Stormwater Management Report

University Station

University Avenue

Westwood, MA

Submitted to:
Town of Westwood

November 30, 2012

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 Introduction

This report summarizes the drainage analysis and Stormwater Management Plan associated with the University Station project (the project). The intent of this report and Stormwater Management Plan is to create the framework and performance standards to which the project must adhere as the design advances. The University Station project includes multiple improvements that may be constructed in multiple phases. The performance standards set forth in this report can be achieved as each phase of the project is completed.

The project is a mixed use development located approximately 12 miles southwest of Boston in the Town of Westwood (Figure 1-1) and involves the redevelopment of a significant portion of the University Avenue Business Park. University Station will replace approximately 1.4 million square feet of the former industrial, warehouse, and office uses with a blend of modern residential, retail, restaurant, hotel, office, and public spaces.

Portions of the former industrial park, associated parking/loading areas, and access driveways have been previously demolished. This analysis utilizes the pre-demolition state of the site as the existing condition, as the site work that had been previously conducted is only an interim step in the overall development of the project.

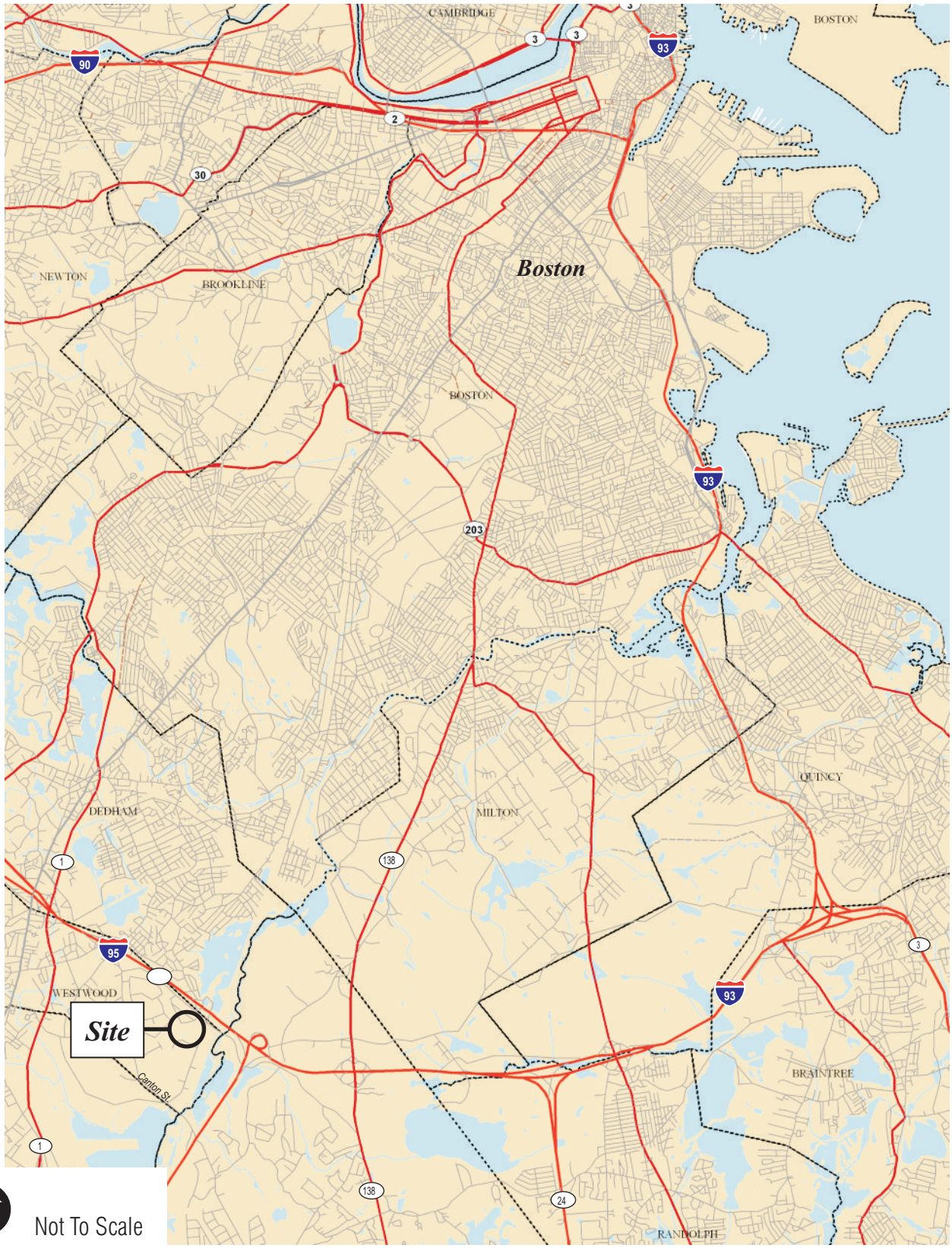
The site is adjacent to the existing University Avenue/Route 128 MBTA Station, and its 2,700 vehicle parking facility. This facility provides a direct transit link to Back Bay and South Station in Downtown Boston. The other land uses adjacent to the project include residential neighborhoods to the west (Town of Westwood), Route 128/95 to the north (Town of Dedham), commercial/industrial uses to the south (Town of Norwood), and the MBTA/Amtrak rail corridor and Neponset River along the eastern boundary (Town of Canton).

