Nitsch Engineering

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STORMWATER MEMORANDUM

For

NEWTON EARLY CHILDHOOD PROGRAM
687 Watertown Street
Newton, MA

Prepared for:

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Nitsch Project #10333.3

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1.0 INTRODUCTION

Nitsch Engineering has prepared this Stormwater Memorandum to support the Site Plan Review application to the City of Newton for the relocated Newton Early Childhood Program site to be moved to the existing Horace Mann Elementary School located at 687 Watertown Street in Newton, MA (subsequently referred to as the "Site"). The Project includes the renovation of the existing elementary school building and necessary site improvements to accommodate the Early Childhood Program.

The proposed improvements include the following:

1. Demolition of existing modular buildings;
2. Renovation of the existing building;
3. Reconfiguration and construction of parking and vehicular access areas;
4. Installation of new utilities to support the renovated building; and
5. Construction of a new stormwater management system to provide mitigation, treatment, and groundwater recharge.

The proposed stormwater management system has been designed to comply with the requirements of the City of Newton Floodplain Ordinance and the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards.

2.0 EXISTING CONDITIONS

The Site is located at 687 Watertown Street in Newton, MA. The 1.6± acre Site is located in an urban area and bounded by Albemarle Road to the west, a City of Newton public park to the north, a private site to the east, and the public road Watertown Street to the south. Cheese Cake Brook is located on the opposite side of Albemarle Road, and it's associated 100-foot Buffer Zone and 200-foot Riverfront Area encroach on to the western portion of the Site.

The Site is comprised of the existing school building, landscaped and pedestrian areas, and a parking lot. The building abuts Watertown Street and Albemarle Road, with landscaped frontage. The parking lot is located on the northeast side of the site. The existing Site generally slopes up from the northwest along Albemarle Road and Cheese Cake Brook to the high side of the site at the southeast corner on Watertown Street. The Site survey completed in February 2019 indicates there is approximately a 10-foot elevation change between the west and east sides of the site, with the highest point of the site at the southeast. The majority of the site is steeply sloped, with the building sitting higher on the site to meet the Watertown Street elevation.

2.1 Existing Drainage Infrastructure

Record documents indicate that the building's main roof drain service and the existing parking lot catch basins are connected to a closed drainage system in the northern driveway, discharges below Albermarle Road and into Cheese Cake Brook. The drainage system within the parking lot appears to provide minimal treatment, and record documents do not indicate that the Site has a stormwater management system to mitigate for stormwater peak rates of runoff or stormwater volumes leaving the site.

The Site survey completed in February 2019 indicates that roof runoff from building additions on the site are collected via roof leaders and splash to grade to infiltrate into crushed stone systems at the surface.

Stormwater that hits the non-vehicular areas of the site sheet flows into landscaped areas. Stormwater runoff from the site is discharged to Cheese Cake Brook and ultimately to the Charles River.

2.2 NRSC Soil Designations

The Soil Classification Summary (Table 1) outlines the Natural Resources Conservation Services (NRCS) designation of the soil series at the Site. The majority of soils are classified as Udorthents which does not have hydrologic soil group (HSG) rating. The site also includes Merrimac-Urban land complex, 0 to 8 percent slopes, which has a HSG rating of A, indicating that the soils have a high infiltrative capacity.

Table 1. NRCS Soil Classification Summary

Soil Unit	Soil Series	Hydrologic Soil Group
654	Udorthents, loamy	-
626B	Merrimac-Urban land complex 0-8% slopes	A

2.3 Wetland Resource Areas

The project site is located adjacent to Cheese Cake Brook and is located within the 100-foot buffer zone to Bank, as well as the 100-foot and 200-foot Riverfront Area associated with Cheese Cake Brook. The Project will require approval through the Newton Conservation Commission and will be required to meet the City of Newton's Flood Plain Ordinance. The Site has been designed in accordance with the Wetlands Protection Act Regulations for Riverfront Area (Sections 10.58.4 and 10.58.5).

2.4 Total Maximum Daily Load (TMDL)

The Site discharges into Cheese Cake Brook, which has a Total Maximum Daily Load (TMDL) for Pathogens. The Site is also located within the Charles River Watershed, which has a Phosphorus TMDL. The Project has been designed to minimize stormwater discharge and associated phosphorus and pathogen pollutants through infiltration practices to meet the intent of the TMDLs.

3.0 PROPOSED CONDITIONS

3.1 Project Description

The Project includes the redevelopment of an existing elementary school building site to accommodate the Early Childhood Program.

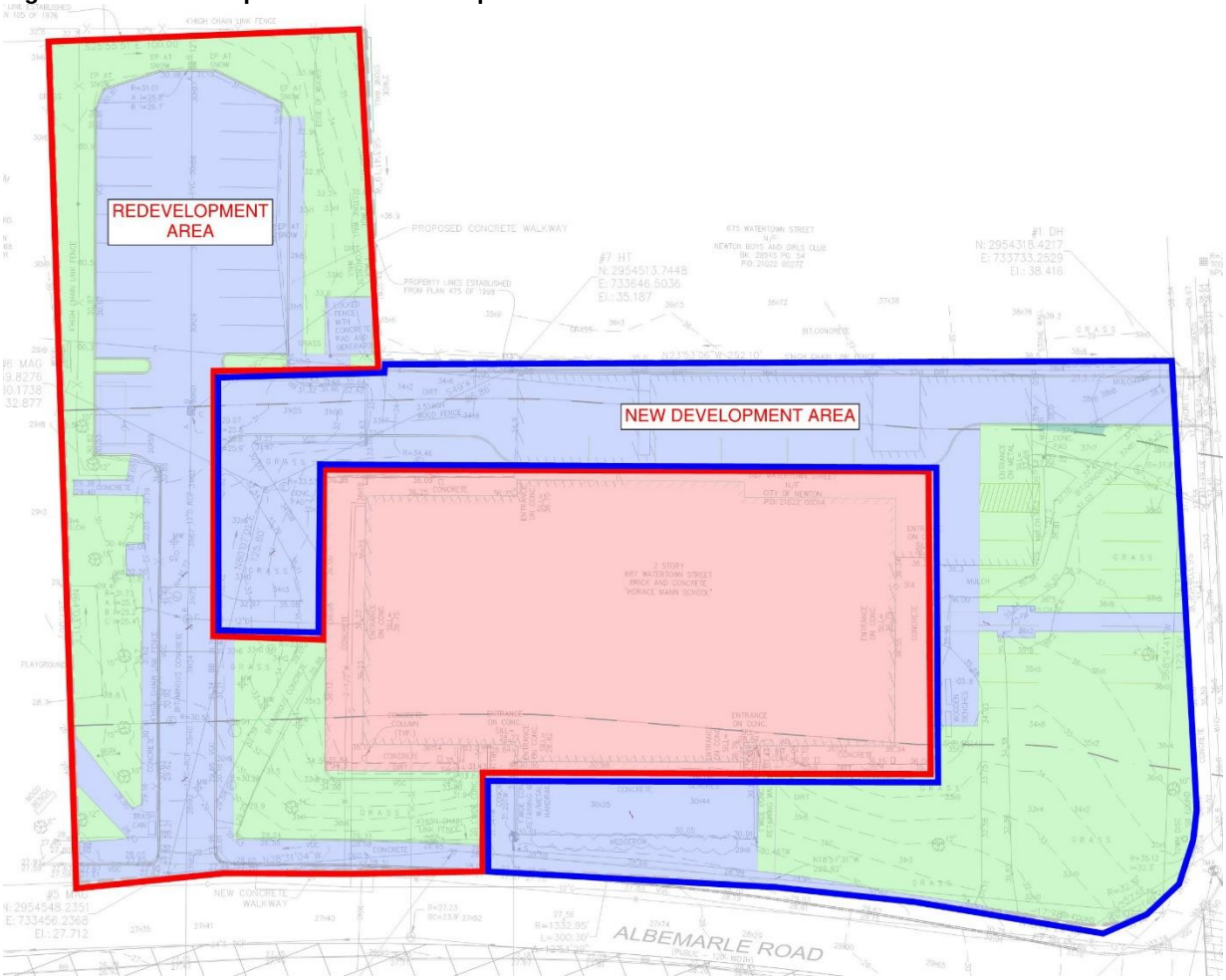
The site improvements include the following:

1. Demolition of existing modular buildings;
2. Renovation of the existing building;
3. Reconfiguration and construction of parking and vehicular access areas;
4. Installation of new utilities to support the renovated building; and
5. Construction of a new stormwater management system.

The Project is considered a mix of new development and redevelopment. The new development area consists of the new vehicular access area, new pedestrian accessible ramp, new paved entrance patio, and adjacent landscape areas. The redevelopment area consists of the existing building to

remain, existing parking lot, and adjacent landscaped areas and walkways. Refer to the following figure for the new development (outlined in blue) and redevelopment (outlined in red) area breakout.

Figure 1. New Development and Redevelopment Area Breakout



The Project is anticipated to increase the overall impervious area for the Project by approximately 4,346 square feet. Refer to Table 2 for a comparison of the existing and proposed land use for the Site.

Table 2. Proposed land use for 687 Watertown Street – New Development (in square feet)

Land Use	Existing Site	Proposed Site	Change
Buildings (Modular)	5,295	0	-5,295
Site Pavement	6,181	15,883	+9,702
Landscaped Areas	16,873	12,466	-4,407
Total	**28,349**	**28,349**	---

Table 3. Proposed land use for 687 Watertown Street – Redevelopment (in square feet)

Land Use	Existing Site	Proposed Site	Change
Building	18,541	18,541	0
Site Pavement	12,116	12,055	-61
Landscaped Areas	10,222	10,283	+61
Total	**40,879**	**40,879**	**---**

Table 4. Proposed land use for 687 Watertown Street – Overall Site (in square feet)

Land Use	Existing Site	Proposed Site	Change
Buildings	23,836	18,541	-5,295
Site Pavement	18,297	27,938	+9,641
Landscaped Areas	27,095	22,749	-4,346
Total	**69,228**	**69,228**	**---**

3.2 Stormwater Management System

The Site will include the installation of a stormwater management system designed to meet the MassDEP Stormwater Management Standards and the City of Newton Regulations. As a mix of new development and redevelopment, the Site is required to provide peak flow and volume mitigation and provide water quality treatment and groundwater recharge in the areas of new development and the Project is required to meet the Stormwater Management Standards to the maximum extent practicable in the areas of redevelopment as described in Section 5: MassDEP Stormwater Standards.

The Project has been designed using environmentally-sensitive site design and LID techniques. This design prevents the generation of stormwater and non-point source pollution by reducing impervious surfaces with disconnecting flow paths, treating and infiltrating stormwater at its source, and protecting

natural processes. Stormwater systems have been designed to model natural hydrologic features, including promoting infiltration throughout the site.

The proposed stormwater management system for the Site will include deep sump and hooded catch basins, subsurface infiltration systems, and proprietary water quality structures. Overflow from the proposed closed drainage system will be discharged to the Cheese Cake Brook through the existing drainage pipe.

Deep Sump and Hooded Catch Basins

Deep sump and hooded catch basins are proposed to provide pretreatment in the impervious areas of the parking lot and driveways. Stormwater captured in the catch basins will be directed to a water quality unit and infiltration BMPs prior to discharge.

