Revised Storm Water Management Calculations with Cornell Study Rainfall Quantities

#17 Malcolm Hoyt Drive
Newburyport, Massachusetts

June 18, 2019
July 10, 2019
February 10, 2020
May 12, 2020

Executive Summary:

The Project, as proposed consists of the construction of a 19,087 square foot (sf.) warehouse addition to the existing Zampell Refractories building located at 17 Malcolm Hoyt Drive in Newburyport, MA. Stormwater runoff from rooftops is considered clean under the Massachusetts Stormwater Standards. The only increase in impervious area associated with the Project is from the proposed rooftop. Rooftop detention was selected to mitigate peak flow rates associated with the project as summarized below.

Existing vs. Proposed Peak Flow Rates (Over Proposed Roof Footprint)

Storm	Existing Q (C.F.S.)	Proposed Q (C.F.S.)	Change Q (C.F.S.)
2 Year (3.22”)	0.65	0.51	-0.14
10 Year (4.95”)	1.37	0.59	-0.78
25 Year (6.32”)	1.98	0.63	-1.35
50 Year (7.62”)	2.57	0.67	-1.90
100 Year (9.18”)	3.28	0.71	-2.57

Introduction and Background

Zampell Refractories is proposing an approximately 19,087 square-foot building expansion to its existing facility at 17 Malcolm Hoyt Drive. The only changes expected on the site is the construction of the proposed warehouse building facility. No new parking spaces or access lanes are proposed.

Due to the complexity of the existing drainage system within the industrial park, and the fact that the only increase in imperviousness is in the form of the proposed building expansion, the decision was made that roof-top storage would be logical for flow mitigation. Note that under stormwater management, infiltration in the poorly-drained soils of the park is not required.

The applicant filed the proposed building expansion with the Newburyport Conservation Commission and has received an Order of Conditions in DEP File No. 051-1012, dated September 5, 2019.

Subsequent to the issuance of that Order of Conditions, the project architect working with the manufacturer of the panel building determined that a different configuration of roof drain would be desirable. Specifically, the building manufacturer favored a design which put the emergency scuppers next to the internal drains at the perimeter of the building. As a consequence, the roof storage geometry changed to the configuration contained as required by the Stormwater Management Policy. The required calculations accompany this narrative.

Newburyport Stormwater Management Permit

Accompanying this report as Appendix B please find a copy of the DRAFT City of Newburyport Stormwater Management Permit Application. Once all approvals have been obtained, and prior to construction, the permit application will be filed with the Department of Public Services Engineering Department.

Massachusetts DEP Storm Water Management Standards

The Project's proposed storm water management system has been designed to comply with the ten (10) standards of the MaDEP Storm Water Management Policy. Each of the standards and the extent of Project compliance are summarized below. Please refer to Appendix C for the completed MassDEP Storm Water Checklist.

1.1 Standard 1: No New Untreated Discharges

No new storm water conveyances (e.g. outfalls) may discharge untreated storm water directly to or cause erosion in wetlands or waters of the Commonwealth.

The Project does not discharge any new storm water requiring treatment directly to a wetland or water of the Commonwealth.

1.2 Standard 2: Peak Rate Attenuation

Storm water management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

Storm water management controls to mitigate peak rates of runoff from the Project were developed for the 2, 10, 25, and 100-year, 24-hour design storm events (Cornell Study). As previously stated, runoff calculations were performed in accordance with the methodology outlined in the NRCS Soil Conservation Service (SCS) methods as defined in Technical Release 55 (TR-55) and Technical Release 20 (TR-20) which are the basis for they HydroCAD® hydrologic model. Calculations are provided as Appendix D to this report.

Pre- and post-development peak rates of runoff for the Project are summarized in the table below:

Peak Rates of Runoff Comparison

Storm	Existing Q (C.F.S.)	Proposed Q (C.F.S.)	Change Q (C.F.S.)
2 Year (3.22”)	0.65	0.51	-0.14
10 Year (4.95”)	1.37	0.59	-0.78
25 Year (6.32”)	1.98	0.63	-1.35
50 Year (7.62”)	2.57	0.67	-1.90
100 Year (9.18”)	3.28	0.71	-2.57

1.3 Standard 3: Recharge

Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration ... At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the storm water management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Storm Water Handbook.

Due to the poorly drained soils and proximity to groundwater the proponent is not proposing any additional infiltration with the Project.

1.4 Standard 4: Water Quality

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The standard is met with pollution prevention plans, storm water best management practices sized to capture the required water quality volume, and pretreatment measures.

The Project, as proposed is a partial redevelopment project. The only increase in impervious surfaces are associated with the roof construction. The Standards recognize rooftop runoff to be clean when it is disconnected from the pavement.

1.5 Standard 5: Land Uses with Higher Potential Pollution Loads

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Storm Water Handbook to eliminate or reduce the discharge of storm water runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all

land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and storm water runoff, the proponent shall use the specific structural storm water BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Storm Water Handbook. Storm water discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Standard 5 is not applicable to the Project. The Project is not associated with uses that will subject the site to higher potential pollutant loads as defined in the MaDEP Wetlands and Water Quality regulations.

Land Uses with Higher Potential Pollutant Loads (LUHPPLs) are identified in 310 CMR 22.20B(2) and C(2) a through k and m and in 310 CMR 22.21(2)(a) 1 through 8 and (b) 1 through 6; areas within a site that are the location of activities that are subject to an individual National Pollutant Discharge Elimination System (NPDES) permit or the NPRDE Multi-Sector General Permit; automotive fueling facilities, exterior fleet storage areas, exterior vehicle service and equipment cleaning areas; marinas and boatyards; parking lots with high-intensity use; confined disposal facilities and disposal sites.

1.6 Standard 6: Critical Areas

Storm water discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and storm water discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural storm water best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Storm Water Handbook.

The Project is not located within nor discharges to a Critical Area.

1.7 Standard 7: Redevelopment Projects

A redevelopment project is required to meet the following Storm Water Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing storm water discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Storm Water Management Standards and improve existing conditions.

Standard 7 is partially applicable to the Project. The MaDEP Storm Water Management Handbook definition of a redevelopment project identifies the, *"development, rehabilitation, expansion, and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area."*

The Project, as proposed, does not increase pavement areas on the project. All increases in impervious areas are associated with the proposed addition rooftop and the drainage from the water quality volume over said rooftop has been designed to be disconnected from other impervious surfaces.

1.8 Standard 8: Construction Period Pollution Prevention

A plan to control construction-related impacts, including erosion sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan), must be developed and implemented.

A Construction Period Pollution Prevention and Erosion Control Plan is included as Appendix E to this report. This program details the construction period operation and maintenance for best management practices employed on the project and provides sequencing for pollution prevention measures and erosion and sedimentation controls. Locations of erosion control measures are depicted on the Definitive Plan set.

1.9 Standard 9: Operation and Maintenance Plan

A long-term operation and maintenance plan must be developed and implemented to ensure that storm water management systems function as designed.

A Long Term Operation and Maintenance Plan is included as Appendix F to this report. The Operation and Maintenance program provides details and scheduled for routine and non-routine maintenance to the selected best management practices used in the Project.

1.10 Standard 10: Illicit Discharges

All illicit discharges to the storm water management system are prohibited.

Illicit discharges to the storm water management system are discharges that are not entirely comprised of storm water. Discharges to the storm water management system from the following activities or facilities are permissible:

- Firefighting
- Water Main Flushing
- Landscape Irrigation
- Uncontaminated Groundwater
- Potable Water Sources
- Foundation Drains
- Air Conditioning Condensation
- Footing Drains
- Individual Resident Car Washing
- Flows from Riparian Habitats and Wetlands
- Dechlorinated Water from Swimming Pools
- Water Used for Street Sweeping
- Water Used to Clean Residential Buildings (without detergents)

All other illicit discharges to the storm water management system are prohibited. There are no known illicit discharges anticipated through the completion of this project. Post-construction prevention of illicit discharges is addressed in the Good Housekeeping Practices section of Appendix G.