The hydrologic study area is 326.1± acres (includes all offsite tributary area) and drains to four individual points of analysis. These four locations represent the individual convergence points of the major watershed boundaries that make up the overall drainage study limits. All four of these watersheds are drained through a combination of open and closed drainage systems and ultimately flow to the Neponset River. Land coverage within the study boundary consists generally of a mix of industrial and residential uses. Non-developed areas are landscaped, wooded, or grassed. Further description of each watershed and point of analysis are included in Sections 2.0 and 3.0.

As indicated in Table 1-1, construction of the proposed project will result in an increase in impervious area from existing conditions. The project will mitigate this increase through a combination of stormwater management practices consistent with the Massachusetts Department of Environmental Protection (MADEP) Stormwater Management Standards as well as standards imposed by the Town of Westwood.

Table 1 Hydrologic Study Area Land Use Distribution Summary

Area	Existing (Acres)	Proposed (Acres)
Roofs/Buildings	49.9	47.5
Pavement, Sidewalks, Hardscape	87.1	104.6
Open Space (woods, grass, landscaped area)	189.1	174.0
Total	**326.1**	**326.1**



Not To Scale

TETRA TECH

University Station
Westwood, Massachusetts

Regional Context Map Figure 1-1

2.0 Existing Conditions

2.1 Topography

The study area elevations range generally from 50± to 190±, with the highest elevations occurring along the western boundary of the study limits in a residential area. Lowest elevations generally occur along the railroad tracks, west of the Neponset River at approximately elevation 50±. The study area slopes from west to east, in the direction of the Neponset River.

2.2 Soils

According to the USDA Soil Survey of Norfolk and Suffolk Counties, the soils within the project and adjoining areas consist mainly of urban land, wet substratum soil map unit Uw (Appendix D). Buildings, industrial areas, pavement, and railroad beds cover more than 75 percent of the land surface. Smaller areas of urban land (Ur) and Udorthents (Ua and Ud) are also located in the area. Areas described as Udorthents are those areas where the original soils have been removed, cut away, or covered. Geotechnical investigations indicate that these areas identified as Urban Land and Udorthents are generally sandy/gravelly soils underlain by bedrock. The bedrock elevation rises quickly in an east to west direction, away from the Neponset River.

In addition to NRCS soil data, significant geotechnical investigations have been performed. Test pits, monitoring wells and infiltration tests have been observed. Based on this data, bedrock contour mapping has been developed and a Stormwater Infiltration Report has been prepared. This information is included in Appendix F.

2.3 Watershed Boundaries

The study area is divided into four major watershed boundaries, each having multiple, smaller sub-catchment areas. The project site drains in an easterly direction towards the Neponset River. A majority of the runoff is generated from the developed impervious areas on the site; specifically, large parking areas, building roofs, and roadways. Limited stormwater management controls exist to attenuate peak flows or control or treat the quality of the stormwater runoff prior to discharge. Much of the stormwater management infrastructure that exists is designed simply to collect and convey runoff. As shown in the Existing Stormwater Infrastructure Plan (Figure 2), the drainage collection system that services the existing site consists of catch basins in roadways and parking lots and the storm drains that convey untreated runoff to open channels and on to the Neponset River. A detailed depiction of the overall watersheds and their sub-catchment areas are shown on Figure 4. Time of concentration flow paths are also shown on Figure 4.

