Stormwater Analysis

For the

Application for a Definitive Subdivision Plan

Salisbury Pine Tree Estates
Holden, Massachusetts

APPLICANT:

Holden Pine Tree, LLC
42 Zottoli Road
Holden, Massachusetts 01520

PLANNER, LANDSCAPE ARCHITECT, CIVIL ENGINEER, SURVEYOR:

PLACES Associates, Inc.

DATE of SUBMITTAL:

October 10, 2019
Revised January 18, 2021
May 25, 2021
August 13, 2021

COMMONWEALTH OF MASSACHUSETTS
Susan E. Carter
CIVIL ENGINEER
NO. 41270
REGISTERED PROFESSIONAL ENGINEER
8-13-21

PLACES Associates, Inc.
256 Great Road, Suite 4, Littleton MA 01460 · (978) 486-0334 · www.placesassociates.com

Table of Contents

Introduction

Excerpt from MADEP Stormwater Management Standards Chapter 1:

In 1996, the Massachusetts Department of Environmental Protection (the "Department" or "MassDEP") issued the Stormwater Policy that established Stormwater Management Standards aimed at encouraging recharge and preventing stormwater discharges from causing or contributing to the pollution of the surface waters and groundwaters of the Commonwealth. In 1997, MassDEP published the Massachusetts Stormwater Handbook as guidance on the Stormwater Policy. MassDEP has revised the Stormwater Management Standards and Massachusetts Stormwater Handbook to promote increased stormwater recharge, the treatment of more runoff from polluting land uses, low impact development (LID) techniques, pollution prevention, the removal of illicit discharges to stormwater management systems, and improved operation and maintenance of stormwater best management practices (BMPs). MassDEP applies the Stormwater Management Standards pursuant to its authority under the Wetlands Protection Act, M.G.L. c. 131, § 40, and the Massachusetts Clean Waters Act, M.G.L .c. 21, §§ 26-53. The revised Stormwater Management Standards have been incorporated in the Wetlands Protection Act Regulations, 310 CMR 10.05(6)(k) and the Water Quality Certification Regulations, 314 CMR 9.06(6)(a).

Stormwater runoff results from rainfall and snow melt and represents the single largest source responsible for water quality impairments in the Commonwealth's rivers, lakes, ponds, and marine waters. New and existing development typically adds impervious surfaces and, if not properly managed, may alter natural drainage features, increase peak discharge rates and volumes, reduce recharge to wetlands and streams, and increase the discharge of pollutants to wetlands and water bodies.

The Stormwater Management Standards address water quality (pollutants) and water quantity (flooding, low base flow and recharge) by establishing standards that require the implementation of a wide variety of stormwater management strategies. These strategies include environmentally sensitive site design and LID techniques to minimize impervious surface and land disturbance, source control and pollution prevention, structural BMPs, construction period erosion and sedimentation control, and the long-term operation and maintenance of stormwater management systems.

Executive Summary

The proposed project contains approximately 25.7 acres of land bordered by Salisbury Street to the east, Bailey Road to the west and the existing railroad tracks to the north. The site is predominately a large moraine with glacial till soils on the hillside transitioning to sand and gravel soils at the toe of the hillside where wetlands are present adjacent to the railroad tracks.

The existing topography creates three major drainage subcatchments: tributary to the wetlands network adjacent to the railroad tracks, tributary to the series of isolated wetlands behind the homes on Bailey Road and tributary to Salisbury Street. The point of analysis by the railroad tracks, is in the DCR Zone A and as such, there are restrictions on the amount of impervious areas, water quality and the location of BMPS.

There are two existing catchbasins located on the existing Pine Tree Road which drain behind the existing apartment building, discharging into the 200' Tributary Zone. The area of the outfall is heavy brush, and the outfall could not be recovered by survey so its condition could not be assessed. These catchbasins are in poor condition and provide no BMPs currently associated with drainage structures with the minimum being deep sumps and regular cleaning. This project includes the reconstruction of this first portion of Pine Tree Road and will provide pre-treatment of the runoff collected in these structures with the use of deep sump catchbasins and a stormwater treatment unit – hydrodynamic separator. A new drainage outfall is proposed so that the system can be maintained.

The NRCS soils maps indicate that the site is a combination of Hydrologic Group A, B and C soils. Based on soil testing performed in 2009 and 2019, a majority of the hill has been classified as C soils due to dense sandy loam being encountered. Soils in the wetlands were hydric and classified as D soils.

As much of the site is Hydrologic group C soils, basins have been sited in areas where the A soils are located to maximize the natural infiltration capacity of the sand and gravel areas. The natural storage capacity has been maintained and expanded to the Bailey Road wetlands system behind the existing 124 Bailey Road.

Drainage analysis was performed for the 2, 10, 25 and 100 year events. The design criteria for design provides attenuation to balance the 2, 10 and 25 year events and to not create flooding in the 100 year event.

POA – 1 Railroad Tracks

Storm event	Pre Development	Post Development
2 year	0.77 cfs	0.69 cfs
10 year	2.62 cfs	2.06 cfs
25 year	5.87 cfs	3.02 cfs
100 year	14.05 cfs	10.18 cfs

POA – Bailey Rd Abutters Isolated Wetland (6P pre development, 60P post development)

Storm event	Pre Development	Post Development
2 year	0.32 cfs	0 cfs
10 year	0.95 cfs	0.06 cfs
25 year	1.39 cfs	0.63cfs
100 year	3.11 cfs	3.05 cfs

POA – Salisbury Street (3 Predevelopment, Link 311 post development)

Storm event	Pre Development	Post Development
2 year	2.65 cfs	2.16 cfs
10 year	6.66 cfs	4.97 cfs
25 year	9.39 cfs	7.68 cfs
100 year	13.78 cfs	10.66 cfs

POA – Overland to abutters to the South (Pre-development 4, Post development 40)

Storm event	Pre Development	Post Development
2 year	0.85 cfs	0.23 cfs
10 year	2.30 cfs	0.54 cfs
25 year	3.30 cfs	0.74 cfs
100 year	4.94 cfs	1.07 cfs

WATER QUALITY

This site design utilizes a variety of BMPs (Best Management Practices) for water quality control on the site. All catchbasins are designed with deep sumps and no water is directly discharged from the drainage without pre-treatment. As the drainage system will be maintained by a Homeowners Association, water quality inlets have been used where possible and hydrodynamic separators (VortSentry or similar) where there is insufficient area for a basin. All basins are designed to drain in between storms. Basin A has been designed as an infiltration basin and contains the entire volume of the 100 year event, maximizing the recharge capacity.

The calculations have been revised to provide 90% TSS removal in compliance with the requirements of the MS4 permit for the Town of Holden. This level of TSS removal required the combination of the traditional TSS removal identified above as well as providing storage for the 1" rainfall over the tributary impervious areas. This resulted in the addition of Basin D-3 at the end of Pine Tree Road to address runoff in this area.

Narrative – Existing Conditions

The proposed project contains approximately 25.7 acres of land bordered on the east by Salisbury Street to the east, Bailey Road to the west and the existing railroad tracks to the north.

Pine Tree Road enters the site from Salisbury Street and is currently paved approximately 120 feet and provides access to the existing apartment buildings at 1 and 2 Pine Tree Road. Pine Tree Road continues as a gravel roadway and provides access to parking for these lots. There are two existing catchbasins located on the existing Pine Tree Road which drain behind the existing apartment building, discharging into the 200' Tributary Zone. The area of the outfall is heavy brush, and the outfall could not be recovered by survey so its condition could not be assessed. These catchbasins are in poor condition and provide no BMPs currently associated with drainage structures with the minimum being deep sumps and regular cleaning.

The site is predominately a large moraine with glacial till soils on the hillside transitioning to sand and gravel soils at the toe of the hillside where wetlands are present adjacent to the railroad tracks.

The existing topography creates three major drainage subcatchments: tributary to the wetlands network adjacent to the railroad tracks, tributary to the series of isolated wetlands behind the homes on Bailey Road and tributary to Salisbury Street. The point of analysis by the railroad tracks, is in the DCR Zone A and as such, there are restrictions on the amount of impervious areas, water quality and the location of BMPS.

The NRCS soils maps indicate that the site is a combination of Hydrologic Group A, B and C soils. Based on soil testing performed in 2009 and 2019, a majority of the hill has been classified as C soils due to dense sandy loam being encountered. Soils in the wetlands were hydric and classified as D soils.

As much of the site is Hydrologic group C soils, basins have been sited in areas where the A soils are located to maximize the natural infiltration capacity of the sand and gravel areas. The natural storage capacity has been maintained and expanded to the Bailey Road wetlands system behind the existing 124 Bailey Road.

Soil Map—Worcester County, Massachusetts, Northeastern Part

Pine Tree Estates

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	5.4	7.1%
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	0.2	0.2%
51A	Swansea muck, 0 to 1 percent slopes	0.8	1.0%
245B	Hinckley loamy sand, 3 to 8 percent slopes	0.3	0.4%
245C	Hinckley loamy sand, 8 to 15 percent slopes	18.5	24.0%
245D	Hinckley loamy sand, 15 to 25 percent slopes	2.5	3.3%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	9.4	12.2%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	4.9	6.3%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	1.3	1.6%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	3.7	4.8%
421B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	4.1	5.3%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	7.7	10.0%
422D	Canton fine sandy loam, 15 to 35 percent slopes, extremely stony	10.9	14.1%
600	Pits, gravel	7.4	9.6%
Totals for Area of Interest		**77.1**	**100.0%**

Narrative – Proposed Conditions

The proposal calls for the construction of 96 residential units as a combination of single family detached, duplex, triples and quads on Pine Tree Road and Henry Road. Pine Tree Road will be extended to a total length of 2150' and will be connected to Bailey Road with Henry Road which is approximately 1180' in length.

The proposed roadways have been reduced in width from 28' to 24' in width and the two 4' wide sidewalks have been reduced to a single 5' wide sidewalk. The initial roadway design has been modified to have a single continuous Pine Tree Road resulting in revisions to both the horizontal and vertical alignment of Pine Tree Road.

The drainage system has been designed to collect runoff from the front of the lots, including the driveways and front portion of the buildings into the street collection system so that the runoff can be pretreated and attenuated with the stormwater basins.

Based on soil testing performed in 2009 and 2019, a majority of the hill has been classified as C soils due to dense sandy loam being encountered. Soils in the wetlands were hydric and classified as D soils. The areas with the A and B soils are located at the lower reaches of the site, adjacent to Bailey Road and near the railroad tracks.

The site consists of three major Points of Analysis, the areas flowing northerly to the railroad tracks (POA 1, Railroad Tracks), areas flowing to the west towards Bailey Road (POA at Pond 60) and those areas flowing east, towards Salisbury Street (POA 3). There is a small tributary flowing onto abutting property to the southwest which is identified as POA 40.

POA-1 Railroad Tracks

POA-1 includes the large stormwater basin, Basin A, which is located on Lots 15-17. The tributary to Basin A includes 7.88 acres of the site with the total tributary area to the railroad tracks being approximately 16.9 acres. Basin A has been designed as an infiltration basin, providing the recharge for the site. Basin C is tributary to Basin A and is located in an area of poor soils and provides only attenuation. The recharge rate to Basin A was reduced from a Rawl's Rate of 8.27 in/hr to 2.42 in/hr to be conservative with a description of medium coarse sand.

Basin E receives runoff from one set of catchbasins on Pine Tree Road and provides attenuation. As this stormwater basin is located in A soils, it will likely provide some recharge but was not utilized in the recharge calculations due to its small size.

The lower portion of Pine Tree Road receives overland flows from the lots on the upper portion of Pine Tree Road as well as the pre-existing apartment buildings on Pine Tree. These two buildings are not part of the development, but a portion of 2 Pine Tree Road will be utilized to provide a subsurface recharge area to provide attenuation after pre-treatment with a hydrodynamic separator. It is not possible to have this drainage feature at the surface due to the impact on these existing residential properties. These properties also limited the road grades in

order to maintain access to the parking.

The two existing catchbasins on Pine Tree Road will be replaced with modern catchbasins with deep sumps and hoods and will discharge in the same general location behind the apartments at 1 Pine Tree Road after pre-treatment via a hydrodynamic separator. These improvements will improve the water quality at the discharge point.

POA 60 – Bailey Road Abutter

POA Pond 60 is the isolated wetlands on abutting property on Bailey Road. The tributary area to this POA includes off site drainage from the south which flows to the isolated wetlands just to the south of Henry station 1+50. In times of flooding, this wetland overflows and flows to the north toward the POA abutting wetlands. The area between these two wetlands is uplands and the overflow is identified by contours but there is no defined channel. The post development drainage will mimic these natural conditions by providing a connection via culverts under Henry to a shallow ponding area behind 124 Bailey Road before discharging and flowing towards the abutting wetlands. This wetland also receives some overland flows from Lots 3, 14 and 15.

The drainage design directs road runoff into basins B-1 and B-2 after pre-treating with a hydrodynamic separator. These stormwater basins will provide attenuation prior to entering the existing on-site wetland by Bailey. Catchbasins at the low point in Henry will be pre-treated with a hydrodynamic separator before being discharged into the shallow basin behind 124 Bailey which is modeled as North Basin, Pond 53P.

POA 311

This is the overland that flows towards Salisbury Street. It includes the backs of Lots 29-39 and the cul-de-sac portion of Pine Tree Road. This area was divided into two sub-areas to review the impacts on the abutters directly downgradient of the Stormwater Basins.

The road runoff is attenuated in Basin D-2 after being pretreated with a hydrodynamic separator. Basins D-1 and D-2 are located in C soils and provide attenuation only. Subdrains are provided to assure that these stormwater basins drain fully between rainfall events. Basin D-3 was added to provide storage to meet the additional requirements of the MS4 permit which requires 90% TSS removal or storage for the 1" rainfall over the impervious surfaces.

Basin D-3 is on a sloped area with the berm in fill. In order to provide storage to mitigate the MS4 requirements and meet the Holden Stormwater Regulations of a maximum depth of 4', the area below elevation 811 will be filled with clean gravel and the calculations utilize the storage in the void space of the soil. Exfiltration from this area utilizes the Rawls Rate for sandy loam, consistent with the soil testing in this area.

