



## STORMWATER ANALYSIS REPORT

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TCE# 13-113 | SOUTH FORTY SOLAR, LLC  
BURLINGTON, VERMONT

Date:

March 31, 2014

Prepared For:

South Forty Solar, LLC

Prepared By:

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South Forty Solar Farm  
Burlington, Vermont  
Stormwater Analysis  
March 31, 2014



## 1. Introduction and Summary

The South Forty Solar Farm will consist of a 2.5 MW (AC) fixed panel solar array on an undeveloped 39.2 acre parcel of land off of Sunset Cliff Road in the New North End of Burlington. The project will create a small amount of impervious surfaces -- an access road, maintenance shed and parking area -- which total approximately 0.36 acres, or less than one percent of the total parcel. Since the impervious area does not exceed one acre, neither a Vermont stormwater operational permit nor are any treatment or detention facilities required. However, due to the downstream neighborhood concerns related to existing issues with surface water drainage problems on their properties, South Forty Solar, LLC ("SFS" or "the Applicant") has voluntarily retained Trudell Consulting Engineers (TCE) to prepare this analysis to determine if there are any potential incremental impacts from the proposed project related to stormwater and to develop a mitigation plan to control post development peak flows in typical design storms.

For the stormwater analysis, hydrologic models of the existing and proposed conditions of the site were prepared. After reviewing the judgments made in preparing these models, a sensitivity analysis was conducted to compare the results against different scenarios. Based on the results of the sensitivity analysis, and the concerns noted by the downstream neighbors in the Strathmore neighborhood, soil rehabilitation in upland areas coupled with a shallow detention basin are voluntarily proposed mitigation goals of the project.

## 2. Discharge Points

Stormwater runoff from this site discharges in two locations, one (S/N 001) on the westerly side of the site, located behind the residences on Muirfield Road, and the other (S/N 002) in the southwest corner of the site. S/N 001 discharges to a catch basin network, and S/N 002 discharges to a swale that drains to an inlet in Appletree Park. All runoff eventually enters a drainage swale behind the residences on Edinborough Drive and Appletree Point Road, which then discharges to Lake Champlain.

## 3. Existing Conditions

Currently, the site consists of a 39.2 acre parcel of land surrounded on most of three sides by existing residential development. The parcel includes approximately 22 acres of Class II wetland. Some offsite area drains onto the

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parcel. Approximately 4 acres of undeveloped land on the north side of Sunset Cliff Road drains to the project parcel through a 12-inch culvert located at the western end of the parcel. In addition to this area, some of the Curtis Avenue neighborhood (approximately 3 acres) drains onto the project parcel. Overall contributing drainage area to S/N 001 is 27.6 acres, and drainage area to S/N 002 is 20.14 acres.

### Soils

The soils on site are a mixture of Adams & Windsor loamy sands (Hydrologic Soil Group (HSG) A), Au Gres fine sandy loam (HSG B), Palantine silt loam (HSG C), and Covington silty clay (HSG D) soils. Refer to Attachment A for a soils map of the site.

### Land Cover

Currently, approximately 8.5 acres of the parcel consists of wet overgrown meadow, the remainder of the parcel consist of woods, with a variety of species including white pine, red maple, white oak, American elm, European buckthorn, multiflora rose, and invasive honeysuckle. Access to the site is uncontrolled, and the public routinely uses this property for walking, dog-walking, skiing and other play activities. In addition, the history of the project parcel includes livestock grazing. These current and former activities have impacted the soils as compared with its natural condition. As a result, the existing woods are characterized as being in “fair” condition.

Notwithstanding the actual land cover noted above, for purposes of hydrologic modeling (see below) we have used a conservative assumption that the entire project site is deemed wooded in its existing condition.

### Hydrologic Modeling

Based on this site information, an existing conditions stormwater model was created in HydroCAD v. 10.00 that characterizes the existing runoff rates from the site. Refer to Attachment B for a map showing the watershed boundaries and cover types of the drainage area, a slope map that demonstrates the average slope used in the time of concentration calculation, and modeling outputs for the selected design storms, including the 1-year, 10-year and 25-year events.

## 4. Proposed Conditions

A proposed conditions HydroCAD model was prepared that takes into account the changes in ground cover on the forested portion of the site and the small amount of new impervious surfaces described in the paragraph above. Construction of the solar array requires clearing approximately 11 acres of upland forest. Once the trees and stumps are cleared, an upland meadow area

will be created in which a portion of the solar array will be placed. Since the array structures rest on narrow metal posts and are elevated 4 feet above the ground surface, there is negligible impact to the site with respect to soil disturbance (during construction in wetland areas) or from stormwater runoff from the panels themselves (during operation). The solar array area as well as the site fence line will be periodically mowed to prevent vegetation from shadowing the panels. See below for an illustrative photograph (note that unlike the project depicted in the photo, the South Forty Solar project will have shrubs, trees and other vegetation beyond the mowed area of the fence line).



Photo 1: Example of Solar Array in Meadow

### Soil Enhancement Program

Because the stormwater runoff impacts from the solar panels and the associated infrastructure improvements are expected to be minimal, the effects can be mitigated through the implementation of a Soil Enhancement Program. To enhance stormwater retention and recharge within the project site, the soils in the upland areas will be modified during construction to improve their infiltrative capacity. By doing so, the peak runoff rate of runoff of stormwater generated from the site will be reduced. Utilizing soil enhancements is consistent with both the principles of Low Impact Design (LID) and Green Infrastructure (GI) treatment standards. The usefulness of existing soils, vegetation, and drainage patterns are

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recognized as being as effective as traditional structures (e.g. stormwater ponds, bioretention areas) in some cases. For this project, a combination of technical experience and the guidelines presented in the 2010 *New York State Stormwater Management Design Manual* (Section 5.1.6, Soil Restoration) were used as a guide for this enhancement program. Soil enhancement is not a currently recognized practice by the State of Vermont, but it is being considered in the upcoming revision of the 2002 Stormwater Management Manual. The following details how the soil enhancement will be implemented.

The underlying principle of the project's soil enhancement is that a deep, well-drained soil, rich in organic matter will absorb more rainfall, be resistant to erosion, filter out pollutants and promotes vigorous plant growth that requires less irrigation, pesticides and fertilizer. This program will be implemented after stumping and grubbing occurs on the upland areas to be cleared and prior to erection of the array. The following steps will be implemented:

- Take samples totaling one pound in weight at 4" and 12" depth from selected planting areas. Take multiple samples to form a composite, however where vegetation or soil moisture is different, take different samples.
- Submit soil samples to an accepted soil testing agency (university agricultural and environmental testing laboratory or extension agency) for written soil analysis and recommendations for amendments and application rates.

Potential additives may include fine sand for texture; ground limestone, potash or sulfur for pH adjustment; compost, manure, soil organic matter and synthetic or organic fertilizers for nutrients deficiencies.

- Cultivate compacted areas. Where soil compaction has occurred, cross-rip using a dozer mounted ripper to a depth of 12 inches, except within existing tree drip lines.
- Till recommended amendments into the existing topsoil and subsoil to a depth of at least 6 inches using a tractor-mounted disc, or tiller, mixing, and circulating air and compost into the subsoil. Ensure six inches of quality soils are present to promote quick growth of vegetation, adding topsoil as necessary to accomplish this goal.
- Do not work the soil when muddy or frozen. Inspect soil for deleterious material such as debris, sticks or rocks over 2" in diameter.
- Plant the seed mix at a rate of 4 pounds per 1,000 square feet and work firmly into the soil. Apply seed on the prepared seed bed with mechanical seeders or hydroseeding equipment. Upon completion of the planting operations, roll all areas leaving the surface of all areas true

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to grade, smooth, and free from hollows or other irregularities. Thoroughly water all newly planted areas immediately after planting, using a fine spray.

Seed Mix:

Common Name	Weight
Macbeth meadow brome	32%
Gain Festilolium	32%
Troy Kentucky Bluegrass	17%
Super Haifa white clover	13%
Leo Trefoil	4%
Inert/Weed/Other content	3%

- Mulch shall be applied at a rate of 70 to 90 pounds (2 bales) per 1000 square feet to a depth of 4 or 5 straws immediately after spreading seed. Mulching shall follow the seeding operation by not more than 24 hours.
- To ensure vegetative growth is properly established, seeding should occur when the soil is free of frost. Vegetation should be established by October 15.
- Watering will occur once every three days for the first month, and providing a half inch of water per week during the first year. Natural rainfall can be considered as part of the watering regimen. Maintain and reseed until plants are fully established.
- Minimize foot and vehicle traffic in the restored soil area. The proposed perimeter fence will keep the general public from treading on the soil, and maintenance associated with the solar panels will be limited.

To confirm the effectiveness of the restoration, an individual should be able to push a 3/8-inch metal bar 12 inches into the soil just with body weight. Once the project is complete, the site will be fenced off to prevent unauthorized foot and vehicle traffic. Inspections should be conducted on the site regularly (at least once per year) to ensure that vegetative growth is well-established, and that no portions of the site exhibit signs of rills or other erosion.

Post-Development Hydrologic Modeling

For the post-development stormwater model, the project area was assumed to have four cover types (as defined by Table 2-2 of the SCS/NRCS TR-55 publication):

1. Impervious surface – Including roofs and roads. Solar panels are not considered to be impervious surfaces by the Agency of Natural Resources as the ground underneath the panels sustains vegetation. As the site is relatively flat, the runoff from the panels can be considered to qualify for

the “rooftop disconnection credit” described in the *Vermont Stormwater Management Manual*.

2. Meadow – The solar array area will remain vegetated and periodically mowed.
3. Brush – The vegetative management zone will be selectively managed, with larger-caliper taller trees (those shading the solar panel arrays) being periodically removed.
4. Woods – The remaining forest will stay in its current condition, hydrologically unchanged from the existing model.

Refer to Attachment C for a map showing the cover types used on the site, as well as the HydroCAD model output for the selected storm events. As no major re-grading is proposed for the site, the slopes used in the existing conditions model were applied to the proposed conditions model as well.

## 5. Baseline Scenario Analysis

With the proposed mitigation measures, the peak runoff rate is reduced from the existing conditions. The tables below summarize the stormwater modeling results for the selected storm events:

Table 1: 1-Year Storm Results

1-Year Storm				
	Existing	Proposed	Differential	% Change
Peak Runoff Rate (cfs)				
S/N 001	1.36	1.17	-0.19	-14%
S/N 002	0.20	0.20	0	0%

Table 2: 10-Year Storm Results

10-Year Storm				
	Existing	Proposed	Differential	% Change
Peak Runoff Rate (cfs)				
S/N 001	6.53	6.14	-0.39	-6%
S/N 002	2.33	2.23	-0.1	-4%

Table 3: 25-Year Storm Results

25-Year Storm				
	Existing	Proposed	Differential	% Change
Peak Runoff Rate (cfs)				
S/N 001	11.20	10.73	-0.47	-4%
S/N 002	4.87	4.64	-0.23	-5%

The results in the above tables can be summarized as follows:

For the 1-year Storm, due to the limited work on the southern portion of the site (watershed 3, draining to S/N 002), the project will not result in a measurable change in the peak rate of runoff. For the project area (watershed 2, draining to S/N 001), there will be a substantial reduction from current levels. For the one-year event, the peak rate is reduced by 14%. As the storm intensity increases, the amount of change decreases, but still results in lower discharge rates than the existing condition. The decreases in this area (S/N 001) are of particular note as this discharge point leads to areas with existing flooding issues (behind Muirfield Road).

Given these results, TCE concludes that the project, after implementation of the soil enhancement program, will reduce peak runoff rates for the typical design storms.

## 6. Sensitivity Analysis

Assessments discussed above are based on engineering judgment and conservative assumptions regarding cover types and soil condition. A sensitivity analysis was conducted to explore what other conclusions might result based on the differing land covers and conditions.

For the baseline scenario analysis discussed in Section 5 above, existing conditions were presumed to be woods in fair condition, and proposed conditions were presumed to be a mixture of woods, brush and meadow in fair condition. Other land covers that could be considered in this sensitivity analysis include pasture (due to the site’s past agricultural history), and the site could also be presumed to be in “good” hydrologic condition. The range of conditions with these parameters would range from a condition of all woods in good condition (a very conservative analysis that assumes there is significant undergrowth in the forest and no agricultural history) to a mixture of woods, brush and pasture in fair condition (somewhat less conservative than the chosen approach as grazing has not occurred in the recent past). As discussed above, based on our engineering judgment, we would characterize the soils as being in fair condition.

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The following table was generated that presents various permutations of the chosen land covers/conditions and the other land covers/conditions discussed. In each case, the existing impervious surfaces are still accounted for. A one-year (2.1") storm was used for this analysis, as this would be a more frequent occurrence than the larger events.

**Table 4: Sensitivity Analysis Results, Existing Conditions, 1-Year Storm Event**

1-Year Storm, Existing Conditions						
Land Cover	S/N 001			S/N 002		
	Peak Runoff Rate (cfs)	Differential from Initial Analysis	% Change	Peak Runoff Rate (cfs)	Differential from Initial Analysis	% Change
All Woods (good)	0.74	-0.62	-46%	0.07	-0.13	-65%
Woods (good), Meadow	0.74	-0.62	-46%	0.07	-0.13	-65%
Woods (good), Pasture (good)	1.08	-0.28	-21%	0.07	-0.13	-65%
All Woods (fair)	1.36	-	-	0.20	-	-
Woods (fair), Meadow	1.36	0	0%	0.20	0.00	0%
Woods (fair), Pasture (fair)	2.58	1.22	90%	0.07	-0.13	-65%

Note: All\_Woods (fair) is shown in this table but not analyzed as it was the baseline scenario and the basis for comparison with the other conditions.