The hydrologic analysis for the former Westwood Station project utilized SWMM modeling software. Data from these previously reviewed and approved Existing Conditions drainage calculations has been directly input into the current HydroCAD model. A set of these previously approved drainage calculations has been submitted

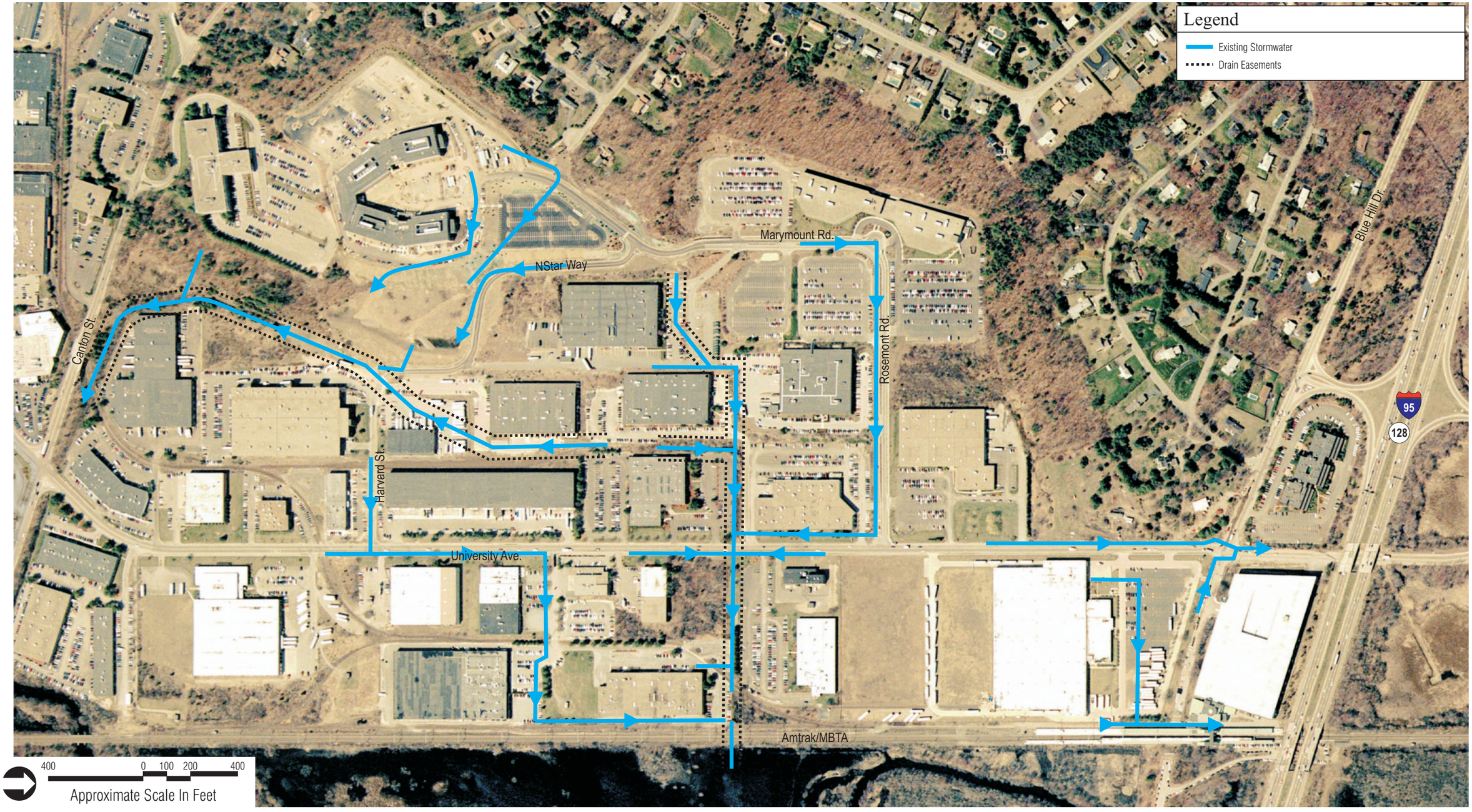
under separate cover in order to provide detailed information of watershed ground covers, hydrologic soil groups and time of concentrations.

Point of Analysis 1 - Runoff from the southwestern portion of the study area is collected and conveyed via catch basins and a closed drainage system to a drainage ditch that runs along Canton Street (Point of Analysis 1). Runoff from the NSTAR property is similarly collected and conveyed through a small detention basin to the Canton Street ditch. Ground coverage within this watershed is comprised largely of industrial, office, and residential uses. The undeveloped areas are either landscaped, lawn, or wooded areas.

