrs HW=252.56' (Free Discharge)

↑**1=Culvert** (Inlet Controls 24.5 cfs @ 13.87 fps)

Summary for Pond LA: LAKE ANDREWS

Inflow Area = 32.763 ac, 41.21% Impervious, Inflow Depth > 3.40" for 25-Year event
 Inflow = 89.2 cfs @ 12.13 hrs, Volume= 9.271 af
 Outflow = 15.4 cfs @ 13.22 hrs, Volume= 8.165 af, Atten= 83%, Lag= 65.3 min
 Primary = 15.4 cfs @ 13.22 hrs, Volume= 8.165 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 231.77' @ 13.22 hrs Surf.Area= 111,215 sf Storage= 198,132 cf

Plug-Flow detention time= 158.3 min calculated for 8.165 af (88% of inflow)
 Center-of-Mass det. time= 121.0 min (902.3 - 781.3)

Volume	Invert	Avail.Storage	Storage Description
#1	229.85'	344,331 cf	Custom Stage Data (Prismatic) Listed below
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
229.85	92,733	0	0
230.00	97,706	14,283	14,283
231.00	103,431	100,569	114,851
232.00	113,572	108,502	223,353
233.00	128,384	120,978	344,331

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Device	Routing	Invert	Outlet Devices
#1	Primary	226.84'	18.0" Round Culvert L= 245.0' CPP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 225.40' S= 0.0059 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	229.85'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=15.4 cfs @ 13.22 hrs HW=231.77' (Free Discharge)
 ↑1=Culvert (Barrel Controls 15.4 cfs @ 8.69 fps)
 ↑2=Broad-Crested Rectangular Weir (Passes 15.4 cfs of 35.2 cfs potential flow)

Summary for Pond R-1: Rainstore

Inflow Area = 2.824 ac, 35.20% Impervious, Inflow Depth > 3.82" for 25-Year event
 Inflow = 12.7 cfs @ 12.09 hrs, Volume= 0.900 af
 Outflow = 5.7 cfs @ 12.28 hrs, Volume= 0.889 af, Atten= 55%, Lag= 11.3 min
 Primary = 5.7 cfs @ 12.28 hrs, Volume= 0.889 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 237.73' @ 12.28 hrs Surf.Area= 2,178 sf Storage= 8,549 cf

Plug-Flow detention time= 24.1 min calculated for 0.889 af (99% of inflow)
 Center-of-Mass det. time= 19.1 min (783.6 - 764.5)

Volume	Invert	Avail.Storage	Storage Description
#1	233.55'	16,379 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 17,424 cf Overall x 94.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
233.55	2,178	0	0
234.55	2,178	2,178	2,178
235.55	2,178	2,178	4,356
236.55	2,178	2,178	6,534
237.55	2,178	2,178	8,712
238.55	2,178	2,178	10,890
239.55	2,178	2,178	13,068
241.55	2,178	4,356	17,424

Device	Routing	Invert	Outlet Devices
#1	Primary	233.25'	18.0" Round Culvert L= 20.0' Ke= 0.010 Outlet Invert= 232.70' S= 0.0275 '/' Cc= 0.900 n= 0.013
#2	Device 1	233.55'	10.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	237.00'	6.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	238.30'	10.0" Vert. Orifice/Grate C= 0.600

FINAL Bates College - Drainage Area C

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 Type III 24-hr 25-Year Rainfall=5.40"

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Primary OutFlow Max=5.7 cfs @ 12.28 hrs HW=237.72' (Free Discharge)

- ↑ 1=Culvert (Passes 5.7 cfs of 22.7 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 5.1 cfs @ 9.33 fps)
- | 3=Orifice/Grate (Orifice Controls 0.6 cfs @ 3.29 fps)
- | 4=Orifice/Grate (Controls 0.0 cfs)

Summary for Pond R-2: Rainstore

Inflow Area = 1.049 ac, 100.00% Impervious, Inflow Depth > 4.93" for 25-Year event
 Inflow = 5.6 cfs @ 12.07 hrs, Volume= 0.431 af
 Outflow = 1.4 cfs @ 12.43 hrs, Volume= 0.415 af, Atten= 75%, Lag= 21.9 min
 Primary = 1.4 cfs @ 12.43 hrs, Volume= 0.415 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 247.30' @ 12.43 hrs Surf.Area= 2,800 sf Storage= 7,373 cf

Plug-Flow detention time= 107.6 min calculated for 0.414 af (96% of inflow)
 Center-of-Mass det. time= 92.3 min (811.0 - 718.7)

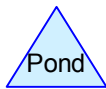
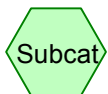
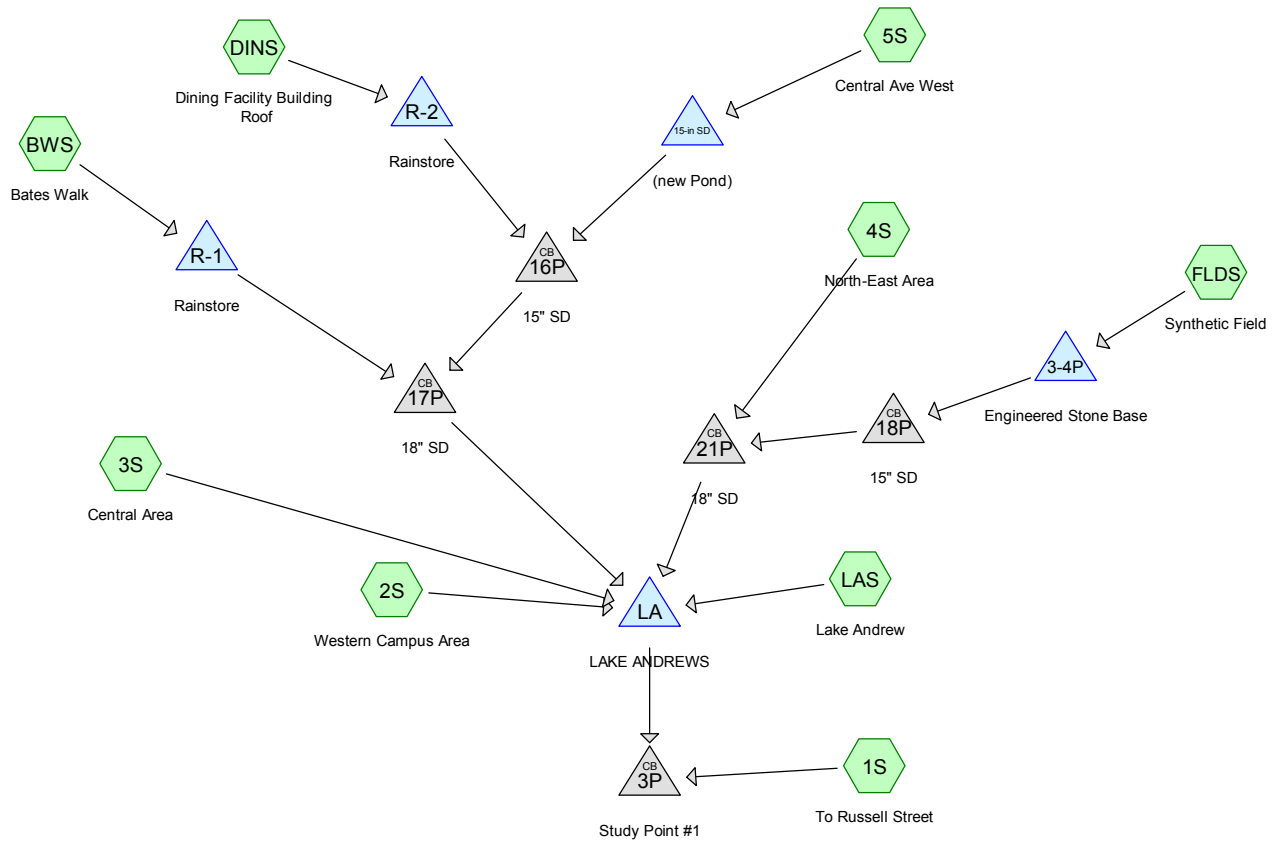
Volume	Invert	Avail.Storage	Storage Description
#1	244.50'	8,765 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 9,324 cf Overall x 94.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
244.50	2,800	0	0
245.50	2,800	2,800	2,800
246.50	2,800	2,800	5,600
247.83	2,800	3,724	9,324

Device	Routing	Invert	Outlet Devices
#1	Primary	244.50'	12.0" Round Culvert L= 160.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 242.90' S= 0.0100 '/ Cc= 0.900 n= 0.013
#2	Device 1	244.50'	4.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	246.20'	4.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	246.94'	6.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=1.4 cfs @ 12.43 hrs HW=247.30' (Free Discharge)

- ↑ 1=Culvert (Passes 1.4 cfs of 4.5 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 0.7 cfs @ 7.81 fps)
- | 3=Orifice/Grate (Orifice Controls 0.4 cfs @ 4.65 fps)
- | 4=Orifice/Grate (Orifice Controls 0.3 cfs @ 2.04 fps)



Drainage Diagram for FINAL Bates College - Drainage Area C

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Type III 24-hr 2-Year Rainfall=3.00"