**Table 5: Sensitivity Analysis Results, Proposed Conditions, 1-Year Storm Event**

1-Year Storm, Proposed Conditions						
Land Cover	S/N 001			S/N 002		
	Peak Runoff Rate (cfs)	Differential from Initial Analysis	% Change	Peak Runoff Rate (cfs)	Differential from Initial Analysis	% Change
Woods, Brush, Meadow (good)	0.92	-0.25	-21%	0.05	-0.15	-75%
Woods, Brush, Pasture (good)	1.62	0.45	38%	0.07	-0.13	-65%
Woods, Brush, Meadow (fair)	1.17	-	-	0.20	-	-
Woods, Brush, Pasture (fair)	4.12	2.95	252%	0.33	0.13	65%

Note: Woods, Brush, Meadow (fair) is shown in this table but not analyzed as it was the baseline scenario and the basis for comparison with the other conditions.

Refer to Attachment D for HydroCAD modeling results of these scenarios.

From the results of this analysis, it is clear that the condition of the land cover is an important variable in determining peak runoff flows. Based on these results, characterizing the woods in "good" condition is a more conservative assumption than what was originally determined. Assuming soils are in good condition the result would carry through to the proposed condition as well, which would provide a 21% decrease in anticipated peak flow rates.

## 7. Detention Basin

Under the most conservative land cover scenario, additional voluntary features would mitigate peak runoff flows. This can be accomplished by the construction of a shallow detention basin located on the uphill side of the proposed project access road. As the road will be built in an upland area on top of existing ground, it would serve as a berm to divert water into the basin. As the soils onsite are sandy, some infiltration will occur. Most of the basin is located on the highly permeable (12-14 inches/hour) soils, with a small portion in a less permeable Palatine silt loam. As a conservative measure, the slowest infiltration rate (approximately 1 inch per hour) was used for modeling<sup>1</sup>.

A drainage map and HydroCAD model of this scenario is provided in Attachment E. The following table summarizes the results of a detention basin compared against an existing condition of woods in good condition:

Table 6: 1-Year Storm Results (with detention)

1-Year Storm				
	Existing	Proposed	Differential	% Change
Peak Runoff Rate (cfs)				
S/N 001	0.74	0.27	-0.47	-64%
S/N 002	0.07	0.05	-0.02	-29%

Table 7: 10-Year Storm Results (with detention)

10-Year Storm				
	Existing	Proposed	Differential	% Change
Peak Runoff Rate (cfs)				
S/N 001	4.60	2.21	-2.39	-52%
S/N 002	1.19	1.19	0	0%

Table 8: 25-Year Storm Results (with detention)

25-Year Storm				
	Existing	Proposed	Differential	% Change
Peak Runoff Rate (cfs)				
S/N 001	8.45	4.27	-4.18	-49%
S/N 002	2.93	2.76	-0.17	-6%

<sup>1</sup> USDA Web Soil Survey

These results demonstrate that the proposed detention basin will result in significant reductions in peak flows .

## 8. Conclusion

Based on reasonable assumptions about the existing and proposed conditions of the property, soil enhancement alone would suffice in controlling the peak runoff flows from the property in a post-development condition, under typical design storms.

A sensitivity analysis of the modeling results with respect to the assumed land cover was also conducted as part of TCE's stormwater analysis. The results indicate that in order to provide an additional margin of safety to ensure downstream recipients of the property's stormwater runoff (Strathmore development) are not detrimentally affected by the project, additional voluntary stormwater mitigation measures should be considered. As a result, the installation of a shallow detention basin in the upland area of the solar array has been considered. A detention basin, in conjunction with the soil enhancement measures described herein, would provide adequate stormwater control.

Based on the hydrologic modeling results for both the baseline scenario (with soil enhancement) and sensitivity analysis (soil enhancement and detention basin), we conclude that the proposed project will not result in an undue adverse impact to the downstream residences from the proposed project. For the vast majority (>90%) of storms in a given year, the anticipated runoff peak flow rate and volume will be reduced from the current condition.



# Attachment A

Soils Map

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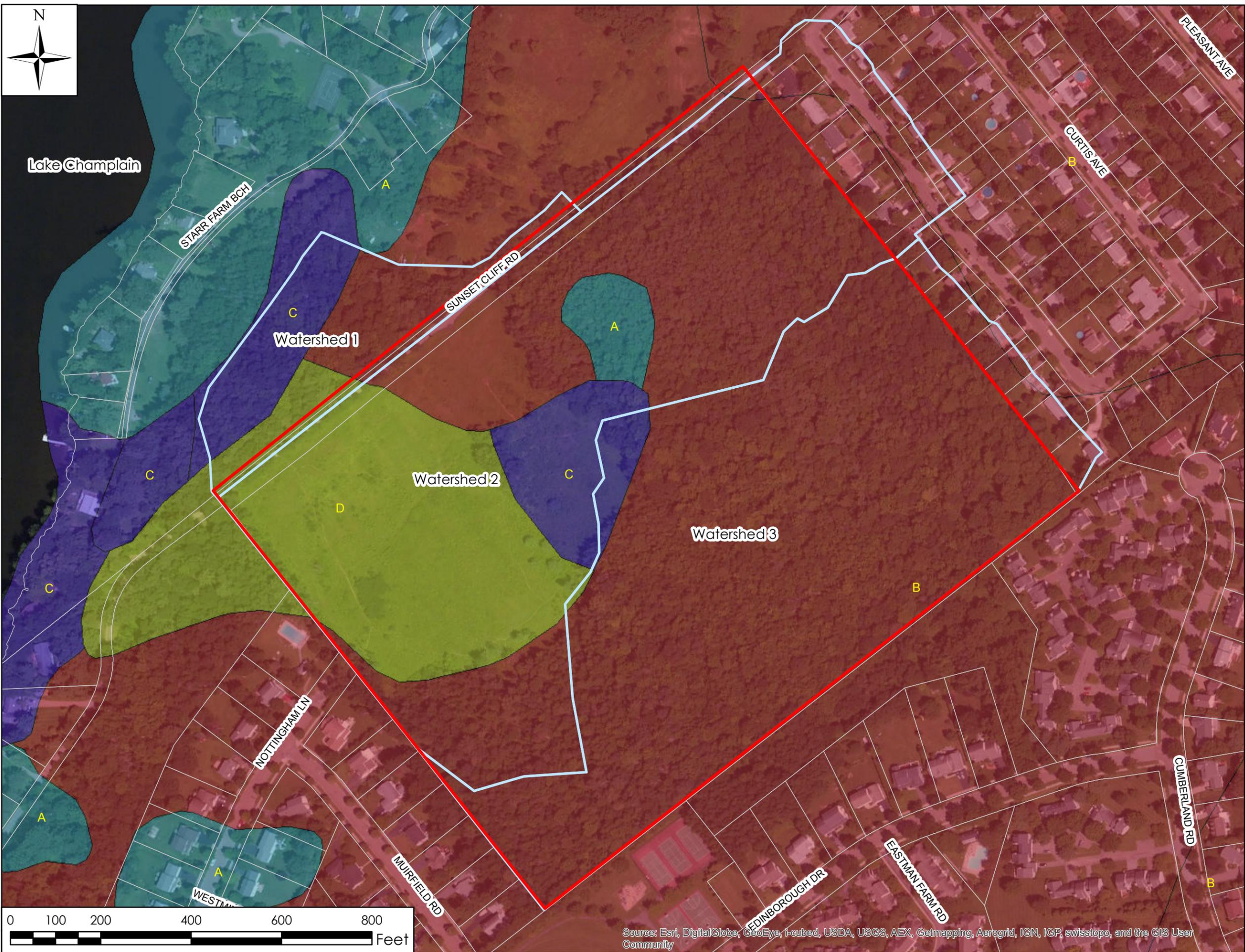


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**Project Location**



Lake Champlain



**Legend**

- Project Site
- Watershed Boundary
- Property Line
- Hydrologic Soil Group (HSG)**
- A
- B
- C
- D
- W
- not rated
- Stream

**Notes**

Sources: Bing aerial photography (2012); VT E911 Roads (2011); Streams by ANR (2012); Watershed Boundaries by TCE (2014); Grass, Impervious, Woods by TCE (2014).

Disclaimer: The accuracy of information presented is determined by its sources. TCE is not responsible for any errors or omissions that may exist. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not a replacement for surveyed information or engineering studies.

**South Forty Solar Farm  
Sunset Cliff Road  
Burlington, VT**

**Soils Map**

Project: 2013113  
Prepared By: LMJ  
02/25/2014  
1 inch = 200 feet

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



## Attachment B

Existing Conditions Watershed Map  
Slope Map  
Existing Conditions HydroCAD Model Results



Lake Champlain



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**Project Location**



**Legend**

-  Project Site
-  Watershed Boundary
-  Property Line
-  Grass
-  Impervious
-  Woods
-  Contour (2')
-  Stream

**Notes**

Sources: Bing aerial photography (2012); VT E911 Roads (2011); Streams by ANR (2012); Watershed Boundaries by TCE (2014); Grass, Impervious, Woods by TCE (2014).

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**South Forty Solar Farm  
Sunset Cliff Road  
Burlington, VT**

**Existing Conditions  
Drainage Map**

Project: 2013113  
Prepared By: LMJ  
02/25/2014  
1 inch = 200 feet



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



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2	1.10556
3	1.381078

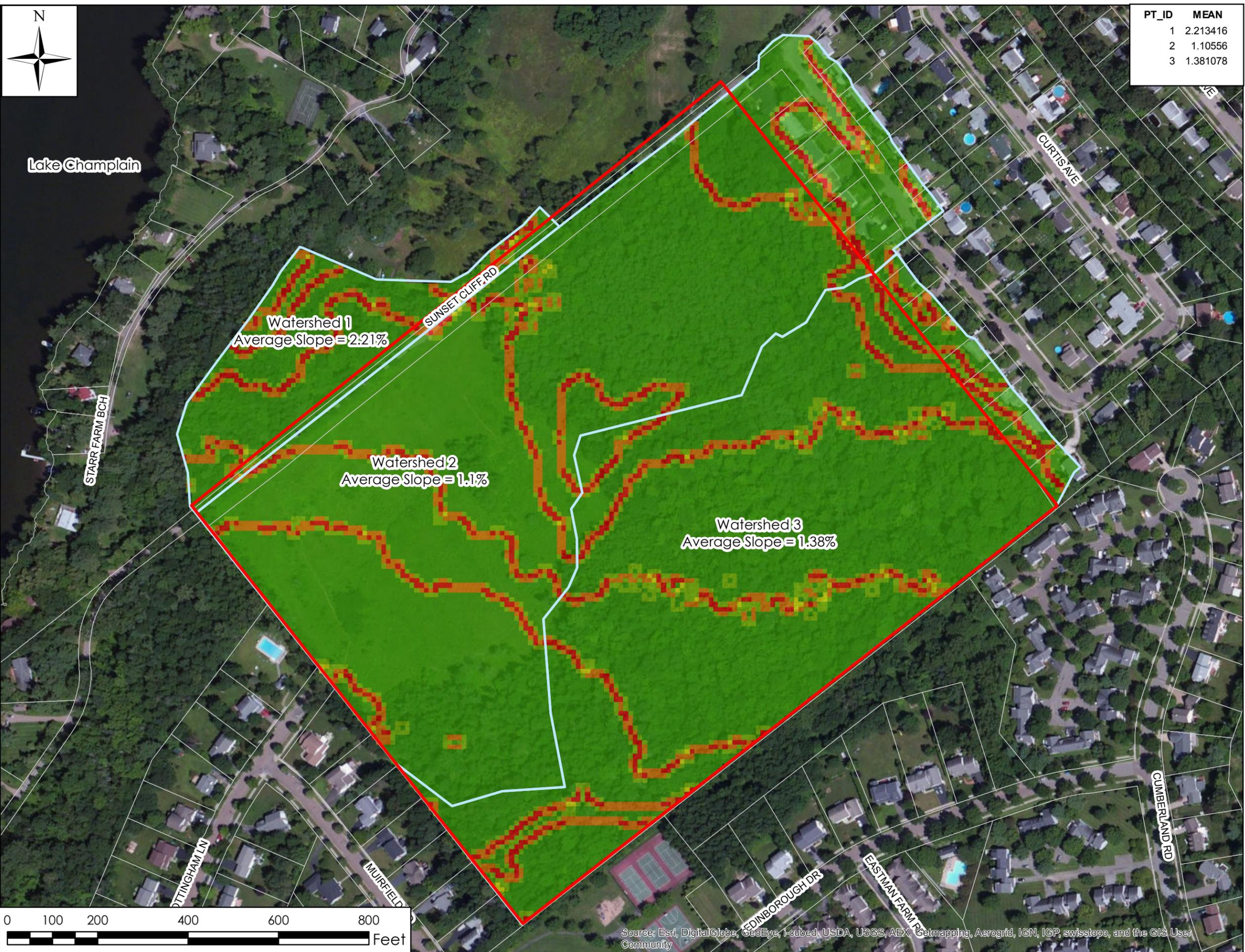


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**Project Location**



Lake Champlain



**Legend**

- Project Site
  - Watershed Boundary
  - Property Line
- Slope**
- <VALUE>**
- 0 - 3
  - 3.000000001 - 5
  - 5.000000001 - 7
  - 7.000000001 - 9
  - 9.000000001 - 11

**Notes**

Sources: Bing aerial photography (2012); VT E911 Roads (2011); Existing Watersheds by TCE (2014); Slopes calculated by TCE (2014) based on CCRPC DEM (2004).