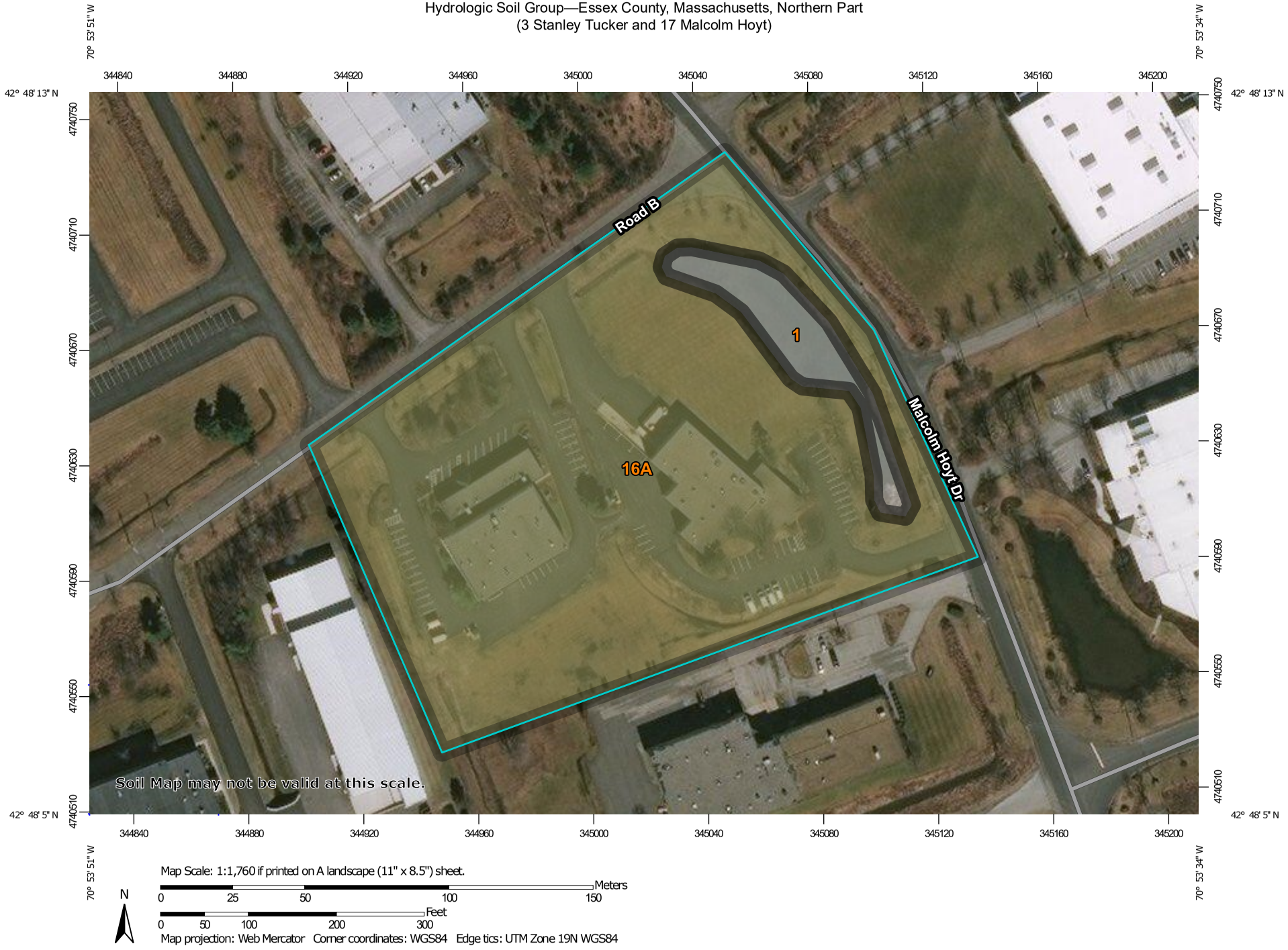
2.0 Conclusion

The Project as proposed has been designed to address both the quality and quantity of storm water runoff from the site improvements. The Project has been designed to meet or exceed each of the ten (10) standards to the maximum extent practicable as identified herein.

APPENDIX A:

NRCS Soil Mapping and Data

Hydrologic Soil Group—Essex County, Massachusetts, Northern Part
(3 Stanley Tucker and 17 Malcolm Hoyt)



Map Scale: 1:1,760 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 15, Sep 12, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Sep 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		0.4	6.6%
16A	Scantic silt loam, 0 to 3 percent slopes	C/D	6.3	93.4%
Totals for Area of Interest			**6.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX B:

Newburyport Stormwater Permit Application

Revised 05/15/14

STORMWATER MANAGEMENT PERMIT

APPLICATION

Received Date: _____
Fee Paid: _____
Date Paid: _____
Permit #: _____
Approved By: _____
Approval Date: _____
(For DPS use only)

Department of Public Services
Engineering Department
16A Perry Way
Newburyport, MA 01950
Telephone: 978-465-4464 x1711

1. Project / Site Information

Is site less than 10,000 sq ft of land disturbance? If 'no', then no permit required. If 'yes', continue below.

Project / Site Name: Zampell Refractories, Inc.

Project Street / Location: 17 Malcolm Hoyt Drive

Assessor's Map: 82 Parcel(s): A4

Applicant Type (Check One) ☐ Single-Family ☒ Commercial and Other Non-Single-Family

Application Fee Structure		Proposed Project Land Disturbance (sq. ft.)	Application Fee (Non-Refundable)
Land disturbance less than 10,000 square feet	No permit required	27,340 sf.	$200.00 base (27.34ksf)($1.00/ksf)=$27.34 Total Fee = $227.34
Land disturbance 10,000 square feet and greater	$200.00 base fee plus $1.00 for every 1,000 square feet of land disturbance		

Total Area of Impervious Surfaces:	Existing[1]	Proposed[1]	Net[1]
(Paved, parking, decks, roofs, etc.) (sq. ft.)	0 sf	19,087 sf	19,087 sf [2]

2. Applicant Information

Name: Stanley Tucker Drive, LLC c/o Zampell Refractories, Inc.

Address: 3 Stanley Tucker Drive, Newburyport. MA

Phone: 978.499.5137

E-mail: james.zampell@zampell.com

3. Owner Information

☒ *Check box if Owner is also the Applicant*

Name: _____

Address: _____

Phone: _____

E-mail: _____

4. Application Waiver

The project described above is exempt from meeting the stormwater management standards as outlined in the Newburyport Stormwater Management Ordinances (Chapter 17) for the following reason:

☐ Land disturbance is less than 10,000 square feet.

[1] Area within area of disturbance only; not total lot area.
[2] The only new impervious surfaces proposed with the project are associated with the proposed 19,087sf building addition.

☐ Other:_____

_____

_____

Attach any relevant and supporting documentation for an Application Waiver.

5. Certification

I hereby certify that the information contained herein including all attachments is true, accurate, and complete to the best of my knowledge. Further, I grant the Newburyport Department of Public Services and its agents permission to enter the property to verify the information in the application and to inspect for compliance with the resulting permit.

_____ _____

Applicant's Signature *Date* *Owner's Signature* *Date*

STORMWATER MANAGEMENT
PERMIT

APPLICATION
REQUIREMENTS & CHECKLIST

REQUIREMENTS & INFORMATION:

1. Documentation requirements are listed in the Stormwater Rules and Regulations for the Stormwater Management Plan, Erosion and Sediment Control Plan, and Operation and Maintenance Plan. Refer to the Stormwater Rules and Regulations for additional important information, including design requirements, standards, etc.

2. The site owner or his/her technical representative shall file **three (3) hardcopies and one (1) digital copy (CAD & PDF)** of the ***Stormwater Management Permit Application Package*** with the City Engineer (Enforcement Officer). While the Applicant can be a representative, the Permittee must be the owner of the site.

3. No change or alteration of the plans approved by the Stormwater Management Permit shall be made without further review by Engineering (see Regs).

4. A Permit shall expire three (3) years from the date of issuance.

5. Engineering Dept shall review the application, all final responses and decisions will be as follows:

a. Approved as Submitted: Approval of the Stormwater Management Permit Application, based upon a determination that the proposed stormwater management systems and measures, as set forth in the design plans submitted in accordance with Section 8, will meet the Standards specified in Section 7, will adequately protect the water resources of the City, and are in compliance with the requirements set forth in the Regulations.

b. Approved with Conditions: Approval of the Stormwater Management Permit Application, based upon a determination that the proposed stormwater management systems and measures, as set forth in the design plans submitted in accordance with Section 8, subject to any conditions, modifications, or restrictions required by the Enforcement Officer to ensure that the project will meet the Standards specified in Section 7, will adequately protect the water resources of the City and are in compliance with the requirements set forth in the Regulations.

c. Not Approved: Disapproval of the Stormwater Management Permit Application, based upon a determination that the proposed stormwater management systems and measures, as set forth in the design plans submitted in accordance with Section 8, will not meet the Standards specified in Section 7, will not adequately protect the water resources of the City, or are not in compliance with the requirements set forth in the Regulations.

