CHAPTER 6
STORMWATER MANAGEMENT

INTRODUCTION

This chapter provides a summary of the detailed analysis of the existing and proposed watershed hydrology and hydraulics of the stormwater management system associated with the New Quincy Center Redevelopment Project (the "Project") that is included in the preliminary Stormwater Management Report (the "Report"). The Report will be submitted for final approval as part of the Notice of Intent application prior to commencement of construction of the first phase (Step 1) of the Project. In addition, this Chapter describes stormwater management practices, low impact development site design techniques, water quality and quantity controls, pre- and post-construction period pollution prevention controls, and long term operation and maintenance requirements. A copy of the Report is included in Appendix D of this report.

EXISTING DRAINAGE CONDITIONS

The approximate 31-acre Project Area is occupied by an existing building program consisting of approximately 1.07 million square feet of building area. The Project Area is part of a larger 84-acre watershed (the "Study Area") that has been analyzed from a direct tributary hydrology standpoint associated with the Project. Existing uses in the Project Area include retail, restaurant, basic services, office, educational, institutional, and residential, with supporting surface and structured parking facilities throughout. See Figure 6.1 for an existing conditions drainage area map.

The existing Project Area is primarily impervious and consists of rooftops, paved roads, and paved parking lots. Under existing conditions, there is no stormwater management for the Project Area. Untreated stormwater runoff from the impervious surfaces is collected in catch basins, routed into a network of drainage conveyance pipes and ultimately discharged into the proposed Town Brook (the "Brook") drainage channel. The existing stormwater conveyance system within the Project Area consists of an aged and undersized stormwater collection system, with little to no water quality enhancements, detention, or infiltration. The main trunk lines within the existing stormwater conveyance system surcharge during storm events and contain illicit sanitary sewer connections. See Figure 6.2 for existing stormwater conveyance system information.

As part of the Town Brook Enhancement Project (EEA#14725), the Brook will be re-aligned prior to any construction activities associated with the New Quincy Center Redevelopment Project. As detailed in Chapter 5,resource areas will be re-associated with the realigned Town Brook.

Town Brook is a perennial stream which originates in Braintree, approximately 2.2 miles upstream of the Project Area at the Old Quincy Reservoir and discharges into Town River Bay, which ultimately connects to the Boston Harbor, approximately 0.7 miles downstream of the Project Area. The overall watershed for Town Brook is over 4 square miles. A vast majority of

the Brook in Quincy is conveyed in artificial channels that alternate between open channel and enclosed segments of culverts of varying materials and dimensions. Many flow control structures have been incorporated in the Brook to alleviate flooding impacts. Refer to Figure 6.3 for an overview of the Town Brook Watershed flood control and flow diversion structures and Figure 6.4 for the existing Town Brook watershed.

The Deep Rock Relief Tunnel (the "Tunnel") project was designed by the Army Corps of Engineers with construction completed in 1997. The Tunnel diverts peak storm event flows from Town Brook, thereby reducing flooding to downstream properties that were historically prone to flooding. Flows from Town Brook enter a diversion structure at the Deep Rock Relief Tunnel Intake, which diverts excess storm event flows from Town Brook to the Deep Rock Relief Tunnel, bypassing downstream areas of Quincy historically prone to flooding. The stormwater flow in the Burgin Parkway Culvert from the south enters the Tunnel Intake structure and is conveyed in its entirety to the Deep Rock Relief Tunnel. Flow in Town Brook not diverted to the Tunnel continues across Burgin Parkway and the MBTA railway tracks via an enclosed culvert system prior to entering the Project Area. By design, this flow is approximately 100 cubic feet per second (cfs).

An inventory of existing wetland resource areas was examined for the Project Site and areas surrounding Quincy Center. Town Brook is the only regulated resource area within the proposed limit of work and contains several resources regulated under the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40; 310 CMR 10.00) and the City of Quincy Wetlands Protection Regulations & Ordinance (Chapter 18.08; Order No. 401 of 1987). According to the Surface Water Quality Standards (314 CMR 4.00) and the 1990 Designated Outstanding Resource Waters of Massachusetts, the Project Site is not located within an Outstanding Resource Water (ORW). In addition, the Project Site is not located within an Area of Critical Environmental Concern, Zone II or Interim Wellhead Protection Area, or Zone A, B, or C Surface Water Protection Area. Refer to Chapter 5 for further information regarding wetland resources areas.

Existing Floodplain Information

According to the May 16, 2006 FEMA Flood Insurance Rate Map for the City of Quincy, Community Panel Numbers 255219-0057D, 255219-0019D, and 255219-0076D, Town Brook contains the majority of the 100-year and 500-year flood, with a small area of mapped surface floodplain adjacent to the open channel segment of Town Brook. The surface floodplain is identified as Zone AE, which is described as being subject to flooding by the 1% annual chance flood, with Base Flood Elevations determined. The base flood elevation determined in this location is 16-feet NAVD88, as depicted on FEMA FIRM map 255219, Panel 0057D.

The Project's stormwater conveyance system connection points to Town Brook are not tidally influenced. According to the Flood Insurance Study (FIS) performed by FEMA, the limit of tidal influence is just downstream of Elm Street, which is approximately 0.5 miles downstream of the connection point. Refer to Figure 6.5 for the existing floodplain information and limits of tidal influence.

Existing Hydrologic Conditions

For the existing conditions hydrologic analysis, the Study Area was divided into six drainage areas that contribute to three design points. Based on NRCS soil characterizations adjacent to the Project Area, the underlying soil is assumed to be classified as Hydrologic Soil Group (HSG) C. The Study Area includes the Project Area and surrounding contributing areas, which totals approximately 84 acres as shown in Table 6.1. The Burgin Parkway sediment chamber, which conveys stormwater flows north of the Deep Rock Tunnel, and the MBTA stormwater lift station have not been included in the hydrologic analysis as they remain unchanged and are connected to the Project Area only by special conditions (described further below). These flows have, however, been included in the hydraulic analysis to properly consider the effects on the existing and proposed stormwater conveyance infrastructure.

The existing Burgin Parkway connection to Project Area stormwater system consists of a 65-foot by 25-foot sedimentation basin in Burgin Parkway with two 36-inch reinforced concrete outlet pipes (RCP) which convey stormwater beneath the MBTA rail tracks, through a vault and into the existing Town Brook drainage culvert via a 42-inch RCP. This system is head driven due to the difference in invert elevations from the high to low side of the MBTA tracks and only flows when enough pressure builds to move the stormwater through. The existing Burgin Parkway stormwater system and conveyance will be maintained during the redevelopment.

The MBTA lift station is located near the intersection of Granite Street and Ross Way, consisting of a wet well and three pumps that discharge into a 36-inch RCP, which connects to the existing Town Brook culvert. Approximately 8 acres is tributary to the MBTA lift station. The MBTA lift station and conveyance will be maintained during redevelopment.

