STORM WATER MANAGEMENT, DRAINAGE CALCULATIONS & BEST MANAGEMENT PRACTICES

Map 65 Lots 299, 372 & 1112

90 East Grove Street
Middleborough, MA 02346

Prepared For:

Cumberland Farms, Inc.
100 Crossing Boulevard
Framingham, MA 01702

December 9, 2013
Revised: February 14, 2014

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Revision 1: (2/14/14)

- Revise Tc & Pre and Post HydroCAD calculations per peer review comments
- Update Pre vs Post Table 1
- Revise O&M Plan

Section 1 EXECUTIVE SUMMARY

The stormwater analysis for the proposed commercial development is designed using proven and accepted methods to meet or exceed state and local regulations for stormwater quantity and quality. Treatment, discharge rates and flood control measures have been incorporated to minimize downstream effects on abutting parcels and receiving areas.

The study watershed area is approximately 1.8-acres that drains towards an existing closed drainage system along East Grove Street and the eastern abutting property line. Current onsite stormwater management consists of sheet and shallow concentrated flow to the above referenced design points. This Cumberland Farms proposal is considered a redevelopment project under the DEP Stormwater Policy Standards and provides for significant onsite improvements in comparison to the existing site conditions. Onsite stormwater controls proposed consist of an underground roof infiltration system for the convenience store, a closed drainage system consisting of curbing and deep sump, hooded catch basins, a Stormceptor treatment device, an Oil/Water Separator and above ground detention basin for the remainder of the onsite runoff.

For analysis purposes the site was modeled with two design points; DP#1, DP #2. Design Point #1 (DP1) is the closed drainage system along East Grove Street and Design Point #2 is the eastern abutting property line.

Table 1: Drainage Summary

Design Storm	Pre-Development (cfs)	Post-Development (cfs)	Change (cfs)
DESIGN POINT #1 (East Grove Street Drainage System)			
2-year	1.06	0.76	-0.30
10-year	2.35	1.56	-0.79
100-year	4.61	3.61	-1.00
DESIGN POINT #2 (Eastern Property Line)			
2-year	0.00	0.00	0.00
10-year	0.08	0.01	-0.07
100-year	0.51	0.12	-0.39

(All values shown are peak rates in CFS)

In Conclusion, the table above indicates that the proposed onsite stormwater drainage system is adequately designed to treat and mitigate any increases in runoff due to the proposed development. The existing drainage system along East Grove Street appears to have more than adequate capacity since the onsite peak runoff is being reduced, approximately 33% on average, in comparison to existing rates, based on the proposed site infrastructure as designed as part of the site development by Cumberland Farms, Inc.

Section 2 NARRATIVE

a) Project Description:

This project entitled Proposed Site Re-Development Plans prepared for Cumberland Farms Inc., is located on a combined tract of land that includes 3 parcels totaling 1.59-ac and located at 90 East Grove Street in Middleborough, MA. The 3 parcels are currently occupied by Hylan Auto Sales and two single family dwellings. The site is located in the General Use (GU) District at the eastern intersection of East Grove Street and Wood Street and is also located within the WRPD Z4 Zone of the Water Resource Protection District.

Cumberland Farms, Inc. is proposing to raze the existing buildings and construct a new retail motor fuel outlet facility. Included in this development is the construction of a 4,513 sf convenience store, fuel dispensing area with 4 dispensers (8 fueling positions) and parking lot with 20 parking spaces. The site work will also include but not limited to site grading, erosion control measures, utility connections and a stormwater management system.

The total area of disturbance is approximately 42,000 sf, all of which is related to the construction of the site development and utility connections and minimizes the extent to which construction and lot disturbance takes place to the maximum extent practicable.

The purpose of this report is to determine the pre- and post-development rates of stormwater runoff generated by this site and the impact of that runoff on the surrounding properties.

b) Methodology:

The drainage system for this project was modeled using HydroCAD, a stormwater modeling computer program that analyzes the hydrology, and hydraulics of stormwater runoff. HydroCAD uses either the Rational steady state method, or SCS hydrograph and routing procedures to estimate stormwater flow and volume.

In HydroCAD, each watershed is modeled as a subcatchment, streams and culverts as reaches and ponds, and large wetlands and storage areas as ponds. SCS hydrograph and routing stormwater models were used for both Pre-development conditions and Post-development conditions.

The Pre-development and Post-development watersheds and sub-area characteristics were determined using actual ground survey, and through visual inspection of runoff paths by walking the site. Conservative estimates were used at all times in evaluating the hydrologic characteristics of these watersheds.

c) Existing Conditions

Map 65 Lot 299 encompasses a 0.4-acre parcel of land that is currently occupied by Hylan Auto Sales. This parcel consists of paved vehicle sales area, gravel parking and a 1-1/2 story garage. Lots 372 & 1112 encompass 0.46 and 0.72-acre parcels of land respectively and consist of single family dwellings with detached garages, paved and gravel driveways and general landscaping and lawn areas with a wooded canopy along the eastern property boundary. Each use is serviced by municipal water and sewer, with existing utilities also consisting of natural gas and overhead electric services.

The three parcels of land are bounded by Wood Street to the north, East Grove Street to the West, Old Wood Street and Wood Cemetery to the south and residential dwellings to the west. The lots are currently accessed via five (5) full access driveway curb cuts along Old Wood Street, East Grove Street and Wood Street and the proposed development reduces this down to three (3) full access curb cuts.

Slopes onsite are relatively flat throughout the site and onsite stormwater flows consist of sheet and shallow concentrated flows. The runoff from the parcels generally drains south easterly across the site towards either the eastern property line or the East Grove Street drainage system. Based on the survey information and onsite field investigations by this office, there appears to be no onsite stormwater management facilities currently in place.

The on-site soils consist of **Merrimac (254A & 254B)** and **Urban Land (602B)**, and described by Natural Resources Conservation Service (NRCS) as follows:

> **254A, 254B - Merrimac** series (SCS Classification "A") This very deep, gently sloping, somewhat excessively drained soil is on rolling areas of outwash plains. The area are long and narrow or irregularly shaped. The range from 10 to 40 acres in size. Permeability in the Merrimac soil is moderate in the surface layer and upper portion of the subsoil and moderately rapid or rapid in the lower part of the subsoil and in the substratum.
>
> **699 - Urban Land** (SCS Classification "Unknown") consists of land that is covered by streets, parking lots and buildings. Areas are rectangular or irregularly shaped and are 4 to 250 acres in size. Inclusions make up 15 percent or less of the map unit. They consist of scattered areas of soil throughout the map unit.

Based on a front portion of the site consisting of Urban Land having no known hydrologic soil classification, the analysis used the hydrologic soil group classification A-soils consistent with the surrounding soils and test pit result obtained by this office.

Section 3 POST DEVELOPMENT

References:

1. SCS - ***TR55 (Second Ed., 1986)*** - for runoff curve numbers.
2. SCS - Rainfall Distribution Maps.
3. NRCS Soils Maps - Plymouth County.
4. DEP – ***Storm water Management Handbook***

This project is subject to both the D.E.P.'s ***Storm water Management Policy*** and the Town of Middleborough Water Protection District By-Laws. As shown herein, the proposed drainage system would provide the maximum feasible protection of groundwater resources, and prevent possible damage to abutting property or natural features in the area.

In order to safeguard against oil or gas introduction into the drainage systems, storm water runoff from parking areas and driveways would be collected into hooded catch basins with deep sumps (see Site Plan Details). Such pretreatment of storm water reduces both suspended solids and oils in the drainage system and is recommended by DEP's ***Storm water Management Handbook.*** Water quality would then further be treated by means of ***Stormceptor*** unit designed to filter suspended solids/silt/debris and/or and Oil/Water Separator. Before being discharged toward the existing closed drainage system, the flow rate would be controlled by means of an above ground detention basin and underground roof infiltration system prior to final discharge.

Stormwater recharge is implemented by the use of an underground perforated pipe and stone infiltration trenches for the Convenience Store roof runoff. Based on the ESHWT and surrounding grades this provides groundwater recharge to the maximum extent practicable as outlined in the DEP Standards. In addition, due to the high seasonal water table and existing site constraints, the recharge system offset to groundwater was reduced from 2' down to 1' only for the infiltration system.

Another safeguard against future intrusion of contaminants into the groundwater is the implementation of an ***Operation & Maintenance Plan (O&M),*** which would assure proper function of drainage components and reduce TSS entering the system.

Further safeguards proposed on the Site Plan to prevent erosion include a line of silt fencing & hay bales during construction, and loam and seed for permanent stabilization. If all the proposed erosion control devises and procedures are adhered to, then there should be minimal or no damage to neighboring properties from work on this site.

The entire drainage system was designed utilizing a closed drainage system to achieve reduced rates of runoff at the point of analysis and would maintain a similar drainage pattern to the existing courses. The methodology is SCS TR-20, Type III rainfalls (2, 10 & 100 year events). This is consistent with the requirements of DEP's Storm water Management guidelines. All pertinent calculations represented in the following pages were developed utilizing ***Hydrocad*** Storm water modeling software.

All pipes used on the project are to be High Density Polyethylene (HDPE) dual-wall (corrugated exterior, smooth interior), unless otherwise noted. Pipe capacities and velocities are included in the ***Hydrocad*** printouts (as part of the data for each "pond" in ***Hydrocad*** terminology).

Storm water Quality Controls:

1. **Street Sweeping** - to capture sediment prior to entering the drainage system. This would be done on a scheduled basis. TSS Removal Rate = 5%
2. **Hooded Catch Basins with Deep Sumps** to capture, treat and redirect storm water toward the proposed aboveground detention system. TSS Removal Rate = 25%
3. **Oil/Water Separator** to capture, treat and redirect storm water prior to discharge from the site. TSS Removal Rate = 25%
4. **Stormceptor** – to treat storm water prior to discharge to the detention basin. TSS removal rate = 70%.
5. **Infiltration Trenches** – to recharge the C-store rooftop. TSS removal rate = 80%

Groundwater Recharge:

In order to provide the maximum possible groundwater recharge, the site plans have incorporated a pipe and stone infiltration to capture building roof runoff to the maximum extent practicable.

Storm water Quantity Controls:

The **Aboveground Detention basin** was designed such that it would control discharges through outlet pipes for the 2, 10 & 100-year events.

The overall system thereby achieves the following:

- Control of runoff rates to abutting properties.
- Water quality maintenance – TSS removal

The points of analysis are the eastern abutting property boundary and existing roadway drainage system.

Stormwater Management Compliance Redevelopment Checklist

Note: This project is a redevelopment project therefore the following information is provided as outlined by the "Checklist for Redevelopment Projects" contained in the Massachusetts Stormwater Management Standards.

Standard # 1: (Untreated Discharges)

Full Compliance:

- No new stormwater conveyances are proposed that would discharge untreated stormwater.
- The site is designed with deep sump, hooded catch basins and a Stormceptor Hydrodynamic Separator and an Oil/Water Separator.
- All outfalls are protected by means of rock rip rap stone outlet aprons to prevent erosion.

Standard # 2: (Peak Rate Control and Flood Prevention)

Full Compliance:

- The stormwater management system is designed so that post-development peak discharge rates are less than the pre-development peak discharge rates.

Improvements to Existing Conditions:

- Project reduces the rate of runoff to less than current conditions by incorporating an above ground detention basin to control peak flows.
- Implementation of a closed drainage system consisting of deep sump, hooded catch basins, a Stormceptor, Oil/Water Separator and roof infiltration system.
- Reduction in curb cuts to eliminate untreated stormwater flows to existing roadway drainage system.

Standard # 3: (Recharge to Groundwater)

Compliance to the Maximum Extent Practicable:

- The site increases recharge comparing post to pre-development conditions.
- Site is comprised of Urban Land and Merrimac Soils.
- Seasonal High Water table @ 48-52" allows limited recharge capability onsite
- The site is considered a LUHPPL due to it being a motor fuel retail facility.

Improvements to Existing Conditions:

- Site runoff has been reduced in the proposed development in comparison to existing conditions.
- The site has incorporated an underground infiltration system to promote groundwater recharge to the maximum extent practicable.

Standard # 4: (TSS Removal)

Full Compliance:

- A long-term pollution plan that meets the requirements of Standard 4 has been developed.
- The pollution prevention plan includes the following source control measures; street sweeping; proper management of snow, salt and sand; proper management of fertilizers, herbicides and pesticides; and stabilization of soils.

Compliance to the Maximum Extent Practicable:

- The stormwater management system has been designed to remove TSS to the maximum extent practicable.
- Parking and driveway areas would be treated by street sweeping and deep sump, hooded catch basins, a Stormceptor and/or an Oil/Water Separator prior to discharge into the existing closed drainage system.

BMP	TSS Removal Rate
Street Sweeping	**5%**
Catch Basin w/sump	**25%**
Stormceptor	**70%**
Oil/Water Separator	**25%**
Infiltration System	**80%**

Improvements to Existing Conditions:

- Measures have been incorporated into the proposed development to comply with the standards to the Maximum Extent Practicable.
- No discharges to impaired waters are proposed in the Re-development project.

Standard # 5: (Higher Potential Pollutant Loads (HPPL)

Pollution Prevention:

- The long term pollution plan includes good housekeeping practices, preventive maintenance procedures and regular inspections.
- The site is designed with a canopy structure covering the fuel dispensing islands.
- The canopy area is designed with spill containment groves surrounding the entire canopy area which will capture any spills that may occur at the dispensing islands.

Treatment:

- The BMP's were sized to remove the pollutants associated with the LUHPPL.
- The site has been designed with hooded catch basins to capture oils and grease as well as an Oil/Water Separator.

Standard # 6: (Critical areas)

The site does not contain critical areas with sensitive resources.

Standard # 7: (Redevelopment)

This site is a redevelopment project.

Standard # 8: (Erosion, Sediment control)

Full Compliance Required:

Erosion and sediment controls are incorporated into the project design and a construction period erosion, sedimentation and pollution control plan has been prepared.

Standard #9: (Operation and Maintenance)

Full Compliance Required:

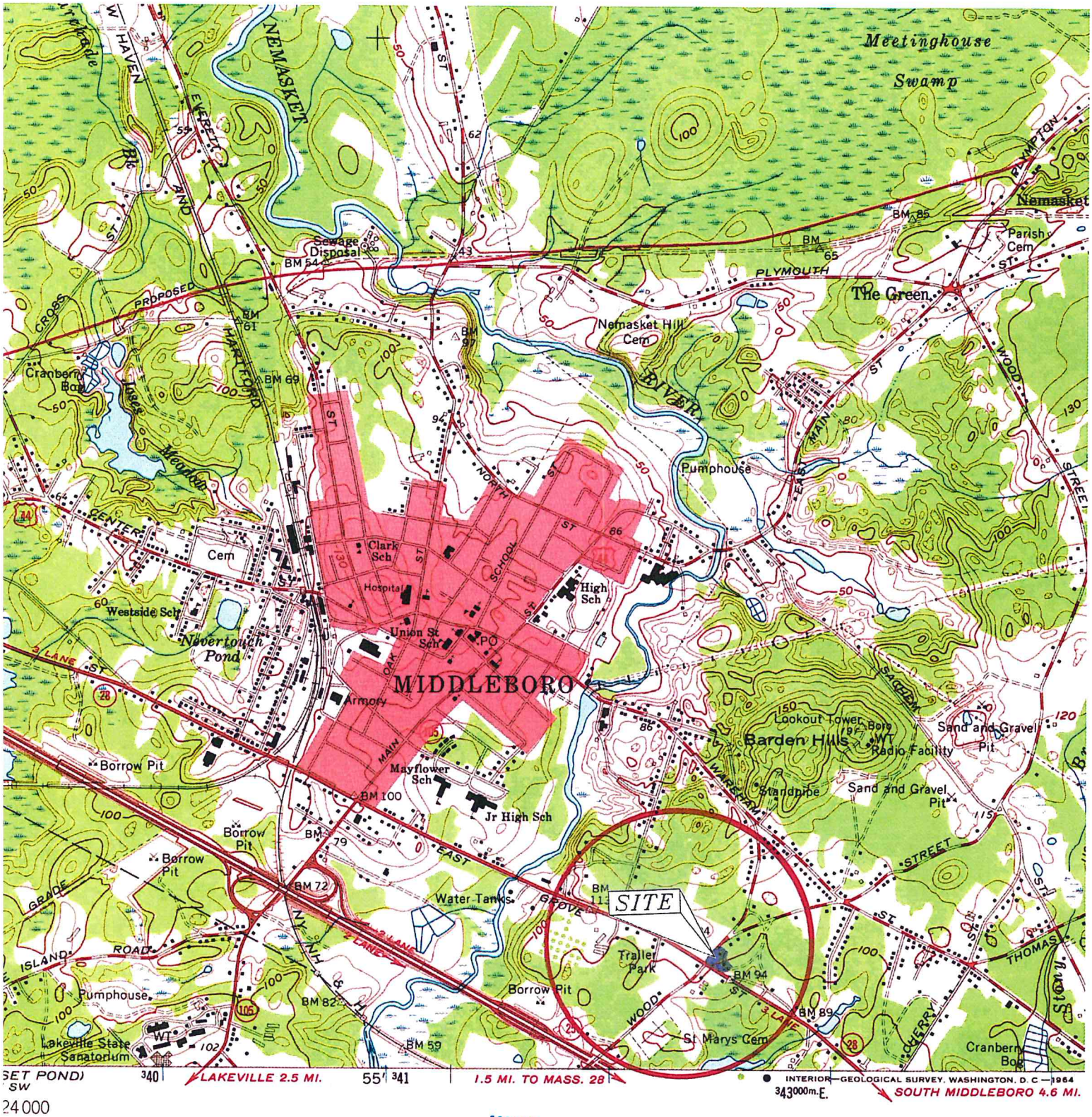
A long term operation and maintenance plan meeting the requirements of this standard has been prepared and is included as a separate document.

Standard #10: (Illicit Discharges)

Full Compliance Required:

To the best of our knowledge, the site does not contain any illicit discharges (see attached Discharge Statement).