CHECKLIST:

The ***Stormwater Management Permit Application Package*** shall include:

☒ Completed Application Form with signatures of all owners;

☒ *Stormwater Management Plan* and supporting documentation, if applicable;

☒ *Erosion and Sediment Control Plan*;

N/A ☐ *Operation and Maintenance Plan*, if applicable;

N/A ☐ *NPDES General Permit for Discharges from Construction Activities* Application, including Notice of Intent and Stormwater Pollution Prevention Plan (SWPPP), if applicable;

☒ *Site Plan*

Pending ☐ Decisions or Approvals of other permitting agencies, including but not limited to the Zoning Board of Appeals, Planning Board, Conservation Commission, as applicable;

☒ *Application Fee*: The application will not be accepted without the non-refundable Application Fee specified in the application. The Application Fee for the Permit shall be in addition to any fee requirements for other applications for permits for the same project before any other City Board or Commission which may review the project.

Pending ☐ *Record at Registry of Deeds*: Prior to commencement of construction, the approved (signed) Stormwater Management Permit Application (2 pages) shall be recorded at the Southern Essex District Registry of Deeds, in the chain of title for the property that is the subject of the Stormwater Management Permit. A copy of the signed Stormwater Management Permit, as recorded at the Registry, shall be provided to the Enforcement Officer.

Pending ☐ *Pre-Construction Meeting:* Prior to any land disturbance, the Applicant is required to meet with the Enforcement Officer to review the permitted work.

Pending ☐ *Site Inspections*: Along with the required inspections defined in the City Stormwater Rules and Regulations, the Applicant is subject to periodic site inspections from the Enforcement Officer during construction to ensure the Applicant has not altered the project from the approved proposed submittal. If during construction a change of conditions is encountered, the Applicant must notify DPS and the Enforcement Officer to determine the most viable solution.

Pending ☐ *Final Inspection*: The Applicant is subject to a final site inspection by the Enforcement Officer upon the completion of construction to ensure the Applicant's work complies with the approved permitted submittal.

Pending ☐ *Final Submittals*: Upon completion of the project and final inspection, the Applicant shall submit all as-builts for the site along with an Operation and Maintenance Plan or other documents if deemed necessary.

Pending ☐ *Certificate of Completion*: The Applicant will be provided a Certificate of Completion upon successful achievement of all prior items listed on the checklist.

APPENDIX C:

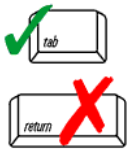
Massachusetts DEP Storm Water Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

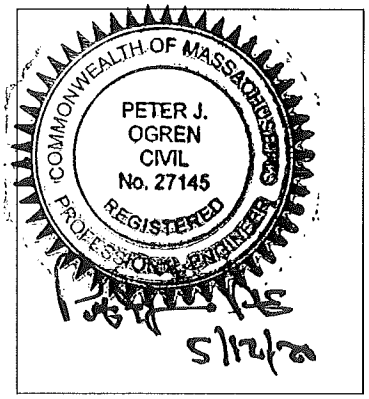
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



PE 5/12/20

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- [X] No disturbance to any Wetland Resource Areas
- [ ] Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- [ ] Reduced Impervious Area (Redevelopment Only)
- [ ] Minimizing disturbance to existing trees and shrubs
- [ ] LID Site Design Credit Requested:
  - [ ] Credit 1
  - [ ] Credit 2
  - [ ] Credit 3
- [ ] Use of "country drainage" versus curb and gutter conveyance and pipe
- [ ] Bioretention Cells (includes Rain Gardens)
- [ ] Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- [ ] Treebox Filter
- [ ] Water Quality Swale
- [ ] Grass Channel
- [ ] Green Roof
- [ ] Other (describe): _____

Standard 1: No New Untreated Discharges

- [X] No new untreated discharges
- [X] Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- [X] Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

☒ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☒ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

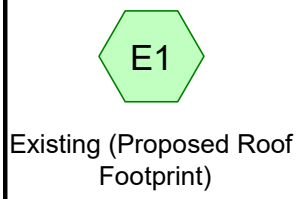
☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

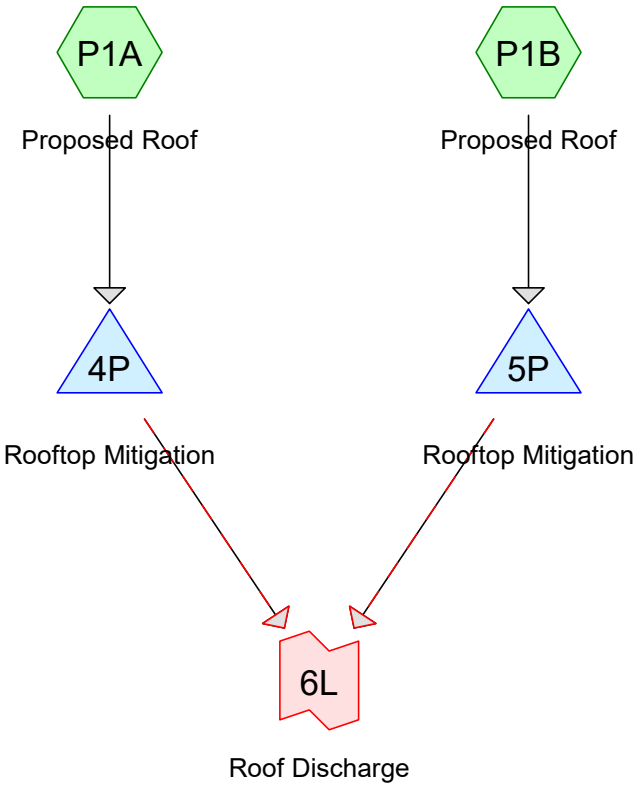
APPENDIX D:

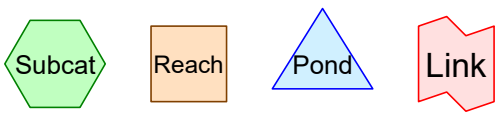
HydroCAD® Calculations

Existing Conditions
#17 Malcolm Hoyt



Proposed Condition
#17 Malcolm Hoyt





Routing Diagram for NBT-0028A-R2
Prepared by Hayes Engineering, Inc., Printed 5/12/2020

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Year	Type III 24-hr		Default	24.00	1	3.22	2
2	10 Year	Type III 24-hr		Default	24.00	1	4.95	2
3	25 Year	Type III 24-hr		Default	24.00	1	6.32	2
4	50 Year	Type III 24-hr		Default	24.00	1	7.62	2
5	100 Year	Type III 24-hr		Default	24.00	1	9.18	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
16,191	74	>75% Grass cover, Good, HSG C (E1)
2,896	98	Paved parking, HSG C (E1)
19,087	98	Roofs, HSG C (P1A, P1B)
38,174	**88**	**TOTAL AREA**

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: Existing (Proposed Roof Runoff Area=19,087 sf 15.17% Impervious Runoff Depth=1.29"
Tc=6.0 min CN=78 Runoff=0.65 cfs 2,049 cf

Subcatchment P1A: Proposed Roof Runoff Area=15,557 sf 100.00% Impervious Runoff Depth=2.99"
Tc=6.0 min CN=98 Runoff=1.12 cfs 3,873 cf

Subcatchment P1B: Proposed Roof Runoff Area=3,530 sf 100.00% Impervious Runoff Depth=2.99"
Tc=6.0 min CN=98 Runoff=0.25 cfs 879 cf

Pond 4P: Rooftop Mitigation Peak Elev=0.31' Storage=619 cf Inflow=1.12 cfs 3,873 cf
Primary=0.39 cfs 3,873 cf Secondary=0.00 cfs 0 cf Outflow=0.39 cfs 3,873 cf

Pond 5P: Rooftop Mitigation Peak Elev=1.00' Storage=94 cf Inflow=0.25 cfs 879 cf
Primary=0.12 cfs 879 cf Secondary=0.00 cfs 0 cf Outflow=0.12 cfs 879 cf

Link 6L: Roof Discharge Inflow=0.51 cfs 4,752 cf
Primary=0.51 cfs 4,752 cf

Total Runoff Area = 38,174 sf Runoff Volume = 6,800 cf Average Runoff Depth = 2.14"
42.41% Pervious = 16,191 sf 57.59% Impervious = 21,983 sf

Summary for Subcatchment E1: Existing (Proposed Roof Footprint)

Runoff = 0.65 cfs @ 12.09 hrs, Volume= 2,049 cf, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.22"

Area (sf)	CN	Description
16,191	74	>75% Grass cover, Good, HSG C
2,896	98	Paved parking, HSG C
19,087	78	Weighted Average
16,191		84.83% Pervious Area
2,896		15.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Subcatchment P1A: Proposed Roof

Runoff = 1.12 cfs @ 12.08 hrs, Volume= 3,873 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.22"

Area (sf)	CN	Description
15,557	98	Roofs, HSG C
15,557		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Subcatchment P1B: Proposed Roof

Runoff = 0.25 cfs @ 12.08 hrs, Volume= 879 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.22"

Area (sf)	CN	Description
3,530	98	Roofs, HSG C
3,530		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Pond 4P: Rooftop Mitigation