Subsurface Infiltration System

Stormwater will be collected and infiltrated using two subsurface infiltration systems. Subsurface Infiltration System #1 is proposed to collect and infiltrate runoff from the existing parking lot and a portion of the new vehicular access drive. Subsurface Infiltration System #2 is proposed to collect and infiltrate runoff from a portion of the renovated roof and a portion of the new vehicular access drive and drop-off area. The systems consist of perforated 18-inch pipe enveloped by crushed stone. The Subsurface Infiltration Systems are designed to completely infiltrate the 1-inch storm, and significantly reduces the peak rate and runoff volumes in the 2-, 10-, 25- and 100-year design storms.

Water Quality Structures

Three water quality inlets are proposed for water quality pretreatment for the existing parking lot and proposed vehicular access drive and drop-off area prior to infiltration. The water quality inlets are expected to remove 62.6% TSS.

One water quality inlet is proposed at the end of the existing driveway. The water quality inlet is expected to remove 62.6% TSS. The existing driveway is part of the redevelopment portion of the project, so water quality treatment in this area is being provided to the maximum extent practicable.

3.3 Stormwater Management During Construction

The Site Contractor will be responsible for stormwater management of the active construction site and is required to adhere to the conditions of the 2017 Construction General Permit under the Environmental Protection Agency (through the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP)). A draft SWPPP will be prepared in accordance with the MassDEP Stormwater Management Standards and the 2017 Construction General Permit.

4.0 STORMWATER MANAGEMENT ANALYSIS

4.1 Methodology

Nitsch Engineering completed a hydrologic analysis of the existing project site utilizing Soil Conservation Service (SCS) Runoff Curve Number (CN) methodology. The SCS method calculates the rate at which the runoff reaches the design point considering several factors: the slope and flow lengths of the subcatchment area, the soil type of the subcatchment area, and the type of surface cover in the subcatchment area. HydroCAD Version 10.00 computer modeling software was used in conjunction with the SCS method to determine the peak runoff rates and runoff volumes for the 2-, 10-, 25-, and 100-year, 24-hour storm events. The proposed project site is being analyzed with the same methodology.

The Site was divided into multiple drainage areas, or subcatchments, which drain to the design points along the property boundary and within the site. For each subcatchment area, SCS Runoff Curve Numbers (CNs) were selected by using the cover type and hydrologic soil group of each area. The peak runoff rates and runoff volumes for the 2-, 10-, 25- and 100-year 24-hour storm events were then determined by inputting the drainage areas, CNs, and time of concentration (T_c) paths into the HydroCAD model.

The National Oceanic and Atmospheric Administration Atlas 14 precipitation frequency estimates were used to calculate the 2-, 10-, and 25-year 24-hour storm events and the City of Newton 100-year 24-hour storm event in HydroCAD.

Rainfall Data
2-year storm: 3.25 inches
10-year storm: 5.12 inches
25-year storm: 6.29 inches
100-year storm: 8.78 inches

4.2 HydroCAD Version 10.00

The HydroCAD computer program uses SCS and TR-20 methods to model drainage systems. TR-20 (Technical Release 20) was developed by the Soil Conservation Service to estimate runoff and peak discharges in small watersheds. TR-20 is generally accepted by engineers and reviewing authorities as the standard method for estimating runoff and peak discharges.

HydroCAD Version 10.00 uses up to four types of components to analyze the hydrology of a given site: subcatchments, reaches, basins, and links. Subcatchments are areas of land that produce surface runoff. The area, weighted CN, and T_c characterize each individual subcatchment area. Reaches are generally uniform streams, channels, or pipes that convey water from one point to another. A basin is any impoundment that fills with water from one or more sources and empties via an outlet structure. Links are used to introduce hydrographs into a project from another source or to provide a junction for more than one hydrograph within a project. The time span for the model was set for 0-48 hours in order to prevent truncation of the hydrograph.

4.3 Existing Hydrologic Conditions

Nitsch Engineering delineated the project site into three (3) on-site subcatchment (watershed) areas discharging to one (1) design point utilizing an existing conditions survey and on-site observations (See Figure DR-1). The design point (DP-EX) is defined as Cheese Cake Brook. The HydroCAD model for existing conditions is provided in Appendix A and results from the HydroCAD calculations are summarized below in Table 5.

4.4 Proposed Hydrologic Conditions

The proposed project has been designed to mitigate the change in stormwater runoff at the design points as required by the DEP Stormwater Management Standards and the City of Newton Regulations. The existing watershed areas were modified to reflect the proposed topography, storm drainage structures and BMPs, and roof area. (See Figure DR-2). The HydroCAD model for proposed conditions is provided in Appendix C and results from the calculations are summarized in Table 5.

4.5 Peak Flow Rates

The proposed stormwater management system is expected to reduce the proposed peak runoff rates to at or below the existing rates for the Design Point (DP-PR). Table 3 below summarize the existing and proposed hydrologic analyses for the site at the design point Cheese Cake Brook).

Table 5 – Peak Rates of Runoff in Cubic Feet per Second (cfs)

	Storm Event	2-year	10-year	25-year	100-year
DP-1	Existing	2.08	4.77	6.59	10.59
	Proposed	1.74	4.15	6.60	10.49

Stormwater Requirements from the City of Newton

In addition to the reduction in rates, the proposed stormwater management system is expected to reduce or maintain the post-development volumes of runoff to at or below the pre-development volumes. Table 6 below demonstrates a reduction in runoff volumes for the required storm events.

Table 6 – Volumes of Runoff for Total Site (in cubic feet)

Storm Event	2-year	10-year	25-year	100-year
Existing	6,722	14,889	20,534	33,265
Proposed	6,319	14,510	20,136	32,841

5.0 MassDEP Stormwater Management Standards

The Project is considered a mix of ***new development*** and a ***redevelopment*** under the DEP Stormwater Management System. As such, the redevelopment portion of the project is required to meet Standards 2, 3, and the pretreatment and structural best management practice requirements of Standards 4,5, and 6 only to the maximum extent practicable. Existing stormwater discharges need to comply with Standard 1 only to the maximum extent practicable. The project will comply with all other Standards. The site will be designed to meet or meet to the maximum extent practicable the MassDEP Stormwater Management Standards as summarized below:

Standard 1: No New Untreated Discharges

The Project will not discharge any new untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. Stormwater from the Site will be collected and treated in accordance with the MassDEP Stormwater Management Standards. The existing outfall is being maintained, and both the new development and redevelopment portions of the site are being directed to it.

Standard 2: Peak Rate Attenuation

The proposed stormwater management system will be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. To prevent storm damage and downstream flooding, the proposed stormwater management practices will mitigate peak runoff rates for the 2-, 10-, 25- and 100-year, 24-hour storm events. Refer to Table 5 for a pre- and post-development peak runoff rate comparison.

Standard 3: Groundwater Recharge

The Site was designed using environmentally-sensitive site design, low impact development techniques, and stormwater BMP treatment trains to minimize the loss of annual recharge to groundwater. The annual recharge from the new development portion of the site will approximate the annual recharge from pre-development conditions based on soil type using the guidelines provided in the MassDEP Stormwater Management Handbook.

New Development Impervious Area in HSG A = 15,883 square feet
Rv (Recharge Volume) = 15,883 x 0.6 in. / (12 inches/ft)
= 795 cubic feet

The infiltration BMPs are sized to exceed the recharge volume required under the MassDEP Stormwater Management Standards (Table 7).

Table 7 – Proposed Recharge Volumes for Stormwater BMPs

Infiltration BMP	Recharge Volume (cf)
Subsurface Infiltration System	2,069
Total	**2,069**

The total required recharge volume of 795 cf for the redevelopment area is less than the provided recharge volume of 2,069 cf.

The HydroCAD reports provided in Appendix C indicate that proposed infiltration BMPs will drain within 36 hours for the 2-, 10-, 25-, and 100-year storm events, meeting the 72-hour MassDEP drawdown requirement.

Standard 4: Water Quality Treatment

The proposed stormwater management system will be designed to remove greater than 80% of the average annual post-construction load of Total Suspended Solids (TSS). Structural stormwater BMPs including deep sump and hooded catch basins, and subsurface infiltration systems are sized to capture the required water quality volume and remove a minimum of 80% of total suspended solids.

One water quality inlet is proposed at the end of the existing driveway. The water quality inlet is expected to remove 62.6% TSS. The existing driveway is part of the redevelopment portion of the project, so water quality treatment in this area is being provided to the maximum extent practicable.

The proposed water quality treatment BMPs are subject to the 44% TSS removal pretreatment requirement and the 1-inch rule for calculating water quality volumes because the site contains soils with a rapid infiltration rate (greater than 2.4 inches per hour).

Pretreatment for all infiltration BMPs will meet or exceed the 44% TSS removal requirement. Pretreatment for the subsurface infiltration systems will be provided using water quality inlets that have been sized using the flow rate associated with the water quality volume.

Source control and pollution prevention measures, such as vacuum cleaning, street sweeping, proper snow management, and stabilization of eroded surfaces, will be included in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan.

Standard 5: Land Uses with Higher Potential Pollutant Loads

The project is not considered a LUHPPL and therefore, this standard is not applicable.

Standard 6: Critical Areas

The Project is not located within any critical areas. Therefore, this standard is not applicable.

Standard 7: Redevelopments

A portion of the Project is considered a redevelopment under the MassDEP Stormwater Management Standards. Therefore, that portion of the Project is required to meet Standard 2, Standard 3, and the pretreatment and structural stormwater BMP requirements of Standards 4, 5, and 6 to the maximum extent practicable. The projects should comply with all other requirements of the Stormwater Management Standards and improve existing conditions. The Project meets this standard.

Standard 8: Construction Period Pollution Prevention and Sedimentation Control

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) will be developed and implemented during the Notice of Intent permitting process.

Because the Project will disturb more than one (1) acre of land, a Notice of Intent will be submitted to the Environmental Protection Agency (EPA) for coverage under the National Pollution Discharge Elimination System (NPDES) Construction General Permit. As part of this application the Applicant is required to prepare a Stormwater Pollution Prevention Plan (SWPPP) and implement the measures in the SWPPP. The SWPPP, which is to be kept on site, includes erosion and sediment controls (stabilization practices and structural practices), temporary and permanent stormwater management measures, Contractor inspection schedules and reporting of all SWPPP features, materials management, waste disposal, off-site vehicle tracking, spill prevention and response, sanitation, and non-stormwater discharges.

Standard 9: Operation and Maintenance Plan

A post-construction operation and maintenance plan will be prepared and will be implemented to ensure that stormwater management systems function as designed. Source control and stormwater BMP operation requirements for the Site will be summarized in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan.