Table 6.1 summarizes the key hydrologic parameters for each drainage area used in the existing conditions analysis.

Table 6.1
Existing Conditions Hydrologic Data

Description (Drainage Area)	**Discharge Location**	**Design Point**	**Area** (acres)	**Curve Number**	**Time of Concentration** (min)
1	Town Brook	1	40.8	95	20.9
2	Town Brook (Downstream)	2	1.4	94	5.0
3	Town Brook	1	5.1	94	4.7
4	Town Brook	1	10.2	96	4.2
5	MBTA Drainage System	3	0.3	96	5.0
6	Town Brook	1	26.0	90	10.0

PROPOSED DRAINAGE CONDITIONS

The Project is a redevelopment that consists of approximately 3.7 million square feet of high density mixed-uses. Overall existing drainage and grading patterns were maintained, while providing the required reduction in stormwater runoff peak rates and volume under post-development conditions. The existing undersized and degraded stormwater infrastructure will be decommissioned as part of the stormwater improvements associated with the Project and the existing illicit sanitary sewer connections within the Project Area will be removed. New stormwater infrastructure is proposed to replace the existing substandard stormwater management system while conforming to the MassDEP Stormwater Management Standards and the City of Quincy Stormwater Ordinance. As part of the proposed stormwater management system, the overall water quality of the stormwater within the Project Area will also be addressed and improved through the use of Low Impact Development (LID) techniques and a decentralized system of stormwater management Best Management Practices (BMP) discussed in more detail later in this chapter.

Stormwater runoff from the Project Area ultimately discharges to Town Brook, a perennial stream,. Refer to Chapter 5 for a comprehensive discussion regarding resource area impacts and mitigation. The Project will have minimal impacts to the existing resource areas upon completion of the Town Brook Enhancement Project. Work within resource areas will be limited to the northern side of the Mayor Hannon Parkway near Mechanic Street. Impacts will only occur within the outer areas of the previously developed 100-Foot Buffer Zone to Bank and BVW. No work for the Project is proposed within BLSF (100-year floodplain), the Riverfront Area, or a wetland resource area, however, the treated stormwater will be conveyed to Town Brook.

Proposed Hydrologic Conditions

The proposed hydrologic conditions were analyzed to determine the effects of the proposed development as compared to the existing conditions. The proposed drainage system within the Project Area will incorporate best management practices (BMPs) in order to mitigate the effects of the proposed development on the receiving waters.

For the proposed conditions hydrologic analysis, the Study Area was divided into six drainage areas. These areas discharge to the same design points where peak discharge rates were evaluated for the existing conditions. Table 6.2 summarizes the proposed conditions hydrologic data. Refer to Figure 6.6 for the proposed conditions drainage areas and Figure 6.7 for the proposed stormwater conveyance system information.

Table 6.2 Proposed Conditions Hydrologic Data					
Description (Drainage Area)	**Discharge Location**	**Design Point**	**Area** (acres)	**Curve Number**	**Time of Concentration** (min)
1	Town Brook	1	38.1	94	21.3
2	Town Brook (Downstream)	2	0.8	88	5.0
3	Town Brook	1	5.0	94	4.7
4	Town Brook	1	13.7	96	4.2
5	MBTA Drainage System	3	0.2	93	5.0
6	Town Brook	1	26.0	90	10.0

Proposed System Hydrologic and Hydraulic Analysis

The Study Area for both the hydrologic and hydraulic analyses was delineated based on field survey in the immediate Quincy Center area and supplemented with GIS topographic and storm drain information provided by the City of Quincy.

For the hydrologic analysis, the rainfall-runoff response under existing and proposed conditions was evaluated for storm events consisting of the 2-year, 10-year, 25-year, and 100-year events. Rainfall runoff for this analysis was calculated using the Natural Resources Conservation Service (NRCS) Type III (SCS), 24-hour storm event for Norfolk County. Runoff coefficients for the pre- and post-development conditions, as previously shown in Tables 6.1 and 6.2 respectively, were determined using NRCS Technical Release 55 (TR-55) methodology as provided in the HydroCAD model included in the Report. Refer to Table 6.3 for rainfall data used for the hydrologic analysis.

Table 6.3 Storm Event Total Precipitation (in)			
2 Year	**10 Year**	**25 Year**	**100 Year**
3.2	4.7	5.5	6.7

The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology. Detailed printouts of the HydroCAD analysis are in the Report included as Appendix D. Peak discharge rates and volumes were evaluated for the drainage areas. Table 6.4 summarizes the comparison between pre and post peak discharge rates, and Table 6.5 summarizes the comparison between pre and post stormwater volumes.

Table 6.4 Peak Discharge Runoff Rates								
Description (Design Point)	**2-Year**		**10-Year**		**25-Year**		**100-Year**	
	Existing (cfs)	**Proposed** (cfs)	**Existing** (cfs)	**Proposed** (cfs)	**Existing** (cfs)	**Proposed** (cfs)	**Existing** (cfs)	**Proposed** (cfs)
1 Town Brook Confluence Point	159.2	158.9	248.7	247.3	295.9	294.0	366.0	363.4
2 Town Brook (Downstream)	4.2	1.9	6.5	3.1	7.7	3.8	9.5	4.8
3 MBTA Track Drainage System	0.8	0.7	1.2	1.1	1.4	1.3	1.7	1.6

Table 6.5 Runoff Volumes								
Description (Design Point)	**2-Year**		**10-Year**		**25-Year**		**100-Year**	
	Existing (af)	**Proposed** (af)	**Existing** (af)	**Proposed** (af)	**Existing** (af)	**Proposed** (af)	**Existing** (af)	**Proposed** (af)
1 Town Brook Confluence Point	17.1	17.0	27.1	27.0	32.5	32.4	40.6	40.6
2 Town Brook (Downstream)	0.3	0.1	0.5	0.2	0.6	0.3	0.7	0.3
3 MBTA Track Drainage System	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

For the hydraulic analysis and design, the stormwater conveyance system will be designed for the 25-year storm event, in accordance with the City of Quincy Department of Public Works (DPW) standards. The proposed stormwater conveyance system was analyzed by the Autodesk® Storm and Sanitary Analysis software using Hydrodynamic routing (Saint Venant flow equations). The main trunk drainage pipes, as shown on Figure 6.7, were sized using the direct step method based on Manning's Equation for full-flow capacity and the NRCS TR-20 & TR-55 methodology to determine the corresponding runoff for the 25-year Type III (SCS), 24-hour storm event for Norfolk County. Flows from the Burgin Parkway sediment chamber and the MBTA Lift Station were conservatively estimated based on the existing capacity of the downstream pipes based on Manning's Equation for full-flow capacity and are considered to be

constant flows. More detailed flow characteristics of the sediment chamber and lift station are being researched and may be revised.