Disclaimer: The accuracy of information presented is determined by its sources. TCE is not responsible for any errors or omissions that may exist. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not a replacement for surveyed information or engineering studies.

**South Forty Solar, LLC**  
**Sunset Cliff Road**  
**Burlington, VT**

**Average Slope Map**

Project: 2013113  
Prepared By: LMJ  
1 Inch = 200 Feet  
02/28/2014



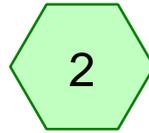
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



offsite area



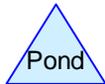
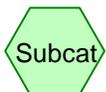
sunset cliff Rd culvert



to Muirfield



to Edinburgh



## Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.852	36	Woods, Fair, HSG A (1, 2)
4.304	58	Meadow, non-grazed, HSG B (1, 2, 3)
29.795	60	Woods, Fair, HSG B (1, 2, 3)
1.570	71	Meadow, non-grazed, HSG C (2, 3)
1.713	73	Woods, Fair, HSG C (1, 3)
7.188	78	Meadow, non-grazed, HSG D (2, 3)
0.743	79	Woods, Fair, HSG D (1, 2, 3)
1.122	98	Paved parking, HSG B (1, 2, 3)
0.112	98	Paved parking, HSG D (1, 2)
47.399	64	TOTAL AREA

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.852	HSG A	1, 2
35.221	HSG B	1, 2, 3
3.283	HSG C	1, 2, 3
8.043	HSG D	1, 2, 3
0.000	Other	
47.399		TOTAL AREA

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	1.122	0.000	0.112	0.000	1.234	Paved parking	1, 2, 3
0.000	4.304	1.570	7.188	0.000	13.062	Meadow, non-grazed	1, 2, 3
0.852	29.795	1.713	0.743	0.000	33.103	Woods, Fair	1, 2, 3
0.852	35.221	3.283	8.043	0.000	47.399	TOTAL AREA	



Summary for Subcatchment 1: offsite area

Runoff = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	36	Woods, Fair, HSG A
1.614	60	Woods, Fair, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.482	73	Woods, Fair, HSG C
0.695	79	Woods, Fair, HSG D
0.038	98	Paved parking, HSG D
3.949	69	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	1,032	0.0221	0.57		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 1.17 cfs @ 13.08 hrs, Volume= 0.400 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.851	36	Woods, Fair, HSG A
9.359	60	Woods, Fair, HSG B
3.556	58	Meadow, non-grazed, HSG B
0.923	98	Paved parking, HSG B
1.334	71	Meadow, non-grazed, HSG C
7.169	78	Meadow, non-grazed, HSG D
0.074	98	Paved parking, HSG D
0.042	79	Woods, Fair, HSG D
23.308	67	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
74.0	1,936	0.0111	0.44		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.20 cfs @ 13.94 hrs, Volume= 0.133 af, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
18.822	60	Woods, Fair, HSG B
0.701	58	Meadow, non-grazed, HSG B
0.127	98	Paved parking, HSG B
0.231	73	Woods, Fair, HSG C
0.236	71	Meadow, non-grazed, HSG C
0.006	79	Woods, Fair, HSG D
0.019	78	Meadow, non-grazed, HSG D
20.142	60	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
75.1	1,804	0.0138	0.40		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.21" for 1-year event  
 Inflow = 1.36 cfs @ 13.07 hrs, Volume= 0.483 af  
 Outflow = 1.36 cfs @ 13.07 hrs, Volume= 0.483 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.08" for 1-year event  
 Inflow = 0.20 cfs @ 13.94 hrs, Volume= 0.133 af  
 Outflow = 0.20 cfs @ 13.94 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 0.25" for 1-year event  
 Inflow = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af  
 Outflow = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.61' @ 12.34 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.50 cfs @ 12.34 hrs HW=130.61' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.50 cfs @ 1.70 fps)



Summary for Subcatchment 1: offsite area

Runoff = 2.28 cfs @ 12.28 hrs, Volume= 0.257 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
0.001	36	Woods, Fair, HSG A
1.614	60	Woods, Fair, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.482	73	Woods, Fair, HSG C
0.695	79	Woods, Fair, HSG D
0.038	98	Paved parking, HSG D
3.949	69	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	1,032	0.0221	0.57		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 5.87 cfs @ 12.91 hrs, Volume= 1.335 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
0.851	36	Woods, Fair, HSG A
9.359	60	Woods, Fair, HSG B
3.556	58	Meadow, non-grazed, HSG B
0.923	98	Paved parking, HSG B
1.334	71	Meadow, non-grazed, HSG C
7.169	78	Meadow, non-grazed, HSG D
0.074	98	Paved parking, HSG D
0.042	79	Woods, Fair, HSG D
23.308	67	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
74.0	1,936	0.0111	0.44		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 2.33 cfs @ 13.02 hrs, Volume= 0.685 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
18.822	60	Woods, Fair, HSG B
0.701	58	Meadow, non-grazed, HSG B
0.127	98	Paved parking, HSG B
0.231	73	Woods, Fair, HSG C
0.236	71	Meadow, non-grazed, HSG C
0.006	79	Woods, Fair, HSG D
0.019	78	Meadow, non-grazed, HSG D
20.142	60	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
75.1	1,804	0.0138	0.40		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.70" for 10-year event  
 Inflow = 6.53 cfs @ 12.91 hrs, Volume= 1.591 af  
 Outflow = 6.53 cfs @ 12.91 hrs, Volume= 1.591 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.41" for 10-year event  
 Inflow = 2.33 cfs @ 13.02 hrs, Volume= 0.685 af  
 Outflow = 2.33 cfs @ 13.02 hrs, Volume= 0.685 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 0.78" for 10-year event  
 Inflow = 2.28 cfs @ 12.28 hrs, Volume= 0.257 af  
 Outflow = 2.28 cfs @ 12.28 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.0 min  
 Primary = 2.28 cfs @ 12.28 hrs, Volume= 0.257 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 131.29' @ 12.28 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.28 cfs @ 12.28 hrs HW=131.29' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 2.28 cfs @ 2.90 fps)



Summary for Subcatchment 1: offsite area

Runoff = 3.79 cfs @ 12.27 hrs, Volume= 0.396 af, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
0.001	36	Woods, Fair, HSG A
1.614	60	Woods, Fair, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.482	73	Woods, Fair, HSG C
0.695	79	Woods, Fair, HSG D
0.038	98	Paved parking, HSG D
3.949	69	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	1,032	0.0221	0.57		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 10.15 cfs @ 12.91 hrs, Volume= 2.105 af, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
0.851	36	Woods, Fair, HSG A
9.359	60	Woods, Fair, HSG B
3.556	58	Meadow, non-grazed, HSG B
0.923	98	Paved parking, HSG B
1.334	71	Meadow, non-grazed, HSG C
7.169	78	Meadow, non-grazed, HSG D
0.074	98	Paved parking, HSG D
0.042	79	Woods, Fair, HSG D
23.308	67	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
74.0	1,936	0.0111	0.44		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 4.87 cfs @ 12.94 hrs, Volume= 1.198 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
18.822	60	Woods, Fair, HSG B
0.701	58	Meadow, non-grazed, HSG B
0.127	98	Paved parking, HSG B
0.231	73	Woods, Fair, HSG C
0.236	71	Meadow, non-grazed, HSG C
0.006	79	Woods, Fair, HSG D
0.019	78	Meadow, non-grazed, HSG D
20.142	60	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
75.1	1,804	0.0138	0.40		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 1.10" for 25-year event  
 Inflow = 11.20 cfs @ 12.83 hrs, Volume= 2.501 af  
 Outflow = 11.20 cfs @ 12.83 hrs, Volume= 2.501 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.71" for 25-year event  
 Inflow = 4.87 cfs @ 12.94 hrs, Volume= 1.198 af  
 Outflow = 4.87 cfs @ 12.94 hrs, Volume= 1.198 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

[58] Hint: Peaked 0.30' above defined flood level

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 1.20" for 25-year event  
 Inflow = 3.79 cfs @ 12.27 hrs, Volume= 0.396 af  
 Outflow = 3.79 cfs @ 12.27 hrs, Volume= 0.396 af, Atten= 0%, Lag= 0.0 min  
 Primary = 3.79 cfs @ 12.27 hrs, Volume= 0.396 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 132.32' @ 12.27 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=3.79 cfs @ 12.27 hrs HW=132.32' TW=0.00' (Dynamic Tailwater)

↑1=Culvert (Inlet Controls 3.79 cfs @ 4.82 fps)



## Appendix C

Post-Development Drainage Map  
Post-Development Conditions HydroCAD Modeling



Lake Champlain

STARR FARM BCH

SUNSET CLIFF RD

CURTIS AVE

PLEASANT AVE

Watershed 1

Watershed 2

Watershed 3

TOTTINGHAM LN

MUIRFIELD

EDINBOROUGH DR

EASTMAN FARM RD

CUMBERLAND RD



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



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**Project Location**



**Legend**

- Project Site
- Watershed Boundary
- Property Line
- Soil Restoration Area
- Solar Panel Array
- Grass
- Impervious
- Brush
- Woods
- Stream

**Notes**

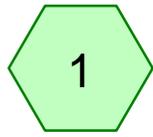
Sources: Bing aerial photography (2012); VT E911 Roads (2011); Streams by ANR (2012); Watershed Boundaries by TCE (2014); Grass, Impervious, Woods by TCE (2014); Panels by TCE (2014); Project Parcel by TCE (2014); Soil Restoration Area by TCE (2014).

Disclaimer: The accuracy of information presented is determined by its sources. TCE is not responsible for any errors or omissions that may exist. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not a replacement for surveyed information or engineering studies.

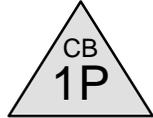
**South Forty Solar Farm  
Sunset Cliff Road  
Burlington, VT**

**Postdevelopment  
Drainage Map**

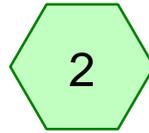
Project: 2013113  
Prepared By: LMJ  
02/25/2014  
1 inch = 200 feet



offsite area



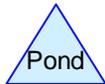
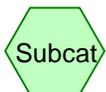
sunset cliff Rd culvert



to Muirfield



to Edinburgh



## Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.783	30	Meadow, non-grazed, HSG A (2)
0.001	36	Woods, Fair, HSG A (1)
3.114	56	Brush, Fair, HSG B (2, 3)
12.251	58	Meadow, non-grazed, HSG B (1, 2, 3)
18.491	60	Woods, Fair, HSG B (1, 2, 3)
0.076	70	Brush, Fair, HSG C (2, 3)
1.988	71	Meadow, non-grazed, HSG C (2, 3)
1.483	73	Woods, Fair, HSG C (1)
0.611	77	Brush, Fair, HSG D (2, 3)
6.595	78	Meadow, non-grazed, HSG D (2)
0.698	79	Woods, Fair, HSG D (1)
0.072	98	Paved parking, HSG A (2)
1.341	98	Paved parking, HSG B (1, 2, 3)
0.067	98	Paved parking, HSG C (2, 3)
0.110	98	Paved parking, HSG D (1, 2)
47.681	64	TOTAL AREA

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.856	HSG A	1, 2
35.197	HSG B	1, 2, 3
3.614	HSG C	1, 2, 3
8.014	HSG D	1, 2, 3
0.000	Other	
47.681		TOTAL AREA

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.072	1.341	0.067	0.110	0.000	1.590	Paved parking	1, 2, 3
0.783	12.251	1.988	6.595	0.000	21.617	Meadow, non-grazed	1, 2, 3
0.000	3.114	0.076	0.611	0.000	3.801	Brush, Fair	2, 3
0.001	18.491	1.483	0.698	0.000	20.673	Woods, Fair	1, 2, 3
0.856	35.197	3.614	8.014	0.000	47.681	TOTAL AREA	