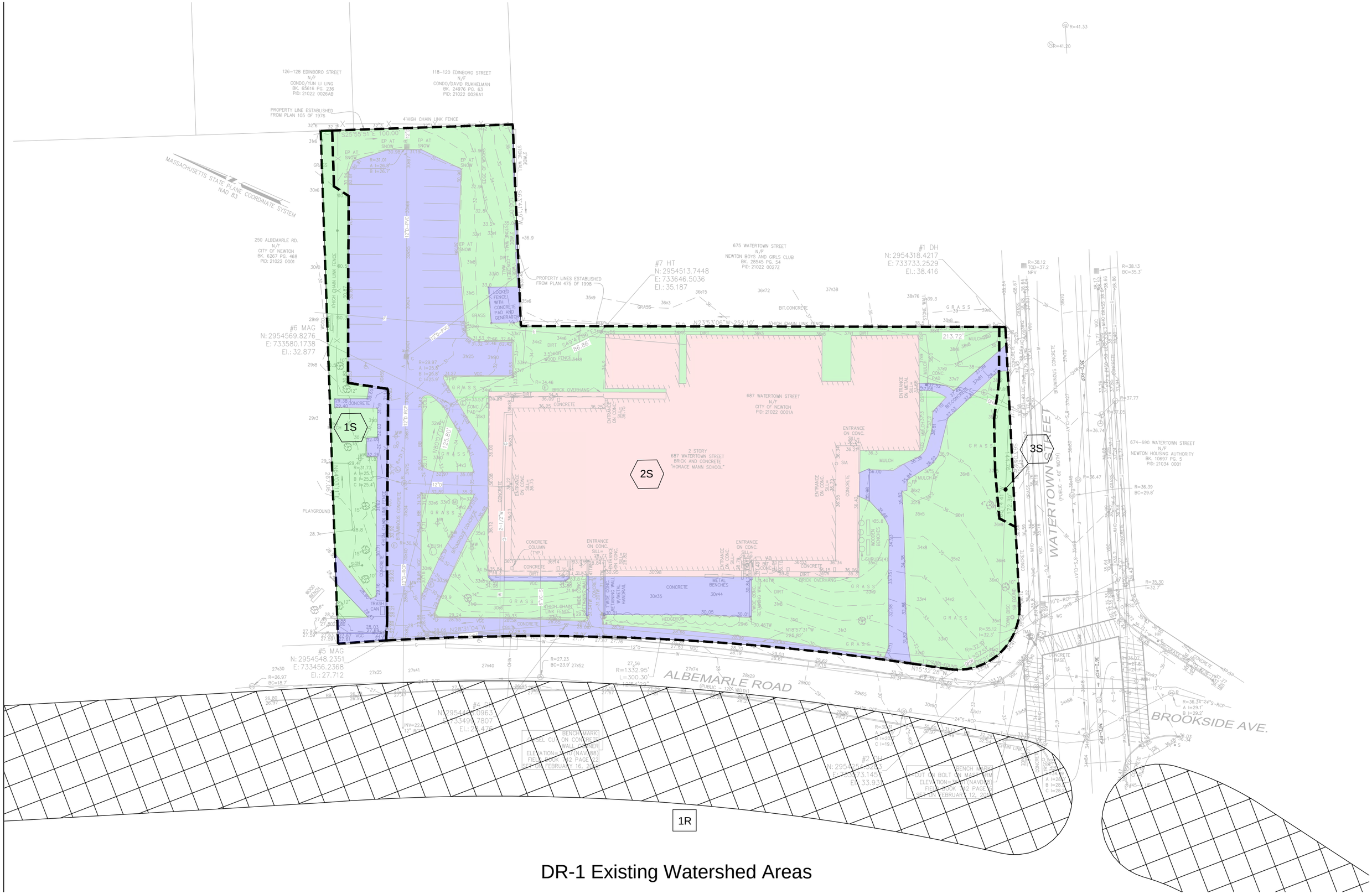
Standard 10: Prohibition of Illicit Discharges

There will be no illicit discharges to the stormwater management system associated with the Project.

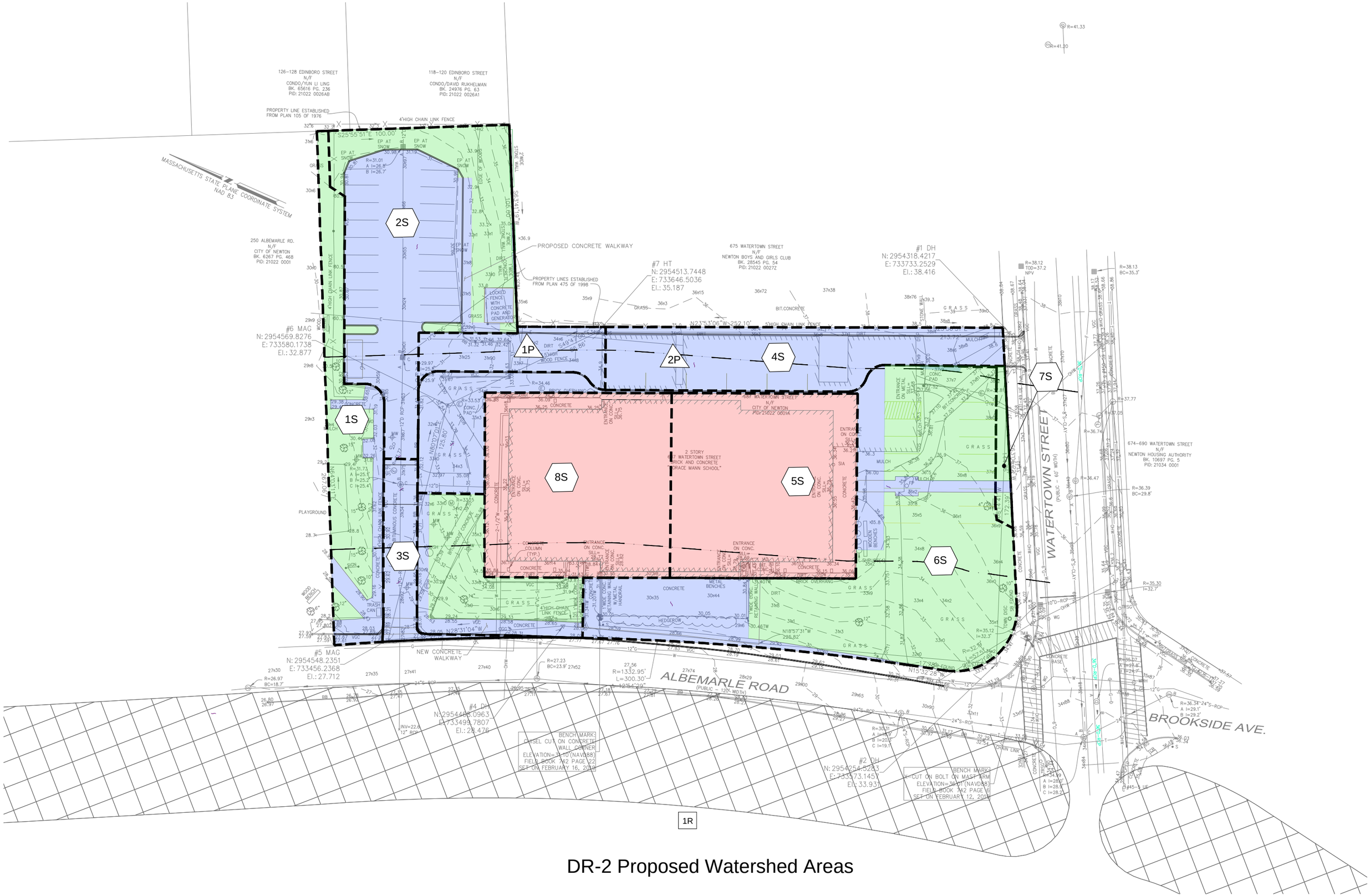
6.0 CONCLUSION

In conclusion, the Project's stormwater management system will reduce or maintain peak runoff rates and volumes through the use of infiltration BMPs and improve the water quality of stormwater being discharged from the Site. Environmentally sensitive site design and low impact development techniques will be implemented throughout the Site. The Project is being designed to meet the MassDEP Stormwater Management Standards and the City of Newton Flood Plain Ordinance.

FIGURES



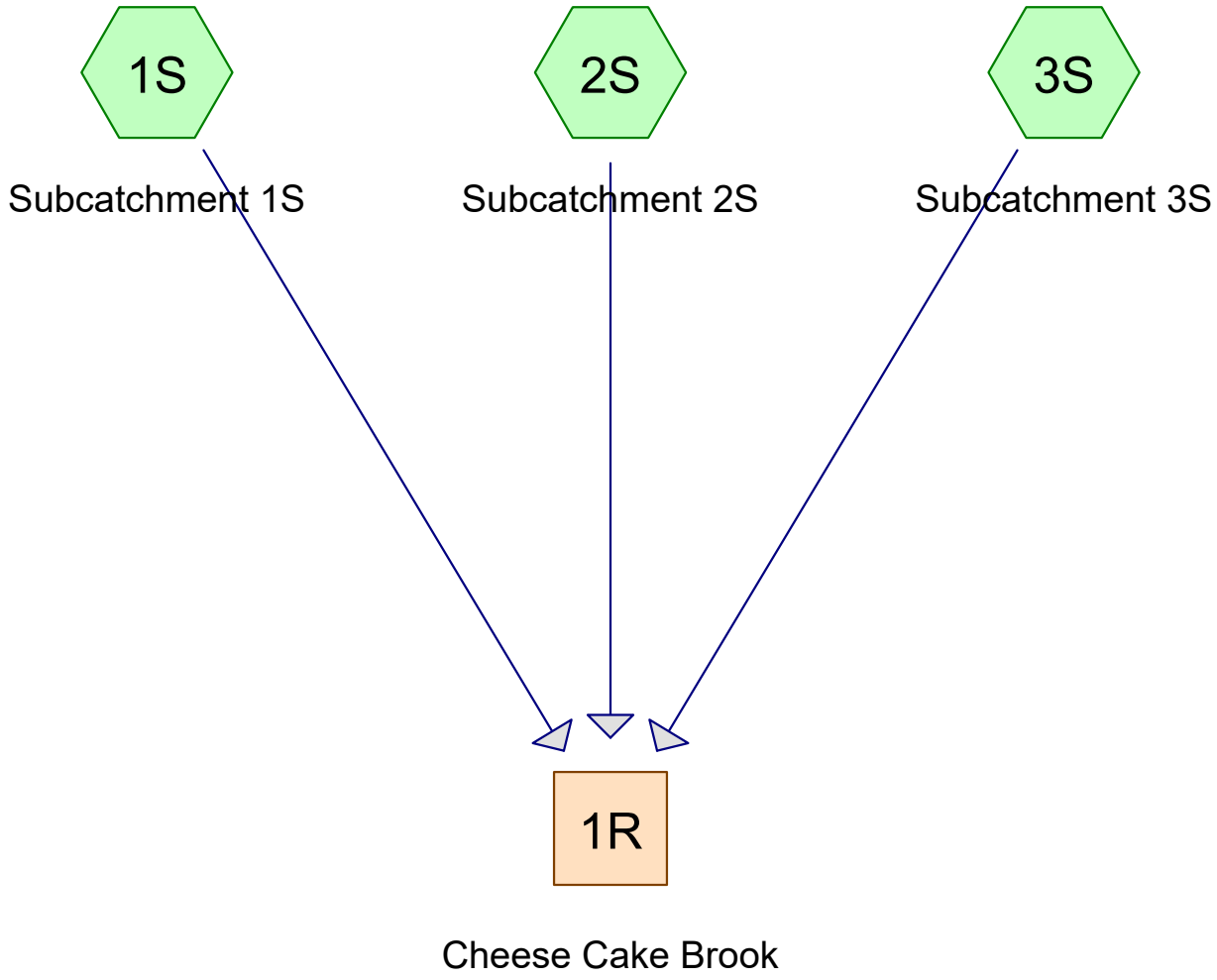
DR-1 Existing Watershed Areas



DR-2 Proposed Watershed Areas

APPENDIX A

Pre-Development Conditions – HydroCAD Calculations



Subcat Reach Pond Link

Routing Diagram for 13033.3-Existing
Prepared by Nitsch Engineering, Printed 5/10/2019