APPENDIX A
Maps & Data



24 000

1 MILE

4000 5000 6000 7000 FEET

1 KILOMETER

VAL 10 FEET
N SEA LEVEL

ROAD CLASSIFICATION

Heavy-duty ——— Light-duty ———

Medium-duty ——— Unimproved dirt - - -

U. S. Route ○ State Route

MASS.

QUADRANGLE LOCATION

SURVEY, WASHINGTON 25, D. C.
AND SYMBOLS IS AVAILABLE ON REQUEST

BRIDGEWATER, M

N4152.5—W7052.5/7

1962

AMS 6867 IV NW—SERIES

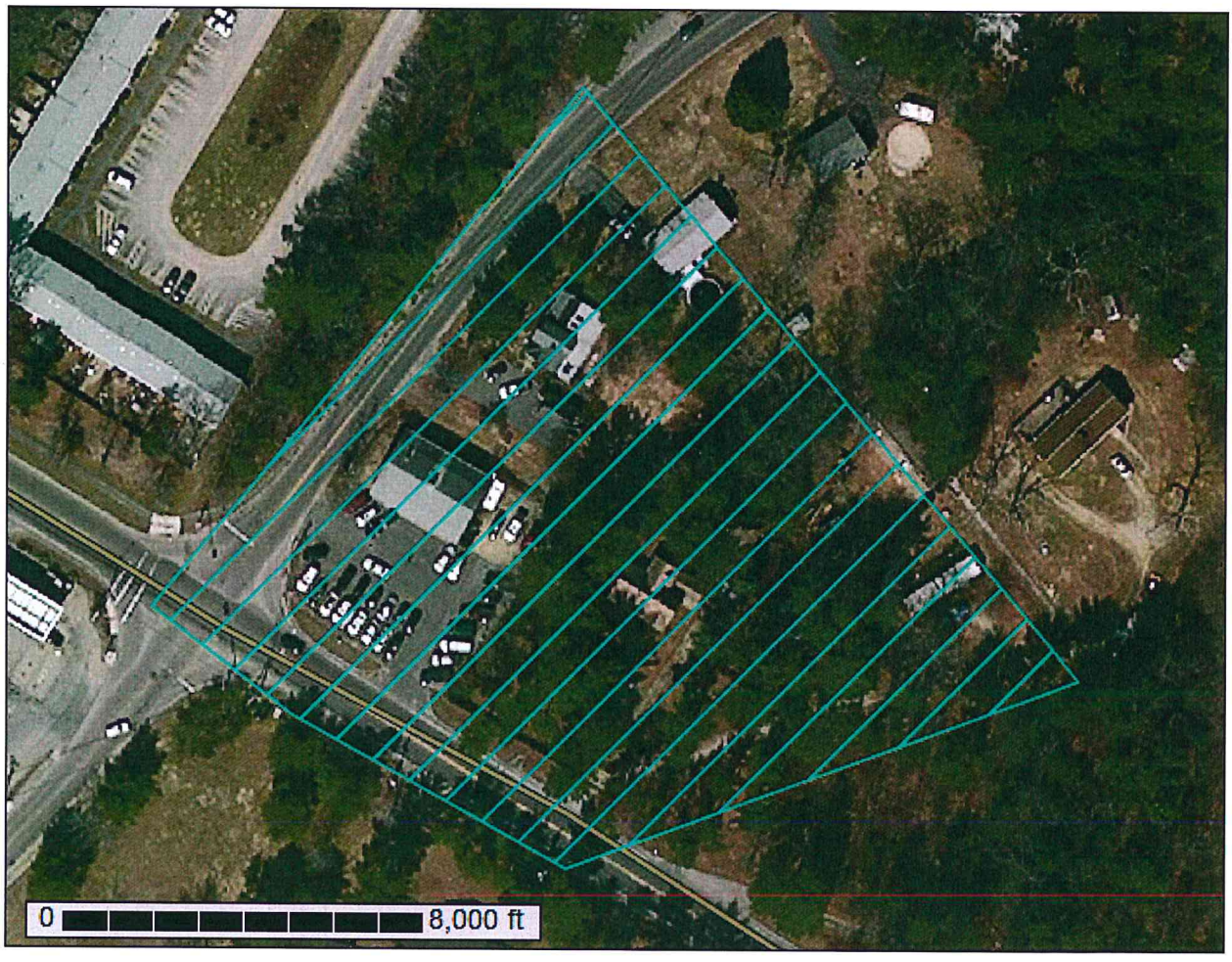
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Plymouth County, Massachusetts



October 15, 2013

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

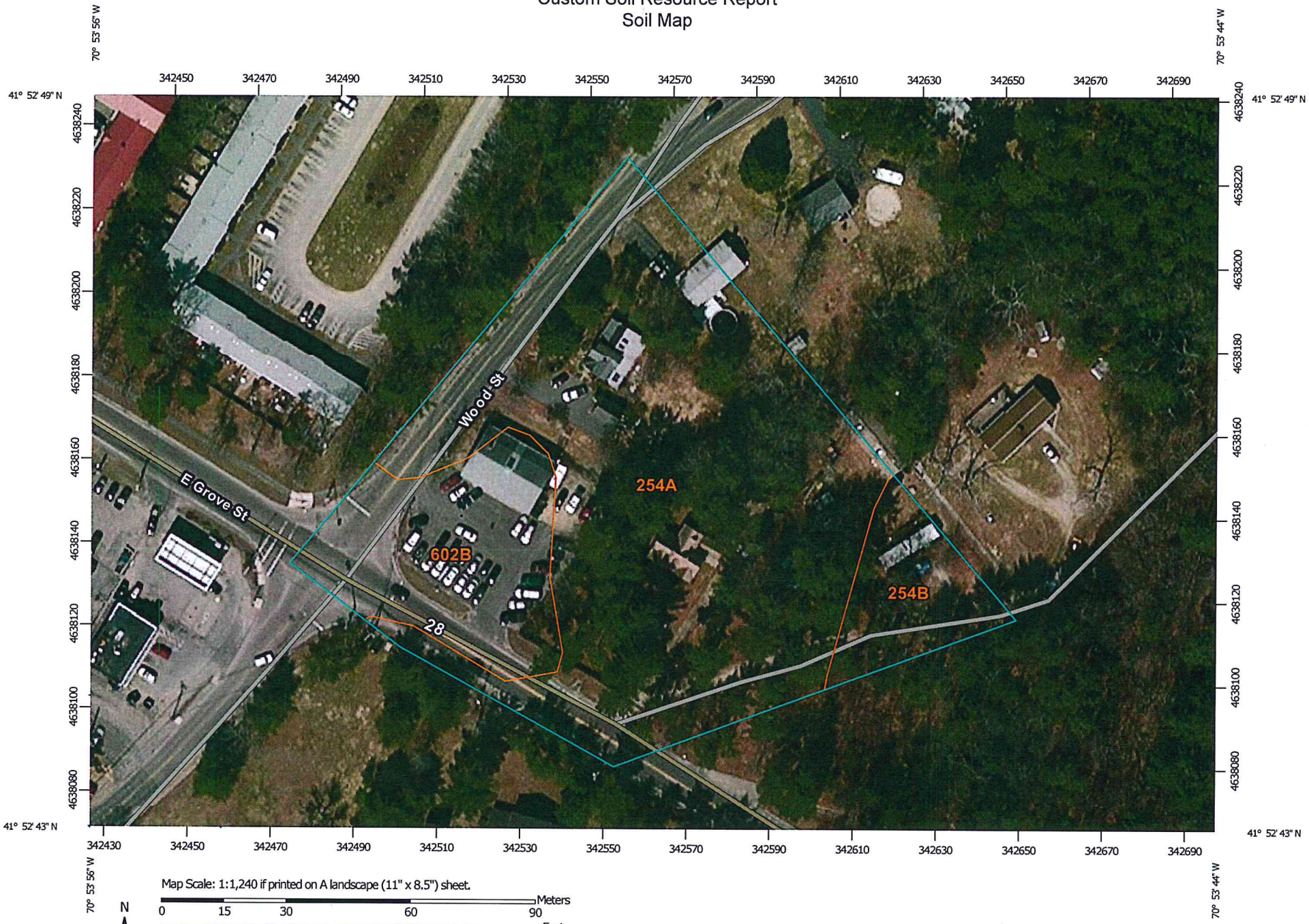
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 5, Jul 27, 2010

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

Date(s) aerial images were photographed: Mar 30, 2011—Oct 8, 2011

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

Map Unit Legend

Plymouth County, Massachusetts (MA023)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
254A	Merrimac sandy loam, 0 to 3 percent slopes	2.3	72.5%
254B	Merrimac sandy loam, 3 to 8 percent slopes	0.3	8.6%
602B	Urban land, 0 to 8 percent slopes	0.6	18.9%
Totals for Area of Interest		**3.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If

intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Plymouth County, Massachusetts

254A—Merrimac sandy loam, 0 to 3 percent slopes

Map Unit Setting

Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days

Map Unit Composition

Merrimac and similar soils: 80 percent
Minor components: 20 percent

Description of Merrimac

Setting

Landform: Outwash plains, kames, terraces
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Coarse-loamy eolian deposits over sandy and gravelly glaciofluvial deposits

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 2s
Hydrologic Soil Group: A

Typical profile

0 to 0 inches: Slightly decomposed plant material
0 to 2 inches: Moderately decomposed plant material
2 to 3 inches: Sandy loam
3 to 5 inches: Coarse sandy loam
5 to 12 inches: Coarse sandy loam
12 to 18 inches: Sandy loam
18 to 22 inches: Gravelly coarse sandy loam
22 to 38 inches: Gravelly sand
38 to 72 inches: Gravelly coarse sand

Minor Components

Carver

Percent of map unit: 8 percent
Landform: Moraines, outwash plains, pitted outwash plains

Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex

Hinckley

Percent of map unit: 5 percent
Landform: Terraces, eskers, kames, outwash deltas
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex

Deerfield

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave

Mashpee

Percent of map unit: 1 percent
Landform: Terraces, depressions, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave

Massasoit

Percent of map unit: 1 percent
Landform: Depressions, drainageways, terraces
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave

254B—Merrimac sandy loam, 3 to 8 percent slopes

Map Unit Setting

Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days

Map Unit Composition

Merrimac and similar soils: 80 percent
Minor components: 20 percent

Description of Merrimac

Setting

Landform: Kames, terraces, outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Coarse-loamy eolian deposits over sandy and gravelly glaciofluvial deposits

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 2e
Hydrologic Soil Group: A

Typical profile

0 to 0 inches: Slightly decomposed plant material
0 to 2 inches: Moderately decomposed plant material
2 to 3 inches: Sandy loam
3 to 5 inches: Coarse sandy loam
5 to 12 inches: Coarse sandy loam
12 to 18 inches: Sandy loam
18 to 22 inches: Gravelly coarse sandy loam
22 to 38 inches: Gravelly sand
38 to 72 inches: Gravelly coarse sand

Minor Components

Carver

Percent of map unit: 8 percent
Landform: Pitted outwash plains, moraines, outwash plains
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex

Hinckley

Percent of map unit: 5 percent
Landform: Outwash deltas, terraces, kames, eskers
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex

Deerfield

Percent of map unit: 5 percent

Landform: Outwash plains, deltas, terraces
Landform position (two-dimensional): Footslope, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave

Mashpee

Percent of map unit: 1 percent
Landform: Depressions, drainageways, terraces
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave

Massasoit

Percent of map unit: 1 percent
Landform: Depressions, drainageways, terraces
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave

602B—Urban land, 0 to 8 percent slopes

Map Unit Composition

Urban land: 95 percent
Minor components: 5 percent

Minor Components

Urban land, wet substratum

Percent of map unit: 5 percent

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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

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

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

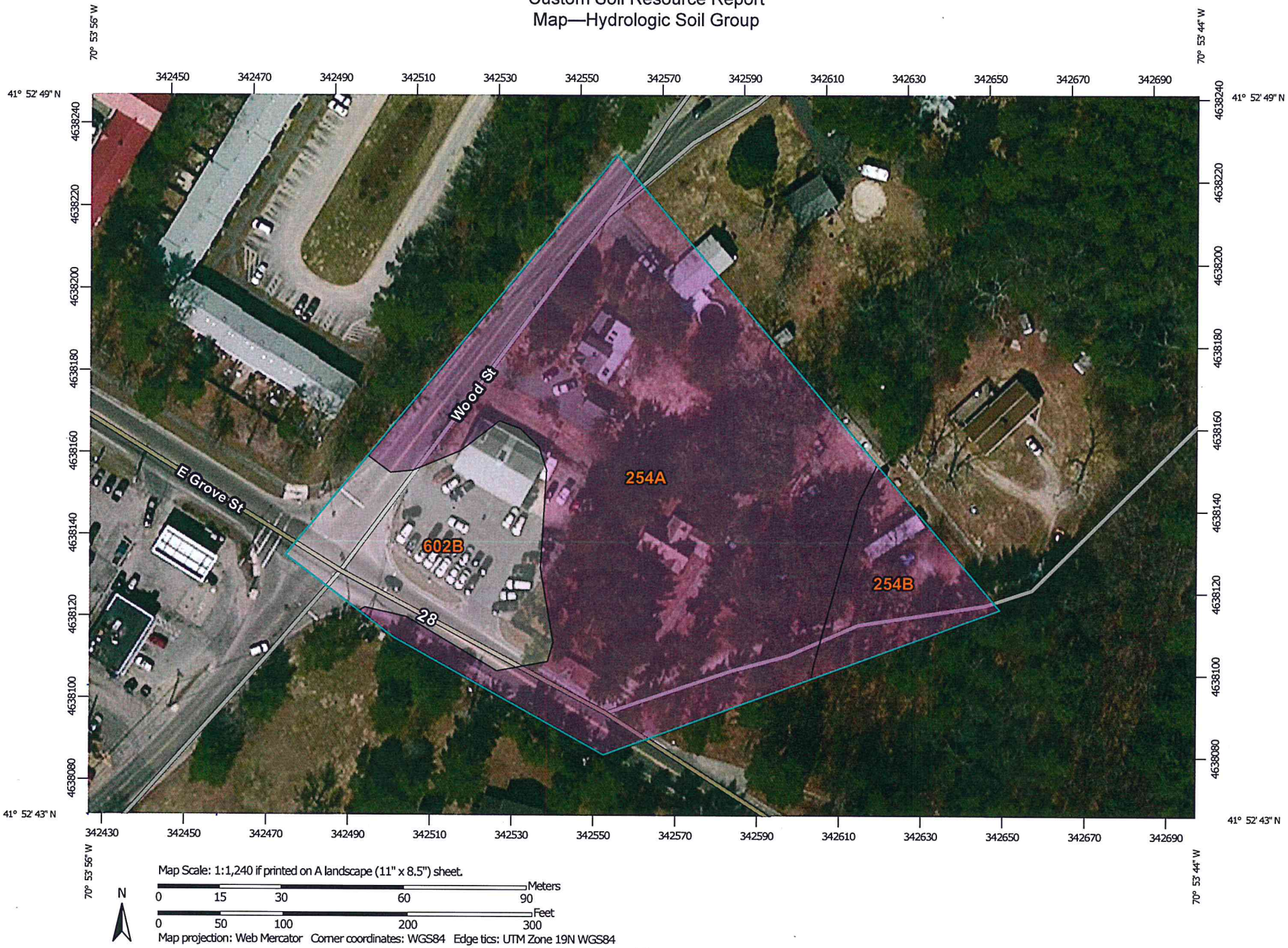
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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

Custom Soil Resource Report
Map—Hydrologic Soil Group



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 5, Jul 27, 2010

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

Date(s) aerial images were photographed: Mar 30, 2011—Oct 8, 2011

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

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Plymouth County, Massachusetts (MA023)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
254A	Merrimac sandy loam, 0 to 3 percent slopes	A	2.3	72.5%
254B	Merrimac sandy loam, 3 to 8 percent slopes	A	0.3	8.6%
602B	Urban land, 0 to 8 percent slopes		0.6	18.9%
Totals for Area of Interest			**3.2**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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OUTLET APRON DESIGN

Project: CFG - MIDDLEBOROUGH Job # 334713
Date: 9-Dec-13

MHF Design Consultants, Inc.
ENGINEERS • PLANNERS • SURVEYORS

Outlet # (from HydroCAD POND **DMH2**)
Q_{10} = 2.72 cfs
D_o = 12 inches
Tw = 1.33 feet

Design Criteria

Apron Dimensions

The dimensions of the apron at the outlet of the pipe shall be determined as follows:

1.) The width of the apron at the outlet of the pipe or channel shall be 3 times the diameter of the pipe of width of the channel.

USE THIS W= **3** feet

2.) The length of the apron shall be determined from the following formula when the tailwater depth at the outlet of the pipe or channel is less than one-half the diameter of the pipe or one-half the width of the channel:

La=1.8*Q/ Do^3/2+ 7Do
La= **11.90** feet

Where:

La is the length of the apron
Q is the discharge from the pipe or channel
D_o is the diameter of pipe of width of channel

3.) When the depth of the tailwater at the outlet of the pipe or channel is equal to or greater than one-half the diameter of the pipe or the width of the channel. Then the following formula applies:

USE THIS La=3.0*Qo/ Do^1.5 +7D_o
La= **15.16** feet

4.) Where there is no well defined channel downstream of the outlet, the width of the downstream end of the apron shall be determined as follows:

a. For minimum tailwater conditions where the tailwater depth is less than the elevation of the center of the pipe:

W=3*Do+La
W= **14.90** feet

b. For maximum tailwater conditions where the tailwater depth is greater than the elevation of the center of the pipe:

USE THIS W=3*Do+0.4*La
W= **9.06** feet

5.) Where there is a stable well-defined channel downstream of the apron, the bottom of the apron shall be equal to the width of the channel.

6.) The side of the apron in a well-defined channel shall be 2:1 (horizontal to vertical) or flatter. The height of the structural lining along the channel sides shall begin at the elevation equal to the top of conduit and taper down to the channel bottom through the length of the apron.

