Applicant:	Grafton Water District 44 Millbury Street Grafton, Massachusetts 01519
Project Name:	Trinity Avenue Pump Station
Project Address:	25R Trinity Avenue (Map 98/Parcel 121) Grafton, Massachusetts 01519
Representative:	Karen L. Gracey, P.E. Tata & Howard, Inc. 67 Forest Street Marlborough, MA 01752

Project Narrative

The Town of Grafton's recent population growth, subsequent increases in water consumption, and the need for redundancy have necessitated the development of an additional municipal water supply. After an extensive groundwater exploration program, the 1.60 acre parcel of land, situated off of Trinity Avenue and owned by the Grafton Water District, was identified as the most viable option for a water supply source in Town. Therefore, the District proposes to construct the Trinity Avenue Pump Station and augment the current water supply to the community. Construction of a pumping station is required to convey the water from the supply source to the water distribution system. Additionally, the facility will incorporate a chemical feed system for pH adjustment and disinfection to maintain high quality, safe drinking water to the residents.

The Trinity Avenue Wellfield includes three existing gravel packed wells. The proposed pump station project will include installation of submersible pumps, individual water mains connecting the wells to the pump station, and a transmission main to convey the water from the wellfield to the water distribution system. The pump station will consist of a single story, rectangular, single wythe block wall building with a wood truss roof system protected by asphalt shingles. It is anticipated that the building's approximate footprint will be 21 feet by 28 feet and be supported on a cast-in-place concrete foundation. Construction of auxiliary systems, including the below grade propane storage tanks, transformer pad, and stormwater collection system will also be included in the project.

The project is located on District-owned property and no construction activities, equipment or supplies associated with the project, are anticipated to extend beyond the parcel boundaries or temporary easements. The project is currently situated along Fisherville Pond. The proposed pump station has been sited within the property bounds of the 1.60 acre, District owned parcel and above the floodplain elevation of 293 feet.

The following Table No. SW-1 details the total disturbance to the entire parcel, disturbance within the resource area buffers, and disturbance within the resource areas. The disturbance is either temporary in nature due to construction related activities or permanent due to construction of the access road for safe, daily access to the site.

Table No. SW-1
Disturbance Areas

Resource Area	Temporary Disturbance (sf)	Permanent Disturbance (sf)	Total (sf)
Entire Parcel	19,190	12,150	31,340
100' Wetland Buffer*	16,330	9,890	26,220
25' Wetland Buffer	1,040	1,180	2,220
Wetlands	1,070	0	1,070
Floodplain	11,385	6,330	17,715
25' Floodplain Buffer	3,080	8,390	11,470

*100' Wetland Buffer areas include areas within the 25' wetland buffer

Approximately 17,715 square feet (sf) of the project is situated below the 100-year floodplain (293 feet MSL); however, construction of the access road for safe, daily access to the site will require a proposed alteration to the existing topography. Of the project area below elevation 293 feet MSL, approximately 11,385 sf will be impacted temporarily due to construction related activities. The temporary disturbance will result in no change to the existing grades. Approximately 1,800 sf will be impacted within the floodplain and the existing grade will be filled for construction of the access road and bridge. The approximate fill volume within this area is 58 cubic yards. A compensatory storage area (totaling 58 cy) of approximately 2,893 sf will be located to the east of the gravel turnaround area.

The wetlands, wetland buffers, and floodplain buffers will incur some temporary disturbance due to construction related activities (See areas listed above in Table No. SW-1). The permanent disturbance areas are related to construction of the access road. No permanent disturbance will occur within the wetlands.

The addition of impervious area results from the roof installation for the pump station and an impervious pavement chemical delivery area, which is required to provide safe, adequate access and contain any chemical spill without immediate infiltration. The proposed 12.5-foot wide access road will be porous pavement between Trinity Avenue and the proposed Bailey Bridge. The approach apron on the south side of the bridge and parking area shall be impervious due to being inside the Zone-I of the wellfield. The proposed turnaround area will be gravel. The porous pavement and gravel will reduce the impervious area associated with the site to the extent practicable.

During construction, best management practices (BMPs) will be utilized to minimize potential impacts to the adjacent resource areas. Erosion control sock, silt fence and dewatering sedimentation basins will be used as necessary to mitigate stormwater impacts during and following rainfall events. The contractor will be required to maintain the working order of these BMPs and perform good housekeeping practices to minimize environmental impacts. All requirements issued by the Conservation Commission in the Order of Conditions will be strictly adhered to.

The site has been designed to minimize increases in impervious surfaces. Impervious surfaces associated with the project include the roof over the proposed pump station (approximately 600 sf) and impervious pavement at the southern bridge approach apron (approximately 330 sf) and chemical delivery/parking area (approximately 285 sf). The access road will be porous pavement and the turnaround are will be finished with gravel to promote natural infiltration of rainwater. The gravel will also improve upon existing drainage conditions by creating pore spaces for stormwater attenuation.

The stormwater management for this site has been designed to incorporate efficient, dependable drainage and minimize additional impacts to the project site. Limited vehicular traffic, and restricted access to the public, along with implementation of good housekeeping practices by the District will maximize efficiency and dependability of the onsite stormwater systems.

With a combination of good housekeeping practices, and proper maintenance of the gravel and porous pavement system and grass-lined channel, the proposed BMPs will manage quantity and quality. No long-term impacts to the adjacent resource areas are anticipated with installation and proper maintenance of the proposed BMPs.

Standard 1: No New Untreated Discharges

The existing site drains towards Fisherville Pond to the Northeast of the proposed project area. The construction of the pump station and associated paved areas will render approximately 3,075 square feet of impervious area. Of this, approximately 600 square feet is the building roof which will discharge clean runoff to the infiltration system to the north of the building. The runoff from the paved access road will be treated by the grass lined channel with check dams to the northeast of the access road. The runoff from the remaining paved access road and parking areas will sheetflow toward the gravel turnaround area.

The use of porous pavement and gravel will allow direct infiltration of rainfall and mitigate runoff resulting from development of the site. The porous pavement and gravel turnaround area will be maintained by the Grafton Water District.

The proposed site is directly adjacent to the floodplain of Fisherville Pond. An increase in grade is proposed within the floodplain for safe, daily access; therefore, resulting in compensatory storage. Any temporary disturbance below the 293 foot MSL floodplain will be returned to existing grade or lower. The proposed fill of the floodplain along the access road is approximately 194 cubic yards. The resulting compensatory storage area

will be located to the east of the gravel turnaround area and will consist of removal of approximately 194 cubic yards of material at the same elevation. Minimal tree clearing will occurring within the compensatory storage area. Flow patterns outside of the limit of work will remain unchanged. There will be no new, untreated discharges within the project site.

Standard 2: Peak Rate Attenuation

The United States Department of Agriculture's (USDA) Soil Report for the proposed site indicates that local soils are comprised almost entirely of Type A and A/D soils. The soil reports are included in Attachment 1.

The Hydrologic Rational Method for estimating peak discharge as referenced in the Massachusetts Highway Department Project Development and Design Guidebook was implemented to verify suitable storage capacities for proper peak-rate attenuation. Storage capacity requirements are further discussed under Standard 4.

Table No. SW-2 shows the pre- and post-development peak runoff rates in cubic feet per second (cfs) as calculated using the above referenced design guidelines. Post-development peak runoff rates do exceed the pre-development peak runoff rates. Best Management Practices have been utilized to the greatest extent possible. Site constraints prevent additional stormwater management.

Table No. SW-2
Peak Runoff Rates for Pre- and Post-Development Rainfall Events

	2-year Storm	10-year Storm
Pre-Development	0.55 cfs	0.73 cfs
Post-Development	0.54 cfs	0.71 cfs

All Rational Method calculations were performed using the Massachusetts Highway Department Project Development and Design Guidebook (2006). Calculations are included in Attachment 2. The proposed check dams and rip rap will slow and retain some of the runoff, further lowering the post-development discharge rate.

Standard 3: Recharge

As mentioned previously, the site is composed of Type A & A/D soils. For these soil types, stormwater regulations (Massachusetts Stormwater Handbook) require 0.60 inches and 0.10 inches, respectively, of recharge for every square foot of new impervious area. Proposed construction on the site will include approximately 3,075 square feet of impervious surface area, however, all impervious areas will be infiltrated on site thereby providing 100% recharge from impervious areas following treatment, as necessary.

The required recharge volume for the pump station roof is 0.60 inches per square foot or approximately 30 cubic feet. Cultec storage calculations are included in Attachment 2. The total storage provided is approximately 158 cubic feet. In accordance with the Massachusetts Stormwater Handbook, minimum infiltration rates shall be 0.17 inches per hour and all infiltration structures must be able to fully drain within 72 hours. Soil sample S3 between depths of 2-6 feet were comprised mainly of sand and gravel. NRCS particle size analysis classifies the above sample as sand. A sand texture class (NRCS hydrologic soil group A) infiltrates at a rate of 8.27 inches per hour. Soil sample results and related calculations are included in Attachment 2.

In accordance with the Massachusetts Stormwater Handbook, the time drawdown (infiltration) of the BMP is as follows:

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Where:
Rv = Storage Volume
K = Saturated Hydraulic Conductivity (Rawls Rate)
Bottom Area = Bottom Area of Recharge Structure

$$Time_{drawdown} = \frac{158\ cubic\ feet}{(8.27\ inches/hour)(1ft/12\ inches)(150\ square\ feet)}$$

$Time_{drawdown}$ = 1.53 hours

1.53 hours < 72 hours so result is satisfactory for design purposes

Standard 4: Water Quality

Water quality during the construction phase is addressed in the Construction Period Stormwater Pollution Prevention Plan, found in Attachment 3. Post-development water quality is addressed both in this stormwater report (see TSS analysis below) and in the Long-Term Pollution Prevention Plan, found in Attachment 4.

Proposed construction will create approximately 2,200 square feet of impervious access road. The runoff from the access road will be directed into the grassed lined channel with check dams for treatment. The grass lined channel provides 50% TSS removal. Stormwater regulations require 44% of the total suspended solids to be removed prior to discharge to an infiltration structure. Due to the high groundwater and proximity to the nearby bordering vegetated wetlands, an infiltration structure north of the bordering vegetated wetlands will not be effective. Discharge from the grass lined channel will be distributed amongst a gravel apron approximately 20 feet by 15 feet (300 square feet). The gravel apron will be inspected seasonally and maintained as necessary.

Proposed construction will create approximately 600 square feet of impervious roof area. The runoff from the pump station roof will be directed to roof drains and infiltration

system. The infiltrators provide 80% TSS removal, as required by stormwater regulations.

Table No. SW-3 depicts the total percentages of TSS removal for the BMPs proposed for this project.

Table No. SW-3
TSS Removal

Treatment Train BMPs	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Grassed Channel	50%	1.00	0.50	0.50
Dry Well / Infiltrators	80%	1.00	0.80	0.20
Porous Pavement	95%	1.00	0.95	0.05

Increased TSS removal rates will be achieved using a combination of good housekeeping practices (sediment removal by means of sweeping, vacuuming, and maintenance on impervious and porous surfaces). Maintenance of all stormwater BMPs is outlined in the Operation and Maintenance Plan, found in Attachment 5. Maintenance must be performed to preserve peak rate attenuation and treatment efficiencies.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)
No LUHPPLs are anticipated with the proposed project.

Standard 6: Critical Areas
Although a small portion of the project is within the 250-foot Zone-I of a District wellfield, the stormwater discharge is located at the furthest extent possible of this critical area.

Standard 7: Redevelopments and Other Projects Subject to the Standards Only to the Maximum Extent Practicable
The project is not applicable for consideration as a redevelopment due to the increased impervious area proposed.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control
Portions of the proposed project are located within the resource area buffer zones. As such, temporary stormwater control devices were selected to protect these sensitive areas during the construction period. These mitigation measures include the installation of erosion control sock, siltation fence, and sedimentation basins.