TOWN BROOK

Town Brook Enhancement Project

The Town Brook Enhancement Project is one of three Core Public Improvement projects that the City of Quincy (the "City") is undertaking to upgrade the aged infrastructure within Quincy Center to facilitate redevelopment under the "Quincy Center Urban Revitalization District Plan (URDP)" in an environmentally sensitive and responsible manner.

The Brook will be re-aligned prior to any construction activities associated with the Project. Therefore, any references to Town Brook in this document are based on the Plans presented in the Town Brook Enhancement Project permitting documents. The Town Brook alignment will run a course of approximately 1,200 linear feet through the Urban Revitalization District (URD) boundary area and outside the Project Area. Refer to Figure 6.2 depicting the existing conditions drainage system, showing the planned relocation alternative and existing Town Brook.

Proposed Floodplain Revisions

According to the May 16, 2006 FEMA Flood Insurance Rate Map for the City of Quincy, Community Panel Numbers 255219-0057D, 255219-0019D, and 255219-0076D, Town Brook contains the 100-year and 500-year flood, with a small area of surface floodplain adjacent to the open channel segment of Town Brook. The surface floodplain is identified as Zone AE, which is described as being subject to inundation by the 1% annual chance flood, with Base Flood Elevations determined. The base flood elevation determined in this location is 16-feet NAVD88, as depicted on FEMA FIRM map 255219, Panel 0057D.

As part of the Town Brook Enhancement Project, the City of Quincy shall submit a Letter of Map Revision (LOMR) for review by FEMA that would propose to revise the currently mapped Floodplain to more accurately reflect the finished conditions once the Town Brook Enhancement Project is constructed. This map revision will adjust the mapped conveyance of the 500-year flood from the existing Town Brook location through downtown Quincy Center to the newly constructed Town Brook along the Walter J. Hannon Parkway.

Bigelow Pool

The "Bigelow Pool area" is an area just downstream of the Project Area within a residential neighborhood adjacent to open channel sections of Town Brook in the vicinity of the Miller Stile Road and Bigelow Street. This area has been identified as being historically prone to flooding and has been the subject of flood studies undertaken by the City of Quincy and the USACE.

These open channel sections of Town Brook within the Bigelow Pool area do not have sufficient capacity to convey up to the 100-year 24-hour modeled storm event, and stormwater in these downstream sections of Town Brook has been documented to cause flooding conditions as

indicated in the FEMA Flood Insurance Study (FIS) dated May 16, 2006. However the 2006 FIS relies upon reports that do not account for recent USACE flood improvement projects, constructed upstream of the Pool area.

For background, in the 1990s the Army Corps of Engineers constructed the Deep Rock Flood Relief Tunnel bypass of Town Brook to address flooding problems associated with the properties along Town Brook. The tunnel is approximately 4,000 feet long, between 140 feet and 190 feet below grade, and 12 feet in diameter. The tunnel entrance is located behind the Star Market building west of the Project Area and runs downstream east of the Project site where it discharges into Town River Bay. The tunnel is designed to divert flow out of Town Brook during large storm events to minimize downstream flooding, and since construction of the Deep Rock Flood Relief bypass, complaints of flooding downstream of the bypass have been reduced greatly.

The City of Quincy and its design team have analyzed the pool area under current conditions and this analysis demonstrates that Town Brook does overtop the existing walled banks during some modeled storm events. However, the potential property damage as a result of these storm events is likely to be minimal, largely because of the effectiveness of the Deep Rock Flood Relief Tunnel. The City will continue to monitor the pool area to determine if there are remaining concerns and further evaluate potential property damage as part of its overall flood protection efforts, although based on documented reports of flooding, the Deep Rock Flood Relief Tunnel does appear to have minimized the flooding issues in the pool area.

Town Brook Watershed Master Plan

The Project Area is located within the Town Brook Watershed, contained within the larger Weymouth & Weir watershed that ultimately drains to Boston Harbor. As part of the City's efforts to improve water quality within the Town Brook Watershed, an overall Town Brook Watershed Master Plan (the "Plan") will be developed to identify, resolve and prevent water quality problems.

The Plan is a means to resolve and prevent water quality problems that result from both point source and nonpoint source pollution in a comprehensive and integrated manner, while providing a framework for growth management at the local level. The Plan will describe the watershed geography, topography and history and the significance of its resources in natural, social, and cultural terms will be explored. The Plan will describe the watershed's existing condition, examine current issues, review efforts underway to improve the watershed, and will recommend standards and actions for continued improvement and management. The Plan will also provide the City of Quincy with a framework to prioritize valuable resources by integrating natural resource protection with other community planning initiatives.

The Plan will be developed incorporating the EPA's guidelines, and will supplement the existing MassDEP Stormwater Management Standards. The tools, as described within the Plan will, enable the City to develop effective management measures to reduce the loads, as well as provide tools to track progress once the Plan is implemented to ensure that the management measures are helping to improve water quality. As part of the Plan, several key components will be addressed, including following:

1. An identification of the causes and sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan and to achieve any additional goals identified in the watershed-based plan.

2. An estimate of the load reductions expected for the management measures described in the Plan (recognizing the natural variability that occurs and the difficulty in precisely predicting the performance of management measures over time).

3. A description of the nonpoint source (NPS) best management practices (BMP) measures that will need to be implemented to achieve the load reductions estimated (as well as to achieve other watershed goals identified in this watershed-based plan), and an identification of the critical areas in which those measures will be needed to implement this plan.

4. An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan.

5. An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.

6. A schedule for implementing the NPS management measures identified in this plan that is reasonably expeditious.

7. A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.

8. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether this watershed-based plan needs to be revised or, if a NPS TMDL has been established, whether the NPS TMDL needs to be revised.

9. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established.

PROPOSED MITIGATION MEASURES

The proposed stormwater management system is designed to mitigate impacts associated with the discharge of stormwater from the Project. The system has been designed to comply with the MassDEP Massachusetts Stormwater Management Standards and City of Quincy Stormwater Ordinances which provide measures for the long-term effectiveness of the system. The system includes over 6,000 feet of new stormwater conveyance piping and countless associated drainage structures.

Low impact development (LID) features are techniques used to decentralize stormwater management and manage and treat stormwater as close to its source as possible. LID features will be incorporated into the site where feasible. LID features may include reduction in impervious area, green roofs, biofiltration basins, porous surfaces, subsurface infiltration basins and tree box filters.

Additionally, the Proponents have committed to LEED-ND certification, which contains credits relating to stormwater management, pre- and post-construction activity pollution prevention, water efficiency and minimizing site disturbance.