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Russell Street	Runoff Area=3.010 ac 2.82% Impervious Runoff Depth>0.87" Flow Length=380' Slope=0.0400 '/' Tc=9.1 min CN=75 Runoff=2.8 cfs 0.219 af
Subcatchment 2S: Western Campus Area	Runoff Area=5.380 ac 47.03% Impervious Runoff Depth>1.48" Flow Length=280' Tc=9.3 min CN=85 Runoff=8.8 cfs 0.662 af
Subcatchment 3S: Central Area	Runoff Area=5.390 ac 36.18% Impervious Runoff Depth>1.34" Flow Length=405' Tc=9.7 min CN=83 Runoff=7.9 cfs 0.602 af
Subcatchment 4S: North-East Area	Runoff Area=5.540 ac 51.08% Impervious Runoff Depth>1.55" Flow Length=400' Tc=11.4 min CN=86 Runoff=9.0 cfs 0.714 af
Subcatchment 5S: Central Ave West	Runoff Area=6.720 ac 23.07% Impervious Runoff Depth>1.09" Flow Length=230' Tc=24.0 min CN=79 Runoff=5.7 cfs 0.608 af
Subcatchment BWS: Bates Walk	Runoff Area=2.824 ac 35.20% Impervious Runoff Depth>1.70" Flow Length=200' Tc=6.1 min CN=88 Runoff=5.9 cfs 0.400 af
Subcatchment DINS: Dining Facility Building	Runoff Area=1.049 ac 100.00% Impervious Runoff Depth>2.64" Tc=5.0 min CN=98 Runoff=3.1 cfs 0.231 af
Subcatchment FLDS: Synthetic Field	Runoff Area=2.900 ac 6.90% Impervious Runoff Depth>0.93" Flow Length=350' Slope=0.0050 '/' Tc=5.9 min CN=76 Runoff=3.3 cfs 0.224 af
Subcatchment LAS: Lake Andrew	Runoff Area=2.960 ac 81.08% Impervious Runoff Depth>2.13" Tc=5.0 min CN=93 Runoff=7.6 cfs 0.525 af
Pond 3-4P: Engineered Stone Base	Peak Elev=250.36' Storage=243 cf Inflow=3.3 cfs 0.224 af Discarded=0.3 cfs 0.021 af Primary=2.8 cfs 0.203 af Outflow=3.1 cfs 0.224 af
Pond 3P: Study Point #1	Peak Elev=227.26' Inflow=9.7 cfs 3.455 af 24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/' Outflow=9.7 cfs 3.455 af
Pond 15-in SD: (new Pond)	Peak Elev=248.02' Storage=12 cf Inflow=5.7 cfs 0.608 af 15.0" Round Culvert n=0.011 L=375.0' S=0.0053 '/' Outflow=5.7 cfs 0.608 af
Pond 16P: 15" SD	Peak Elev=244.07' Inflow=6.2 cfs 0.829 af 15.0" Round Culvert n=0.011 L=20.0' S=0.0100 '/' Outflow=6.2 cfs 0.829 af
Pond 17P: 18" SD	Peak Elev=235.18' Inflow=9.1 cfs 1.222 af 18.0" Round Culvert n=0.011 L=280.0' S=0.0129 '/' Outflow=9.1 cfs 1.222 af
Pond 18P: 15" SD	Peak Elev=241.10' Inflow=2.8 cfs 0.203 af 15.0" Round Culvert n=0.011 L=300.0' S=0.0050 '/' Outflow=2.8 cfs 0.203 af
Pond 21P: 18" SD	Peak Elev=242.25' Inflow=11.6 cfs 0.917 af 18.0" Round Culvert n=0.011 L=260.0' S=0.0365 '/' Outflow=11.6 cfs 0.917 af

FINAL Bates College - Drainage Area C

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Type III 24-hr 2-Year Rainfall=3.00"

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Pond LA: LAKE ANDREWS

Peak Elev=230.64' Storage=78,394 cf Inflow=40.5 cfs 3.927 af
Outflow=9.2 cfs 3.236 af

Pond R-1: Rainstore

Peak Elev=235.27' Storage=3,513 cf Inflow=5.9 cfs 0.400 af
Outflow=3.0 cfs 0.393 af

Pond R-2: Rainstore

Peak Elev=246.10' Storage=4,199 cf Inflow=3.1 cfs 0.231 af
Outflow=0.5 cfs 0.221 af

Total Runoff Area = 35.773 ac Runoff Volume = 4.185 af Average Runoff Depth = 1.40"
62.02% Pervious = 22.185 ac 37.98% Impervious = 13.588 ac

FINAL Bates College - Drainage Area C

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Type III 24-hr 10-Year Rainfall=4.60"

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Russell Street	Runoff Area=3.010 ac 2.82% Impervious Runoff Depth>1.97" Flow Length=380' Slope=0.0400 '/' Tc=9.1 min CN=75 Runoff=6.6 cfs 0.494 af
Subcatchment 2S: Western Campus Area	Runoff Area=5.380 ac 47.03% Impervious Runoff Depth>2.81" Flow Length=280' Tc=9.3 min CN=85 Runoff=16.5 cfs 1.261 af
Subcatchment 3S: Central Area	Runoff Area=5.390 ac 36.18% Impervious Runoff Depth>2.63" Flow Length=405' Tc=9.7 min CN=83 Runoff=15.4 cfs 1.182 af
Subcatchment 4S: North-East Area	Runoff Area=5.540 ac 51.08% Impervious Runoff Depth>2.90" Flow Length=400' Tc=11.4 min CN=86 Runoff=16.6 cfs 1.341 af
Subcatchment 5S: Central Ave West	Runoff Area=6.720 ac 23.07% Impervious Runoff Depth>2.28" Flow Length=230' Tc=24.0 min CN=79 Runoff=12.1 cfs 1.275 af
Subcatchment BWS: Bates Walk	Runoff Area=2.824 ac 35.20% Impervious Runoff Depth>3.10" Flow Length=200' Tc=6.1 min CN=88 Runoff=10.4 cfs 0.730 af
Subcatchment DINS: Dining Facility Building	Runoff Area=1.049 ac 100.00% Impervious Runoff Depth>4.16" Tc=5.0 min CN=98 Runoff=4.7 cfs 0.364 af
Subcatchment FLDS: Synthetic Field	Runoff Area=2.900 ac 6.90% Impervious Runoff Depth>2.05" Flow Length=350' Slope=0.0050 '/' Tc=5.9 min CN=76 Runoff=7.4 cfs 0.495 af
Subcatchment LAS: Lake Andrew	Runoff Area=2.960 ac 81.08% Impervious Runoff Depth>3.61" Tc=5.0 min CN=93 Runoff=12.6 cfs 0.890 af
Pond 3-4P: Engineered Stone Base	Peak Elev=250.39' Storage=1,392 cf Inflow=7.4 cfs 0.495 af Discarded=0.4 cfs 0.047 af Primary=4.2 cfs 0.448 af Outflow=4.7 cfs 0.495 af
Pond 3P: Study Point #1	Peak Elev=228.81' Inflow=18.9 cfs 6.996 af 24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/' Outflow=18.9 cfs 6.996 af
Pond 15-in SD: (new Pond)	Peak Elev=249.25' Storage=3,546 cf Inflow=12.1 cfs 1.275 af 15.0" Round Culvert n=0.011 L=375.0' S=0.0053 '/' Outflow=8.6 cfs 1.246 af
Pond 16P: 15" SD	Peak Elev=246.50' Inflow=9.5 cfs 1.597 af 15.0" Round Culvert n=0.011 L=20.0' S=0.0100 '/' Outflow=9.5 cfs 1.597 af
Pond 17P: 18" SD	Peak Elev=237.59' Inflow=13.8 cfs 2.317 af 18.0" Round Culvert n=0.011 L=280.0' S=0.0129 '/' Outflow=13.8 cfs 2.317 af
Pond 18P: 15" SD	Peak Elev=241.55' Inflow=4.2 cfs 0.448 af 15.0" Round Culvert n=0.011 L=300.0' S=0.0050 '/' Outflow=4.2 cfs 0.448 af
Pond 21P: 18" SD	Peak Elev=248.84' Inflow=20.8 cfs 1.789 af 18.0" Round Culvert n=0.011 L=260.0' S=0.0365 '/' Outflow=20.8 cfs 1.789 af

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Type III 24-hr 10-Year Rainfall=4.60"

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Pond LA: LAKE ANDREWS

Peak Elev=231.34' Storage=152,273 cf Inflow=74.2 cfs 7.440 af
Outflow=14.7 cfs 6.502 af

Pond R-1: Rainstore

Peak Elev=236.93' Storage=6,911 cf Inflow=10.4 cfs 0.730 af
Outflow=4.5 cfs 0.720 af

Pond R-2: Rainstore

Peak Elev=246.94' Storage=6,423 cf Inflow=4.7 cfs 0.364 af
Outflow=1.0 cfs 0.351 af

Total Runoff Area = 35.773 ac Runoff Volume = 8.033 af Average Runoff Depth = 2.69"
62.02% Pervious = 22.185 ac 37.98% Impervious = 13.588 ac

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Type III 24-hr 50-Year Rainfall=6.00"