Each of these devices will be installed prior to the start of construction and maintained for the duration of the project. Upon completion of construction, all temporary stormwater control devices will be removed and properly disposed. Specific construction period pollution prevention and stormwater mitigation details can be found in the Construction Period Stormwater Pollution Prevention Plan, provided in Attachment 3.

Standard 9: Operation and Maintenance Plan

The long-term Operation and Maintenance Plan is included in Attachment 5.

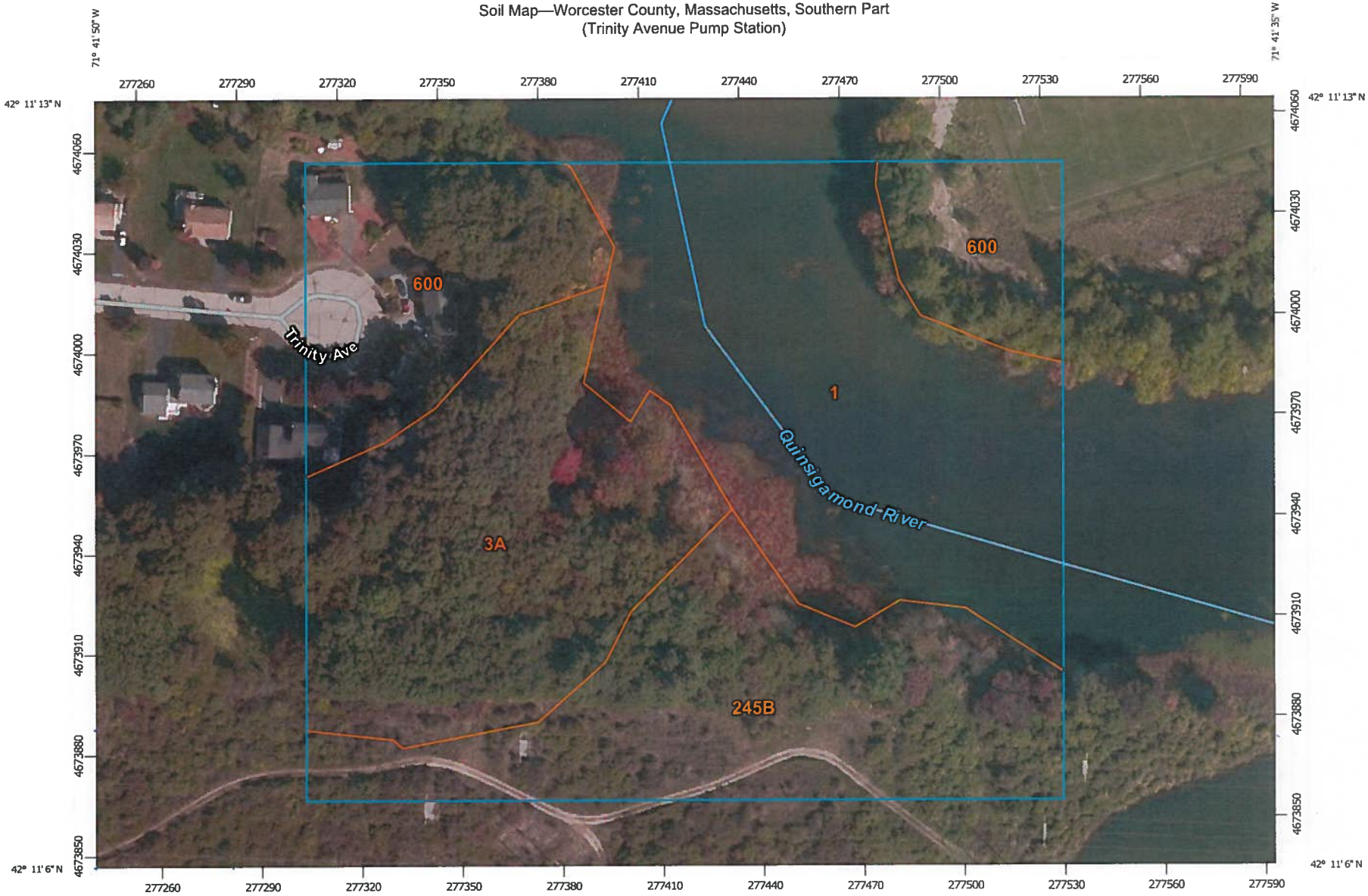
Standard 10: Prohibition of Illicit Discharges

The Illicit Compliance Statement is included in the Long Term Pollution Prevention Plan found in Attachment 4.

Attachment 1

TATA & HOWARD

Soil Map—Worcester County, Massachusetts, Southern Part
(Trinity Avenue Pump Station)



Map Scale: 1:1,610 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

MAP LEGEND

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

Soils
- Soil 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 1:25,000.

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: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 8, Sep 28, 2015

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

Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

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

Worcester County, Massachusetts, Southern Part (MA615)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1	Water	3.4	31.8%
3A	Scarboro and Walpole soils, 0 to 3 percent slopes	2.7	25.0%
245B	Hinckley loamy sand, 3 to 8 percent slopes	2.5	23.7%
600	Pits, gravel	2.1	19.5%
Totals for Area of Interest		**10.7**	**100.0%**

Worcester County, Massachusetts, Southern Part

3A—Scarboro and Walpole soils, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svks
Elevation: 160 to 480 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 45 percent
Walpole and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Depressions, outwash terraces, drainageways, outwash deltas
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from schist and/or sandy glaciofluvial deposits derived from gneiss and/or sandy glaciofluvial deposits derived from granite

Typical profile

Oe - 0 to 3 inches: mucky peat
A - 3 to 11 inches: mucky fine sandy loam
Cg1 - 11 to 21 inches: sand
Cg2 - 21 to 65 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D

Description of Walpole

Setting

Landform: Drainageways on outwash terraces, depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip, talf
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from granite and/or schist and/or gneiss

Typical profile

O - 0 to 2 inches: muck
A - 2 to 11 inches: fine sandy loam
Bg - 11 to 24 inches: fine sandy loam
Bw - 24 to 28 inches: sandy loam
Cg - 28 to 65 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D

Minor Components

Swansea

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave

Wareham

Percent of map unit: 10 percent
Landform: Depressions
Down-slope shape: Concave

Across-slope shape: Concave

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 8, Sep 28, 2015

Worcester County, Massachusetts, Southern Part

245B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svm8
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 53 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Eskers, outwash deltas, moraines, outwash terraces, outwash plains, kame terraces, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Base slope, crest, nose slope, side slope, riser, tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A

Minor Components

Windsor

Percent of map unit: 8 percent
Landform: Moraines, outwash terraces, outwash plains, kame terraces, kames, eskers, outwash deltas
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave

Sudbury

Percent of map unit: 5 percent
Landform: Kame terraces, outwash deltas, moraines, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope, head slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Agawam

Percent of map unit: 2 percent
Landform: Kames, eskers, outwash deltas, moraines, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 8, Sep 28, 2015

Attachment 2

ATTACHMENT 2

TATA & HOWARD

CULTEC
Founder of Plastic Chamber Technology
Stormwater and Septic Solutions
Since 1986
1-800-4-CULTEC
custservice@cultec.com

Prepared For:
Name: Matthew Pearson
Grafton Water District
Street: 44 Millbury Street
City: Grafton
MA 01519
(508) 839-2302
graftonh20@aol.com

Project Information:
Name: Trinity Avenue Pump Station
Street: Address 25R Trinity Ave
City: Grafton
MA 01519

Date: March 14, 2016

Engineer:
Name: Matthew Barry
Tata & Howard, Inc.
Street: 67 Forest Street
City: Marlborough
MA 01519
(508) 232-6228
(508) 449-9400
mbarry@tataandhoward.com

Calculations Performed By:
Name: Matthew Barry
Tata & Howard, Inc.
Street: 67 Forest Street
City: Marlborough
MA 01519
(508) 232-6228
(508) 449-9400
mbarry@tataandhoward.com

Input Given Parameters

Unit of Measure	English	
Select Model	Contactor 100HD	
Stone Porosity	40.0%	
Number of Header Systems	1 Header	
Stone Depth **Above** Chamber	6	inches
Stone Depth **Below** Chamber	6	inches
Workable Bed Depth	5.00	feet
Max. Bed Width	15.00	feet
Storage Volume Required	50.00	cu. feet

Image for visual reference only. May not reflect selected model.

Chamber Specifications

Height	12.5	inches
Width	36.00	inches
Length	8.00	feet
Installed Length	7.50	feet
Bare Chamber Volume	14.00	cu. feet
Installed Chamber Volume	28.81	cu. feet
Bed Depth	2.96	feet
Bed Width	15.00	feet
Storage Volume Provided	158.50	cu. feet

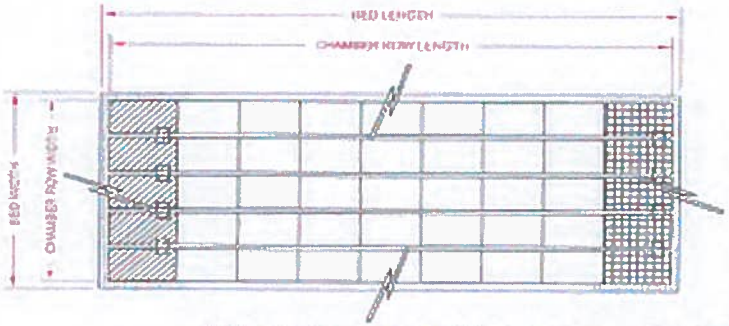
Materials List

Contactor 100HD Stormwater System by CULTEC, Inc.

Approx. Unit Count - not for construction	1	pieces
Actual Number of Chambers Required	4	pieces
Starter Chambers	4	pieces
Intermediate Chambers	0	pieces
End Chambers	0	pieces

HVLV SFCx2 Feed Connector	3	pieces
CULTEC No. 410™ Filter Fabric	49.14	sq. yards
CULTEC No. 201 Polyethylene Liner	15.00	feet
Stone	9.12	cu. yards

Bed Detail



Number of Rows Wide	4	pieces
Number of Chambers Long	1	pieces
Chamber Row Width	13.00	feet
Chamber Row Length	8.00	feet
Bed Width	15.00	feet
Bed Length	10.00	feet
Bed Area Required	150.00	sq. feet

Bed detail for reference only. Not project specific. Not to scale. Use CULTEC StormCenter to output project specific detail.

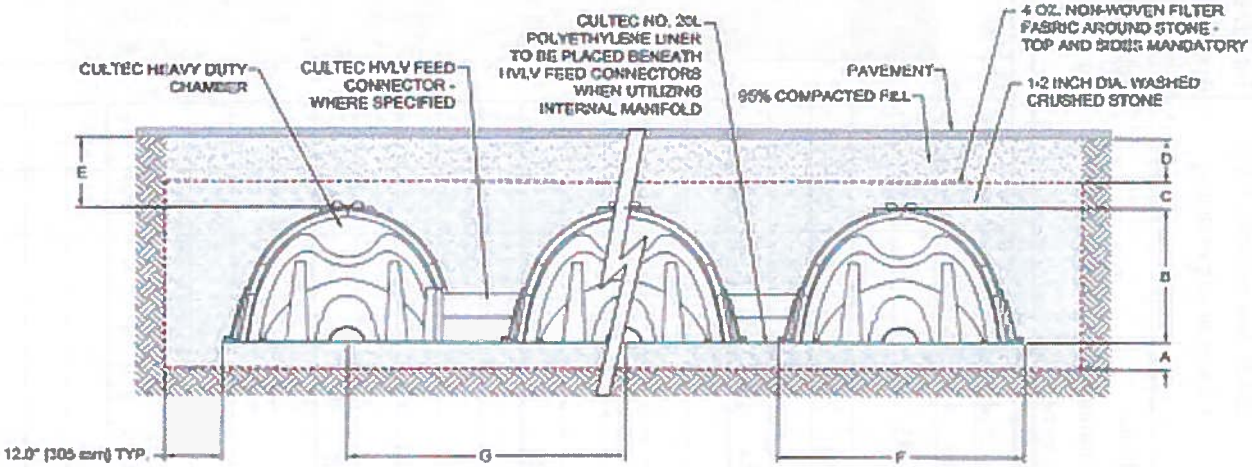
CULTEC, Inc.
P.O. Box 280, Brookfield, CT 06804 USA
Phone: 203-775-4416 · Fax: 203-775-1462 · www.cultec.com

Project Name: Name: Trinity Avenue Pump Station **Date:** March 14, 2016

Cross Section Detail

Conceptual graphic only. Not job specific.