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
27,169	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S)
1,495	98	Paved parking, HSG A (1S, 3S)
23,836	98	Roofs, HSG A (2S)
16,728	98	Unconnected pavement, HSG A (2S)
69,228	**75**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
69,228	HSG A	1S, 2S, 3S
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
69,228		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
27,169	0	0	0	0	27,169	>75% Grass cover, Good	
1,495	0	0	0	0	1,495	Paved parking	
23,836	0	0	0	0	23,836	Roofs	
16,728	0	0	0	0	16,728	Unconnected pavement	
69,228	**0**	**0**	**0**	**0**	**69,228**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=5,081 sf 28.44% Impervious Runoff Depth=0.30"
Tc=6.0 min CN=56 Runoff=0.02 cfs 125 cf

Subcatchment2S: Subcatchment2S Runoff Area=63,439 sf 63.94% Impervious Runoff Depth=1.25"
Tc=6.0 min CN=77 Runoff=2.07 cfs 6,596 cf

Subcatchment3S: Subcatchment3S Runoff Area=708 sf 7.06% Impervious Runoff Depth=0.03"
Tc=6.0 min CN=43 Runoff=0.00 cfs 2 cf

Reach 1R: Cheese Cake Brook Inflow=2.08 cfs 6,722 cf
Outflow=2.08 cfs 6,722 cf

Total Runoff Area = 69,228 sf Runoff Volume = 6,722 cf Average Runoff Depth = 1.17"
39.25% Pervious = 27,169 sf 60.75% Impervious = 42,059 sf

Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 0.02 cfs @ 12.30 hrs, Volume= 125 cf, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
1,445	98	Paved parking, HSG A
3,636	39	>75% Grass cover, Good, HSG A
5,081	56	Weighted Average
3,636		71.56% Pervious Area
1,445		28.44% Impervious Area

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

Summary for Subcatchment 2S: Subcatchment 2S

Runoff = 2.07 cfs @ 12.09 hrs, Volume= 6,596 cf, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
23,836	98	Roofs, HSG A
16,728	98	Unconnected pavement, HSG A
22,875	39	>75% Grass cover, Good, HSG A
63,439	77	Weighted Average
22,875		36.06% Pervious Area
40,564		63.94% Impervious Area
16,728		41.24% Unconnected

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

Summary for Subcatchment 3S: Subcatchment 3S

Runoff = 0.00 cfs @ 16.96 hrs, Volume= 2 cf, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
50	98	Paved parking, HSG A
658	39	>75% Grass cover, Good, HSG A
708	43	Weighted Average
658		92.94% Pervious Area
50		7.06% Impervious Area

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

Summary for Reach 1R: Cheese Cake Brook

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

Inflow Area = 69,228 sf, 60.75% Impervious, Inflow Depth = 1.17" for 2-year event
Inflow = 2.08 cfs @ 12.09 hrs, Volume= 6,722 cf
Outflow = 2.08 cfs @ 12.09 hrs, Volume= 6,722 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=5,081 sf 28.44% Impervious Runoff Depth=1.10"
Tc=6.0 min CN=56 Runoff=0.13 cfs 467 cf

Subcatchment2S: Subcatchment2S Runoff Area=63,439 sf 63.94% Impervious Runoff Depth=2.72"
Tc=6.0 min CN=77 Runoff=4.64 cfs 14,399 cf

Subcatchment3S: Subcatchment3S Runoff Area=708 sf 7.06% Impervious Runoff Depth=0.39"
Tc=6.0 min CN=43 Runoff=0.00 cfs 23 cf

Reach 1R: Cheese Cake Brook Inflow=4.77 cfs 14,889 cf
Outflow=4.77 cfs 14,889 cf

Total Runoff Area = 69,228 sf Runoff Volume = 14,889 cf Average Runoff Depth = 2.58"
39.25% Pervious = 27,169 sf 60.75% Impervious = 42,059 sf

Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 0.13 cfs @ 12.10 hrs, Volume= 467 cf, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
1,445	98	Paved parking, HSG A
3,636	39	>75% Grass cover, Good, HSG A
5,081	56	Weighted Average
3,636		71.56% Pervious Area
1,445		28.44% Impervious Area

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

Summary for Subcatchment 2S: Subcatchment 2S

Runoff = 4.64 cfs @ 12.09 hrs, Volume= 14,399 cf, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
23,836	98	Roofs, HSG A
16,728	98	Unconnected pavement, HSG A
22,875	39	>75% Grass cover, Good, HSG A
63,439	77	Weighted Average
22,875		36.06% Pervious Area
40,564		63.94% Impervious Area
16,728		41.24% Unconnected

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

Summary for Subcatchment 3S: Subcatchment 3S

Runoff = 0.00 cfs @ 12.34 hrs, Volume= 23 cf, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
50	98	Paved parking, HSG A
658	39	>75% Grass cover, Good, HSG A
708	43	Weighted Average
658		92.94% Pervious Area
50		7.06% Impervious Area

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

Summary for Reach 1R: Cheese Cake Brook

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

Inflow Area = 69,228 sf, 60.75% Impervious, Inflow Depth = 2.58" for 10-year event
Inflow = 4.77 cfs @ 12.09 hrs, Volume= 14,889 cf
Outflow = 4.77 cfs @ 12.09 hrs, Volume= 14,889 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=5,081 sf 28.44% Impervious Runoff Depth=1.77"
Tc=6.0 min CN=56 Runoff=0.22 cfs 750 cf

Subcatchment2S: Subcatchment2S Runoff Area=63,439 sf 63.94% Impervious Runoff Depth=3.73"
Tc=6.0 min CN=77 Runoff=6.36 cfs 19,738 cf

Subcatchment3S: Subcatchment3S Runoff Area=708 sf 7.06% Impervious Runoff Depth=0.78"
Tc=6.0 min CN=43 Runoff=0.01 cfs 46 cf

Reach 1R: Cheese Cake Brook Inflow=6.59 cfs 20,534 cf
Outflow=6.59 cfs 20,534 cf

Total Runoff Area = 69,228 sf Runoff Volume = 20,534 cf Average Runoff Depth = 3.56"
39.25% Pervious = 27,169 sf 60.75% Impervious = 42,059 sf

Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 0.22 cfs @ 12.10 hrs, Volume= 750 cf, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
1,445	98	Paved parking, HSG A
3,636	39	>75% Grass cover, Good, HSG A
5,081	56	Weighted Average
3,636		71.56% Pervious Area
1,445		28.44% Impervious Area

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

Summary for Subcatchment 2S: Subcatchment 2S

Runoff = 6.36 cfs @ 12.09 hrs, Volume= 19,738 cf, Depth= 3.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
23,836	98	Roofs, HSG A
16,728	98	Unconnected pavement, HSG A
22,875	39	>75% Grass cover, Good, HSG A
63,439	77	Weighted Average
22,875		36.06% Pervious Area
40,564		63.94% Impervious Area
16,728		41.24% Unconnected

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

Summary for Subcatchment 3S: Subcatchment 3S

Runoff = 0.01 cfs @ 12.13 hrs, Volume= 46 cf, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
50	98	Paved parking, HSG A
658	39	>75% Grass cover, Good, HSG A
708	43	Weighted Average
658		92.94% Pervious Area
50		7.06% Impervious Area

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

Summary for Reach 1R: Cheese Cake Brook

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

Inflow Area = 69,228 sf, 60.75% Impervious, Inflow Depth = 3.56" for 25-year event
Inflow = 6.59 cfs @ 12.09 hrs, Volume= 20,534 cf
Outflow = 6.59 cfs @ 12.09 hrs, Volume= 20,534 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=5,081 sf 28.44% Impervious Runoff Depth=3.45"
Tc=6.0 min CN=56 Runoff=0.46 cfs 1,460 cf

Subcatchment2S: Subcatchment2S Runoff Area=63,439 sf 63.94% Impervious Runoff Depth=5.99"
Tc=6.0 min CN=77 Runoff=10.10 cfs 31,690 cf

Subcatchment3S: Subcatchment3S Runoff Area=708 sf 7.06% Impervious Runoff Depth=1.94"
Tc=6.0 min CN=43 Runoff=0.03 cfs 114 cf

Reach 1R: Cheese Cake Brook Inflow=10.59 cfs 33,265 cf
Outflow=10.59 cfs 33,265 cf

Total Runoff Area = 69,228 sf Runoff Volume = 33,265 cf Average Runoff Depth = 5.77"
39.25% Pervious = 27,169 sf 60.75% Impervious = 42,059 sf

Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 0.46 cfs @ 12.09 hrs, Volume= 1,460 cf, Depth= 3.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
1,445	98	Paved parking, HSG A
3,636	39	>75% Grass cover, Good, HSG A
5,081	56	Weighted Average
3,636		71.56% Pervious Area
1,445		28.44% Impervious Area

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

Summary for Subcatchment 2S: Subcatchment 2S

Runoff = 10.10 cfs @ 12.09 hrs, Volume= 31,690 cf, Depth= 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
23,836	98	Roofs, HSG A
16,728	98	Unconnected pavement, HSG A
22,875	39	>75% Grass cover, Good, HSG A
63,439	77	Weighted Average
22,875		36.06% Pervious Area
40,564		63.94% Impervious Area
16,728		41.24% Unconnected

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

Summary for Subcatchment 3S: Subcatchment 3S

Runoff = 0.03 cfs @ 12.10 hrs, Volume= 114 cf, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
50	98	Paved parking, HSG A
658	39	>75% Grass cover, Good, HSG A
708	43	Weighted Average
658		92.94% Pervious Area
50		7.06% Impervious Area

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

Summary for Reach 1R: Cheese Cake Brook

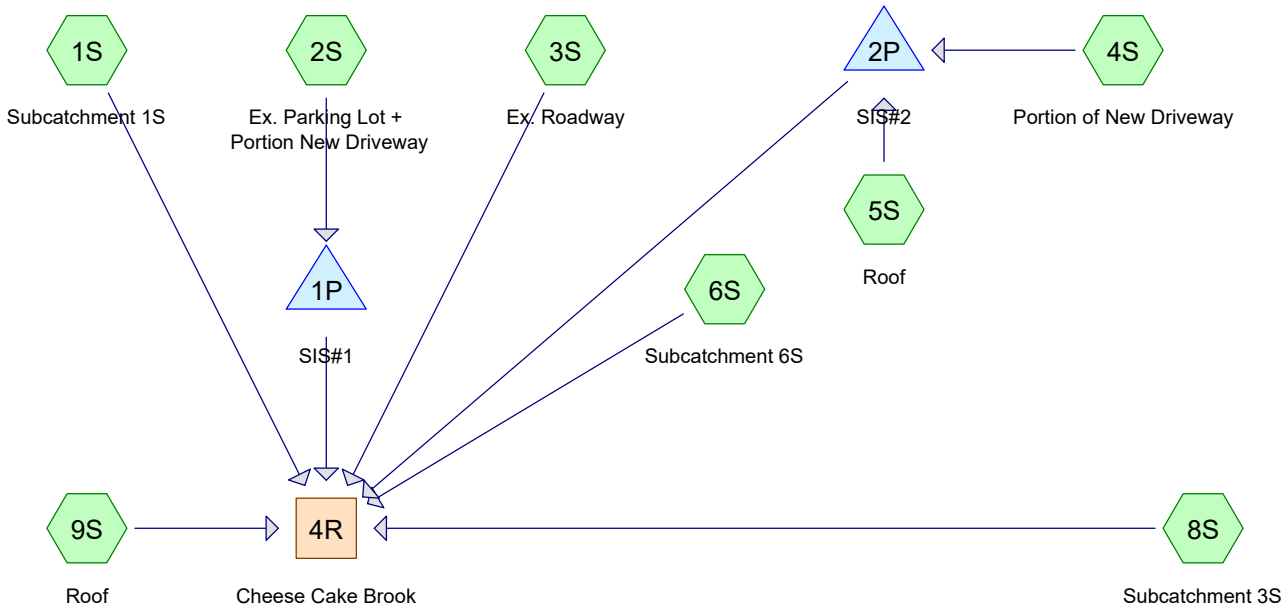
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 69,228 sf, 60.75% Impervious, Inflow Depth = 5.77" for 100-year event
Inflow = 10.59 cfs @ 12.09 hrs, Volume= 33,265 cf
Outflow = 10.59 cfs @ 12.09 hrs, Volume= 33,265 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