Point of Analysis 2 - Stormwater within the central portion of the hydrological study area is collected and conveyed through a series of catch basins, storm drains and ditches to the second discharge point (Points of Analysis 2). There are no controls in place to attenuate peak flow rates or to provide water quality treatment stormwater prior to discharge. This outlet consists of 60 inch culvert beneath the lead railroad track and into a pocket wetland. From there, stormwater flows into a 72 inch culvert beneath the main railroad track and discharges to a wetland up gradient of the Neponset River. This point of analysis is largely made up of industrial and office uses, their associated parking areas, and roadways. The remaining area is a mix of various forms of open space.

Point of Analysis 3 - The third point of analysis is comprised of the land to the north/northwest of the study area. Land coverage in this watershed consists of office and industrial uses with associated parking and access drives, scattered residential development and undeveloped/wooded areas. This watershed generally drains northwest to southeast through as a combination of overland flow, piped stormwater collection and conveyance systems, and open channel/ditches. This network of pipes run north along University Avenue, through the northern portion of the site, and ultimately flows towards the Neponset River, north of the Amtrak/Route 128 station.

Point of Analysis 4 - This point of analysis consists largely of industrial uses with limited undisturbed areas. The stormwater runoff from the north end of University Avenue, along with the stormwater runoff from Blue Hill Drive, is conveyed via catch basins and a closed stormwater management system to the fourth major point of analysis (Point of Analysis 4). Storm water is discharged into the University Avenue stormwater collection system which then drains through a 36 inch pipe into a 48 inch collector drain along the Amtrak/Route 128 station and, eventually on to the Neponset River.



TETRA TECH

University Station
Westwood, Massachusetts

Base Map: MassGIS, 2001

Existing Stormwater Infrastructure

Figure 2-1

3.0 Proposed Conditions

The proposed stormwater management plan for the project has been developed to exceed the requirements of the MADEP Stormwater Management Policy. In terms of stormwater quantity**,** the plan provides substantial groundwater recharge to the aquifer system located under the central portion of the project through a system of innovative stormwater infiltration systems. The infiltration provided by the project exceeds the requirements of the MADEP Stormwater Management Policy. The project also provides peak flow attenuation through a combination of sub-surface infiltration and surface extended detention basins to control the discharge of stormwater runoff from large individual storms (2, 10, 25 and 100-year storms). These stormwater management measures will act to mitigate stormwater discharges so that post construction discharge rates will not exceed preconstruction stormwater discharge rates.

A reduction in the volume of runoff associated with Point of Analysis 3 is anticipated for each of the analyzed storm events when compared to both the results of the previously approved calculations and the current existing conditions model. This is accomplished through a system of low and high flow outlets in the proposed upper basin (52.1P) that will convey water from this watershed to Point of Analysis 2. These devices were included in an effort to route stormwater to Point of Analysis 2 that is being collected within the proposed boundaries of watershed 3 but was previously collected and discharged to the second point of analysis (POA 2).

In terms of the stormwater quality, the stormwater management plan exceeds the MADEP Stormwater Management Policy's requirements for pollutant removal by implementing a combination of stormwater Best Management Practices (BMP's) and an aggressive street sweeping program. Figure 5 shows the boundaries of the four watersheds in the proposed condition. The proposed stormwater infrastructure is shown in greater detail on the revised Site Development Plans (provided under separate cover).

As indicated in Section 1, construction of the proposed project will result in an increase in impervious area from existing conditions in each of the four major water watersheds. However, increased runoff and water quality effects from the increased impervious cover will be mitigated by compliance with the ten standards of the MADEP Stormwater Management Policy. Compliance with each of the ten standards is summarized below.

3.1 Stormwater Management Standards

The purpose of the Stormwater Management Plan is to provide a comprehensive framework for the long-term protection of natural resources in and around the project area from degradation as a result of stormwater discharges. This is achieved through the use of a variety of water quality and quantity control measures designed to decrease pollutants discharged from the project area and to mitigate post construction stormwater discharge rates.

The proposed stormwater management system complies with the current MADEP Stormwater Management Policy. The Checklist for a Stormwater Report is included in Appendix C.

3.1.1 Standard # 1 – Untreated Stormwater

No point discharges of untreated stormwater to resource areas are proposed. Stormwater quality control for the project includes street sweeping, deep-sump, hooded catch basins, water quality structures, sub-surface infiltration basins, and extended dry and wet detention basins with sediment forebays. All points of discharge are designed to prevent scour and erosion.