Contactor 100HD		
Pavement	3	inches
95% Compacted Fill	8	inches
Stone Above	6	inches
Chamber Height	12.5	inches
Stone Below	6	inches
Effective Depth	24.5	inches
Bed Depth	35.5	inches



A	Depth of Stone Base	6.0	Inches
B	Chamber Height	12.5	Inches
C	Depth of Stone Above Units	6.0	Inches
D	Depth of 95% Compacted Fill	8.0	Inches
E	Max. Depth of Cover Allowed Above Crown of Chamber	12.0	feet
F	Chamber Width	36.0	Inches
G	Center to Center Spacing	3.33	feet

Breakdown of Storage Provided by	Contactor 100HD	Stormwater System
Chambers	59.71	cu. feet
Feed Connectors	0.29	cu. feet
Stone	98.50	cu. feet
Total Storage Provided	158.50	cu. feet

CULTEC, Inc.
P.O. Box 280, Brookfield, CT 06804 USA
Phone: 203-775-4416 · Fax 203-775-1462 · www.cultec.com

LGCI
Lahlaf Geotechnical Consulting, Inc.

BORING LOG

Boring B-2
Page 1 of 1

Project:	**Proposed Trinity Avenue Pump Station**		
Client:	**Tata & Howard, Inc.**		LGCI Project No.: 1528
Drilling Subcontractor:	Technical Drilling Services	Date Started:	9/14/2015
Drilling Foreman:	Brett Balyk	Date Completed:	9/14/2015
LGCI Engineer:	Todd Dwyer	Location:	NW corner of pump station footprint
Ground Surface El:	294.5', see remarks 1 & 2	Total Depth:	21 feet
Groundwater Depth:	4.3 feet at end of drilling	Drill Rig Type:	CME 55, Rubber Track
		Drilling Method:	4.25" ID - Hollow stem augers
Hammer Weight:	140 lbs	Split Spoon Diameter:	ID - 1.375", OD - 2"
Hammer Type:	Automatic	Rock Core Barrel Size:	N/A
Drop:	30 inches		

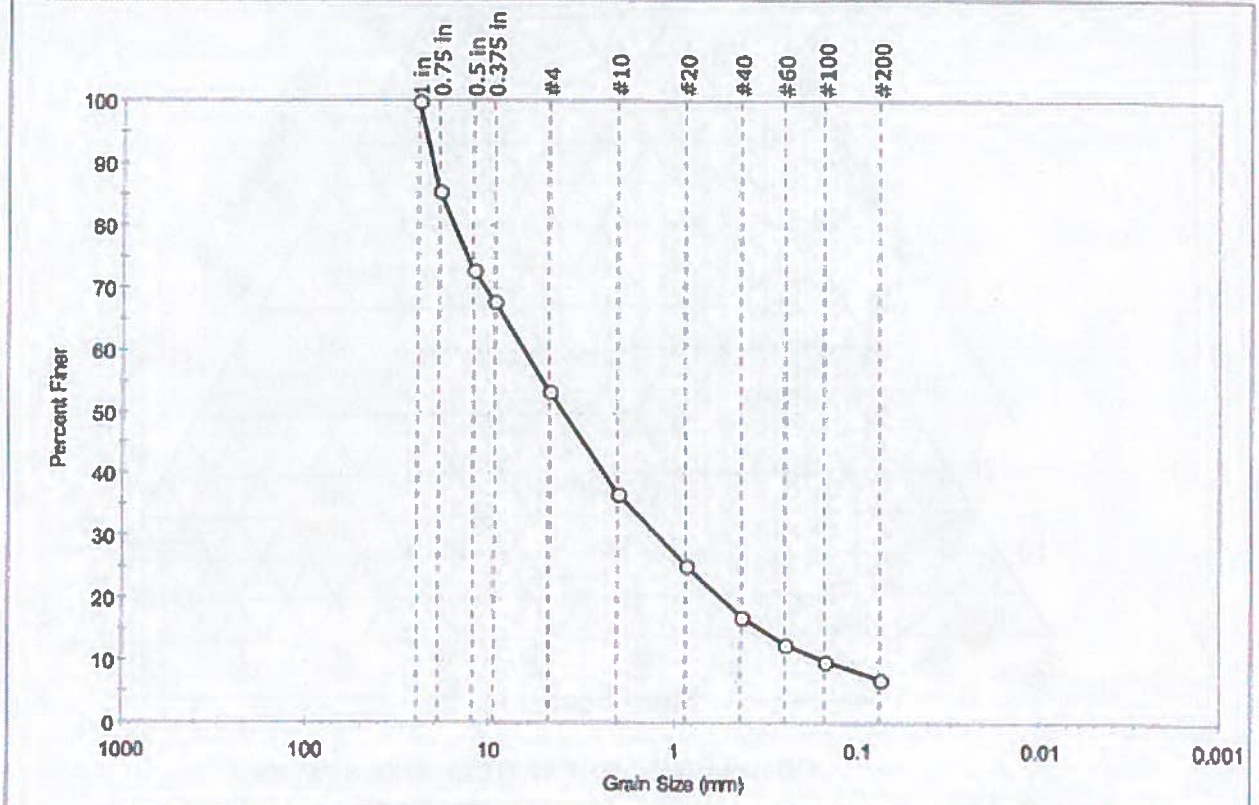
Depth Scale	Sample Depth (ft)	Sample No	Blows per 6 inches 0-6	6-12	12-18	18-24	Pen (in)	Rec (in)	Remarks	Strata	Sample Description
	0-2	S1	WOH	1	3	5	24	14		Forest Mat / Silt (subsoil)	S1 - Top 3": Organic Soil (OL), non-plastic, 10-15% fine sand, 10-15% roots and organic matter, dark brown, moist
											Bot. 11": SILT (ML), non-plastic, 10-15% fine sand, trace fine roots, orange brown, moist (subsoil)
	2-4	S2	13	10	22	24	24	6			S2 - Silty SAND (SM), fine , ~15% fines, trace fine gravel, light brown, moist
5ft	4-6	S3	14	26	25	21	24	6			S3- Similar to S2, cobble in tip of sampler, moist to wet
10ft	9-11	S4	25	9	7	5	24	12			S4 - Top 4": Silty SAND (SM), fine, ~15% fines, trace fine gravel, light brown, wet
											Bot. 8": Well-Graded SAND (SW), fine to medium, ~5% fines, trace fine gravel, gray-brown, wet
										Stratified coarse deposits	
15ft	14-16	S5	8	9	8	6	24	15			S5 - Top 7": Well-Graded SAND (SW), fine to medium, ~5% fines, trace fine gravel, gray-brown, wet
											Bot. 8": Well-Graded SAND with Silt and Gravel (SW-SM), fine to coarse, ~10% fines, ~30% fine gravel, brown, wet
20ft	19-21	S6	10	6	4	5	24				S6 - Well-Graded SAND (SW), fine to coarse, ~5% fines, ~10% fine gravel, gray, wet
											End of boring at 21 feet. Backfilled borehole with auger cuttings.

Remarks:
1. The elevations were interpolated from plan titled "Site Plan," prepared by Tata & Howard, Inc. and dated August 2015, and are approximate.
2. The elevations reference the North American Vertical Datum 1988.

GeoTesting EXPRESS

Client:	Lahlaf Geotechnical Consulting				
Project:	Trinity Ave Pump Station				
Location:	Grafton, MA			Project No:	GTX-303741
Boring ID:	B4	Sample Type:	jar	Tested By:	jbr
Sample ID:	S3	Test Date:	09/22/15	Checked By:	emm
Depth :	4-6	Test Id:	347321		
Test Comment:	---				
Visual Description:	Moist, gray gravel with silt and sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
–	46.5	46.3	7.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	85		
0.5 in	12.50	73		
0.375 in	9.50	68		
#4	4.75	53		
#10	2.00	37		
#20	0.85	25		
#40	0.42	17		
#60	0.25	13		
#100	0.15	10		
#200	0.075	7.2		

Coefficients

D_{85} = 18.7010 mm	D_{30} = 1.2098 mm
D_{60} = 6.5327 mm	D_{15} = 0.3323 mm
D_{50} = 3.9729 mm	D_{10} = 0.1531 mm
C_u = 42.669	C_c = 1.463

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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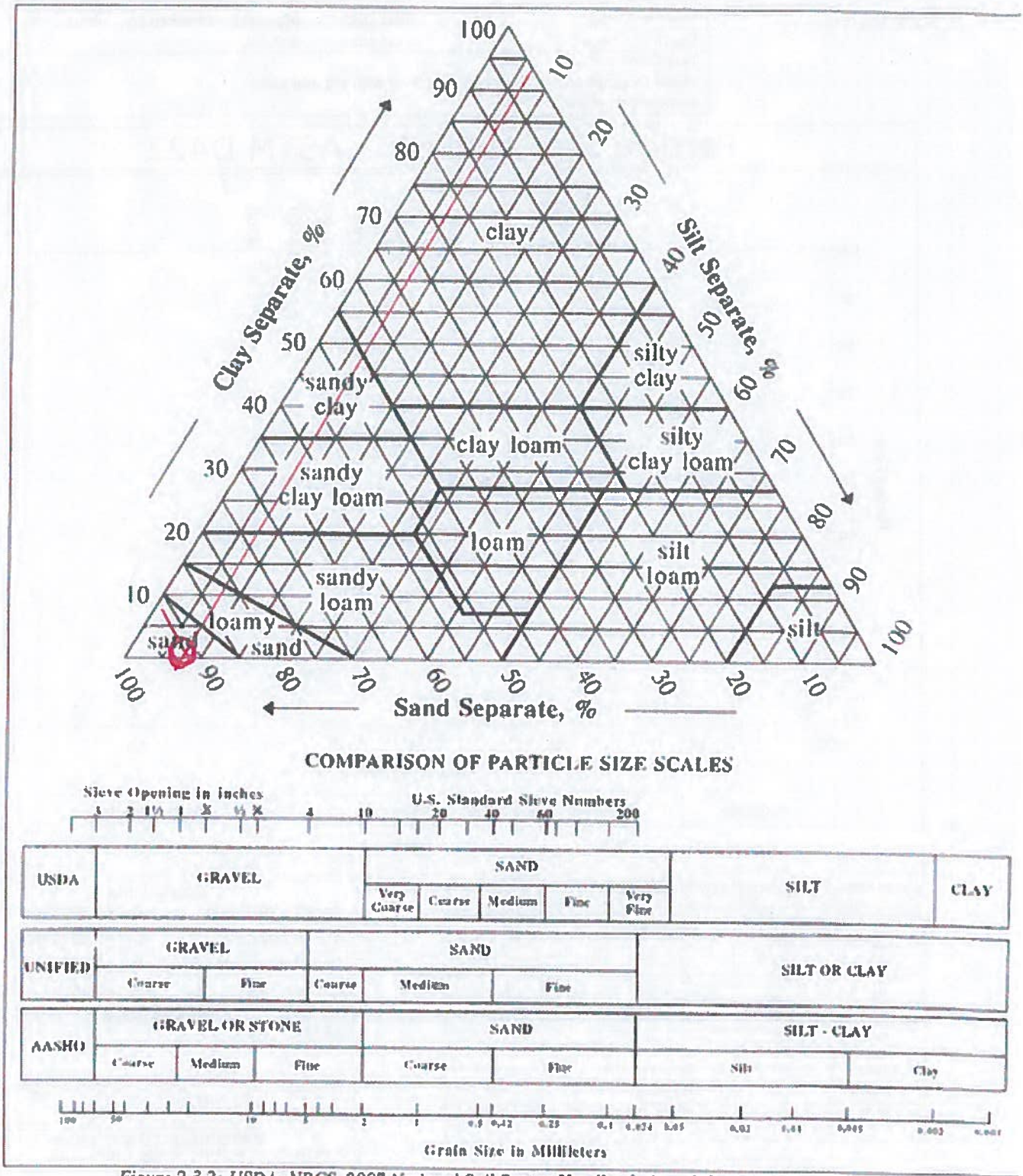