7.) The bottom grade of the apron shall be level (0% grade). No overfall is allowable at the end of the apron.

8.) The apron shall be located so that there are no bends in the horizontal alignment of the apron.

Rock Riprap

The following criteria shall be used to determine the dimensions of the rock riprap used for the apron:

1.) The median stone diameter shall be determined using the formula:

d_{50}=0.02*Q^4/3/(Tw*D_o)

d_{50}= **0.68** inches **USE** **3** inches

d_{50} minimum 3 inches

Where:

d_{50} is the median stone diameter in feet

Tw is the tailwater depth above the invert of the pipe channel in feet

Q is the discharge from the pipe or channel in cubic feet per second

D_o is the diameter of the pipe or width of the channel in feet

2.) Fifty percent by weight of the riprap mixture shall be smaller the than median size stone designated as d_{50}. The largest stone size in the mixture shall be 1.5 times the d_{50} size.

3.) The quality and gradation of the rock, the thickness of the riprap lining, filter material and the quality of the stone shall meet the requirements in the Rock Riprap BMP. The minimum depth shall be 6 inches or 1.5 times the largest stone size in the mixture whichever is larger (d).

Thickness of the riprap

d = 1.5*(1.5*d_{50}(largest stone size))

d= 7 inches*

* must use a minimum of 6"

Rock Rip Rap Gradation

% of weight smaller than the given size	size of stone in inches		
100	**4.5**	to	**6.0**
85	**3.9**	to	**5.4**
50	**3.0**	to	**4.5**
15	**0.9**	to	**1.5**

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	11/25/2013
Project Name	CFG - MIDDLEBOROUGH
Project Number	334713
Location	DMH-2

Designer Information

Company	MHF DESIGN CONSULTANTS, INC
Contact	CHRIS TYMULA

Notes

N/A

Drainage Area

Total Area (ac)	0.64
Imperviousness (%)	91.6

The Stormceptor System model STC 450i achieves the water quality objective removing 82% TSS for a Fine (organics, silts and sand) particle size distribution.

Rainfall

Name	BLUE HILL
State	MA
ID	736
Years of Records	1948 to 2005
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ac-ft)	Discharge (cfs)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 450i	**82**
STC 900	89
STC 1200	89
STC 1800	89
STC 2400	91
STC 3600	92
STC 4800	94
STC 6000	94
STC 7200	95
STC 11000	96
STC 13000	97
STC 16000	97

Stormceptor®

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s
20	20	1.3	0.0013					
60	20	1.8	0.0051					
150	20	2.2	0.0354					
400	20	2.65	0.2123					
2000	20	2.65	0.9417					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in.	1 in.	3 in.
Multiple inlet pipes	3 in.	3 in.	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com

Rinker MATERIALS™

MHF Design Consultants, Inc.
ENGINEERS • PLANNERS • SURVEYORS

MHF Project No.	334713	**Sheet**	1 of 1
Project Description	Cumberland Farms, Inc.		
Task	Pond Drawdown Calculations		
Calculated By	CMT	**Date**	12/09/13
Checked By		**Date**	

Drawdown within 72 hours Analysis for Static Method

Roof Infiltration System

Infiltration Rate:	2.41	inches/hour (From table 2.3.3: Rawls, Brakensiek, Saxton, 1982)
Design Infiltration Rate:	2.41	inches/hour
Volume Provide for Infiltration:	505	cf
Basin bottom area:	543	sf

Time $_{drawdown}$ = (Required Recharge Volume in cubic feet as determined by the Static Method)(1/Design Infiltration Rate in inches per hour)(conversion for inches to feet)(1/bottom area in feet)

Time $_{drawdown}$ = (505 cf) (1 / 2.41 in/hr) (1ft/12 in.) (1 / 543 sf)

= 4.63 hours

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot No. 90-92 East Grove Street & 147 Wood Street, Middleborough, MA

On-site Review

Deep Hole Number: 10-1 Date: 10/10/13 Weather: Sunny 50s

Location (identify on site plan)

Land Use Residential/Commerical Slope (%) 0-2% Surface Stones None Visible

Vegetation

Landform

Position on landscape (sketch on back)

Distances from:

Open Water Body >100 feet Drainage way >10 feet

Possible Wet Area >100 feet Property Line >10 feet

Drinking Water Well >100 feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-12"	A	Loamy Sand	10yr 3/2		
12-24"	B	Loamy Sand	10yr 5/6		
24-78"	C1	Loamy Sand	10yr 6/2	@ 50"	
78-144"	C2	Sand	2.5y 7/2		

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic): Outwash Depth to Bedrock: >144"

Depth to Groundwater: 50" Standing Water in Hole: None Weeping from pit face: None

Estimated Seasonal High Groundwater: 50"

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot No. 90-92 East Grove Street & 147 Wood Street, Middleborough, MA

On-site Review

Deep Hole Number: 10-2 Date: 10/10/13 Weather: Sunny 50s

Location (identify on site plan)

Land Use Residential/Commerical Slope (%) 0-2% Surface Stones None Visible

Vegetation

Landform

Position on landscape (sketch on back)

Distances from:

Open Water Body >100 feet Drainage way >10 feet

Possible Wet Area >100 feet Property Line >10 feet

Drinking Water Well >100 feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-10"	A	Loamy Sand	10yr 3/2		
10-22"	B	Loamy Sand	10yr 5/6		
22-132"	C	Loamy Sand	10yr 6/2	@ 48"	

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic): Outwash Depth to Bedrock: >132"

Depth to Groundwater: 48" Standing Water in Hole: None Weeping from pit face: None

Estimated Seasonal High Groundwater: 48"

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot No. 90-92 East Grove Street & 147 Wood Street, Middleborough, MA

On-site Review

Deep Hole Number: 10-3 Date: 10/10/13 Weather: Sunny 50s

Location (identify on site plan)

Land Use Residential/Commerical Slope (%) 0-2% Surface Stones None Visible

Vegetation

Landform

Position on landscape (sketch on back)

Distances from:

Open Water Body >100 feet Drainage way >10 feet

Possible Wet Area >100 feet Property Line >10 feet

Drinking Water Well >100 feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-11"	A	Loamy Sand	10yr 3/2		
11-23"	B	Loamy Sand	10yr 5/8		
23-120"	C	Loamy Sand	2.5y 6/2	@ 52"	

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic): Outwash Depth to Bedrock: >120"

Depth to Groundwater: 52" Standing Water in Hole: None Weeping from pit face: None

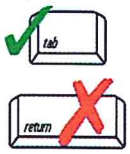
Estimated Seasonal High Groundwater: 52"

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

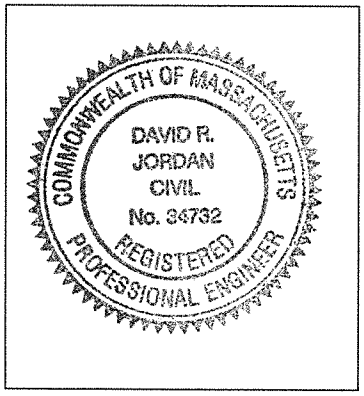
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



12/13/13
Signature and Date

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☒ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

MHF Design Consultants, Inc.

44 Stiles Road • Suite One • Salem, New Hampshire 03079
TEL (603) 893-0720 • FAX (603) 893-0733
www.mhfdesign.com

December 9, 2013

Middleborough Board of Selectman
10 Nickerson Avenue
Middleborough, MA 02346

Re: 90 East Grove Street
Map 65 Lots 299, 372 &1112

Sub: Illicit Discharge Statement
Standard #10

Dear Board Members:

On behalf of our client, Cumberland Farms, Inc., we hereby state that to the best of our knowledge, no illicit discharges exist on the above referenced site and none are proposed with the site re-development plans. Implementing the pollution prevention plan measures outlined in the site redevelopment plans will prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. Refer to the Grading & Drainage Plan from the site plan set for additional information.

Sincerely,
MHF Design Consultants, Inc.

David R. Jordan, P.E., R.L.S., LEED AP
Senior Project Manager

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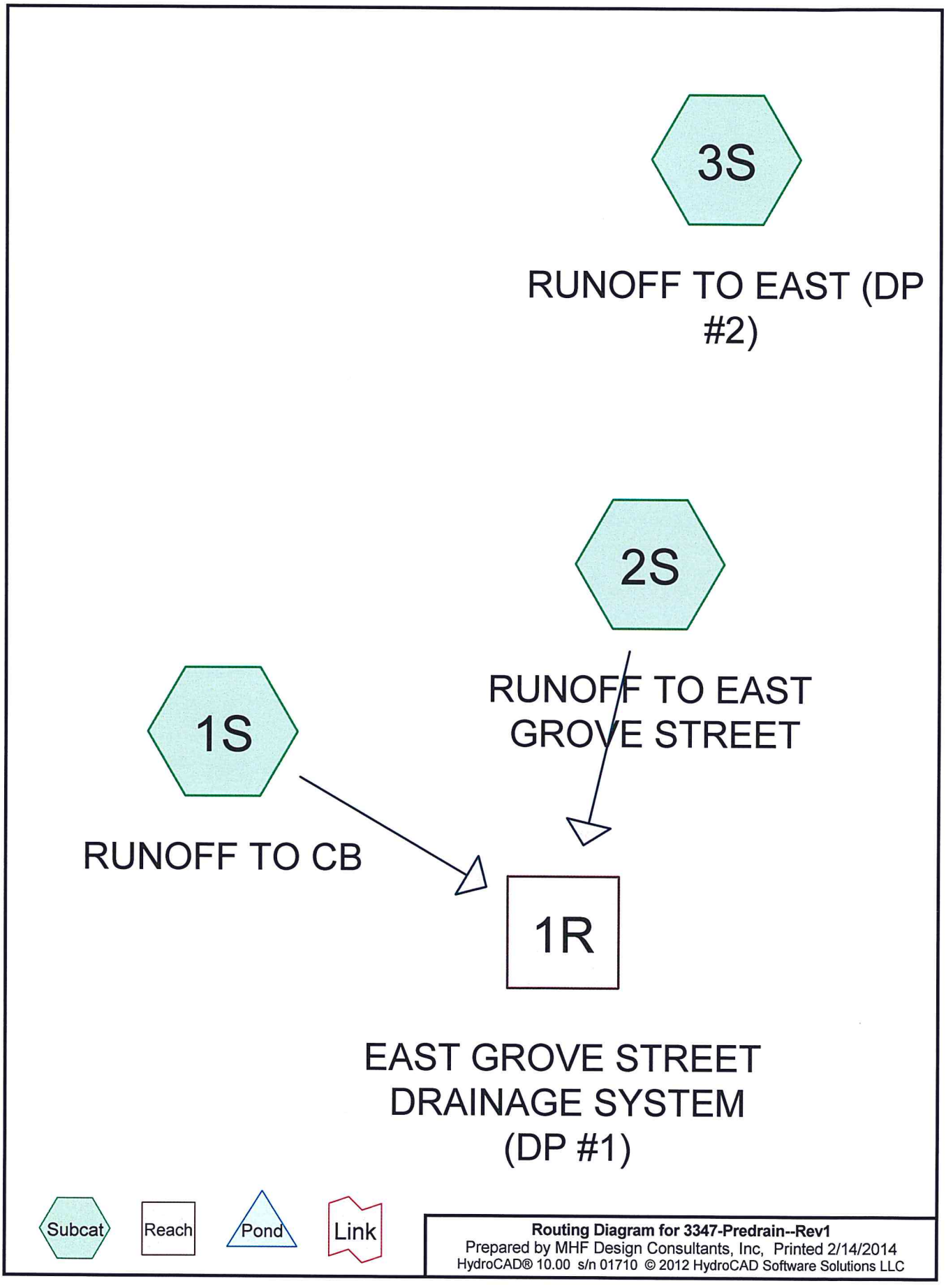
APPENDIX B
PRE DEVELOPMENT
DRAINAGE CALCULATIONS

2, 10 & 100-YEAR STORM EVENTS



Routing Diagram for 3347-Predrain--Rev1
Prepared by MHF Design Consultants, Inc, Printed 2/14/2014

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
35,467	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S)
8,684	96	Gravel surface, HSG A (1S, 2S, 3S)
19,277	98	Paved parking, HSG A (1S)
6,946	98	Roofs, HSG A (1S, 2S, 3S)
5,926	30	Woods, Good, HSG A (1S, 3S)
76,300	**65**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
76,300	HSG A	1S, 2S, 3S
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
76,300		**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	Subcatchment Numbers
35,467	0	0	0	0	35,467	>75% Grass cover, Good	1S, 2S, 3S
8,684	0	0	0	0	8,684	Gravel surface	1S, 2S, 3S
19,277	0	0	0	0	19,277	Paved parking	1S
6,946	0	0	0	0	6,946	Roofs	1S, 2S, 3S
5,926	0	0	0	0	5,926	Woods, Good	1S, 3S
76,300	**0**	**0**	**0**	**0**	**76,300**	**TOTAL AREA**	

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: RUNOFF TO CB Runoff Area=48,444 sf 49.82% Impervious Runoff Depth=1.04"
Flow Length=332' Tc=12.4 min CN=74 Runoff=1.02 cfs 4,189 cf

Subcatchment 2S: RUNOFF TO EAST GROVE Runoff Area=7,124 sf 8.91% Impervious Runoff Depth=0.37"
Flow Length=137' Tc=6.0 min CN=59 Runoff=0.04 cfs 222 cf

Subcatchment 3S: RUNOFF TO EAST (DP #2) Runoff Area=20,732 sf 7.00% Impervious Runoff Depth=0.06"
Flow Length=175' Slope=0.0300 '/' Tc=8.9 min CN=46 Runoff=0.00 cfs 100 cf

Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP #1) Inflow=1.06 cfs 4,411 cf
Outflow=1.06 cfs 4,411 cf

Total Runoff Area = 76,300 sf Runoff Volume = 4,510 cf Average Runoff Depth = 0.71"
65.63% Pervious = 50,077 sf 34.37% Impervious = 26,223 sf

Summary for Subcatchment 1S: RUNOFF TO CB

Runoff = 1.02 cfs @ 12.19 hrs, Volume= 4,189 cf, Depth= 1.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
4,860	98	Roofs, HSG A
1,978	30	Woods, Good, HSG A
17,152	39	>75% Grass cover, Good, HSG A
5,177	96	Gravel surface, HSG A
19,277	98	Paved parking, HSG A
48,444	74	Weighted Average
24,307		50.18% Pervious Area
24,137		49.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	25	0.0150	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.5	55	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	50	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	52	0.0140	0.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	90	0.0180	2.16		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	60	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.4	332	Total			

Summary for Subcatchment 2S: RUNOFF TO EAST GROVE STREET

Runoff = 0.04 cfs @ 12.15 hrs, Volume= 222 cf, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
635	98	Roofs, HSG A
1,851	96	Gravel surface, HSG A
4,638	39	>75% Grass cover, Good, HSG A
7,124	59	Weighted Average
6,489		91.09% Pervious Area
635		8.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	18	0.0330	2.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	44	0.0170	0.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	55	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
3.4	137	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: RUNOFF TO EAST (DP #2)

Runoff = 0.00 cfs @ 15.10 hrs, Volume= 100 cf, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
1,451	98	Roofs, HSG A
3,948	30	Woods, Good, HSG A
1,656	96	Gravel surface, HSG A
13,677	39	>75% Grass cover, Good, HSG A
20,732	46	Weighted Average
19,281		93.00% Pervious Area
1,451		7.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	25	0.0300	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	150	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	175	Total			

Summary for Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP #1)

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

Inflow Area = 55,568 sf, 44.58% Impervious, Inflow Depth = 0.95" for 2-year event
Inflow = 1.06 cfs @ 12.19 hrs, Volume= 4,411 cf
Outflow = 1.06 cfs @ 12.19 hrs, Volume= 4,411 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: RUNOFF TO CB Runoff Area=48,444 sf 49.82% Impervious Runoff Depth=2.13"
Flow Length=332' Tc=12.4 min CN=74 Runoff=2.20 cfs 8,588 cf

Subcatchment 2S: RUNOFF TO EAST GROVE Runoff Area=7,124 sf 8.91% Impervious Runoff Depth=1.07"
Flow Length=137' Tc=6.0 min CN=59 Runoff=0.17 cfs 634 cf

Subcatchment 3S: RUNOFF TO EAST (DP #2) Runoff Area=20,732 sf 7.00% Impervious Runoff Depth=0.39"
Flow Length=175' Slope=0.0300 '/' Tc=8.9 min CN=46 Runoff=0.08 cfs 678 cf

Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP #1) Inflow=2.35 cfs 9,222 cf
Outflow=2.35 cfs 9,222 cf

Total Runoff Area = 76,300 sf Runoff Volume = 9,901 cf Average Runoff Depth = 1.56"
65.63% Pervious = 50,077 sf 34.37% Impervious = 26,223 sf

Summary for Subcatchment 1S: RUNOFF TO CB

Runoff = 2.20 cfs @ 12.18 hrs, Volume= 8,588 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.70"

Area (sf)	CN	Description
4,860	98	Roofs, HSG A
1,978	30	Woods, Good, HSG A
17,152	39	>75% Grass cover, Good, HSG A
5,177	96	Gravel surface, HSG A
19,277	98	Paved parking, HSG A
48,444	74	Weighted Average
24,307		50.18% Pervious Area
24,137		49.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	25	0.0150	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.5	55	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	50	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	52	0.0140	0.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	90	0.0180	2.16		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	60	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.4	332	Total			

Summary for Subcatchment 2S: RUNOFF TO EAST GROVE STREET

Runoff = 0.17 cfs @ 12.11 hrs, Volume= 634 cf, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.70"

Area (sf)	CN	Description
635	98	Roofs, HSG A
1,851	96	Gravel surface, HSG A
4,638	39	>75% Grass cover, Good, HSG A
7,124	59	Weighted Average
6,489		91.09% Pervious Area
635		8.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	18	0.0330	2.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	44	0.0170	0.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	55	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
3.4	137	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: RUNOFF TO EAST (DP #2)