This design is in compliance with the MADEP Stormwater Management Standards and incorporates best management practices (BMP's) consistent with low impact development (LID) and incorporates many of the concepts emphasized in LID. Additional TSS removal calculations demonstrating compliance with the MS4 requirements have been incorporated into these calculations.

BMP's utilized:

- Deep sump catchbasins
- Hydrodynamic Separators (Vortsentry or similar)
- Vegetated grass filter strips / overland flow
- Infiltration basins
- Infiltration Chambers

Documenting Compliance

Standard 1 - No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

Stormwater velocity at all outlets are included in the HydroCAD data and all outlets shall be provided with a rip-rap apron to resist erosion.

Standard 2 - Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates...To prevent storm damage and downstream and off-site flooding, Standard 2 requires that the post-development peak discharge rate is equal to or less than the pre-development rate from the 2-year and the 10-year 24-hour storms...Proponents must also evaluate the impact of peak discharges from the 100-year 24-hour storm. If this evaluation shows that increased off-site flooding will result from peak discharges from the 100-year 24-hour storms, BMPs must also be provided to attenuate these discharges.

The site has been designed to have no increase in offsite runoff for the 2-year and 10-year storm and the 100-year storm.

POA – 1 Railroad Tracks

Storm event	Pre Development	Post Development
2 year	0.77 cfs	0.69 cfs
10 year	2.62 cfs	2.06 cfs
25 year	5.87 cfs	3.02 cfs
100 year	14.05 cfs	10.18 cfs

POA – Bailey Rd Abutters Isolated Wetland (6P pre development, 60P post development)

Storm event	Pre Development	Post Development
2 year	0.32 cfs	0 cfs
10 year	0.95 cfs	0.06 cfs
25 year	1.39 cfs	0.63cfs
100 year	3.11 cfs	3.05 cfs

POA – Salisbury Street (3 Predevelopment, Link 311 post development)

Storm event	Pre Development	Post Development
2 year	2.65 cfs	2.16 cfs
10 year	6.66 cfs	5.17 cfs
25 year	9.39 cfs	7.47 cfs
100 year	13.78 cfs	10.67 cfs

POA – Overland to abutters to the South (Pre-development 4, Post development 40)

Storm event	Pre Development	Post Development
2 year	0.85 cfs	0.23 cfs
10 year	2.30 cfs	0.54 cfs
25 year	3.30 cfs	0.74 cfs
100 year	4.94 cfs	1.07 cfs

ANALYSIS OF FLOWS WETLANDS AND CRITICAL AREAS:

Pond 7P – Wetlands in old Gravel Pit

Storm Event	Pre Development		Post Development		Recharge Volume Basin A
	Rate (cfs)	Volume (c.f.)	Rate (cfs)	Volume (c.f.)	
2 year	0.01	147	0.01	150	42,413
10 year	0.14	3399	0.12	2396	81,816
25 year	0.55	7152	0.50	4868	107,884
100 year	2.04	15013	1.72	9963	149,953

This wetland is an old gravel pit that is maintained by the interception of the localized water table which is typical in an area of coarse sands and gravel as the runoff volumes would be insufficient to sustain this relatively large wetlands. The post-development surface runoff volume is reduced, however, the use of Recharge Basin A, directly upgradient of this wetland will act as a sponge, and provides direct recharge to the water table which sustains these wetlands.

Isolated Wetlands by Bailey Road

Storm Event	Pre Development		Post Development		Recharge Volume Basin B-1, B-2 and B-3
	Rate (cfs)	Volume (c.f.)	Rate (cfs)	Volume (c.f.)	
2 year	0.09	3306	0.09	689	10,239
10 year	1.61	18,818	1.03	9111	20,049
25 year	3.83	33,054	2.63	11,952	25,906
100 year	8.27	60,295	7.34	34,425	33,400

The wetlands by Bailey Road are also likely the result of the interception of the localized water table in the saddle in the area behind 124 Bailey Road. The flow rates to the isolated wetlands were not increased and the proximity of Basins B-1, B-2 and B-3 will provide a slow recharge to the water table to maintain the wetlands.

Property Line at 114 Bailey Road (added 8-2021)

The Conservation Commission requested the flow rates at the property line at the outlet to Basin B-3. This point of analysis is Reach 5R for both Pre and Post development.

Storm Event	Pre Development	Post Development
	Rate (cfs)	Rate (cfs)
2 year	0	0.00
10 year	0	0.08
25 year	0	0.70
100 year	3.48	3.23

Abutting Wetlands

Storm Event	Pre Development		Post Development	
	Rate (cfs)	Volume (c.f.)	Rate (cfs)	Volume (c.f.)
2 year	0.32	1898	0.00	0
10 year	0.95	4958	0.06	615
25 year	1.39	7207	0.63	4989
100 year	3.11	16,995	3.05	19,379

The goal for this POA is to not increase the rate of runoff to this abutter. The smaller storms have a net decrease in volume due in order to mitigate the rate of runoff and to meet the additional requirements of the MS4 Water Quality Standards with 90% TSS removal which is met with a combination of 85% TSS removal and storage for the 1" of runoff from the remaining impervious areas. The wetlands is an isolated area with an overflow (surface area of approximately 6,000 s.f.) so the increase in the 100 year volume will have minimal impact on the abutter.

Salisbury Street Abutters

At the request of the Town, the analysis at Salisbury was divided so that the impact on abutting properties down gradient of the detention basins at the end of Pine Tree Road could be analyzed.

Storm Event	Pre Development		Post Development	
	Rate (cfs)	Volume (c.f.)	Rate (cfs)	Volume (c.f.)
2 year	0.94	4485	0.42	2170
10 year	2.35	10,735	2.10	8357
25 year	3.30	15,184	2.77	12,809
100 year	4.86	22,635	4.39	22,189

The net result of the 3 stormwater basins is a net decrease in both the rate and volume of runoff for all storms analyzed.

Salisbury Street Abutter directly below outlet from Basin D-3 (N/F Spakauskas) (added 8-2021)

Storm Event	Pre Development Rate (cfs)	Post Development Rate (cfs)
2 year	0.68	0.48
10 year	1.69	1.38
25 year	2.38	2.29
100 year	3.50	3.87

The flow rates at the toe of the slope on the N/F Spakauskas property has no increase in the rate of runoff for the 25 year design storm. For the 100 year storm there is a 10% increase in the rate of runoff. However, we note the that land is sloped away from the house and towards Salisbury Street which has a decrease in the rate of runoff from the site for the 100 year event.

These calculations are contained in the drainage calculations identified as " Pine Tree-Supplemental- Abutter where the calculations were modified to choose a point of analysis at the toe of the slope on this abutting property.

Standard 3 - Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. 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 stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Total impervious Area onsite:

A soils: 81,860 s.f.
B Soils: 18,520 s.f.
C Soils: 202,422 s.f.

Class A soils = 0.6 inches x impervious area= 4093 c.f.
Class B soils = 0.35 x impervious area = 540 c.f.
Class C soils= 0.25 x impervious area= 4217c.f.

Required recharge = 4093 c.f. +540 c.f. = 4217 c.f. = 8850 c.f.

Capture Area Adjustment
302,662 s.f. impervious total impervious area
146,667 s.f. impervious tributary to infiltration basin
Capture adjustment factor = total area / tributary area = 302622/146667 = 2.06
Required recharge = 2.06 x 8850 = **18,231 cubic feet**

Simple Dynamic Recharge – Calculations attached

Drawdown Time: 18,231 cubic feet / (2.41 in/hr x 5190* sq.ft. x 1/12ft/in) = **17.5 hours**

* Only the bottom area of Basin A, not included in the Sediment Forebays is considered for recharge. An exfiltration rate of 2.41 in/hr was utilized to be conservative with coarse medium sand for the exfiltration rate as the bottom surface is crushed stone not loam and seed to maintain the hydraulic conductivity.

Groundwater offsets is greater than four feet so no mounding analysis is required. Bottom of basin is 784, matching the existing elevation in the southwesterly corner of the basin. The groundwater elevation is 779.37 (Test hole 309-11) No mounding analysis of other stormwater basins is required as they are utilized for attenuation, not recharge.

Standard 4 - Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

At least 44% TSS pretreatment is required prior to discharge to the stormwater infiltration BMP when:

- The infiltration BMP is located within an area with a rapid infiltration

MS4 Permit Requirements:

Stormwater management systems on new development shall be designed to meet an average annual pollutant removal equivalent to 90% of the average annual load of Total Suspended Solids (TSS) related to the total post-construction impervious area on the site and 60% of the average annual load of Total Phosphorous (TP) related to the post construction impervious area on the site.

a) *Average annual pollutant removal requirements are achieved through one of the following methods:*
   1. *Installing BMP's that meet the pollutant removal percentages based on calculations consistent with EPA Region 1's BMP Accounting and Tracking tool or other BMP performance evaluation tools provided by EPA Region 1 where available…any federally or State-approved BMP design guidance or performance standards (e.g. State Stormwater handbooks and designe guidance manuals)may be used to calculate BMP performance.*
   2. *Retaining volume of runoff equivalent to, or greater than, one (1.0) inch multiplied by the total post-construction impervious surface area on the new development site; or*
   3. *Meeting a combination of retention and treatment that achieves the above standards; or*
   4. *Utilizing off site mitigation that meets the above standards within the same USGS HUC12 as the new development site.*

Treatment Train 1 Drainage Basin A (Pond 700)

44% TSS removal required prior to infiltration

- 25% removal from Deep Sump Catchbasin = 75% remaining
- 25% removal from Sediment Forebay x 0.75 remaining= 19% removal
- Total removal = 25+19= 44%
- Total storage available in basin is 93,964 c.f. at elevation 790.0; 100 year peak elevation is 789.24 which is a volume of 76,006 c.f.

Overall Treatment Train removal:

		Removal Rate	Remains	
Pretreatment	Deep sump catch basins	25%	75%	
Treatment	Infiltration	80%	15%	No discharge from Infiltration basin so practical final removal rate is 100%
Final Rate			**removal**	**85%** No discharge Effective Rate 100%

Treatment Train 2 Recharge Area including Treatment Unit PT 0+60 and Basin E

44% TSS removal required prior to infiltration

- 25% removal from Deep Sump Catchbasin = 75% remaining
- 80% removal from Hydrodynamic Separator x 0.75 remaining= 60% removal
- Total removal = 25+60= 95%

		Removal Rate	Remains	
Pretreatment	Deep sump catch basins	25%	75%	
Treatment	Hydrodynamic Separator	80 %	15%*	
Treatment	Infiltration	80%	3%	
Final Rate			**removal**	**97%**

This treatment train meets 90%.

Treatment Train 3

Basin B-1, Basin B-2, Basin B-3 behind 124 Bailey AND Basin D-3

		Removal Rate	Remains	
Pretreatment	Deep sump catch basins	25%	75%	
Treatment	Hydrodynamic Separator	80 %	15%*	
Final Rate			**removal**	**85%**

Basin B-1

Total impervious to treatment unit = 10,465 s.f (disconnected roof runoff considered clean)
1" rainfall over 10,465 s.f.= 872 c.f. storage in Basin B-1 below basin outlet is 326, therefore 526 c.f. needs to be retained in Basin B-2

Basin B-2

Total impervious to B-2 = 0
Volume needed to be retained = 526 c.f. from Basin B-1
Storage Volume below outlet elevation 779 is 1028 c.f. >526.

Basin B-3

Total impervious to treatment unit = 25,410 s.f
1" rainfall over 25,410 s.f.= 2117 c.f.
Storage in Basin B-3 below basin outlet is 1337 and storage around Wetland between elev 277.0 (outlet from Wetland to elev 277.25 (outlet Basin B-3) is 929 c.f., therefore 2266 c.f. provided. 2117 c.f. required.

Basin D-3 (Basins D-1 and D-2 receive Runoff from Unconnected Roofs- roof runoff considered to be clean)

Total impervious to D-3 = 27,474 s.f.
Volume needed to be retained = 2,290 c.f.
Storage Volume below outlet elevation 811.90 is 3077 c.f. >2290.

PHOSPHORUS REMOVAL:

MS4 requirements for 60% Total Phosphorous Removal.