Figure 2.3.2: USDA, NRCS, 2007 National Soil Survey Handbook, Part 618, Exhibit 8, http://soils.usda.gov/technical/handbook/contents/part618ex.html#ex8

Type III 24-hr Rainfall=1.29"

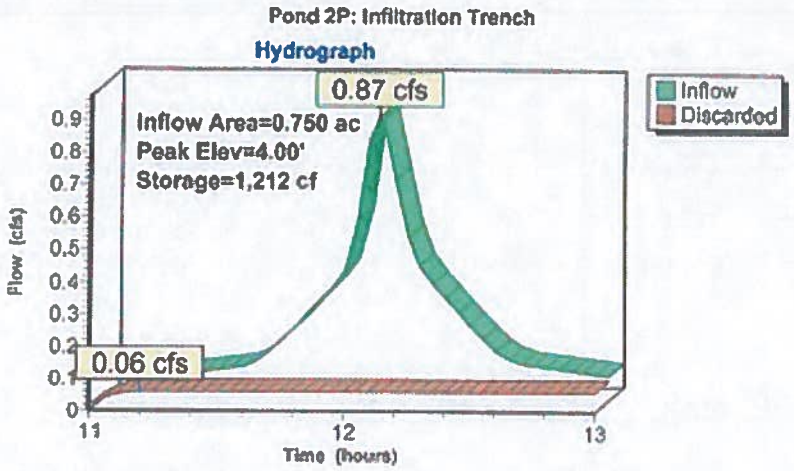


Table 2.3.3. 1982 Rawls Rates[18]

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

18 Rawls, Brakensiek and Saxton, 1982

TATA & HOWARD
INCORPORATED
CONSULTING ENGINEERS

JOB 3703 Grafton PB Access Rd
SHEET NO. 1 OF 11
CALCULATED BY MSB DATE 3/10/16
CHECKED BY LSS DATE 3/14/16
SCALE None

Trinity Avenue Channel Sizing Calcs

Notes: ✓ - Rational Method Used (Mass Hwy Ch. 8 pg. 8-13)
✓ - Ex. + Prop Access Rd considered 125-ft wide
✓ - Areas, length, elevations from survey / CAD

Flow Calcs

$Q = C_a C i A$

100-Year
where $C_a = 1.25$ (MHwy Ch. 8 pg 8-25)
$C_a = 1.0$ 2 to 10 year

- i is derived using watercourse length and elevation (T_c) data. Hence to determine slope.
- A = Area of Enclosure
- T_c = Length (Watercourse) / Velocity
- C is derived from Exhibit 8-8 and Exhibit 8-9, MHwy Ch. 8 pg 8-24
- Calculations are based on 100-yr & 25-yr storm events.
- C = 0.20 based on average value for Woodland + Unimproved

Slope is used in Exhibit 8-11 Mass Highway Ch. 8 pg 8-26. to determine velocity. Velocity and watercourse length are used to determine T_c, which is used in Exhibit 8-12 MHwy Ch. 8 pg 8-29

✓ C = 0.85 Pavement
✓ C = 0.20 Lawns / Unimproved (Also used for gravel) Sandy Soils
C = 0.20 Porous Pavement (Coefficient = 0 per Metropolitan Area Flooding Council Regs) C = 0.20 for conservative calculation

2 YR
Pre

TATA & HOWARD

JOB 3703 Grafton PS Access Rd
SHEET NO. 2 OF 11
CALCULATED BY MEB DATE 6/2/16
CHECKED BY LSS DATE 6/2/16
SCALE None

A1 $A = (7,188\ ft^2) / (43,560\ ft^2/Acre) = 0.165$ Acres

watercourse length = 171 ft Elev. Diff. = 311 - 291 = 20 ft

$S = (20\ ft)/(171\ ft) = 11.7\%$ ⟶ $V = 2.5$ ft/s

$T_t = (171\ ft)/(2.5\ ft) = (68.4\ s)/(60\ s/min) = 1.14$ min

5 minute minimum on Exhibit 8-14 = $i = 4.5$ in/hr

$C_a = 1.0$ $C = 0.20$ $A = 0.165$ Acres

$Q = CaCiA = (1.0)(0.20)(4.5)(0.165) = 0.149\ ft^3/s$

A_2: $A = (26,313\ ft^2)/(43,560\ ft^2/Acre) = 0.604$ Acres

watercourse length = 401 ft Elev. Diff = 293 - 292 = 1 ft

$S = (1\ ft)/(401\ ft) = 0.3\% \longrightarrow V = 0.55$ ft/s

$T_t = (401\ ft)/(0.55\ ft/s) = (729.1)/(60\ sec/min) = 12.15$ min

$i = 3.30$ in/hr $C_a = 1.0$ $C = 0.20$ $A = 0.604$ Acres

$Q = CaCiA = (1.0)(0.20)(3.3)(0.604) = 0.399\ ft^3/sec$

Pre-Development Discharge = $A_1 + A_2 =$

$0.149\ ft^3/s + 0.399\ ft^3/s = 0.548\ ft^3/sec$

$0.55\ ft^3/sec$

10 yr
Pre

TATA & HOWARD

JOB 3703 Grafton PS Access Rd
SHEET NO. 3 OF 11
CALCULATED BY MER DATE 6/2/16
CHECKED BY LSS DATE 6/2/16
SCALE None

A_1: $A = (7,188\ ft^2) / (43,560\ ft^2/acre) = 0.165$ acres

Watercourse length = 171 ft Elev. Diff = 314 − 294 = 20 ft

$S = (20ft)/(171ft) = 11.7\% \longrightarrow V = 2.5$ ft/sec

$T_t = (171ft)/(2.5\ ft/s) = (68.4\ sec)/(60\ sec/min) = 1.14$ min

5 minute minimum on Exhibit E-14 = $i = 5.5$ in/hr

$C_a = 1.0$ $C = 0.20$ $A = 0.165$ Acres

$Q = CaCiA = (1.0)(0.20)(5.5)(0.165) = 0.182\ ft^3/sec$

A_2: $A = (26,313\ ft^2) / (43,560\ ft^2/acre) = 0.604$ Acres

Watercourse length = 401 ft Elev. Diff = 293 − 292 = 1 ft

$S = (1ft)/(401ft) = 0.3\% \longrightarrow V = 0.55$ ft/s

$T_t = (401ft)/(0.55\ ft/s) = (729.1)/(60\ sec/min) = 12.15$ min

$i = 4.5$ $C_a = 1.0$ $C = 0.20$ $A = 0.604$ Acres

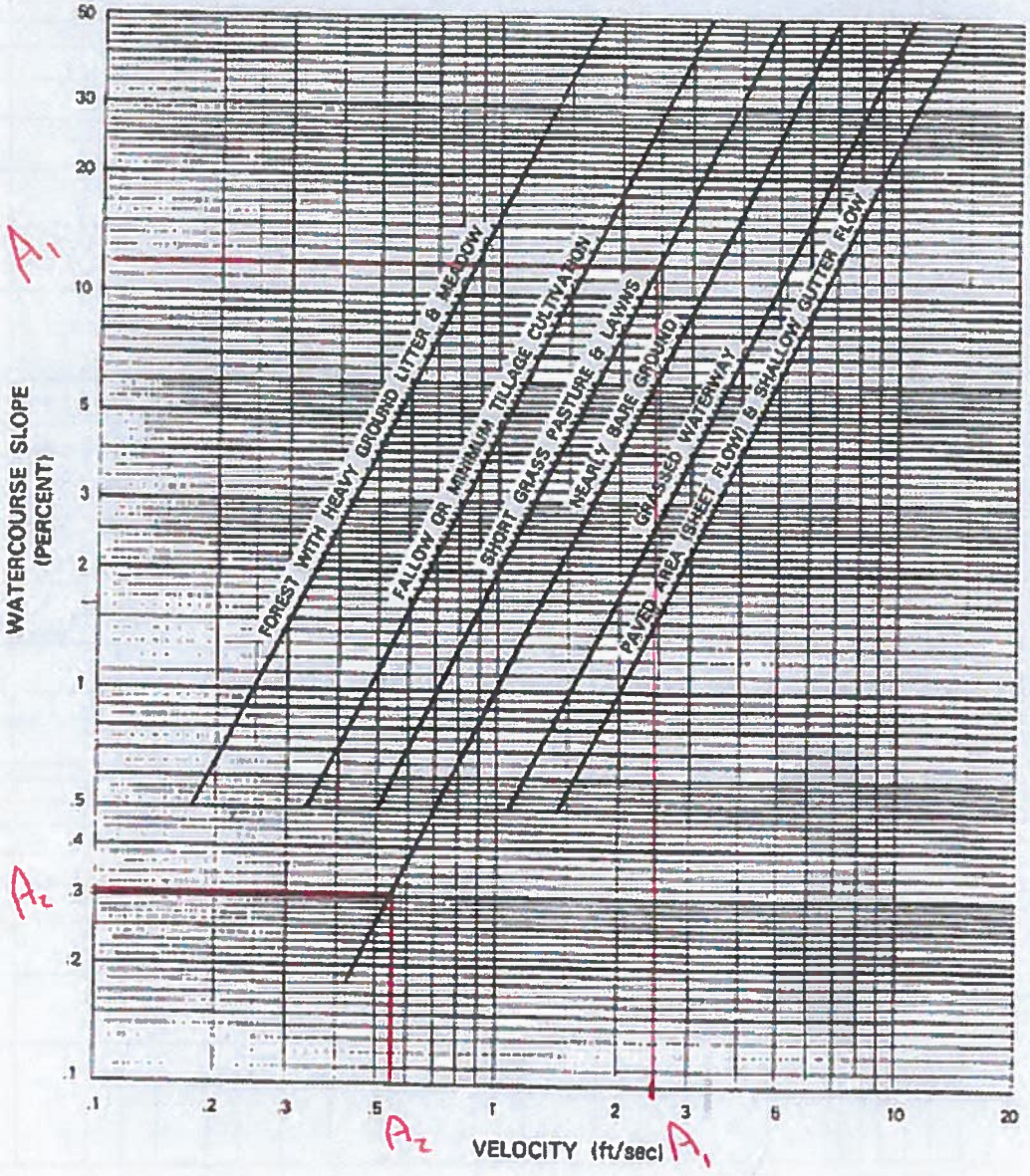
$Q = CaCiA = (1.0)(0.20)(4.5)(0.604) = 0.544\ ft^3/sec$