Inflow Area = 15,557 sf,100.00% Impervious, Inflow Depth = 2.99" for 2 Year event
Inflow = 1.12 cfs @ 12.08 hrs, Volume= 3,873 cf
Outflow = 0.39 cfs @ 12.34 hrs, Volume= 3,873 cf, Atten= 65%, Lag= 15.5 min
Primary = 0.39 cfs @ 12.34 hrs, Volume= 3,873 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 0.31' @ 12.34 hrs Surf.Area= 5,891 sf Storage= 619 cf
Flood Elev= 1.60' Surf.Area= 45,000 sf Storage= 24,815 cf

Plug-Flow detention time= 8.1 min calculated for 3,873 cf (100% of inflow)
Center-of-Mass det. time= 8.1 min (764.4 - 756.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	24,515 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) x 2
#2	1.58'	11,850 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)
		36,365 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.00	20	20.0	0	0	20
0.10	300	150.0	13	13	1,779
0.20	1,250	300.0	72	85	7,150
0.30	2,840	440.0	199	284	15,395
0.40	4,190	450.0	349	634	16,104
0.50	5,400	455.0	478	1,112	16,467
0.60	6,450	465.0	592	1,704	17,201
0.70	7,400	470.0	692	2,396	17,576
0.80	8,250	480.0	782	3,178	18,333
0.90	9,100	485.0	867	4,045	18,720
1.00	10,000	490.0	955	5,000	19,111
1.10	10,850	500.0	1,042	6,042	19,900
1.20	11,700	510.0	1,127	7,169	20,706
1.30	12,600	520.0	1,215	8,384	21,527
1.40	13,500	530.0	1,305	9,689	22,364
1.50	14,380	540.0	1,394	11,082	23,217
1.58	15,000	545.0	1,175	12,257	23,651

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1.58	15,000	0	0	15,000
2.37	15,000	11,850	11,850	15,387

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**3.0" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1.60'	**6.0" W x 3.0" H Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.39 cfs @ 12.34 hrs HW=0.31' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.39 cfs @ 2.67 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 5P: Rooftop Mitigation

Inflow Area = 3,530 sf,100.00% Impervious, Inflow Depth = 2.99" for 2 Year event
Inflow = 0.25 cfs @ 12.08 hrs, Volume= 879 cf
Outflow = 0.12 cfs @ 12.24 hrs, Volume= 879 cf, Atten= 53%, Lag= 9.4 min
Primary = 0.12 cfs @ 12.24 hrs, Volume= 879 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 1.00' @ 12.24 hrs Surf.Area= 1,087 sf Storage= 94 cf
Flood Elev= 1.60' Surf.Area= 9,889 sf Storage= 2,388 cf

Plug-Flow detention time= 3.9 min calculated for 879 cf (100% of inflow)
Center-of-Mass det. time= 3.9 min (760.2 - 756.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.74'	2,321 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) x 2
#2	1.58'	2,646 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)
		4,966 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.74	10	10.0	0	0	10
0.80	30	30.0	1	1	74
0.90	210	80.0	11	12	511
1.00	560	130.0	37	49	1,347
1.10	1,050	160.0	79	128	2,039
1.20	1,500	190.0	127	255	2,875
1.30	2,000	200.0	174	429	3,186
1.40	2,400	230.0	220	649	4,213
1.50	2,900	260.0	265	914	5,383
1.58	3,270	270.0	247	1,160	5,805

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1.58	3,349	0	0	3,349
2.37	3,349	2,646	2,646	3,532

Device	Routing	Invert	Outlet Devices
#1	Primary	0.74'	**3.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1.60'	**6.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.12 cfs @ 12.24 hrs HW=1.00' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.12 cfs @ 2.44 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.74' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link 6L: Roof Discharge

Inflow Area = 19,087 sf,100.00% Impervious, Inflow Depth = 2.99" for 2 Year event
Inflow = 0.51 cfs @ 12.30 hrs, Volume= 4,752 cf
Primary = 0.51 cfs @ 12.30 hrs, Volume= 4,752 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: Existing (Proposed Roof Runoff Area=19,087 sf 15.17% Impervious Runoff Depth=2.67"
Tc=6.0 min CN=78 Runoff=1.37 cfs 4,246 cf

Subcatchment P1A: Proposed Roof Runoff Area=15,557 sf 100.00% Impervious Runoff Depth=4.71"
Tc=6.0 min CN=98 Runoff=1.73 cfs 6,110 cf

Subcatchment P1B: Proposed Roof Runoff Area=3,530 sf 100.00% Impervious Runoff Depth=4.71"
Tc=6.0 min CN=98 Runoff=0.39 cfs 1,386 cf

Pond 4P: Rooftop Mitigation Peak Elev=0.40' Storage=1,301 cf Inflow=1.73 cfs 6,110 cf
Primary=0.45 cfs 6,110 cf Secondary=0.00 cfs 0 cf Outflow=0.45 cfs 6,110 cf

Pond 5P: Rooftop Mitigation Peak Elev=1.08' Storage=218 cf Inflow=0.39 cfs 1,386 cf
Primary=0.14 cfs 1,386 cf Secondary=0.00 cfs 0 cf Outflow=0.14 cfs 1,386 cf

Link 6L: Roof Discharge Inflow=0.59 cfs 7,497 cf
Primary=0.59 cfs 7,497 cf

Total Runoff Area = 38,174 sf Runoff Volume = 11,743 cf Average Runoff Depth = 3.69"
42.41% Pervious = 16,191 sf 57.59% Impervious = 21,983 sf

Summary for Subcatchment E1: Existing (Proposed Roof Footprint)

Runoff = 1.37 cfs @ 12.09 hrs, Volume= 4,246 cf, Depth= 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.95"

Area (sf)	CN	Description
16,191	74	>75% Grass cover, Good, HSG C
2,896	98	Paved parking, HSG C
19,087	78	Weighted Average
16,191		84.83% Pervious Area
2,896		15.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Subcatchment P1A: Proposed Roof

Runoff = 1.73 cfs @ 12.08 hrs, Volume= 6,110 cf, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.95"

Area (sf)	CN	Description
15,557	98	Roofs, HSG C
15,557		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Subcatchment P1B: Proposed Roof

Runoff = 0.39 cfs @ 12.08 hrs, Volume= 1,386 cf, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.95"

Area (sf)	CN	Description
3,530	98	Roofs, HSG C
3,530		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Pond 4P: Rooftop Mitigation

Inflow Area = 15,557 sf,100.00% Impervious, Inflow Depth = 4.71" for 10 Year event
Inflow = 1.73 cfs @ 12.08 hrs, Volume= 6,110 cf
Outflow = 0.45 cfs @ 12.44 hrs, Volume= 6,110 cf, Atten= 74%, Lag= 21.4 min
Primary = 0.45 cfs @ 12.44 hrs, Volume= 6,110 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 0.40' @ 12.44 hrs Surf.Area= 8,471 sf Storage= 1,301 cf
Flood Elev= 1.60' Surf.Area= 45,000 sf Storage= 24,815 cf

Plug-Flow detention time= 15.7 min calculated for 6,110 cf (100% of inflow)
Center-of-Mass det. time= 15.7 min (763.9 - 748.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	24,515 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) x 2
#2	1.58'	11,850 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)
		36,365 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.00	20	20.0	0	0	20
0.10	300	150.0	13	13	1,779
0.20	1,250	300.0	72	85	7,150
0.30	2,840	440.0	199	284	15,395
0.40	4,190	450.0	349	634	16,104
0.50	5,400	455.0	478	1,112	16,467
0.60	6,450	465.0	592	1,704	17,201
0.70	7,400	470.0	692	2,396	17,576
0.80	8,250	480.0	782	3,178	18,333
0.90	9,100	485.0	867	4,045	18,720
1.00	10,000	490.0	955	5,000	19,111
1.10	10,850	500.0	1,042	6,042	19,900
1.20	11,700	510.0	1,127	7,169	20,706
1.30	12,600	520.0	1,215	8,384	21,527
1.40	13,500	530.0	1,305	9,689	22,364
1.50	14,380	540.0	1,394	11,082	23,217
1.58	15,000	545.0	1,175	12,257	23,651

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1.58	15,000	0	0	15,000
2.37	15,000	11,850	11,850	15,387

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**3.0" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1.60'	**6.0" W x 3.0" H Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.45 cfs @ 12.44 hrs HW=0.40' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.45 cfs @ 3.06 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 5P: Rooftop Mitigation