3.1.2 Standard # 2 – Post-Development Peak Discharge Rates

Stormwater management controls are developed for the 2-, 10-, 25-, and 100-year 24-hour storm events. Under existing and proposed conditions, hydrologic analyses were performed utilizing the computer program, HydroCAD®. In order to determine the peak rate of discharge for existing and proposed conditions, runoff hydrographs were generated for the storm events using the SCS TR-20 Method (refer to Appendix B, HydroCAD® Input/Output). Table 3-1 summarizes the pre- and post-development peak runoff discharge rates determined in the hydrologic/hydraulic analyses performed for the project area. As shown below, there will be no increase in peak run-off discharge rates as a result of the project for the 2-, 10-, 25-, or 100-year storms.

Table 2 Comparison of Peak Runoff Rates (in cfs)

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
PA1	61.36	50.27	-11.05	104.67	90.89	-13.78	132.62	119.42	-13.20	161.58	159.28	-2.30
PA2	135.99	71.80	-64.19	224.95	128.44	-96.51	257.07	169.54	-87.53	265.05	227.87	-37.18
PA3*	23.45	15.84	-7.61	63.16	28.06	-35.10	91.34	43.84	-47.50	135.60	65.37	-70.23
PA4	29.02	11.26	-17.76	42.85	21.97	-20.88	47.12	31.51	-15.61	52.23	46.51	-5.74

*****The pre and post development peak runoff rates associated with PA 3 have been obtained from the current HydroCAD model. Tetra Tech has reviewed the modeling approach with the developer of the HydroCAD software. Based on the discussions with HydroCAD, no modeling errors were discovered. As discussed above, a reduction in the volume of runoff to PA 3 is anticipated for the 2, 10, 25, and 100 year storm events when compared to both the results of the previously approved calculations and the current model.

3.1.3 Standard # 3 – Recharge to Groundwater

Substantial recharge of groundwater is provided through a system of sub-surface infiltration galleries located beneath the parking areas associated with the western retail

portion of the project and beneath the Village Green. The University Station project once constructed will have approximately 84.3 acres of impervious surfaces (existing and proposed building roofs, parking lots, roads, driveways and walks). As required by MassDEP Stormwater Management Policy, all impervious surfaces on the project site must be considered in the required recharge calculations. For the purposes of recharge calculations, the entire site was assumed to be a hydrologic soil group A (a conservative assumption). These recharge systems as designed will infiltrate approximately 4.24 acre-feet of stormwater, exceeding the 4.22 acre-feet required by MassDEP. The provided recharge volume was calculated using the dynamic method. Calculations have been provided to demonstrate the recharge volume will "drain down" within 72 hours.

Infiltration rates in the core retail area are based permeability tests and recommended infiltration design rates provided by the Geotechnical Engineer. A Stromwater Infiltration Data report has been prepared by the Geotechnical Engineer and is included in Appendix F. For the infiltration system located in the Village Green, Rawl's rates were utilized. The Stormwater Infiltration Data report also addresses seasonal high groundwater elevations.

3.1.4 Standard # 4 – TSS Removal (Stormwater Quality)

Best Management Practices (BMPs) will be used to provide water quality. The following BMPs will be provided with in the project area: roadway sweeping, deep sump, hooded catch basins, water quality structures, sediment forebays, and extended dry and wet detention basins. Water quality calculations are included in Appendix D.

Street Sweeping

The proposed design incorporates street sweeping as a BMP to control the amount of sediment that enters the drainage system. Street sweeping will be conducted on a monthly average, with a mechanical sweeper. In accordance with the MADEP Stormwater Management Policy, a 5 percent TSS removal rate is credited for this BMP.

Deep Sump, Hooded Catch Basins.

All proposed catch basins within the project area will be deep sump, hooded catch basins, which will serve to trap sediment and floatables before entering the drainage system. Sumps will be four-foot deep. Inlets should be inspected and, if necessary, cleaned a minimum of two (2) times per year. Sediments and hydrocarbons shall be properly handled and disposed of, in accordance with local, state, and federal requirements. All catch basins will be installed with sediment sumps and oil hoods. In accordance with the MADEP Standards, a 25 percent TSS removal rate is credited for this BMP.

Water Quality Structures

Proprietary water quality structures (Stormceptors) are proposed to treat runoff from paved portions of the project area. The structures are located at the end of drainage systems before the parking lot runoff enters into the stormwater

management basins or infiltration systems. A 50 percent TSS removal rate has been selected for discharges to detention basins and a 75% TSS removal rate has been selected for discharges to underground infiltration systems.