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Russell Street	Runoff Area=3.010 ac 2.82% Impervious Runoff Depth>3.06" Flow Length=380' Slope=0.0400 '/' Tc=9.1 min CN=75 Runoff=10.2 cfs 0.766 af
Subcatchment 2S: Western Campus Area	Runoff Area=5.380 ac 47.03% Impervious Runoff Depth>4.05" Flow Length=280' Tc=9.3 min CN=85 Runoff=23.4 cfs 1.816 af
Subcatchment 3S: Central Area	Runoff Area=5.390 ac 36.18% Impervious Runoff Depth>3.84" Flow Length=405' Tc=9.7 min CN=83 Runoff=22.2 cfs 1.726 af
Subcatchment 4S: North-East Area	Runoff Area=5.540 ac 51.08% Impervious Runoff Depth>4.15" Flow Length=400' Tc=11.4 min CN=86 Runoff=23.3 cfs 1.917 af
Subcatchment 5S: Central Ave West	Runoff Area=6.720 ac 23.07% Impervious Runoff Depth>3.43" Flow Length=230' Tc=24.0 min CN=79 Runoff=18.0 cfs 1.918 af
Subcatchment BWS: Bates Walk	Runoff Area=2.824 ac 35.20% Impervious Runoff Depth>4.37" Flow Length=200' Tc=6.1 min CN=88 Runoff=14.4 cfs 1.029 af
Subcatchment DINS: Dining Facility Building	Runoff Area=1.049 ac 100.00% Impervious Runoff Depth>5.50" Tc=5.0 min CN=98 Runoff=6.2 cfs 0.481 af
Subcatchment FLDS: Synthetic Field	Runoff Area=2.900 ac 6.90% Impervious Runoff Depth>3.15" Flow Length=350' Slope=0.0050 '/' Tc=5.9 min CN=76 Runoff=11.3 cfs 0.762 af
Subcatchment LAS: Lake Andrew	Runoff Area=2.960 ac 81.08% Impervious Runoff Depth>4.92" Tc=5.0 min CN=93 Runoff=16.8 cfs 1.215 af
Pond 3-4P: Engineered Stone Base	Peak Elev=250.47' Storage=4,173 cf Inflow=11.3 cfs 0.762 af Discarded=0.4 cfs 0.072 af Primary=4.5 cfs 0.690 af Outflow=4.9 cfs 0.762 af
Pond 3P: Study Point #1	Peak Elev=230.49' Inflow=24.5 cfs 10.269 af 24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/' Outflow=24.5 cfs 10.269 af
Pond 15-in SD: (new Pond)	Peak Elev=250.41' Storage=11,987 cf Inflow=18.0 cfs 1.918 af 15.0" Round Culvert n=0.011 L=375.0' S=0.0053 '/' Outflow=9.4 cfs 1.981 af
Pond 16P: 15" SD	Peak Elev=247.81' Inflow=10.9 cfs 2.445 af 15.0" Round Culvert n=0.011 L=20.0' S=0.0100 '/' Outflow=10.9 cfs 2.445 af
Pond 17P: 18" SD	Peak Elev=239.77' Inflow=17.0 cfs 3.462 af 18.0" Round Culvert n=0.011 L=280.0' S=0.0129 '/' Outflow=17.0 cfs 3.462 af
Pond 18P: 15" SD	Peak Elev=241.65' Inflow=4.5 cfs 0.690 af 15.0" Round Culvert n=0.011 L=300.0' S=0.0050 '/' Outflow=4.5 cfs 0.690 af
Pond 21P: 18" SD	Peak Elev=256.25' Inflow=27.7 cfs 2.608 af 18.0" Round Culvert n=0.011 L=260.0' S=0.0365 '/' Outflow=27.7 cfs 2.608 af

FINAL Bates College - Drainage Area C

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Type III 24-hr 50-Year Rainfall=6.00"

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Pond LA: LAKE ANDREWS

Peak Elev=232.09' Storage=234,097 cf Inflow=100.5 cfs 10.827 af
Outflow=15.9 cfs 9.503 af

Pond R-1: Rainstore

Peak Elev=238.34' Storage=9,802 cf Inflow=14.4 cfs 1.029 af
Outflow=6.5 cfs 1.018 af

Pond R-2: Rainstore

Peak Elev=247.54' Storage=7,991 cf Inflow=6.2 cfs 0.481 af
Outflow=1.7 cfs 0.463 af

Total Runoff Area = 35.773 ac Runoff Volume = 11.632 af Average Runoff Depth = 3.90"
62.02% Pervious = 22.185 ac 37.98% Impervious = 13.588 ac

FINAL Bates College - Drainage Area C

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Type III 24-hr 100-Year Rainfall=6.50"

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Russell Street	Runoff Area=3.010 ac 2.82% Impervious Runoff Depth>3.46" Flow Length=380' Slope=0.0400 '/' Tc=9.1 min CN=75 Runoff=11.6 cfs 0.868 af
Subcatchment 2S: Western Campus Area	Runoff Area=5.380 ac 47.03% Impervious Runoff Depth>4.50" Flow Length=280' Tc=9.3 min CN=85 Runoff=25.9 cfs 2.018 af
Subcatchment 3S: Central Area	Runoff Area=5.390 ac 36.18% Impervious Runoff Depth>4.29" Flow Length=405' Tc=9.7 min CN=83 Runoff=24.7 cfs 1.925 af
Subcatchment 4S: North-East Area	Runoff Area=5.540 ac 51.08% Impervious Runoff Depth>4.61" Flow Length=400' Tc=11.4 min CN=86 Runoff=25.7 cfs 2.127 af
Subcatchment 5S: Central Ave West	Runoff Area=6.720 ac 23.07% Impervious Runoff Depth>3.85" Flow Length=230' Tc=24.0 min CN=79 Runoff=20.2 cfs 2.156 af
Subcatchment BWS: Bates Walk	Runoff Area=2.824 ac 35.20% Impervious Runoff Depth>4.83" Flow Length=200' Tc=6.1 min CN=88 Runoff=15.9 cfs 1.137 af
Subcatchment DINS: Dining Facility Building	Runoff Area=1.049 ac 100.00% Impervious Runoff Depth>5.98" Tc=5.0 min CN=98 Runoff=6.7 cfs 0.523 af
Subcatchment FLDS: Synthetic Field	Runoff Area=2.900 ac 6.90% Impervious Runoff Depth>3.57" Flow Length=350' Slope=0.0050 '/' Tc=5.9 min CN=76 Runoff=12.7 cfs 0.862 af
Subcatchment LAS: Lake Andrew	Runoff Area=2.960 ac 81.08% Impervious Runoff Depth>5.40" Tc=5.0 min CN=93 Runoff=18.3 cfs 1.331 af
Pond 3-4P: Engineered Stone Base	Peak Elev=250.50' Storage=5,407 cf Inflow=12.7 cfs 0.862 af Discarded=0.4 cfs 0.081 af Primary=4.6 cfs 0.781 af Outflow=5.1 cfs 0.861 af
Pond 3P: Study Point #1	Peak Elev=231.04' Inflow=26.0 cfs 11.306 af 24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/' Outflow=26.0 cfs 11.306 af
Pond 15-in SD: (new Pond)	Peak Elev=250.80' Storage=15,568 cf Inflow=20.2 cfs 2.156 af 15.0" Round Culvert n=0.011 L=375.0' S=0.0053 '/' Outflow=9.6 cfs 2.213 af
Pond 16P: 15" SD	Peak Elev=248.24' Inflow=11.3 cfs 2.717 af 15.0" Round Culvert n=0.011 L=20.0' S=0.0100 '/' Outflow=11.3 cfs 2.717 af
Pond 17P: 18" SD	Peak Elev=240.77' Inflow=18.3 cfs 3.842 af 18.0" Round Culvert n=0.011 L=280.0' S=0.0129 '/' Outflow=18.3 cfs 3.842 af
Pond 18P: 15" SD	Peak Elev=241.72' Inflow=4.6 cfs 0.781 af 15.0" Round Culvert n=0.011 L=300.0' S=0.0050 '/' Outflow=4.6 cfs 0.781 af
Pond 21P: 18" SD	Peak Elev=259.46' Inflow=30.2 cfs 2.908 af 18.0" Round Culvert n=0.011 L=260.0' S=0.0365 '/' Outflow=30.2 cfs 2.908 af

FINAL Bates College - Drainage Area C

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Type III 24-hr 100-Year Rainfall=6.50"

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Pond LA: LAKE ANDREWS

Peak Elev=232.34' Storage=264,082 cf Inflow=110.0 cfs 12.024 af
Outflow=16.2 cfs 10.437 af

Pond R-1: Rainstore

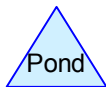
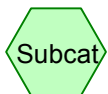
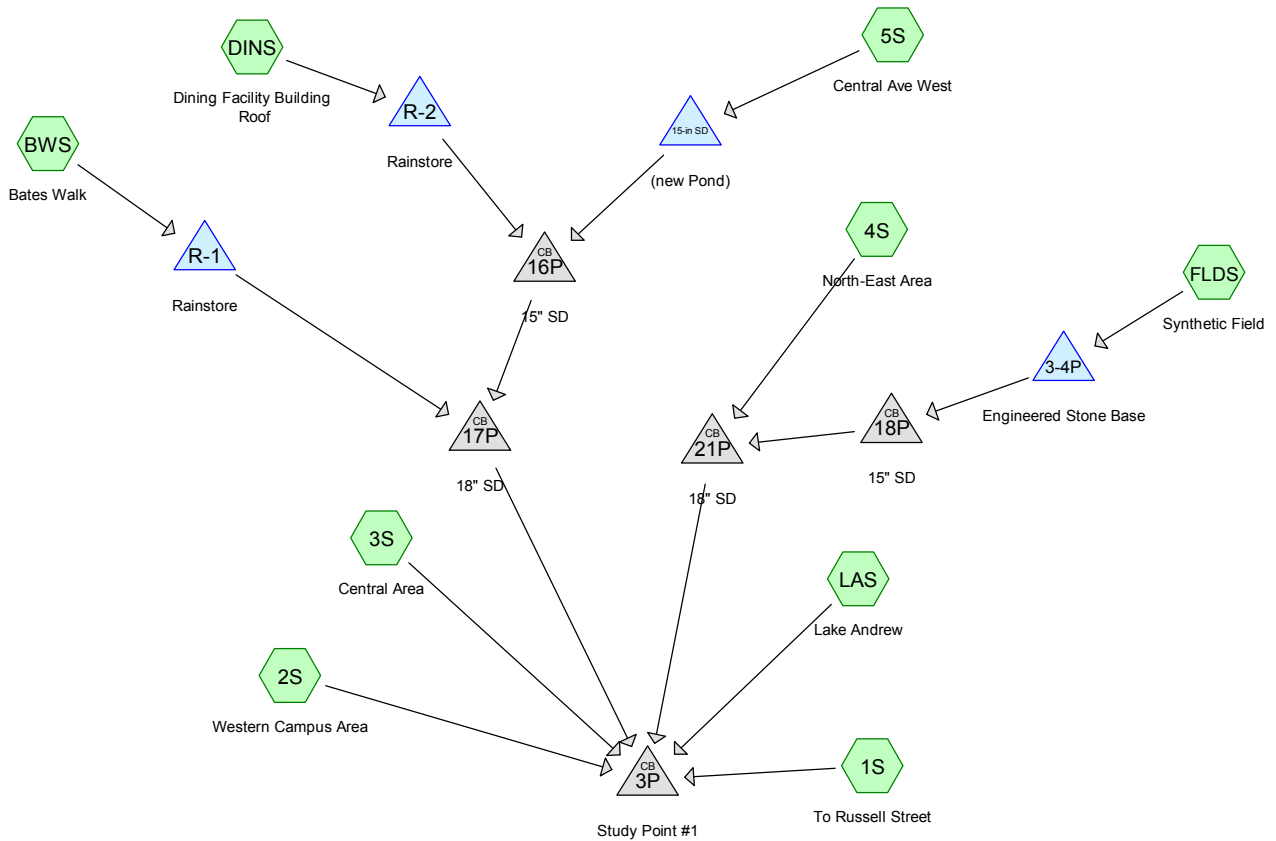
Peak Elev=238.77' Storage=10,697 cf Inflow=15.9 cfs 1.137 af
Outflow=7.7 cfs 1.125 af