Pre-Development Discharge = $A_1 + A_2$ =

$(0.182\ ft^3/sec) + (0.544\ ft^3/sec) = 0.726\ ft^3/sec$

$0.73\ ft^3/sec$

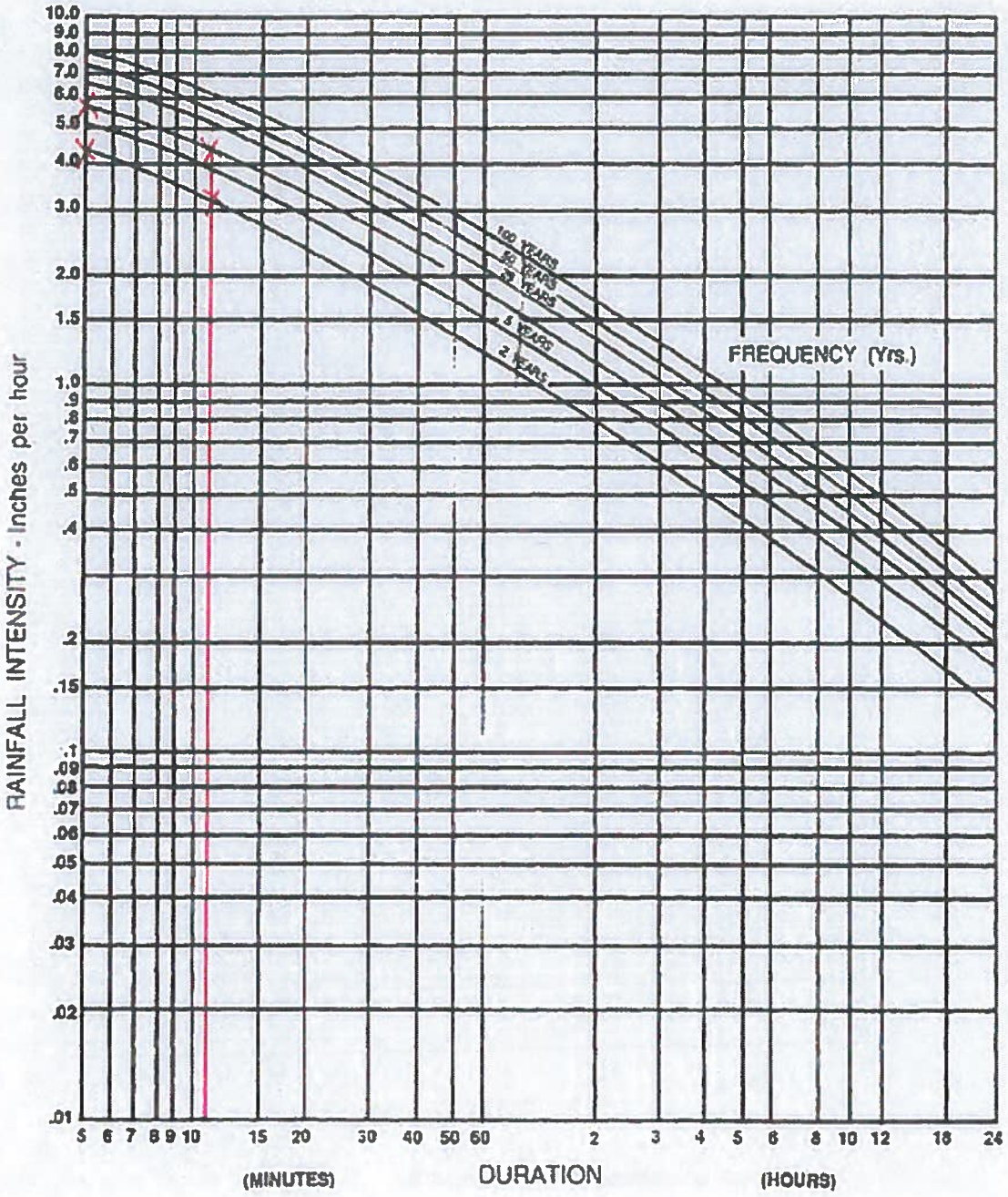
Exhibit 8-11
Average Velocities for Overland Flow



Source: TR55 - Urban Hydrology for Small Watersheds, NRCS

Sheet No. 5 of 11

Exhibit 8-14
Intensity - Duration - Frequency Curve for Worcester, MA



Source: TR55 - Urban Hydrology for Small Wetlands, NRCS

2-yr
Post

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JOB 3703 Carrollton 25 Acres
SHEET NO. 6 OF 11
CALCULATED BY mes DATE 6/2/16
CHECKED BY LSS DATE 6/2/16
SCALE None

Porous Pavers

A_3:

$A = (2{,}146\ ft^2) / (43{,}560\ ft^2/Acre) = 0.049$ Acres

Watercourse Length = 83 ft. Elev. Diff. = 310.5 − 306 = 4.5 ft

$S = (4.5\ ft) / (83\ ft) = 5.4\% \rightarrow V = 4.75\ ft/s$

$T_t = (83\ ft) / (4.75\ ft/s) = (17.5\ s) / (60\ s/min) = 0.29$ min

5 min. min. or Ex 8-14 $i = 4.3$ in/hr

$C_a = 1.0$ $C = 0.20$ $A = 0.49$ Acres

$Q_{pavers} = C_a C_i A = (1.0)(0.20)(4.3)(0.049) = 0.042\ ft^3/s$

Scale / Pavers

$A = (5{,}042\ ft^2) / (43{,}560\ ft^2/Acre) = 0.116$ Acres

Watercourse Length = 125 ft. Elev Diff = 306 − 291 = 15 ft

$S = (15\ ft) / (125\ ft) = 12\% \rightarrow V = 5.1\ ft/s$

$T_t = (125\ ft) / (5.1\ ft/s) = (24.5\ s) / (60\ s/min) = 0.411$ min

5 min. min. or Ex 8-14 $i = 4.3$ in/hr

$C_a = 1.0$ $C = 0.20$ $A = 0.116$ Acres

$Q_{scale} = C_a C_i A = (1.0)(0.20)(4.3)(0.116) = 0.10\ ft^3/s$

$Q_{pavers} + Q_{scale} = Q_{A3} =$

$0.042 + 0.10 = 0.142\ ft^3/s$

2-yr Post

TATA & HOWARD INCORPORATED
CONSULTING ENGINEERS

JOB 3703 Gretta PS Access Rd
SHEET NO. 7 OF 11
CALCULATED BY MSB DATE 6/2/16
CHECKED BY LSS DATE 6/2/16
SCALE None

A_{A4}: $A = (26{,}313\ ft^2) / (43{,}560\ ft^2/Ac) = 0.604$ Acres

Waterway Length = 401 ft Elev. Diff = 293-292 = 1 ft.

$S = (1\ ft) / (401\ ft) = 0.3\%$ $V = 0.55\ ft/s$

$T_t = (401\ ft) / (0.55\ ft/s) = (729.1\ s) / (60\ s/min) = 12.15$ min

$C = 3.3$ $C_a = 1.0$ $C = 0.20$ $A = 0.604$ Acres

$Q = C_a C I A = (1.0)(0.20)(3.3)(0.604) = 0.399\ ft^3/s$

$Q_{A4} = 0.399\ ft^3/s$

$Q_{A3} + Q_{A4} = 0.142 + 0.399 = 0.541\ ft^3/s$

Post Development Discharge

10 yr

Post

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CONSULTING ENGINEERS

JOB 3703 Grotto PS Access Rd
SHEET NO. 8 OF 11
CALCULATED BY MJB DATE 6/2/16
CHECKED BY LSS DATE 6/2/16
SCALE None

Pervious
A_3

Pavers

$A = (2{,}146\ ft^2) / (43{,}560\ ft^2/Acre) = 0.049$ Acres

Watercourse Length = 83 ft. Elev. Diff. = 310.5 − 306 = 4.5 ft

$S = (4.5\ ft) / (83\ ft) = 5.4\% \rightarrow V = 4.75\ ft/s$

$T_t = (83\ ft) / (4.75\ ft/s) = (17.5\ s) / (60\ s/min) = 0.29$ min

5 min. min. or Ex 8-14 $i = 5.7$ in/hr

$C_u = 1.0$ $C = 0.20$ $A = 0.049$ Acres

$Q_{paver} = C_u C_i A = (1.0)(0.20)(5.7)(0.049) = 0.056\ ft^3/s$

Swale / Pervious

$A = (5{,}042\ ft^2) / (43{,}560\ ft^2/Acre) = 0.116$ Acres

Watercourse Length = 125 ft. Elev. Diff. = 306 − 299.5 = 6.5 ft

$S = (6.5\ ft) / (125\ ft) = 5.2\% \rightarrow V = 5.1\ ft/s$

$T_t = (125\ ft) / (5.1\ ft/s) = (24.5\ s) / (60\ s/min) = 0.411$ min

5 min. min. or Ex 8-14 $i = 5.7$ in/hr

$C_u = 1.0$ $C = 0.20$ $A = 0.116$ Acres

$Q_{swale} = C_u C_i A = (1.0)(0.20)(5.7)(0.116) = 0.132\ ft^3/s$

$Q_{paver} + Q_{swale} = Q_{A3} =$

$0.056 + 0.132 = 0.188\ ft^3/s$

10-yr Post

TATA & HOWARD INCORPORATED
CONSULTING ENGINEERS

JOB 3703 Grealton Rd Access Rd
SHEET NO. 9 OF 11
CALCULATED BY MSG DATE 6/2/16
CHECKED BY LSS DATE 6/2/16
SCALE None

A_{A4}: $A = (26313\ ft^2)/(43{,}560\ ft^2/Ac) = 0.604$ Acres

Waterway Length = 401 ft Elev. Diff = 293-292 = 1 ft.