The Stormceptor water quality structures have been sized to adequately treat the 1" water quality volume equivalent flow rate, consistent with MADEP requirements (See enclosed Checklist for Stormwater Report). The 1" water quality volume was converted to a flow rate based on MADEP methodology. In all cases, the selected Stormceptor unit achieves the desired TSS removal rate and provides positive continuous treatment for the equivalent water quality volume flow rate. Please see the Stormceptor sizing summary and sizing reports included in Appendix D.

Sub-Surface Stormwater Infiltration Systems

A series of sub-surface infiltration galleries are proposed to collect, treat, and recharge stormwater to groundwater resources. Each system consists of a large, single, open chamber that is surrounded by crushed stone and filter fabric. These infiltration systems are proposed to run linearly along the lower reaches of some of the parking areas as well as within the central open space located in the Village portion of the project. Runoff from building rooftops and paved surfaces will be directed to these systems. Runoff entering the infiltration areas will be treated to remove a minimum of 44 percent TSS prior to discharge into the infiltration systems.

The configuration of these systems provides an effective and efficient means of infiltrating stormwater. They allow for multiple inlets to evenly distribute stormwater into the system rather than at one location. By nature of its footprint, it allows for uniform recharge to groundwater and does not concentrate discharges into a small area. The locations of these systems are shown on Figure 3-1. Details are included with the revised Site Development Plans (under separate cover). Consistent with MA DEP standards, an 80 percent TSS removal rate is credited for this BMP.

Extended Dry Detention Basins with Sediment Forebays

The proposed design incorporates extended dry detention basins with sediment forebays as a BMP to control the amount of sediment that discharges from the project area. The basins are located at the low end of drainage system in Rosemont Avenue and Merrymount Way before the runoff discharges toward to their respective outlets. Sediment forebays were sized in accordance with the Massachusetts Stormwater Policy. In accordance with the MADEP Standards a 50 percent TSS removal rate is credited for this BMP.

Wet Detention Basin with Sediment Forebays

The proposed design incorporates wet detention basin with sediment forebay as a BMP to control the amount of sediment that discharges from the project area. The basin is located below the dry detention basin on Rosemount Avenue and will

provide the opportunity to create a signature water feature as well as provide further stormwater polishing prior to discharging to Design Point 4. In accordance with the MADEP Standards an 80 percent TSS removal rate is credited for this BMP.

The incorporation of these BMP's will achieve a TSS removal rate of greater than 80 percent, exceeding the current MADEP requirement (Refer to Appendix D, Water Quality Calculations).

A significant concern in the design of the stormwater management system is adequate stormwater quality treatment adjacent to the Dedham Westwood Water District Municipal wells. Only clean roof runoff will be infiltrated within 400 feet of any wellhead. In all other areas contributing to the underground infiltrations systems, a weekly pavement sweeping program will be implemented that will reduce potential for sediment and other contaminants from entering the drainage system. Catch basins with deep sumps and hoods (as well as "Don't Dump" plaques) will remove sediments while trapping any floatable contaminants. Stormceptors will also provide for additional sediment and floatable pollutant removals. A Stormwater Operation and Maintenance Plan is included with this report. The implementation of that plan coupled with the BMP's discussed above will provide a significant level of protection for the adjacent well heads.

3.1.5 Standard # 5 – Higher Pollutant Load

The project is classified as use that will generate higher pollutant loads and is subject to the requirements of Standard 5, including pretreatment of stormwater. In accordance with these standards, the project area stormwater management system has been designed to achieve a TSS removal rate of greater than 80% which exceeds the rate required under the MADEP Stormwater Management Policy. As discussed under Standard #3, significant groundwater recharge is provided. The portions of the project that are directed to the sub-surface infiltration galleries have been designed to achieve a TSS removal rate of 64% prior to entering the infiltration areas, which is greater than the 44% required in the MADEP Stormwater Management Standards.

Consistent with MADEP Stormwater Management Standards, the Stormceptor water quality structures proposed as part of the project area stormwater management system will be sized to treat the equivalent flow rate for the 1" water quality volume.