Inflow Area = 3,530 sf,100.00% Impervious, Inflow Depth = 4.71" for 10 Year event
Inflow = 0.39 cfs @ 12.08 hrs, Volume= 1,386 cf
Outflow = 0.14 cfs @ 12.34 hrs, Volume= 1,386 cf, Atten= 65%, Lag= 15.5 min
Primary = 0.14 cfs @ 12.34 hrs, Volume= 1,386 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 1.08' @ 12.34 hrs Surf.Area= 1,886 sf Storage= 218 cf
Flood Elev= 1.60' Surf.Area= 9,889 sf Storage= 2,388 cf

Plug-Flow detention time= 8.0 min calculated for 1,386 cf (100% of inflow)
Center-of-Mass det. time= 8.0 min (756.2 - 748.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.74'	2,321 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) x 2
#2	1.58'	2,646 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)
		4,966 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.74	10	10.0	0	0	10
0.80	30	30.0	1	1	74
0.90	210	80.0	11	12	511
1.00	560	130.0	37	49	1,347
1.10	1,050	160.0	79	128	2,039
1.20	1,500	190.0	127	255	2,875
1.30	2,000	200.0	174	429	3,186
1.40	2,400	230.0	220	649	4,213
1.50	2,900	260.0	265	914	5,383
1.58	3,270	270.0	247	1,160	5,805

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1.58	3,349	0	0	3,349
2.37	3,349	2,646	2,646	3,532

Device	Routing	Invert	Outlet Devices
#1	Primary	0.74'	**3.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1.60'	**6.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 12.34 hrs HW=1.08' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.14 cfs @ 2.81 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.74' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link 6L: Roof Discharge

Inflow Area = 19,087 sf,100.00% Impervious, Inflow Depth = 4.71" for 10 Year event
Inflow = 0.59 cfs @ 12.41 hrs, Volume= 7,497 cf
Primary = 0.59 cfs @ 12.41 hrs, Volume= 7,497 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: Existing (Proposed Roof Runoff Area=19,087 sf 15.17% Impervious Runoff Depth=3.86"
Tc=6.0 min CN=78 Runoff=1.98 cfs 6,144 cf

Subcatchment P1A: Proposed Roof Runoff Area=15,557 sf 100.00% Impervious Runoff Depth=6.08"
Tc=6.0 min CN=98 Runoff=2.21 cfs 7,884 cf

Subcatchment P1B: Proposed Roof Runoff Area=3,530 sf 100.00% Impervious Runoff Depth=6.08"
Tc=6.0 min CN=98 Runoff=0.50 cfs 1,789 cf

Pond 4P: Rooftop Mitigation Peak Elev=0.47' Storage=1,904 cf Inflow=2.21 cfs 7,884 cf
Primary=0.49 cfs 7,884 cf Secondary=0.00 cfs 0 cf Outflow=0.49 cfs 7,884 cf

Pond 5P: Rooftop Mitigation Peak Elev=1.14' Storage=335 cf Inflow=0.50 cfs 1,789 cf
Primary=0.15 cfs 1,789 cf Secondary=0.00 cfs 0 cf Outflow=0.15 cfs 1,789 cf

Link 6L: Roof Discharge Inflow=0.63 cfs 9,673 cf
Primary=0.63 cfs 9,673 cf

Total Runoff Area = 38,174 sf Runoff Volume = 15,818 cf Average Runoff Depth = 4.97"
42.41% Pervious = 16,191 sf 57.59% Impervious = 21,983 sf

Summary for Subcatchment E1: Existing (Proposed Roof Footprint)

Runoff = 1.98 cfs @ 12.09 hrs, Volume= 6,144 cf, Depth= 3.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=6.32"

Area (sf)	CN	Description
16,191	74	>75% Grass cover, Good, HSG C
2,896	98	Paved parking, HSG C
19,087	78	Weighted Average
16,191		84.83% Pervious Area
2,896		15.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Subcatchment P1A: Proposed Roof

Runoff = 2.21 cfs @ 12.08 hrs, Volume= 7,884 cf, Depth= 6.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=6.32"

Area (sf)	CN	Description
15,557	98	Roofs, HSG C
15,557		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Subcatchment P1B: Proposed Roof

Runoff = 0.50 cfs @ 12.08 hrs, Volume= 1,789 cf, Depth= 6.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=6.32"

Area (sf)	CN	Description
3,530	98	Roofs, HSG C
3,530		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Pond 4P: Rooftop Mitigation

Inflow Area = 15,557 sf,100.00% Impervious, Inflow Depth = 6.08" for 25 Year event
Inflow = 2.21 cfs @ 12.08 hrs, Volume= 7,884 cf
Outflow = 0.49 cfs @ 12.48 hrs, Volume= 7,884 cf, Atten= 78%, Lag= 24.1 min
Primary = 0.49 cfs @ 12.48 hrs, Volume= 7,884 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 0.47' @ 12.48 hrs Surf.Area= 10,025 sf Storage= 1,904 cf
Flood Elev= 1.60' Surf.Area= 45,000 sf Storage= 24,815 cf

Plug-Flow detention time= 22.3 min calculated for 7,884 cf (100% of inflow)
Center-of-Mass det. time= 22.3 min (766.7 - 744.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	24,515 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) x 2
#2	1.58'	11,850 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)
		36,365 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.00	20	20.0	0	0	20
0.10	300	150.0	13	13	1,779
0.20	1,250	300.0	72	85	7,150
0.30	2,840	440.0	199	284	15,395
0.40	4,190	450.0	349	634	16,104
0.50	5,400	455.0	478	1,112	16,467
0.60	6,450	465.0	592	1,704	17,201
0.70	7,400	470.0	692	2,396	17,576
0.80	8,250	480.0	782	3,178	18,333
0.90	9,100	485.0	867	4,045	18,720
1.00	10,000	490.0	955	5,000	19,111
1.10	10,850	500.0	1,042	6,042	19,900
1.20	11,700	510.0	1,127	7,169	20,706
1.30	12,600	520.0	1,215	8,384	21,527
1.40	13,500	530.0	1,305	9,689	22,364
1.50	14,380	540.0	1,394	11,082	23,217
1.58	15,000	545.0	1,175	12,257	23,651

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1.58	15,000	0	0	15,000
2.37	15,000	11,850	11,850	15,387

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**3.0" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1.60'	**6.0" W x 3.0" H Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.49 cfs @ 12.48 hrs HW=0.47' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.49 cfs @ 3.30 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
2=Orifice/Grate (Controls 0.00 cfs)

Summary for Pond 5P: Rooftop Mitigation

Inflow Area = 3,530 sf,100.00% Impervious, Inflow Depth = 6.08" for 25 Year event
Inflow = 0.50 cfs @ 12.08 hrs, Volume= 1,789 cf
Outflow = 0.15 cfs @ 12.40 hrs, Volume= 1,789 cf, Atten= 70%, Lag= 19.0 min
Primary = 0.15 cfs @ 12.40 hrs, Volume= 1,789 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 1.14' @ 12.40 hrs Surf.Area= 2,398 sf Storage= 335 cf
Flood Elev= 1.60' Surf.Area= 9,889 sf Storage= 2,388 cf

Plug-Flow detention time= 11.7 min calculated for 1,789 cf (100% of inflow)
Center-of-Mass det. time= 11.7 min (756.1 - 744.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.74'	2,321 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) x 2
#2	1.58'	2,646 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)
		4,966 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.74	10	10.0	0	0	10
0.80	30	30.0	1	1	74
0.90	210	80.0	11	12	511
1.00	560	130.0	37	49	1,347
1.10	1,050	160.0	79	128	2,039
1.20	1,500	190.0	127	255	2,875
1.30	2,000	200.0	174	429	3,186
1.40	2,400	230.0	220	649	4,213
1.50	2,900	260.0	265	914	5,383
1.58	3,270	270.0	247	1,160	5,805

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1.58	3,349	0	0	3,349
2.37	3,349	2,646	2,646	3,532

Device	Routing	Invert	Outlet Devices
#1	Primary	0.74'	**3.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1.60'	**6.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.15 cfs @ 12.40 hrs HW=1.14' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.15 cfs @ 3.03 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.74' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link 6L: Roof Discharge

Inflow Area = 19,087 sf,100.00% Impervious, Inflow Depth = 6.08" for 25 Year event
Inflow = 0.63 cfs @ 12.46 hrs, Volume= 9,673 cf
Primary = 0.63 cfs @ 12.46 hrs, Volume= 9,673 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: Existing (Proposed Roof Runoff Area=19,087 sf 15.17% Impervious Runoff Depth=5.04"
Tc=6.0 min CN=78 Runoff=2.57 cfs 8,018 cf

Subcatchment P1A: Proposed Roof Runoff Area=15,557 sf 100.00% Impervious Runoff Depth=7.38"
Tc=6.0 min CN=98 Runoff=2.67 cfs 9,568 cf

Subcatchment P1B: Proposed Roof Runoff Area=3,530 sf 100.00% Impervious Runoff Depth=7.38"
Tc=6.0 min CN=98 Runoff=0.61 cfs 2,171 cf