Water Quantity and Quality Control Measures

Parts of the Project Area that discharge stormwater runoff to an infiltrating BMP and will generate greater than 1,000 vehicle trips per day are required to treat the 1-inch water quality volume and provide 44% TSS pretreatment prior to entering the infiltration BMP.
It should be noted that the majority of the proposed parking spaces that attribute to the high intensity use would be in structured garages rather than large surface parking lots. Structured parking will prevent the exposure to rain and snow. Any oil and grit in the runoff from the garages will be captured in structured oil and grit separators prior to discharge to the sanitary sewer system rather than the stormwater conveyance system. Final number, types and locations of structural and non-structural BMPs are subject to final design, review and feasibility. Refer to Figure 6.7 for a conceptual layout of proposed BMPs. Below is a description of the potential structural and non-structural BMPs the could potentially be used in the Project Area.

Structural and Non-Structural Stormwater BMPs

Source Control

A comprehensive source control program will be implemented at the Site, which includes pavement sweeping, catch basin cleaning, and enclosure and maintenance of all dumpsters and loading areas. Further discussion of the site maintenance is included in the Report.

Water Quality Unit

Proprietary water quality units provide efficient removal of free oils, debris and total suspended solids (TSS) and are ideal for use within ultra-urban and constrained sites.

Numerous products are available to achieve the required TSS removal efficiencies and can operate in an online or offline configuration. These manufacturers have followed rigorous testing as required by some local and state agencies. Although the Massachusetts Strategic Envirotechnology Partnership (STEP) recalled the Technology Fact Sheets that instructed local and state government officials regarding the technology used by various proprietary units last year, the Technology Acceptance and Reciprocity Partnership (TARP) Tier 2 Protocol and the New Jersey DEP Total Suspended Solids Laboratory Testing Procedure have become accepted sources of testing verification. Although not the main objective of a water quality unit some removal of other pollutants such as heavy metals, pathogens, and other nutrients may be achieved. See the Report included as Appendix D for supporting technical information and a sample manufacturer's Operation & Maintenance (O&M) Plan.

A typical water quality unit's maintenance procedures are also included in the Report.

Subsurface Infiltration Basin (Subsurface Structure)

A subsurface infiltration basin is an underground stormwater LID feature that provides both water quality and quantity control by capturing, detaining, filtering and infiltrating stormwater runoff to the groundwater. The subsurface infiltration basin is designed to infiltrate the required water quality volume. The water quality volume is considered the volume stored within the basin below the lowest outletted invert elevation (elevation below the lowest pipe invert). The water quality volume is infiltrated or "recharged" into the ground, providing final treatment prior to entering the groundwater. If necessary, the basin can also be sized to provide water quantity control by attenuating the runoff and discharging through an outlet control structure at a controlled rate to reduce peak runoff rates. The use of subsurface infiltration basins are often limited by high ground water tables and/or poor subsurface soils. Pretreatment of the stormwater runoff entering the subsurface infiltration basin is required if the runoff originated from a paved surface that generates more than 1,000 vehicle trips per day (LUHPPL).

A typical subsurface infiltration basin maintenance procedure is included in the Report.

Bioretention Basin

A bioretention basin is an LID site feature that provides water quality benefits prior to discharging to receiving waters. The bioretention basin treats stormwater using a specific planting soil bed mixture to naturally filter out pollutants. The bioretention basin has been designed to collect surface runoff from proposed pavement area. Pretreatment and energy dissipation can be provided prior to collecting in the bioretention basin by a gravel filter strip or a sediment forebay. The bioretention basin is designed to infiltrate the required water quality volume (i.e. typical average small storm events are infiltrated). In larger storm events where runoff volume is increased, runoff will flow into the bioretention basin and an overflow outlet will collect excess flows and convey them into the drainage system.

A typical bioretention basin maintenance procedure is included in the Report.

Deep Sump Catch Basin with Oil and Debris Trap

Proposed catch basins at the Site are to be constructed with sumps (minimum 4-feet) and an oil/debris trap that blocks sediments and floating contaminants from reaching receiving waters.

A typical catch basin maintenance procedure is included in the Report.

Sediment Forebays

A sediment forebay is a BMP consisting of an excavated pit or bermed area designed to slow incoming stormwater runoff and facilitating the gravity separation of suspended solids. Sediment forebays can be used as a pretreatment device prior to infiltration. The sediment forebay volume is designed to hold 0.1-inch per impervious acre to pretreat the water quality volume.

A typical sediment forebay maintenance procedure is included in the Report.

Porous Surfaces

Porous surfaces are an LID feature that can be used on the Site. Porous surfaces are typically made up of concrete with higher than normal percentage of air voids to allow water to pass through and infiltrate into the subsoil while still providing the necessary structural support. The porous surfaces are typically placed on a stone storage bed set on natural soils. Where applicable porous surfaces will provide added infiltration to the groundwater and will reduced the temperature of stormwater runoff.

A typical porous surface maintenance procedure is included in the Report.

Street Sweeping

Street sweeping is an effective nonstructural source control practice and will be implemented at the Site. Due to the high frequency demand of street sweeping and specific equipment requirements to achieve pollutant removal credits, street sweeping will not be counted for TSS removal credit, however, will have added benefit when performed regularly. Once removed from the paved surface, the collected waste will be reused per MassDEP's regulations or disposed of properly.

Green Roofs

A green roof is a permanent rooftop planting system containing live plants in a lightweight engineered soil medium designed to retain precipitation where the water is taken up by plants and transpired into the air. As a result, less water runs off the roof compared to conventional rooftops. Green roofs can range from extensive to intensive. Extensive roofs typically have shallow soil depths with low lying plants species and are not open to public access because they are installed to achieve an environmental benefit. Intensive roofs are installed to primarily achieve an aesthetic benefit and have deeper soil depths with taller plants species. Buildings that benefit from a green roof will

incur energy savings, higher roof durability, reduction of stormwater runoff, reduction of heat island effects, and more appealing aesthetics.

Tree Box Filters

Tree box filters are mini bioretention areas installed beneath trees that can be very effective at controlling and filtering runoff and are well suited for urban environments. Runoff is directed to the tree box, where it is filtered by combination of vegetation and an engineering soil mixture (typically enclosed in precast concrete) before entering a the stormwater conveyance system. The runoff collected in the boxes helps irrigate the tree. Tree box filters with an open bottom will also infiltrate stormwater runoff during smaller storm events and will bypass higher flows to the stormwater conveyance system.

Snow Management

The snow stockpile areas are located to take advantage of the numerous stormwater BMPs proposed on the site. Melting snow from the stockpiles will be collected by the site stormwater collection system, which will then be processed through a series of stormwater BMPs to remove sediment, debris and contaminants from the stockpiled snow. Stormwater BMPs proposed on the site include deep sump catch basins with oil/debris traps, tree filter boxes and street sweeping.

It is the responsibility of the Contractor to manage snow during the construction period. Long-term maintenance of snow removal of the privately held areas will be the responsibility of the Owner of record for each parcel. The City of Quincy will be responsible for snow management on all Public Rights of Ways and City-Owned parcels.