Summary for Subcatchment 1: offsite area

Runoff = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	36	Woods, Fair, HSG A
1.614	60	Woods, Fair, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.483	73	Woods, Fair, HSG C
0.698	79	Woods, Fair, HSG D
0.037	98	Paved parking, HSG D
3.952	69	Weighted Average
3.843		97.24% Pervious Area
0.109		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	1,032	0.0221	0.57		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 0.99 cfs @ 13.14 hrs, Volume= 0.362 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.783	30	Meadow, non-grazed, HSG A
0.072	98	Paved parking, HSG A
2.389	60	Woods, Fair, HSG B
9.307	58	Meadow, non-grazed, HSG B
0.983	56	Brush, Fair, HSG B
1.143	98	Paved parking, HSG B
1.591	71	Meadow, non-grazed, HSG C
0.054	98	Paved parking, HSG C
0.019	70	Brush, Fair, HSG C
6.595	78	Meadow, non-grazed, HSG D
0.584	77	Brush, Fair, HSG D
0.073	98	Paved parking, HSG D
23.593	66	Weighted Average
22.251		94.31% Pervious Area
1.342		5.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
73.0	1,936	0.0120	0.44		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.20 cfs @ 14.11 hrs, Volume= 0.133 af, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
14.488	60	Woods, Fair, HSG B
2.897	58	Meadow, non-grazed, HSG B
0.126	98	Paved parking, HSG B
2.131	56	Brush, Fair, HSG B
0.397	71	Meadow, non-grazed, HSG C
0.013	98	Paved parking, HSG C
0.057	70	Brush, Fair, HSG C
0.027	77	Brush, Fair, HSG D
20.136	60	Weighted Average
19.997		99.31% Pervious Area
0.139		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
79.9	1,804	0.0122	0.38		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.545 ac, 5.27% Impervious, Inflow Depth = 0.19" for 1-year event  
 Inflow = 1.17 cfs @ 13.06 hrs, Volume= 0.445 af  
 Outflow = 1.17 cfs @ 13.06 hrs, Volume= 0.445 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.136 ac, 0.69% Impervious, Inflow Depth = 0.08" for 1-year event  
 Inflow = 0.20 cfs @ 14.11 hrs, Volume= 0.133 af  
 Outflow = 0.20 cfs @ 14.11 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.952 ac, 2.76% Impervious, Inflow Depth = 0.25" for 1-year event  
 Inflow = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af  
 Outflow = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.61' @ 12.34 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.50 cfs @ 12.34 hrs HW=130.61' (Free Discharge)

↑1=Culvert (Inlet Controls 0.50 cfs @ 1.70 fps)



Summary for Subcatchment 1: offsite area

Runoff = 2.28 cfs @ 12.28 hrs, Volume= 0.257 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
0.001	36	Woods, Fair, HSG A
1.614	60	Woods, Fair, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.483	73	Woods, Fair, HSG C
0.698	79	Woods, Fair, HSG D
0.037	98	Paved parking, HSG D
3.952	69	Weighted Average
3.843		97.24% Pervious Area
0.109		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	1,032	0.0221	0.57		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 5.46 cfs @ 12.90 hrs, Volume= 1.264 af, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
0.783	30	Meadow, non-grazed, HSG A
0.072	98	Paved parking, HSG A
2.389	60	Woods, Fair, HSG B
9.307	58	Meadow, non-grazed, HSG B
0.983	56	Brush, Fair, HSG B
1.143	98	Paved parking, HSG B
1.591	71	Meadow, non-grazed, HSG C
0.054	98	Paved parking, HSG C
0.019	70	Brush, Fair, HSG C
6.595	78	Meadow, non-grazed, HSG D
0.584	77	Brush, Fair, HSG D
0.073	98	Paved parking, HSG D
23.593	66	Weighted Average
22.251		94.31% Pervious Area
1.342		5.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
73.0	1,936	0.0120	0.44		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 2.23 cfs @ 13.13 hrs, Volume= 0.685 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
14.488	60	Woods, Fair, HSG B
2.897	58	Meadow, non-grazed, HSG B
0.126	98	Paved parking, HSG B
2.131	56	Brush, Fair, HSG B
0.397	71	Meadow, non-grazed, HSG C
0.013	98	Paved parking, HSG C
0.057	70	Brush, Fair, HSG C
0.027	77	Brush, Fair, HSG D
20.136	60	Weighted Average
19.997		99.31% Pervious Area
0.139		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
79.9	1,804	0.0122	0.38		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.545 ac, 5.27% Impervious, Inflow Depth = 0.66" for 10-year event  
 Inflow = 6.14 cfs @ 12.89 hrs, Volume= 1.521 af  
 Outflow = 6.14 cfs @ 12.89 hrs, Volume= 1.521 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.136 ac, 0.69% Impervious, Inflow Depth = 0.41" for 10-year event  
 Inflow = 2.23 cfs @ 13.13 hrs, Volume= 0.685 af  
 Outflow = 2.23 cfs @ 13.13 hrs, Volume= 0.685 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.952 ac, 2.76% Impervious, Inflow Depth = 0.78" for 10-year event  
 Inflow = 2.28 cfs @ 12.28 hrs, Volume= 0.257 af  
 Outflow = 2.28 cfs @ 12.28 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.0 min  
 Primary = 2.28 cfs @ 12.28 hrs, Volume= 0.257 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 131.29' @ 12.28 hrs  
 Flood Elev= 132.02'

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Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

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Primary OutFlow Max=2.28 cfs @ 12.28 hrs HW=131.29' (Free Discharge)

↑1=Culvert (Inlet Controls 2.28 cfs @ 2.90 fps)



Summary for Subcatchment 1: offsite area

Runoff = 3.79 cfs @ 12.27 hrs, Volume= 0.396 af, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
0.001	36	Woods, Fair, HSG A
1.614	60	Woods, Fair, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.483	73	Woods, Fair, HSG C
0.698	79	Woods, Fair, HSG D
0.037	98	Paved parking, HSG D
3.952	69	Weighted Average
3.843		97.24% Pervious Area
0.109		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	1,032	0.0221	0.57		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 9.66 cfs @ 12.90 hrs, Volume= 2.019 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
0.783	30	Meadow, non-grazed, HSG A
0.072	98	Paved parking, HSG A
2.389	60	Woods, Fair, HSG B
9.307	58	Meadow, non-grazed, HSG B
0.983	56	Brush, Fair, HSG B
1.143	98	Paved parking, HSG B
1.591	71	Meadow, non-grazed, HSG C
0.054	98	Paved parking, HSG C
0.019	70	Brush, Fair, HSG C
6.595	78	Meadow, non-grazed, HSG D
0.584	77	Brush, Fair, HSG D
0.073	98	Paved parking, HSG D
23.593	66	Weighted Average
22.251		94.31% Pervious Area
1.342		5.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
73.0	1,936	0.0120	0.44		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 4.64 cfs @ 13.05 hrs, Volume= 1.197 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
14.488	60	Woods, Fair, HSG B
2.897	58	Meadow, non-grazed, HSG B
0.126	98	Paved parking, HSG B
2.131	56	Brush, Fair, HSG B
0.397	71	Meadow, non-grazed, HSG C
0.013	98	Paved parking, HSG C
0.057	70	Brush, Fair, HSG C
0.027	77	Brush, Fair, HSG D
20.136	60	Weighted Average
19.997		99.31% Pervious Area
0.139		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
79.9	1,804	0.0122	0.38		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.545 ac, 5.27% Impervious, Inflow Depth = 1.05" for 25-year event  
 Inflow = 10.73 cfs @ 12.82 hrs, Volume= 2.414 af  
 Outflow = 10.73 cfs @ 12.82 hrs, Volume= 2.414 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.136 ac, 0.69% Impervious, Inflow Depth = 0.71" for 25-year event  
 Inflow = 4.64 cfs @ 13.05 hrs, Volume= 1.197 af  
 Outflow = 4.64 cfs @ 13.05 hrs, Volume= 1.197 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

[58] Hint: Peaked 0.30' above defined flood level

Inflow Area = 3.952 ac, 2.76% Impervious, Inflow Depth = 1.20" for 25-year event  
 Inflow = 3.79 cfs @ 12.27 hrs, Volume= 0.396 af  
 Outflow = 3.79 cfs @ 12.27 hrs, Volume= 0.396 af, Atten= 0%, Lag= 0.0 min  
 Primary = 3.79 cfs @ 12.27 hrs, Volume= 0.396 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 132.32' @ 12.27 hrs

Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=3.79 cfs @ 12.27 hrs HW=132.32' (Free Discharge)

↑1=Culvert (Inlet Controls 3.79 cfs @ 4.82 fps)



## Appendix D

### Sensitivity Analysis Modeling Results

Summary for Subcatchment 1: offsite area

Runoff = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	55	Woods, Good, HSG B
0.072	98	Paved parking, HSG B
1.482	70	Woods, Good, HSG C
0.695	77	Woods, Good, HSG D
0.038	98	Paved parking, HSG D
3.949	66	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 0.62 cfs @ 13.34 hrs, Volume= 0.280 af, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.851	30	Woods, Good, HSG A
9.359	55	Woods, Good, HSG B
3.556	55	Woods, Good, HSG B
0.923	98	Paved parking, HSG B
1.334	70	Woods, Good, HSG C
7.169	77	Woods, Good, HSG D
0.074	98	Paved parking, HSG D
0.042	77	Woods, Good, HSG D
23.308	64	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
80.0	1,936	0.0111	0.40		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
18.822	55	Woods, Good, HSG B
0.701	55	Woods, Good, HSG B
0.127	98	Paved parking, HSG B
0.231	70	Woods, Good, HSG C
0.236	70	Woods, Good, HSG C
0.006	77	Woods, Good, HSG D
0.019	77	Woods, Good, HSG D
20.142	56	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
83.1	1,804	0.0138	0.36		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.15" for 1-year event  
 Inflow = 0.74 cfs @ 13.25 hrs, Volume= 0.340 af  
 Outflow = 0.74 cfs @ 13.25 hrs, Volume= 0.340 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.03" for 1-year event  
 Inflow = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af  
 Outflow = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 0.18" for 1-year event  
 Inflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af  
 Outflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.49' @ 12.42 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.26 cfs @ 12.42 hrs HW=130.49' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.26 cfs @ 1.43 fps)

Summary for Subcatchment 1: offsite area

Runoff = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	36	Woods, Fair, HSG A
1.614	60	Woods, Fair, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.482	73	Woods, Fair, HSG C
0.695	79	Woods, Fair, HSG D
0.038	98	Paved parking, HSG D
3.949	69	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	1,032	0.0221	0.57		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 1.17 cfs @ 13.08 hrs, Volume= 0.400 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.851	36	Woods, Fair, HSG A
9.359	60	Woods, Fair, HSG B
3.556	58	Meadow, non-grazed, HSG B
0.923	98	Paved parking, HSG B
1.334	71	Meadow, non-grazed, HSG C
7.169	78	Meadow, non-grazed, HSG D
0.074	98	Paved parking, HSG D
0.042	79	Woods, Fair, HSG D
23.308	67	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
74.0	1,936	0.0111	0.44		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.20 cfs @ 13.94 hrs, Volume= 0.133 af, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
18.822	60	Woods, Fair, HSG B
0.701	58	Meadow, non-grazed, HSG B
0.127	98	Paved parking, HSG B
0.231	73	Woods, Fair, HSG C
0.236	71	Meadow, non-grazed, HSG C
0.006	79	Woods, Fair, HSG D
0.019	78	Meadow, non-grazed, HSG D
20.142	60	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
75.1	1,804	0.0138	0.40		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.21" for 1-year event  
 Inflow = 1.36 cfs @ 13.07 hrs, Volume= 0.483 af  
 Outflow = 1.36 cfs @ 13.07 hrs, Volume= 0.483 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.08" for 1-year event  
 Inflow = 0.20 cfs @ 13.94 hrs, Volume= 0.133 af  
 Outflow = 0.20 cfs @ 13.94 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 0.25" for 1-year event  
 Inflow = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af  
 Outflow = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.61' @ 12.34 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.50 cfs @ 12.34 hrs HW=130.61' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.50 cfs @ 1.70 fps)

Summary for Subcatchment 1: offsite area

Runoff = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.482	70	Woods, Good, HSG C
0.695	77	Woods, Good, HSG D
0.038	98	Paved parking, HSG D
3.949	66	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 0.62 cfs @ 13.34 hrs, Volume= 0.280 af, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.851	30	Woods, Good, HSG A
9.359	55	Woods, Good, HSG B
3.556	58	Meadow, non-grazed, HSG B
0.923	98	Paved parking, HSG B
1.334	71	Meadow, non-grazed, HSG C
7.169	78	Meadow, non-grazed, HSG D
0.074	98	Paved parking, HSG D
0.042	77	Woods, Good, HSG D
23.308	64	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
80.0	1,936	0.0111	0.40		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
18.822	55	Woods, Good, HSG B
0.701	58	Meadow, non-grazed, HSG B
0.127	98	Paved parking, HSG B
0.231	70	Woods, Good, HSG C
0.236	71	Meadow, non-grazed, HSG C
0.006	77	Woods, Good, HSG D
0.019	78	Meadow, non-grazed, HSG D
20.142	56	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
83.1	1,804	0.0138	0.36		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.15" for 1-year event  
 Inflow = 0.74 cfs @ 13.25 hrs, Volume= 0.340 af  
 Outflow = 0.74 cfs @ 13.25 hrs, Volume= 0.340 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.03" for 1-year event  
 Inflow = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af  
 Outflow = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 0.18" for 1-year event  
 Inflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af  
 Outflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 130.49' @ 12.42 hrs

Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.26 cfs @ 12.42 hrs HW=130.49' TW=0.00' (Dynamic Tailwater)

↑1=Culvert (Inlet Controls 0.26 cfs @ 1.43 fps)