Runoff = 0.08 cfs @ 12.36 hrs, Volume= 678 cf, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.70"

Area (sf)	CN	Description
1,451	98	Roofs, HSG A
3,948	30	Woods, Good, HSG A
1,656	96	Gravel surface, HSG A
13,677	39	>75% Grass cover, Good, HSG A
20,732	46	Weighted Average
19,281		93.00% Pervious Area
1,451		7.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	25	0.0300	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	150	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	175	Total			

Summary for Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP #1)

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

Inflow Area = 55,568 sf, 44.58% Impervious, Inflow Depth = 1.99" for 10-year event
Inflow = 2.35 cfs @ 12.17 hrs, Volume= 9,222 cf
Outflow = 2.35 cfs @ 12.17 hrs, Volume= 9,222 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: RUNOFF TO CB Runoff Area=48,444 sf 49.82% Impervious Runoff Depth=4.04"
Flow Length=332' Tc=12.4 min CN=74 Runoff=4.25 cfs 16,318 cf

Subcatchment 2S: RUNOFF TO EAST GROVE Runoff Area=7,124 sf 8.91% Impervious Runoff Depth=2.51"
Flow Length=137' Tc=6.0 min CN=59 Runoff=0.46 cfs 1,488 cf

Subcatchment 3S: RUNOFF TO EAST (DP #2) Runoff Area=20,732 sf 7.00% Impervious Runoff Depth=1.32"
Flow Length=175' Slope=0.0300 '/' Tc=8.9 min CN=46 Runoff=0.51 cfs 2,281 cf

Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP #1) Inflow=4.61 cfs 17,806 cf
Outflow=4.61 cfs 17,806 cf

Total Runoff Area = 76,300 sf Runoff Volume = 20,087 cf Average Runoff Depth = 3.16"
65.63% Pervious = 50,077 sf 34.37% Impervious = 26,223 sf

Summary for Subcatchment 1S: RUNOFF TO CB

Runoff = 4.25 cfs @ 12.17 hrs, Volume= 16,318 cf, Depth= 4.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
4,860	98	Roofs, HSG A
1,978	30	Woods, Good, HSG A
17,152	39	>75% Grass cover, Good, HSG A
5,177	96	Gravel surface, HSG A
19,277	98	Paved parking, HSG A
48,444	74	Weighted Average
24,307		50.18% Pervious Area
24,137		49.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	25	0.0150	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.5	55	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	50	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	52	0.0140	0.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	90	0.0180	2.16		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	60	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.4	332	Total			

Summary for Subcatchment 2S: RUNOFF TO EAST GROVE STREET

Runoff = 0.46 cfs @ 12.10 hrs, Volume= 1,488 cf, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
635	98	Roofs, HSG A
1,851	96	Gravel surface, HSG A
4,638	39	>75% Grass cover, Good, HSG A
7,124	59	Weighted Average
6,489		91.09% Pervious Area
635		8.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	18	0.0330	2.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	44	0.0170	0.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	55	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
3.4	137	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: RUNOFF TO EAST (DP #2)

Runoff = 0.51 cfs @ 12.16 hrs, Volume= 2,281 cf, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
1,451	98	Roofs, HSG A
3,948	30	Woods, Good, HSG A
1,656	96	Gravel surface, HSG A
13,677	39	>75% Grass cover, Good, HSG A
20,732	46	Weighted Average
19,281		93.00% Pervious Area
1,451		7.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	25	0.0300	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	150	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	175	Total			

Summary for Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP #1)

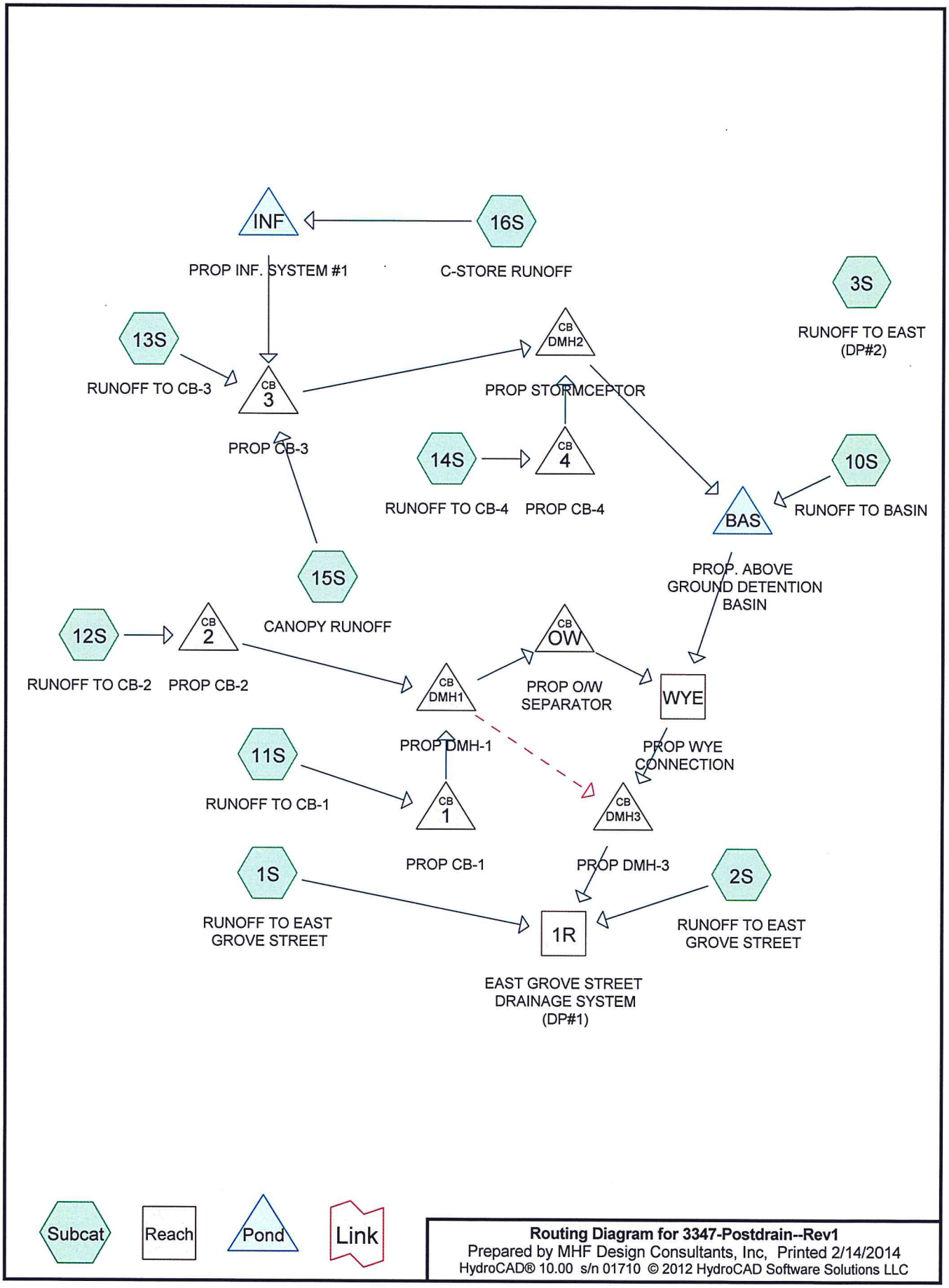
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 55,568 sf, 44.58% Impervious, Inflow Depth = 3.85" for 100-year event
Inflow = 4.61 cfs @ 12.17 hrs, Volume= 17,806 cf
Outflow = 4.61 cfs @ 12.17 hrs, Volume= 17,806 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

APPENDIX C
POST DEVELOPMENT
DRAINAGE CALCULATIONS

2, 10 & 100-YEAR STORM EVENTS



Routing Diagram for 3347-Postdrain--Rev1
Prepared by MHF Design Consultants, Inc, Printed 2/14/2014
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
34,317	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 10S, 11S, 12S, 13S)
29,512	98	Paved parking, HSG A (1S, 11S, 12S, 13S, 14S)
8,361	98	Roofs, HSG A (15S, 16S)
4,110	30	Woods, Good, HSG A (3S)
76,300	**68**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
76,300	HSG A	1S, 2S, 3S, 10S, 11S, 12S, 13S, 14S, 15S, 16S
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
76,300		**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	Subcatchment Numbers
34,317	0	0	0	0	34,317	>75% Grass cover, Good	1S, 2S, 3S, 10S, 11S, 12S, 13S
29,512	0	0	0	0	29,512	Paved parking	1S, 11S, 12S, 13S, 14S
8,361	0	0	0	0	8,361	Roofs	15S, 16S
4,110	0	0	0	0	4,110	Woods, Good	3S
76,300	**0**	**0**	**0**	**0**	**76,300**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	WYE	95.00	94.90	10.0	0.0100	0.013	12.0	0.0	0.0
2	1	95.50	95.45	5.0	0.0100	0.013	12.0	0.0	0.0
3	2	96.35	95.45	128.0	0.0070	0.013	12.0	0.0	0.0
4	3	96.75	96.00	157.0	0.0048	0.013	12.0	0.0	0.0
5	4	96.10	96.00	5.0	0.0200	0.013	12.0	0.0	0.0
6	BAS	95.50	95.00	95.0	0.0053	0.013	12.0	0.0	0.0
7	DMH1	95.35	95.30	5.0	0.0100	0.010	6.0	0.0	0.0
8	DMH1	95.50	94.90	10.0	0.0600	0.013	12.0	0.0	0.0
9	DMH2	95.75	95.50	28.0	0.0089	0.013	12.0	0.0	0.0
10	DMH3	94.80	94.35	20.0	0.0225	0.013	12.0	0.0	0.0
11	INF	99.25	97.00	93.0	0.0242	0.010	6.0	0.0	0.0
12	OW	95.05	95.00	5.0	0.0100	0.010	6.0	0.0	0.0

Notes Listing (all nodes)

Line#	Node Number	Notes
1	INF	RAWL'S RATES BASED ON LOAMY SAND = 2.41 IN/HR

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: RUNOFF TO EAST GROVE Runoff Area=10,161 sf 45.80% Impervious Runoff Depth=0.64"
Flow Length=255' Tc=6.9 min CN=66 Runoff=0.14 cfs 544 cf

Subcatchment 2S: RUNOFF TO EAST GROVE Runoff Area=2,269 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=100' Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment 3S: RUNOFF TO EAST (DP#2) Runoff Area=19,275 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=175' Slope=0.0300 '/' Tc=8.9 min CN=37 Runoff=0.00 cfs 0 cf

Subcatchment 10S: RUNOFF TO BASIN Runoff Area=5,947 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=33' Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment 11S: RUNOFF TO CB-1 Runoff Area=5,711 sf 82.82% Impervious Runoff Depth=2.00"
Flow Length=78' Tc=6.0 min CN=88 Runoff=0.30 cfs 950 cf

Subcatchment 12S: RUNOFF TO CB-2 Runoff Area=4,979 sf 57.82% Impervious Runoff Depth=0.98"
Flow Length=65' Tc=6.0 min CN=73 Runoff=0.12 cfs 408 cf

Subcatchment 13S: RUNOFF TO CB-3 Runoff Area=14,166 sf 83.43% Impervious Runoff Depth=2.00"
Flow Length=145' Tc=6.0 min CN=88 Runoff=0.74 cfs 2,357 cf

Subcatchment 14S: RUNOFF TO CB-4 Runoff Area=5,431 sf 100.00% Impervious Runoff Depth=2.97"
Flow Length=90' Slope=0.0100 '/' Tc=6.0 min CN=98 Runoff=0.38 cfs 1,343 cf

Subcatchment 15S: CANOPY RUNOFF Runoff Area=2,928 sf 100.00% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=98 Runoff=0.20 cfs 724 cf

Subcatchment 16S: C-STORE RUNOFF Runoff Area=5,433 sf 100.00% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=98 Runoff=0.38 cfs 1,344 cf

Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP#1) Inflow=0.76 cfs 6,592 cf
Outflow=0.76 cfs 6,592 cf

Reach WYE: PROP WYE CONNECTION Avg. Flow Depth=0.24' Max Vel=3.10 fps Inflow=0.45 cfs 5,877 cf
12.0" Round Pipe n=0.013 L=10.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=0.45 cfs 5,878 cf

Pond 1: PROP CB-1 Peak Elev=95.81' Inflow=0.30 cfs 950 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0100 '/' Outflow=0.30 cfs 950 cf

Pond 2: PROP CB-2 Peak Elev=96.54' Inflow=0.12 cfs 408 cf
12.0" Round Culvert n=0.013 L=128.0' S=0.0070 '/' Outflow=0.12 cfs 408 cf

Pond 3: PROP CB-3 Peak Elev=97.35' Inflow=0.97 cfs 3,347 cf
12.0" Round Culvert n=0.013 L=157.0' S=0.0048 '/' Outflow=0.97 cfs 3,347 cf

Pond 4: PROP CB-4 Peak Elev=96.85' Inflow=0.38 cfs 1,343 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.38 cfs 1,343 cf

Pond BAS: PROP. ABOVE GROUND DETENTION Peak Elev=96.84' Storage=1,507 cf Inflow=1.35 cfs 4,690 cf
Outflow=0.33 cfs 4,690 cf

Pond DMH1: PROP DMH-1 Peak Elev=95.70' Inflow=0.42 cfs 1,358 cf
Primary=0.24 cfs 1,188 cf Secondary=0.18 cfs 170 cf Outflow=0.42 cfs 1,358 cf

Pond DMH2: PROP STORMCEPTOR Peak Elev=96.85' Inflow=1.35 cfs 4,690 cf
12.0" Round Culvert n=0.013 L=28.0' S=0.0089 '/' Outflow=1.35 cfs 4,690 cf

Pond DMH3: PROP DMH-3 Peak Elev=95.20' Inflow=0.63 cfs 6,048 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0225 '/' Outflow=0.63 cfs 6,048 cf

Pond INF: PROP INF. SYSTEM #1 Peak Elev=99.53' Storage=313 cf Inflow=0.38 cfs 1,344 cf
Discarded=0.03 cfs 1,079 cf Primary=0.16 cfs 265 cf Outflow=0.19 cfs 1,344 cf

Pond OW: PROP O/W SEPARATOR Peak Elev=95.40' Inflow=0.24 cfs 1,188 cf
6.0" Round Culvert n=0.010 L=5.0' S=0.0100 '/' Outflow=0.24 cfs 1,188 cf

Total Runoff Area = 76,300 sf Runoff Volume = 7,671 cf Average Runoff Depth = 1.21"
50.36% Pervious = 38,427 sf 49.64% Impervious = 37,873 sf

Summary for Subcatchment 1S: RUNOFF TO EAST GROVE STREET

Runoff = 0.14 cfs @ 12.12 hrs, Volume= 544 cf, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
5,507	39	>75% Grass cover, Good, HSG A
4,654	98	Paved parking, HSG A
10,161	66	Weighted Average
5,507		54.20% Pervious Area
4,654		45.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	25	0.0100	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.5	65	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	165	0.0140	2.40		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.9	255	Total			

Summary for Subcatchment 2S: RUNOFF TO EAST GROVE STREET

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

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
2,269	39	>75% Grass cover, Good, HSG A
2,269		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	20	0.0250	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9	80	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
3.4	100	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: RUNOFF TO EAST (DP#2)

[45] Hint: Runoff=Zero

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

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
4,110	30	Woods, Good, HSG A
15,165	39	>75% Grass cover, Good, HSG A
19,275	37	Weighted Average
19,275		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	25	0.0300	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	150	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	175	Total			

Summary for Subcatchment 10S: RUNOFF TO BASIN

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

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
5,947	39	>75% Grass cover, Good, HSG A
5,947		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	20	0.0200	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.0	13	0.3300	8.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
2.7	33	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 11S: RUNOFF TO CB-1

Runoff = 0.30 cfs @ 12.09 hrs, Volume= 950 cf, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
981	39	>75% Grass cover, Good, HSG A
4,730	98	Paved parking, HSG A
5,711	88	Weighted Average
981		17.18% Pervious Area
4,730		82.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	13	0.1500	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	65	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.4	78	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 12S: RUNOFF TO CB-2

Runoff = 0.12 cfs @ 12.10 hrs, Volume= 408 cf, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
2,100	39	>75% Grass cover, Good, HSG A
2,879	98	Paved parking, HSG A
4,979	73	Weighted Average
2,100		42.18% Pervious Area
2,879		57.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	25	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.5	65	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 13S: RUNOFF TO CB-3

Runoff = 0.74 cfs @ 12.09 hrs, Volume= 2,357 cf, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
2,348	39	>75% Grass cover, Good, HSG A
11,818	98	Paved parking, HSG A
14,166	88	Weighted Average
2,348		16.57% Pervious Area
11,818		83.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	15	0.2500	0.32		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.7	130	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	145	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 14S: RUNOFF TO CB-4

Runoff = 0.38 cfs @ 12.09 hrs, Volume= 1,343 cf, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
5,431	98	Paved parking, HSG A
5,431		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0100	0.79		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.5	65	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	90	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 15S: CANOPY RUNOFF

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 724 cf, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
2,928	98	Roofs, HSG A
2,928		100.00% Impervious Area

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

Summary for Subcatchment 16S: C-STORE RUNOFF

Runoff = 0.38 cfs @ 12.09 hrs, Volume= 1,344 cf, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
5,433	98	Roofs, HSG A
5,433		100.00% Impervious Area

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

Summary for Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP#1)

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

Inflow Area = 57,025 sf, 66.41% Impervious, Inflow Depth = 1.39" for 2-year event
Inflow = 0.76 cfs @ 12.11 hrs, Volume= 6,592 cf
Outflow = 0.76 cfs @ 12.11 hrs, Volume= 6,592 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach WYE: PROP WYE CONNECTION