Snow stockpiles areas are not to be located within 100 feet of any open water body or regulated wetland resource area. In addition, snow shall not be stockpiled within a bioretention basin.

Additionally, should significant snow fall events occur, which result in stockpiled snow impacting the operation of the Project Area through the temporary loss of parking or limiting access in any way, the property manager may choose to have snow removed from the site. All snow removal operations will be performed in accordance with Massachusetts DEP guidelines BRPG01-01, effective date March 8, 2001.

Construction Period Pollution Prevention and Erosion and Sedimentation Control

Due to the size, scheduling and complexity of the Project, the Proponents will develop a Construction Period Pollution Prevention and an Erosion and Sedimentation Control Plan for the Project Area prior to the start of each construction phase of the Project in order to protect wetland resources and property down gradient from the Project. The Erosion and Sedimentation Control Plan identifies Best Management Practices (BMPs) as specified in the Massachusetts Stormwater Handbook developed by MassDEP and also provided by the United States Environmental Protection Agency (EPA) for compliance with the National Pollutant Discharge Elimination System (NPDES).

Typical BMPs to be used during the construction activities associated with the Project are described below. In addition to the BMPs described below, further information regarding the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in the Report.

Straw Bales and Silt Fence

Straw bales and silt fences are used as temporary perimeter controls where construction activities will disturb existing surfaces. They can also be used to contain soil stockpile areas. Straw bales and silt fence consists of a length of filter fabric stretched between anchoring posts spaced at regular intervals along the site at low/downslope areas with staked straw bales. The filter fabric should be entrenched in the ground between the support posts. When installed correctly and inspected frequently, straw bales and silt fence can be an effective barrier to sediment leaving the site in stormwater runoff.

Compost Filter Sock

A compost filter sock is a type of contained compost filter berm. It is a mesh tube filled with composted material that is placed perpendicular to sheet-flow runoff to control erosion and retain sediment in disturbed areas. The filter sock can be used in place of a traditional sediment and erosion control tool such as a silt fence or straw bale barrier. Compost filter socks are generally placed along the perimeter of a site, or at intervals along a slope, to capture and treat stormwater that runs off as sheet flow. Filter socks can also be used on pavement as inlet protection for storm drains and to slow water flow in small ditches. Filter socks used for erosion control are usually 12 inches in diameter, although 8 inch, 18 inch, and 24 inch– diameter socks are used in some applications. The smaller, 8 inch–diameter filter socks are commonly used for stormwater inlet protection. The outer shell of a compost filter sock is typically biodegradable and can remain on pervious surfaces post construction versus having to be removed as construction waste.

Temporary Stabilized Construction Vehicle Entrance/Exit

The purpose of stabilized entrances to a construction site is to minimize the amount of sediment leaving the area as mud and sediment attached to vehicles. Installing a pad of gravel over filter cloth where construction traffic leaves a site can help stabilize a construction entrance. As a vehicle drives over the pad, the pad removes mud and sediment from the wheels and reduces soil transport off the site. The filter cloth separates the gravel from the soil below, keeping the gravel from being ground into the soil. The fabric also reduces the amount of rutting caused by vehicle tires. It spreads the vehicle's weight over a soil area larger than the tire width.

Pavement Sweeping

Paved areas within the active construction site can be swept on a regular basis to remove larger sediment particles from construction activities. Pavement areas adjacent to the Site will be swept if dirt and debris is tracked from the construction site.

Storm Drain Inlet Protection

Storm drain inlet protection measures prevent soil and debris from entering storm drain inlets. These measures will be implemented before the Site is disturbed by using silt sacks, compost filter socks, or staked bales in combination with silt fence. Storm drain inlet protection will be installed at all down gradient catch basins adjacent to the project site outside the protection of other erosion control barriers, all catch basins within the construction site, and at low points within the construction site that are connected to the storm drainage system.

Temporary Sedimentation Basins

Temporary sediment basins can be used to capture sediment from stormwater runoff before it leaves a construction site. The basins allow a pool to form in an excavated or natural depression, where sediment can settle. The pool is dewatered through a single riser and drainage hole leading to a suitable outlet on the downstream side of the embankment.

A temporary sediment basin is constructed by excavation or by erecting an earthen embankment across a low area or drainage swale. Basins can be designed to drain completely during dry periods or to create a shallow pool of water that remains between storm events.

Sediment accumulated within the basin shall be removed and disposed of on a regular basis. Temporary sediment basins shall not be located in areas where final proposed infiltration BMPs are located.

Temporary Seeding and Slope Stabilization

Seeding shall be used to temporarily stabilize areas that will not be brought to final grade for a period of more than 30 working days and to stabilize disturbed areas before final grading or in a season not suitable for permanent seeding.

Temporary seeding controls runoff and erosion until permanent vegetation or other erosion control measures can be established. Root systems restrain the soils so that they are less apt to be dislodged and carried offsite by stormwater runoff or wind. Temporary seeding also reduces the problems associated with mud and dust from bare soil surfaces during construction.

Slope stabilization of the disturbed areas will be achieved by using a mulch layer, erosion control blanket, or for steeper slopes, a root fiber mulch blanket.

Inspection and Maintenance

An inspection and maintenance program will be developed by the Contractor prior to the start of construction. Minimum requirement of the inspection and maintenance program will be included as part of the Report and final requirements listed in the stormwater pollution prevention plan (SWPPP) prepared for the Site.

The Inspection and Maintenance will include weekly inspections for the BMP's used at the construction site. Additionally, after significant rainfall events, the contractor must inspect each BMP. Shall any degradation and/or failure of any BMP device exist, the contractor shall repair immediately and make the necessary changes based on direction of design engineer if additional BMPs are required.

Removal of Illicit Discharges

Illicit discharges identified during the design process will be eliminated and/or repaired during construction. Illicit connections have been identified within the existing Town Brook culvert and will be removed as part of the Project.

The majority of existing onsite sanitary sewer and storm drainage structures on the site will be decommissioned and removed. Structures that are to remain will be inspected for illicit connections, and illicit connections will be removed. The sanitary sewer and storm drainage systems have been designed to comply with Standard 10 of the MassDEP Stormwater Management Standards, stating '*all illicit discharges to the storm water management system are prohibited*.'

CONSTRUCTION PERIOD IMPACTS

Phasing

The Project will be constructed in three Steps (phases). Each Step will include erosion and sedimentation control plans and the SWPPP prepared for the Site will be updated for each Step, identifying and locating temporary BMPs used during construction. The drainage network improvements are shown in the Construction Period Impacts Chapter of this report, which identifies drainage improvements required for each Step.