Summary for Subcatchment 1: offsite area

Runoff = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	36	Woods, Fair, HSG A
1.614	60	Woods, Fair, HSG B
0.047	69	Pasture/grassland/range, Fair, HSG B
0.072	98	Paved parking, HSG B
1.482	73	Woods, Fair, HSG C
0.695	79	Woods, Fair, HSG D
0.038	98	Paved parking, HSG D
3.949	69	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	1,032	0.0221	0.57		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 2.34 cfs @ 12.91 hrs, Volume= 0.596 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.851	36	Woods, Fair, HSG A
9.359	60	Woods, Fair, HSG B
3.556	69	Pasture/grassland/range, Fair, HSG B
0.923	98	Paved parking, HSG B
1.334	79	Pasture/grassland/range, Fair, HSG C
7.169	84	Pasture/grassland/range, Fair, HSG D
0.074	98	Paved parking, HSG D
0.042	79	Woods, Fair, HSG D
23.308	71	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
66.4	1,936	0.0111	0.49		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
18.822	55	Woods, Good, HSG B
0.701	61	Pasture/grassland/range, Good, HSG B
0.127	98	Paved parking, HSG B
0.231	70	Woods, Good, HSG C
0.236	74	Pasture/grassland/range, Good, HSG C
0.006	77	Woods, Good, HSG D
0.019	80	Pasture/grassland/range, Good, HSG D
20.142	56	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
83.1	1,804	0.0138	0.36		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.30" for 1-year event  
 Inflow = 2.58 cfs @ 12.84 hrs, Volume= 0.679 af  
 Outflow = 2.58 cfs @ 12.84 hrs, Volume= 0.679 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.03" for 1-year event  
 Inflow = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af  
 Outflow = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 0.25" for 1-year event  
 Inflow = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af  
 Outflow = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.61' @ 12.34 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.50 cfs @ 12.34 hrs HW=130.61' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.50 cfs @ 1.70 fps)

Summary for Subcatchment 1: offsite area

Runoff = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	61	Pasture/grassland/range, Good, HSG B
0.072	98	Paved parking, HSG B
1.482	70	Woods, Good, HSG C
0.695	77	Woods, Good, HSG D
0.038	98	Paved parking, HSG D
3.949	66	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 0.95 cfs @ 13.16 hrs, Volume= 0.357 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.851	30	Woods, Good, HSG A
9.359	55	Woods, Good, HSG B
3.556	61	Pasture/grassland/range, Good, HSG B
0.923	98	Paved parking, HSG B
1.334	74	Pasture/grassland/range, Good, HSG C
7.169	80	Pasture/grassland/range, Good, HSG D
0.074	98	Paved parking, HSG D
0.042	77	Woods, Good, HSG D
23.308	66	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
75.9	1,936	0.0111	0.42		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
18.822	55	Woods, Good, HSG B
0.701	61	Pasture/grassland/range, Good, HSG B
0.127	98	Paved parking, HSG B
0.231	70	Woods, Good, HSG C
0.236	74	Pasture/grassland/range, Good, HSG C
0.006	77	Woods, Good, HSG D
0.019	80	Pasture/grassland/range, Good, HSG D
20.142	56	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
83.1	1,804	0.0138	0.36		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.18" for 1-year event  
 Inflow = 1.08 cfs @ 13.08 hrs, Volume= 0.418 af  
 Outflow = 1.08 cfs @ 13.08 hrs, Volume= 0.418 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.03" for 1-year event  
 Inflow = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af  
 Outflow = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 0.18" for 1-year event  
 Inflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af  
 Outflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 130.49' @ 12.42 hrs

Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.26 cfs @ 12.42 hrs HW=130.49' TW=0.00' (Dynamic Tailwater)

↑1=Culvert (Inlet Controls 0.26 cfs @ 1.43 fps)

Summary for Subcatchment 1: offsite area

Runoff = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.483	70	Woods, Good, HSG C
0.698	77	Woods, Good, HSG D
0.037	98	Paved parking, HSG D
3.952	66	Weighted Average
3.843		97.24% Pervious Area
0.109		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 0.80 cfs @ 13.17 hrs, Volume= 0.321 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.783	30	Meadow, non-grazed, HSG A
0.072	98	Paved parking, HSG A
2.389	55	Woods, Good, HSG B
9.307	58	Meadow, non-grazed, HSG B
0.983	48	Brush, Good, HSG B
1.143	98	Paved parking, HSG B
1.591	71	Meadow, non-grazed, HSG C
0.054	98	Paved parking, HSG C
0.019	65	Brush, Good, HSG C
6.595	78	Meadow, non-grazed, HSG D
0.584	73	Brush, Good, HSG D
0.073	98	Paved parking, HSG D
23.593	65	Weighted Average
22.251		94.31% Pervious Area
1.342		5.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
75.0	1,936	0.0120	0.43		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.05 cfs @ 19.03 hrs, Volume= 0.042 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
14.488	55	Woods, Good, HSG B
2.897	58	Meadow, non-grazed, HSG B
0.126	98	Paved parking, HSG B
2.131	48	Brush, Good, HSG B
0.397	71	Meadow, non-grazed, HSG C
0.013	98	Paved parking, HSG C
0.057	65	Brush, Good, HSG C
0.027	73	Brush, Good, HSG D
20.136	55	Weighted Average
19.997		99.31% Pervious Area
0.139		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.6	1,804	0.0122	0.33		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.545 ac, 5.27% Impervious, Inflow Depth = 0.17" for 1-year event  
 Inflow = 0.92 cfs @ 13.16 hrs, Volume= 0.382 af  
 Outflow = 0.92 cfs @ 13.16 hrs, Volume= 0.382 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.136 ac, 0.69% Impervious, Inflow Depth = 0.02" for 1-year event  
 Inflow = 0.05 cfs @ 19.03 hrs, Volume= 0.042 af  
 Outflow = 0.05 cfs @ 19.03 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.952 ac, 2.76% Impervious, Inflow Depth = 0.18" for 1-year event  
 Inflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af  
 Outflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.49' @ 12.42 hrs  
 Flood Elev= 132.02'

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Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

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Primary OutFlow Max=0.26 cfs @ 12.42 hrs HW=130.49' (Free Discharge)

↑1=Culvert (Inlet Controls 0.26 cfs @ 1.43 fps)

Summary for Subcatchment 1: offsite area

Runoff = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	36	Woods, Fair, HSG A
1.614	60	Woods, Fair, HSG B
0.047	69	Pasture/grassland/range, Fair, HSG B
0.072	98	Paved parking, HSG B
1.483	73	Woods, Fair, HSG C
0.698	79	Woods, Fair, HSG D
0.037	98	Paved parking, HSG D
3.952	69	Weighted Average
3.843		97.24% Pervious Area
0.109		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	1,032	0.0221	0.57		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 3.84 cfs @ 12.74 hrs, Volume= 0.782 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.783	49	Pasture/grassland/range, Fair, HSG A
0.072	98	Paved parking, HSG A
2.389	60	Woods, Fair, HSG B
9.307	69	Pasture/grassland/range, Fair, HSG B
0.983	56	Brush, Fair, HSG B
1.143	98	Paved parking, HSG B
1.591	79	Pasture/grassland/range, Fair, HSG C
0.054	98	Paved parking, HSG C
0.019	70	Brush, Fair, HSG C
6.595	84	Pasture/grassland/range, Fair, HSG D
0.584	77	Brush, Fair, HSG D
0.073	98	Paved parking, HSG D
23.593	74	Weighted Average
22.251		94.31% Pervious Area
1.342		5.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
58.8	1,936	0.0120	0.55		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.33 cfs @ 13.49 hrs, Volume= 0.183 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
14.488	60	Woods, Fair, HSG B
2.897	69	Pasture/grassland/range, Fair, HSG B
0.126	98	Paved parking, HSG B
2.131	56	Brush, Fair, HSG B
0.397	79	Pasture/grassland/range, Fair, HSG C
0.013	98	Paved parking, HSG C
0.057	70	Brush, Fair, HSG C
0.027	77	Brush, Fair, HSG D
20.136	62	Weighted Average
19.997		99.31% Pervious Area
0.139		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
75.9	1,804	0.0122	0.40		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.545 ac, 5.27% Impervious, Inflow Depth = 0.38" for 1-year event  
 Inflow = 4.12 cfs @ 12.73 hrs, Volume= 0.865 af  
 Outflow = 4.12 cfs @ 12.73 hrs, Volume= 0.865 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.136 ac, 0.69% Impervious, Inflow Depth = 0.11" for 1-year event  
 Inflow = 0.33 cfs @ 13.49 hrs, Volume= 0.183 af  
 Outflow = 0.33 cfs @ 13.49 hrs, Volume= 0.183 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.952 ac, 2.76% Impervious, Inflow Depth = 0.25" for 1-year event  
 Inflow = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af  
 Outflow = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.50 cfs @ 12.34 hrs, Volume= 0.083 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.61' @ 12.34 hrs  
 Flood Elev= 132.02'

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Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

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Primary OutFlow Max=0.50 cfs @ 12.34 hrs HW=130.61' (Free Discharge)

↑1=Culvert (Inlet Controls 0.50 cfs @ 1.70 fps)

Summary for Subcatchment 1: offsite area

Runoff = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	61	Pasture/grassland/range, Good, HSG B
0.072	98	Paved parking, HSG B
1.483	70	Woods, Good, HSG C
0.698	77	Woods, Good, HSG D
0.037	98	Paved parking, HSG D
3.952	66	Weighted Average
3.843		97.24% Pervious Area
0.109		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 1.47 cfs @ 13.01 hrs, Volume= 0.450 af, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.783	39	Pasture/grassland/range, Good, HSG A
0.072	98	Paved parking, HSG A
2.389	55	Woods, Good, HSG B
9.307	61	Pasture/grassland/range, Good, HSG B
0.983	48	Brush, Good, HSG B
1.143	98	Paved parking, HSG B
1.591	74	Pasture/grassland/range, Good, HSG C
0.054	98	Paved parking, HSG C
0.019	65	Brush, Good, HSG C
6.595	80	Pasture/grassland/range, Good, HSG D
0.584	73	Brush, Good, HSG D
0.073	98	Paved parking, HSG D
23.593	68	Weighted Average
22.251		94.31% Pervious Area
1.342		5.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
69.3	1,936	0.0120	0.47		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.07 cfs @ 18.15 hrs, Volume= 0.056 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
14.488	55	Woods, Good, HSG B
2.897	61	Pasture/grassland/range, Good, HSG B
0.126	98	Paved parking, HSG B
2.131	48	Brush, Good, HSG B
0.397	74	Pasture/grassland/range, Good, HSG C
0.013	98	Paved parking, HSG C
0.057	65	Brush, Good, HSG C
0.027	73	Brush, Good, HSG D
20.136	56	Weighted Average
19.997		99.31% Pervious Area
0.139		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
88.3	1,804	0.0122	0.34		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.545 ac, 5.27% Impervious, Inflow Depth = 0.22" for 1-year event  
 Inflow = 1.62 cfs @ 12.94 hrs, Volume= 0.511 af  
 Outflow = 1.62 cfs @ 12.94 hrs, Volume= 0.511 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.136 ac, 0.69% Impervious, Inflow Depth = 0.03" for 1-year event  
 Inflow = 0.07 cfs @ 18.15 hrs, Volume= 0.056 af  
 Outflow = 0.07 cfs @ 18.15 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.952 ac, 2.76% Impervious, Inflow Depth = 0.18" for 1-year event  
 Inflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af  
 Outflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.49' @ 12.42 hrs  
 Flood Elev= 132.02'

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Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

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Primary OutFlow Max=0.26 cfs @ 12.42 hrs HW=130.49' (Free Discharge)

↑1=Culvert (Inlet Controls 0.26 cfs @ 1.43 fps)



## Appendix E

Post-Development Drainage Map – Detention Option  
HydroCAD Modeling Results – Detention Option



Lake Champlain



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**Project Location**



**Legend**

- Project Site
- Detention Basin
- Watershed Boundary
- Property Line
- Soil Restoration Area
- Solar Panel Array
- Grass
- Impervious
- Brush
- Woods
- Stream

**Notes**

Sources: Bing aerial photography (2012); VT E911 Roads (2011); Streams by ANR (2012); Watershed Boundaries by TCE (2014); Grass, Impervious, Woods by TCE (2014); Panels by TCE (2014); Project Parcel by TCE (2014); Soil Restoration Area by TCE (2014); Detention Basin by TCE (2014).

Disclaimer: The accuracy of information presented is determined by its sources. TCE is not responsible for any errors or omissions that may exist. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not a replacement for surveyed information or engineering studies.