Basin A:

Design Vol=46,977 (this volume is less than the total volume of the basin as the calculations do not provide data for a large oversized basin.
Infiltration Rate=2.41

Rainfall Depth= (46,977)/3.366 Ac imp x (12in/1 ft/ 43560 sf/ac)= 3.84 inches

Pervious BMP Volume (see excel chart)= 9221 c.f.
Impervious BMP Volume = 46,977-9277= 37,700 c.f.
Impervious BMP Volume= 37,700 c.f./3.366 x (12 in/ft) x 1 ac/43560 s.f.)= 3.08 inches

From Chart: Runoff volume Reduction> 99.8%

Basin B-1:

Design Vol=1823 c.f (Storage volume below outlet for Basin B-1 and B-2 since they are in series)
Infiltration Rate=2.41

Rainfall Depth= (1823)/0.67 Ac imp x (12in/1 ft/ 43560 sf/ac)= 0.75 inches

Pervious BMP Volume (see excel chart)= 170 c.f.
Impervious BMP Volume = 1823-170= 1753 c.f.
Impervious BMP Volume= 1753 c.f./0.67 x (12 in/ft) x 1 ac/43560 s.f.)= 0.72" inches <5%

From Chart: Runoff volume Reduction> 90%

Basin B-3:

Design Vol=2266 c.f
Infiltration Rate=2.41

Rainfall Depth= (2266)/0.62 Ac imp x (12in/1 ft/ 43560 sf/ac)= 1.0 inches

Pervious BMP Volume (see excel chart)= 129 c.f.
Impervious BMP Volume = 2266-129= 2137 c.f.
Impervious BMP Volume= 2137 c.f./0.62 x (12 in/ft) x 1 ac/43560 s.f.)= 0.94" inches <5%

From Chart: Runoff volume Reduction> 90%

Basin D-3:

Design Vol=2266 c.f

Infiltration Rate=1.02

Rainfall Depth= (3077)/0.67 Ac imp x (12in/1 ft/ 43560 sf/ac)= 1.26 inches

Pervious BMP Volume (see excel chart)= 609 c.f.
Impervious BMP Volume = 3077-609= 2468 c.f.
Impervious BMP Volume= 2468 c.f./(0.67 x (12 in/ft) x 1 ac/43560 s.f.)= 1.01" inches >5%
Start with Runoff Depth of 1.0"
Pervious BMP Volume (see excel chart)= 522 c.f.
Impervious BMP Volume = 3077-522= 2555 c.f.
Impervious BMP Volume= 2555 c.f./0.67 x (12 in/ft) x 1 ac/43560 s.f.)= 1.05" inches >5%

From Chart: Runoff volume Reduction> 90%

Recharge Area (Pond 110P):

Design Vol=4404 c.f
Infiltration Rate=8.27

Rainfall Depth= (4404)/0.41 Ac imp x (12in/1 ft/ 43560 sf/ac)= 2.96 inches

Pervious BMP Volume = 1327 c.f.
Impervious BMP Volume = 4404-1489=3077 c.f.
Impervious BMP Volume= 3077 c.f./0.41 x (12 in/ft) x 1 ac/43560 s.f.)= 0.84 inches >5%

Start with Rainfall depth of 0.8"
Pervious BMP Volume= 175 c.f.
Impervious BMP Volume = 4404-175=4229 c.f.
Impervious BMP Volume= 4229 c.f./0.41 x (12 in/ft) x 1 ac/43560 s.f.)= 1.16 inches >5%

Start with Rainfall depth of 1.2"
Pervious BMP Volume (see excel chart)= 378 c.f.
Impervious BMP Volume = 4404-378=4026 c.f.
Impervious BMP Volume= 4026 c.f./0.41 x (12 in/ft) x 1 ac/43560 s.f.)= 1.10 inches <5%

From Chart: Runoff volume Reduction> 90%

Basin E:

Design Vol=1768 c.f
Infiltration Rate=8.27

Rainfall Depth= (1768)/0.13 Ac imp x (12in/1 ft/ 43560 sf/ac)= 3.74 inches

Pervious BMP Volume (see excel chart)= 1045 c.f.
Impervious BMP Volume = 1768-1045= 723 c.f.
Impervious BMP Volume= 723 c.f./0.13 x (12 in/ft) x 1 ac/43560 s.f.)= 1.53" inches >5%

Start with Runoff Depth of 1.5"
Pervious BMP Volume (see excel chart)= 584 c.f.
Impervious BMP Volume = 1768-584= 1184 c.f.
Impervious BMP Volume= 1184 c.f./0.13 x (12 in/ft) x 1 ac/43560 s.f.)= 2.5" inches >5%

Start with Runoff Depth of 1.75"

Pervious BMP Volume (see excel chart)= 814 c.f.
Impervious BMP Volume = 1768-814= 954 c.f.
Impervious BMP Volume= 954 c.f./0.13 x (12 in/ft) x 1 ac/43560 s.f.)= 2.02" inches >5%

Start with Runoff Depth of 1.9"
Pervious BMP Volume (see excel chart)= 942 c.f.
Impervious BMP Volume = 1768-942= 826 c.f.
Impervious BMP Volume= 826 c.f./0.13 x (12 in/ft) x 1 ac/43560 s.f.)= 1.75" inches >5%

Start with Runoff Depth of 1.85"
Pervious BMP Volume (see excel chart)= 906 c.f.
Impervious BMP Volume = 1768-906= 862 c.f.
Impervious BMP Volume= 862 c.f./0.13 x (12 in/ft) x 1 ac/43560 s.f.)= 1.82" inches <5%

From Chart: Runoff volume Reduction> 90%

TOTAL REDUCTION OF PHOSPHORUS SITEWIDE = 83.74% >60% MINIMUM

BMP Sizing

Note: VortSentry unit is used to pre-treat Stormwater runoff prior to discharge into recharge basins. These units meet or exceed the 1" rainfall (first flush) which is the minimum required.

VortSentry at DMH H 0+24

Summary for Pond 528P: H 1+10 Stormwater Unit

Inflow Area =	48,978 sf,	51.88% Impervious,	Inflow Depth =	0.85"	for 1-yr event
Inflow =	1.27 cfs @	12.04 hrs, Volume=	3,455 cf		
Outflow =	1.27 cfs @	12.04 hrs, Volume=	3,455 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	1.27 cfs @	12.04 hrs, Volume=	3,455 cf		

With peak flows less than 2.2 cfs we can follow the manufactures sizing requirements below resulting in a VortSentry Model HS60 or approved equal.

VortSentry prior to Drainage Basin B-1 (Flows to DMH H 3+10)

Summary for Pond 534P: DMH H 3+10 Stormwater Unit

Inflow Area =	57,150 sf,	44.58% Impervious,	Inflow Depth =	0.69"	for 1-yr event
Inflow =	1.15 cfs @	12.04 hrs, Volume=	3,270 cf		
Outflow =	1.15 cfs @	12.04 hrs, Volume=	3,270 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	1.15 cfs @	12.04 hrs, Volume=	3,270 cf		

With peak flows less than 1.2 cfs we can follow the manufactures sizing requirements below resulting in a VortSentry Model HS48 or approved equal.

VortSentry PT 0+ 24

Summary for Pond 204P: DMH PT 0+24

Inflow Area =	119,018 sf,	25.33% Impervious,	Inflow Depth =	0.15"	for 1-yr event
Inflow =	0.32 cfs @	12.06 hrs, Volume=	1,478 cf		
Outflow =	0.32 cfs @	12.06 hrs, Volume=	1,478 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	0.32 cfs @	12.06 hrs, Volume=	1,478 cf		

With peak flows less than 0.55 cfs we can follow the manufactures sizing requirements below resulting in

a VortSentry Model HS36 or approved equal.
VortSentry PT 0+ 60 (Same as DMH PT 2+15)

Pine Tree Post- REV 2020 *MA-Holden_files 24-hr S1 1-yr Rainfall=2.61"*
Prepared by Places Associates, Inc. Printed 1/13/2021
HydroCAD® 10.10-4a s/n 02908 © 2020 HydroCAD Software Solutions LLC Page 1

Summary for Pond 114P: DMH PT 2+15

Inflow Area =	50,638 sf,	29.65% Impervious,	Inflow Depth =	0.68"	for 1-yr event
Inflow =	0.91 cfs @	12.06 hrs,	Volume=	2,890 cf	
Outflow =	0.91 cfs @	12.06 hrs,	Volume=	2,890 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.91 cfs @	12.06 hrs,	Volume=	2,890 cf	

With peak flows less than 1.2 cfs we can follow the manufactures sizing requirements below resulting in a VortSentry Model HS48 or approved equal.

VortSentry PT 4+60

Pine Tree Post- REV 2020 *MA-Holden_files 24-hr S1 1-yr Rainfall=2.61"*
Prepared by Places Associates, Inc. Printed 1/13/2021
HydroCAD® 10.10-4a s/n 02908 © 2020 HydroCAD Software Solutions LLC Page 1

Summary for Pond 105P: DMH PT 4+60

Inflow Area =	28,298 sf,	20.67% Impervious,	Inflow Depth =	0.24"	for 1-yr event
Inflow =	0.07 cfs @	12.06 hrs,	Volume=	556 cf	
Outflow =	0.07 cfs @	12.06 hrs,	Volume=	556 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.07 cfs @	12.06 hrs,	Volume=	556 cf	

With peak flows less than 0.55 cfs we can follow the manufactures sizing requirements below resulting in a VortSentry Model HS36 or approved equal.

VortSentry PT 21+48

Pine Tree Post- REV 2020 *MA-Holden_files 24-hr S1 1-yr Rainfall=2.61"*
Prepared by Places Associates, Inc. Printed 1/13/2021
HydroCAD® 10.10-4a s/n 02908 © 2020 HydroCAD Software Solutions LLC Page 2

Summary for Pond 4P: DMH 21+48 Treatment

Inflow Area =	47,270 sf,	58.08% Impervious,	Inflow Depth =	1.51"	for 1-yr event
Inflow =	2.35 cfs @	12.04 hrs,	Volume=	5,957 cf	
Outflow =	2.35 cfs @	12.04 hrs,	Volume=	5,957 cf,	Atten= 0%, Lag= 0.0 min
Primary =	2.35 cfs @	12.04 hrs,	Volume=	5,957 cf	

With peak flows less than 3.7 cfs we can follow the manufactures sizing requirements below resulting in a VortSentry Model HS72 or approved equal.

Manufacturer's Sizing Chart

VortSentry HS Model	Swirl Chamber Diameter		Typical Depth Below Invert		Design Flow Rate[1] 240 µm		Max. Size Inlet/Outlet		Sediment Storage	
	ft	m	ft	m	cfs	L/s	in	mm	yd^3	m^3
HS36*	3	0.9	5.6	1.7	0.55	15.6	18	460	0.5	0.4
HS48	4	1.2	6.8	2.1	1.2	34.0	24	600	0.9	0.7
HS60*	5	1.5	8.0	2.4	2.2	62.3	30	760	1.5	1.1
HS72	6	1.8	9.2	2.8	3.7	104.8	36	900	2.1	1.6
HS84*	7	2.1	10.4	3.2	5.6	158.6	42	1050	2.8	2.1
HS96	8	2.4	11.5	3.5	8.1	229.4	48	1200	3.7	2.8

* Models may not be manufactured in your area. Check with your local representative for availability.

1. Design Flow Rate is based on 80% removal of a particle size distribution with an average particle size of 240-µm. This flow also represents the maximum flow prior to which bypass occurs.

Notes: Systems can be sized based on a water quality flow (e.g. 1 inch storm) or on a net annual basis depending on the local regulatory requirement.
When sizing based on a water quality storm, the required flow to be treated should be equal or less than the listed water quality flow for the selected system. Systems sized based on a water quality storm are generally more conservatively sized.
Additional particle size distributions are available for sizing purposes upon request.
Depth below invert is measured to the inside bottom of the system. This depth can be adjusted to meet specific storage or maintenance requirements.
Contact our support staff for the most cost effective sizing for your area.

UNIVERSITY OF MASSACHUSETTS AT AMHERST
Water Resources Research Center
Blaisdell House, UMass
310 Hicks Way
Amherst, MA 01003

Massachusetts Stormwater Evaluation Project

(413) 545-5532
(413) 545-2304 FAX
www.mastep.net

MASTEP Technology Review

Technology Name: VortSentry

Studies Reviewed:
- NJCAT Technology Verification, VortSentry Stormwater Treatment System December 2005

Date: January 23, 2008

Reviewer: Jerry Schoen

Rating: 2

Brief rationale for rating: This is a well conducted laboratory study, but it was run by Vortechnics staff, and is therefore not a third-party study. The particle size distribution was slightly higher than recommended (d50 120 microns vs. recommended < 100 microns). Sediment removal was measured according to SSC method; this method is considered by many to be superior than TSS for stormwater monitoring; however, Massachusetts policy and guidance documents reference TSS rather than SSC. The MASTEP rating is for SSC only - MASTEP has not evaluated any studies that focus on TSS removal.

Recommended Study Protocols Not Met:

- Studies should be conducted by independent third parties.
- Sediment removal performance measured using Suspended Sediment Concentration (SSC) method; it is preferable to measure both SSC and Total Suspended Sediment (TSS) methods. If only one, TSS is preferred for technologies used in Massachusetts.

Other Comments:

- The report contains little discussion of quality assurance/quality control measures. However, Contech (formerly Vortechnics) has subsequently provided supporting information that documents QC procedures generally followed at the company's testing facilities.
- Aside from the issues mentioned above, the study did closely follow recommended laboratory testing procedures, including a sufficient number of test runs at preferred operating rates and influent sediment concentration levels.
- Scour test was performed according to NJ-recommended procedures. Results satisfactory – this unit did not appear to contribute re-suspended sediment into the waste stream when the system runs at operating rates up to and including the design flow.

BMP Sizing

Drainage Basin A

Sediment Forebay 1 -Easterly End (Discharge from DMH PT 7+60)

Total Area= 108,960 s.f. with 55.28% impervious = 60,233 s.f. impervious
Water Quality Volume (WQv)= 1"x 60,233 s.f.= 5019 cf.

Required WQv= **5019 c.f.**
Volume provided in Sediment Forebay 1 = 3355 s.f. x 1.5' depth = **5033 s.f. > than minimum**

Sediment Forebay 2 -Westerly End (Discharge from DMH PT 8+75 and DMH A-1)

DMH PT 8+75
Total Area= 149,050 s.f. with 52.5% impervious = 78,251 s.f. impervious
Water Quality Volume (WQv)= 1"x 78,251 s.f.= 6521 cf.

DMH A-2
Total Area= 34,105 s.f. with 15.51% impervious = 5290 s.f. impervious
Water Quality Volume (WQv)= 1"x 5290 s.f.= 441 cf.

Required WQv= 6521 s.f.+441 s.f.= **6962 c.f.**
Volume provided in Sediment Forebay 2 = 4975 s.f. x 1.5' depth = **7462 s.f. > than minimum**

Standard 5 - For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater 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 stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater 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.

The site does not qualify as a land uses with higher potential pollutant loads.

Standard 6 - Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

This site does not discharge to a Zone A or within the DCR 200' tributary area.

Standard 7 - A redevelopment project is required to meet the following Stormwater 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 stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The site is not being proposed as a redevelopment project.

Standard 8 - 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) shall be developed and implemented.

See draft Stormwater Pollution Prevention Plan included in this document. This document is draft only as the final document will include contact information on the site contractor and may have some minor modifications to reflect the contractor's equipment and construction schedule.

Standard 9 - A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

See the Operation and Maintenance Plan included in this document.

Standard 10 - All illicit discharges to the stormwater management system are prohibited.

Illicit Discharge Compliance Statement

To the best of my knowledge no illicit discharges currently exist on the site and no future illicit discharge will be allowed, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease.

_____

Signature of Owner Date

To be completed and submitted prior to the start of construction.