Stormwater Pollution Prevention Plan (SWPPP)

The SWPPP details construction activities, erosion control measures, and inspection schedules to be implemented during construction to ensure that the construction activities do not have an adverse impact on wetlands and waterways. The SWPPP will be developed by the Contractor prior to the start of construction in accordance with the Massachusetts Stormwater Handbook developed by MassDEP and a Notice of Intent will also be filed with the United States Environmental Protection Agency (EPA) for compliance with the National Pollutant Discharge Elimination System (NPDES) and Construction General Permit as applicable.

LEED Considerations

The Proponents have committed to LEED-ND Silver certification. According to the LEED 2009 for Neighborhood Development, the primary stormwater management related items include:

SLL, Prerequisite 5, *Floodplain Avoidance;*
GIB, Prerequisite 4, *Construction Activity Pollution Prevention;*

GIB, Credit 4, *Water Efficient Landscaping;*
GIB, Credit 7, *Minimized Site Disturbance in Design and Construction;*
GIB, Credit 8, *Stormwater Management;*
GIB, Credit 9, *Heat Island Reduction;*

Additional credits are linked to stormwater management and will be evaluated as LEED ND credits are identified for the Project.

Long Term Operations and Maintenance Plan

The Long Term Operations and Maintenance (O&M) Plan is included in the Report included as Appendix D. Included within this O&M Plan are the long-term maintenance and inspection requirements for the BMPs selected for the Site. Additionally, checklists for each BMP outlining inspection frequency, inspection dates, inspector, minimum maintenance and key items to check, and the dates for any action taken to repair the BMP.

REQUIRED PERMITS AND REGULATORY COMPLIANCE

Local and federal permits and approvals are required prior to the start of construction. Table 5.2 in Chapter 5 summarizes the permits and approvals anticipated to be required for the Project, and the status of each, as related to wetland resource areas only. The Project will require an Order of Conditions from the Quincy Conservation Commission and a National Pollution Discharge Elimination System Construction General Permit.

National Pollutant Discharge Elimination System (NPDES) Compliance

Under the NPDES provisions of the Clean Water Act, the U.S. Environmental Protection Agency regulates water quality, sediment, and pollutant discharge of stormwater runoff from construction sites. Construction projects that propose the alteration of one or more acres of land must obtain coverage under the NPDES Stormwater Construction General Permit (CGP). The Project Proponents must submit a one-page registration form known as a Notice of Intent to the EPA and must develop and implement a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP details construction activities, erosion control measures, and inspection schedules to be implemented during construction to ensure that the construction activities do not have an adverse impact on wetlands and waterways. A Construction General Permit will be obtained prior to the start of construction for related impacts.

Order of Conditions

As previously noted in Chapter 5, the City of Quincy has a local Wetland Protection Regulations (Chapter 18.08) and Wetlands Protection Ordinance (Order No. 401 of 1987). Work within resource areas and the 100-Foot Buffer Zone will require the filing of a Notice of Intent. The resource areas regulated under the local Regulations and Ordinance are similar to those within the WPA. Work associated with the Project will be limited to areas located within the Buffer Zones Bank and BVW only with no direct or temporary impacts proposed within wetland

resource area or the Riverfront Area. The NOI(s) associated with this work will be filed with the Quincy Conservation Commission.

Massachusetts Stormwater Management Standards Compliance

The methods for compliance with the ten stormwater performance standards developed by the MassDEP are summarized below.

1. *No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

   The proposed stormwater conveyance system located within the Project Area includes a number of Best Management Practices (BMPs) to treat surface runoff such as street sweeping, deep sump catch basins with oil/debris traps, bioretention basins, subsurface infiltration structures, water quality units, and tree box filters. No new stormwater conveyances are proposed that will discharge untreated stormwater directly to or cause erosion to wetland resources.

2. *Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.*

   The Project has been designed to reduce the post-development discharge rates when compared with the pre-development peak discharge rates. The reduction in peak discharges rates is accomplished by providing green roofs and BMPs with water quantity control features and matching or decreasing the amount of proposed impervious areas.

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, storm water best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater handbook. .*

   Low Impact Development measures have been incorporated into the site design, which include tree box filters, green roofs, bioretention basins, and subsurface infiltration structures. At a minimum, the annual recharge from the Project shall approximate the annual recharge from the pre-development conditions. Additional recharge may also be achieved through incorporating LID measures mentioned above.

   According to the NRCS soil survey, the underlying soils within the Project Area are classified as Urban land, 0 to 15 percent slopes (602). Underlying soils surrounding the Project Area are classified as Hydrologic Soil Group (HSG) B, C, and C/D with varying levels of groundwater and permeability. Hydrologic Soil Group C classification will be used for the purposes of supporting calculations included in the Report. Preliminary geotechnical information is available to determine existing groundwater elevations for the Project Area. However, a complex pattern of groundwater elevations and seepage

directions has been identified likely as a result of the presence of the numerous underground drainage and sewer conveyance structures subject to groundwater inflow and infiltration. In order to function properly infiltrating BMPs require a minimum two-foot separation to groundwater and soil conditions conducive to infiltration and as such, final locations of infiltrating BMPs are subject to future geotechnical explorations.

4. *Stormwater Management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:*

   - *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
   - *Structural storm water best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook.*
   - *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

   A combination of stormwater BMPs including street sweeping (no TSS removal credit applied), deep sump catch basins with oil/debris traps, tree box filters, bioretention basins with adequate pretreatment, and water quality units are proposed to treat stormwater surface runoff and infiltrate it to the groundwater where feasible. The Project does not discharge stormwater runoff near or to a critical area.

   Parts of the Project Area that discharge stormwater runoff to an infiltrating BMP and will generate greater than 1,000 vehicle trips per day are required to treat the 1-inch water quality volume and provide 44% TSS pretreatment prior to entering the infiltration BMP.

   Typical stormwater treatment will consist of street sweeping (no TSS removal credit applied), deep sump catch basins with oil/debris traps, and a water quality unit, which will provide a TSS removal rate of at least 80%. Where feasible, parts of the Project Area will take advantage of other LID BMPs for further TSS removal. Proposed water quality units will be sized to provide treatment for the 1-inch water quality volume. Typical TSS removal rate spreadsheets and supporting water quality flow rates calculations can be found in the Report.

   An operations and maintenance plan is provided in the Report found in Appendix D, which addresses the long-term pollution prevention.

5. *For land uses with higher potential pollutant loads (LUHPPL), source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If, through source control and/ or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt and storm water runoff, the proponent shall use the specific structural storm water BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater handbook. Stormwater discharges from land uses with higher potential pollutant loads*

shall also comply with the requirements of the Massachusetts Clean Waters Act.