$S = (1\ ft)/(401\ ft) = 0.3\%$ $V = 0.55$ ft/s

$T_t = (401\ ft)/(0.55\ ft/s) = (729.1\ s)/(60\ s/min) = 12.15$ min

$i = 4.3$ in/hr $C_a = 1.0$ $C = 0.20$ $A = 0.604$ Acres

$Q = C_a C i A = (1.0)(0.20)(4.3)(0.604) = 0.519$

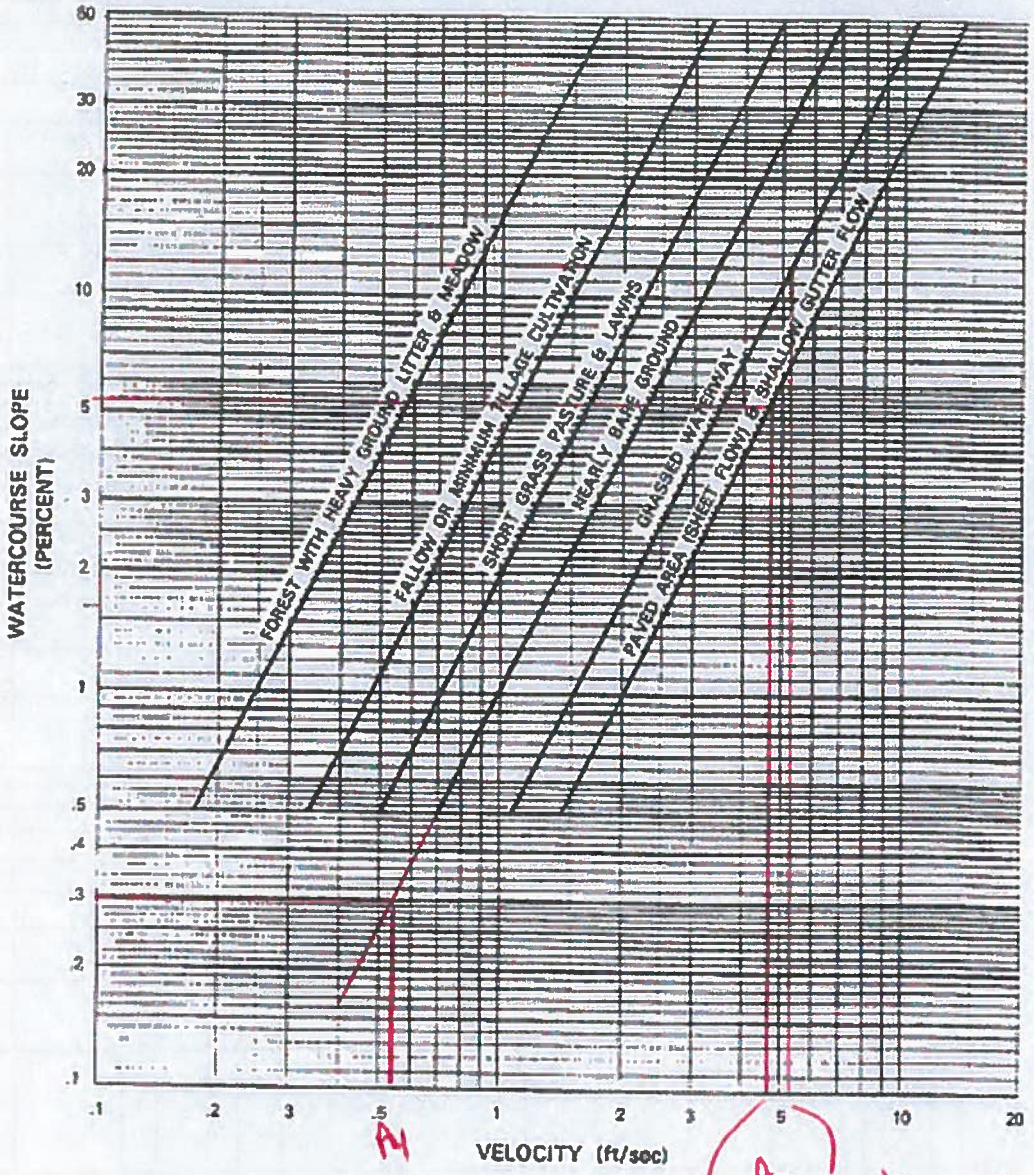
$Q_{A4} = 0.519\ ft^3/s$

$Q_{P3} = Q_{A4} = 0.1881 + 0.519 = 0.707\ ft^3/s$

Post Development Discharge

Shed No. 10 of 11

Exhibit 8-11
Average Velocities for Overland Flow

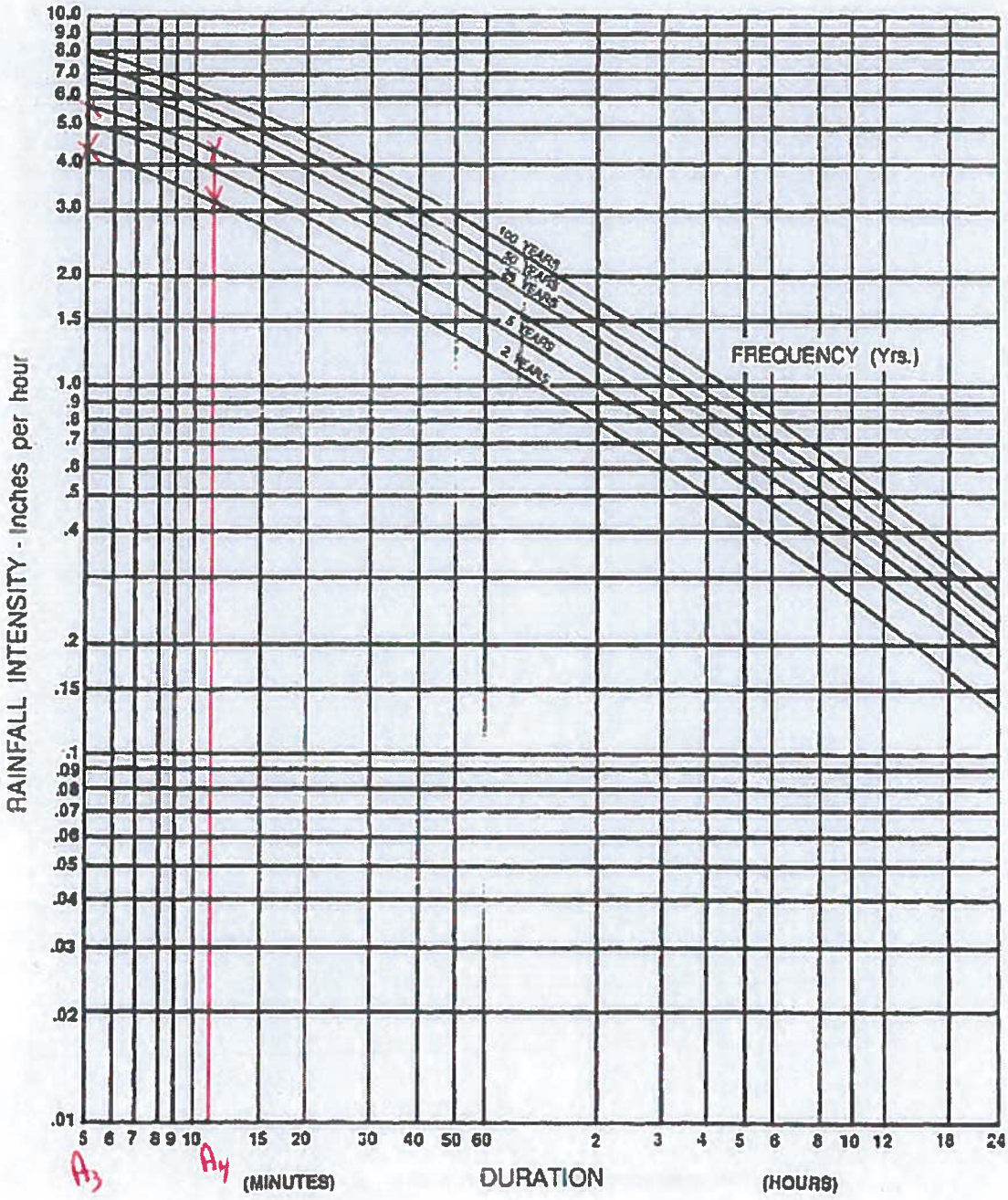


Source: TR55 - Urban Hydrology for Small Wetlands, NRCS

A1 A3 Paved V=4.8 ft/sec Swale V=5.1 ft/sec

Sheet No. 11 of 11

Exhibit 8-14
Intensity - Duration - Frequency Curve for Worcester, MA



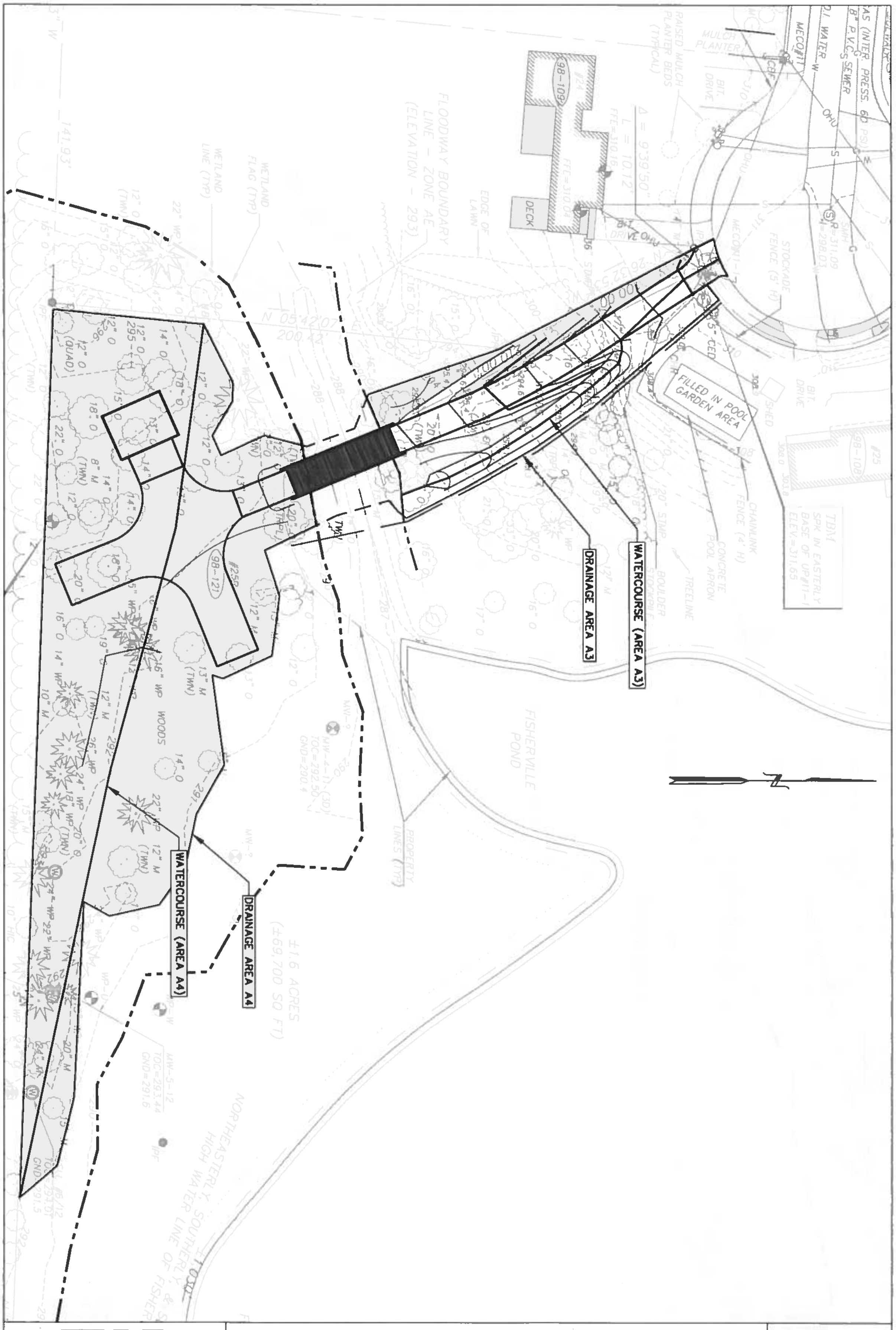
Source: TR55 - Urban Hydrology for Small Wetlands, NRCS

TATA & HOWARD

Pre Drainage Areas
Stormwater Report
Trinity Avenue Pump Station
Grafton Water District

Figure No.

1



TATA & HOWARD

Post Drainage Areas
Stormwater Report
Trinity Avenue Pump Station
Grafton Water District

Figure No.
2

Job:	Trinity Avenue Pump Station		
Sheet No.	1 of 1		
Calculated By:	MSB	Date:	6/2/2016
Checked By:	LSS	Date:	6/2/2016

From Elev. (Ft)	To Elev. (Ft)	Fill Volumes (CY) in Floodplain	Fill Volumes (CF) in Floodplain	Compensatory Storage Area	Compensatory Storage Area (SF)	Depth (Ft)
290	291	0.4	9.5	A	18.0	0.5
291	292	10.7	288.8	B	575.0	0.5
292	293	47.1	1,271.5	C	2,300.0	0.6

*Volumes calculated using average end area method

Attachment 3

ATTACHMENT 3

TATA & HOWARD

1. **Narrative:**
   The proposed Construction Period Pollution Prevention Plan will focus on the delineation of the limits of work in the field with the installation of erosion control socks and silt fence. This limit of work will serve two purposes: it will clearly define the acceptable limits of construction to prevent non-permitted work within the resource areas or buffers, and the erosion control socks and silt fence will prevent the migration of silt material into the resource areas during rain events. If dewatering is necessary, sedimentation basins will be used to remove silt particles from the water prior to discharge to the buffer zone.

2. **Construction Period Pollution Prevention Measures:**
   a. Maintain site, landscaping, and vegetation.
   b. Sweep and pick up litter on pavement and grounds.
   c. Deliveries shall be monitored to prevent on-site spillage of chemicals during delivery.
   d. Keep porous and impervious pavement in good repair. Maintain landscaped areas.
   e. Install and maintain erosion control measures.

3. **Erosion and Sedimentation Control Plan Drawings:**
   a. See attached Drawings.

4. **Detail drawings and specifications for erosion control BMPs**
   a. See attached Drawing No. C-6.
   b. See Attachment 6, Related Specification Sections

5. **Vegetation Planning**
   a. Vegetation is an important part of the post-construction stormwater treatment process. Special care is to be taken to protect the stormwater BMPs during construction. This includes, but is not limited to, the protection of these areas from construction period erosion with silt fence and erosion control socks. The stormwater control features will be inspected at the completion of the project to ensure they are free from construction period silt and other damage. Traffic over these areas should be limited to prevent compaction.