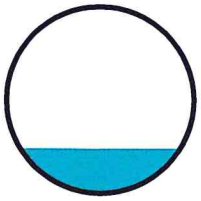
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 44,595 sf, 74.49% Impervious, Inflow Depth = 1.58" for 2-year event
Inflow = 0.45 cfs @ 12.11 hrs, Volume= 5,877 cf
Outflow = 0.45 cfs @ 12.11 hrs, Volume= 5,878 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.10 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.56 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 10.0' Slope= 0.0100 '/'
Inlet Invert= 95.00', Outlet Invert= 94.90'



Summary for Pond 1: PROP CB-1

Inflow Area = 5,711 sf, 82.82% Impervious, Inflow Depth = 2.00" for 2-year event
Inflow = 0.30 cfs @ 12.09 hrs, Volume= 950 cf
Outflow = 0.30 cfs @ 12.09 hrs, Volume= 950 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.30 cfs @ 12.09 hrs, Volume= 950 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 95.81' @ 12.10 hrs
Flood Elev= 99.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	95.50'	**12.0" Round Culvert** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.50' / 95.45' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.27 cfs @ 12.09 hrs HW=95.81' TW=95.70' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.27 cfs @ 1.96 fps)

Summary for Pond 2: PROP CB-2

Inflow Area = 4,979 sf, 57.82% Impervious, Inflow Depth = 0.98" for 2-year event
Inflow = 0.12 cfs @ 12.10 hrs, Volume= 408 cf
Outflow = 0.12 cfs @ 12.10 hrs, Volume= 408 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.12 cfs @ 12.10 hrs, Volume= 408 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 96.54' @ 12.10 hrs
Flood Elev= 100.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	96.35'	**12.0" Round Culvert** L= 128.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 96.35' / 95.45' S= 0.0070 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.12 cfs @ 12.10 hrs HW=96.54' TW=95.70' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.12 cfs @ 1.75 fps)

Summary for Pond 3: PROP CB-3

Inflow Area = 22,527 sf, 89.58% Impervious, Inflow Depth = 1.78" for 2-year event
Inflow = 0.97 cfs @ 12.10 hrs, Volume= 3,347 cf
Outflow = 0.97 cfs @ 12.10 hrs, Volume= 3,347 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.97 cfs @ 12.10 hrs, Volume= 3,347 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 97.35' @ 12.11 hrs
Flood Elev= 99.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	96.75'	**12.0" Round Culvert** L= 157.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 96.75' / 96.00' S= 0.0048 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.92 cfs @ 12.10 hrs HW=97.34' TW=96.54' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.92 cfs @ 2.73 fps)

Summary for Pond 4: PROP CB-4

Inflow Area = 5,431 sf,100.00% Impervious, Inflow Depth = 2.97" for 2-year event
Inflow = 0.38 cfs @ 12.09 hrs, Volume= 1,343 cf
Outflow = 0.38 cfs @ 12.09 hrs, Volume= 1,343 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.38 cfs @ 12.09 hrs, Volume= 1,343 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 96.85' @ 12.62 hrs
Flood Elev= 100.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	96.10'	**12.0" Round Culvert** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 96.10' / 96.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=96.51' TW=96.52' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)

Summary for Pond BAS: PROP. ABOVE GROUND DETENTION BASIN

[80] Warning: Exceeded Pond DMH2 by 0.01' @ 12.35 hrs (0.36 cfs 271 cf)

Inflow Area = 33,905 sf, 75.53% Impervious, Inflow Depth = 1.66" for 2-year event
Inflow = 1.35 cfs @ 12.10 hrs, Volume= 4,690 cf
Outflow = 0.33 cfs @ 12.54 hrs, Volume= 4,690 cf, Atten= 76%, Lag= 26.6 min
Primary = 0.33 cfs @ 12.54 hrs, Volume= 4,690 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 96.84' @ 12.54 hrs Surf.Area= 1,745 sf Storage= 1,507 cf
Flood Elev= 99.00' Surf.Area= 4,080 sf Storage= 7,125 cf

Plug-Flow detention time= 43.6 min calculated for 4,682 cf (100% of inflow)
Center-of-Mass det. time= 43.5 min (828.9 - 785.4)

Volume	Invert	Avail.Storage	Storage Description
#1	95.50'	7,125 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
95.50	0	0.0	0	0	0
96.00	1,325	144.0	221	221	1,651
98.00	2,420	194.0	3,690	3,911	3,037
99.00	4,080	250.0	3,214	7,125	5,028

Device	Routing	Invert	Outlet Devices
#1	Primary	95.50'	**12.0" Round Culvert** L= 95.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.50' / 95.00' S= 0.0053 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	95.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.70'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	97.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 1	98.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.33 cfs @ 12.54 hrs HW=96.84' TW=95.23' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.33 cfs of 2.73 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.26 cfs @ 5.31 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.07 cfs @ 1.27 fps)
  ├─**4=Orifice/Grate** (Controls 0.00 cfs)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond DMH1: PROP DMH-1

Inflow Area =	10,690 sf, 71.18% Impervious,	Inflow Depth =	1.52"	for 2-year event
Inflow =	0.42 cfs @ 12.09 hrs, Volume=	1,358 cf		
Outflow =	0.42 cfs @ 12.09 hrs, Volume=	1,358 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	0.24 cfs @ 12.09 hrs, Volume=	1,188 cf		
Secondary =	0.18 cfs @ 12.09 hrs, Volume=	170 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 95.70' @ 12.09 hrs
Flood Elev= 99.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	95.35'	**6.0" Round Culvert** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.35' / 95.30' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Secondary	95.50'	**12.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.50' / 94.90' S= 0.0600 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.24 cfs @ 12.09 hrs HW=95.70' TW=95.40' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.24 cfs @ 2.27 fps)

Secondary OutFlow Max=0.17 cfs @ 12.09 hrs HW=95.70' TW=95.20' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 0.17 cfs @ 1.53 fps)

Summary for Pond DMH2: PROP STORMCEPTOR

[80] Warning: Exceeded Pond 4 by 0.04' @ 12.25 hrs (0.43 cfs 589 cf)

Inflow Area =	27,958 sf, 91.60% Impervious,	Inflow Depth =	2.01"	for 2-year event
Inflow =	1.35 cfs @ 12.10 hrs, Volume=	4,690 cf		
Outflow =	1.35 cfs @ 12.10 hrs, Volume=	4,690 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	1.35 cfs @ 12.10 hrs, Volume=	4,690 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 96.85' @ 12.57 hrs
Flood Elev= 100.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	95.75'	**12.0" Round Culvert** L= 28.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.75' / 95.50' S= 0.0089 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.97 cfs @ 12.10 hrs HW=96.53' TW=96.39' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.97 cfs @ 2.03 fps)

Summary for Pond DMH3: PROP DMH-3

[62] Hint: Exceeded Reach WYE OUTLET depth by 0.06' @ 12.10 hrs

Inflow Area =	44,595 sf,	74.49% Impervious,	Inflow Depth =	1.63"	for 2-year event
Inflow =	0.63 cfs @	12.10 hrs, Volume=	6,048 cf		
Outflow =	0.63 cfs @	12.10 hrs, Volume=	6,048 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	0.63 cfs @	12.10 hrs, Volume=	6,048 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 95.20' @ 12.10 hrs
Flood Elev= 100.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	94.80'	**12.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.80' / 94.35' S= 0.0225 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.63 cfs @ 12.10 hrs HW=95.20' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.63 cfs @ 2.15 fps)

Summary for Pond INF: PROP INF. SYSTEM #1

RAWL'S RATES BASED ON LOAMY SAND = 2.41 IN/HR

[87] Warning: Oscillations may require Finer Routing or smaller dt (severity=66)

Inflow Area =	5,433 sf,100.00%	Impervious,	Inflow Depth =	2.97"	for 2-year event
Inflow =	0.38 cfs @	12.09 hrs, Volume=	1,344 cf		
Outflow =	0.19 cfs @	12.24 hrs, Volume=	1,344 cf,	Atten= 50%,	Lag= 9.2 min
Discarded =	0.03 cfs @	12.24 hrs, Volume=	1,079 cf		
Primary =	0.16 cfs @	12.24 hrs, Volume=	265 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 99.53' @ 12.24 hrs Surf.Area= 543 sf Storage= 313 cf
Flood Elev= 100.27' Surf.Area= 543 sf Storage= 499 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 41.0 min (797.4 - 756.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	98.42'	303 cf	**13.13'W x 41.33'L x 1.88'H Field A** 1,018 cf Overall - 261 cf Embedded = 757 cf x 40.0% Voids
#2A	98.75'	202 cf	**ADS N-12 12** x 12 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf Row Length Adjustment= -2.42' x 0.81 sf x 6 rows 11.79' Header x 0.81 sf x 2 = 19.1 cf Inside
		505 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	99.25'	**6.0" Round Culvert** L= 93.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 99.25' / 97.00' S= 0.0242 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Discarded	98.42'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.03 cfs @ 12.24 hrs HW=99.53' (Free Discharge)
2=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.16 cfs @ 12.24 hrs HW=99.53' TW=97.26' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.16 cfs @ 1.42 fps)

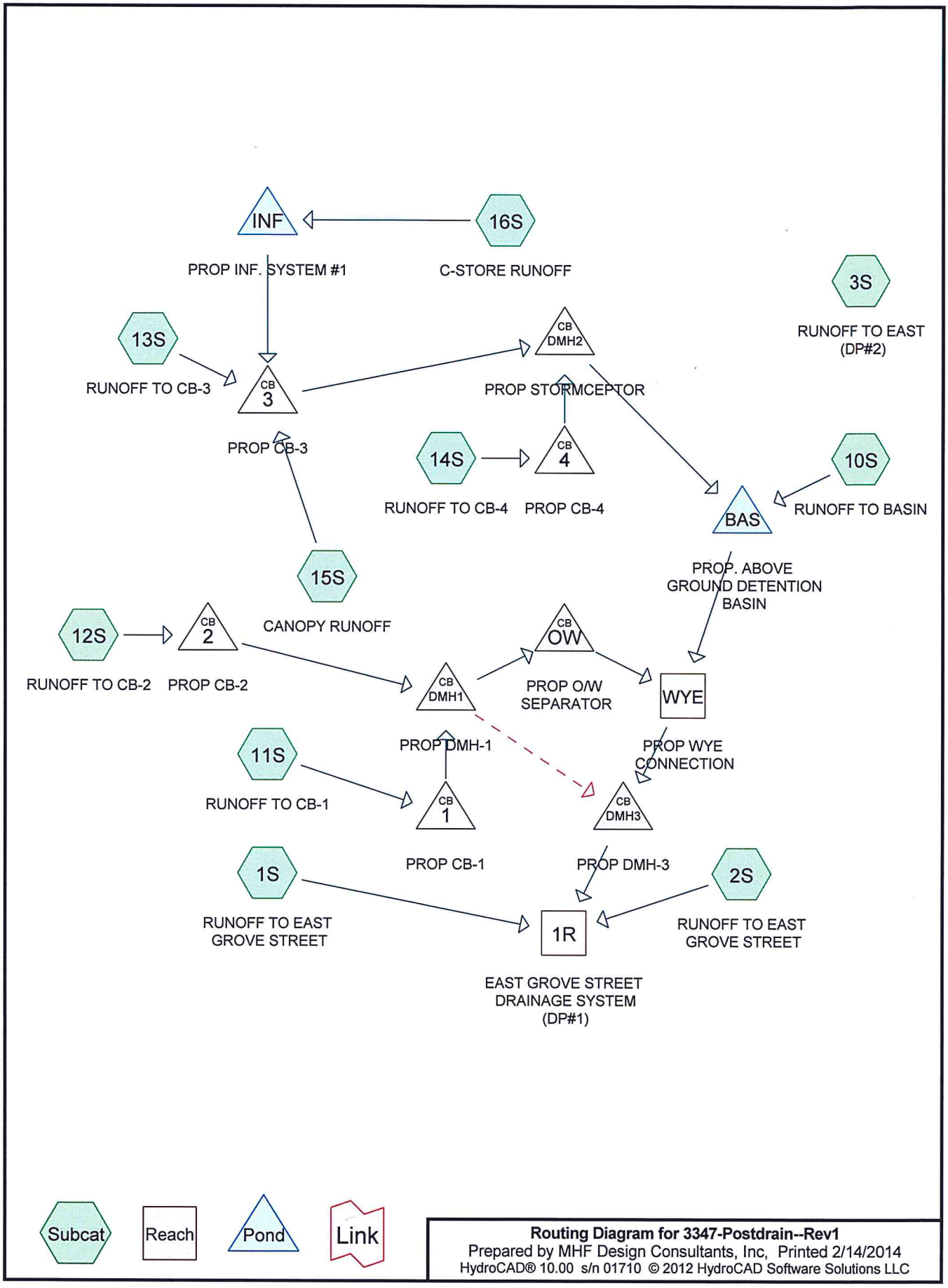
Summary for Pond OW: PROP O/W SEPARATOR

Inflow Area = 10,690 sf, 71.18% Impervious, Inflow Depth = 1.33" for 2-year event
Inflow = 0.24 cfs @ 12.09 hrs, Volume= 1,188 cf
Outflow = 0.24 cfs @ 12.09 hrs, Volume= 1,188 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.24 cfs @ 12.09 hrs, Volume= 1,188 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 95.40' @ 12.09 hrs
Flood Elev= 99.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	95.05'	**6.0" Round Culvert** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.05' / 95.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.24 cfs @ 12.09 hrs HW=95.40' TW=95.24' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.24 cfs @ 2.27 fps)



Routing Diagram for 3347-Postdrain--Rev1
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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	WYE	95.00	94.90	10.0	0.0100	0.013	12.0	0.0	0.0
2	1	95.50	95.45	5.0	0.0100	0.013	12.0	0.0	0.0
3	2	96.35	95.45	128.0	0.0070	0.013	12.0	0.0	0.0
4	3	96.75	96.00	157.0	0.0048	0.013	12.0	0.0	0.0
5	4	96.10	96.00	5.0	0.0200	0.013	12.0	0.0	0.0
6	BAS	95.50	95.00	95.0	0.0053	0.013	12.0	0.0	0.0
7	DMH1	95.35	95.30	5.0	0.0100	0.010	6.0	0.0	0.0
8	DMH1	95.50	94.90	10.0	0.0600	0.013	12.0	0.0	0.0
9	DMH2	95.75	95.50	28.0	0.0089	0.013	12.0	0.0	0.0
10	DMH3	94.80	94.35	20.0	0.0225	0.013	12.0	0.0	0.0
11	INF	99.25	97.00	93.0	0.0242	0.010	6.0	0.0	0.0
12	OW	95.05	95.00	5.0	0.0100	0.010	6.0	0.0	0.0

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: RUNOFF TO EAST GROVE Runoff Area=10,161 sf 45.80% Impervious Runoff Depth=0.00"
Flow Length=255' Tc=6.9 min CN=66 Runoff=0.00 cfs 0 cf

Subcatchment 2S: RUNOFF TO EAST GROVE Runoff Area=2,269 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=100' Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment 3S: RUNOFF TO EAST (DP#2) Runoff Area=19,275 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=175' Slope=0.0300 '/' Tc=8.9 min CN=37 Runoff=0.00 cfs 0 cf

Subcatchment 10S: RUNOFF TO BASIN Runoff Area=5,947 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=33' Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment 11S: RUNOFF TO CB-1 Runoff Area=5,711 sf 82.82% Impervious Runoff Depth=0.25"
Flow Length=78' Tc=6.0 min CN=88 Runoff=0.03 cfs 120 cf

Subcatchment 12S: RUNOFF TO CB-2 Runoff Area=4,979 sf 57.82% Impervious Runoff Depth=0.02"
Flow Length=65' Tc=6.0 min CN=73 Runoff=0.00 cfs 7 cf

Subcatchment 13S: RUNOFF TO CB-3 Runoff Area=14,166 sf 83.43% Impervious Runoff Depth=0.25"
Flow Length=145' Tc=6.0 min CN=88 Runoff=0.08 cfs 299 cf

Subcatchment 14S: RUNOFF TO CB-4 Runoff Area=5,431 sf 100.00% Impervious Runoff Depth=0.79"
Flow Length=90' Slope=0.0100 '/' Tc=6.0 min CN=98 Runoff=0.11 cfs 358 cf

Subcatchment 15S: CANOPY RUNOFF Runoff Area=2,928 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=98 Runoff=0.06 cfs 193 cf

Subcatchment 16S: C-STORE RUNOFF Runoff Area=5,433 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=98 Runoff=0.11 cfs 358 cf

Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP#1) Inflow=0.15 cfs 977 cf
Outflow=0.15 cfs 977 cf

Reach WYE: PROP WYE CONNECTION Avg. Flow Depth=0.14' Max Vel=2.23 fps Inflow=0.15 cfs 977 cf
12.0" Round Pipe n=0.013 L=10.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=0.15 cfs 977 cf

Pond 1: PROP CB-1 Peak Elev=95.60' Inflow=0.03 cfs 120 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0100 '/' Outflow=0.03 cfs 120 cf

Pond 2: PROP CB-2 Peak Elev=96.36' Inflow=0.00 cfs 7 cf
12.0" Round Culvert n=0.013 L=128.0' S=0.0070 '/' Outflow=0.00 cfs 7 cf

Pond 3: PROP CB-3 Peak Elev=96.97' Inflow=0.14 cfs 492 cf
12.0" Round Culvert n=0.013 L=157.0' S=0.0048 '/' Outflow=0.14 cfs 492 cf

Pond 4: PROP CB-4 Peak Elev=96.26' Inflow=0.11 cfs 358 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.11 cfs 358 cf

Pond BAS: PROP. ABOVE GROUND DETENTION Peak Elev=95.89' Storage=104 cf Inflow=0.25 cfs 850 cf
Outflow=0.12 cfs 850 cf

Pond DMH1: PROP DMH-1 Peak Elev=95.47' Inflow=0.03 cfs 127 cf
Primary=0.03 cfs 127 cf Secondary=0.00 cfs 0 cf Outflow=0.03 cfs 127 cf