APPENDIX B

Post-Development Conditions – HydroCAD Calculations



Subcat Reach Pond Link

Routing Diagram for 13033.3-Proposed
Prepared by Nitsch Engineering, Printed 5/10/2019

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
20,697	39	>75% Grass cover, Good, HSG A (1S, 2S, 6S, 8S)
1,447	98	Paved parking, HSG A (1S)
18,541	98	Roofs, HSG A (5S, 9S)
28,543	98	Unconnected pavement, HSG A (2S, 3S, 4S, 6S)
69,228	**80**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
69,228	HSG A	1S, 2S, 3S, 4S, 5S, 6S, 8S, 9S
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
69,228		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
20,697	0	0	0	0	20,697	>75% Grass cover, Good	
1,447	0	0	0	0	1,447	Paved parking	
18,541	0	0	0	0	18,541	Roofs	
28,543	0	0	0	0	28,543	Unconnected pavement	
69,228	**0**	**0**	**0**	**0**	**69,228**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=5,091 sf 28.42% Impervious Runoff Depth=0.30"
Tc=6.0 min CN=56 Runoff=0.02 cfs 125 cf

Subcatchment2S: Ex. Parking Lot + Runoff Area=13,548 sf 73.81% Impervious Runoff Depth=1.65"
Tc=6.0 min CN=83 Runoff=0.60 cfs 1,863 cf

Subcatchment3S: Ex. Roadway Runoff Area=1,775 sf 100.00% Impervious Runoff Depth=3.02"
Tc=6.0 min CN=98 Runoff=0.13 cfs 446 cf

Subcatchment4S: Portion of New Runoff Area=5,881 sf 100.00% Impervious Runoff Depth=3.02"
Tc=6.0 min CN=98 Runoff=0.43 cfs 1,479 cf

Subcatchment5S: Roof Runoff Area=9,267 sf 100.00% Impervious Runoff Depth=3.02"
Tc=6.0 min CN=98 Runoff=0.67 cfs 2,330 cf

Subcatchment6S: Subcatchment6S Runoff Area=23,849 sf 45.65% Impervious Runoff Depth=0.67"
Tc=6.0 min CN=66 Runoff=0.35 cfs 1,328 cf

Subcatchment8S: Subcatchment3S Runoff Area=543 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment9S: Roof Runoff Area=9,274 sf 100.00% Impervious Runoff Depth=3.02"
Tc=6.0 min CN=98 Runoff=0.67 cfs 2,332 cf

Reach 4R: Cheese Cake Brook Inflow=1.74 cfs 6,319 cf
Outflow=1.74 cfs 6,319 cf

Pond 1P: SIS#1 Peak Elev=2.13' Storage=242 cf Inflow=0.60 cfs 1,863 cf
Discarded=0.00 cfs 338 cf Primary=0.60 cfs 1,525 cf Outflow=0.60 cfs 1,863 cf

Pond 2P: SIS#2 Peak Elev=1.79' Storage=1,978 cf Inflow=1.10 cfs 3,809 cf
Discarded=0.02 cfs 3,247 cf Primary=0.08 cfs 562 cf Outflow=0.11 cfs 3,809 cf

Total Runoff Area = 69,228 sf Runoff Volume = 9,904 cf Average Runoff Depth = 1.72"
29.90% Pervious = 20,697 sf 70.10% Impervious = 48,531 sf

Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 0.02 cfs @ 12.30 hrs, Volume= 125 cf, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
1,447	98	Paved parking, HSG A
3,644	39	>75% Grass cover, Good, HSG A
5,091	56	Weighted Average
3,644		71.58% Pervious Area
1,447		28.42% Impervious Area

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

Summary for Subcatchment 2S: Ex. Parking Lot + Portion New Driveway

Runoff = 0.60 cfs @ 12.09 hrs, Volume= 1,863 cf, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
3,548	39	>75% Grass cover, Good, HSG A
10,000	98	Unconnected pavement, HSG A
13,548	83	Weighted Average
3,548		26.19% Pervious Area
10,000		73.81% Impervious Area
10,000		100.00% Unconnected

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

Summary for Subcatchment 3S: Ex. Roadway

Runoff = 0.13 cfs @ 12.08 hrs, Volume= 446 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
1,775	98	Unconnected pavement, HSG A
1,775		100.00% Impervious Area
1,775		100.00% Unconnected

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

Summary for Subcatchment 4S: Portion of New Driveway

Runoff = 0.43 cfs @ 12.08 hrs, Volume= 1,479 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
5,881	98	Unconnected pavement, HSG A
5,881		100.00% Impervious Area
5,881		100.00% Unconnected

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

Summary for Subcatchment 5S: Roof

Runoff = 0.67 cfs @ 12.08 hrs, Volume= 2,330 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
9,267	98	Roofs, HSG A
9,267		100.00% Impervious Area

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

Summary for Subcatchment 6S: Subcatchment 6S

Runoff = 0.35 cfs @ 12.11 hrs, Volume= 1,328 cf, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
12,962	39	>75% Grass cover, Good, HSG A
10,887	98	Unconnected pavement, HSG A
23,849	66	Weighted Average
12,962		54.35% Pervious Area
10,887		45.65% Impervious Area
10,887		100.00% Unconnected

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

Summary for Subcatchment 8S: Subcatchment 3S

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
543	39	>75% Grass cover, Good, HSG A
543		100.00% Pervious Area

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

Summary for Subcatchment 9S: Roof

Runoff = 0.67 cfs @ 12.08 hrs, Volume= 2,332 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
9,274	98	Roofs, HSG A
9,274		100.00% Impervious Area

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

Summary for Reach 4R: Cheese Cake Brook

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

Inflow Area = 69,228 sf, 70.10% Impervious, Inflow Depth = 1.10" for 2-year event
Inflow = 1.74 cfs @ 12.09 hrs, Volume= 6,319 cf
Outflow = 1.74 cfs @ 12.09 hrs, Volume= 6,319 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Summary for Pond 1P: SIS#1

Inflow Area = 13,548 sf, 73.81% Impervious, Inflow Depth = 1.65" for 2-year event
Inflow = 0.60 cfs @ 12.09 hrs, Volume= 1,863 cf
Outflow = 0.60 cfs @ 12.10 hrs, Volume= 1,863 cf, Atten= 0%, Lag= 0.5 min
Discarded = 0.00 cfs @ 9.36 hrs, Volume= 338 cf
Primary = 0.60 cfs @ 12.10 hrs, Volume= 1,525 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Peak Elev= 2.13' @ 12.10 hrs Surf.Area= 202 sf Storage= 242 cf

Plug-Flow detention time= 164.5 min calculated for 1,863 cf (100% of inflow)
Center-of-Mass det. time= 164.4 min (996.6 - 832.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	156 cf	**8.25'W x 24.50'L x 2.75'H Field A** 556 cf Overall - 166 cf Embedded = 390 cf x 40.0% Voids
#2A	0.50'	134 cf	**ADS N-12 18"** x 3 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf 3 Rows of 1 Chambers 7.25' Header x 1.80 sf x 2 = 26.1 cf Inside
		290 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	1.80'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	2.60'	**5.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.00 (C= 2.50)

Discarded OutFlow Max=0.00 cfs @ 9.36 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.59 cfs @ 12.10 hrs HW=2.12' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.59 cfs @ 1.83 fps)
└**3=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Pond 1P: SIS#1 - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf

21.0" Wide + 12.0" Spacing = 33.0" C-C Row Spacing

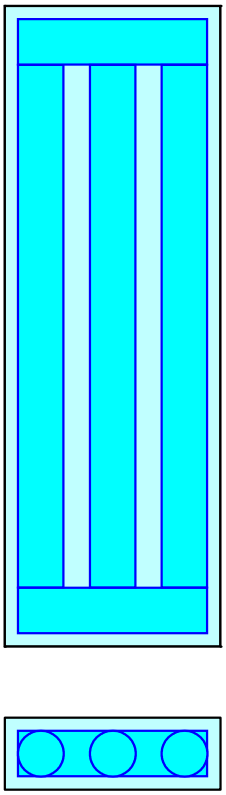
1 Chambers/Row x 20.00' Long +1.75' Header x 2 = 23.50' Row Length +6.0" End Stone x 2 = 24.50' Base Length
3 Rows x 21.0" Wide + 12.0" Spacing x 2 + 6.0" Side Stone x 2 = 8.25' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

3 Chambers x 36.0 cf + 7.25' Header x 1.80 sf x 2 = 134.1 cf Chamber Storage
3 Chambers x 44.5 cf + 7.25' Header x 2.23 sf x 2 = 165.8 cf Displacement

556.1 cf Field - 165.8 cf Chambers = 390.3 cf Stone x 40.0% Voids = 156.1 cf Stone Storage

Chamber Storage + Stone Storage = 290.2 cf = 0.007 af
Overall Storage Efficiency = 52.2%
Overall System Size = 24.50' x 8.25' x 2.75'

3 Chambers
20.6 cy Field
14.5 cy Stone



Summary for Pond 2P: SIS#2

Inflow Area = 15,148 sf,100.00% Impervious, Inflow Depth = 3.02" for 2-year event
Inflow = 1.10 cfs @ 12.08 hrs, Volume= 3,809 cf
Outflow = 0.11 cfs @ 12.88 hrs, Volume= 3,809 cf, Atten= 90%, Lag= 47.5 min
Discarded = 0.02 cfs @ 8.10 hrs, Volume= 3,247 cf
Primary = 0.08 cfs @ 12.88 hrs, Volume= 562 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 1.79' @ 12.88 hrs Surf.Area= 1,972 sf Storage= 1,978 cf

Plug-Flow detention time= 609.4 min calculated for 3,807 cf (100% of inflow)
Center-of-Mass det. time= 609.7 min (1,365.7 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	1,528 cf	**16.50'W x 119.50'L x 2.75'H Field A** 5,425 cf Overall - 1,605 cf Embedded = 3,819 cf x 40.0% Voids
#2A	0.50'	1,298 cf	**ADS N-12 18"** x 36 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf Row Length Adjustment= -5.00' x 1.80 sf x 6 rows 15.50' Header x 1.80 sf x 2 = 55.8 cf Inside
		2,826 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	1.70'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	2.60'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.02 cfs @ 8.10 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.08 cfs @ 12.88 hrs HW=1.79' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.08 cfs @ 0.94 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: SIS#2 - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf
Row Length Adjustment= -5.00' x 1.80 sf x 6 rows