Although the proposed development as a whole generates more than 1,000 vehicle trips per day it is not considered a LUHPPL because the majority of the parking facilities responsible for the high-intensity use are structured garages that are not exposed to rain or snow. Top floors of structured garages that are open to the elements will be treated with a water quality unit or an oil/water separator prior to discharging to the stormwater conveyance system. The Proponents will promote the use of green roofs to provide cover from the elements for upper levels of parking garages as currently proposed at Block 5. At a minimum, public and private roadways within the Project Area will be treated by BMPs such as street sweeping, deep sump catch basins with oil/debris traps and water quality units. Other portions of roadways, where feasible, may take advantage of tree box filters and biofiltration basins for treatment.

6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and storm water discharges near any other critical area require the use of the specific source control and pollution prevention measures and the specific structural storm water best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the Massachusetts Stormwater Handbook.*

   The Project Area is not within a Zone II, Interim Wellhead Protection Area, or critical area. Surface runoff from the Project Area will be treated through a series of stormwater BMPs.

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural storm water best management practice requirements of Standards 4, 5 and 6. Existing Stormwater discharges shall comply with Standard I only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater management Standards and improve existing conditions.*

   This Project is a redevelopment in accordance with the Massachusetts Stormwater Handbook. The Project currently complies with Standards 3, 4, and 5 to the maximum extent practicable and the remaining Standards are in full compliance. The Project, when completed as designed, will significantly improve water quality and water quantity control measures as compared to the existing conditions.

8. *A plan to control construction related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

   Erosion and sedimentation control BMPs have been identified in the above Erosion and Sedimentation Control section and are further described in the Report included as Appendix D. A Stormwater Pollution Prevention Plan (SWPPP) will also be developed prior to construction which will detail the location, quantity and type of BMPs utilized during the construction Steps.

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

   Recommended practices for operating and maintaining long-term stormwater BMPs is included in the preliminary Stormwater Management Report attached as Appendix D. A recommended checklist for maintenance inspections and follow up is also included.

10. *All illicit discharges to the storm water management system are prohibited*

    The majority of existing onsite sanitary sewer and storm drainage structures within the Project Area will be decommissioned and removed. Structures that are to remain will be inspected for illicit connections, and illicit connections will be removed. The proposed sewer and storm drainage systems will be designed to comply with this standard.

City of Quincy Stormwater Management and Land Disturbance Ordinance

The Project has been designed with substantial stormwater improvements, which will provide water quality and water quantity mitigation and will meet the objectives outlined in the City of Quincy's Ordinances, Title 13 Public Services, Chapter 13.14, Stormwater Management and Land Disturbance Ordinance. The objectives of the ordinance are:

1. *Protect groundwater and surface water from degradation;*
2. *Require practices that eliminate soil erosion and sedimentation and control the volume and rate of stormwater runoff resulting from land disturbances;*
3. *Promote infiltration and the recharge of groundwater;*
4. *Ensure that soil erosion and sedimentation control measures and stormwater runoff control practices are incorporated into the site planning and design process and are implemented and maintained;*
5. *Require practices to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality;*
6. *Comply with state and federal statutes and regulations relating to stormwater discharges; and*
7. *Establish the City of Quincy's legal authority to ensure compliance with the provisions of the ordinance through inspection, monitoring, and enforcement.*

Chapter 13.14 seeks to implement these goals through the following objectives (Project compliance is discussed):

1. *Minimize total area of disturbance;*

   The Project is located within an existing urban area. Existing topography will be primarily maintained through the proposed conditions in most areas. Land disturbance will be minimized to the maximum extent practicable.

2. *Sequence activities to minimize simultaneous areas of disturbance;*

The Project will be constructed in three phases, referred to as Steps. The Steps will be comprised of continuous sections of land to minimize areas of disturbance within Quincy Center.

3. *Minimize peak rate of runoff in accordance with the Massachusetts Stormwater Handbook and Policy;*

   The Project has been designed to reduce the post-development discharge rates when compared with the pre-development peak discharge rates, in accordance with the Massachusetts Stormwater Management Standards.

4. *Minimize soil erosion and control sedimentation during construction, provided that prevention of erosion is preferred over sedimentation control;*

   Erosion and sedimentation control BMPs have been identified in the above Erosion and Sedimentation Control section, and also in more detail in the Report included as Appendix D. A Stormwater Pollution Prevention Plan (SWPPP) will be developed prior to construction which will detail the location, quantity and type of BMPs utilized during the construction Steps.

5. *Divert uncontaminated water around disturbed areas;*

   The SWPPP will include measures to divert uncontaminated water around disturbed areas.

6. *Maximize groundwater recharge;*

   The proposed Project matches or reduces the amount of impervious area as compared to existing conditions. Additionally, BMPs including tree box filters, subsurface infiltration structures and bioretention basins that promote infiltration will further increase recharge to groundwater.

7. *Install and maintain all Erosion and Sediment Control measures in accordance with the manufacturers specifications and good engineering practices;*

   The Contractor will install and maintain all erosion and sedimentation control measures according to manufacturer's recommendations. The erosion and sedimentation control devices shall be inspected by the engineer and maintained in accordance with the SWPPP by the Contractor, or responsible party.

8. *Prevent off-site transport of sediment;*

   The BMPs selected for erosion and sedimentation control, when installed and maintained correctly, will prevent off-site transport of sediment. The SWPPP inspection and maintenance requirements will provide routine checks of all BMPs to ensure proper performance.

9. *Protect and manage on and off-site material storage areas (overburden and stockpiles of dirt, borrow areas, or other areas used solely by the permitted project are considered a part of the project);*

   The SWPPP will outline measures to protect the onsite material storage areas. It is not anticipated that offsite areas will be required for material storage, however, if the need arises, a SWPPP shall be developed by the Contractor for each specific site.

10. *Comply with applicable Federal, State and local laws and regulations including waste disposal, sanitary sewer or septic system regulations, and air quality requirement, including dust control;*

    The Project will comply with all applicable laws and regulations as outlined in this report. The Construction Management Plan will include specific laws and regulations for the various aspects of the construction process.

11. *Prevent significant alteration of habitats mapped by the Massachusetts Natural Heritage & Endangered Species Program as Endangered, Threatened or Of Special Concern, Estimated Habitats of Rare Wildlife and Certified Vernal Pools, and Priority Habitats of Rare Species from the proposed activities;*

    According to the MassGIS database, there are no locations listed above within or adjacent to the Project Area.

12. *Institute interim and permanent stabilization measures, which shall be instituted on a disturbed area as soon as practicable but no more than 14 days after construction activity has temporarily or permanently ceased on that portion of the site;*

    The SWPPP will outline measures for interim and permanent stabilization measures to be implemented at the Site.

13. *Properly manage on-site construction and waste materials; and*

    The SWPPP will identify areas on the Site where construction and waste materials will be located. These areas will be properly maintained during the construction process. Material management for the Site is discussed in the Construction Period Impacts chapter, which also identifies applicable laws and regulations relating to waste management.