Simple Dynamic Method for Recharge

Material previously submitted.

Modifications not required.

MADEP Stormwater Checklist

Material previously submitted.

Modifications not required.

Stormwater Operation and Maintenance Plan

Stormwater Operation and Maintenance Plan - Long Term Pollution Prevention

Ongoing maintenance is required for the proper function of the stormwater management system allowing the system prevent pollution for the long term. This document provides a guideline for this work and allows for record keeping.

Stormwater Management System Owner:	Site Contractor during construction Homeowners' Association post construction
Party Responsible for Maintenance:	Site Contractor during construction Homeowners' Association post construction

Snow Removal

Snow removal from the public ways will be the responsibility of the Town of Holden. Removal from private lots will be the responsibility of the homeowners. Snow should not be plowed or stockpiled in sediment forebays or infiltration basins.

Preliminary Stormwater O&M Maintenance Budget

Inspection and maintenance = $5,000 x 4 times per year = $10,000±

Site Specific BMP Maintenance Plans

(Reference MADEP Volume 2, Chapter – Structural BMP Specifications for the Massachusetts Stormwater Handbook and/or Manufacturer's specifications)

Deep Sump/Hooded Catchbasins

Inspect and clean deep sump basins 4 times per year.

If handling runoff from land uses with higher potential pollutant loads or discharging runoff near or to a critical area, more frequent cleaning may be necessary. Clamshell buckets are typically used to remove sediment in Massachusetts. However, vacuum trucks are preferable because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin. Structural BMPs. Although catch basin debris often contains concentrations of oil and hazardous materials such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Unless there is evidence that they have been contaminated by a spill or other means, MassDEP does not routinely require catch basin cleanings to be tested before disposal.

VortSentry® HS Maintenance

The VortSentry HS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit, i.e., unstable soils or heavy winter sanding will cause the treatment chamber to fill more quickly, but regular sweeping will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant deposition and transport may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall) however more frequent inspections may be necessary in equipment washdown areas and in climates where winter sanding operations may lead to rapid accumulations of a large volume of sediment. It is useful and often required as part of a permit to keep a record of each inspection. A simple inspection and maintenance log form for doing so is available for download at www.contechstormwater.com.

The VortSentry HS should be cleaned when the sediment has accumulated to a depth of two feet in the treatment chamber. This determination can be made by taking two measurements with a stadia rod or similar measuring device; one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the distance given in Table 1, the VortSentry HS should be maintained to ensure effective treatment.

Cleaning

Cleaning of the VortSentry HS should be done during dry weather conditions when no flow is entering the system. Cleanout of the VortSentry HS with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system. Simply remove the manhole cover and insert the vacuum hose into the sump. All pollutants can be removed from this one access point from the surface with no requirements for Confined Space Entry.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use adsorbent pads, which solidify the oils. These are usually much easier to remove from the unit individually, and less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Floating trash can be netted out if you wish to separate it from the other pollutants.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure proper safety precautions. If anyone physically enters the unit, Confined Space Entry procedures need to be followed.

Disposal of all material removed from the VortSentry HS should be done is accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

VortSentry HS Model	Diameter		Distance Between Water Surface and Top of Storage Sump		Sediment Storage		Oil Spill Storage	
	in.	m	ft.	m	yd^3	m^3	gal.	liter
HS36	36	0.9	3.6	1.1	0.5	0.4	83	314
HS48	48	1.2	4.7	1.4	0.9	0.7	158	598
HS60	60	1.5	6.0	1.8	1.5	1.1	258	978
HS72	72	1.8	7.1	2.2	2.1	1.6	372	1409
HS84	84	2.1	8.4	2.6	2.9	2.2	649	2458
HS96	96	2.4	9.5	2.9	3.7	2.8	845	3199

Table 1: VortSentry HS Maintenance Indicators and Sediment Storage Capacities.

Infiltration Basins

Inspect and complete preventive maintenance at least twice a year. Inspect the pretreatment BMPs per previous sections. Inspect it after every major storm for the first few months to ensure it is stabilized and functioning properly and if necessary take corrective action. Note how long water remains standing in the basin after a storm; standing water within the basin 48 to 72 hours after a storm indicates that the infiltration capacity may have been overestimated. If the ponding is due to clogging, immediately address the reasons for the clogging (such as upland sediment erosion, excessive compaction of soils, or low spots). Thereafter, inspect the infiltration basin at least twice per year.

Important items to check during the inspection include:

- Signs of differential settlement
- Cracking
- Erosion
- Condition of riprap

Stormwater BMP Inspection and Maintenance Log
(print a log for each BMP and maintain a log book for the project)

BMP:_____

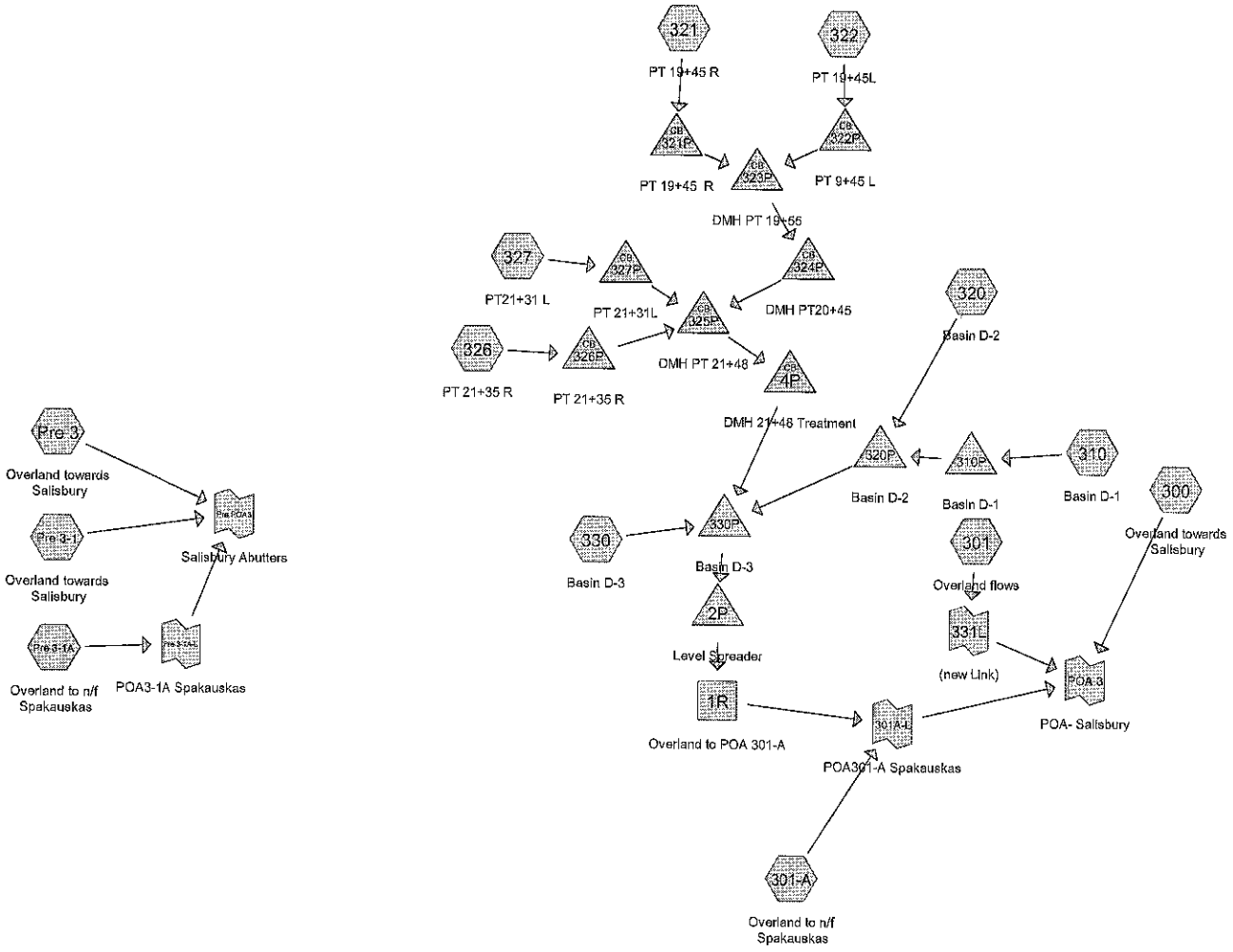
Date	Inspector	Issues Observed	Corrective Action Taken	Notes

Draft Stormwater Pollution Prevention Plan

Material previously submitted.

Modifications not required.

Pine Tree Supplemental Abutter Calculations



Subcat Reach Pond Link

Routing Diagram for Pine Tree- Supplemental-Abutter
Prepared by Places Associates, Inc., Printed 8/13/2021
HydroCAD® 10.10-4a s/n 02908 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment 300: Overland towards Salisbury

Runoff = 5.49 cfs @ 12.06 hrs, Volume= 17,338 cf, Depth= 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Adj	Description
13,773	98		Unconnected roofs, HSG C
32,021	74		>75% Grass cover, Good, HSG C
18,430	70		Woods, Good, HSG C
64,224	78	75	Weighted Average, UI Adjusted
50,451			78.55% Pervious Area
13,773			21.45% Impervious Area
13,773			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.17"
0.1	20	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	66	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	20	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	45	0.1300	2.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	20	0.5000	11.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	30	0.3000	2.74		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.7	251	Total			

Summary for Subcatchment 301: Overland flows

Runoff = 1.32 cfs @ 12.16 hrs, Volume= 5,824 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Adj	Description
10,790	74		>75% Grass cover, Good, HSG C
10,704	70		Woods, Good, HSG C
1,442	98		Unconnected roofs, HSG C
22,936	74	73	Weighted Average, UI Adjusted
21,494			93.71% Pervious Area
1,442			6.29% Impervious Area
1,442			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.17"
1.4	96	0.0520	1.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	140	0.0820	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.4	286	Total			

Summary for Subcatchment 301-A: Overland to n/f Spakauskas

Runoff = 1.63 cfs @ 12.19 hrs, Volume= 7,567 cf, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Adj	Description
9,185	74		>75% Grass cover, Good, HSG C
21,859	70		Woods, Good, HSG C
722	98		Unconnected roofs, HSG C
31,766	72	71	Weighted Average, UI Adjusted
31,044			97.73% Pervious Area
722			2.27% Impervious Area
722			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.17"
1.4	96	0.0520	1.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	140	0.0820	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.1	120	0.1410	1.88		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	30	0.5300	3.64		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	15	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.7	451	Total			

Summary for Subcatchment 310: Basin D-1

Runoff = 1.29 cfs @ 12.05 hrs, Volume= 3,844 cf, Depth= 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Adj	Description
12,965	74		>75% Grass cover, Good, HSG C
1,275	98		Unconnected roofs, HSG C
14,240	76	75	Weighted Average, UI Adjusted
12,965			91.05% Pervious Area
1,275			8.95% Impervious Area
1,275			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	30	0.0100	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
0.1	30	0.3000	3.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.4	72	0.0140	0.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	30	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.7	162	Total			

Summary for Subcatchment 320: Basin D-2

Runoff = 1.18 cfs @ 12.05 hrs, Volume= 3,499 cf, Depth= 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Description
12,325	74	>75% Grass cover, Good, HSG C
635	98	Unconnected roofs, HSG C
12,960	75	Weighted Average
12,325		95.10% Pervious Area
635		4.90% Impervious Area
635		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	30	0.0100	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
0.1	30	0.3000	3.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.4	72	0.0140	0.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	30	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.7	162	Total			

Summary for Subcatchment 321: PT 19+45 R

Runoff = 1.84 cfs @ 12.04 hrs, Volume= 5,478 cf, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Description
9,491	74	>75% Grass cover, Good, HSG C
6,349	98	Paved roads w/curbs & sewers, HSG C
15,840	84	Weighted Average
9,491		59.92% Pervious Area
6,349		40.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	30	0.0100	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
0.4	30	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	75	0.0660	1.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	100	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.5	235	Total			

Summary for Subcatchment 322: PT 19+45L

Runoff = 0.91 cfs @ 12.04 hrs, Volume= 2,783 cf, Depth= 5.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Description
1,433	74	>75% Grass cover, Good, HSG C
5,072	98	Paved roads w/curbs & sewers, HSG C
6,505	93	Weighted Average
1,433		22.03% Pervious Area
5,072		77.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	295	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.2	295	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 326: PT 21+35 R

Runoff = 2.01 cfs @ 12.04 hrs, Volume= 5,885 cf, Depth= 4.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Description
7,470	74	>75% Grass cover, Good, HSG C
8,330	98	Paved roads w/curbs & sewers, HSG C
15,800	87	Weighted Average
7,470		47.28% Pervious Area
8,330		52.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	32	0.1560	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
0.4	40	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	18	0.2200	3.28		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0600	1.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	125	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.2	255	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 327: PT21+31 L

Runoff = 1.29 cfs @ 12.04 hrs, Volume= 3,990 cf, Depth= 5.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Description
1,422	74	>75% Grass cover, Good, HSG C
7,703	98	Paved roads w/curbs & sewers, HSG C
9,125	94	Weighted Average
1,422		15.58% Pervious Area
7,703		84.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	295	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.2	295	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 330: Basin D-3

Runoff = 0.65 cfs @ 12.04 hrs, Volume= 1,869 cf, Depth= 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Description
7,135	74	>75% Grass cover, Good, HSG C
7,135		100.00% Pervious Area

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

Summary for Subcatchment Pre 3: Overland towards Salisbury

Runoff = 6.08 cfs @ 12.18 hrs, Volume= 27,637 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Description
119,920	70	Woods, Good, HSG C
119,920		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.17"
0.9	95	0.1150	1.70		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	173	0.1560	1.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.6	63	0.1280	1.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	30	0.1666	2.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	65	0.3000	2.74		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.0	476	Total			

Summary for Subcatchment Pre 3-1: Overland towards Salisbury

Runoff = 1.48 cfs @ 12.18 hrs, Volume= 6,809 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Description
29,546	70	Woods, Good, HSG C
29,546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.17"
3.9	430	0.1350	1.84		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.3	480	Total			