3.1.6 Standard # 6 – Protection of Critical Areas

Stormwater infiltration systems are proposed within the Zone II wellhead protection area, therefore this is a critical area as defined by MADEP. The MADEP Stormwater Management Policy sets forth certain requirements and specific BMP's that should be considered for projects within a Zone II. Limits on impervious cover are imposed, unless adequate groundwater recharge can be provided that does not degrade groundwater quality. Water quality volumes must be designed to treat 1" of runoff from onsite impervious surfaces. Also, at least 44% pre-treatment is required prior to discharging to

any infiltration structure. Other practices are also encouraged in Critical Areas, such as limitations or prohibitions on storage or application of salts for deicing purposes.

In developing the design for the infiltration system in the Zone II, table CA 3 in the MADEP Stormwater Management Policy was reviewed. The following BMP's are encouraged for use in Zone II's and have been incorporated into the University Station project:

Pretreatment -	Deep Sump Catch Basin Proprietary Separators (Stormceptors that have been sized to remove at least 75% TSS prior to discharging to the subsurface infiltration system)
Infiltration BMP's	Infiltration Basins (highly recommended)

The University Station project adheres to the requirements for a project within a critical area by utilizing the following strategies and BMP's:

1. Infiltration structures will not be located within the Zone I area.

2. A monthly street sweeping program will be implemented.

3. The proponent has agreed to a prohibition on the use of salts for winter deicing as noted in the previously issued Order of Conditions.

4. Offline deep sump, hooded catch basins will collect runoff from parking lots and adjacent streets.

5. Stormceptor units have been designed to remove at least 50% TSS and to treat the required water quality volume equivalent flow rate. When combined, the street sweeping, Stormceptors and deep sump catch basins will remove 64% of TSS, which exceeds the 44% pretreatment requirement for discharge to infiltration systems.

6. Large infiltration systems have been designed to recharge both clean roof runoff and pretreated parking lot and roadway runoff (82% pretreatment has been demonstrated). These recharge systems as designed will recharge 95% of all storm events, based on data compiled at the Norwood airport over the past decade.

7. Monitoring wells that were previously installed within the Zone I will be monitored in accordance the provisions of the previously issued Water Resource Protection District Special Permit.

8. Although not a stormwater item, all sewer manholes will be fitted with water tight, lock gasket covers. All sewer piping will be SDR-35 PVC piping with bell and spigot joints.

3.1.7 Standard # 7 – Redevelopment Project

Although this project is a redevelopment project, the stormwater management system has been designed to meet the all the standards for a new development.

3.1.8 Standard # 8 – Erosion / Sediment Control Plan

The project will result in the disturbance of greater than one acre of land and discharges to a water of the US or a municipal separate storm drain system which discharges to a water of the US, and therefore requires the preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities. The Construction General Permit (CGP) authorizes the discharge of storm water from construction activities.

The SWPPP will include site specific temporary and permanent erosion and sediment control practices including the following:

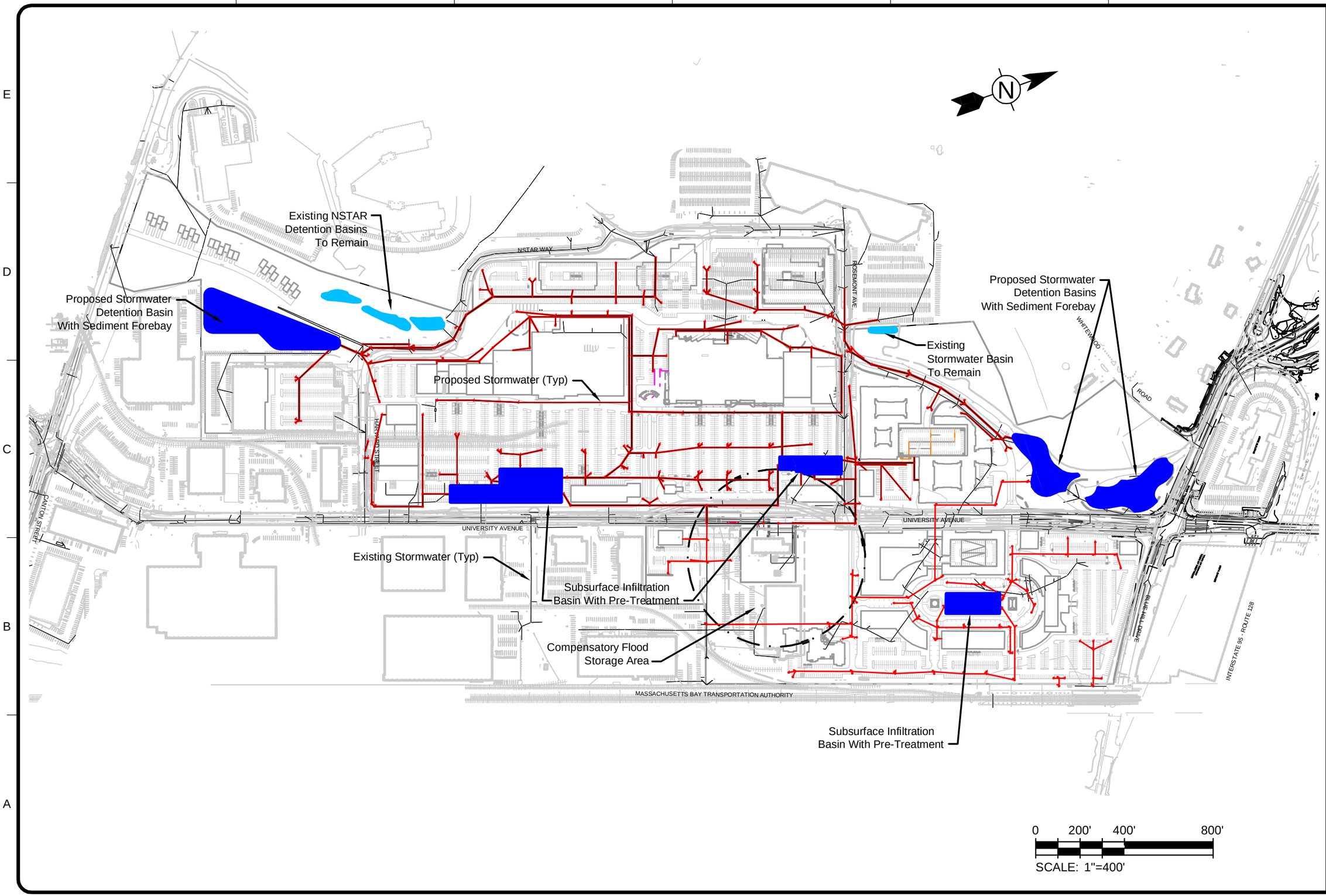
- Installation of compost filter sock between the limit of work and wetland resource areas to minimize sediment laden runoff from entering resource areas.
- Establish stabilized crushed stone construction entrances to prevent sediment tracking on the public ways.
- Immediate stabilization of all re-graded area adjacent to wetland areas; stabilization will be achieved by hydro-seed and/or the use of erosion control blankets until permanent ground cover can be established.
- Site specific construction sequencing plans in order to minimize the extent of the disturbance at any given time.
- Construction of temporary sediment basin(s) and swales to divert, convey and detain construction term storm runoff and allow for settling of solids prior to discharge.
- A Notice of Intent will be filed with the U.S. EPA to obtain coverage under the NPDES Construction General Permit.

3.1.9 Standard # 9 – Operation / Maintenance Plan

The stormwater management system will be owned and operated by the owner. The General Contractor (under Contract with the owner) will appoint a Project Manager who will be responsible during construction. Costs associated with the operation and maintenance of the stormwater management systems are subject to contracts with licensed maintenance providers and are variable. As a result, costs associated with the Operation and Maintenance Plans are not currently included with this report. The Stormwater Drainage Operations and Maintenance Plans are included in Appendix E.

3.1.10 Standard # 10 – Illicit Discharges

The Stormwater Management System has been designed such that prior to stormwater runoff discharging from the site, it is treated through a series of best management practices. To the Engineer's knowledge, there are no known or designed non-stormwater discharges that are or will be connected to the stormwater collection system that would convey pollutants directly to groundwater or surface waters.



TETRA TECH
www.tetratech.com
One Grant Street
Framingham, MA 01701
PHONE: (508) 903-2000 FAX: (508) 903-2001

MARK	DATE	DESCRIPTION	BY
1	10/9/12	Preliminary Site Development Plans	N.H.C.
2	11/30/12	Revised Site Development Plans	N.H.C.

Westwood Marketplace Holdings LLC
University Ave, Westwood, MA

University Station - University Avenue
Redevelopment

Proposed Stormwater Infrastructure

Project No.:	127-3659-12003
Designed By:	N.H.C.
Drawn By:	J.V.B.
Checked By:	R.F.D.

Figure 3-1

Bar Measures 1 inch

4.0 Conclusions

The Stormwater Management System addresses both the quantity and quality of stormwater runoff from the site and conforms, and some cases significantly exceed the ten (10) standards outlined by the MA DEP Stormwater Policy and the Town of Westwood Stormwater Standards.