Pond 4P: Rooftop Mitigation Peak Elev=0.53' Storage=2,514 cf Inflow=2.67 cfs 9,568 cf
Primary=0.51 cfs 9,568 cf Secondary=0.00 cfs 0 cf Outflow=0.51 cfs 9,568 cf

Pond 5P: Rooftop Mitigation Peak Elev=1.18' Storage=457 cf Inflow=0.61 cfs 2,171 cf
Primary=0.16 cfs 2,171 cf Secondary=0.00 cfs 0 cf Outflow=0.16 cfs 2,171 cf

Link 6L: Roof Discharge Inflow=0.67 cfs 11,739 cf
Primary=0.67 cfs 11,739 cf

Total Runoff Area = 38,174 sf Runoff Volume = 19,757 cf Average Runoff Depth = 6.21"
42.41% Pervious = 16,191 sf 57.59% Impervious = 21,983 sf

Summary for Subcatchment E1: Existing (Proposed Roof Footprint)

Runoff = 2.57 cfs @ 12.09 hrs, Volume= 8,018 cf, Depth= 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 Year Rainfall=7.62"

Area (sf)	CN	Description
16,191	74	>75% Grass cover, Good, HSG C
2,896	98	Paved parking, HSG C
19,087	78	Weighted Average
16,191		84.83% Pervious Area
2,896		15.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Subcatchment P1A: Proposed Roof

Runoff = 2.67 cfs @ 12.08 hrs, Volume= 9,568 cf, Depth= 7.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 Year Rainfall=7.62"

Area (sf)	CN	Description
15,557	98	Roofs, HSG C
15,557		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Subcatchment P1B: Proposed Roof

Runoff = 0.61 cfs @ 12.08 hrs, Volume= 2,171 cf, Depth= 7.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 Year Rainfall=7.62"

Area (sf)	CN	Description
3,530	98	Roofs, HSG C
3,530		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Pond 4P: Rooftop Mitigation

Inflow Area = 15,557 sf,100.00% Impervious, Inflow Depth = 7.38" for 50 Year event
Inflow = 2.67 cfs @ 12.08 hrs, Volume= 9,568 cf
Outflow = 0.51 cfs @ 12.51 hrs, Volume= 9,568 cf, Atten= 81%, Lag= 25.9 min
Primary = 0.51 cfs @ 12.51 hrs, Volume= 9,568 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 0.53' @ 12.51 hrs Surf.Area= 11,332 sf Storage= 2,514 cf
Flood Elev= 1.60' Surf.Area= 45,000 sf Storage= 24,815 cf

Plug-Flow detention time= 29.1 min calculated for 9,566 cf (100% of inflow)
Center-of-Mass det. time= 29.1 min (771.0 - 741.8)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	24,515 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) x 2
#2	1.58'	11,850 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)
		36,365 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.00	20	20.0	0	0	20
0.10	300	150.0	13	13	1,779
0.20	1,250	300.0	72	85	7,150
0.30	2,840	440.0	199	284	15,395
0.40	4,190	450.0	349	634	16,104
0.50	5,400	455.0	478	1,112	16,467
0.60	6,450	465.0	592	1,704	17,201
0.70	7,400	470.0	692	2,396	17,576
0.80	8,250	480.0	782	3,178	18,333
0.90	9,100	485.0	867	4,045	18,720
1.00	10,000	490.0	955	5,000	19,111
1.10	10,850	500.0	1,042	6,042	19,900
1.20	11,700	510.0	1,127	7,169	20,706
1.30	12,600	520.0	1,215	8,384	21,527
1.40	13,500	530.0	1,305	9,689	22,364
1.50	14,380	540.0	1,394	11,082	23,217
1.58	15,000	545.0	1,175	12,257	23,651

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1.58	15,000	0	0	15,000
2.37	15,000	11,850	11,850	15,387

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**3.0" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1.60'	**6.0" W x 3.0" H Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.51 cfs @ 12.51 hrs HW=0.53' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.51 cfs @ 3.49 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 5P: Rooftop Mitigation

Inflow Area = 3,530 sf,100.00% Impervious, Inflow Depth = 7.38" for 50 Year event
Inflow = 0.61 cfs @ 12.08 hrs, Volume= 2,171 cf
Outflow = 0.16 cfs @ 12.44 hrs, Volume= 2,171 cf, Atten= 74%, Lag= 21.5 min
Primary = 0.16 cfs @ 12.44 hrs, Volume= 2,171 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 1.18' @ 12.44 hrs Surf.Area= 2,824 sf Storage= 457 cf
Flood Elev= 1.60' Surf.Area= 9,889 sf Storage= 2,388 cf

Plug-Flow detention time= 15.5 min calculated for 2,171 cf (100% of inflow)
Center-of-Mass det. time= 15.5 min (757.3 - 741.8)

Volume	Invert	Avail.Storage	Storage Description
#1	0.74'	2,321 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) x 2
#2	1.58'	2,646 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)
		4,966 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.74	10	10.0	0	0	10
0.80	30	30.0	1	1	74
0.90	210	80.0	11	12	511
1.00	560	130.0	37	49	1,347
1.10	1,050	160.0	79	128	2,039
1.20	1,500	190.0	127	255	2,875
1.30	2,000	200.0	174	429	3,186
1.40	2,400	230.0	220	649	4,213
1.50	2,900	260.0	265	914	5,383
1.58	3,270	270.0	247	1,160	5,805

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1.58	3,349	0	0	3,349
2.37	3,349	2,646	2,646	3,532

Device	Routing	Invert	Outlet Devices
#1	Primary	0.74'	**3.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1.60'	**6.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.16 cfs @ 12.44 hrs HW=1.18' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.16 cfs @ 3.20 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.74' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link 6L: Roof Discharge

Inflow Area = 19,087 sf,100.00% Impervious, Inflow Depth = 7.38" for 50 Year event
Inflow = 0.67 cfs @ 12.50 hrs, Volume= 11,739 cf
Primary = 0.67 cfs @ 12.50 hrs, Volume= 11,739 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: Existing (Proposed Roof Runoff Area=19,087 sf 15.17% Impervious Runoff Depth=6.49"
Tc=6.0 min CN=78 Runoff=3.28 cfs 10,324 cf

Subcatchment P1A: Proposed Roof Runoff Area=15,557 sf 100.00% Impervious Runoff Depth=8.94"
Tc=6.0 min CN=98 Runoff=3.22 cfs 11,589 cf

Subcatchment P1B: Proposed Roof Runoff Area=3,530 sf 100.00% Impervious Runoff Depth=8.94"
Tc=6.0 min CN=98 Runoff=0.73 cfs 2,630 cf

Pond 4P: Rooftop Mitigation Peak Elev=0.59' Storage=3,281 cf Inflow=3.22 cfs 11,589 cf
Primary=0.54 cfs 11,589 cf Secondary=0.00 cfs 0 cf Outflow=0.54 cfs 11,589 cf

Pond 5P: Rooftop Mitigation Peak Elev=1.23' Storage=612 cf Inflow=0.73 cfs 2,630 cf
Primary=0.17 cfs 2,630 cf Secondary=0.00 cfs 0 cf Outflow=0.17 cfs 2,630 cf

Link 6L: Roof Discharge Inflow=0.71 cfs 14,219 cf
Primary=0.71 cfs 14,219 cf

Total Runoff Area = 38,174 sf Runoff Volume = 24,544 cf Average Runoff Depth = 7.72"
42.41% Pervious = 16,191 sf 57.59% Impervious = 21,983 sf

Summary for Subcatchment E1: Existing (Proposed Roof Footprint)

Runoff = 3.28 cfs @ 12.09 hrs, Volume= 10,324 cf, Depth= 6.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=9.18"

Area (sf)	CN	Description
16,191	74	>75% Grass cover, Good, HSG C
2,896	98	Paved parking, HSG C
19,087	78	Weighted Average
16,191		84.83% Pervious Area
2,896		15.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Subcatchment P1A: Proposed Roof

Runoff = 3.22 cfs @ 12.08 hrs, Volume= 11,589 cf, Depth= 8.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=9.18"

Area (sf)	CN	Description
15,557	98	Roofs, HSG C
15,557		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Subcatchment P1B: Proposed Roof

Runoff = 0.73 cfs @ 12.08 hrs, Volume= 2,630 cf, Depth= 8.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=9.18"

Area (sf)	CN	Description
3,530	98	Roofs, HSG C
3,530		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc = 0.1 hours**