Summary for Subcatchment Pre 3-1A: Overland to n/f Spakauskas

Runoff = 2.38 cfs @ 12.20 hrs, Volume= 11,509 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
MA-Holden_files 24-hr S1 25-yr Rainfall=5.95"

Area (sf)	CN	Description
49,940	70	Woods, Good, HSG C
49,940		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.17"
1.4	135	0.1100	1.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	60	0.1600	2.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.5	395	0.1410	1.88		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	30	0.5300	3.64		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	15	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.0	685	Total			

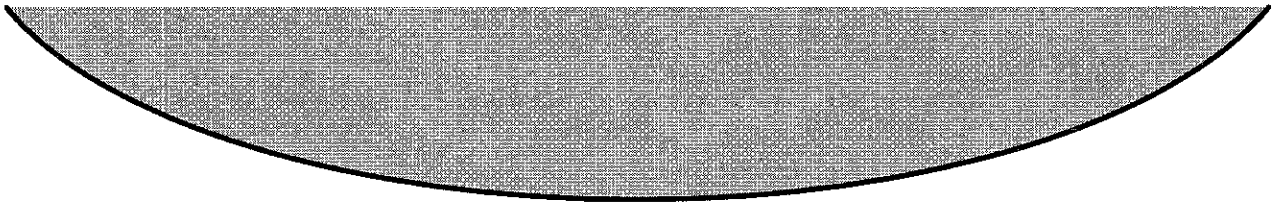
Summary for Reach 1R: Overland to POA 301-A

Inflow Area = 81,605 sf, 35.98% Impervious, Inflow Depth = 1.03" for 25-yr event
Inflow = 1.50 cfs @ 12.23 hrs, Volume= 6,984 cf
Outflow = 1.25 cfs @ 12.59 hrs, Volume= 6,983 cf, Atten= 17%, Lag= 21.8 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.24 fps, Min. Travel Time= 13.2 min
Avg. Velocity = 0.06 fps, Avg. Travel Time= 55.5 min

Peak Storage= 991 cf @ 12.59 hrs
Average Depth at Peak Storage= 0.13' , Surface Width= 64.00'
Bank-Full Depth= 0.08' Flow Area= 2.7 sf, Capacity= 0.53 cfs

50.00' x 0.08' deep Parabolic Channel, n= 0.450
Length= 190.0' Slope= 0.1789 '/'
Inlet Invert= 806.00', Outlet Invert= 772.00'



‡

Summary for Pond 4P: DMH 21+48 Treatment

Inflow Area =	47,270 sf,	58.08% Impervious,	Inflow Depth =	4.60"	for 25-yr event
Inflow =	6.04 cfs @	12.04 hrs, Volume=	18,135 cf		
Outflow =	6.04 cfs @	12.04 hrs, Volume=	18,135 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	6.04 cfs @	12.04 hrs, Volume=	18,135 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 817.94' @ 12.04 hrs
Flood Elev= 821.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	816.50'	**18.0" Round Culvert** L= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 816.50' / 816.32' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=6.03 cfs @ 12.04 hrs HW=817.94' TW=813.07' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 6.03 cfs @ 4.44 fps)

Summary for Pond 310P: Basin D-1

Inflow Area =	14,240 sf,	8.95% Impervious,	Inflow Depth =	3.24"	for 25-yr event
Inflow =	1.29 cfs @	12.05 hrs, Volume=	3,844 cf		
Outflow =	0.16 cfs @	12.66 hrs, Volume=	3,146 cf,	Atten= 88%,	Lag= 36.7 min
Primary =	0.16 cfs @	12.66 hrs, Volume=	3,146 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 836.03' @ 12.66 hrs Surf.Area= 1,924 sf Storage= 1,640 cf

Plug-Flow detention time= 216.6 min calculated for 3,146 cf (82% of inflow)
Center-of-Mass det. time= 131.1 min (984.5 - 853.3)

Volume	Invert	Avail.Storage	Storage Description
#1	835.00'	7,970 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
835.00	1,350	0	0
836.00	1,825	1,588	1,588
837.00	5,350	3,588	5,175
837.50	5,830	2,795	7,970

Device	Routing	Invert	Outlet Devices
#1	Primary	836.50'	**15.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Primary	830.00'	**6.0" Round Culvert** L= 68.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 830.00' / 820.00' S= 0.1471 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#3	Device 2	835.45'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.16 cfs @ 12.66 hrs HW=836.03' TW=817.91' (Dynamic Tailwater)
- **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **2=Culvert** (Passes 0.16 cfs of 2.27 cfs potential flow)
  - **3=Orifice/Grate** (Orifice Controls 0.16 cfs @ 3.24 fps)

Summary for Pond 320P: Basin D-2

Inflow Area =	27,200 sf,	7.02% Impervious,	Inflow Depth >	2.93"	for 25-yr event
Inflow =	1.26 cfs @	12.05 hrs, Volume=	6,645 cf		
Outflow =	0.03 cfs @	24.19 hrs, Volume=	1,385 cf,	Atten= 98%,	Lag= 728.7 min
Discarded =	0.03 cfs @	24.19 hrs, Volume=	1,385 cf		
Primary =	0.00 cfs @	1.00 hrs, Volume=	0 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 819.11' @ 24.19 hrs Surf.Area= 3,353 sf Storage= 5,637 cf

Plug-Flow detention time= 625.7 min calculated for 1,385 cf (21% of inflow)
Center-of-Mass det. time= 399.5 min (1,314.9 - 915.4)

Volume	Invert	Avail.Storage	Storage Description
#1	817.00'	8,921 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
817.00	2,033	0	0
818.00	2,628	2,331	2,331
819.00	3,275	2,952	5,282
820.00	4,003	3,639	8,921

Device	Routing	Invert	Outlet Devices
#1	Primary	815.00'	**15.0" Round Culvert** L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 815.00' / 814.50' S= 0.0122 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	819.20'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	819.30'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Discarded	817.00'	**0.520 in/hr Exfiltration over Surface area above 817.00'** Conductivity to Groundwater Elevation = 815.90' Excluded Surface area = 2,033 sf

Discarded OutFlow Max=0.03 cfs @ 24.19 hrs HW=819.11' (Free Discharge)
└**4=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=817.00' TW=806.00' (Dynamic Tailwater)
├**1=Culvert** (Passes 0.00 cfs of 6.93 cfs potential flow)
│└**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 321P: PT 19+45 R

Inflow Area = 15,840 sf, 40.08% Impervious, Inflow Depth = 4.15" for 25-yr event
Inflow = 1.84 cfs @ 12.04 hrs, Volume= 5,478 cf
Outflow = 1.84 cfs @ 12.04 hrs, Volume= 5,478 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.84 cfs @ 12.04 hrs, Volume= 5,478 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 823.34' @ 12.04 hrs
Flood Elev= 826.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	822.60'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 822.60' / 822.12' S= 0.0400 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.83 cfs @ 12.04 hrs HW=823.34' TW=822.79' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 1.83 cfs @ 2.93 fps)

Summary for Pond 322P: PT 9+45 L

Inflow Area = 6,505 sf, 77.97% Impervious, Inflow Depth = 5.13" for 25-yr event
Inflow = 0.91 cfs @ 12.04 hrs, Volume= 2,783 cf
Outflow = 0.91 cfs @ 12.04 hrs, Volume= 2,783 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.91 cfs @ 12.04 hrs, Volume= 2,783 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 823.13' @ 12.04 hrs
Flood Elev= 826.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	822.60'	**12.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 822.60' / 822.12' S= 0.0218 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.87 cfs @ 12.04 hrs HW=823.13' TW=822.79' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.87 cfs @ 3.03 fps)

Summary for Pond 323P: DMH PT 19+55

Inflow Area = 22,345 sf, 51.11% Impervious, Inflow Depth = 4.44" for 25-yr event
Inflow = 2.75 cfs @ 12.04 hrs, Volume= 8,260 cf
Outflow = 2.75 cfs @ 12.04 hrs, Volume= 8,260 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.75 cfs @ 12.04 hrs, Volume= 8,260 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 822.80' @ 12.04 hrs
Flood Elev= 826.38'

Device	Routing	Invert	Outlet Devices
#1	Primary	821.77'	**12.0" Round Culvert** L= 99.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 821.77' / 819.79' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.75 cfs @ 12.04 hrs HW=822.80' TW=820.82' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 2.75 cfs @ 3.50 fps)

Summary for Pond 324P: DMH PT20+45

Inflow Area = 22,345 sf, 51.11% Impervious, Inflow Depth = 4.44" for 25-yr event
Inflow = 2.75 cfs @ 12.04 hrs, Volume= 8,260 cf
Outflow = 2.75 cfs @ 12.04 hrs, Volume= 8,260 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.75 cfs @ 12.04 hrs, Volume= 8,260 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 820.82' @ 12.04 hrs
Flood Elev= 823.79'

Device	Routing	Invert	Outlet Devices
#1	Primary	819.79'	**12.0" Round Culvert** L= 93.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 819.79' / 817.75' S= 0.0219 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.75 cfs @ 12.04 hrs HW=820.82' TW=818.43' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 2.75 cfs @ 3.50 fps)

Summary for Pond 325P: DMH PT 21+48

Inflow Area = 47,270 sf, 58.08% Impervious, Inflow Depth = 4.60" for 25-yr event
Inflow = 6.04 cfs @ 12.04 hrs, Volume= 18,135 cf
Outflow = 6.04 cfs @ 12.04 hrs, Volume= 18,135 cf, Atten= 0%, Lag= 0.0 min
Primary = 6.04 cfs @ 12.04 hrs, Volume= 18,135 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 818.44' @ 12.04 hrs
Flood Elev= 821.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	816.70'	**18.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 816.70' / 816.50' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.95 cfs @ 12.04 hrs HW=818.42' TW=817.94' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 5.95 cfs @ 3.37 fps)

Summary for Pond 326P: PT 21+35 R

Inflow Area = 15,800 sf, 52.72% Impervious, Inflow Depth = 4.47" for 25-yr event
Inflow = 2.01 cfs @ 12.04 hrs, Volume= 5,885 cf
Outflow = 2.01 cfs @ 12.04 hrs, Volume= 5,885 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.01 cfs @ 12.04 hrs, Volume= 5,885 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 818.70' @ 12.05 hrs
Flood Elev= 821.28'

Device	Routing	Invert	Outlet Devices
#1	Primary	817.28'	**12.0" Round Culvert** L= 13.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 817.28' / 817.00' S= 0.0215 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.79 cfs @ 12.04 hrs HW=818.64' TW=818.42' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 1.79 cfs @ 2.28 fps)

Summary for Pond 327P: PT 21+31L

Inflow Area = 9,125 sf, 84.42% Impervious, Inflow Depth = 5.25" for 25-yr event
Inflow = 1.29 cfs @ 12.04 hrs, Volume= 3,990 cf
Outflow = 1.29 cfs @ 12.04 hrs, Volume= 3,990 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.29 cfs @ 12.04 hrs, Volume= 3,990 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 818.56' @ 12.05 hrs
Flood Elev= 821.34'

Device	Routing	Invert	Outlet Devices
#1	Primary	817.34'	**12.0" Round Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 817.34' / 817.07' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.97 cfs @ 12.04 hrs HW=818.50' TW=818.42' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.97 cfs @ 1.34 fps)

Summary for Pond 330-A: Level Spreader

Inflow Area =	81,605 sf, 35.98% Impervious,	Inflow Depth =	1.07"	for 25-yr event
Inflow =	1.45 cfs @ 12.26 hrs,	Volume=	7,259 cf	
Outflow =	1.51 cfs @ 12.23 hrs,	Volume=	7,241 cf,	Atten= 0%, Lag= 0.0 min
Discarded =	0.00 cfs @ 12.59 hrs,	Volume=	258 cf	
Primary =	1.50 cfs @ 12.23 hrs,	Volume=	6,984 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 806.13' @ 12.59 hrs Surf.Area= 120 sf Storage= 192 cf

Plug-Flow detention time= 16.6 min calculated for 7,241 cf (100% of inflow)
Center-of-Mass det. time= 16.0 min (798.2 - 782.2)

Volume	Invert	Avail.Storage	Storage Description
#1	803.00'	139 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 420 cf Overall - 72 cf Embedded = 348 cf x 40.0% Voids
#2	803.50'	71 cf	**18.0" Round Pipe Storage** Inside #1 L= 40.0' S= 0.0001 '/' 72 cf Overall - 0.1" Wall Thickness = 71 cf
		210 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
803.00	120	0	0
806.50	120	420	420

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**40.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height
#2	Discarded	803.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 798.00'

Discarded OutFlow Max=0.00 cfs @ 12.59 hrs HW=806.13' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=1.11 cfs @ 12.23 hrs HW=806.10' TW=806.10' (Dynamic Tailwater)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.11 cfs @ 0.28 fps)

Summary for Pond 330P: Basin D-3

Inflow Area = 81,605 sf, 35.98% Impervious, Inflow Depth = 2.94" for 25-yr event
Inflow = 6.70 cfs @ 12.04 hrs, Volume= 20,004 cf
Outflow = 1.73 cfs @ 12.26 hrs, Volume= 19,774 cf, Atten= 74%, Lag= 13.2 min
Discarded = 0.29 cfs @ 12.26 hrs, Volume= 12,515 cf
Primary = 1.45 cfs @ 12.26 hrs, Volume= 7,259 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 813.75' @ 12.26 hrs Surf.Area= 5,549 sf Storage= 6,678 cf

Plug-Flow detention time= 148.1 min calculated for 19,774 cf (99% of inflow)
Center-of-Mass det. time= 140.9 min (947.3 - 806.4)

Volume	Invert	Avail.Storage	Storage Description
#1	811.00'	8,484 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	806.00'	2,047 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,823 cf Overall x 30.0% Voids
		10,531 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
811.00	908	0	0
812.00	1,435	1,172	1,172
813.00	2,006	1,721	2,892
814.00	2,798	2,402	5,294
815.00	3,582	3,190	8,484