Pond R-2: Rainstore

Peak Elev=247.75' Storage=8,546 cf Inflow=6.7 cfs 0.523 af
Outflow=1.9 cfs 0.503 af

Total Runoff Area = 35.773 ac Runoff Volume = 12.948 af Average Runoff Depth = 4.34"
62.02% Pervious = 22.185 ac 37.98% Impervious = 13.588 ac

APPENDIX 2
HYDROLOGIC MODEL 2 -
DRAINAGE AREA
DIRECT TO CITY OF LEWISTON'S SYSTEM



Drainage Diagram for FINAL Bates College - Drainage Area C No Lake Andrews

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
 Runoff by SCS TR-20 method, UH=SCS
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Russell Street	Runoff Area=3.010 ac 2.82% Impervious Runoff Depth>2.58" Flow Length=380' Slope=0.0400 '/ Tc=9.1 min CN=75 Runoff=8.6 cfs 0.647 af
Subcatchment 2S: Western Campus Area	Runoff Area=5.380 ac 47.03% Impervious Runoff Depth>3.52" Flow Length=280' Tc=9.3 min CN=85 Runoff=20.4 cfs 1.576 af
Subcatchment 3S: Central Area	Runoff Area=5.390 ac 36.18% Impervious Runoff Depth>3.32" Flow Length=405' Tc=9.7 min CN=83 Runoff=19.3 cfs 1.490 af
Subcatchment 4S: North-East Area	Runoff Area=5.540 ac 51.08% Impervious Runoff Depth>3.61" Flow Length=400' Tc=11.4 min CN=86 Runoff=20.4 cfs 1.668 af
Subcatchment 5S: Central Ave West	Runoff Area=6.720 ac 23.07% Impervious Runoff Depth>2.93" Flow Length=230' Tc=24.0 min CN=79 Runoff=15.4 cfs 1.638 af
Subcatchment BWS: Bates Walk	Runoff Area=2.824 ac 35.20% Impervious Runoff Depth>3.82" Flow Length=200' Tc=6.1 min CN=88 Runoff=12.7 cfs 0.900 af
Subcatchment DINS: Dining Facility Building	Runoff Area=1.049 ac 100.00% Impervious Runoff Depth>4.93" Tc=5.0 min CN=98 Runoff=5.6 cfs 0.431 af
Subcatchment FLDS: Synthetic Field	Runoff Area=2.900 ac 6.90% Impervious Runoff Depth>2.67" Flow Length=350' Slope=0.0050 '/ Tc=5.9 min CN=76 Runoff=9.6 cfs 0.645 af
Subcatchment LAS: Lake Andrew	Runoff Area=2.960 ac 81.08% Impervious Runoff Depth>4.36" Tc=5.0 min CN=93 Runoff=15.0 cfs 1.075 af
Pond 3-4P: Engineered Stone Base	Peak Elev=250.43' Storage=2,823 cf Inflow=9.6 cfs 0.645 af Discarded=0.4 cfs 0.061 af Primary=4.3 cfs 0.584 af Outflow=4.8 cfs 0.645 af
Pond 3P: Study Point #1	Peak Elev=293.28' Inflow=97.8 cfs 9.918 af 24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/ Outflow=97.8 cfs 9.918 af
Pond 15-in SD: (new Pond)	Peak Elev=249.94' Storage=8,038 cf Inflow=15.4 cfs 1.638 af 15.0" Round Culvert n=0.011 L=375.0' S=0.0053 '/ Outflow=9.0 cfs 1.573 af
Pond 16P: 15" SD	Peak Elev=247.25' Inflow=10.3 cfs 1.988 af 15.0" Round Culvert n=0.011 L=20.0' S=0.0100 '/ Outflow=10.3 cfs 1.988 af
Pond 17P: 18" SD	Peak Elev=238.81' Inflow=15.7 cfs 2.877 af 18.0" Round Culvert n=0.011 L=280.0' S=0.0129 '/ Outflow=15.7 cfs 2.877 af
Pond 18P: 15" SD	Peak Elev=241.59' Inflow=4.3 cfs 0.584 af 15.0" Round Culvert n=0.011 L=300.0' S=0.0050 '/ Outflow=4.3 cfs 0.584 af
Pond 21P: 18" SD	Peak Elev=252.80' Inflow=24.7 cfs 2.252 af 18.0" Round Culvert n=0.011 L=260.0' S=0.0365 '/ Outflow=24.7 cfs 2.252 af

Pond R-1: Rainstore Peak Elev=237.73' Storage=8,549 cf Inflow=12.7 cfs 0.900 af
Outflow=5.7 cfs 0.889 af

Pond R-2: Rainstore Peak Elev=247.30' Storage=7,373 cf Inflow=5.6 cfs 0.431 af
Outflow=1.4 cfs 0.415 af

Total Runoff Area = 35.773 ac Runoff Volume = 10.071 af Average Runoff Depth = 3.38"
62.02% Pervious = 22.185 ac 37.98% Impervious = 13.588 ac

Summary for Subcatchment 1S: To Russell Street

Runoff = 8.6 cfs @ 12.13 hrs, Volume= 0.647 af, Depth> 2.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
0.085	98	Paved parking, HSG C
2.925	74	>75% Grass cover, Good, HSG C
3.010	75	Weighted Average
2.925		97.18% Pervious Area
0.085		2.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.0400	0.22		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
1.4	280	0.0400	3.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.1	380	Total			

Summary for Subcatchment 2S: Western Campus Area

Runoff = 20.4 cfs @ 12.13 hrs, Volume= 1.576 af, Depth> 3.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 2.530	98	Paved Parking & Roofs
2.850	74	>75% Grass cover, Good, HSG C
5.380	85	Weighted Average
2.850		52.97% Pervious Area
2.530		47.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	100	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
0.3	80	0.0400	4.06		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	100	0.0600	3.94		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.3	280	Total			

FINAL Bates College - Drainage Area C No Lake Andrew Type III 24-hr 25-Year Rainfall=5.40"

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Summary for Subcatchment 3S: Central Area

Runoff = 19.3 cfs @ 12.14 hrs, Volume= 1.490 af, Depth> 3.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 1.950	98	Paved Parking & Roofs
3.440	74	>75% Grass cover, Good, HSG C
5.390	83	Weighted Average
3.440		63.82% Pervious Area
1.950		36.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	100	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
0.8	200	0.0400	4.06		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.3	105	0.1000	5.09		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.7	405	Total			

Summary for Subcatchment 4S: North-East Area

Runoff = 20.4 cfs @ 12.16 hrs, Volume= 1.668 af, Depth> 3.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 2.830	98	Paved Parking & Roofs
2.710	74	>75% Grass cover, Good, HSG C
5.540	86	Weighted Average
2.710		48.92% Pervious Area
2.830		51.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	100	0.0200	0.16		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
1.3	300	0.0050	3.79	2.98	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
11.4	400	Total			

Summary for Subcatchment 5S: Central Ave West

Runoff = 15.4 cfs @ 12.33 hrs, Volume= 1.638 af, Depth> 2.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 1.550	98	Paved Parking & Roofs
4.520	74	>75% Grass cover, Good, HSG C
0.650	70	Woods, Good, HSG C
6.720	79	Weighted Average
5.170		76.93% Pervious Area
1.550		23.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.2	100	0.0200	0.08		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
1.8	130	0.0300	1.21		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
24.0	230	Total			

Summary for Subcatchment BWS: Bates Walk

Runoff = 12.7 cfs @ 12.09 hrs, Volume= 0.900 af, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 0.994	98	Paved Parking & Roofs
0.821	74	>75% Grass cover, Good, HSG C
1.009	89	Gravel roads, HSG C
2.824	88	Weighted Average
1.830		64.80% Pervious Area
0.994		35.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	70	0.0500	0.22		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
0.8	130	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.1	200	Total			

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Summary for Subcatchment DINS: Dining Facility Building Roof

Runoff = 5.6 cfs @ 12.07 hrs, Volume= 0.431 af, Depth> 4.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
* 1.049	98	Paved Parking & Roofs
1.049		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Minimum Tc Used

Summary for Subcatchment FLDS: Synthetic Field

Runoff = 9.6 cfs @ 12.09 hrs, Volume= 0.645 af, Depth> 2.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
2.060	74	>75% Grass cover, Good, HSG C
0.200	98	Paved parking, HSG C
0.640	74	>75% Grass cover, Good, HSG C
2.900	76	Weighted Average
2.700		93.10% Pervious Area
0.200		6.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	100	0.0050	0.76		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.00"
3.7	250	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
5.9	350	Total			