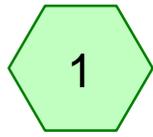
**South Forty Solar Farm  
Sunset Cliff Road  
Burlington, VT**

**Postdevelopment  
Drainage Map with Basin**

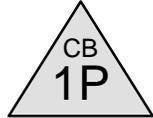
Project: 2013113  
Prepared By: LMJ  
03/25/2014  
1 inch = 200 feet



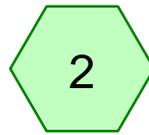
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



offsite area



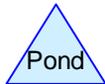
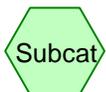
sunset cliff Rd culvert



to Muirfield



to Edinburgh



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.852	30	Woods, Good, HSG A (1, 2)
34.099	55	Woods, Good, HSG B (1, 2, 3)
3.283	70	Woods, Good, HSG C (1, 2, 3)
7.931	77	Woods, Good, HSG D (1, 2, 3)
1.122	98	Paved parking, HSG B (1, 2, 3)
0.112	98	Paved parking, HSG D (1, 2)
47.399	60	TOTAL AREA

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.852	HSG A	1, 2
35.221	HSG B	1, 2, 3
3.283	HSG C	1, 2, 3
8.043	HSG D	1, 2, 3
0.000	Other	
47.399		TOTAL AREA

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	1.122	0.000	0.112	0.000	1.234	Paved parking	1, 2, 3
0.852	34.099	3.283	7.931	0.000	46.165	Woods, Good	1, 2, 3
0.852	35.221	3.283	8.043	0.000	47.399	TOTAL AREA	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: offsite area	Runoff Area=3.949 ac	2.79% Impervious	Runoff Depth=0.18"
	Flow Length=1,032'	Slope=0.0221 '/'	Tc=32.5 min CN=66 Runoff=0.26 cfs 0.061 af

Subcatchment 2: to Muirfield	Runoff Area=23.308 ac	4.28% Impervious	Runoff Depth=0.14"
	Flow Length=1,936'	Slope=0.0111 '/'	Tc=80.0 min CN=64 Runoff=0.62 cfs 0.280 af

Subcatchment 3: to Edinborough	Runoff Area=20.142 ac	0.63% Impervious	Runoff Depth=0.03"
	Flow Length=1,804'	Slope=0.0138 '/'	Tc=83.1 min CN=56 Runoff=0.07 cfs 0.056 af

Reach SN 001:	Inflow=0.74 cfs 0.340 af
	Outflow=0.74 cfs 0.340 af

Reach SN 002:	Inflow=0.07 cfs 0.056 af
	Outflow=0.07 cfs 0.056 af

Pond 1P: sunset cliff Rd culvert	Peak Elev=130.49'	Inflow=0.26 cfs 0.061 af
	12.0" Round Culvert n=0.013 L=18.0' S=0.0128 '/'	Outflow=0.26 cfs 0.061 af

Total Runoff Area = 47.399 ac	Runoff Volume = 0.396 af	Average Runoff Depth = 0.10"
	97.40% Pervious = 46.165 ac	2.60% Impervious = 1.234 ac

Summary for Subcatchment 1: offsite area

Runoff = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	55	Woods, Good, HSG B
0.072	98	Paved parking, HSG B
1.482	70	Woods, Good, HSG C
0.695	77	Woods, Good, HSG D
0.038	98	Paved parking, HSG D
3.949	66	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 0.62 cfs @ 13.34 hrs, Volume= 0.280 af, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.851	30	Woods, Good, HSG A
9.359	55	Woods, Good, HSG B
3.556	55	Woods, Good, HSG B
0.923	98	Paved parking, HSG B
1.334	70	Woods, Good, HSG C
7.169	77	Woods, Good, HSG D
0.074	98	Paved parking, HSG D
0.042	77	Woods, Good, HSG D
23.308	64	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
80.0	1,936	0.0111	0.40		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
18.822	55	Woods, Good, HSG B
0.701	55	Woods, Good, HSG B
0.127	98	Paved parking, HSG B
0.231	70	Woods, Good, HSG C
0.236	70	Woods, Good, HSG C
0.006	77	Woods, Good, HSG D
0.019	77	Woods, Good, HSG D
20.142	56	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
83.1	1,804	0.0138	0.36		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.15" for 1-year event  
 Inflow = 0.74 cfs @ 13.25 hrs, Volume= 0.340 af  
 Outflow = 0.74 cfs @ 13.25 hrs, Volume= 0.340 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.03" for 1-year event  
 Inflow = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af  
 Outflow = 0.07 cfs @ 18.19 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 0.18" for 1-year event  
 Inflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af  
 Outflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.49' @ 12.42 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.26 cfs @ 12.42 hrs HW=130.49' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.26 cfs @ 1.43 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: offsite area	Runoff Area=3.949 ac	2.79% Impervious	Runoff Depth=0.25"
	Flow Length=1,032'	Slope=0.0221 '/'	Tc=32.5 min CN=66 Runoff=0.43 cfs 0.083 af

Subcatchment 2: to Muirfield	Runoff Area=23.308 ac	4.28% Impervious	Runoff Depth=0.20"
	Flow Length=1,936'	Slope=0.0111 '/'	Tc=80.0 min CN=64 Runoff=1.04 cfs 0.394 af

Subcatchment 3: to Edinborough	Runoff Area=20.142 ac	0.63% Impervious	Runoff Depth=0.06"
	Flow Length=1,804'	Slope=0.0138 '/'	Tc=83.1 min CN=56 Runoff=0.13 cfs 0.104 af

Reach SN 001:	Inflow=1.20 cfs 0.477 af
	Outflow=1.20 cfs 0.477 af

Reach SN 002:	Inflow=0.13 cfs 0.104 af
	Outflow=0.13 cfs 0.104 af

Pond 1P: sunset cliff Rd culvert	Peak Elev=130.58'	Inflow=0.43 cfs 0.083 af
	12.0" Round Culvert n=0.013 L=18.0' S=0.0128 '/'	Outflow=0.43 cfs 0.083 af

Total Runoff Area = 47.399 ac	Runoff Volume = 0.581 af	Average Runoff Depth = 0.15"
	97.40% Pervious = 46.165 ac	2.60% Impervious = 1.234 ac

Summary for Subcatchment 1: offsite area

Runoff = 0.43 cfs @ 12.39 hrs, Volume= 0.083 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 2-year Rainfall=2.30"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	55	Woods, Good, HSG B
0.072	98	Paved parking, HSG B
1.482	70	Woods, Good, HSG C
0.695	77	Woods, Good, HSG D
0.038	98	Paved parking, HSG D
3.949	66	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 1.04 cfs @ 13.24 hrs, Volume= 0.394 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 2-year Rainfall=2.30"

Area (ac)	CN	Description
0.851	30	Woods, Good, HSG A
9.359	55	Woods, Good, HSG B
3.556	55	Woods, Good, HSG B
0.923	98	Paved parking, HSG B
1.334	70	Woods, Good, HSG C
7.169	77	Woods, Good, HSG D
0.074	98	Paved parking, HSG D
0.042	77	Woods, Good, HSG D
23.308	64	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
80.0	1,936	0.0111	0.40		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.13 cfs @ 15.05 hrs, Volume= 0.104 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 2-year Rainfall=2.30"

Area (ac)	CN	Description
18.822	55	Woods, Good, HSG B
0.701	55	Woods, Good, HSG B
0.127	98	Paved parking, HSG B
0.231	70	Woods, Good, HSG C
0.236	70	Woods, Good, HSG C
0.006	77	Woods, Good, HSG D
0.019	77	Woods, Good, HSG D
20.142	56	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
83.1	1,804	0.0138	0.36		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.21" for 2-year event  
 Inflow = 1.20 cfs @ 13.16 hrs, Volume= 0.477 af  
 Outflow = 1.20 cfs @ 13.16 hrs, Volume= 0.477 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.06" for 2-year event  
 Inflow = 0.13 cfs @ 15.05 hrs, Volume= 0.104 af  
 Outflow = 0.13 cfs @ 15.05 hrs, Volume= 0.104 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 0.25" for 2-year event  
 Inflow = 0.43 cfs @ 12.39 hrs, Volume= 0.083 af  
 Outflow = 0.43 cfs @ 12.39 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.43 cfs @ 12.39 hrs, Volume= 0.083 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.58' @ 12.39 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.43 cfs @ 12.39 hrs HW=130.58' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.43 cfs @ 1.64 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: offsite area	Runoff Area=3.949 ac	2.79% Impervious	Runoff Depth=0.64"
	Flow Length=1,032'	Slope=0.0221 '/'	Tc=32.5 min CN=66 Runoff=1.64 cfs 0.212 af

Subcatchment 2: to Muirfield	Runoff Area=23.308 ac	4.28% Impervious	Runoff Depth=0.56"
	Flow Length=1,936'	Slope=0.0111 '/'	Tc=80.0 min CN=64 Runoff=4.11 cfs 1.086 af

Subcatchment 3: to Edinborough	Runoff Area=20.142 ac	0.63% Impervious	Runoff Depth=0.28"
	Flow Length=1,804'	Slope=0.0138 '/'	Tc=83.1 min CN=56 Runoff=1.19 cfs 0.469 af

Reach SN 001:	Inflow=4.60 cfs 1.298 af
	Outflow=4.60 cfs 1.298 af

Reach SN 002:	Inflow=1.19 cfs 0.469 af
	Outflow=1.19 cfs 0.469 af

Pond 1P: sunset cliff Rd culvert	Peak Elev=131.02'	Inflow=1.64 cfs 0.212 af
	12.0" Round Culvert n=0.013 L=18.0' S=0.0128 '/'	Outflow=1.64 cfs 0.212 af

Total Runoff Area = 47.399 ac	Runoff Volume = 1.767 af	Average Runoff Depth = 0.45"
	97.40% Pervious = 46.165 ac	2.60% Impervious = 1.234 ac

Summary for Subcatchment 1: offsite area

Runoff = 1.64 cfs @ 12.32 hrs, Volume= 0.212 af, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	55	Woods, Good, HSG B
0.072	98	Paved parking, HSG B
1.482	70	Woods, Good, HSG C
0.695	77	Woods, Good, HSG D
0.038	98	Paved parking, HSG D
3.949	66	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 4.11 cfs @ 13.07 hrs, Volume= 1.086 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
0.851	30	Woods, Good, HSG A
9.359	55	Woods, Good, HSG B
3.556	55	Woods, Good, HSG B
0.923	98	Paved parking, HSG B
1.334	70	Woods, Good, HSG C
7.169	77	Woods, Good, HSG D
0.074	98	Paved parking, HSG D
0.042	77	Woods, Good, HSG D
23.308	64	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
80.0	1,936	0.0111	0.40		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 1.19 cfs @ 13.29 hrs, Volume= 0.469 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
18.822	55	Woods, Good, HSG B
0.701	55	Woods, Good, HSG B
0.127	98	Paved parking, HSG B
0.231	70	Woods, Good, HSG C
0.236	70	Woods, Good, HSG C
0.006	77	Woods, Good, HSG D
0.019	77	Woods, Good, HSG D
20.142	56	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
83.1	1,804	0.0138	0.36		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.57" for 10-year event  
 Inflow = 4.60 cfs @ 12.98 hrs, Volume= 1.298 af  
 Outflow = 4.60 cfs @ 12.98 hrs, Volume= 1.298 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.28" for 10-year event  
 Inflow = 1.19 cfs @ 13.29 hrs, Volume= 0.469 af  
 Outflow = 1.19 cfs @ 13.29 hrs, Volume= 0.469 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 0.64" for 10-year event  
 Inflow = 1.64 cfs @ 12.32 hrs, Volume= 0.212 af  
 Outflow = 1.64 cfs @ 12.32 hrs, Volume= 0.212 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.64 cfs @ 12.32 hrs, Volume= 0.212 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 131.02' @ 12.32 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.64 cfs @ 12.32 hrs HW=131.02' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 1.64 cfs @ 2.41 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: offsite area	Runoff Area=3.949 ac	2.79% Impervious	Runoff Depth=1.03"
	Flow Length=1,032'	Slope=0.0221 '/'	Tc=32.5 min CN=66 Runoff=2.93 cfs 0.338 af

Subcatchment 2: to Muirfield	Runoff Area=23.308 ac	4.28% Impervious	Runoff Depth=0.92"
	Flow Length=1,936'	Slope=0.0111 '/'	Tc=80.0 min CN=64 Runoff=7.57 cfs 1.781 af

Subcatchment 3: to Edinborough	Runoff Area=20.142 ac	0.63% Impervious	Runoff Depth=0.53"
	Flow Length=1,804'	Slope=0.0138 '/'	Tc=83.1 min CN=56 Runoff=2.93 cfs 0.894 af

Reach SN 001:	Inflow=8.45 cfs 2.118 af
	Outflow=8.45 cfs 2.118 af

Reach SN 002:	Inflow=2.93 cfs 0.894 af
	Outflow=2.93 cfs 0.894 af

Pond 1P: sunset cliff Rd culvert	Peak Elev=131.67'	Inflow=2.93 cfs 0.338 af
	12.0" Round Culvert n=0.013 L=18.0' S=0.0128 '/'	Outflow=2.93 cfs 0.338 af

Total Runoff Area = 47.399 ac	Runoff Volume = 3.012 af	Average Runoff Depth = 0.76"
	97.40% Pervious = 46.165 ac	2.60% Impervious = 1.234 ac

Summary for Subcatchment 1: offsite area

Runoff = 2.93 cfs @ 12.31 hrs, Volume= 0.338 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	55	Woods, Good, HSG B
0.072	98	Paved parking, HSG B
1.482	70	Woods, Good, HSG C
0.695	77	Woods, Good, HSG D
0.038	98	Paved parking, HSG D
3.949	66	Weighted Average
3.839		97.21% Pervious Area
0.110		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2: to Muirfield