21.0" Wide + 12.0" Spacing = 33.0" C-C Row Spacing

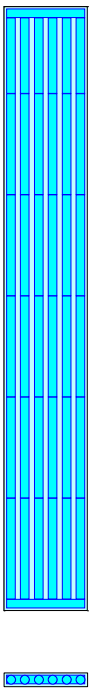
6 Chambers/Row x 20.00' Long -5.00' Row Adjustment +1.75' Header x 2 = 118.50' Row Length +6.0" End Stone x 2 = 119.50' Base Length
6 Rows x 21.0" Wide + 12.0" Spacing x 5 + 6.0" Side Stone x 2 = 16.50' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

36 Chambers x 36.0 cf -5.00' Row Adjustment x 1.80 sf x 6 Rows + 15.50' Header x 1.80 sf x 2 = 1,297.8 cf Chamber Storage
36 Chambers x 44.5 cf -5.00' Row Adjustment x 2.23 sf x 6 Rows + 15.50' Header x 2.23 sf x 2 = 1,604.5 cf Displacement

5,424.5 cf Field - 1,604.5 cf Chambers = 3,820.0 cf Stone x 40.0% Voids = 1,528.0 cf Stone Storage

Chamber Storage + Stone Storage = 2,825.8 cf = 0.065 af
Overall Storage Efficiency = 52.1%
Overall System Size = 119.50' x 16.50' x 2.75'

36 Chambers
200.9 cy Field
141.5 cy Stone



Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=5,091 sf 28.42% Impervious Runoff Depth=1.10"
Tc=6.0 min CN=56 Runoff=0.13 cfs 468 cf

Subcatchment2S: Ex. Parking Lot + Runoff Area=13,548 sf 73.81% Impervious Runoff Depth=3.28"
Tc=6.0 min CN=83 Runoff=1.19 cfs 3,706 cf

Subcatchment3S: Ex. Roadway Runoff Area=1,775 sf 100.00% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=98 Runoff=0.20 cfs 722 cf

Subcatchment4S: Portion of New Runoff Area=5,881 sf 100.00% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=98 Runoff=0.68 cfs 2,393 cf

Subcatchment5S: Roof Runoff Area=9,267 sf 100.00% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=98 Runoff=1.06 cfs 3,771 cf

Subcatchment6S: Subcatchment6S Runoff Area=23,849 sf 45.65% Impervious Runoff Depth=1.81"
Tc=6.0 min CN=66 Runoff=1.12 cfs 3,597 cf

Subcatchment8S: Subcatchment3S Runoff Area=543 sf 0.00% Impervious Runoff Depth=0.22"
Tc=6.0 min CN=39 Runoff=0.00 cfs 10 cf

Subcatchment9S: Roof Runoff Area=9,274 sf 100.00% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=98 Runoff=1.07 cfs 3,774 cf

Reach 4R: Cheese Cake Brook Inflow=4.15 cfs 14,510 cf
Outflow=4.15 cfs 14,510 cf

Pond 1P: SIS#1 Peak Elev=2.31' Storage=255 cf Inflow=1.19 cfs 3,706 cf
Discarded=0.00 cfs 355 cf Primary=1.18 cfs 3,352 cf Outflow=1.18 cfs 3,706 cf

Pond 2P: SIS#2 Peak Elev=2.17' Storage=2,376 cf Inflow=1.74 cfs 6,164 cf
Discarded=0.02 cfs 3,577 cf Primary=1.02 cfs 2,587 cf Outflow=1.05 cfs 6,164 cf

Total Runoff Area = 69,228 sf Runoff Volume = 18,442 cf Average Runoff Depth = 3.20"
29.90% Pervious = 20,697 sf 70.10% Impervious = 48,531 sf

Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 0.13 cfs @ 12.10 hrs, Volume= 468 cf, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
1,447	98	Paved parking, HSG A
3,644	39	>75% Grass cover, Good, HSG A
5,091	56	Weighted Average
3,644		71.58% Pervious Area
1,447		28.42% Impervious Area

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

Summary for Subcatchment 2S: Ex. Parking Lot + Portion New Driveway

Runoff = 1.19 cfs @ 12.09 hrs, Volume= 3,706 cf, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
3,548	39	>75% Grass cover, Good, HSG A
10,000	98	Unconnected pavement, HSG A
13,548	83	Weighted Average
3,548		26.19% Pervious Area
10,000		73.81% Impervious Area
10,000		100.00% Unconnected

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

Summary for Subcatchment 3S: Ex. Roadway

Runoff = 0.20 cfs @ 12.08 hrs, Volume= 722 cf, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
1,775	98	Unconnected pavement, HSG A
1,775		100.00% Impervious Area
1,775		100.00% Unconnected

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

Summary for Subcatchment 4S: Portion of New Driveway

Runoff = 0.68 cfs @ 12.08 hrs, Volume= 2,393 cf, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
5,881	98	Unconnected pavement, HSG A
5,881		100.00% Impervious Area
5,881		100.00% Unconnected

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

Summary for Subcatchment 5S: Roof

Runoff = 1.06 cfs @ 12.08 hrs, Volume= 3,771 cf, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
9,267	98	Roofs, HSG A
9,267		100.00% Impervious Area

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

Summary for Subcatchment 6S: Subcatchment 6S

Runoff = 1.12 cfs @ 12.09 hrs, Volume= 3,597 cf, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
12,962	39	>75% Grass cover, Good, HSG A
10,887	98	Unconnected pavement, HSG A
23,849	66	Weighted Average
12,962		54.35% Pervious Area
10,887		45.65% Impervious Area
10,887		100.00% Unconnected

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

Summary for Subcatchment 8S: Subcatchment 3S

Runoff = 0.00 cfs @ 12.45 hrs, Volume= 10 cf, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
543	39	>75% Grass cover, Good, HSG A
543		100.00% Pervious Area

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

Summary for Subcatchment 9S: Roof

Runoff = 1.07 cfs @ 12.08 hrs, Volume= 3,774 cf, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN	Description
9,274	98	Roofs, HSG A
9,274		100.00% Impervious Area

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

Summary for Reach 4R: Cheese Cake Brook

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

Inflow Area = 69,228 sf, 70.10% Impervious, Inflow Depth = 2.52" for 10-year event
Inflow = 4.15 cfs @ 12.11 hrs, Volume= 14,510 cf
Outflow = 4.15 cfs @ 12.11 hrs, Volume= 14,510 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Summary for Pond 1P: SIS#1

Inflow Area = 13,548 sf, 73.81% Impervious, Inflow Depth = 3.28" for 10-year event
Inflow = 1.19 cfs @ 12.09 hrs, Volume= 3,706 cf
Outflow = 1.18 cfs @ 12.09 hrs, Volume= 3,706 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.00 cfs @ 7.54 hrs, Volume= 355 cf
Primary = 1.18 cfs @ 12.09 hrs, Volume= 3,352 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Peak Elev= 2.31' @ 12.09 hrs Surf.Area= 202 sf Storage= 255 cf

Plug-Flow detention time= 87.8 min calculated for 3,705 cf (100% of inflow)
Center-of-Mass det. time= 88.3 min (900.8 - 812.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	156 cf	**8.25'W x 24.50'L x 2.75'H Field A** 556 cf Overall - 166 cf Embedded = 390 cf x 40.0% Voids
#2A	0.50'	134 cf	**ADS N-12 18"** x 3 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf 3 Rows of 1 Chambers 7.25' Header x 1.80 sf x 2 = 26.1 cf Inside
		290 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	1.80'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	2.60'	**5.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.00 (C= 2.50)

Discarded OutFlow Max=0.00 cfs @ 7.54 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.17 cfs @ 12.09 hrs HW=2.31' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 1.17 cfs @ 2.30 fps)
└**3=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Pond 1P: SIS#1 - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf

21.0" Wide + 12.0" Spacing = 33.0" C-C Row Spacing

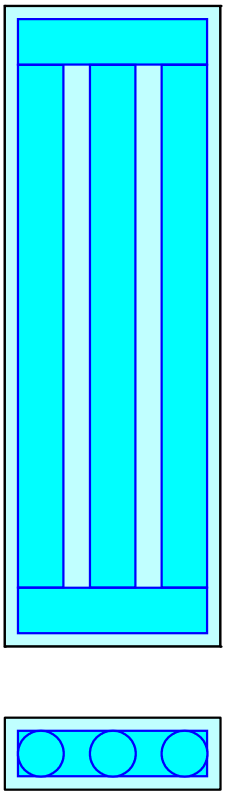
1 Chambers/Row x 20.00' Long +1.75' Header x 2 = 23.50' Row Length +6.0" End Stone x 2 = 24.50' Base Length
3 Rows x 21.0" Wide + 12.0" Spacing x 2 + 6.0" Side Stone x 2 = 8.25' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

3 Chambers x 36.0 cf + 7.25' Header x 1.80 sf x 2 = 134.1 cf Chamber Storage
3 Chambers x 44.5 cf + 7.25' Header x 2.23 sf x 2 = 165.8 cf Displacement

556.1 cf Field - 165.8 cf Chambers = 390.3 cf Stone x 40.0% Voids = 156.1 cf Stone Storage

Chamber Storage + Stone Storage = 290.2 cf = 0.007 af
Overall Storage Efficiency = 52.2%
Overall System Size = 24.50' x 8.25' x 2.75'

3 Chambers
20.6 cy Field
14.5 cy Stone



Summary for Pond 2P: SIS#2

Inflow Area = 15,148 sf,100.00% Impervious, Inflow Depth = 4.88" for 10-year event
Inflow = 1.74 cfs @ 12.08 hrs, Volume= 6,164 cf
Outflow = 1.05 cfs @ 12.19 hrs, Volume= 6,164 cf, Atten= 40%, Lag= 6.3 min
Discarded = 0.02 cfs @ 6.14 hrs, Volume= 3,577 cf
Primary = 1.02 cfs @ 12.19 hrs, Volume= 2,587 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 2.17' @ 12.19 hrs Surf.Area= 1,972 sf Storage= 2,376 cf

Plug-Flow detention time= 430.7 min calculated for 6,162 cf (100% of inflow)
Center-of-Mass det. time= 431.1 min (1,178.7 - 747.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	1,528 cf	**16.50'W x 119.50'L x 2.75'H Field A** 5,425 cf Overall - 1,605 cf Embedded = 3,819 cf x 40.0% Voids
#2A	0.50'	1,298 cf	**ADS N-12 18"** x 36 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf Row Length Adjustment= -5.00' x 1.80 sf x 6 rows 15.50' Header x 1.80 sf x 2 = 55.8 cf Inside
		2,826 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	1.70'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	2.60'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.02 cfs @ 6.14 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.02 cfs @ 12.19 hrs HW=2.16' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 1.02 cfs @ 2.19 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: SIS#2 - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf
Row Length Adjustment= -5.00' x 1.80 sf x 6 rows

21.0" Wide + 12.0" Spacing = 33.0" C-C Row Spacing

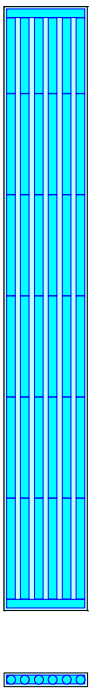
6 Chambers/Row x 20.00' Long -5.00' Row Adjustment +1.75' Header x 2 = 118.50' Row Length +6.0" End Stone x 2 = 119.50' Base Length
6 Rows x 21.0" Wide + 12.0" Spacing x 5 + 6.0" Side Stone x 2 = 16.50' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