Summary for Subcatchment LAS: Lake Andrew

Runoff = 15.0 cfs @ 12.07 hrs, Volume= 1.075 af, Depth> 4.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

FINAL Bates College - Drainage Area C No Lake Andrew Type III 24-hr 25-Year Rainfall=5.40"

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Area (ac)	CN	Description
2.130	98	Water Surface, HSG C
* 0.270	98	Paved Parking & Roofs
0.560	74	>75% Grass cover, Good, HSG C
2.960	93	Weighted Average
0.560		18.92% Pervious Area
2.400		81.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Pond 3-4P: Engineered Stone Base

Inflow Area = 2.900 ac, 6.90% Impervious, Inflow Depth > 2.67" for 25-Year event
 Inflow = 9.6 cfs @ 12.09 hrs, Volume= 0.645 af
 Outflow = 4.8 cfs @ 12.26 hrs, Volume= 0.645 af, Atten= 50%, Lag= 10.2 min
 Discarded = 0.4 cfs @ 12.00 hrs, Volume= 0.061 af
 Primary = 4.3 cfs @ 12.26 hrs, Volume= 0.584 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 250.43' @ 12.26 hrs Surf.Area= 89,856 sf Storage= 2,823 cf

Plug-Flow detention time= 3.4 min calculated for 0.643 af (100% of inflow)
 Center-of-Mass det. time= 3.2 min (795.8 - 792.6)

Volume	Invert	Avail.Storage	Storage Description
#1	250.35'	35,942 cf	234.00'W x 384.00'L x 1.00'H Prismatic 89,856 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	247.40'	12.0" Round Culvert L= 180.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 246.20' S= 0.0067 ' S= 0.0067 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior
#2	Primary	250.35'	Custom Weir/Orifice X 14.00, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 Width (feet) 0.08 1.00
#3	Discarded	250.35'	0.213 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.4 cfs @ 12.00 hrs HW=250.36' (Free Discharge)
 ↳ **3=Exfiltration** (Exfiltration Controls 0.4 cfs)

Primary OutFlow Max=4.3 cfs @ 12.26 hrs HW=250.43' (Free Discharge)
 ↳ **1=Culvert** (Barrel Controls 4.2 cfs @ 5.39 fps)
 ↳ **2=Custom Weir/Orifice** (Weir Controls 0.1 cfs @ 0.86 fps)

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Summary for Pond 3P: Study Point #1

Inflow Area = 35.773 ac, 37.98% Impervious, Inflow Depth > 3.33" for 25-Year event
 Inflow = 97.8 cfs @ 12.13 hrs, Volume= 9.918 af
 Outflow = 97.8 cfs @ 12.13 hrs, Volume= 9.918 af, Atten= 0%, Lag= 0.0 min
 Primary = 97.8 cfs @ 12.13 hrs, Volume= 9.918 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 293.28' @ 12.13 hrs
 Flood Elev= 231.12'

Device	Routing	Invert	Outlet Devices
#1	Primary	225.30'	24.0" Round Culvert L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 225.20' S= 0.0010 '/' Cc= 0.900 n= 0.010 PVC, smooth interior

Primary OutFlow Max=96.5 cfs @ 12.13 hrs HW=291.53' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 96.5 cfs @ 30.70 fps)

Summary for Pond 15-in SD: (new Pond)

Inflow Area = 6.720 ac, 23.07% Impervious, Inflow Depth > 2.93" for 25-Year event
 Inflow = 15.4 cfs @ 12.33 hrs, Volume= 1.638 af
 Outflow = 9.0 cfs @ 12.65 hrs, Volume= 1.573 af, Atten= 41%, Lag= 18.9 min
 Primary = 9.0 cfs @ 12.65 hrs, Volume= 1.573 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 249.94' @ 12.65 hrs Surf.Area= 7,781 sf Storage= 8,038 cf

Plug-Flow detention time= 18.6 min calculated for 1.569 af (96% of inflow)
 Center-of-Mass det. time= 4.3 min (805.0 - 800.7)

Volume	Invert	Avail.Storage	Storage Description
#1	248.00'	17,500 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
248.00	500	0	0
250.00	8,000	8,500	8,500
251.00	10,000	9,000	17,500

Device	Routing	Invert	Outlet Devices
#1	Primary	243.80'	15.0" Round Culvert L= 375.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 241.80' S= 0.0053 '/' Cc= 0.900 n= 0.011

Primary OutFlow Max=9.0 cfs @ 12.65 hrs HW=249.94' (Free Discharge)
 ↑**1=Culvert** (Barrel Controls 9.0 cfs @ 7.37 fps)

Summary for Pond 16P: 15" SD

Inflow Area = 7.769 ac, 33.45% Impervious, Inflow Depth > 3.07" for 25-Year event
 Inflow = 10.3 cfs @ 12.53 hrs, Volume= 1.988 af
 Outflow = 10.3 cfs @ 12.53 hrs, Volume= 1.988 af, Atten= 0%, Lag= 0.0 min
 Primary = 10.3 cfs @ 12.53 hrs, Volume= 1.988 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 247.25' @ 12.53 hrs

Flood Elev= 250.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	241.70'	15.0" Round Culvert L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 241.50' S= 0.0100 1/ S= 0.0100 1/ Cc= 0.900 n= 0.011

Primary OutFlow Max=10.3 cfs @ 12.53 hrs HW=247.24' (Free Discharge)

↑**1=Culvert** (Inlet Controls 10.3 cfs @ 8.43 fps)

Summary for Pond 17P: 18" SD

Inflow Area = 10.593 ac, 33.92% Impervious, Inflow Depth > 3.26" for 25-Year event
 Inflow = 15.7 cfs @ 12.38 hrs, Volume= 2.877 af
 Outflow = 15.7 cfs @ 12.38 hrs, Volume= 2.877 af, Atten= 0%, Lag= 0.0 min
 Primary = 15.7 cfs @ 12.38 hrs, Volume= 2.877 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 238.81' @ 12.38 hrs

Flood Elev= 249.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	232.60'	18.0" Round Culvert L= 280.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 229.00' S= 0.0129 1/ S= 0.0129 1/ Cc= 0.900 n= 0.011

Primary OutFlow Max=15.7 cfs @ 12.38 hrs HW=238.80' (Free Discharge)

↑**1=Culvert** (Inlet Controls 15.7 cfs @ 8.88 fps)

Summary for Pond 18P: 15" SD

Inflow Area = 2.900 ac, 6.90% Impervious, Inflow Depth > 2.42" for 25-Year event
 Inflow = 4.3 cfs @ 12.26 hrs, Volume= 0.584 af
 Outflow = 4.3 cfs @ 12.26 hrs, Volume= 0.584 af, Atten= 0%, Lag= 0.0 min
 Primary = 4.3 cfs @ 12.26 hrs, Volume= 0.584 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 241.59' @ 12.26 hrs

Flood Elev= 250.45'

FINAL Bates College - Drainage Area C No Lake Andrew Type III 24-hr 25-Year Rainfall=5.40"

Prepared by Wright-Pierce

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Device	Routing	Invert	Outlet Devices
#1	Primary	240.10'	15.0" Round Culvert L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 238.60' S= 0.0050 '/' Cc= 0.900 n= 0.011

Primary OutFlow Max=4.3 cfs @ 12.26 hrs HW=241.59' (Free Discharge)

↑**1=Culvert** (Inlet Controls 4.3 cfs @ 3.54 fps)

Summary for Pond 21P: 18" SD

Inflow Area = 8.440 ac, 35.90% Impervious, Inflow Depth > 3.20" for 25-Year event
 Inflow = 24.7 cfs @ 12.16 hrs, Volume= 2.252 af
 Outflow = 24.7 cfs @ 12.16 hrs, Volume= 2.252 af, Atten= 0%, Lag= 0.0 min
 Primary = 24.7 cfs @ 12.16 hrs, Volume= 2.252 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 252.80' @ 12.16 hrs
 Flood Elev= 250.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.50'	18.0" Round Culvert L= 260.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 229.00' S= 0.0365 '/' Cc= 0.900 n= 0.011

Primary OutFlow Max=24.5 cfs @ 12.16 hrs HW=252.56' (Free Discharge)

↑**1=Culvert** (Inlet Controls 24.5 cfs @ 13.87 fps)

Summary for Pond R-1: Rainstore

Inflow Area = 2.824 ac, 35.20% Impervious, Inflow Depth > 3.82" for 25-Year event
 Inflow = 12.7 cfs @ 12.09 hrs, Volume= 0.900 af
 Outflow = 5.7 cfs @ 12.28 hrs, Volume= 0.889 af, Atten= 55%, Lag= 11.3 min
 Primary = 5.7 cfs @ 12.28 hrs, Volume= 0.889 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 237.73' @ 12.28 hrs Surf.Area= 2,178 sf Storage= 8,549 cf

Plug-Flow detention time= 24.1 min calculated for 0.889 af (99% of inflow)
 Center-of-Mass det. time= 19.1 min (783.6 - 764.5)

Volume	Invert	Avail.Storage	Storage Description
#1	233.55'	16,379 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 17,424 cf Overall x 94.0% Voids

FINAL Bates College - Drainage Area C No Lake Andrew Type III 24-hr 25-Year Rainfall=5.40"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
233.55	2,178	0	0
234.55	2,178	2,178	2,178
235.55	2,178	2,178	4,356
236.55	2,178	2,178	6,534
237.55	2,178	2,178	8,712
238.55	2,178	2,178	10,890
239.55	2,178	2,178	13,068
241.55	2,178	4,356	17,424