Runoff = 7.57 cfs @ 12.98 hrs, Volume= 1.781 af, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
0.851	30	Woods, Good, HSG A
9.359	55	Woods, Good, HSG B
3.556	55	Woods, Good, HSG B
0.923	98	Paved parking, HSG B
1.334	70	Woods, Good, HSG C
7.169	77	Woods, Good, HSG D
0.074	98	Paved parking, HSG D
0.042	77	Woods, Good, HSG D
23.308	64	Weighted Average
22.311		95.72% Pervious Area
0.997		4.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
80.0	1,936	0.0111	0.40		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 2.93 cfs @ 13.12 hrs, Volume= 0.894 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
18.822	55	Woods, Good, HSG B
0.701	55	Woods, Good, HSG B
0.127	98	Paved parking, HSG B
0.231	70	Woods, Good, HSG C
0.236	70	Woods, Good, HSG C
0.006	77	Woods, Good, HSG D
0.019	77	Woods, Good, HSG D
20.142	56	Weighted Average
20.015		99.37% Pervious Area
0.127		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
83.1	1,804	0.0138	0.36		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 27.257 ac, 4.06% Impervious, Inflow Depth = 0.93" for 25-year event  
 Inflow = 8.45 cfs @ 12.89 hrs, Volume= 2.118 af  
 Outflow = 8.45 cfs @ 12.89 hrs, Volume= 2.118 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.142 ac, 0.63% Impervious, Inflow Depth = 0.53" for 25-year event  
 Inflow = 2.93 cfs @ 13.12 hrs, Volume= 0.894 af  
 Outflow = 2.93 cfs @ 13.12 hrs, Volume= 0.894 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

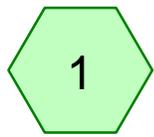
Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.949 ac, 2.79% Impervious, Inflow Depth = 1.03" for 25-year event  
 Inflow = 2.93 cfs @ 12.31 hrs, Volume= 0.338 af  
 Outflow = 2.93 cfs @ 12.31 hrs, Volume= 0.338 af, Atten= 0%, Lag= 0.0 min  
 Primary = 2.93 cfs @ 12.31 hrs, Volume= 0.338 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 131.67' @ 12.31 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.92 cfs @ 12.31 hrs HW=131.67' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 2.92 cfs @ 3.72 fps)



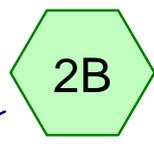
offsite area



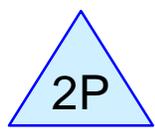
sunset cliff Rd culvert



wetland area



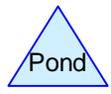
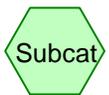
upland area



detention basin



to Edinborough



Routing Diagram for 13113 - prop w det 2014 0325  
Prepared by Trudell Consulting Engineers, Printed 3/25/2014  
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## Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.787	30	Meadow, non-grazed, HSG A (2A, 2B)
0.549	30	Woods, Good, HSG A (1, 2A)
3.114	48	Brush, Good, HSG B (2A, 2B, 3)
17.943	55	Woods, Good, HSG B (1, 2B, 3)
12.245	58	Meadow, non-grazed, HSG B (1, 2A, 2B, 3)
0.078	65	Brush, Good, HSG C (2B, 3)
1.483	70	Woods, Good, HSG C (1)
1.986	71	Meadow, non-grazed, HSG C (2A, 2B, 3)
0.616	73	Brush, Good, HSG D (2B, 3)
0.698	77	Woods, Good, HSG D (1)
6.596	78	Meadow, non-grazed, HSG D (2B)
0.067	98	Paved parking, HSG A (2A)
1.336	98	Paved parking, HSG B (1, 2A, 2B, 3)
0.061	98	Paved parking, HSG C (2A, 3)
0.111	98	Paved parking, HSG D (1, 2B)
47.670	61	TOTAL AREA

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.403	HSG A	1, 2A, 2B
34.638	HSG B	1, 2A, 2B, 3
3.608	HSG C	1, 2A, 2B, 3
8.021	HSG D	1, 2B, 3
0.000	Other	
47.670		TOTAL AREA

## Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.067	1.336	0.061	0.111	0.000	1.575	Paved parking	1, 2A, 2B, 3
0.787	12.245	1.986	6.596	0.000	21.614	Meadow, non-grazed	1, 2A, 2B, 3
0.000	3.114	0.078	0.616	0.000	3.808	Brush, Good	2A, 2B, 3
0.549	17.943	1.483	0.698	0.000	20.673	Woods, Good	1, 2A, 2B, 3
1.403	34.638	3.608	8.021	0.000	47.670	TOTAL AREA	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points  
Runoff by SCS TR-20 method, UH=SCS  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: offsite area	Runoff Area=3.952 ac 2.76% Impervious	Runoff Depth=0.18"
Flow Length=1,032'	Slope=0.0221 '/'	Tc=32.5 min CN=66 Runoff=0.26 cfs 0.061 af
Subcatchment 2A: wetland area	Runoff Area=8.650 ac 12.64% Impervious	Runoff Depth=0.08"
Flow Length=1,264'	Slope=0.0120 '/'	Tc=60.6 min CN=60 Runoff=0.09 cfs 0.057 af
Subcatchment 2B: upland area	Runoff Area=14.932 ac 1.57% Impervious	Runoff Depth=0.23"
Flow Length=655'	Slope=0.0120 '/'	Tc=29.1 min CN=68 Runoff=1.60 cfs 0.285 af
Subcatchment 3: to Edinborough	Runoff Area=20.136 ac 0.69% Impervious	Runoff Depth=0.02"
Flow Length=1,804'	Slope=0.0122 '/'	Tc=90.6 min CN=55 Runoff=0.05 cfs 0.042 af
Reach SN 001:		Inflow=0.27 cfs 0.118 af Outflow=0.27 cfs 0.118 af
Reach SN 002:		Inflow=0.05 cfs 0.042 af Outflow=0.05 cfs 0.042 af
Pond 1P: sunset cliff Rd culvert	Peak Elev=130.49'	Inflow=0.26 cfs 0.061 af 12.0" Round Culvert n=0.013 L=18.0' S=0.0128 '/'
		Outflow=0.26 cfs 0.061 af
Pond 2P: detention basin	Peak Elev=137.02'	Storage=791 cf Inflow=1.60 cfs 0.285 af
	Discarded=1.12 cfs 0.285 af	Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af
		Outflow=1.12 cfs 0.285 af
Total Runoff Area = 47.670 ac Runoff Volume = 0.444 af Average Runoff Depth = 0.11"		
96.70% Pervious = 46.095 ac 3.30% Impervious = 1.575 ac		

Summary for Subcatchment 1: offsite area

Runoff = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.483	70	Woods, Good, HSG C
0.698	77	Woods, Good, HSG D
0.037	98	Paved parking, HSG D
3.952	66	Weighted Average
3.843		97.24% Pervious Area
0.109		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2A: wetland area

Runoff = 0.09 cfs @ 13.67 hrs, Volume= 0.057 af, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.530	30	Meadow, non-grazed, HSG A
0.067	98	Paved parking, HSG A
6.073	58	Meadow, non-grazed, HSG B
0.978	98	Paved parking, HSG B
0.218	48	Brush, Good, HSG B
0.548	30	Woods, Good, HSG A
0.188	71	Meadow, non-grazed, HSG C
0.048	98	Paved parking, HSG C
8.650	60	Weighted Average
7.557		87.36% Pervious Area
1.093		12.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.6	1,264	0.0120	0.35		Lag/CN Method,

Summary for Subcatchment 2B: upland area

Runoff = 1.60 cfs @ 12.32 hrs, Volume= 0.285 af, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
0.257	30	Meadow, non-grazed, HSG A
3.228	58	Meadow, non-grazed, HSG B
0.160	98	Paved parking, HSG B
0.765	48	Brush, Good, HSG B
1.841	55	Woods, Good, HSG B
1.401	71	Meadow, non-grazed, HSG C
0.021	65	Brush, Good, HSG C
6.596	78	Meadow, non-grazed, HSG D
0.074	98	Paved parking, HSG D
0.589	73	Brush, Good, HSG D
14.932	68	Weighted Average
14.698		98.43% Pervious Area
0.234		1.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.1	655	0.0120	0.37		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.05 cfs @ 19.03 hrs, Volume= 0.042 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (ac)	CN	Description
14.488	55	Woods, Good, HSG B
2.897	58	Meadow, non-grazed, HSG B
0.126	98	Paved parking, HSG B
2.131	48	Brush, Good, HSG B
0.397	71	Meadow, non-grazed, HSG C
0.013	98	Paved parking, HSG C
0.057	65	Brush, Good, HSG C
0.027	73	Brush, Good, HSG D
20.136	55	Weighted Average
19.997		99.31% Pervious Area
0.139		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.6	1,804	0.0122	0.33		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.602 ac, 9.54% Impervious, Inflow Depth = 0.11" for 1-year event  
 Inflow = 0.27 cfs @ 12.46 hrs, Volume= 0.118 af  
 Outflow = 0.27 cfs @ 12.46 hrs, Volume= 0.118 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 35.068 ac, 1.06% Impervious, Inflow Depth = 0.01" for 1-year event  
 Inflow = 0.05 cfs @ 19.03 hrs, Volume= 0.042 af  
 Outflow = 0.05 cfs @ 19.03 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.952 ac, 2.76% Impervious, Inflow Depth = 0.18" for 1-year event  
 Inflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af  
 Outflow = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.26 cfs @ 12.42 hrs, Volume= 0.061 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 130.49' @ 12.42 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.26 cfs @ 12.42 hrs HW=130.49' (Free Discharge)  
 ↑1=Culvert (Inlet Controls 0.26 cfs @ 1.43 fps)

Summary for Pond 2P: detention basin

Inflow Area = 14.932 ac, 1.57% Impervious, Inflow Depth = 0.23" for 1-year event  
 Inflow = 1.60 cfs @ 12.32 hrs, Volume= 0.285 af  
 Outflow = 1.12 cfs @ 12.60 hrs, Volume= 0.285 af, Atten= 30%, Lag= 16.3 min  
 Discarded = 1.12 cfs @ 12.60 hrs, Volume= 0.285 af  
 Primary = 0.00 cfs @ 12.60 hrs, Volume= 0.000 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 137.02' @ 12.60 hrs Surf.Area= 48,386 sf Storage= 791 cf  
 Flood Elev= 138.00' Surf.Area= 66,063 sf Storage= 56,852 cf

Plug-Flow detention time= 7.8 min calculated for 0.285 af (100% of inflow)  
 Center-of-Mass det. time= 7.8 min ( 960.0 - 952.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.00'	56,852 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
137.00	48,115	834.0	0	0	48,115
138.00	66,063	960.0	56,852	56,852	66,125

Device	Routing	Invert	Outlet Devices
#1	Discarded	137.00'	1.000 in/hr Exfiltration over Surface area
#2	Primary	137.00'	12.0" Round Culvert L= 268.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 137.00' / 135.00' S= 0.0075 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	137.00'	4.0" Horiz. control orifice C= 0.600 Limited to weir flow at low heads
#4	Secondary	137.75'	10.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=1.12 cfs @ 12.60 hrs HW=137.02' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 1.12 cfs)

Primary OutFlow Max=0.00 cfs @ 12.60 hrs HW=137.02' (Free Discharge)

↑2=Culvert (Barrel Controls 0.00 cfs @ 0.40 fps)

↑3=control orifice (Passes 0.00 cfs of 0.01 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=137.00' (Free Discharge)

↑4=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points  
Runoff by SCS TR-20 method, UH=SCS  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: offsite area	Runoff Area=3.952 ac 2.76% Impervious Runoff Depth=0.64" Flow Length=1,032' Slope=0.0221 '/' Tc=32.5 min CN=66 Runoff=1.64 cfs 0.212 af
Subcatchment 2A: wetland area	Runoff Area=8.650 ac 12.64% Impervious Runoff Depth=0.41" Flow Length=1,264' Slope=0.0120 '/' Tc=60.6 min CN=60 Runoff=1.15 cfs 0.294 af
Subcatchment 2B: upland area	Runoff Area=14.932 ac 1.57% Impervious Runoff Depth=0.73" Flow Length=655' Slope=0.0120 '/' Tc=29.1 min CN=68 Runoff=8.08 cfs 0.912 af
Subcatchment 3: to Edinborough	Runoff Area=20.136 ac 0.69% Impervious Runoff Depth=0.25" Flow Length=1,804' Slope=0.0122 '/' Tc=90.6 min CN=55 Runoff=0.97 cfs 0.421 af
Reach SN 001:	Inflow=2.21 cfs 0.506 af Outflow=2.21 cfs 0.506 af
Reach SN 002:	Inflow=1.19 cfs 0.485 af Outflow=1.19 cfs 0.485 af
Pond 1P: sunset cliff Rd culvert	Peak Elev=131.02' Inflow=1.64 cfs 0.212 af 12.0" Round Culvert n=0.013 L=18.0' S=0.0128 '/' Outflow=1.64 cfs 0.212 af
Pond 2P: detention basin	Peak Elev=137.26' Storage=13,134 cf Inflow=8.08 cfs 0.912 af Discarded=1.22 cfs 0.848 af Primary=0.21 cfs 0.064 af Secondary=0.00 cfs 0.000 af Outflow=1.43 cfs 0.912 af
Total Runoff Area = 47.670 ac Runoff Volume = 1.839 af Average Runoff Depth = 0.46" 96.70% Pervious = 46.095 ac 3.30% Impervious = 1.575 ac	