Pond DMH2: PROP STORMCEPTOR Peak Elev=96.03' Inflow=0.25 cfs 850 cf
12.0" Round Culvert n=0.013 L=28.0' S=0.0089 '/' Outflow=0.25 cfs 850 cf

Pond DMH3: PROP DMH-3 Peak Elev=94.98' Inflow=0.15 cfs 977 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0225 '/' Outflow=0.15 cfs 977 cf

Pond INF: PROP INF. SYSTEM #1 Peak Elev=98.72' Storage=65 cf Inflow=0.11 cfs 358 cf
Discarded=0.03 cfs 359 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 359 cf

Pond OW: PROP O/W SEPARATOR Peak Elev=95.18' Inflow=0.03 cfs 127 cf
6.0" Round Culvert n=0.010 L=5.0' S=0.0100 '/' Outflow=0.03 cfs 127 cf

Total Runoff Area = 76,300 sf Runoff Volume = 1,335 cf Average Runoff Depth = 0.21"
50.36% Pervious = 38,427 sf 49.64% Impervious = 37,873 sf

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: RUNOFF TO EAST GROVE Runoff Area=10,161 sf 45.80% Impervious Runoff Depth=1.53"
Flow Length=255' Tc=6.9 min CN=66 Runoff=0.38 cfs 1,293 cf

Subcatchment 2S: RUNOFF TO EAST GROVE Runoff Area=2,269 sf 0.00% Impervious Runoff Depth=0.14"
Flow Length=100' Tc=6.0 min CN=39 Runoff=0.00 cfs 27 cf

Subcatchment 3S: RUNOFF TO EAST (DP#2) Runoff Area=19,275 sf 0.00% Impervious Runoff Depth=0.09"
Flow Length=175' Slope=0.0300 '/' Tc=8.9 min CN=37 Runoff=0.01 cfs 147 cf

Subcatchment 10S: RUNOFF TO BASIN Runoff Area=5,947 sf 0.00% Impervious Runoff Depth=0.14"
Flow Length=33' Tc=6.0 min CN=39 Runoff=0.00 cfs 71 cf

Subcatchment 11S: RUNOFF TO CB-1 Runoff Area=5,711 sf 82.82% Impervious Runoff Depth=3.38"
Flow Length=78' Tc=6.0 min CN=88 Runoff=0.50 cfs 1,611 cf

Subcatchment 12S: RUNOFF TO CB-2 Runoff Area=4,979 sf 57.82% Impervious Runoff Depth=2.05"
Flow Length=65' Tc=6.0 min CN=73 Runoff=0.27 cfs 850 cf

Subcatchment 13S: RUNOFF TO CB-3 Runoff Area=14,166 sf 83.43% Impervious Runoff Depth=3.38"
Flow Length=145' Tc=6.0 min CN=88 Runoff=1.24 cfs 3,996 cf

Subcatchment 14S: RUNOFF TO CB-4 Runoff Area=5,431 sf 100.00% Impervious Runoff Depth=4.46"
Flow Length=90' Slope=0.0100 '/' Tc=6.0 min CN=98 Runoff=0.56 cfs 2,020 cf

Subcatchment 15S: CANOPY RUNOFF Runoff Area=2,928 sf 100.00% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=98 Runoff=0.30 cfs 1,089 cf

Subcatchment 16S: C-STORE RUNOFF Runoff Area=5,433 sf 100.00% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=98 Runoff=0.56 cfs 2,021 cf

Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP#1) Inflow=1.56 cfs 11,605 cf
Outflow=1.56 cfs 11,605 cf

Reach WYE: PROP WYE CONNECTION Avg. Flow Depth=0.40' Max Vel=4.09 fps Inflow=1.21 cfs 9,823 cf
12.0" Round Pipe n=0.013 L=10.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=1.21 cfs 9,823 cf

Pond 1: PROP CB-1 Peak Elev=95.93' Inflow=0.50 cfs 1,611 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0100 '/' Outflow=0.50 cfs 1,611 cf

Pond 2: PROP CB-2 Peak Elev=96.63' Inflow=0.27 cfs 850 cf
12.0" Round Culvert n=0.013 L=128.0' S=0.0070 '/' Outflow=0.27 cfs 850 cf

Pond 3: PROP CB-3 Peak Elev=97.69' Inflow=1.86 cfs 5,733 cf
12.0" Round Culvert n=0.013 L=157.0' S=0.0048 '/' Outflow=1.86 cfs 5,733 cf

Pond 4: PROP CB-4 Peak Elev=97.28' Inflow=0.56 cfs 2,020 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.56 cfs 2,020 cf

Pond BAS: PROP. ABOVE GROUND DETENTION Peak Elev=97.22' Storage=2,202 cf Inflow=2.42 cfs 7,824 cf
Outflow=1.01 cfs 7,824 cf

Pond DMH1: PROP DMH-1 Peak Elev=95.81' Inflow=0.76 cfs 2,461 cf
Primary=0.37 cfs 1,998 cf Secondary=0.40 cfs 462 cf Outflow=0.76 cfs 2,461 cf

Pond DMH2: PROP STORMCEPTOR Peak Elev=97.28' Inflow=2.42 cfs 7,753 cf
12.0" Round Culvert n=0.013 L=28.0' S=0.0089 '/' Outflow=2.42 cfs 7,753 cf

Pond DMH3: PROP DMH-3 Peak Elev=95.41' Inflow=1.33 cfs 10,285 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0225 '/' Outflow=1.33 cfs 10,285 cf

Pond INF: PROP INF. SYSTEM #1 Peak Elev=99.77' Storage=390 cf Inflow=0.56 cfs 2,021 cf
Discarded=0.03 cfs 1,374 cf Primary=0.38 cfs 648 cf Outflow=0.42 cfs 2,022 cf

Pond OW: PROP O/W SEPARATOR Peak Elev=95.51' Inflow=0.37 cfs 1,998 cf
6.0" Round Culvert n=0.010 L=5.0' S=0.0100 '/' Outflow=0.37 cfs 1,998 cf

Total Runoff Area = 76,300 sf Runoff Volume = 13,124 cf Average Runoff Depth = 2.06"
50.36% Pervious = 38,427 sf 49.64% Impervious = 37,873 sf

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: RUNOFF TO EAST GROVE Runoff Area=10,161 sf 45.80% Impervious Runoff Depth=3.20"
Flow Length=255' Tc=6.9 min CN=66 Runoff=0.83 cfs 2,713 cf

Subcatchment 2S: RUNOFF TO EAST GROVE Runoff Area=2,269 sf 0.00% Impervious Runoff Depth=0.77"
Flow Length=100' Tc=6.0 min CN=39 Runoff=0.02 cfs 145 cf

Subcatchment 3S: RUNOFF TO EAST (DP#2) Runoff Area=19,275 sf 0.00% Impervious Runoff Depth=0.63"
Flow Length=175' Slope=0.0300 '/' Tc=8.9 min CN=37 Runoff=0.12 cfs 1,006 cf

Subcatchment 10S: RUNOFF TO BASIN Runoff Area=5,947 sf 0.00% Impervious Runoff Depth=0.77"
Flow Length=33' Tc=6.0 min CN=39 Runoff=0.06 cfs 381 cf

Subcatchment 11S: RUNOFF TO CB-1 Runoff Area=5,711 sf 82.82% Impervious Runoff Depth=5.59"
Flow Length=78' Tc=6.0 min CN=88 Runoff=0.80 cfs 2,662 cf

Subcatchment 12S: RUNOFF TO CB-2 Runoff Area=4,979 sf 57.82% Impervious Runoff Depth=3.94"
Flow Length=65' Tc=6.0 min CN=73 Runoff=0.52 cfs 1,633 cf

Subcatchment 13S: RUNOFF TO CB-3 Runoff Area=14,166 sf 83.43% Impervious Runoff Depth=5.59"
Flow Length=145' Tc=6.0 min CN=88 Runoff=1.99 cfs 6,603 cf

Subcatchment 14S: RUNOFF TO CB-4 Runoff Area=5,431 sf 100.00% Impervious Runoff Depth=6.76"
Flow Length=90' Slope=0.0100 '/' Tc=6.0 min CN=98 Runoff=0.84 cfs 3,060 cf

Subcatchment 15S: CANOPY RUNOFF Runoff Area=2,928 sf 100.00% Impervious Runoff Depth=6.76"
Tc=6.0 min CN=98 Runoff=0.45 cfs 1,650 cf

Subcatchment 16S: C-STORE RUNOFF Runoff Area=5,433 sf 100.00% Impervious Runoff Depth=6.76"
Tc=6.0 min CN=98 Runoff=0.84 cfs 3,061 cf

Reach 1R: EAST GROVE STREET DRAINAGE SYSTEM (DP#1) Inflow=3.61 cfs 20,199 cf
Outflow=3.61 cfs 20,199 cf

Reach WYE: PROP WYE CONNECTION Avg. Flow Depth=0.56' Max Vel=4.76 fps Inflow=2.17 cfs 16,277 cf
12.0" Round Pipe n=0.013 L=10.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=2.17 cfs 16,277 cf

Pond 1: PROP CB-1 Peak Elev=96.08' Inflow=0.80 cfs 2,662 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0100 '/' Outflow=0.80 cfs 2,662 cf

Pond 2: PROP CB-2 Peak Elev=96.75' Inflow=0.52 cfs 1,633 cf
12.0" Round Culvert n=0.013 L=128.0' S=0.0070 '/' Outflow=0.52 cfs 1,633 cf

Pond 3: PROP CB-3 Peak Elev=99.42' Inflow=3.01 cfs 9,605 cf
12.0" Round Culvert n=0.013 L=157.0' S=0.0048 '/' Outflow=3.01 cfs 9,605 cf

Pond 4: PROP CB-4 Peak Elev=98.30' Inflow=0.84 cfs 3,060 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.84 cfs 3,060 cf

Pond BAS: PROP. ABOVE GROUND DETENTION Peak Elev=97.78' Storage=3,392 cf Inflow=3.89 cfs 13,045 cf
Outflow=1.85 cfs 13,045 cf

Pond DMH1: PROP DMH-1 Peak Elev=95.99' Inflow=1.32 cfs 4,295 cf
Primary=0.53 cfs 3,232 cf Secondary=0.79 cfs 1,063 cf Outflow=1.32 cfs 4,295 cf

Pond DMH2: PROP STORMCEPTOR Peak Elev=98.28' Inflow=3.84 cfs 12,665 cf
12.0" Round Culvert n=0.013 L=28.0' S=0.0089 '/' Outflow=3.84 cfs 12,665 cf

Pond DMH3: PROP DMH-3 Peak Elev=95.83' Inflow=2.76 cfs 17,340 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0225 '/' Outflow=2.76 cfs 17,340 cf

Pond INF: PROP INF. SYSTEM #1 Peak Elev=100.20' Storage=485 cf Inflow=0.84 cfs 3,061 cf
Discarded=0.03 cfs 1,710 cf Primary=0.60 cfs 1,352 cf Outflow=0.63 cfs 3,062 cf

Pond OW: PROP O/W SEPARATOR Peak Elev=95.78' Inflow=0.53 cfs 3,232 cf
6.0" Round Culvert n=0.010 L=5.0' S=0.0100 '/' Outflow=0.53 cfs 3,232 cf

Total Runoff Area = 76,300 sf Runoff Volume = 22,914 cf Average Runoff Depth = 3.60"
50.36% Pervious = 38,427 sf 49.64% Impervious = 37,873 sf

MAP 65 LOT 349
N/F RONALD & ANN SHOGAM
149 WOOD STREET
MIDDLEBOROUGH, MA 02346
BOOK 4101 PAGE 44

MAP 65 LOT 264
N/F HEATHER GARDENS
CONDOMINIUMS

MAP 65 LOT 387
N/F JOHN JR., & DALE SYNNOTT
P.O. BOX 211
MIDDLEBOROUGH, MA 02346
BOOK 5207 PAGE 285

MAP 65 LOT 1137
N/F SEVEN HILL TRUST
ERNESTO V. CAPARRATTA, TRUSTEE
195 LIBBEY PARKWAY, UNIT 2
WEYMOUTH, MA 02189
BOOK 37512 PAGE 70

MAP 65 LOT 372
20,062 Sq.Ft.
0.46 Ac.±

DESIGN POINT #2

DESIGN POINT #1

PROPOSED CONVENIENCE STORE
4,513 SF
FF=101.70

PROPOSED DETENTION BASIN #1

PROP. LIMIT OF STONE

PROP. ROOF INFILTRATION SYSTEM

OCS #2

PROP. 12" RISER (4-TOTAL)

PROP. 6" CLEANOUT (8-TOTAL)

PROP. ROOF DRAIN

PROP. CANOPY DRAIN

PROPOSED OIL/WATER SEPARATOR

OCS-1

WOOD STREET

OLD WOOD STREET

EAST GROVE STREET
(PUBLIC-70' WIDE-LAYOUT #2679)

S58°31'36"E 195.17'

S58°21'54"W 61.28'

S32°30'25"W 171.34'

N58°31'36"W 171.48'

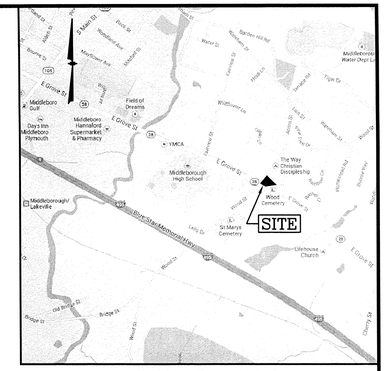
S=96°34'10"
R=50.00'
L=84.27'

1S 3S 10S 11S 12S 13S 14S 15S 16S 2S

MASS HIGHWAY LAYOUT No. 2679 BASELINE

MAP 65 LOT 1067

LOCATION MAP



WATERSHED LEGEND:

1 — SUBCATCHMENT: A relatively homogeneous area of land that drains into a single reach or pond. Each subcatchment generates a runoff hydrograph. (A subcatchment may also be used to account for the rain falling directly on the surface of a pond.)

1 — REACH: A uniform stream, channel, or pipe that conveys water from one point to another reach or pond. The outflow of each reach is determined by a hydrograph routing calculation.

1 — POND: A pond, swamp, dam, or other impoundment that fills with water from one or more sources and empties in a manner determined by a weir, culvert, or other device(s) at its outlet. The outflow(s) of each pond is determined by a hydrograph routing calculation. The primary and/or secondary outflow may drain into a reach or into another pond.

- Time of Concentration Path (Tc)

DRAINAGE DIVIDE LINE

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

LEGEND

- OVERHEAD SERVICE WIRES
- VERTICAL GRANITE CURB
- VERICAL CONCRETE CURB
- SIGN
- OBSERVATION WELL
- SPOT ELEVATION
- CONTOUR ELEVATION
- LANDSCAPED
- UNDERGROUND ELECTRIC
- POST AND RAIL FENCE
- UTILITY POLE
- DRAIN MANHOLE
- SEWER MANHOLE
- TELEPHONE MANHOLE
- CATCH BASIN
- WATER LINE
- GAS LINE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT

DIG SAFE
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MA-ME-NH-RI-VT
1-888-DIGSAFE
NY 1-800-962-7962
CT 1-800-922-4455

REVISIONS		
DATE	REV. BY.	DESCRIPTION

69,179 SQUARE FEET
1.588± ACRES
V #X
Store #X
Gas Station#
Facility #X

MHF Design Consultants, Inc.
44 Stiles Road, Suite One
Salem, New Hampshire 03079
(603) 893-0720
ENGINEERS • PLANNERS • SURVEYORS
www.mhfdesign.com

90 EAST GROVE STREET
MIDDLEBOROUGH, MASSACHUSETTS

CUMBERLAND FARMS INC.
100 CROSSING BLVD.
FRAMINGHAM, MA 01702

SCALE: 1"= 20'
DATE: DECEMBER 9, 2013
FILE: 3347PrePost.dwg
DRAWN BY: MHF
CHECKED BY:

POST DEVELOPMENT DRAINAGE PLAN

1 OF 1

F:\Projects\Eng\3347113\Drainage\3347PrePost.dwg Postdrain 12/13/13 10:30am cmt

OPERATION & MAINTENANCE PLAN
And
LONG TERM POLLUTION PREVENTION PLAN
For
STORMWATER MANAGEMENT SYSTEMS

Map 65 Lots 299, 372 & 1112

90 East Grove Street
Middleborough, MA 02346

Prepared For:

Cumberland Farms, Inc.
100 Crossing Boulevard
Framingham, MA 01702

December 9, 2013
Revised: February 14, 2014

Prepared By:

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ENGINEERS • PLANNERS • SURVEYORS
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MHF Project #334713

OPERATION & MAINTENANCE PLAN AND LONG TERM POLLUTION PREVENTION PLAN

The Stormwater Policy developed by the Massachusetts Department of Environmental Protection and Office of Coastal Zone Management requires that an Operation and Maintenance Plan (O&M) and a Long Term Pollution Prevention Plan (LTPPP) be submitted for review and approval. As suggested in the Stormwater Handbook these plans have been combined to provide one focal point for the control of stormwater quality and quantity from the site. The plans shall include the parties responsible for scheduling inspections and maintenance, routine and non-routine maintenance tasks, nutrient source control procedures and provisions for appropriate access and maintenance easements surrounding controls and extending to the public right-of-way.

The owner of record shall be responsible for the installation, operation, and maintenance of all stormwater management systems after construction and for the implementation of the LTPPP. Logs of inspections and cleanings shall be maintained by the owner of record and annual BMP inspection forms shall be filed with the Town of Middleborough, as required. Copies will need to be kept for the most recent three years and made available to the Board of Selectman upon request. An annual summary (in log form) of the Inspection and Maintenance performed on site shall also be included as part of the submittal.

Operation and Maintenance Plan:

Documentation:
A maintenance log shall be kept summarizing inspections, maintenance and any corrective actions taken. The log shall include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations. The logs shall be made accessible to department staff and a copy provided to the department upon request.

Inspection and Maintenance Frequency and Corrective Measures:
The following areas, facilities and measures will be inspected and the identified deficiencies will be corrected. Clean out must include the removal and legal disposal of any accumulated sediments and debris and disposed of in accordance with applicable local, state, and federal guidelines and regulations.