Device	Routing	Invert	Outlet Devices
#1	Primary	233.25'	18.0" Round Culvert L= 20.0' Ke= 0.010 Outlet Invert= 232.70' S= 0.0275 '/' Cc= 0.900 n= 0.013
#2	Device 1	233.55'	10.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	237.00'	6.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	238.30'	10.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=5.7 cfs @ 12.28 hrs HW=237.72' (Free Discharge)

- 1=Culvert (Passes 5.7 cfs of 22.7 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 5.1 cfs @ 9.33 fps)
- 3=Orifice/Grate (Orifice Controls 0.6 cfs @ 3.29 fps)
- 4=Orifice/Grate (Controls 0.0 cfs)

Summary for Pond R-2: Rainstore

Inflow Area = 1.049 ac, 100.00% Impervious, Inflow Depth > 4.93" for 25-Year event
 Inflow = 5.6 cfs @ 12.07 hrs, Volume= 0.431 af
 Outflow = 1.4 cfs @ 12.43 hrs, Volume= 0.415 af, Atten= 75%, Lag= 21.9 min
 Primary = 1.4 cfs @ 12.43 hrs, Volume= 0.415 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 247.30' @ 12.43 hrs Surf.Area= 2,800 sf Storage= 7,373 cf

Plug-Flow detention time= 107.6 min calculated for 0.414 af (96% of inflow)
 Center-of-Mass det. time= 92.3 min (811.0 - 718.7)

Volume	Invert	Avail.Storage	Storage Description
#1	244.50'	8,765 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 9,324 cf Overall x 94.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
244.50	2,800	0	0
245.50	2,800	2,800	2,800
246.50	2,800	2,800	5,600
247.83	2,800	3,724	9,324

FINAL Bates College - Drainage Area C No Lake Andrew Type III 24-hr 25-Year Rainfall=5.40"

Prepared by Wright-Pierce

Printed 8/17/2010

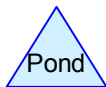
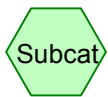
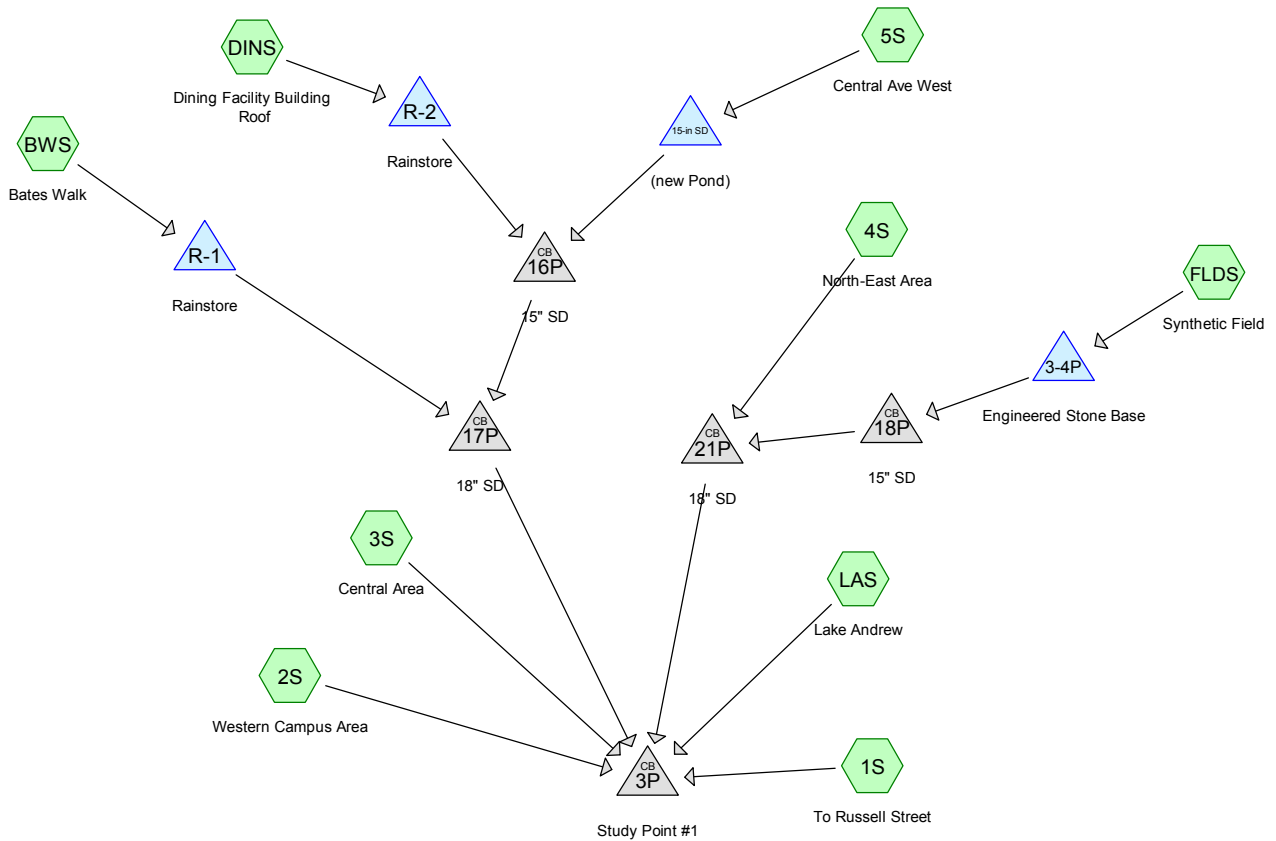
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Device	Routing	Invert	Outlet Devices
#1	Primary	244.50'	12.0" Round Culvert L= 160.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 242.90' S= 0.0100 '/' Cc= 0.900 n= 0.013
#2	Device 1	244.50'	4.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	246.20'	4.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	246.94'	6.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=1.4 cfs @ 12.43 hrs HW=247.30' (Free Discharge)

- ↑ **1=Culvert** (Passes 1.4 cfs of 4.5 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.7 cfs @ 7.81 fps)
- ↑ **3=Orifice/Grate** (Orifice Controls 0.4 cfs @ 4.65 fps)
- ↑ **4=Orifice/Grate** (Orifice Controls 0.3 cfs @ 2.04 fps)



Drainage Diagram for FINAL Bates College - Drainage Area C No Lake Andrews

Prepared by Wright-Pierce, Printed 8/17/2010

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
 Runoff by SCS TR-20 method, UH=SCS
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Russell Street	Runoff Area=3.010 ac 2.82% Impervious Runoff Depth>0.87" Flow Length=380' Slope=0.0400 '/' Tc=9.1 min CN=75 Runoff=2.8 cfs 0.219 af
Subcatchment 2S: Western Campus Area	Runoff Area=5.380 ac 47.03% Impervious Runoff Depth>1.48" Flow Length=280' Tc=9.3 min CN=85 Runoff=8.8 cfs 0.662 af
Subcatchment 3S: Central Area	Runoff Area=5.390 ac 36.18% Impervious Runoff Depth>1.34" Flow Length=405' Tc=9.7 min CN=83 Runoff=7.9 cfs 0.602 af
Subcatchment 4S: North-East Area	Runoff Area=5.540 ac 51.08% Impervious Runoff Depth>1.55" Flow Length=400' Tc=11.4 min CN=86 Runoff=9.0 cfs 0.714 af
Subcatchment 5S: Central Ave West	Runoff Area=6.720 ac 23.07% Impervious Runoff Depth>1.09" Flow Length=230' Tc=24.0 min CN=79 Runoff=5.7 cfs 0.608 af
Subcatchment BWS: Bates Walk	Runoff Area=2.824 ac 35.20% Impervious Runoff Depth>1.70" Flow Length=200' Tc=6.1 min CN=88 Runoff=5.9 cfs 0.400 af
Subcatchment DINS: Dining Facility Building	Runoff Area=1.049 ac 100.00% Impervious Runoff Depth>2.64" Tc=5.0 min CN=98 Runoff=3.1 cfs 0.231 af
Subcatchment FLDS: Synthetic Field	Runoff Area=2.900 ac 6.90% Impervious Runoff Depth>0.93" Flow Length=350' Slope=0.0050 '/' Tc=5.9 min CN=76 Runoff=3.3 cfs 0.224 af
Subcatchment LAS: Lake Andrew	Runoff Area=2.960 ac 81.08% Impervious Runoff Depth>2.13" Tc=5.0 min CN=93 Runoff=7.6 cfs 0.525 af
Pond 3-4P: Engineered Stone Base	Peak Elev=250.36' Storage=243 cf Inflow=3.3 cfs 0.224 af Discarded=0.3 cfs 0.021 af Primary=2.8 cfs 0.203 af Outflow=3.1 cfs 0.224 af
Pond 3P: Study Point #1	Peak Elev=239.44' Inflow=43.3 cfs 4.147 af 24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/' Outflow=43.3 cfs 4.147 af
Pond 15-in SD: (new Pond)	Peak Elev=248.02' Storage=12 cf Inflow=5.7 cfs 0.608 af 15.0" Round Culvert n=0.011 L=375.0' S=0.0053 '/' Outflow=5.7 cfs 0.608 af
Pond 16P: 15" SD	Peak Elev=244.07' Inflow=6.2 cfs 0.829 af 15.0" Round Culvert n=0.011 L=20.0' S=0.0100 '/' Outflow=6.2 cfs 0.829 af
Pond 17P: 18" SD	Peak Elev=235.18' Inflow=9.1 cfs 1.222 af 18.0" Round Culvert n=0.011 L=280.0' S=0.0129 '/' Outflow=9.1 cfs 1.222 af
Pond 18P: 15" SD	Peak Elev=241.10' Inflow=2.8 cfs 0.203 af 15.0" Round Culvert n=0.011 L=300.0' S=0.0050 '/' Outflow=2.8 cfs 0.203 af
Pond 21P: 18" SD	Peak Elev=242.25' Inflow=11.6 cfs 0.917 af 18.0" Round Culvert n=0.011 L=260.0' S=0.0365 '/' Outflow=11.6 cfs 0.917 af