Summary for Subcatchment 1: offsite area

Runoff = 1.64 cfs @ 12.32 hrs, Volume= 0.212 af, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.483	70	Woods, Good, HSG C
0.698	77	Woods, Good, HSG D
0.037	98	Paved parking, HSG D
3.952	66	Weighted Average
3.843		97.24% Pervious Area
0.109		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2A: wetland area

Runoff = 1.15 cfs @ 12.80 hrs, Volume= 0.294 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
0.530	30	Meadow, non-grazed, HSG A
0.067	98	Paved parking, HSG A
6.073	58	Meadow, non-grazed, HSG B
0.978	98	Paved parking, HSG B
0.218	48	Brush, Good, HSG B
0.548	30	Woods, Good, HSG A
0.188	71	Meadow, non-grazed, HSG C
0.048	98	Paved parking, HSG C
8.650	60	Weighted Average
7.557		87.36% Pervious Area
1.093		12.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.6	1,264	0.0120	0.35		Lag/CN Method,

Summary for Subcatchment 2B: upland area

Runoff = 8.08 cfs @ 12.26 hrs, Volume= 0.912 af, Depth= 0.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
0.257	30	Meadow, non-grazed, HSG A
3.228	58	Meadow, non-grazed, HSG B
0.160	98	Paved parking, HSG B
0.765	48	Brush, Good, HSG B
1.841	55	Woods, Good, HSG B
1.401	71	Meadow, non-grazed, HSG C
0.021	65	Brush, Good, HSG C
6.596	78	Meadow, non-grazed, HSG D
0.074	98	Paved parking, HSG D
0.589	73	Brush, Good, HSG D
14.932	68	Weighted Average
14.698		98.43% Pervious Area
0.234		1.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.1	655	0.0120	0.37		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 0.97 cfs @ 13.49 hrs, Volume= 0.421 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (ac)	CN	Description
14.488	55	Woods, Good, HSG B
2.897	58	Meadow, non-grazed, HSG B
0.126	98	Paved parking, HSG B
2.131	48	Brush, Good, HSG B
0.397	71	Meadow, non-grazed, HSG C
0.013	98	Paved parking, HSG C
0.057	65	Brush, Good, HSG C
0.027	73	Brush, Good, HSG D
20.136	55	Weighted Average
19.997		99.31% Pervious Area
0.139		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.6	1,804	0.0122	0.33		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.602 ac, 9.54% Impervious, Inflow Depth = 0.48" for 10-year event  
 Inflow = 2.21 cfs @ 12.43 hrs, Volume= 0.506 af  
 Outflow = 2.21 cfs @ 12.43 hrs, Volume= 0.506 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 35.068 ac, 1.06% Impervious, Inflow Depth = 0.17" for 10-year event  
 Inflow = 1.19 cfs @ 13.49 hrs, Volume= 0.485 af  
 Outflow = 1.19 cfs @ 13.49 hrs, Volume= 0.485 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.952 ac, 2.76% Impervious, Inflow Depth = 0.64" for 10-year event  
 Inflow = 1.64 cfs @ 12.32 hrs, Volume= 0.212 af  
 Outflow = 1.64 cfs @ 12.32 hrs, Volume= 0.212 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.64 cfs @ 12.32 hrs, Volume= 0.212 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 131.02' @ 12.32 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.64 cfs @ 12.32 hrs HW=131.02' (Free Discharge)  
 ↑1=Culvert (Inlet Controls 1.64 cfs @ 2.41 fps)

Summary for Pond 2P: detention basin

Inflow Area = 14.932 ac, 1.57% Impervious, Inflow Depth = 0.73" for 10-year event  
 Inflow = 8.08 cfs @ 12.26 hrs, Volume= 0.912 af  
 Outflow = 1.43 cfs @ 13.35 hrs, Volume= 0.912 af, Atten= 82%, Lag= 65.4 min  
 Discarded = 1.22 cfs @ 13.35 hrs, Volume= 0.848 af  
 Primary = 0.21 cfs @ 13.35 hrs, Volume= 0.064 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 137.26' @ 13.35 hrs Surf.Area= 52,527 sf Storage= 13,134 cf  
 Flood Elev= 138.00' Surf.Area= 66,063 sf Storage= 56,852 cf

Plug-Flow detention time= 85.4 min calculated for 0.911 af (100% of inflow)  
 Center-of-Mass det. time= 85.4 min ( 987.1 - 901.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.00'	56,852 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
137.00	48,115	834.0	0	0	48,115
138.00	66,063	960.0	56,852	56,852	66,125

Device	Routing	Invert	Outlet Devices
#1	Discarded	137.00'	1.000 in/hr Exfiltration over Surface area
#2	Primary	137.00'	12.0" Round Culvert L= 268.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 137.00' / 135.00' S= 0.0075 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	137.00'	4.0" Horiz. control orifice C= 0.600 Limited to weir flow at low heads
#4	Secondary	137.75'	10.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=1.22 cfs @ 13.35 hrs HW=137.26' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 1.22 cfs)

Primary OutFlow Max=0.21 cfs @ 13.35 hrs HW=137.26' (Free Discharge)

↑2=Culvert (Passes 0.21 cfs of 0.25 cfs potential flow)

↑3=control orifice (Orifice Controls 0.21 cfs @ 2.46 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=137.00' (Free Discharge)

↑4=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points  
Runoff by SCS TR-20 method, UH=SCS  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: offsite area	Runoff Area=3.952 ac 2.76% Impervious Runoff Depth=1.03" Flow Length=1,032' Slope=0.0221 '/' Tc=32.5 min CN=66 Runoff=2.93 cfs 0.338 af
Subcatchment 2A: wetland area	Runoff Area=8.650 ac 12.64% Impervious Runoff Depth=0.71" Flow Length=1,264' Slope=0.0120 '/' Tc=60.6 min CN=60 Runoff=2.44 cfs 0.514 af
Subcatchment 2B: upland area	Runoff Area=14.932 ac 1.57% Impervious Runoff Depth=1.14" Flow Length=655' Slope=0.0120 '/' Tc=29.1 min CN=68 Runoff=13.73 cfs 1.421 af
Subcatchment 3: to Edinborough	Runoff Area=20.136 ac 0.69% Impervious Runoff Depth=0.49" Flow Length=1,804' Slope=0.0122 '/' Tc=90.6 min CN=55 Runoff=2.46 cfs 0.823 af
Reach SN 001:	Inflow=4.27 cfs 0.852 af Outflow=4.27 cfs 0.852 af
Reach SN 002:	Inflow=2.76 cfs 1.006 af Outflow=2.76 cfs 1.006 af
Pond 1P: sunset cliff Rd culvert	Peak Elev=131.67' Inflow=2.93 cfs 0.338 af 12.0" Round Culvert n=0.013 L=18.0' S=0.0128 '/' Outflow=2.93 cfs 0.338 af
Pond 2P: detention basin	Peak Elev=137.50' Storage=25,921 cf Inflow=13.73 cfs 1.421 af Discarded=1.31 cfs 1.238 af Primary=0.30 cfs 0.183 af Secondary=0.00 cfs 0.000 af Outflow=1.61 cfs 1.421 af
Total Runoff Area = 47.670 ac Runoff Volume = 3.097 af Average Runoff Depth = 0.78" 96.70% Pervious = 46.095 ac 3.30% Impervious = 1.575 ac	

Summary for Subcatchment 1: offsite area

Runoff = 2.93 cfs @ 12.31 hrs, Volume= 0.338 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
0.001	30	Woods, Good, HSG A
1.614	55	Woods, Good, HSG B
0.047	58	Meadow, non-grazed, HSG B
0.072	98	Paved parking, HSG B
1.483	70	Woods, Good, HSG C
0.698	77	Woods, Good, HSG D
0.037	98	Paved parking, HSG D
3.952	66	Weighted Average
3.843		97.24% Pervious Area
0.109		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.5	1,032	0.0221	0.53		Lag/CN Method,

Summary for Subcatchment 2A: wetland area

Runoff = 2.44 cfs @ 12.73 hrs, Volume= 0.514 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
0.530	30	Meadow, non-grazed, HSG A
0.067	98	Paved parking, HSG A
6.073	58	Meadow, non-grazed, HSG B
0.978	98	Paved parking, HSG B
0.218	48	Brush, Good, HSG B
0.548	30	Woods, Good, HSG A
0.188	71	Meadow, non-grazed, HSG C
0.048	98	Paved parking, HSG C
8.650	60	Weighted Average
7.557		87.36% Pervious Area
1.093		12.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.6	1,264	0.0120	0.35		Lag/CN Method,

Summary for Subcatchment 2B: upland area

Runoff = 13.73 cfs @ 12.26 hrs, Volume= 1.421 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
0.257	30	Meadow, non-grazed, HSG A
3.228	58	Meadow, non-grazed, HSG B
0.160	98	Paved parking, HSG B
0.765	48	Brush, Good, HSG B
1.841	55	Woods, Good, HSG B
1.401	71	Meadow, non-grazed, HSG C
0.021	65	Brush, Good, HSG C
6.596	78	Meadow, non-grazed, HSG D
0.074	98	Paved parking, HSG D
0.589	73	Brush, Good, HSG D
14.932	68	Weighted Average
14.698		98.43% Pervious Area
0.234		1.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.1	655	0.0120	0.37		Lag/CN Method,

Summary for Subcatchment 3: to Edinborough

Runoff = 2.46 cfs @ 13.29 hrs, Volume= 0.823 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 25-year Rainfall=3.90"

Area (ac)	CN	Description
14.488	55	Woods, Good, HSG B
2.897	58	Meadow, non-grazed, HSG B
0.126	98	Paved parking, HSG B
2.131	48	Brush, Good, HSG B
0.397	71	Meadow, non-grazed, HSG C
0.013	98	Paved parking, HSG C
0.057	65	Brush, Good, HSG C
0.027	73	Brush, Good, HSG D
20.136	55	Weighted Average
19.997		99.31% Pervious Area
0.139		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.6	1,804	0.0122	0.33		Lag/CN Method,

Summary for Reach SN 001:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.602 ac, 9.54% Impervious, Inflow Depth = 0.81" for 25-year event  
 Inflow = 4.27 cfs @ 12.45 hrs, Volume= 0.852 af  
 Outflow = 4.27 cfs @ 12.45 hrs, Volume= 0.852 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach SN 002:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 35.068 ac, 1.06% Impervious, Inflow Depth = 0.34" for 25-year event  
 Inflow = 2.76 cfs @ 13.29 hrs, Volume= 1.006 af  
 Outflow = 2.76 cfs @ 13.29 hrs, Volume= 1.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: sunset cliff Rd culvert

Inflow Area = 3.952 ac, 2.76% Impervious, Inflow Depth = 1.03" for 25-year event  
 Inflow = 2.93 cfs @ 12.31 hrs, Volume= 0.338 af  
 Outflow = 2.93 cfs @ 12.31 hrs, Volume= 0.338 af, Atten= 0%, Lag= 0.0 min  
 Primary = 2.93 cfs @ 12.31 hrs, Volume= 0.338 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 131.67' @ 12.31 hrs  
 Flood Elev= 132.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.21'	12.0" Round Culvert L= 18.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 130.21' / 129.98' S= 0.0128 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.93 cfs @ 12.31 hrs HW=131.67' (Free Discharge)  
 ↑1=Culvert (Inlet Controls 2.93 cfs @ 3.73 fps)

Summary for Pond 2P: detention basin

Inflow Area = 14.932 ac, 1.57% Impervious, Inflow Depth = 1.14" for 25-year event  
 Inflow = 13.73 cfs @ 12.26 hrs, Volume= 1.421 af  
 Outflow = 1.61 cfs @ 13.79 hrs, Volume= 1.421 af, Atten= 88%, Lag= 92.2 min  
 Discarded = 1.31 cfs @ 13.79 hrs, Volume= 1.238 af  
 Primary = 0.30 cfs @ 13.79 hrs, Volume= 0.183 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 137.50' @ 13.79 hrs Surf.Area= 56,651 sf Storage= 25,921 cf  
 Flood Elev= 138.00' Surf.Area= 66,063 sf Storage= 56,852 cf

Plug-Flow detention time= 170.8 min calculated for 1.421 af (100% of inflow)  
 Center-of-Mass det. time= 170.8 min ( 1,057.2 - 886.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.00'	56,852 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
137.00	48,115	834.0	0	0	48,115
138.00	66,063	960.0	56,852	56,852	66,125

Device	Routing	Invert	Outlet Devices
#1	Discarded	137.00'	1.000 in/hr Exfiltration over Surface area
#2	Primary	137.00'	12.0" Round Culvert L= 268.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 137.00' / 135.00' S= 0.0075 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	137.00'	4.0" Horiz. control orifice C= 0.600 Limited to weir flow at low heads
#4	Secondary	137.75'	10.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=1.31 cfs @ 13.79 hrs HW=137.50' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 1.31 cfs)

Primary OutFlow Max=0.30 cfs @ 13.79 hrs HW=137.50' (Free Discharge)

↑2=Culvert (Passes 0.30 cfs of 0.87 cfs potential flow)

↑3=control orifice (Orifice Controls 0.30 cfs @ 3.39 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=137.00' (Free Discharge)

↑4=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)