Summary for Pond 4P: Rooftop Mitigation

Inflow Area = 15,557 sf,100.00% Impervious, Inflow Depth = 8.94" for 100 Year event
Inflow = 3.22 cfs @ 12.08 hrs, Volume= 11,589 cf
Outflow = 0.54 cfs @ 12.54 hrs, Volume= 11,589 cf, Atten= 83%, Lag= 27.5 min
Primary = 0.54 cfs @ 12.54 hrs, Volume= 11,589 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 0.59' @ 12.54 hrs Surf.Area= 12,684 sf Storage= 3,281 cf
Flood Elev= 1.60' Surf.Area= 45,000 sf Storage= 24,815 cf

Plug-Flow detention time= 37.8 min calculated for 11,589 cf (100% of inflow)
Center-of-Mass det. time= 37.8 min (777.3 - 739.6)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	24,515 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) x 2
#2	1.58'	11,850 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)
		36,365 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.00	20	20.0	0	0	20
0.10	300	150.0	13	13	1,779
0.20	1,250	300.0	72	85	7,150
0.30	2,840	440.0	199	284	15,395
0.40	4,190	450.0	349	634	16,104
0.50	5,400	455.0	478	1,112	16,467
0.60	6,450	465.0	592	1,704	17,201
0.70	7,400	470.0	692	2,396	17,576
0.80	8,250	480.0	782	3,178	18,333
0.90	9,100	485.0	867	4,045	18,720
1.00	10,000	490.0	955	5,000	19,111
1.10	10,850	500.0	1,042	6,042	19,900
1.20	11,700	510.0	1,127	7,169	20,706
1.30	12,600	520.0	1,215	8,384	21,527
1.40	13,500	530.0	1,305	9,689	22,364
1.50	14,380	540.0	1,394	11,082	23,217
1.58	15,000	545.0	1,175	12,257	23,651

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1.58	15,000	0	0	15,000
2.37	15,000	11,850	11,850	15,387

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**3.0" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1.60'	**6.0" W x 3.0" H Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.54 cfs @ 12.54 hrs HW=0.59' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.54 cfs @ 3.70 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 5P: Rooftop Mitigation

Inflow Area = 3,530 sf,100.00% Impervious, Inflow Depth = 8.94" for 100 Year event
Inflow = 0.73 cfs @ 12.08 hrs, Volume= 2,630 cf
Outflow = 0.17 cfs @ 12.48 hrs, Volume= 2,630 cf, Atten= 77%, Lag= 23.6 min
Primary = 0.17 cfs @ 12.48 hrs, Volume= 2,630 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 1.23' @ 12.48 hrs Surf.Area= 3,307 sf Storage= 612 cf
Flood Elev= 1.60' Surf.Area= 9,889 sf Storage= 2,388 cf

Plug-Flow detention time= 20.4 min calculated for 2,630 cf (100% of inflow)
Center-of-Mass det. time= 20.4 min (760.0 - 739.6)

Volume	Invert	Avail.Storage	Storage Description
#1	0.74'	2,321 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) x 2
#2	1.58'	2,646 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)
		4,966 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.74	10	10.0	0	0	10
0.80	30	30.0	1	1	74
0.90	210	80.0	11	12	511
1.00	560	130.0	37	49	1,347
1.10	1,050	160.0	79	128	2,039
1.20	1,500	190.0	127	255	2,875
1.30	2,000	200.0	174	429	3,186
1.40	2,400	230.0	220	649	4,213
1.50	2,900	260.0	265	914	5,383
1.58	3,270	270.0	247	1,160	5,805

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1.58	3,349	0	0	3,349
2.37	3,349	2,646	2,646	3,532

Device	Routing	Invert	Outlet Devices
#1	Primary	0.74'	**3.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1.60'	**6.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.17 cfs @ 12.48 hrs HW=1.23' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.17 cfs @ 3.38 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.74' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link 6L: Roof Discharge

Inflow Area = 19,087 sf,100.00% Impervious, Inflow Depth = 8.94" for 100 Year event
Inflow = 0.71 cfs @ 12.53 hrs, Volume= 14,219 cf
Primary = 0.71 cfs @ 12.53 hrs, Volume= 14,219 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs

Events for Subcatchment E1: Existing (Proposed Roof Footprint)

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 Year	3.22	0.65	2,049	1.29
10 Year	4.95	1.37	4,246	2.67
25 Year	6.32	1.98	6,144	3.86
50 Year	7.62	2.57	8,018	5.04
100 Year	**9.18**	**3.28**	**10,324**	**6.49**

Events for Subcatchment P1A: Proposed Roof

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 Year	3.22	1.12	3,873	2.99
10 Year	4.95	1.73	6,110	4.71
25 Year	6.32	2.21	7,884	6.08
50 Year	7.62	2.67	9,568	7.38
100 Year	**9.18**	**3.22**	**11,589**	**8.94**

Events for Subcatchment P1B: Proposed Roof

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 Year	3.22	0.25	879	2.99
10 Year	4.95	0.39	1,386	4.71
25 Year	6.32	0.50	1,789	6.08
50 Year	7.62	0.61	2,171	7.38
100 Year	**9.18**	**0.73**	**2,630**	**8.94**

Events for Pond 4P: Rooftop Mitigation

Event	Inflow (cfs)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 Year	1.12	0.39	0.39	**0.00**	0.31	619
10 Year	1.73	0.45	0.45	0.00	0.40	1,301
25 Year	2.21	0.49	0.49	0.00	0.47	1,904
50 Year	2.67	0.51	0.51	0.00	0.53	2,514
100 Year	**3.22**	**0.54**	**0.54**	0.00	**0.59**	**3,281**

Events for Pond 5P: Rooftop Mitigation

Event	Inflow (cfs)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 Year	0.25	0.12	0.12	**0.00**	1.00	94
10 Year	0.39	0.14	0.14	0.00	1.08	218
25 Year	0.50	0.15	0.15	0.00	1.14	335
50 Year	0.61	0.16	0.16	0.00	1.18	457
100 Year	**0.73**	**0.17**	**0.17**	0.00	**1.23**	**612**

Events for Link 6L: Roof Discharge

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2 Year	0.51	0.51	**0.00**
10 Year	0.59	0.59	0.00
25 Year	0.63	0.63	0.00
50 Year	0.67	0.67	0.00
100 Year	**0.71**	**0.71**	0.00

APPENDIX D:

Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

Construction Period Pollution Prevention Plan
17 Malcolm Hoyt Drive
Newburyport, MA

Project Name: 17 Malcolm Hoyt Drive

Owner's Name: Zampell Refractories, LLC

Applicant's Name: Same as above

Party Responsible for Maintenance: To be determined

Project Description:

The Applicant proposes to construct an addition to an existing building and associated driveway and parking area.

Erosion and Sedimentation Control Measures During Construction Activities:

Siltation Fence and Straw Bales or Straw Wattles

Silt fence with hay bales are to be installed as shown on the Plan to Accompany Notice of Intent. Silt fence and hay bales are to be installed prior to the commencement of work on the site and in accordance with the design plans. An additional supply of silt fence and hay bales shall be maintained on-site for repair and/or replacement of any disturbed silt fence or hay bales. The silt fence and hay bale line(s) shall be inspected and maintained on a weekly basis. Deposited sediment shall be removed when the level of deposition reaches approximately one-third (1/3) the height of the fence.

Storm Drain Inlet Protection

A temporary storm inlet protection filter will be placed in all catch basin units. The purpose of the filter is to prevent the inflow of sediment into the closed drainage system(s). The filters shall remain in place until a permanent vegetative cover is established and the transport of sediment is no longer visibly apparent. The filter shall be inspected and maintained on a weekly basis and after significant storm events. Significant storm events are those having greater than one-quarter (1/4) inch of precipitation in a 24-hour period.

Surface Stabilization

The surface of all disturbed areas shall be stabilized during and after construction. Temporary measures shall be taken during construction to prevent erosion and sedimentation. No construction sediment shall be allowed to enter infiltration areas. All disturbed slopes shall be stabilized with a permanent vegetative cover. Some or all of the following measures can be used on the Project as conditions may warrant:

- Temporary Seeding
- Temporary Mulching
- Placement of Hay
- Placement of Geo-Synthetic Fabrics
- Hydroseeding
- Permanent Seeding
- Placement of Sod

Surface and Subsurface Infiltration Facilities

No construction period runoff should be directed toward infiltration facilities. The performance of these facilities shall be checked weekly and after significant storm events throughout construction.

Construction Period Pollution Prevention Plan
17 Malcolm Hoyt Drive
Newburyport, MA

INSPECTION SCHEDULE and EVALUATION CHECKLIST

To be completed weekly and within 24-hours of significant rainfall events (greater than 1/4-inches in a 24-hour period).