Pond R-1: Rainstore Peak Elev=235.27' Storage=3,513 cf Inflow=5.9 cfs 0.400 af
Outflow=3.0 cfs 0.393 af

Pond R-2: Rainstore Peak Elev=246.10' Storage=4,199 cf Inflow=3.1 cfs 0.231 af
Outflow=0.5 cfs 0.221 af

Total Runoff Area = 35.773 ac Runoff Volume = 4.185 af Average Runoff Depth = 1.40"
62.02% Pervious = 22.185 ac 37.98% Impervious = 13.588 ac

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
 Runoff by SCS TR-20 method, UH=SCS
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Russell Street	Runoff Area=3.010 ac 2.82% Impervious Runoff Depth>1.97" Flow Length=380' Slope=0.0400 '/' Tc=9.1 min CN=75 Runoff=6.6 cfs 0.494 af
Subcatchment 2S: Western Campus Area	Runoff Area=5.380 ac 47.03% Impervious Runoff Depth>2.81" Flow Length=280' Tc=9.3 min CN=85 Runoff=16.5 cfs 1.261 af
Subcatchment 3S: Central Area	Runoff Area=5.390 ac 36.18% Impervious Runoff Depth>2.63" Flow Length=405' Tc=9.7 min CN=83 Runoff=15.4 cfs 1.182 af
Subcatchment 4S: North-East Area	Runoff Area=5.540 ac 51.08% Impervious Runoff Depth>2.90" Flow Length=400' Tc=11.4 min CN=86 Runoff=16.6 cfs 1.341 af
Subcatchment 5S: Central Ave West	Runoff Area=6.720 ac 23.07% Impervious Runoff Depth>2.28" Flow Length=230' Tc=24.0 min CN=79 Runoff=12.1 cfs 1.275 af
Subcatchment BWS: Bates Walk	Runoff Area=2.824 ac 35.20% Impervious Runoff Depth>3.10" Flow Length=200' Tc=6.1 min CN=88 Runoff=10.4 cfs 0.730 af
Subcatchment DINS: Dining Facility Building	Runoff Area=1.049 ac 100.00% Impervious Runoff Depth>4.16" Tc=5.0 min CN=98 Runoff=4.7 cfs 0.364 af
Subcatchment FLDS: Synthetic Field	Runoff Area=2.900 ac 6.90% Impervious Runoff Depth>2.05" Flow Length=350' Slope=0.0050 '/' Tc=5.9 min CN=76 Runoff=7.4 cfs 0.495 af
Subcatchment LAS: Lake Andrew	Runoff Area=2.960 ac 81.08% Impervious Runoff Depth>3.61" Tc=5.0 min CN=93 Runoff=12.6 cfs 0.890 af
Pond 3-4P: Engineered Stone Base	Peak Elev=250.39' Storage=1,392 cf Inflow=7.4 cfs 0.495 af Discarded=0.4 cfs 0.047 af Primary=4.2 cfs 0.448 af Outflow=4.7 cfs 0.495 af
Pond 3P: Study Point #1	Peak Elev=272.05' Inflow=80.8 cfs 7.933 af 24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/' Outflow=80.8 cfs 7.933 af
Pond 15-in SD: (new Pond)	Peak Elev=249.25' Storage=3,546 cf Inflow=12.1 cfs 1.275 af 15.0" Round Culvert n=0.011 L=375.0' S=0.0053 '/' Outflow=8.6 cfs 1.246 af
Pond 16P: 15" SD	Peak Elev=246.50' Inflow=9.5 cfs 1.597 af 15.0" Round Culvert n=0.011 L=20.0' S=0.0100 '/' Outflow=9.5 cfs 1.597 af
Pond 17P: 18" SD	Peak Elev=237.59' Inflow=13.8 cfs 2.317 af 18.0" Round Culvert n=0.011 L=280.0' S=0.0129 '/' Outflow=13.8 cfs 2.317 af
Pond 18P: 15" SD	Peak Elev=241.55' Inflow=4.2 cfs 0.448 af 15.0" Round Culvert n=0.011 L=300.0' S=0.0050 '/' Outflow=4.2 cfs 0.448 af
Pond 21P: 18" SD	Peak Elev=248.84' Inflow=20.8 cfs 1.789 af 18.0" Round Culvert n=0.011 L=260.0' S=0.0365 '/' Outflow=20.8 cfs 1.789 af

Pond R-1: Rainstore

Peak Elev=236.93' Storage=6,911 cf Inflow=10.4 cfs 0.730 af
Outflow=4.5 cfs 0.720 af

Pond R-2: Rainstore

Peak Elev=246.94' Storage=6,423 cf Inflow=4.7 cfs 0.364 af
Outflow=1.0 cfs 0.351 af

Total Runoff Area = 35.773 ac Runoff Volume = 8.033 af Average Runoff Depth = 2.69"
62.02% Pervious = 22.185 ac 37.98% Impervious = 13.588 ac

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
 Runoff by SCS TR-20 method, UH=SCS
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Russell Street	Runoff Area=3.010 ac 2.82% Impervious Runoff Depth>3.06" Flow Length=380' Slope=0.0400 '/' Tc=9.1 min CN=75 Runoff=10.2 cfs 0.766 af
Subcatchment 2S: Western Campus Area	Runoff Area=5.380 ac 47.03% Impervious Runoff Depth>4.05" Flow Length=280' Tc=9.3 min CN=85 Runoff=23.4 cfs 1.816 af
Subcatchment 3S: Central Area	Runoff Area=5.390 ac 36.18% Impervious Runoff Depth>3.84" Flow Length=405' Tc=9.7 min CN=83 Runoff=22.2 cfs 1.726 af
Subcatchment 4S: North-East Area	Runoff Area=5.540 ac 51.08% Impervious Runoff Depth>4.15" Flow Length=400' Tc=11.4 min CN=86 Runoff=23.3 cfs 1.917 af
Subcatchment 5S: Central Ave West	Runoff Area=6.720 ac 23.07% Impervious Runoff Depth>3.43" Flow Length=230' Tc=24.0 min CN=79 Runoff=18.0 cfs 1.918 af
Subcatchment BWS: Bates Walk	Runoff Area=2.824 ac 35.20% Impervious Runoff Depth>4.37" Flow Length=200' Tc=6.1 min CN=88 Runoff=14.4 cfs 1.029 af
Subcatchment DINS: Dining Facility Building	Runoff Area=1.049 ac 100.00% Impervious Runoff Depth>5.50" Tc=5.0 min CN=98 Runoff=6.2 cfs 0.481 af
Subcatchment FLDS: Synthetic Field	Runoff Area=2.900 ac 6.90% Impervious Runoff Depth>3.15" Flow Length=350' Slope=0.0050 '/' Tc=5.9 min CN=76 Runoff=11.3 cfs 0.762 af
Subcatchment LAS: Lake Andrew	Runoff Area=2.960 ac 81.08% Impervious Runoff Depth>4.92" Tc=5.0 min CN=93 Runoff=16.8 cfs 1.215 af
Pond 3-4P: Engineered Stone Base	Peak Elev=250.47' Storage=4,173 cf Inflow=11.3 cfs 0.762 af Discarded=0.4 cfs 0.072 af Primary=4.5 cfs 0.690 af Outflow=4.9 cfs 0.762 af
Pond 3P: Study Point #1	Peak Elev=312.19' Inflow=110.8 cfs 11.594 af 24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/' Outflow=110.8 cfs 11.594 af
Pond 15-in SD: (new Pond)	Peak Elev=250.41' Storage=11,987 cf Inflow=18.0 cfs 1.918 af 15.0" Round Culvert n=0.011 L=375.0' S=0.0053 '/' Outflow=9.4 cfs 1.981 af
Pond 16P: 15" SD	Peak Elev=247.81' Inflow=10.9 cfs 2.445 af 15.0" Round Culvert n=0.011 L=20.0' S=0.0100 '/' Outflow=10.9 cfs 2.445 af
Pond 17P: 18" SD	Peak Elev=239.77' Inflow=17.0 cfs 3.462 af 18.0" Round Culvert n=0.011 L=280.0' S=0.0129 '/' Outflow=17.0 cfs 3.462 af
Pond 18P: 15" SD	Peak Elev=241.65' Inflow=4.5 cfs 0.690 af 15.0" Round Culvert n=0.011 L=300.0' S=0.0050 '/' Outflow=4.5 cfs 0.690 af
Pond 21P: 18" SD	Peak Elev=256.25' Inflow=27.7 cfs 2.608 af 18.0" Round Culvert n=0.011 L=260.0' S=0.0365 '/' Outflow=27.7 cfs 2.608 af

Pond R-1: Rainstore

Peak Elev=238.34' Storage=9,802 cf Inflow=14.4 cfs 1.029 af
Outflow=6.5 cfs 1.018 af

Pond R-2: Rainstore

Peak Elev=247.54' Storage=7,991 cf Inflow=6.2 cfs 0.481 af
Outflow=1.7 cfs 0.463 af

Total Runoff Area = 35.773 ac Runoff Volume = 11.632 af Average Runoff Depth = 3.90"
62.02% Pervious = 22.185 ac 37.98% Impervious = 13.588 ac

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
 Runoff by SCS TR-20 method, UH=SCS
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