6. **Site Development Plan**
   a. See attached Drawings.

7. **Construction Sequencing**
   a. Clearing (no grubbing) of trees to the limit of work;
   b. Installation of erosion control measures;
   c. Grubbing;
   d. Excavation and construction of proposed bridge abutments;
   e. Installation of Bailey Bridge;
   f. Construction of stormwater structures;
   g. Excavation and construction of proposed building and appurtenances;

h. Site grading and paving;
i. Final stabilization of all disturbed areas;
j. Removal of erosion control measures.

8. **Sequencing of Erosion and Sedimentation Controls**
   a. Erosion control socks and silt fence will be installed prior to any grubbing, excavation or construction.
   b. Sedimentation basins are to be constructed prior to the discharge of water from any dewatering operation.

9. **Operation and Maintenance of Erosion and Sedimentation Controls**
   a. Erosion control socks to be replaced when saturated with silt, when structurally deteriorated to 2/3 the original height, or when gaps appear.
   b. Silt fence is to be installed with a minimum of 1 foot of fabric buried. Silt fence is to be replaced when it has been torn or fallen down. The replacement piece must overlap the silt fence in good condition by a minimum of 10 feet.
   c. The sedimentation basins shall receive the water from dewatering pumps and allow the settling and filtration of silt materials prior to discharge to the resource areas. Sediment collected shall be properly disposed of off-site, as directed by Owner.

10. **Inspection Schedule**
    a. Inspection of all sedimentation controls shall be completed by the contractor on a daily workday basis.

11. **Maintenance Schedule**
    a. Maintenance of all sedimentation controls shall be completed by the contractor as needed.

12. **Inspection and Maintenance Log Form**
    a. The contractor is to maintain a log of daily inspections, required corrective action, and maintenance performed on all sedimentation and erosion control devices.

Attachment 4

ATTACHMENT 4

TATA & HOWARD

1. **Narrative**
   The proposed pump station will be located adjacent to a District water supply and the following plan has been designed to minimize the potential for pollution in the long-term.

2. **Good housekeeping practices:**
   a. Maintain site, landscaping, and vegetation.
   b. Sweep and pick up litter on pavement and grounds. Continue sweeping activities.
   c. Deliveries shall be monitored to prevent on-site spillage of chemicals during delivery.
   d. Keep pavement in good repair. Maintain landscaped areas.
   e. Use appropriate snow removal spreading device and use of dedicated snow stockpile areas.

3. **Storage of waste materials:**
   a. There are no provisions for a dumpster.
   b. All chemicals will be delivered to the chemical delivery area and stored inside the pump station. As required by the Massachusetts Department of Environmental Protection, secondary chemical containment is provided in the pump station.

4. **Vehicle washing control:**
   a. There will be no vehicle washing or storage on site.

5. **Inspection and maintenance of BMPs:**
   a. Regular inspection and maintenance should be conducted in accordance with the Operation and Maintenance Plan, found in Attachment 5.

6. **Spill prevention and response:**
   a. Inventory materials to be present at the pump station.
   b. Train employees and subcontractors in prevention and clean-up procedures.
   c. Store materials in their appropriate containers within the pump station.
   d. Follow manufacturer's recommendation for disposal of used containers.
   e. Do not store excessive amounts of material to minimize the potential of a large spill or leak.
   f. Clean up spills.
      1. Maintain spill kits and absorbent materials on-site.
      2. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry clean up methods (sawdust, cat litter and/or rags and absorbent pads) and properly dispose of contaminated material.
      3. Sweep up dry materials immediately. Never wash them away or bury them.
      4. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil.
      5. Report significant spills to the Grafton Water District, Town of Grafton Conservation Commission, and Town of Grafton Board of Health.

7. **Provisions for maintenance of lawns, gardens, and other landscaped areas:**
   a. Fertilizer shall not be used on site.
   b. Shrubbery and encroaching natural vegetation shall be maintained with trimming and cutting as necessary.

8. **Requirements for storage and use of fertilizers, herbicides, and pesticides:**
   a. The use of fertilizer, herbicides or pesticides is not allowed on site.

9. **Pet waste management provisions:**
   a. Pets will not be allowed onsite and in the vicinity of the pump station and wellfield.

10. **Provisions for operation and management of septic systems:**
    a. The site is not equipped with sanitary facilities. The pump station has a sample sink for use in water quality testing by trained personnel and an emergency shower/eyewash. The sample sink and emergency eyewash drain to a drywell located on site, and are not to be used for disposal of any substance not related to the sampling and testing of drinking water.

11. **Proper Management of Deicing chemicals and snow:**
    a. Snow shall not be stored near environmentally sensitive areas. Plowing and/or sanding of the access drive and paved areas must be done in accordance with the guidelines set forth in the Operation and Maintenance Plan.
    b. No sand or rock salt will be stored on site. The use of salt, sodium chloride or calcium chloride is not allowed due to close proximity to a drinking water supply. Sand may be used but kept to a minimum. Excess sand is to be removed in the early spring by a street sweeper and or vacuum as described in the Operation and Maintenance Plan to avoid discharge to the resource areas and buffers and mitigate clogging of the porous pavement.
    c. Sweeping can be done by mechanical sweepers, vacuum sweeper (when required) or hand sweeper. The quantity of sand is a direct correlation with the treatment of ice and snow. Sweeping for this site should be done each spring. Collecting the particulate before it enters the buffer zones, resource areas or BMPs is environmentally friendly and can lengthen the life of the BMPs.

12. **Emergency contacts for implementing Long-Term Pollution Prevention Plan:**

Matthew Pearson, System Manager

Grafton Water District

Address: 44 Millbury Street
P.O. Box 537
Grafton, MA 01519
Phone: (508) 839-2302

Attachment
Illicit Compliance Statement

It is the intent of the Grafton Water District (Owner) to control illicit disposal into the storm drainage system. There will be no connection to the storm water system to inadvertently direct other types of liquids, chemicals or solids into the storm drainage system. The Owner will also promote a clean green environment by mitigating spills onto pavements; oils, chemicals, debris and litter.

Respectfully Acknowledged,

Matthew Pearson, System Manager
Grafton Water District

Attachment 5

TATA & HOWARD

ATTACHMENT 5

Stormwater Management Owners:

Upon completion of the project, the Grafton Water District will assume responsibility for the stormwater management system and the operation and maintenance of the BMPs.

Responsible Party:

The District will be responsible for the annual inspection and maintenance of the site. The General Manager will be responsible for keeping BMPs operating properly. Properly functioning BMPs will have longer life spans and a properly maintained site will provide greater protection to the public water supply.

Schedule of Maintenance Tasks

The following is the required maintenance schedule for each BMP located on site.

Porous Paved Access Road and Gravel Turnaround

1. Porous pavement areas should be checked seasonally for deterioration and for low levels of fill. Crushed stone and gravel should be swept or raked to maintain a fill level even with the top of the structural rings. Additional fill should be added as needed. Gravel areas should be swept or raked to maintain a clean area. Additional gravel should be added as needed.

2. Leaves and other organic matter should be raked or vacuumed from porous pavement and gravel areas regularly to prevent weed growth. Any weeds should be removed to maintain porosity.

3. Care should be taken during snowplowing of porous pavement and gravel areas to avoid contact between the plow blade and the porous pavement and gravel systems. A skid may be attached to the bottom of the plow to avoid problems.

General Maintenance

1. The use of deicing agents (sodium chloride, etc.) is prohibited. Sand may be used for traction control and to assist with ice-melting during winter conditions. To the greatest extent practicable, snow will be stockpiled outside the 100-foot buffer. Snow should be plowed away from the resource areas.

2. During normal pump station operations, vehicles will remain exclusively on the gravel and paved areas.

3. Access to the site will only be granted to personnel authorized by the Grafton Water District. Access to the site will be gated at all times.

4. The areas of the site that are not needed for operation and maintenance of the pump station will be allowed to re-naturalize. Following construction, native vegetation will be allowed to establish within disturbed areas and will not be pruned or removed unless vegetation encroaches into maintained areas.

Scaled Drawings of BMPs

Attached are scaled drawing of the site and the location of the BMPs. See Drawing Nos. C-4 and C-6.

Public Safety Features

As a public water supply, this site is gated to restrict the public's access. With respect to the BMPs, modified "country drainage" was implemented to minimize potential impacts to estimated and priority habitat areas. Further, the proposed system does not pose restrictions on year round vehicular access and promotes safe chemical deliveries to the pump station. It is not anticipated that the proposed operation and maintenance activities will pose risk to public safety.

Estimated Budget

Below is a table of the required maintenance tasks, the frequency and anticipated cost. The Grafton Water District staff will be responsible for regular maintenance along the access road and gravel areas, and will not introduce additional costs.

Estimated Maintenance Expenses

Porous Pavement and Gravel Areas		
Inspect	4 times yearly	Time and labor
Remove Organic Debris	As needed	Time and labor
Rake/Sweep/Add Gravel	As needed	Time and labor
General Maintenance		
Vegetation management	As needed	Time and labor

Attachment 6

TATA & HOWARD

SECTION 01100

SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section consists of special project procedures during construction including:
   1. Installation of access road and Bailey Bridge.
   2. Coordination of the connection of the existing wells to the proposed pump station.
   3. Coordination with utility company for primary power and installation of below grade electrical services to adjacent properties at #24 and #25 Trinity Avenue.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 GENERAL SEQUENCE OF WORK TO BE PERFORMED:

A. Installation of a stabilized construction entrance and erosion controls shall be completed by the Contractor and approved by the Town of Grafton Conservation Commission prior to the start of any work. The stabilized construction entrance shall prevent sediments from entering the public way.
   1. Contractor shall install a stabilized construction entrance with the use of stone or other course aggregate approved by the Engineer. Sufficent material (8-inch depth minimum and geotextile fabric) shall be placed to accommodate all construction vehicles. Install stabilized construction entrance in a way to prevent vehicles from bypassing construction entrance leaving project site. Construction entrance shall scrub the tires of all construction equipment prior to exiting to the public right of way.
   2. Contractor shall maintain the condition of Trinity Avenue. Any construction material tracked onto the public way shall be swept daily by the Contractor at no additional cost to the Owner.

B. All trees on the site larger than 6-inches in diameter shall be flagged and reviewed with the Town of Grafton Conservation Commission Agent prior to clearing and grubbing.

C. The Contractor shall properly grade the access to the site, excavate, form, and pour the Bailey Bridge abutments, and install the Bailey Bridge prior to completing any additional work associated with the construction of the pump station facility. The access road and Bailey Bridge is necessary span the existing wetlands.
   1. Trees shall be flagged for removal and reviewed with the Town Conservation Agent as described in 3.01B prior to removal.
   2. Unsuitable material shall be removed and disposed of off-site at no additional cost to the Owner.

3. The access road shall be properly backfilled and compacted to allow construction equipment access to the approximate location of the abutments.
4. Coffer dams and bypass piping shall be installed as necessary to bypass the existing wetlands. Dewatering equipment will be necessary during excavation. A sedimentation basin shall be used during dewatering operations. The coffer dams, bypass piping, and sedimentation basin shall be inspected by the Town Conservation Agent prior to excavation.
5. Following excavation and dewatering, the abutments shall be formed and poured. Following proper curing procedures, the abutments shall be backfilled and the wetlands shall be restored to equal condition prior to construction.
6. The banks of the wetlands shall be stabilized and inspected by the Town Conservation Agent following substantial completion of the abutment installation.

D. Installation of the Bailey Bridge abutments and below grade utilities crossing the existing wetlands shall be completed during low flow periods. Coffer dams shall be installed and approved by the Town of Grafton Conservation Commission Agent if necessary.

E. The grass lined channel and rip rap apron shall be installed in conjunction with the access road. The grass lined channel shall be stabilized and maintained during construction of the access road and pump station.