Inspector's Name: _____ Date: _____

Qualifications: _____

_____

Days since last rainfall: _____ days Amount of last rainfall: _____inches

Stabilization Measures

Sub-Catchment	Date of Last Disturbance	Date of Next Disturbance	Stabilized (Yes or No)	Stabilized With:	Condition

Stabilization required: _____

_____

_____

_____

_____

_____

_____

To be performed by: _____ on or before: _____

PERIMETER CONTROLS

Date of Inspection: _____

Silt Fence and Straw Bales/Wattles:

To Study Area:	Has sediment reached 1/3 height of silt fence? (Yes or No)	Depth of Silt (inches)	Is fence secure? (Yes or No)	Is there evidence of bypass or overtopping? (Yes or No)	Describe location of Problem(s), if any.
DP1					
DP2					

Maintenance required for silt fence and hay bales: _____

_____

_____

To be performed by: _____ on or before: _____

Stabilized Construction Entrance:

Location	Does much sediment get tracked onto roadway? (Yes or No)	Is gravel clean or full of sediment?	Is all traffic using the entrance to access/exit the site? (Yes or No)	Is the culvert beneath the entrance working? (Yes or No)

Maintenance required for stabilized construction entrance: _____

_____

_____

To be performed by: _____ on or before: _____

Other Best Management Practices:

BMP	In use? (Yes or No)	Maintenance Required? (Yes or No)	Describe location of Problem(s), if any.
Sweeping of Adjacent Roads			
Catch Basin Inlet Protection			

Maintenance required: _____

_____

_____

_____

_____

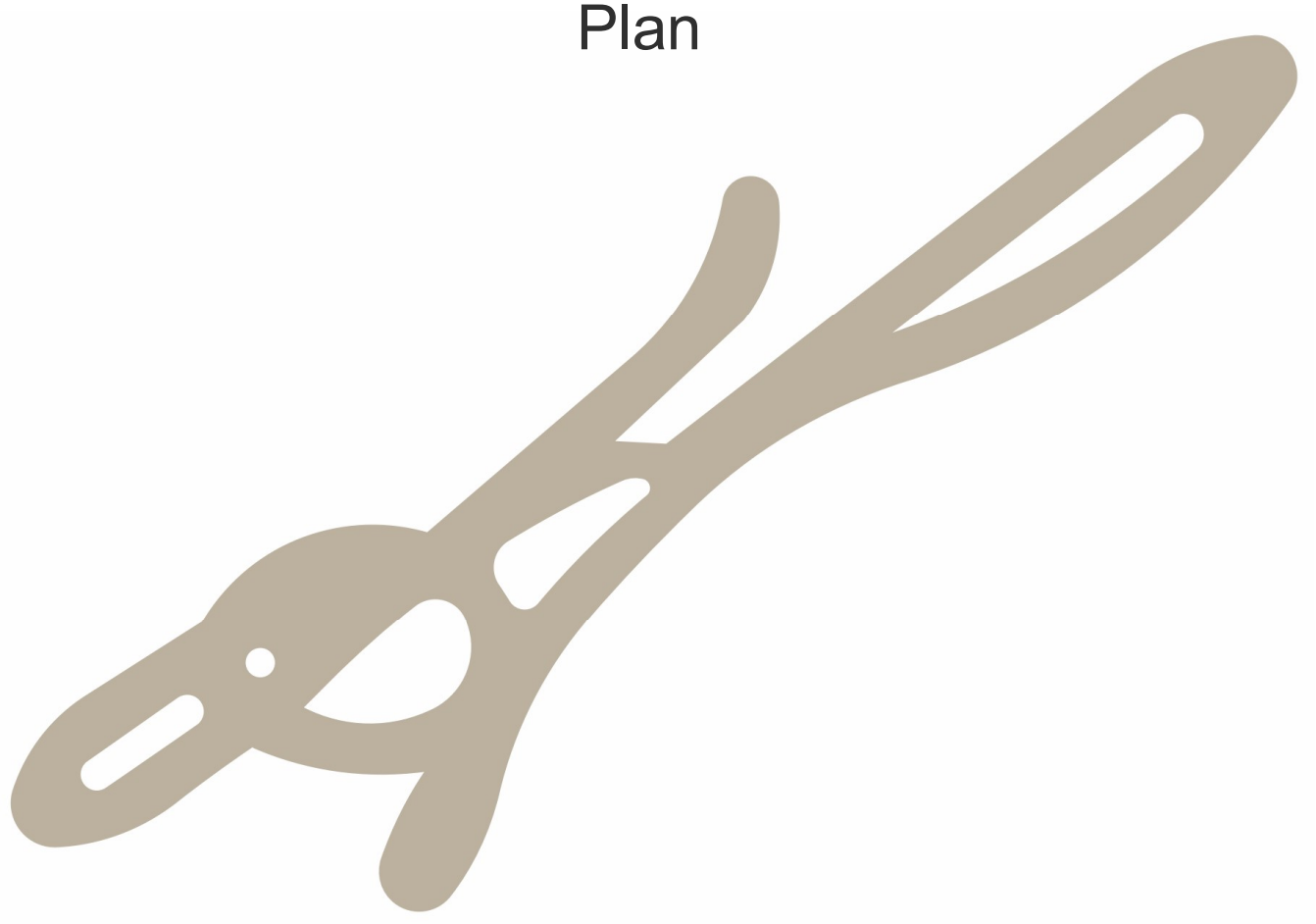
To be performed by: _____ on or before: _____

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: _____ Date: _____

APPENDIX E:

Long Term Operation and Maintenance Plan



Long-term Operations and Maintenance Plan
17 Malcolm Hoyt Drive
Newburyport, MA

Project Name: 3 Stanley Tucker Drive

Owner's Name: Zampell Refractories, LLC

Applicant's Name: Same as above

Party Responsible for Maintenance: To be determined

Project Description:

Tthe "Applicant" proposes to construct an addition to an existing building and associated driveway and parking area.

Post-Construction Inspection and Maintenance Measures:

Erosion Control

Sedimentation caused from erosion of soils can adversely affect the performance of the storm water management system. Areas that are barren and/or showing signs of erosion should be stabilized through immediate re-vegetation.

Debris and Litter Removal

Litter and other debris may collect in storm water best management practices (BMPs), potentially causing clogging of facilities. All debris and litter shall be removed as necessary, at a minimum of four (4) times per year in the spring, summer, fall and winter.

Good Housekeeping Practices:

Provisions for storing paints, cleaners, automotive waste and other potentially hazardous household waste products inside or under cover:

- All materials stored on-site shall be in a neat, orderly manner in their appropriate containers with original manufacturer's label(s);
- Only store enough material as needed; whenever possible, all of a product shall be used prior to disposing of container;
- Manufacturer, federal, state and local recommendations for proper use and disposal shall be followed.

Vehicle Washing Controls:

- Use commercial car washes whenever possible. Car washes treat and/or recycle wash water;
- Cars shall be washed on gravel, grass or other permeable surfaces to allow filtration to occur;
- Use biodegradable soaps only;
- Use hose nozzles that automatically turn off when unattended.

Routine Inspection and Maintenance of Storm Water BMPs

- Previously addressed.

Spill Prevention and Response Plans

- Spill control practices shall be in conformance with the guidelines set forth in the National Pollutant Discharge Elimination System (NPDES) Storm Water Pollution Prevention Plan (SWPPP).

Maintenance of Lawns, Gardens and Other Landscaped Areas:

- Grass shall not be cut shorter than two (2) to three (3) inches and mulch clipping should be left on lawns as a natural fertilizer;
- Use low volume water approaches for irrigation such as drip-type or sprinkler systems. Water plants only when needed to enhance root growth and avoid runoff problems;
- Mulch shall be used wherever practicable. Mulch helps retain water and prevents erosion.

Storage and Use of Fertilizers, Herbicides and Pesticides:

- Fertilizers shall be applied in the minimum amounts recommended by the manufacturer. Once applied, fertilizer shall be worked into the soil to limit exposure to storm water. Storage will be in covered areas only. Contents of partially used bags shall be transferred into sealable plastic containers to avoid spills;
- Do not fertilize before or during rain events;
- Consider the use of organic fertilizers;
- Pesticides shall be applied only when necessary and only in the minimum amounts recommended by the manufacturer.

Pet Waste Management

- Scoop up and seal pet waste in plastic bags. Dispose of in garbage.

Solid Waste Management

- All solid waste shall be disposed of or recycled in accordance with all federal, state and local regulations.

List of Emergency Contacts for Plan Implementation

To be determined by Owner.

POST-CONSTRUCTION
OPERATION AND MAINTENANCE LOG

Inspector's Name: _____ Date: _____

Qualifications: _____

_____

Inspection Type: ☐ Routine ☐ Spill ☐ Other: _____

☐ Post-Rainfall (Precipitation in Inches: _____)

BMP	Frequency	Date Last Performed	Comments
Litter and Debris Removal	After Significant Rain Events		