36 Chambers x 36.0 cf -5.00' Row Adjustment x 1.80 sf x 6 Rows + 15.50' Header x 1.80 sf x 2 = 1,297.8 cf Chamber Storage
36 Chambers x 44.5 cf -5.00' Row Adjustment x 2.23 sf x 6 Rows + 15.50' Header x 2.23 sf x 2 = 1,604.5 cf Displacement

5,424.5 cf Field - 1,604.5 cf Chambers = 3,820.0 cf Stone x 40.0% Voids = 1,528.0 cf Stone Storage

Chamber Storage + Stone Storage = 2,825.8 cf = 0.065 af
Overall Storage Efficiency = 52.1%
Overall System Size = 119.50' x 16.50' x 2.75'

36 Chambers
200.9 cy Field
141.5 cy Stone



Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=5,091 sf 28.42% Impervious Runoff Depth=1.77"
Tc=6.0 min CN=56 Runoff=0.22 cfs 751 cf

Subcatchment2S: Ex. Parking Lot + Runoff Area=13,548 sf 73.81% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=83 Runoff=1.57 cfs 4,924 cf

Subcatchment3S: Ex. Roadway Runoff Area=1,775 sf 100.00% Impervious Runoff Depth=6.05"
Tc=6.0 min CN=98 Runoff=0.25 cfs 895 cf

Subcatchment4S: Portion of New Runoff Area=5,881 sf 100.00% Impervious Runoff Depth=6.05"
Tc=6.0 min CN=98 Runoff=0.83 cfs 2,966 cf

Subcatchment5S: Roof Runoff Area=9,267 sf 100.00% Impervious Runoff Depth=6.05"
Tc=6.0 min CN=98 Runoff=1.31 cfs 4,673 cf

Subcatchment6S: Subcatchment6S Runoff Area=23,849 sf 45.65% Impervious Runoff Depth=2.66"
Tc=6.0 min CN=66 Runoff=1.68 cfs 5,281 cf

Subcatchment8S: Subcatchment3S Runoff Area=543 sf 0.00% Impervious Runoff Depth=0.53"
Tc=6.0 min CN=39 Runoff=0.00 cfs 24 cf

Subcatchment9S: Roof Runoff Area=9,274 sf 100.00% Impervious Runoff Depth=6.05"
Tc=6.0 min CN=98 Runoff=1.31 cfs 4,677 cf

Reach 4R: Cheese Cake Brook Inflow=6.60 cfs 20,136 cf
Outflow=6.60 cfs 20,136 cf

Pond 1P: SIS#1 Peak Elev=2.42' Storage=263 cf Inflow=1.57 cfs 4,924 cf
Discarded=0.00 cfs 363 cf Primary=1.56 cfs 4,561 cf Outflow=1.56 cfs 4,924 cf

Pond 2P: SIS#2 Peak Elev=2.37' Storage=2,525 cf Inflow=2.14 cfs 7,639 cf
Discarded=0.02 cfs 3,692 cf Primary=1.76 cfs 3,947 cf Outflow=1.78 cfs 7,639 cf

Total Runoff Area = 69,228 sf Runoff Volume = 24,191 cf Average Runoff Depth = 4.19"
29.90% Pervious = 20,697 sf 70.10% Impervious = 48,531 sf

Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 0.22 cfs @ 12.10 hrs, Volume= 751 cf, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
1,447	98	Paved parking, HSG A
3,644	39	>75% Grass cover, Good, HSG A
5,091	56	Weighted Average
3,644		71.58% Pervious Area
1,447		28.42% Impervious Area

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

Summary for Subcatchment 2S: Ex. Parking Lot + Portion New Driveway

Runoff = 1.57 cfs @ 12.09 hrs, Volume= 4,924 cf, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
3,548	39	>75% Grass cover, Good, HSG A
10,000	98	Unconnected pavement, HSG A
13,548	83	Weighted Average
3,548		26.19% Pervious Area
10,000		73.81% Impervious Area
10,000		100.00% Unconnected

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

Summary for Subcatchment 3S: Ex. Roadway

Runoff = 0.25 cfs @ 12.08 hrs, Volume= 895 cf, Depth= 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
1,775	98	Unconnected pavement, HSG A
1,775		100.00% Impervious Area
1,775		100.00% Unconnected

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

Summary for Subcatchment 4S: Portion of New Driveway

Runoff = 0.83 cfs @ 12.08 hrs, Volume= 2,966 cf, Depth= 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
5,881	98	Unconnected pavement, HSG A
5,881		100.00% Impervious Area
5,881		100.00% Unconnected

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

Summary for Subcatchment 5S: Roof

Runoff = 1.31 cfs @ 12.08 hrs, Volume= 4,673 cf, Depth= 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
9,267	98	Roofs, HSG A
9,267		100.00% Impervious Area

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

Summary for Subcatchment 6S: Subcatchment 6S

Runoff = 1.68 cfs @ 12.09 hrs, Volume= 5,281 cf, Depth= 2.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
12,962	39	>75% Grass cover, Good, HSG A
10,887	98	Unconnected pavement, HSG A
23,849	66	Weighted Average
12,962		54.35% Pervious Area
10,887		45.65% Impervious Area
10,887		100.00% Unconnected

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

Summary for Subcatchment 8S: Subcatchment 3S

Runoff = 0.00 cfs @ 12.32 hrs, Volume= 24 cf, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
543	39	>75% Grass cover, Good, HSG A
543		100.00% Pervious Area

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

Summary for Subcatchment 9S: Roof

Runoff = 1.31 cfs @ 12.08 hrs, Volume= 4,677 cf, Depth= 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=6.29"

Area (sf)	CN	Description
9,274	98	Roofs, HSG A
9,274		100.00% Impervious Area

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

Summary for Reach 4R: Cheese Cake Brook

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

Inflow Area = 69,228 sf, 70.10% Impervious, Inflow Depth = 3.49" for 25-year event
Inflow = 6.60 cfs @ 12.10 hrs, Volume= 20,136 cf
Outflow = 6.60 cfs @ 12.10 hrs, Volume= 20,136 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Summary for Pond 1P: SIS#1

Inflow Area = 13,548 sf, 73.81% Impervious, Inflow Depth = 4.36" for 25-year event
Inflow = 1.57 cfs @ 12.09 hrs, Volume= 4,924 cf
Outflow = 1.56 cfs @ 12.09 hrs, Volume= 4,924 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.00 cfs @ 6.64 hrs, Volume= 363 cf
Primary = 1.56 cfs @ 12.09 hrs, Volume= 4,561 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Peak Elev= 2.42' @ 12.09 hrs Surf.Area= 202 sf Storage= 263 cf

Plug-Flow detention time= 68.3 min calculated for 4,922 cf (100% of inflow)
Center-of-Mass det. time= 68.8 min (873.2 - 804.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	156 cf	**8.25'W x 24.50'L x 2.75'H Field A** 556 cf Overall - 166 cf Embedded = 390 cf x 40.0% Voids
#2A	0.50'	134 cf	**ADS N-12 18"** x 3 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf 3 Rows of 1 Chambers 7.25' Header x 1.80 sf x 2 = 26.1 cf Inside
		290 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	1.80'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	2.60'	**5.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.00 (C= 2.50)

Discarded OutFlow Max=0.00 cfs @ 6.64 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.55 cfs @ 12.09 hrs HW=2.41' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 1.55 cfs @ 2.52 fps)
└**3=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Pond 1P: SIS#1 - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf

21.0" Wide + 12.0" Spacing = 33.0" C-C Row Spacing

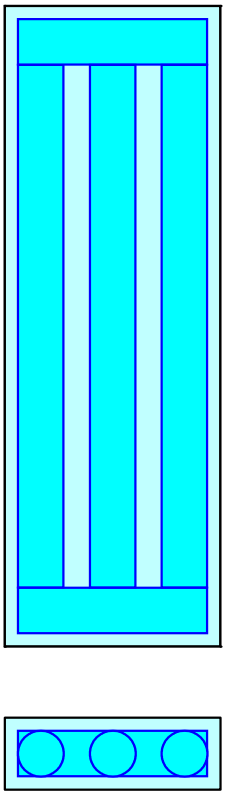
1 Chambers/Row x 20.00' Long +1.75' Header x 2 = 23.50' Row Length +6.0" End Stone x 2 = 24.50' Base Length
3 Rows x 21.0" Wide + 12.0" Spacing x 2 + 6.0" Side Stone x 2 = 8.25' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

3 Chambers x 36.0 cf + 7.25' Header x 1.80 sf x 2 = 134.1 cf Chamber Storage
3 Chambers x 44.5 cf + 7.25' Header x 2.23 sf x 2 = 165.8 cf Displacement

556.1 cf Field - 165.8 cf Chambers = 390.3 cf Stone x 40.0% Voids = 156.1 cf Stone Storage

Chamber Storage + Stone Storage = 290.2 cf = 0.007 af
Overall Storage Efficiency = 52.2%
Overall System Size = 24.50' x 8.25' x 2.75'

3 Chambers
20.6 cy Field
14.5 cy Stone



Summary for Pond 2P: SIS#2

Inflow Area = 15,148 sf,100.00% Impervious, Inflow Depth = 6.05" for 25-year event
Inflow = 2.14 cfs @ 12.08 hrs, Volume= 7,639 cf
Outflow = 1.78 cfs @ 12.14 hrs, Volume= 7,639 cf, Atten= 17%, Lag= 3.2 min
Discarded = 0.02 cfs @ 4.64 hrs, Volume= 3,692 cf
Primary = 1.76 cfs @ 12.14 hrs, Volume= 3,947 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 2.37' @ 12.14 hrs Surf.Area= 1,972 sf Storage= 2,525 cf

Plug-Flow detention time= 365.8 min calculated for 7,639 cf (100% of inflow)
Center-of-Mass det. time= 365.8 min (1,110.2 - 744.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	1,528 cf	**16.50'W x 119.50'L x 2.75'H Field A** 5,425 cf Overall - 1,605 cf Embedded = 3,819 cf x 40.0% Voids
#2A	0.50'	1,298 cf	**ADS N-12 18"** x 36 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf Row Length Adjustment= -5.00' x 1.80 sf x 6 rows 15.50' Header x 1.80 sf x 2 = 55.8 cf Inside
		2,826 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	1.70'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	2.60'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.02 cfs @ 4.64 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.76 cfs @ 12.14 hrs HW=2.37' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 1.76 cfs @ 2.63 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: SIS#2 - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf
Row Length Adjustment= -5.00' x 1.80 sf x 6 rows

21.0" Wide + 12.0" Spacing = 33.0" C-C Row Spacing

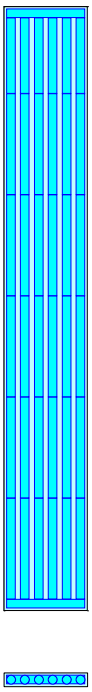
6 Chambers/Row x 20.00' Long -5.00' Row Adjustment +1.75' Header x 2 = 118.50' Row Length +6.0" End Stone x 2 = 119.50' Base Length
6 Rows x 21.0" Wide + 12.0" Spacing x 5 + 6.0" Side Stone x 2 = 16.50' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

36 Chambers x 36.0 cf -5.00' Row Adjustment x 1.80 sf x 6 Rows + 15.50' Header x 1.80 sf x 2 = 1,297.8 cf Chamber Storage
36 Chambers x 44.5 cf -5.00' Row Adjustment x 2.23 sf x 6 Rows + 15.50' Header x 2.23 sf x 2 = 1,604.5 cf Displacement