1. Street Sweeping

Sweeping should be conducted a minimum of once per month (primarily during spring and fall). Sweeping shall be done once in the early fall and then immediately following spring snowmelt to remove sand and other debris. Pavement surfaces shall be swept at other times such as in the fall after leaves have dropped to remove accumulated debris. Since contaminants typically accumulate within 12 inches of the curbline, street cleaning operations should concentrate in cleaning curb and gutter lines for maximum pollutant removal efficiency. Other areas shall also be swept periodically when visual buildup of debris is apparent. Once removed from paved surfaces, the sweeping must

be handled and disposed of properly. In accordance with MassDEP's Bureau of Waste Prevention, the reuse and disposal of sweepings can be used in three ways: In one of the ways already approved by MassDEP (e.g. daily cover in a landfill, additive to compost, fill in a public way); if approved under a Beneficial Use Determination; disposed in a landfill.

2. Deep Sump Hooded Catch Basins

Inspect catch basins at least 4 times per year and at the end of the foliage and snow removal seasons (preferably in spring and fall) to ensure that the catch basins are working in their intended fashion and that they are free of debris. Sediment must also be removed 4 times per year of whenever the depth of deposits is greater than or equal to one half the depth form the bottom of the invert of the lowest pipe in the basin. If the basin outlet is designed with a hood to trap floatable materials check to ensure watertight seal is working. At a minimum, remove floating debris and hydrocarbons at the time of the inspection. Sediment and debris can be removed by a clamshell bucket; however a vacuum truck is preferred. A vacuum truck must be used at a minimum of once per year for sediment removal. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations.

3. Vegetated Areas

Inspect slopes and embankments early in the growing season to identify active or potential erosion problems. Replant bare areas or areas with sparse growth. Where rill erosion is evident, armor the area with an appropriate lining or divert the erosive flows to on-site areas able to withstand the concentrated flows. During the summer months, all landscape features are to be maintained with the minimum possible amount of fertilizers, pesticides or herbicides. Lawn fertilizers is to be organic and a reduced nitrogen content. If in question, maintenance personnel should check with the Conservation Commission. All personnel involved with the maintenance of landscaping will be informed of this condition.

4. Subsurface Stormwater Systems

A system should initially be inspected within the first three months after completion of the site's construction.

Preventive maintenance should be performed at least every six months and sediment shall be removed from pretreatment BMP's after every major storm event. The Infiltration System shall be inspected on regular bi-annual scheduled dates. During the first year of operation, the system shall be inspected after at least two large storm events (> 1 inch) to ensure that it is fully drained within 72 hours. If standing water is present more than 72 hours after a rainfall event, the infiltration system shall be cleaned.

Ponded water in the system indicates potential infiltration failure in the bottom of the pipe and/or stone. In this case, accumulated sediment shall be removed from the bottom utilizing water jets and/or truck mounted vacuum equipment. Sediment and debris removal should be through the use of truck mounted vacuum equipment. Outlet pipes should be flushed to point of discharge on the same frequency as mentioned above. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations.

The following is the recommended procedure to inspect the underground system in service:

1. Locate the riser or cleanout section of the system. The riser/cleanout will typically be 6 or 12" in diameter or larger.
2. Remove the lid from the riser/cleanout.
3. Measure the sediment buildup at each riser and cleanout location. Only certified confined space entry personnel having appropriate equipment should be permitted to enter the system.
4. Inspect each manifold, all laterals, and outlet pipes for sediment build up, obstructions, or other problems. Obstructions should be removed at this time.
5. If measured sediment build up is between 2" to 8", cleaning should be considered; if sediment build up exceeds 8", cleaning should be performed at the earliest opportunity. A thorough cleaning of the system (manifolds and laterals) shall be performed by water jets and/or truck mounted vacuum equipment.

Pretreatment BMP's shall be inspected and cleaned during the regular bi-annual inspections.

Clearing Inlets and Outlets: The inlet and outlet of the Infiltration System should be checked periodically to ensure that flow structures are not blocked by debris. All pipes connecting the structures to the system should be checked for debris that may obstruct flow. Inspections should be conducted monthly during wet weather conditions from March to November. It is important to design flow structures that can be easily inspected for debris blockage.

5. Aboveground Detention Basin

The system should initially be inspected within the first three months after completion of the site's construction and after any rainfall greater than 1-inch. The following maintenance should be followed in accordance with the MADEP Stormwater Handbook. Preventative maintenance will aid in proper function of the Basin.

The bottoms, interior and exterior side slopes and crest of the basin should be mowed periodically and the vegetation maintained in healthy condition. Mowing should be done on an as needed basis and at a minimum once per year to prevent establishment of woody vegetation.

Embankments should be inspected at least annually by a qualified professional for settlement, erosion, seepage, animal burrows, woody vegetation and other conditions that could degrade the embankment and reduce its stability for impounding water. Immediate corrective action should be implemented if any such conditions area found.

Inlet and outlet pipes, outlet structures, rip rap aprons or other practices should be inspected at least annually by a qualified professional and corrective action implemented (e.g. maintenance, repairs or replacement) as needed.

Trash and debris and sediment should be removed from the basin and any inlet or outlet structures whenever observed by inspection. Sediment should be removed when it significantly affects basin capacity.

6. Snow Storage and Removal

Proposed snow storage areas are as shown, on the Site Plans prepared for Cumberland Farms, Inc., and any excess snow is to be trucked offsite. During the winter months all snow is to be stored such

that snowmelt is controlled. In the event the amount of snow exceeds such capacity, it is to be removed off-site. The minimum amount of deicing chemicals needed is to be used. Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches.
For questions and additional information regarding snow storage or disposal, please contact the Mass DEP's Southeast Regional Office in Lakeville at 508-946-2700.

7. Stormceptor

Initial maintenance to be performed twice a year for the first year after the unit is online and operational. A vacuum truck must be used at a minimum of once per year for sediment removal. Refer to the attached Stormceptor Owner's manual for operation and maintenance procedures and schedules thereafter.

8. Oil/Water Separator

The system should initially be inspected within the first three months after completion of the site's construction and after any rainfall greater than 1-inch. The units should be inspected after every major storm but at least on a monthly basis. Cleaning of the units should be done at least twice a year and should include the following:

1. Removal of accumulated oil and grease and sediment by using a vacuum truck or similar catch basin cleaning device.
2. Visually inspect, and clean as needed, inlet and outlets including tees during each inspection.
3. At a minimum, remove any floating debris at the time of the inspection.

Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations.

Long Term Pollution Prevention Plan:

In accordance with DEP Stormwater Standard #4 the development and implementation of suitable practices for source control and pollution prevention shall be incorporated in a Long Term Pollution Prevention Plan (LTPPP). The primary focus of the LTPPP is to establish procedures and controls for limiting the potential sources of pollutants, including nutrients that may contribute to excessive contaminant levels in the site's stormwater runoff. To this end the following source controls and procedures will be in place at the site:

- **Good House Keeping** – It shall be the responsibility of the property owner to keep the site clean at all times. Refuse disposal and pickup shall occur on a regular basis and all material shall be disposed of in the specified dumpster location area on the Site Development Plans.
- **Storing Material and waste products inside or under cover** – No material storage is to take place outside the proposed facility on either paved or lawn areas. All material stored on site will conform with all storage requirements of local, state and federal agencies.
- **Vehicle washing** – Vehicle washing is not allowed to take place on premises. Rinsing with a hose is allowed on impervious surfaces.
- **Routine inspections and maintenance of stormwater BMP's** – Refer to the Operation and Maintenance procedures for each BMP as described in the O&M Plan as described herein.

- **Spill prevention and response** – A Spill Prevention and Response Plan is incorporated for the development including an appropriately sized spill recovery kit and access to an emergency cleanup vendor.
- **Maintenance of lawns, gardens and other landscaped areas** – All landscaping and maintenance to be performed by an authorized company chosen by the property owner.
- **Storage and use of fertilizers, herbicides and pesticides** – All landscape maintenance will be conducted by an authorized company chosen by the property owner. Any application of herbicides or pesticides will be applied by a licensed applicator.
- **Proper management of deicing chemicals and snow** – Deicing chemicals and snow removal shall primarily be the responsibility of the property owner additional information can be found in the O&M Plan as described herein.
- **Nutrient management plan**- The goal of the nutrient management plan is to minimize the potential sources of excess nutrients on the site and the release of nutrients in the stormwater from the site. This minimization relates both to infiltrated water and runoff. In general the nature of the site use will tend to reduce the nutrients in the stormwater. Further, procedures indicated above or in the O&M Plan related to deicing procedures, BMP maintenance procedures, and street sweeping will act to reduce the levels of nutrients in the stormwater, and the nutrients entering the adjacent wetland and the groundwater.

Stormceptor®

MAINTENANCE

Inspection and Maintenance. Easy. Convenient.

When it rains, oils, sediment and other contaminants are captured and contained by over 20,000 Stormceptor units operating worldwide. While Stormceptor's patented scour prevention technology ensures captured pollutants remain in the unit during all rainfall events, the accumulated pollutants must eventually be removed as part of a regular maintenance program.

If neglected, oil and sediment gradually build up and diminish any BMP's efficiency, harming the environment and leaving owners and operators vulnerable to fines, surcharges and bad publicity.

Maintenance is a must

Ease, frequency and cost of maintenance are often overlooked by specifiers when considering the merits of a stormwater treatment system. In reality, maintenance is fundamental to the long-term performance of any stormwater quality treatment device.

While regular maintenance is crucial, it shouldn't be complicated. An ongoing maintenance program with Stormceptor is convenient and practically effortless. With virtually no disruptions, you can concentrate on your core business.

Quick inspections

Inspections are easily carried out above ground from any standard surface access cover through a visual inspection of the orifice and drop tee components. A sludge judge and oil dip-stick are all that are needed for sediment and oil depth measurements.

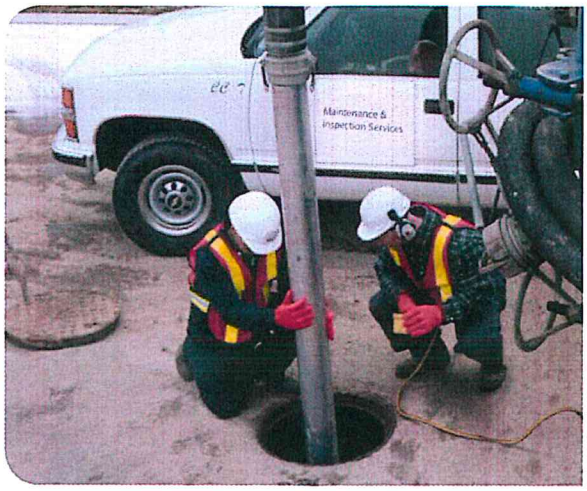
Easy unit access

Maintenance is typically conducted from the same surface access cover, eliminating the need for confined space entry into the unit. Your site remains undisturbed, saving you time and money.

imbrium

No muss, no fuss and fast

Maintenance is performed quickly and inexpensively with a standard vacuum truck. Servicing usually takes less than two hours, with no disruption to your site.



A complete stormwater management plan for Stormceptor extends beyond installation and performance to regular maintenance. It's the smart, cost-effective way to ensure your unit continues to remove more pollutants than any other separator for decades to come.

Stormceptor maintenance recommendations

- Units should be inspected post-construction, prior to being put into service.
- Inspect every six months for the first year of operation to determine the oil and sediment accumulation rate.
- In subsequent years, inspections can be based on first-year observations or local requirements.
- Cleaning is required once the sediment depth reaches 15% of storage capacity, (generally taking one year or longer). Local regulations for maintenance frequency may vary.
- Inspect the unit immediately after an oil, fuel or chemical spill.
- A licensed waste management company should remove captured petroleum waste products from any oil, chemical or fuel spills and dispose responsibly.

With over 20,000 units operating worldwide, Stormceptor performs and protects every day, in every storm.

imbrium

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CANADA: (800) 565 4801

334713 Stormwater Operation and Maintenance Log

General Information			
Project Name			
NPDES Tracking No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Describe present phase of construction			
Type of Inspection ☐ **Regular** ☐ **Post-storm event**			
Weather Information			
Current Conditions:			
Do you suspect that discharges may have occurred since the last inspection? ☐ Yes ☐ No			
Are there any discharges at the time of inspection? ☐ Yes ☐ No			

Site-specific BMPs

	Temporary (Construction Phase) BMP Description	BMP Installed and Operating Properly?	Corrective Action Needed	Party contacted / Method of contact
A	Overall Site Construction Activities	☐ Yes ☐ No		
B	Silt Fence	☐ Yes ☐ No		
C	Construction entrance	☐ Yes ☐ No		
D	Stockpiles	☐ Yes ☐ No		
E	Silt bags – on-site	☐ Yes ☐ No		
F	Temporary Dewatering Basins	☐ Yes ☐ No		

	Permanent (Post Construction) BMP Description	BMP Installed and Operating Properly?	Corrective Action Needed	Party contacted / Method of contact
1	Street Sweeping	☐ Yes ☐ No		
	• Evidence of oil grease	☐ Yes ☐ No		
2	Deep Sump Hooded Catch Basin	☐ Yes ☐ No		
	• Grates clear of debris	☐ Yes ☐ No		
	• Inlet and outlet clear of debris	☐ Yes ☐ No		
	• Evidence of oil grease	☐ Yes ☐ No		
	• Observance of accumulated sediment	☐ Yes ☐ No		
	• Evidence of structural deterioration	☐ Yes ☐ No		
	• Evidence of spalling or cracking of structural parts	☐ Yes ☐ No		
	• Evidence of flow bypassing facility	☐ Yes ☐ No		
3	Stormceptor & O/W Separator	☐ Yes ☐ No		
	• Grates clear of debris	☐ Yes ☐ No		
	• Inlet and outlet clear of debris	☐ Yes ☐ No		
	• Observance of accumulated sediment	☐ Yes ☐ No		
	• Evidence of oil grease	☐ Yes ☐ No		
	• Evidence of flow bypassing facility	☐ Yes ☐ No		
4	Stone Lined Outlet Protection Area	☐ Yes ☐ No		
	• Inlet/Inflow pipes clear of debris	☐ Yes ☐ No		
	• Overflow spillway clear of debris	☐ Yes ☐ No		
	• Outlet clear of debris	☐ Yes ☐ No		
	• Evidence subsidence	☐ Yes ☐ No		
	• Tree growth	☐ Yes ☐ No		
	• Other (specify)	☐ Yes ☐ No		
5	Ditches, swales & channels	☐ Yes ☐ No		
	• Inlet/Outlet clear of debris	☐ Yes ☐ No		
	• Bottom surface clear of debris	☐ Yes ☐ No		
	• Evidence of rilling or gullying	☐ Yes ☐ No		
	• Observance of accumulated sediment	☐ Yes ☐ No		
	• Bottom dewaters between storms	☐ Yes ☐ No		
	• Vegetation healthy and growing	☐ Yes ☐ No		
	• Standing water or wet spots	☐ Yes ☐ No		
	• Tree growth	☐ Yes ☐ No		
	• Other (specify)	☐ Yes ☐ No		

	Permanent (Post Construction) BMP Description	BMP Installed and Operating Properly?	Corrective Action Needed	Party contacted / Method of contact
6	Subsurface Stormwater System	☐ Yes ☐ No		
	• Pipe bottom clear of debris	☐ Yes ☐ No		
	• Inlet/Inflow pipes clear of debris	☐ Yes ☐ No		
	• Overflow spillway clear of debris	☐ Yes ☐ No		
	• Outlet clear of debris	☐ Yes ☐ No		
	• Observance of accumulated sediment	☐ Yes ☐ No		
	• Other (specify)	☐ Yes ☐ No		
7	Aboveground Detention Basin	☐ Yes ☐ No		
	• Basin bottom or trench surface clear of debris	☐ Yes ☐ No		
	• Inlet/Inflow pipes clear of debris	☐ Yes ☐ No		
	• Overflow spillway clear of debris	☐ Yes ☐ No		
	• Outlet clear of debris	☐ Yes ☐ No		
	• Basin dewaters between storms	☐ Yes ☐ No		
	• Observance of accumulated sediment	☐ Yes ☐ No		
	• Embankment erosion	☐ Yes ☐ No		
	• Animal burrows	☐ Yes ☐ No		
	• Unauthorized planting	☐ Yes ☐ No		
	• Cracking, bulging, or sliding of embankments	☐ Yes ☐ No		
	• Slope erosion	☐ Yes ☐ No		
	• Other (specify)	☐ Yes ☐ No		

ADDITIONAL COMMENTS

Overall Site Issues

	BMP/activity	Implemented?	Maintained?	Corrective Action	Party contacted / Method of contact
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	☐ Yes ☐ No	☐ Yes ☐ No		
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	☐ Yes ☐ No	☐ Yes ☐ No		
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	☐ Yes ☐ No	☐ Yes ☐ No		
4	Are discharge points and receiving waters free of sediment deposits?	☐ Yes ☐ No	☐ Yes ☐ No		
5	Are storm drain inlets properly protected?	☐ Yes ☐ No	☐ Yes ☐ No		
6	Is there evidence of sediment being tracked into the street?	☐ Yes ☐ No	☐ Yes ☐ No		
7	Is trash/litter from work areas collected and placed in covered dumpsters?	☐ Yes ☐ No	☐ Yes ☐ No		
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	☐ Yes ☐ No	☐ Yes ☐ No		
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	☐ Yes ☐ No	☐ Yes ☐ No		
10	Are materials that are potential stormwater contaminants stored inside or under cover?	☐ Yes ☐ No	☐ Yes ☐ No		
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	☐ Yes ☐ No	☐ Yes ☐ No		

Certification statement:

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

Print name: _____

Signature: _____ Date: _____

Copies to:

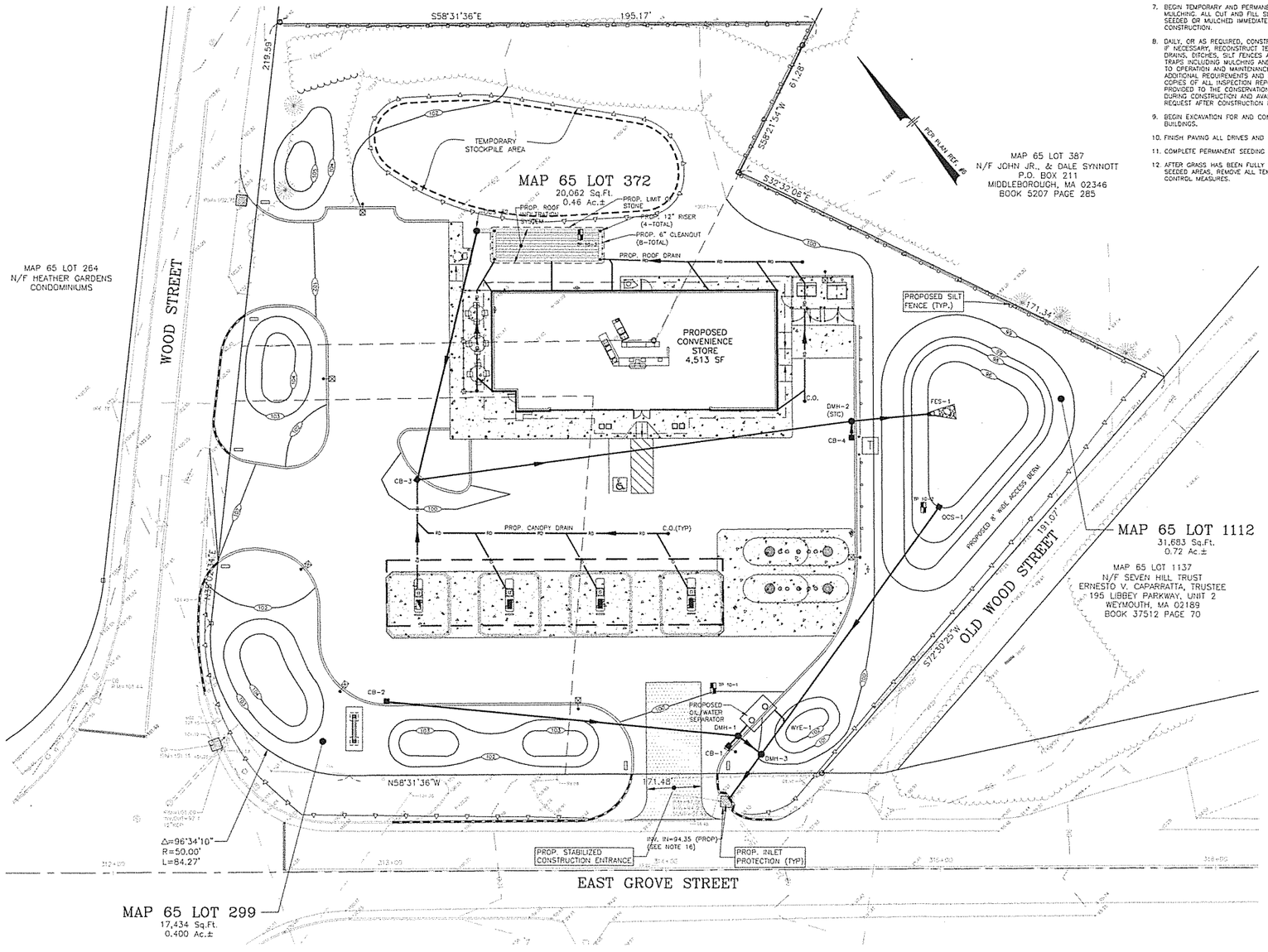
☐ Owner: _____

☐ Contractor: _____

☐ Conservation Commission: _____

☐ MHF Project Manager: _____

☐ Other: _____

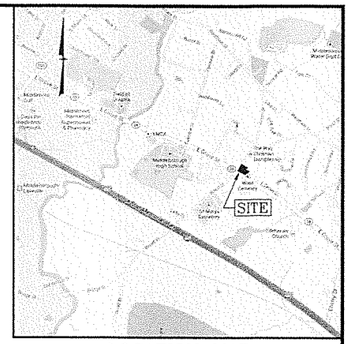


CONSTRUCTION SEQUENCE:

1. INSTALL TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES AS REQUIRED.
2. CUT AND STUMP AREAS OF PROPOSED CONSTRUCTION.
3. REMOVE AND STOCKPILE TOPSOIL. STOCKPILE SHALL BE SEEDED TO PREVENT EROSION.
4. CONSTRUCT CLOSED DRAINAGE SYSTEM AND DETENTION PONDS. PROTECT CULVERT INLETS AND CATCH BASINS WITH SEDIMENTATION BARRIERS.
5. PERFORM SITE GRADING, PLACING SILTATION FENCES AS REQUIRED TO CONTROL SOIL EROSION.
6. INSTALL UNDERGROUND UTILITIES.
7. BEGIN TEMPORARY AND PERMANENT SEEDING AND MULCHING. ALL CUT AND FILL SLOPES SHALL BE SEEDED OR MULCHED IMMEDIATELY AFTER THEIR CONSTRUCTION.
8. DAILY, OR AS REQUIRED, CONSTRUCT, INSPECT, AND IF NECESSARY, RECONSTRUCT TEMPORARY BERMS, DRAINS, DITCHES, SILT FENCES AND SEDIMENT TRAPS INCLUDING MULCHING AND SEEDING. REFER TO OPERATION AND MAINTENANCE PLAN FOR ADDITIONAL REQUIREMENTS AND INFORMATION. COPIES OF ALL INSPECTION REPORTS ARE TO BE PROVIDED TO THE CONSERVATION COMMISSION DURING CONSTRUCTION AND AVAILABLE UPON REQUEST AFTER CONSTRUCTION IS COMPLETED.
9. BEGIN EXCAVATION FOR AND CONSTRUCTION OF BUILDINGS.
10. FINISH PAVING ALL DRIVES AND PARKING AREAS.
11. COMPLETE PERMANENT SEEDING AND LANDSCAPING.
12. AFTER GRASS HAS BEEN FULLY GERMINATED IN ALL SEEDED AREAS, REMOVE ALL TEMPORARY EROSION CONTROL MEASURES.

TEMPORARY EROSION CONTROL MEASURES:

1) SEDIMENT TRAPS SHALL BE INSTALLED AS REQUIRED. BARRIERS AND TRAPS ARE TO BE MAINTAINED AND CLEANED UNTIL ALL SLOPES HAVE A HEALTHY STAND OF GRASS.
2) MULCH SHALL BE MOWINGS OF ACCEPTABLE HERBACEOUS GROWTH, FREE FROM NOXIOUS WEEDS OR WOODY STEMS, AND SHALL BE DRY. NO SALT HAY SHALL BE USED.
3) FILL MATERIAL SHALL BE FREE FROM STUMPS, WOOD, ROOTS, ETC.
4) STOCKPILED MATERIALS SHALL BE PLACED ONLY IN AREAS SHOWN ON THE PLANS. STOCKPILES SHALL BE PROTECTED BY SILTATION FENCE AND SEEDED TO PREVENT EROSION. THESE MEASURES SHALL REMAIN UNTIL ALL MATERIAL HAS BEEN PLACED OR DISPOSED OFF SITE.
5) ALL DISTURBED AREAS SHALL BE LOAMED AND SEEDED. A MINIMUM OF 6 INCHES OF LOAM SHALL BE INSTALLED WITH NOT LESS THAN ONE POUND OF SEED PER 50 SQUARE YARDS OF AREA.
6) SEED MIX SHALL BE EQUAL PARTS OF RED FESCUE (CREEPING), KENTUCKY BLUEGRASS, REDTOP, PERENNIAL RYEGRASS.
7) AFTER ALL DISTURBED AREAS HAVE BEEN STABILIZED THE TEMPORARY EROSION CONTROL MEASURES ARE TO BE REMOVED.
8) PAVED ROADWAYS AND PARKING LOTS MUST BE KEPT CLEAN AT ALL TIMES. PROVIDE SWEEPING ON A DAILY BASIS OR AS DIRECTED BY THE TOWN.
9) ALL CATCH BASIN INLETS WILL BE PROTECTED WITH INLET PROTECTION – SEE DETAIL.
10) ALL DEWATERING OPERATIONS MUST DISCHARGE DIRECTLY INTO A SEDIMENT FILTER AREA.



LOCATION MAP
(NOT TO SCALE)

OPERATIONS/MAINTENANCE PLAN FOR STORMWATER SYSTEM

CONSTRUCTION PHASE:

THE BMP'S ASSOCIATED WITH THIS PROJECT WILL BE OWNED BY CUMBERLAND FARMS, INC. WHO WILL BE RESPONSIBLE FOR INSPECTION, OPERATION AND MAINTENANCE.

1) THE CONTRACTOR IS TO INSTALL AND MAINTAIN DRAINAGE FACILITIES AS SHOWN ON THE SITE PLANS BY MHF DESIGN CONSULTANTS, INC.
2) PRIOR TO CONSTRUCTION, ALL EROSION/SILT CONTROL DEVICES SHOWN ON ABOVE PLAN ARE TO BE INSTALLED. TO PREVENT SILT INTRUSION INTO SURROUNDING AREAS DURING CONSTRUCTION, THE CONTRACTOR IS TO SET SILT FENCING AT ALL SLOPES WHICH MAY ERODE IN THE DIRECTION OF ANY OPEN DRAINAGE FACILITIES OR ABUTTING PROPERTY. SUCH PREVENTIVE MEASURES ARE TO BE MAINTAINED THROUGHOUT THE CONSTRUCTION PROCESS.
3) ALL CONSTRUCTION OF DRAINAGE FACILITIES IS TO BE INSPECTED BY INSPECTORS FROM THE TOWN OF MIDDLEBOROUGH AND BY AN AUTHORIZED AGENT TO VERIFY CONFORMANCE TO THE DESIGN PLAN.
4) THE SEQUENCE OF DRAINAGE CONSTRUCTION SHALL BE AS FOLLOWS:
   A) CLEAR, GRUB, EXCAVATE AREAS FOR DETENTION SYSTEMS.
   B) INSTALL CATCH BASINS, PIPES AND MANHOLES.
5) EROSION CONTROLS ARE TO BE INSPECTED AND MAINTAINED ON A DAILY BASIS. UPON DISCOVERY OF SILTATION BUILD-UP IN ANY CATCH BASIN SUMP OR ANY OTHER STRUCTURE, CLEANING SHALL BE PERFORMED WITHIN 24 HOURS.
6) ALL EXPOSED SOILS SHALL BE IMMEDIATELY STABILIZED WITH A LAYER OF MULCH HAY.
7) UPON INSTALLATION OF CATCH BASINS, INLET PROTECTION – AS DESCRIBED ON AFOREMENTIONED PLAN – SHALL BE INSTALLED AND MAINTAINED UNTIL READY FOR PAVING.
8) PRIOR TO CONSTRUCTION OF IMPERVIOUS AREAS, ALL DRAINAGE STRUCTURES AND PIPES SHALL BE INSTALLED AND INSPECTED FOR PROPER FUNCTION. DURING CONSTRUCTION OF OTHER SITE FEATURES, ALL DRAINAGE FACILITIES SHALL BE INSPECTED ON A DAILY BASIS AND CLEANED/REPAIRED IMMEDIATELY UPON DISCOVERY OF SEDIMENT BUILD-UP OR DAMAGE.
9) AFTER PAVING IS INSTALLED, IT SHALL BE SWEPT CLEAN ON A MONTHLY BASIS.
10) INSPECTIONS ARE TO BE PERFORMED AND INSPECTION LOGS FILLED OUT ON A WEEKLY BASIS FROM THE START OF CONSTRUCTION THROUGH FINAL STABILIZATION. THE START OF CONSTRUCTION MEANS THE INITIAL DISTURBANCE OF SOILS ASSOCIATED WITH CONSTRUCTION. FINAL STABILIZATION MEANS 70% VEGETATIVE GROWTH FOR UNPAVED AREAS.

POST CONSTRUCTION PHASE:

THE OWNER IS TO BE RESPONSIBLE FOR MAINTENANCE OF ALL DRAINAGE STRUCTURES IN THE PROJECT – INCLUDING DRAIN PIPES AND DRAINAGE SYSTEM. THE FUTURE OWNER IS EXPECTED TO BE CUMBERLAND FARMS, INC. WHO WILL ULTIMATELY BE RESPONSIBLE FOR COMPLIANCE WITH PLAN.

REGULAR MAINTENANCE IS TO INCLUDE THE FOLLOWING:

1) INSPECTION OF ALL DRAINAGE FACILITIES (CATCH BASINS, MANHOLES & DETENTION SYSTEM) EVERY THREE MONTHS, DURING THE FIRST YEAR OF OPERATION. ALL DRAINAGE FACILITIES SHOULD BE INSPECTED AFTER EVERY STORM, AND 2–3 DAYS AFTERWARD. DURING THESE INSPECTIONS, THE INSPECTOR AS DESIGNATED BY CUMBERLAND FARMS, INC. SHALL LOOK FOR EVIDENCE OF THE FOLLOWING: STRUCTURAL DAMAGE, SILT ACCUMULATION (NEAR INLET INVERTS ON CATCH BASINS), AND IMPROPER FUNCTION. REPORTS SHALL BE FILED FOR EVERY INSPECTION AND SUBMITTED TO THE TOWN FOR COMPLIANCE FOR ONE (1) YEAR AFTER THE ISSUANCE OF THE OCCUPANCY PERMIT OR UNTIL DEEMED NECESSARY BY THE TOWN ENGINEER.
2) AFTER INSPECTION, IF ANY OF THE ABOVE CONDITIONS EXIST, THE INSPECTOR SHALL NOTIFY THE DEVELOPER, WHO SHALL IMMEDIATELY ARRANGE FOR ALL NECESSARY REPAIRS AND SEDIMENT REMOVAL.
3) PARKING AREAS ARE TO BE SWEPT CLEAN EVERY MONTH SPRING THROUGH FALL AND OTHERWISE AS NEEDED (I.E. VISUALLY NOTICEABLE DEBRIS BUILD-UP).
4) THE CATCH BASINS AND DRAINAGE SYSTEM ARE TO BE INSPECTED EVERY THREE MONTHS. REMOVE OIL, DEBRIS AND SEDIMENT AFTER INSPECTIONS.
5) ALL GRADED SLOPES SHALL BE INSPECTED EVERY SPRING FOR EROSION. UPON DISCOVERY OF ANY FAILURE (I.E. EROSION) LOAM AND SEED SHALL BE PUT IN PLACE AND NURTURED.
6) DURING THE WINTER MONTHS, ALL SNOW IS TO BE STORED SUCH THAT SNOWMELT IS CONTROLLED. IN THE EVENT THE AMOUNT OF SNOW EXCEEDS SUCH CAPACITY, IT IS TO BE REMOVED OFF-SITE. THE MINIMUM AMOUNT OF DEICING CHEMICALS NEEDED IS TO BE USED.
7) DURING THE SUMMER MONTHS, ALL LANDSCAPE FEATURES ARE TO BE MAINTAINED WITH THE MINIMUM POSSIBLE AMOUNT OF FERTILIZERS, PESTICIDES OR HERBICIDES. IF IN QUESTION, MAINTENANCE PERSONNEL SHOULD CHECK WITH THE CONSERVATION COMMISSION. ALL PERSONNEL INVOLVED WITH THE MAINTENANCE OF LANDSCAPING WILL BE INFORMED OF THIS CONDITION.
8) FOR ADDITIONAL INFORMATION REFER TO THE OPERATION AND MAINTENANCE AND LONG TERM POLLUTION PREVENTION PLAN FOR STORMWATER MANAGEMENT SYSTEMS.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

LEGEND

UTILITY POLE	OVERHEAD SERVICE WIRES	PROP. CONTOUR ELEVATION
DRAIN MANHOLE	DOUBLE SOLID YELLOW LINE	PROP. SILT FENCE
SEWER MANHOLE	SINGLE SOLID WHITE LINE	C.O. PROP. CLEANOUT
TELEPHONE MANHOLE	SIGN	CB-1 PROP. CATCH BASIN
CATCH BASIN	OBSERVATION WELL	DMH-1 PROP. DRAIN MANHOLE
WATER LINE	TREELINE	SMH-1 PROP. SEWER MANHOLE
WATER VALVE	CONTOUR ELEVATION	
FIRE HYDRANT	GAS LINE	
GAS VALVE		

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NY 1-800-962-7962
CT 1-800-922-4455

OWNERS OF RECORD:

MAP 65 LOT 299
TOMI, LLC
C/O HYLAN AUTO SALES
90 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
BOOK 32570 PAGE 63

MAP 65 LOT 372
EUGENE & CAROLINE WELDON
147 WOOD STREET
MIDDLEBOROUGH, MA 02346
BOOK 10506 PAGE 2

MAP 65 LOT 1112
92 EAST GROVE STREET TRUST
BRENDA J. WALANIS, TRUSTEE
92 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
BOOK 38430 PAGE 87

REVISIONS		
DATE	REV. BY	DESCRIPTION
2/14/14	CMT	MISC. REVISIONS

69,179 SQUARE FEET	
1.588± ACRES	
V #X	
Store #X	
Gas Station#	
Facility #X	

MHF Design Consultants, Inc.
44 Stiles Road, Suite One
Salem, New Hampshire 03079
(603) 893-0720
ENGINEERS • PLANNERS • SURVEYORS
www.mhfdesign.com

90 EAST GROVE STREET
MIDDLEBOROUGH, MASSACHUSETTS

CUMBERLAND FARMS INC.
100 CROSSING BLVD.
FRAMINGHAM, MA 01702

SCALE:	1"= 20'
DATE:	DECEMBER 9, 2013
FILE:	33473SP.dwg
DRAWN BY:	MHF
CHECKED BY:	

EROSION CONTROL PLAN — CFG6.0