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	150	0	0
807.00	500	325	325
808.00	1,005	753	1,078
809.00	1,560	1,283	2,360
810.00	2,210	1,885	4,245
811.00	2,945	2,578	6,823

Device	Routing	Invert	Outlet Devices
#1	Primary	808.50'	**15.0" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 808.50' / 807.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	811.90'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	812.25'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	812.75'	**5.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 1	813.45'	**30.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.61 (C= 3.26)
#6	Device 1	814.30'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#7	Primary	814.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

#8 Discarded 806.00' **1.020 in/hr Exfiltration over Surface area**
Conductivity to Groundwater Elevation = 805.00'

Discarded OutFlow Max=0.29 cfs @ 12.26 hrs HW=813.75' (Free Discharge)
└**8=Exfiltration** (Controls 0.29 cfs)

Primary OutFlow Max=1.45 cfs @ 12.26 hrs HW=813.75' TW=806.10' (Dynamic Tailwater)
├**1=Culvert** (Passes 1.45 cfs of 12.41 cfs potential flow)
│ ├**2=Orifice/Grate** (Orifice Controls 0.55 cfs @ 6.26 fps)
│ ├**3=Orifice/Grate** (Orifice Controls 0.28 cfs @ 5.66 fps)
│ ├**4=Orifice/Grate** (Orifice Controls 0.59 cfs @ 4.30 fps)
│ ├**5=Sharp-Crested Vee/Trap Weir** (Weir Controls 0.04 cfs @ 1.44 fps)
│ └**6=Orifice/Grate** (Controls 0.00 cfs)
└**7=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link 301A-L: POA301-A Spakauskas

Inflow Area = 113,371 sf, 26.54% Impervious, Inflow Depth = 1.54" for 25-yr event
Inflow = 2.29 cfs @ 12.23 hrs, Volume= 14,550 cf
Primary = 2.29 cfs @ 12.23 hrs, Volume= 14,550 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Summary for Link 331L: (new Link)

Inflow Area = 22,936 sf, 6.29% Impervious, Inflow Depth = 3.05" for 25-yr event
Inflow = 1.32 cfs @ 12.16 hrs, Volume= 5,824 cf
Primary = 1.32 cfs @ 12.16 hrs, Volume= 5,824 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Summary for Link POA 3: POA- Salisbury

Inflow Area = 200,531 sf, 22.59% Impervious, Inflow Depth = 2.26" for 25-yr event
Inflow = 7.50 cfs @ 12.07 hrs, Volume= 37,712 cf
Primary = 7.50 cfs @ 12.07 hrs, Volume= 37,712 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Summary for Link Pre 3-1A-L: POA3-1A Spakauskas

Inflow Area = 49,940 sf, 0.00% Impervious, Inflow Depth = 2.77" for 25-yr event
Inflow = 2.38 cfs @ 12.20 hrs, Volume= 11,509 cf
Primary = 2.38 cfs @ 12.20 hrs, Volume= 11,509 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Summary for Link Pre POA3: Salisbury Abutters

Inflow Area = 199,406 sf, 0.00% Impervious, Inflow Depth = 2.77" for 25-yr event
Inflow = 9.93 cfs @ 12.18 hrs, Volume= 45,956 cf
Primary = 9.93 cfs @ 12.18 hrs, Volume= 45,956 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Time span=1.00-30.00 hrs, dt=0.01 hrs, 2901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 300: Overland towards Runoff Area=64,224 sf 21.45% Impervious Runoff Depth=1.08"
Flow Length=251' Tc=7.7 min UI Adjusted CN=75 Runoff=1.90 cfs 5,782 cf

Subcatchment 301: Overland flows Runoff Area=22,936 sf 6.29% Impervious Runoff Depth=0.97"
Flow Length=286' Tc=15.4 min UI Adjusted CN=73 Runoff=0.42 cfs 1,854 cf

Subcatchment 301-A: Overland to n/f Runoff Area=31,766 sf 2.27% Impervious Runoff Depth=0.87"
Flow Length=451' Tc=16.7 min UI Adjusted CN=71 Runoff=0.48 cfs 2,293 cf

Subcatchment 310: Basin D-1 Runoff Area=14,240 sf 8.95% Impervious Runoff Depth=1.08"
Flow Length=162' Tc=6.7 min UI Adjusted CN=75 Runoff=0.45 cfs 1,282 cf

Subcatchment 320: Basin D-2 Runoff Area=12,960 sf 4.90% Impervious Runoff Depth=1.08"
Flow Length=162' Tc=6.7 min CN=75 Runoff=0.41 cfs 1,167 cf

Subcatchment 321: PT 19+45 R Runoff Area=15,840 sf 40.08% Impervious Runoff Depth=1.67"
Flow Length=235' Tc=6.5 min CN=84 Runoff=0.82 cfs 2,199 cf

Subcatchment 322: PT 19+45L Runoff Area=6,505 sf 77.97% Impervious Runoff Depth=2.43"
Flow Length=295' Slope=0.0400 '/' Tc=6.0 min CN=93 Runoff=0.50 cfs 1,315 cf

Subcatchment 326: PT 21+35 R Runoff Area=15,800 sf 52.72% Impervious Runoff Depth=1.90"
Flow Length=255' Tc=6.0 min CN=87 Runoff=0.96 cfs 2,498 cf

Subcatchment 327: PT21+31 L Runoff Area=9,125 sf 84.42% Impervious Runoff Depth=2.52"
Flow Length=295' Slope=0.0400 '/' Tc=6.0 min CN=94 Runoff=0.72 cfs 1,920 cf

Subcatchment 330: Basin D-3 Runoff Area=7,135 sf 0.00% Impervious Runoff Depth=1.02"
Tc=6.0 min CN=74 Runoff=0.22 cfs 609 cf

Subcatchment Pre 3: Overland towards Runoff Area=119,920 sf 0.00% Impervious Runoff Depth=0.82"
Flow Length=476' Tc=16.0 min CN=70 Runoff=1.72 cfs 8,159 cf

Subcatchment Pre 3-1: Overland towards Runoff Area=29,546 sf 0.00% Impervious Runoff Depth=0.82"
Flow Length=480' Tc=16.3 min CN=70 Runoff=0.42 cfs 2,010 cf

Subcatchment Pre 3-1A: Overland to n/f Runoff Area=49,940 sf 0.00% Impervious Runoff Depth=0.82"
Flow Length=685' Tc=18.0 min CN=70 Runoff=0.68 cfs 3,398 cf

Reach 1R: Overland to POA 301-A Avg. Flow Depth=0.03' Max Vel=0.12 fps Inflow=0.18 cfs 309 cf
n=0.400 L=190.0' S=0.1789 '/' Capacity=0.22 cfs Outflow=0.08 cfs 308 cf

Pond 2P: Level Spreader Peak Elev=809.01' Storage=186 cf Inflow=0.16 cfs 532 cf
Discarded=0.01 cfs 223 cf Primary=0.18 cfs 309 cf Outflow=0.19 cfs 532 cf

Pond 4P: DMH 21+48 Treatment Peak Elev=817.42' Inflow=2.99 cfs 7,932 cf
18.0" Round Culvert n=0.013 L=18.0' S=0.0100 '/' Outflow=2.99 cfs 7,932 cf

Pond 310P: Basin D-1 Peak Elev=835.54' Storage=805 cf Inflow=0.45 cfs 1,282 cf
Outflow=0.02 cfs 590 cf

Pond 320P: Basin D-2 Peak Elev=817.68' Storage=1,509 cf Inflow=0.41 cfs 1,757 cf
Discarded=0.01 cfs 306 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 306 cf

Pond 321P: PT 19+45 R Peak Elev=823.06' Inflow=0.82 cfs 2,199 cf
12.0" Round Culvert n=0.013 L=12.0' S=0.0400 '/' Outflow=0.82 cfs 2,199 cf

Pond 322P: PT 9+45 L Peak Elev=822.95' Inflow=0.50 cfs 1,315 cf
12.0" Round Culvert n=0.013 L=22.0' S=0.0218 '/' Outflow=0.50 cfs 1,315 cf

Pond 323P: DMH PT 19+55 Peak Elev=822.37' Inflow=1.31 cfs 3,514 cf
12.0" Round Culvert n=0.013 L=99.0' S=0.0200 '/' Outflow=1.31 cfs 3,514 cf

Pond 324P: DMH PT20+45 Peak Elev=820.39' Inflow=1.31 cfs 3,514 cf
12.0" Round Culvert n=0.013 L=93.0' S=0.0219 '/' Outflow=1.31 cfs 3,514 cf

Pond 325P: DMH PT 21+48 Peak Elev=817.71' Inflow=2.99 cfs 7,932 cf
18.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=2.99 cfs 7,932 cf

Pond 326P: PT 21+35 R Peak Elev=817.91' Inflow=0.96 cfs 2,498 cf
12.0" Round Culvert n=0.013 L=13.0' S=0.0215 '/' Outflow=0.96 cfs 2,498 cf

Pond 327P: PT 21+31L Peak Elev=817.93' Inflow=0.72 cfs 1,920 cf
12.0" Round Culvert n=0.013 L=55.0' S=0.0049 '/' Outflow=0.72 cfs 1,920 cf

Pond 330P: Basin D-3 Peak Elev=812.20' Storage=3,523 cf Inflow=3.21 cfs 8,541 cf
Discarded=0.22 cfs 7,976 cf Primary=0.16 cfs 532 cf Outflow=0.37 cfs 8,508 cf

Link 301A-L: POA301-A Spakauskas Inflow=0.48 cfs 2,601 cf
Primary=0.48 cfs 2,601 cf

Link 331L: (new Link) Inflow=0.42 cfs 1,854 cf
Primary=0.42 cfs 1,854 cf

Link POA 3: POA- Salisbury Inflow=2.44 cfs 10,238 cf
Primary=2.44 cfs 10,238 cf

Link Pre 3-1A-L: POA3-1A Spakauskas Inflow=0.68 cfs 3,398 cf
Primary=0.68 cfs 3,398 cf

Link Pre POA3: Salisbury Abutters Inflow=2.81 cfs 13,567 cf
Primary=2.81 cfs 13,567 cf

Total Runoff Area = 399,937 sf Runoff Volume = 34,486 cf Average Runoff Depth = 1.03"
88.67% Pervious = 354,636 sf 11.33% Impervious = 45,301 sf

Time span=1.00-30.00 hrs, dt=0.01 hrs, 2901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 300: Overland towards Runoff Area=64,224 sf 21.45% Impervious Runoff Depth=2.36"
Flow Length=251' Tc=7.7 min UI Adjusted CN=75 Runoff=4.07 cfs 12,633 cf

Subcatchment 301: Overland flows Runoff Area=22,936 sf 6.29% Impervious Runoff Depth=2.19"
Flow Length=286' Tc=15.4 min UI Adjusted CN=73 Runoff=0.96 cfs 4,195 cf

Subcatchment 301-A: Overland to n/f Runoff Area=31,766 sf 2.27% Impervious Runoff Depth=2.03"
Flow Length=451' Tc=16.7 min UI Adjusted CN=71 Runoff=1.17 cfs 5,384 cf

Subcatchment 310: Basin D-1 Runoff Area=14,240 sf 8.95% Impervious Runoff Depth=2.36"
Flow Length=162' Tc=6.7 min UI Adjusted CN=75 Runoff=0.96 cfs 2,801 cf

Subcatchment 320: Basin D-2 Runoff Area=12,960 sf 4.90% Impervious Runoff Depth=2.36"
Flow Length=162' Tc=6.7 min CN=75 Runoff=0.87 cfs 2,549 cf

Subcatchment 321: PT 19+45 R Runoff Area=15,840 sf 40.08% Impervious Runoff Depth=3.17"
Flow Length=235' Tc=6.5 min CN=84 Runoff=1.45 cfs 4,184 cf

Subcatchment 322: PT 19+45L Runoff Area=6,505 sf 77.97% Impervious Runoff Depth=4.09"
Flow Length=295' Slope=0.0400 '/' Tc=6.0 min CN=93 Runoff=0.75 cfs 2,217 cf

Subcatchment 326: PT 21+35 R Runoff Area=15,800 sf 52.72% Impervious Runoff Depth=3.46"
Flow Length=255' Tc=6.0 min CN=87 Runoff=1.61 cfs 4,561 cf

Subcatchment 327: PT21+31 L Runoff Area=9,125 sf 84.42% Impervious Runoff Depth=4.20"
Flow Length=295' Slope=0.0400 '/' Tc=6.0 min CN=94 Runoff=1.07 cfs 3,193 cf

Subcatchment 330: Basin D-3 Runoff Area=7,135 sf 0.00% Impervious Runoff Depth=2.28"
Tc=6.0 min CN=74 Runoff=0.48 cfs 1,354 cf

Subcatchment Pre 3: Overland towards Runoff Area=119,920 sf 0.00% Impervious Runoff Depth=1.96"
Flow Length=476' Tc=16.0 min CN=70 Runoff=4.32 cfs 19,538 cf

Subcatchment Pre 3-1: Overland towards Runoff Area=29,546 sf 0.00% Impervious Runoff Depth=1.96"
Flow Length=480' Tc=16.3 min CN=70 Runoff=1.05 cfs 4,814 cf

Subcatchment Pre 3-1A: Overland to n/f Runoff Area=49,940 sf 0.00% Impervious Runoff Depth=1.96"
Flow Length=685' Tc=18.0 min CN=70 Runoff=1.69 cfs 8,137 cf

Reach 1R: Overland to POA 301-A Avg. Flow Depth=0.11' Max Vel=0.21 fps Inflow=1.48 cfs 4,148 cf
n=0.400 L=190.0' S=0.1789 '/' Capacity=0.22 cfs Outflow=0.79 cfs 4,148 cf

Pond 2P: Level Spreader Peak Elev=809.05' Storage=186 cf Inflow=1.00 cfs 4,414 cf
Discarded=0.01 cfs 262 cf Primary=1.48 cfs 4,148 cf Outflow=1.48 cfs 4,410 cf

Pond 4P: DMH 21+48 Treatment Peak Elev=817.75' Inflow=4.88 cfs 14,155 cf
18.0" Round Culvert n=0.013 L=18.0' S=0.0100 '/' Outflow=4.88 cfs 14,155 cf