5,424.5 cf Field - 1,604.5 cf Chambers = 3,820.0 cf Stone x 40.0% Voids = 1,528.0 cf Stone Storage

Chamber Storage + Stone Storage = 2,825.8 cf = 0.065 af
Overall Storage Efficiency = 52.1%
Overall System Size = 119.50' x 16.50' x 2.75'

36 Chambers
200.9 cy Field
141.5 cy Stone



Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=5,091 sf 28.42% Impervious Runoff Depth=3.45"
Tc=6.0 min CN=56 Runoff=0.46 cfs 1,463 cf

Subcatchment2S: Ex. Parking Lot + Runoff Area=13,548 sf 73.81% Impervious Runoff Depth=6.72"
Tc=6.0 min CN=83 Runoff=2.37 cfs 7,592 cf

Subcatchment3S: Ex. Roadway Runoff Area=1,775 sf 100.00% Impervious Runoff Depth=8.54"
Tc=6.0 min CN=98 Runoff=0.35 cfs 1,263 cf

Subcatchment4S: Portion of New Runoff Area=5,881 sf 100.00% Impervious Runoff Depth=8.54"
Tc=6.0 min CN=98 Runoff=1.16 cfs 4,185 cf

Subcatchment5S: Roof Runoff Area=9,267 sf 100.00% Impervious Runoff Depth=8.54"
Tc=6.0 min CN=98 Runoff=1.83 cfs 6,595 cf

Subcatchment6S: Subcatchment6S Runoff Area=23,849 sf 45.65% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=66 Runoff=2.98 cfs 9,252 cf

Subcatchment8S: Subcatchment3S Runoff Area=543 sf 0.00% Impervious Runoff Depth=1.50"
Tc=6.0 min CN=39 Runoff=0.02 cfs 68 cf

Subcatchment9S: Roof Runoff Area=9,274 sf 100.00% Impervious Runoff Depth=8.54"
Tc=6.0 min CN=98 Runoff=1.83 cfs 6,600 cf

Reach 4R: Cheese Cake Brook Inflow=10.49 cfs 32,841 cf
Outflow=10.49 cfs 32,841 cf

Pond 1P: SIS#1 Peak Elev=2.61' Storage=279 cf Inflow=2.37 cfs 7,592 cf
Discarded=0.00 cfs 375 cf Primary=2.36 cfs 7,217 cf Outflow=2.37 cfs 7,592 cf

Pond 2P: SIS#2 Peak Elev=2.58' Storage=2,689 cf Inflow=2.99 cfs 10,780 cf
Discarded=0.02 cfs 3,802 cf Primary=2.64 cfs 6,978 cf Outflow=2.66 cfs 10,780 cf

Total Runoff Area = 69,228 sf Runoff Volume = 37,018 cf Average Runoff Depth = 6.42"
29.90% Pervious = 20,697 sf 70.10% Impervious = 48,531 sf

Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 0.46 cfs @ 12.09 hrs, Volume= 1,463 cf, Depth= 3.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
1,447	98	Paved parking, HSG A
3,644	39	>75% Grass cover, Good, HSG A
5,091	56	Weighted Average
3,644		71.58% Pervious Area
1,447		28.42% Impervious Area

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

Summary for Subcatchment 2S: Ex. Parking Lot + Portion New Driveway

Runoff = 2.37 cfs @ 12.09 hrs, Volume= 7,592 cf, Depth= 6.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
3,548	39	>75% Grass cover, Good, HSG A
10,000	98	Unconnected pavement, HSG A
13,548	83	Weighted Average
3,548		26.19% Pervious Area
10,000		73.81% Impervious Area
10,000		100.00% Unconnected

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

Summary for Subcatchment 3S: Ex. Roadway

Runoff = 0.35 cfs @ 12.08 hrs, Volume= 1,263 cf, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
1,775	98	Unconnected pavement, HSG A
1,775		100.00% Impervious Area
1,775		100.00% Unconnected

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

Summary for Subcatchment 4S: Portion of New Driveway

Runoff = 1.16 cfs @ 12.08 hrs, Volume= 4,185 cf, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
5,881	98	Unconnected pavement, HSG A
5,881		100.00% Impervious Area
5,881		100.00% Unconnected

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

Summary for Subcatchment 5S: Roof

Runoff = 1.83 cfs @ 12.08 hrs, Volume= 6,595 cf, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
9,267	98	Roofs, HSG A
9,267		100.00% Impervious Area

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

Summary for Subcatchment 6S: Subcatchment 6S

Runoff = 2.98 cfs @ 12.09 hrs, Volume= 9,252 cf, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
12,962	39	>75% Grass cover, Good, HSG A
10,887	98	Unconnected pavement, HSG A
23,849	66	Weighted Average
12,962		54.35% Pervious Area
10,887		45.65% Impervious Area
10,887		100.00% Unconnected

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

Summary for Subcatchment 8S: Subcatchment 3S

Runoff = 0.02 cfs @ 12.11 hrs, Volume= 68 cf, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
543	39	>75% Grass cover, Good, HSG A
543		100.00% Pervious Area

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

Summary for Subcatchment 9S: Roof

Runoff = 1.83 cfs @ 12.08 hrs, Volume= 6,600 cf, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-year Rainfall=8.78"

Area (sf)	CN	Description
9,274	98	Roofs, HSG A
9,274		100.00% Impervious Area

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

Summary for Reach 4R: Cheese Cake Brook

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

Inflow Area = 69,228 sf, 70.10% Impervious, Inflow Depth = 5.69" for 100-year event
Inflow = 10.49 cfs @ 12.10 hrs, Volume= 32,841 cf
Outflow = 10.49 cfs @ 12.10 hrs, Volume= 32,841 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Summary for Pond 1P: SIS#1

Inflow Area = 13,548 sf, 73.81% Impervious, Inflow Depth = 6.72" for 100-year event
Inflow = 2.37 cfs @ 12.09 hrs, Volume= 7,592 cf
Outflow = 2.37 cfs @ 12.09 hrs, Volume= 7,592 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.00 cfs @ 5.18 hrs, Volume= 375 cf
Primary = 2.36 cfs @ 12.09 hrs, Volume= 7,217 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Peak Elev= 2.61' @ 12.09 hrs Surf.Area= 202 sf Storage= 279 cf

Plug-Flow detention time= 47.3 min calculated for 7,592 cf (100% of inflow)
Center-of-Mass det. time= 47.3 min (839.6 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	156 cf	**8.25'W x 24.50'L x 2.75'H Field A** 556 cf Overall - 166 cf Embedded = 390 cf x 40.0% Voids
#2A	0.50'	134 cf	**ADS N-12 18"** x 3 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf 3 Rows of 1 Chambers 7.25' Header x 1.80 sf x 2 = 26.1 cf Inside
		290 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	1.80'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	2.60'	**5.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.00 (C= 2.50)

Discarded OutFlow Max=0.00 cfs @ 5.18 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=2.34 cfs @ 12.09 hrs HW=2.61' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 2.33 cfs @ 2.89 fps)
└**3=Sharp-Crested Vee/Trap Weir** (Weir Controls 0.01 cfs @ 0.22 fps)

Pond 1P: SIS#1 - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf

21.0" Wide + 12.0" Spacing = 33.0" C-C Row Spacing

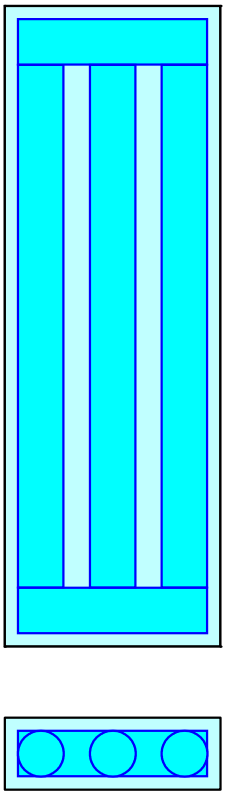
1 Chambers/Row x 20.00' Long +1.75' Header x 2 = 23.50' Row Length +6.0" End Stone x 2 = 24.50' Base Length
3 Rows x 21.0" Wide + 12.0" Spacing x 2 + 6.0" Side Stone x 2 = 8.25' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

3 Chambers x 36.0 cf + 7.25' Header x 1.80 sf x 2 = 134.1 cf Chamber Storage
3 Chambers x 44.5 cf + 7.25' Header x 2.23 sf x 2 = 165.8 cf Displacement

556.1 cf Field - 165.8 cf Chambers = 390.3 cf Stone x 40.0% Voids = 156.1 cf Stone Storage

Chamber Storage + Stone Storage = 290.2 cf = 0.007 af
Overall Storage Efficiency = 52.2%
Overall System Size = 24.50' x 8.25' x 2.75'

3 Chambers
20.6 cy Field
14.5 cy Stone



Summary for Pond 2P: SIS#2

Inflow Area = 15,148 sf,100.00% Impervious, Inflow Depth = 8.54" for 100-year event
Inflow = 2.99 cfs @ 12.08 hrs, Volume= 10,780 cf
Outflow = 2.66 cfs @ 12.12 hrs, Volume= 10,780 cf, Atten= 11%, Lag= 2.5 min
Discarded = 0.02 cfs @ 2.86 hrs, Volume= 3,802 cf
Primary = 2.64 cfs @ 12.12 hrs, Volume= 6,978 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 2.58' @ 12.12 hrs Surf.Area= 1,972 sf Storage= 2,689 cf

Plug-Flow detention time= 278.5 min calculated for 10,780 cf (100% of inflow)
Center-of-Mass det. time= 278.5 min (1,018.6 - 740.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	1,528 cf	**16.50'W x 119.50'L x 2.75'H Field A** 5,425 cf Overall - 1,605 cf Embedded = 3,819 cf x 40.0% Voids
#2A	0.50'	1,298 cf	**ADS N-12 18"** x 36 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf Row Length Adjustment= -5.00' x 1.80 sf x 6 rows 15.50' Header x 1.80 sf x 2 = 55.8 cf Inside
		2,826 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	1.70'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	2.60'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.02 cfs @ 2.86 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=2.63 cfs @ 12.12 hrs HW=2.58' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 2.63 cfs @ 3.00 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: SIS#2 - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf
Row Length Adjustment= -5.00' x 1.80 sf x 6 rows

21.0" Wide + 12.0" Spacing = 33.0" C-C Row Spacing

6 Chambers/Row x 20.00' Long -5.00' Row Adjustment +1.75' Header x 2 = 118.50' Row Length +6.0" End Stone x 2 = 119.50' Base Length
6 Rows x 21.0" Wide + 12.0" Spacing x 5 + 6.0" Side Stone x 2 = 16.50' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

36 Chambers x 36.0 cf -5.00' Row Adjustment x 1.80 sf x 6 Rows + 15.50' Header x 1.80 sf x 2 = 1,297.8 cf Chamber Storage
36 Chambers x 44.5 cf -5.00' Row Adjustment x 2.23 sf x 6 Rows + 15.50' Header x 2.23 sf x 2 = 1,604.5 cf Displacement

5,424.5 cf Field - 1,604.5 cf Chambers = 3,820.0 cf Stone x 40.0% Voids = 1,528.0 cf Stone Storage

Chamber Storage + Stone Storage = 2,825.8 cf = 0.065 af
Overall Storage Efficiency = 52.1%
Overall System Size = 119.50' x 16.50' x 2.75'

36 Chambers
200.9 cy Field
141.5 cy Stone