F. Temporary pavement and temporary bridge decking shall be used during construction. Final pavement and installation of bridge decking shall be completed following completion of all site work.

G. Contractor shall coordinate installation of underground electrical services to abutting properties at #24 & #25 Trinity Avenue. Coordination shall also involve relocation of additional existing overhead communication lines, etc. to be relocated underground in the same trench as the proposed electrical services. Contractor shall repair the exterior house finishes to like-new condition (fill holes, paint, replace siding, etc.) upon removal of overhead drops following underground installation of all utilities.

3.02 CONTRACTOR'S EMERGENCY SERVICE

A. Any contractor whose place of business is located beyond the vicinity of the site of work and who does not maintain local headquarters 24 hours a day must make satisfactory arrangements with the Owner to service emergencies or complaints which may occur at night, over the week-end, or when the job is shut down.
   1. If he does not, the Owner may make arrangements, and the cost will be charged to the Contractor.
   2. Before the final estimate is certified for payment, the Contractor shall make similar arrangements to cover the guarantee period.

3.03 COMPLIANCE WITH REDUCTION OF LEAD IN DRINKING WATER ACT AND SECTION 1417 OF THE SAFE DRINKING WATER ACT (SDWA)

A. All pipes, pipe fittings, plumbing fittings and fixtures must meet the requirements of the 2011 Reduction of Lead in Drinking Water Act and amendments to SDWA Section 1417 for potable water use.

B. Certification of compliance shall be provided for all applicable materials herein.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 01567

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.01 DESCRIPTION

A. The work covered by this section of the specifications consists of furnishing all labor, materials, equipment and services, and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this section of the specifications apply to any areas adjacent to wetlands, unless otherwise specifically stated or directed by Engineer, Owner, or Town of Grafton.

C. All work under this Contract shall be in accordance with the conditions stated herein and in the GENERAL CONDITIONS.

D. All erosion control devices shall be constructed or installed prior to beginning any form of excavation, grading, placement of materials, or general construction.

E. Insofar as possible, construction activities shall be confined to those areas defined by the plans and specifications. All land resources within the project shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work.

F. The location of storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared, as approved.

G. Adequate measures for erosion and sediment control such as the placement of erosion control socks around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

H. Any water that is pumped and discharged from an excavation shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

I. The pumped water shall be filtered through erosion control socks, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than one foot per second. The sediment shall be cleared from the channel periodically.

J. In order to trap sediment and to prevent sediment from clogging drainage systems, erosion control socks shall be used as shown on the following detail(s) or as directed by the Owner. Care shall be taken to keep them from breaking apart. The bales should be securely staked to prevent overturning, flotation, or displacement. All deposited sediment shall be removed periodically.

K. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, drains, pipes or structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

PART 2 PRODUCTS

2.01 EROSION CONTROL SOCKS

A. Erosion control socks shall be constructed with a mesh tube filled with biodegradable material (straw only), with a tube diameter of 8-inches, as manufactured by Silt Sock Erosion Control Products, Inc. or approved equal. The sock shall be installed as indicated in the Contract Documents.

2.02 SILT FENCE

A. The silt fence shall consist of a 3-foot wide continuous length sediment control fabric, stitched to a 25-foot wide continuous length support netting, and stapled to preweathered oak posts spaced at a maximum of 7-feet. The oak posts shall be 2-inches by 2-inches by 4-feet and shall be tapered. The support netting shall be industrial strength polypropylene. The sediment control fabric should conform to the following properties:

1. Minimum weight of 2.5 oz/sy (ASTM D3776-79)
2. Minimum thickness of 17 mils (ASTM D1777-79)
3. Minimum tear strength of 65 lbs. (ASTM D1117-80)
4. Minimum burst strength of 210 psi (ASTM D3786-80)
5. Minimum coeff. of permeability of 0.0009 cm/sec.
6. Equivalent opening size (EOS) 20 (U.S. Standard Sieve)
7. Water flow rate of 40 gal/min/st.

B. Sediment control fabric shall be non-rotting, acid and alkali resistant and have sufficient strength and permeability for the purpose intended, including handling and backfilling operations. Fibers shall be low water absorbent. The fiber network must be dimensionally stable and resistant to delamination. The fabric shall be free of any chemical treatment or coating that will reduce its permeability. The fabric shall also be free of any flaws or defects which will alter its physical properties. Torn or punctured fabrics shall not be used. For each specific use, only commercially available fabric which is certified in writing by the manufacturer for the purpose intended shall be used. The Contractor shall submit a two-foot square sample of each type of fabric to be used, along with technical data sheet and certified test reports. The Owner reserves the right to reject any fabric which he deems unsatisfactory for a specific use. The brand name shall be labeled on the fabric or the fabric container.

C. Fabrics which are susceptible to damage from sunlight or heat shall be so identified by suitable warning information on the packaging material. Fabrics susceptible to sunlight damage shall not be used in any installations where exposure to light will exceed 30 days, unless specifically authorized in writing by the Owner.

2.03 CATCH BASIN SILT FILTERING SYSTEM

A. Silt filtering system for catch basins accepting drainage from the site shall be Siltsack as manufactured by ACF Environmental Inc. Richmond, VA. and distributed by A. H. Harris, or approved equal.
   1. Manufactured to fit opening of catch basins or drop inlet.
   2. Two dump straps attached to the bottom to facilitate emptying the sack.
   3. Lifting loops as an integral part of the Siltsack to be used in lifting the Siltsack from the basin.
   4. A restraint cord approximately halfway up the sack to keep the sides away from the catch basin walls.
   5. Manufactured from woven polypropylene fabric with the following properties:

a.	Grab Tensile	ASTM D-4632	300 lbs.
b.	Grab Elongation	ASTM D-4632	20%
c.	Puncture	ASTM D-4833	120 lbs.
d.	Mullen Burst	ASTM D-3786	800 psi.
e.	Trapezoid Tear	ASTM D-4533	120 lbs.
f.	Apparent Opng.	ASTM D-4751	40 US Sieve
g.	Flow Rate	ASTM D-4491	40 gpm/sf

PART 3 EXECUTION

3.01 NOTIFICATION

A. The Owner will notify the Contractor in writing of any non-compliance with the foregoing provisions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work until satisfactorily corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREAS OF CONSTRUCTION ACTIVITY

A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES

A. The Contractor shall not pollute streams, wetlands, or ponds with fuels, oils, bitumens, calcium chloride, acids or harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers, wetlands and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.04 LOCATION OF STORAGE AREAS

A. The location of the Contractor's storage areas for equipment and/or materials shall be upon portions of the job site and shall require written approval of the Owner. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Owner.

B. Adequate measures for erosion and sediment control, such as the placement of erosion control socks around the downstream perimeter of stockpiles, shall be employed to protect any downstream areas from siltation.

C. The Owner may designate a particular area or areas where the Contractor may store materials used in his operations.

3.05 DISCHARGE OF DEWATERING OPERATIONS

A. Any water that is pumped and discharged from an excavation as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

B. The pumped water shall be filtered through erosion control socks, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. The sediment shall be cleared from the channel periodically.

3.06 PROTECTION OF AIR RESOURCES

A. During the progress of work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of water as necessary, so as to minimize the creation and dispersion of dust.
   1. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control, then the Contractor shall furnish and apply the material as directed.
   2. Calcium chloride shall be commercial grade, furnished in 100-pound, 5-ply bags, stored under weatherproof cover and stacked alternately for ventilation.
   3. Application for dust control shall be at the rate of about 1/2 pound per square yard per application.

B. Burning of rubbish and waste material on the site shall not be permitted.

3.07 SEPARATION AND REPLACEMENT OF TOPSOIL

A. Topsoil shall be carefully removed and separately stored to be used again as directed. The topsoil shall be stored in an area acceptable to the Owner and adequate measures shall be employed to prevent erosion of said material.

3.08 EROSION CONTROL SOCKS

A. To trap sediment and to prevent sediment from clogging drainage systems, erosion control socks shall be used where indicated on the drawings or where directed by the Owner. Care shall be taken to keep them from breaking apart. The socks should be securely staked to prevent overturning, flotation, or displacement. All deposited sediment shall be removed periodically.

B. Socks shall be maintained or replaced until they are no longer necessary for the program intended or are ordered removed by the Owner.

3.09 SILT FENCE

A. Where indicated on the drawings or where directed by the Owner, the Contractor shall erect and maintain a temporary silt fence. The silt fence shall be used specifically to contain sediment from runoff water and to minimize environmental damage caused by construction.

B. The 4.5 foot oak posts shall be driven so that 2-feet remain above the ground. A 6-inch by 6-inch trench shall then be excavated at the base of the fence for the purpose of laying, backfilling and tamping, a minimum of 6-inches of the filter fabric.

C. The Contractor shall remove the trapped sediment as soon as it reaches a depth of 1-foot or when directed by the Owner.

D. The silt fence systems will be completely removed from the project at the completion of the project, unless specifically authorized by the Owner to be left in place.

3.10 DUST CONTROL

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities so as to minimize the creation and dispersion of dust. Dust control shall be accomplished by the wetting down of the affected areas with a water truck with distributors for that purpose.

B. The use of calcium chloride for dust control shall be prohibited.

END OF SECTION

SECTION 02140

SITE DRAINAGE AND DEWATERING

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide drainage and dewatering as required by the Contract Documents.
   1. In general the Contractor shall furnish all materials, equipment, labor and incidentals necessary to provide dewatering and drainage control during construction.

1.02 RELATED WORK

A. Documents affecting the work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.
   1. Section 01567 Environmental Protection
   2. Section 02222 Earthwork

1.03 SUBMITTALS

A. None required.

PART 2 PRODUCTS

2.01 EROSION AND SEDIMENTATION CONTROL

A. Devices for erosion and sedimentation control for effluent of dewatering operations shall be as specified in Section 01567, Environmental Protection

PART 3 EXECUTION

3.01 INSTALLATION

A. To insure proper conditions at all times during construction the Contractor shall provide and maintain ample means and devices with which to remove and dispose of all water entering trenches and other excavations.
   1. Means of water removal and disposal shall include but not be limited to wells, surface pumps, and/or well point systems, to the extent required to prevent "boils" or softening of the foundation soils.
   2. The Contractor shall pitch the ground around the excavation to prevent water from running into excavated areas and to prevent damage to other structures or work on adjacent property.

3. The Contractor shall remove immediately any surface or seepage water or water from sewers, drains, creeks, or other sources, which may accumulate during the excavation and construction work.

B. Excavations shall be kept dry until the structures, pipes and appurtenances, to be built or installed therein, have been completed and backfilled to such extent that they shall not float or otherwise be damaged by water in the excavation.
   1. In no event shall water rise to cause unbalanced pressure on the pipe or other structures. The Contractor shall prevent flotation of the pipe or structures.
   2. Pipe, masonry and concrete shall not be placed in water. Water shall not submerge new masonry or concrete within four (4) hours after placement.

C. Sufficient stand-by pumping equipment shall be installed and mounted for immediate use in case of emergencies. The Contractor shall be responsible for the adequacy of their dewatering equipment and system in controlling the water and for protection to adjacent public and private property from damage. Any damage to permanent work or existing property resulting from the failure of the Contractor to provide an adequate dewatering system shall be repaired by the Contractor at their expense.
   1. Wells, well points and pump sumps shall be installed with adequate filters to prevent loss of fine grained soils.

3.02 DISPOSAL OF DRAINAGE WATER

A. All water pumped or drained from the work shall be disposed of in such a manner as to not cause injury to public health, damage to public or private property, interference with other work or adverse impacts to adjacent wetlands.
   1. Effluent from dewatering operations shall not be discharged directly to wetlands or waterways and shall not be discharged to storm drain systems prior to being filtered through a siltation basin.
   2. Discharge shall be such that no erosion occurs. Erosion protection shall be as specified in Section 01567, Environmental Protection.

END OF SECTION