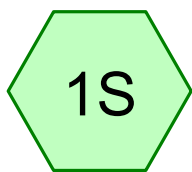
Subcatchment 1S: To Russell Street	Runoff Area=3.010 ac 2.82% Impervious Runoff Depth>3.46" Flow Length=380' Slope=0.0400 '/ Tc=9.1 min CN=75 Runoff=11.6 cfs 0.868 af
Subcatchment 2S: Western Campus Area	Runoff Area=5.380 ac 47.03% Impervious Runoff Depth>4.50" Flow Length=280' Tc=9.3 min CN=85 Runoff=25.9 cfs 2.018 af
Subcatchment 3S: Central Area	Runoff Area=5.390 ac 36.18% Impervious Runoff Depth>4.29" Flow Length=405' Tc=9.7 min CN=83 Runoff=24.7 cfs 1.925 af
Subcatchment 4S: North-East Area	Runoff Area=5.540 ac 51.08% Impervious Runoff Depth>4.61" Flow Length=400' Tc=11.4 min CN=86 Runoff=25.7 cfs 2.127 af
Subcatchment 5S: Central Ave West	Runoff Area=6.720 ac 23.07% Impervious Runoff Depth>3.85" Flow Length=230' Tc=24.0 min CN=79 Runoff=20.2 cfs 2.156 af
Subcatchment BWS: Bates Walk	Runoff Area=2.824 ac 35.20% Impervious Runoff Depth>4.83" Flow Length=200' Tc=6.1 min CN=88 Runoff=15.9 cfs 1.137 af
Subcatchment DINS: Dining Facility Building	Runoff Area=1.049 ac 100.00% Impervious Runoff Depth>5.98" Tc=5.0 min CN=98 Runoff=6.7 cfs 0.523 af
Subcatchment FLDS: Synthetic Field	Runoff Area=2.900 ac 6.90% Impervious Runoff Depth>3.57" Flow Length=350' Slope=0.0050 '/ Tc=5.9 min CN=76 Runoff=12.7 cfs 0.862 af
Subcatchment LAS: Lake Andrew	Runoff Area=2.960 ac 81.08% Impervious Runoff Depth>5.40" Tc=5.0 min CN=93 Runoff=18.3 cfs 1.331 af
Pond 3-4P: Engineered Stone Base	Peak Elev=250.50' Storage=5,407 cf Inflow=12.7 cfs 0.862 af Discarded=0.4 cfs 0.081 af Primary=4.6 cfs 0.781 af Outflow=5.1 cfs 0.861 af
Pond 3P: Study Point #1	Peak Elev=329.83' Inflow=121.6 cfs 12.893 af 24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/ Outflow=121.6 cfs 12.893 af
Pond 15-in SD: (new Pond)	Peak Elev=250.80' Storage=15,568 cf Inflow=20.2 cfs 2.156 af 15.0" Round Culvert n=0.011 L=375.0' S=0.0053 '/ Outflow=9.6 cfs 2.213 af
Pond 16P: 15" SD	Peak Elev=248.24' Inflow=11.3 cfs 2.717 af 15.0" Round Culvert n=0.011 L=20.0' S=0.0100 '/ Outflow=11.3 cfs 2.717 af
Pond 17P: 18" SD	Peak Elev=240.77' Inflow=18.3 cfs 3.842 af 18.0" Round Culvert n=0.011 L=280.0' S=0.0129 '/ Outflow=18.3 cfs 3.842 af
Pond 18P: 15" SD	Peak Elev=241.72' Inflow=4.6 cfs 0.781 af 15.0" Round Culvert n=0.011 L=300.0' S=0.0050 '/ Outflow=4.6 cfs 0.781 af
Pond 21P: 18" SD	Peak Elev=259.46' Inflow=30.2 cfs 2.908 af 18.0" Round Culvert n=0.011 L=260.0' S=0.0365 '/ Outflow=30.2 cfs 2.908 af

Pond R-1: Rainstore Peak Elev=238.77' Storage=10,697 cf Inflow=15.9 cfs 1.137 af
Outflow=7.7 cfs 1.125 af

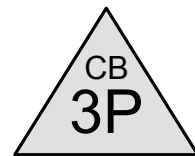
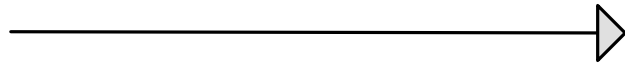
Pond R-2: Rainstore Peak Elev=247.75' Storage=8,546 cf Inflow=6.7 cfs 0.523 af
Outflow=1.9 cfs 0.503 af

Total Runoff Area = 35.773 ac Runoff Volume = 12.948 af Average Runoff Depth = 4.34"
62.02% Pervious = 22.185 ac 37.98% Impervious = 13.588 ac

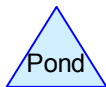
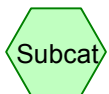
APPENDIX 3
HYDROLOGIC MODEL 3 -
DRAINAGE AREA MODELED AS UNDEVELOPED



No development



Study Point #1



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Type III 24-hr 25-Year Rainfall=5.40"

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: No development

Runoff Area=35.700 ac 0.00% Impervious Runoff Depth>2.29"

Flow Length=1,900' Slope=0.0400 '/' Tc=46.8 min CN=72 Runoff=47.2 cfs 6.806 af

Pond 3P: Study Point #1

Peak Elev=241.94' Inflow=47.2 cfs 6.806 af

24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/' Outflow=47.2 cfs 6.806 af

Total Runoff Area = 35.700 ac Runoff Volume = 6.806 af Average Runoff Depth = 2.29"

100.00% Pervious = 35.700 ac 0.00% Impervious = 0.000 ac

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Type III 24-hr 25-Year Rainfall=5.40"

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Summary for Subcatchment 1S: No development

Runoff = 47.2 cfs @ 12.66 hrs, Volume= 6.806 af, Depth> 2.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (ac)	CN	Description
35.700	72	Woods/grass comb., Good, HSG C
35.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	100	0.0400	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
30.0	1,800	0.0400	1.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
46.8	1,900	Total			

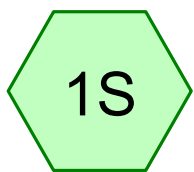
Summary for Pond 3P: Study Point #1

Inflow Area = 35.700 ac, 0.00% Impervious, Inflow Depth > 2.29" for 25-Year event
 Inflow = 47.2 cfs @ 12.66 hrs, Volume= 6.806 af
 Outflow = 47.2 cfs @ 12.66 hrs, Volume= 6.806 af, Atten= 0%, Lag= 0.0 min
 Primary = 47.2 cfs @ 12.66 hrs, Volume= 6.806 af

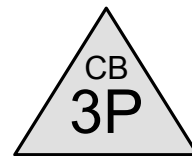
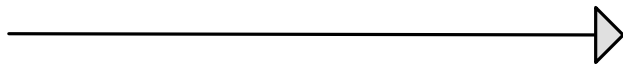
Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 241.94' @ 12.66 hrs
 Flood Elev= 231.12'

Device	Routing	Invert	Outlet Devices
#1	Primary	225.30'	24.0" Round Culvert L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 225.20' S= 0.0010 '/' Cc= 0.900 n= 0.010 PVC, smooth interior

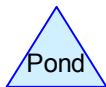
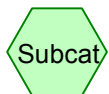
Primary OutFlow Max=47.2 cfs @ 12.66 hrs HW=241.89' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 47.2 cfs @ 15.01 fps)



No development



Study Point #1



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Type III 24-hr 2-Year Rainfall=3.00"

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: No development

Runoff Area=35.700 ac 0.00% Impervious Runoff Depth>0.72"

Flow Length=1,900' Slope=0.0400 '/ S_c=46.8 min CN=72 Runoff=13.8 cfs 2.130 af

Pond 3P: Study Point #1

Peak Elev=228.00' Inflow=13.8 cfs 2.130 af

24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/ Outflow=13.8 cfs 2.130 af

Total Runoff Area = 35.700 ac Runoff Volume = 2.130 af Average Runoff Depth = 0.72"

100.00% Pervious = 35.700 ac 0.00% Impervious = 0.000 ac

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Type III 24-hr 10-Year Rainfall=4.60"

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: No development

Runoff Area=35.700 ac 0.00% Impervious Runoff Depth>1.72"

Flow Length=1,900' Slope=0.0400 '/ S=0.0010 ' Tc=46.8 min CN=72 Runoff=35.2 cfs 5.106 af

Pond 3P: Study Point #1

Peak Elev=234.99' Inflow=35.2 cfs 5.106 af

24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/ Outflow=35.2 cfs 5.106 af

Total Runoff Area = 35.700 ac Runoff Volume = 5.106 af Average Runoff Depth = 1.72"

100.00% Pervious = 35.700 ac 0.00% Impervious = 0.000 ac

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Type III 24-hr 50-Year Rainfall=6.00"

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: No development

Runoff Area=35.700 ac 0.00% Impervious Runoff Depth>2.74"

Flow Length=1,900' Slope=0.0400 '/' Tc=46.8 min CN=72 Runoff=56.6 cfs 8.144 af

Pond 3P: Study Point #1

Peak Elev=248.75' Inflow=56.6 cfs 8.144 af

24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/' Outflow=56.6 cfs 8.144 af

Total Runoff Area = 35.700 ac Runoff Volume = 8.144 af Average Runoff Depth = 2.74"

100.00% Pervious = 35.700 ac 0.00% Impervious = 0.000 ac

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Type III 24-hr 100-Year Rainfall=6.50"

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Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: No development

Runoff Area=35.700 ac 0.00% Impervious Runoff Depth>3.12"

Flow Length=1,900' Slope=0.0400 '/ S_c=46.8 min CN=72 Runoff=64.6 cfs 9.292 af

Pond 3P: Study Point #1

Peak Elev=255.52' Inflow=64.6 cfs 9.292 af

24.0" Round Culvert n=0.010 L=100.0' S=0.0010 '/ Outflow=64.6 cfs 9.292 af

Total Runoff Area = 35.700 ac Runoff Volume = 9.292 af Average Runoff Depth = 3.12"

100.00% Pervious = 35.700 ac 0.00% Impervious = 0.000 ac