Pond 310P: Basin D-1 Peak Elev=835.78' Storage=1,198 cf Inflow=0.96 cfs 2,801 cf
Outflow=0.11 cfs 2,105 cf

Pond 320P: Basin D-2 Peak Elev=818.58' Storage=3,959 cf Inflow=0.87 cfs 4,654 cf
Discarded=0.02 cfs 934 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 934 cf

Pond 321P: PT 19+45 R Peak Elev=823.24' Inflow=1.45 cfs 4,184 cf
12.0" Round Culvert n=0.013 L=12.0' S=0.0400 '/' Outflow=1.45 cfs 4,184 cf

Pond 322P: PT 9+45 L Peak Elev=823.04' Inflow=0.75 cfs 2,217 cf
12.0" Round Culvert n=0.013 L=22.0' S=0.0218 '/' Outflow=0.75 cfs 2,217 cf

Pond 323P: DMH PT 19+55 Peak Elev=822.61' Inflow=2.20 cfs 6,401 cf
12.0" Round Culvert n=0.013 L=99.0' S=0.0200 '/' Outflow=2.20 cfs 6,401 cf

Pond 324P: DMH PT20+45 Peak Elev=820.63' Inflow=2.20 cfs 6,401 cf
12.0" Round Culvert n=0.013 L=93.0' S=0.0219 '/' Outflow=2.20 cfs 6,401 cf

Pond 325P: DMH PT 21+48 Peak Elev=818.09' Inflow=4.88 cfs 14,155 cf
18.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=4.88 cfs 14,155 cf

Pond 326P: PT 21+35 R Peak Elev=818.27' Inflow=1.61 cfs 4,561 cf
12.0" Round Culvert n=0.013 L=13.0' S=0.0215 '/' Outflow=1.61 cfs 4,561 cf

Pond 327P: PT 21+31L Peak Elev=818.24' Inflow=1.07 cfs 3,193 cf
12.0" Round Culvert n=0.013 L=55.0' S=0.0049 '/' Outflow=1.07 cfs 3,193 cf

Pond 330P: Basin D-3 Peak Elev=813.21' Storage=5,385 cf Inflow=5.36 cfs 15,509 cf
Discarded=0.26 cfs 10,946 cf Primary=1.00 cfs 4,414 cf Outflow=1.26 cfs 15,360 cf

Link 301A-L: POA301-A Spakauskas Inflow=1.40 cfs 9,532 cf
Primary=1.40 cfs 9,532 cf

Link 331L: (new Link) Inflow=0.96 cfs 4,195 cf
Primary=0.96 cfs 4,195 cf

Link POA 3: POA- Salisbury Inflow=5.44 cfs 26,359 cf
Primary=5.44 cfs 26,359 cf

Link Pre 3-1A-L: POA3-1A Spakauskas Inflow=1.69 cfs 8,137 cf
Primary=1.69 cfs 8,137 cf

Link Pre POA3: Salisbury Abutters Inflow=7.04 cfs 32,489 cf
Primary=7.04 cfs 32,489 cf

Total Runoff Area = 399,937 sf Runoff Volume = 75,559 cf Average Runoff Depth = 2.27"
88.67% Pervious = 354,636 sf 11.33% Impervious = 45,301 sf

Time span=1.00-30.00 hrs, dt=0.01 hrs, 2901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 300: Overland towards Runoff Area=64,224 sf 21.45% Impervious Runoff Depth=3.24"
Flow Length=251' Tc=7.7 min UI Adjusted CN=75 Runoff=5.49 cfs 17,338 cf

Subcatchment 301: Overland flows Runoff Area=22,936 sf 6.29% Impervious Runoff Depth=3.05"
Flow Length=286' Tc=15.4 min UI Adjusted CN=73 Runoff=1.32 cfs 5,824 cf

Subcatchment 301-A: Overland to n/f Runoff Area=31,766 sf 2.27% Impervious Runoff Depth=2.86"
Flow Length=451' Tc=16.7 min UI Adjusted CN=71 Runoff=1.63 cfs 7,567 cf

Subcatchment 310: Basin D-1 Runoff Area=14,240 sf 8.95% Impervious Runoff Depth=3.24"
Flow Length=162' Tc=6.7 min UI Adjusted CN=75 Runoff=1.29 cfs 3,844 cf

Subcatchment 320: Basin D-2 Runoff Area=12,960 sf 4.90% Impervious Runoff Depth=3.24"
Flow Length=162' Tc=6.7 min CN=75 Runoff=1.18 cfs 3,499 cf

Subcatchment 321: PT 19+45 R Runoff Area=15,840 sf 40.08% Impervious Runoff Depth=4.15"
Flow Length=235' Tc=6.5 min CN=84 Runoff=1.84 cfs 5,478 cf

Subcatchment 322: PT 19+45L Runoff Area=6,505 sf 77.97% Impervious Runoff Depth=5.13"
Flow Length=295' Slope=0.0400 '/' Tc=6.0 min CN=93 Runoff=0.91 cfs 2,783 cf

Subcatchment 326: PT 21+35 R Runoff Area=15,800 sf 52.72% Impervious Runoff Depth=4.47"
Flow Length=255' Tc=6.0 min CN=87 Runoff=2.01 cfs 5,885 cf

Subcatchment 327: PT21+31 L Runoff Area=9,125 sf 84.42% Impervious Runoff Depth=5.25"
Flow Length=295' Slope=0.0400 '/' Tc=6.0 min CN=94 Runoff=1.29 cfs 3,990 cf

Subcatchment 330: Basin D-3 Runoff Area=7,135 sf 0.00% Impervious Runoff Depth=3.14"
Tc=6.0 min CN=74 Runoff=0.65 cfs 1,869 cf

Subcatchment Pre 3: Overland towards Runoff Area=119,920 sf 0.00% Impervious Runoff Depth=2.77"
Flow Length=476' Tc=16.0 min CN=70 Runoff=6.08 cfs 27,637 cf

Subcatchment Pre 3-1: Overland towards Runoff Area=29,546 sf 0.00% Impervious Runoff Depth=2.77"
Flow Length=480' Tc=16.3 min CN=70 Runoff=1.48 cfs 6,809 cf

Subcatchment Pre 3-1A: Overland to n/f Runoff Area=49,940 sf 0.00% Impervious Runoff Depth=2.77"
Flow Length=685' Tc=18.0 min CN=70 Runoff=2.38 cfs 11,509 cf

Reach 1R: Overland to POA 301-A Avg. Flow Depth=0.16' Max Vel=0.22 fps Inflow=1.71 cfs 6,963 cf
n=0.400 L=190.0' S=0.1789 '/' Capacity=0.22 cfs Outflow=1.22 cfs 6,963 cf

Pond 2P: Level Spreader Peak Elev=809.06' Storage=186 cf Inflow=1.45 cfs 7,259 cf
Discarded=0.01 cfs 279 cf Primary=1.71 cfs 6,963 cf Outflow=1.72 cfs 7,242 cf

Pond 4P: DMH 21+48 Treatment Peak Elev=817.94' Inflow=6.04 cfs 18,135 cf
18.0" Round Culvert n=0.013 L=18.0' S=0.0100 '/' Outflow=6.04 cfs 18,135 cf

Pond 310P: Basin D-1 Peak Elev=836.03' Storage=1,640 cf Inflow=1.29 cfs 3,844 cf
Outflow=0.16 cfs 3,146 cf

Pond 320P: Basin D-2 Peak Elev=819.11' Storage=5,637 cf Inflow=1.26 cfs 6,645 cf
Discarded=0.03 cfs 1,385 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 1,385 cf

Pond 321P: PT 19+45 R Peak Elev=823.34' Inflow=1.84 cfs 5,478 cf
12.0" Round Culvert n=0.013 L=12.0' S=0.0400 '/' Outflow=1.84 cfs 5,478 cf

Pond 322P: PT 9+45 L Peak Elev=823.13' Inflow=0.91 cfs 2,783 cf
12.0" Round Culvert n=0.013 L=22.0' S=0.0218 '/' Outflow=0.91 cfs 2,783 cf

Pond 323P: DMH PT 19+55 Peak Elev=822.80' Inflow=2.75 cfs 8,260 cf
12.0" Round Culvert n=0.013 L=99.0' S=0.0200 '/' Outflow=2.75 cfs 8,260 cf

Pond 324P: DMH PT20+45 Peak Elev=820.82' Inflow=2.75 cfs 8,260 cf
12.0" Round Culvert n=0.013 L=93.0' S=0.0219 '/' Outflow=2.75 cfs 8,260 cf

Pond 325P: DMH PT 21+48 Peak Elev=818.44' Inflow=6.04 cfs 18,135 cf
18.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=6.04 cfs 18,135 cf

Pond 326P: PT 21+35 R Peak Elev=818.70' Inflow=2.01 cfs 5,885 cf
12.0" Round Culvert n=0.013 L=13.0' S=0.0215 '/' Outflow=2.01 cfs 5,885 cf

Pond 327P: PT 21+31L Peak Elev=818.56' Inflow=1.29 cfs 3,990 cf
12.0" Round Culvert n=0.013 L=55.0' S=0.0049 '/' Outflow=1.29 cfs 3,990 cf

Pond 330P: Basin D-3 Peak Elev=813.75' Storage=6,678 cf Inflow=6.70 cfs 20,004 cf
Discarded=0.29 cfs 12,515 cf Primary=1.45 cfs 7,259 cf Outflow=1.73 cfs 19,774 cf

Link 301A-L: POA301-A Spakauskas Inflow=2.26 cfs 14,530 cf
Primary=2.26 cfs 14,530 cf

Link 331L: (new Link) Inflow=1.32 cfs 5,824 cf
Primary=1.32 cfs 5,824 cf

Link POA 3: POA- Salisbury Inflow=7.50 cfs 37,692 cf
Primary=7.50 cfs 37,692 cf

Link Pre 3-1A-L: POA3-1A Spakauskas Inflow=2.38 cfs 11,509 cf
Primary=2.38 cfs 11,509 cf

Link Pre POA3: Salisbury Abutters Inflow=9.93 cfs 45,956 cf
Primary=9.93 cfs 45,956 cf

Total Runoff Area = 399,937 sf Runoff Volume = 104,031 cf Average Runoff Depth = 3.12"
88.67% Pervious = 354,636 sf 11.33% Impervious = 45,301 sf

Time span=1.00-30.00 hrs, dt=0.01 hrs, 2901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 300: Overland towards Runoff Area=64,224 sf 21.45% Impervious Runoff Depth=4.68"
Flow Length=251' Tc=7.7 min UI Adjusted CN=75 Runoff=7.73 cfs 25,059 cf

Subcatchment 301: Overland flows Runoff Area=22,936 sf 6.29% Impervious Runoff Depth=4.46"
Flow Length=286' Tc=15.4 min UI Adjusted CN=73 Runoff=1.89 cfs 8,519 cf

Subcatchment 301-A: Overland to n/f Runoff Area=31,766 sf 2.27% Impervious Runoff Depth=4.23"
Flow Length=451' Tc=16.7 min UI Adjusted CN=71 Runoff=2.38 cfs 11,207 cf

Subcatchment 310: Basin D-1 Runoff Area=14,240 sf 8.95% Impervious Runoff Depth=4.68"
Flow Length=162' Tc=6.7 min UI Adjusted CN=75 Runoff=1.82 cfs 5,556 cf

Subcatchment 320: Basin D-2 Runoff Area=12,960 sf 4.90% Impervious Runoff Depth=4.68"
Flow Length=162' Tc=6.7 min CN=75 Runoff=1.65 cfs 5,057 cf

Subcatchment 321: PT 19+45 R Runoff Area=15,840 sf 40.08% Impervious Runoff Depth=5.71"
Flow Length=235' Tc=6.5 min CN=84 Runoff=2.43 cfs 7,540 cf

Subcatchment 322: PT 19+45L Runoff Area=6,505 sf 77.97% Impervious Runoff Depth=6.77"
Flow Length=295' Slope=0.0400 '/' Tc=6.0 min CN=93 Runoff=1.15 cfs 3,668 cf

Subcatchment 326: PT 21+35 R Runoff Area=15,800 sf 52.72% Impervious Runoff Depth=6.06"
Flow Length=255' Tc=6.0 min CN=87 Runoff=2.61 cfs 7,980 cf

Subcatchment 327: PT21+31 L Runoff Area=9,125 sf 84.42% Impervious Runoff Depth=6.88"
Flow Length=295' Slope=0.0400 '/' Tc=6.0 min CN=94 Runoff=1.63 cfs 5,235 cf

Subcatchment 330: Basin D-3 Runoff Area=7,135 sf 0.00% Impervious Runoff Depth=4.57"
Tc=6.0 min CN=74 Runoff=0.92 cfs 2,717 cf

Subcatchment Pre 3: Overland towards Runoff Area=119,920 sf 0.00% Impervious Runoff Depth=4.12"
Flow Length=476' Tc=16.0 min CN=70 Runoff=8.93 cfs 41,198 cf

Subcatchment Pre 3-1: Overland towards Runoff Area=29,546 sf 0.00% Impervious Runoff Depth=4.12"
Flow Length=480' Tc=16.3 min CN=70 Runoff=2.18 cfs 10,150 cf

Subcatchment Pre 3-1A: Overland to n/f Runoff Area=49,940 sf 0.00% Impervious Runoff Depth=4.12"
Flow Length=685' Tc=18.0 min CN=70 Runoff=3.50 cfs 17,157 cf

Reach 1R: Overland to POA 301-A Avg. Flow Depth=0.23' Max Vel=0.22 fps Inflow=2.72 cfs 13,617 cf
n=0.400 L=190.0' S=0.1789 '/' Capacity=0.22 cfs Outflow=1.89 cfs 13,616 cf

Pond 2P: Level Spreader Peak Elev=809.07' Storage=186 cf Inflow=2.57 cfs 14,048 cf
Discarded=0.01 cfs 343 cf Primary=2.72 cfs 13,617 cf Outflow=2.72 cfs 13,960 cf

Pond 4P: DMH 21+48 Treatment Peak Elev=818.25' Inflow=7.81 cfs 24,422 cf
18.0" Round Culvert n=0.013 L=18.0' S=0.0100 '/' Outflow=7.81 cfs 24,422 cf

Pond 310P: Basin D-1 Peak Elev=836.34' Storage=2,411 cf Inflow=1.82 cfs 5,556 cf
Outflow=0.21 cfs 4,856 cf

Pond 320P: Basin D-2 Peak Elev=819.24' Storage=6,073 cf Inflow=1.81 cfs 9,913 cf
Discarded=0.03 cfs 1,662 cf Primary=0.17 cfs 2,670 cf Outflow=0.20 cfs 4,332 cf

Pond 321P: PT 19+45 R Peak Elev=823.59' Inflow=2.43 cfs 7,540 cf
12.0" Round Culvert n=0.013 L=12.0' S=0.0400 '/' Outflow=2.43 cfs 7,540 cf

Pond 322P: PT 9+45 L Peak Elev=823.36' Inflow=1.15 cfs 3,668 cf
12.0" Round Culvert n=0.013 L=22.0' S=0.0218 '/' Outflow=1.15 cfs 3,668 cf

Pond 323P: DMH PT 19+55 Peak Elev=823.17' Inflow=3.58 cfs 11,207 cf
12.0" Round Culvert n=0.013 L=99.0' S=0.0200 '/' Outflow=3.58 cfs 11,207 cf

Pond 324P: DMH PT20+45 Peak Elev=821.19' Inflow=3.58 cfs 11,207 cf
12.0" Round Culvert n=0.013 L=93.0' S=0.0219 '/' Outflow=3.58 cfs 11,207 cf

Pond 325P: DMH PT 21+48 Peak Elev=819.08' Inflow=7.81 cfs 24,422 cf
18.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=7.81 cfs 24,422 cf

Pond 326P: PT 21+35 R Peak Elev=819.54' Inflow=2.61 cfs 7,980 cf
12.0" Round Culvert n=0.013 L=13.0' S=0.0215 '/' Outflow=2.61 cfs 7,980 cf

Pond 327P: PT 21+31L Peak Elev=819.28' Inflow=1.63 cfs 5,235 cf
12.0" Round Culvert n=0.013 L=55.0' S=0.0049 '/' Outflow=1.63 cfs 5,235 cf

Pond 330P: Basin D-3 Peak Elev=814.35' Storage=8,367 cf Inflow=8.74 cfs 29,810 cf
Discarded=0.32 cfs 15,239 cf Primary=2.57 cfs 14,048 cf Outflow=2.89 cfs 29,287 cf

Link 301A-L: POA301-A Spakauskas Inflow=3.73 cfs 24,823 cf
Primary=3.73 cfs 24,823 cf

Link 331L: (new Link) Inflow=1.89 cfs 8,519 cf
Primary=1.89 cfs 8,519 cf

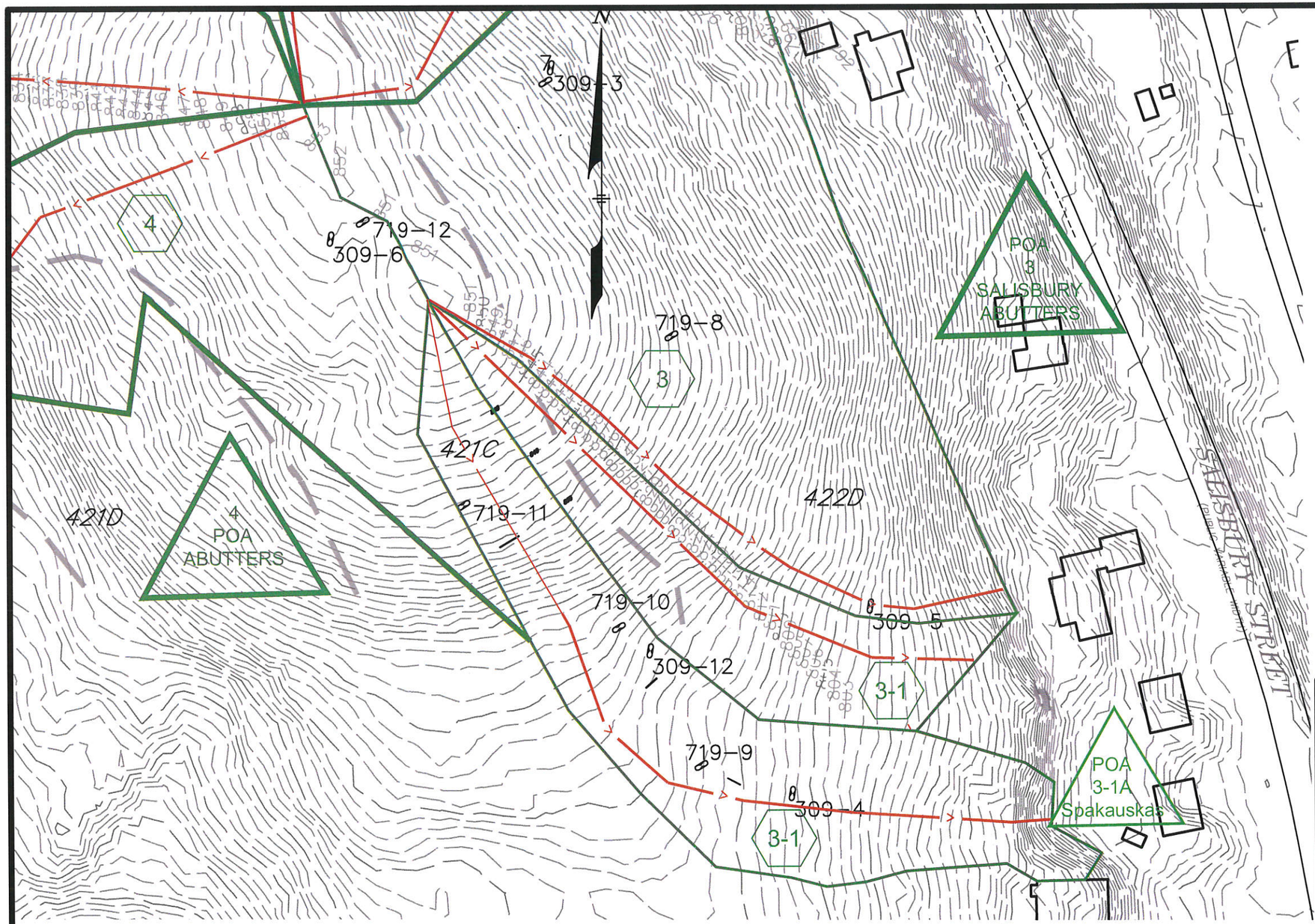
Link POA 3: POA- Salisbury Inflow=11.26 cfs 58,402 cf
Primary=11.26 cfs 58,402 cf

Link Pre 3-1A-L: POA3-1A Spakauskas Inflow=3.50 cfs 17,157 cf
Primary=3.50 cfs 17,157 cf

Link Pre POA3: Salisbury Abutters Inflow=14.59 cfs 68,506 cf
Primary=14.59 cfs 68,506 cf

Total Runoff Area = 399,937 sf Runoff Volume = 151,044 cf Average Runoff Depth = 4.53"
88.67% Pervious = 354,636 sf 11.33% Impervious = 45,301 sf

Pre-Development and Post-Development
Abutter Calculation Watershed Worksheets (11" x 17")



THIS DRAINAGE IS TO EXAMINE DRAINAGE DOWN-GRADIENT OF BASIN D-3 ONLY. SEE OVERALL PRE-DEVELOPMENT DRAINAGE PLANS FOR REMAINING AREAS.

SALISBURY PINE TREE ESTATES PRE-DEVELOPMENT DRAINAGE AREA PLAN

LOCATION: Salisbury St., Pine Tree & Bailey Rds
TOWN: HOLDEN, MASSACHUSETTS

PREPARED FOR:

Holden Pine Tree, LLC

SCALE: 1"=80' DATE: AUGUST 2021

NCRS SOILS LEGEND

1 WATER
245 HINKLEY SANDY LOAM
254 MERRIMAC FINE SANDY LOAM
260 SUDBURY FINE SANDY LOAM
421 CANTON FINE SANDY LOAM 422 CANTON FINE SANDY LOAM
600 GRAVEL PITS

(310) SUBCATCHMENT

(310) POND

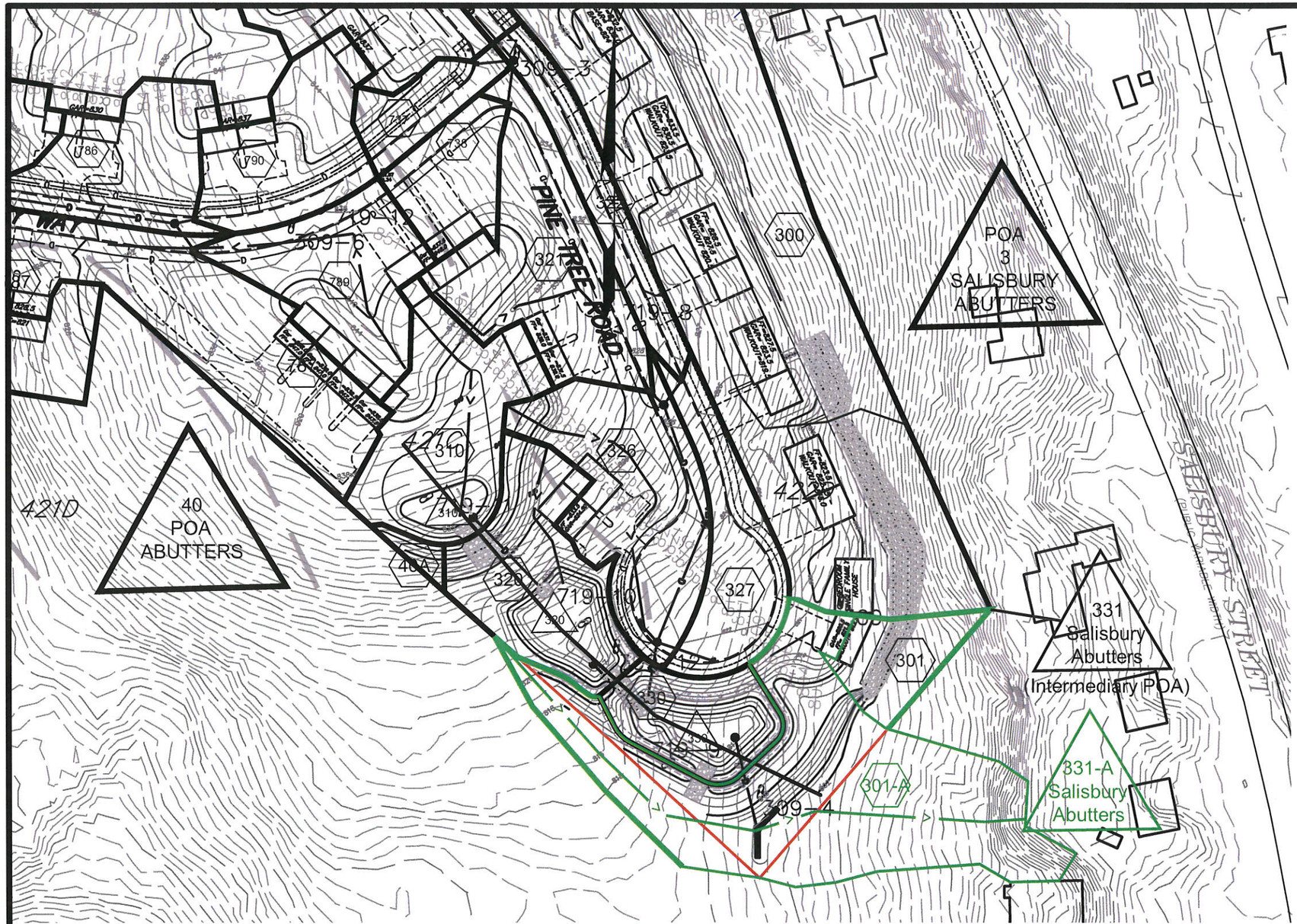
Tc PATH

BAR SCALE
1"=80'
CHECK GRAPHIC SCALE BEFORE USING

Susan E. Carter
CIVIL ENGINEER
NO. 41270
REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF MASSACHUSETTS

PLACES Associates, Inc.
· Planning
· Landscape Architecture
· Civil Engineering
· Surveying
256 Great Road, Suite 4
Littleton, MA 01460
(978) 486-0334
www.placesassociates.com

PROJECT No.: 7602 PRE- ABUTTER



THIS DRAINAGE IS TO EXAMINE DRAINAGE DOWN-GRADIENT OF BASIN D-3 ONLY. SEE OVERALL PRE-DEVELOPMENT DRAINAGE PLANS FOR REMAINING AREAS.

SALISBURY PINE TREE ESTATES POST-DEVELOPMENT DRAINAGE AREA PLAN

LOCATION: Salisbury St., Pine Tree & Bailey Rds
TOWN: HOLDEN, MASSACHUSETTS
PREPARED FOR:

Holden Pine Tree, LLC

SCALE: 1"=80' DATE: AUGUST 2021

NCRS SOILS LEGEND

1	WATER
245	HINKLEY SANDY LOAM
254	MERRIMAC FINE SANDY LOAM
260	SUDBURY FINE SANDY LOAM
421	CANTON FINE SANDY LOAM
422	CANTON FINE SANDY LOAM
600	GRAVEL PITS

80' 0 80' 160'

BAR SCALE
1"=80'
CHECK GRAPHIC SCALE BEFORE USING

COMMONWEALTH OF MASSACHUSETTS
Susan E. Carter
CIVIL ENGINEER
NO. 41270
REGISTERED PROFESSIONAL ENGINEER

PLACES Associates, Inc.
· Planning
· Landscape Architecture
· Civil Engineering
· Surveying
256 Great Road, Suite 4
Littleton, MA 01460
(978) 486-0334
www.placesassociates.com

PROJECT No.: 7602 POST- ABUTTER