14. *Prevent off-site vehicle tracking of sediments*

    A temporary construction exit will be proposed for all truck exits at the construction Site. The temporary construction exit provides measures to remove sediment from trucks leaving the Site, as previously described in this chapter, and also in the Report included as Appendix D. Additionally, if sediments are tracked offsite, the Contractor may conduct street sweeping on the affected areas.

City of Quincy Post-Construction Stormwater Management Ordinance

The proposed project has been designed to comply with the City of Quincy Chapter 13.16, Post-Construction Stormwater Management Ordinance, which outlines performance standards to protect the City of Quincy's water bodies and groundwater, and to safeguard the public health, safety, welfare and the environment. The objectives of the ordinance are:

1. *Protect the groundwater and surface water from degradation;*
2. *Require practices to control the flow of stormwater from new and redeveloped sites into the City of Quincy's storm drainage system in order to prevent flooding and erosion;*
3. *Promote infiltration and the recharge of groundwater;*
4. *Prevent pollutants from entering the City of Quincy's municipal separate storm sewer system (MS4) and to minimize discharge of pollutants from the MS4;*
5. *Ensure adequate long-term operation and maintenance of structural stormwater best management practices so that they work as designed;*
6. *Comply with state and federal statutes and regulations relating to stormwater discharges; and*
7. *Establish the City of Quincy's legal authority to ensure compliance with the provisions of this ordinance through inspection, monitoring, and enforcement.*

Chapter 13.16 seeks to implement these goals through the following objectives (Project compliance is discussed):

(a). Application for a Post-Construction Stormwater Management Permit shall include the submittal of a Stormwater Management Plan to the Board. This Stormwater Management Plan shall contain sufficient information for the Board to evaluate the environmental impact, effectiveness, and acceptability of the measures proposed by the applicant for reducing adverse impacts from stormwater. The plan shall be designed to meet the Massachusetts Stormwater Management Standards as set forth in the Stormwater Management Handbook. The Stormwater Management Plan shall fully describe the project in drawings and narrative. It shall include:

1. *A locus map;*
2. *The existing zoning, and land use at the site,*
3. *The proposed land use,*
4. *The location(s) of existing and proposed easements,*
5. *The location of existing and proposed utilities,*
6. *The site's existing & proposed topography with contours at 2 foot intervals,*
7. *The existing site hydrology,*
8. *A description & delineation of existing stormwater conveyances, impoundments, and wetlands on or adjacent to the site or into which stormwater flows.*
9. *A delineation of 100-year flood plains, if applicable*
10. *Estimated seasonal high groundwater elevation (November to April) in areas to be used for stormwater retentions, detention, or infiltration.*
11. *The existing and proposed vegetation and ground surfaces with runoff coefficient for each,*

12. *A drainage area map showing pre and post construction watershed boundaries, drainage area and stormwater flow paths,*
13. *A description and drawings of all components of the proposed drainage system including?*

a. *Locations, cross sections, and profiles of all brooks, streams, drainage swales and their method of stabilization,*
b. *All measures for the detention, retention or infiltration of water,*
c. *All measures for the protection of water quality,*
d. *The structural details for all components of the proposed drainage systems and stormwater management facilities,*
e. *Notes on drawings specifying materials to be used, construction specifications, and standards, and*
f. *Expected hydrology with supporting calculations.*

14. *Proposed improvements including location of buildings or other structures, impervious surfaces, and drainage facilities, if applicable,*
15. *Timing, schedules, and sequence of development including clearing, stripping, rough grading, construction, final grading, and vegetative stabilization,*
16. *A maintenance schedule for the period of construction, and*
17. *Any other information requested by the Board.*

The preliminary Stormwater Management Report included in Appendix D has been prepared to comply with the Massachusetts Stormwater Management Standards and the City of Quincy Stormwater Ordinance. Items 4, 6, 13, 15, 16, and 17 are related to final design and construction scheduling which are subject to review and changes but will be provided as part of the Notice of Intent applications for future Steps of the Project.

(b). Standards. Project shall meet Massachusetts Stormwater Management Standards

The preliminary Stormwater Management Report included in Appendix D has been prepared to comply with the Massachusetts Stormwater Management Standards and the City of Quincy Stormwater Management and Land Disturbance Ordinance.

(c). An Operation and maintenance plan (O&M Plan) is required at the time of application for all projects.

The preliminary Stormwater Management Report (Appendix D) includes an operation and maintenance plan for the Site. The Operation and Maintenance Plan is also described in the above sections.

(d). Item (d) is not listed in ordinance.

(e). Item (e) is not listed in ordinance.

(f). Stormwater Management Easement(s).

Utility Easements will be included on the plans accompanying the final Stormwater Management Report submitted as part of the Notice of Intent application for future Steps of the Project.

City of Quincy MS4 Permit Compliance

The Project complies with the City of Quincy Stormwater Management and Land Disturbance Ordinance, which have been developed to achieve compliance with the City of Quincy's NPDES Phase II MS4 General Permit (MAR041081)

MITIGATION SUMMARY

The proposed stormwater conveyance system includes over 6,000 feet of new piping and countless new drainage structures including the required BMPs and LID features. The LID features used to decentralize stormwater management and treat stormwater proposed to be incorporated into the Project design include green roofs, biofiltration basins, porous surfaces, subsurface infiltration basins and tree box filters.

The Project will provide significantly enhanced water quality benefits as compared to the existing conditions where stormwater discharges to receiving waters untreated. Some of the proposed LID features also provide additional recharge to groundwater.

CONCLUSION

The proposed stormwater management system is designed to mitigate impacts associated with the discharge of stormwater from the Project. The system has been designed to comply with the MassDEP Massachusetts Stormwater Standards and City of Quincy Stormwater Ordinances which provide measures for the long-term effectiveness of the system through requirement of specific practices including BMP selection, construction period erosion and sediment control and long term operating and maintenance procedures.The stormwater management system for the Project is designed to improve the quality of stormwater runoff from the Project Area, and also reduce the peak rate of runoff that eventually discharges into Town Brook. The existing conditions stormwater management for the Project Area provides little to no treatment of runoff.

As part of the City's efforts to improve water quality within the overall Town Brook Watershed, an overall Town Brook Watershed Master Plan will be developed to identify, resolve and prevent water quality problems. The Proponents have also committed to LEED-ND Silver certification, which includes credits related to stormwater management. The Proponents will evaluate the potential and feasibility for stormwater related LEED-ND.

Numerous stormwater LID features and BMPs will be evaluated for use within the Project such as deep sump catch basins, water quality units, bioretention basins, subsurface infiltration structures, tree box filters, porous surfaces and green roofs. In addition to the proposed stormwater system improvements, a construction period erosion and sediment control plan and a long term operations and maintenance plan have been developed for the Project Area to ensure the long-term effectiveness of the overall stormwater system. The Project will provide significantly enhanced water quality benefits as compared to the existing conditions where stormwater discharges to receiving waters untreated.

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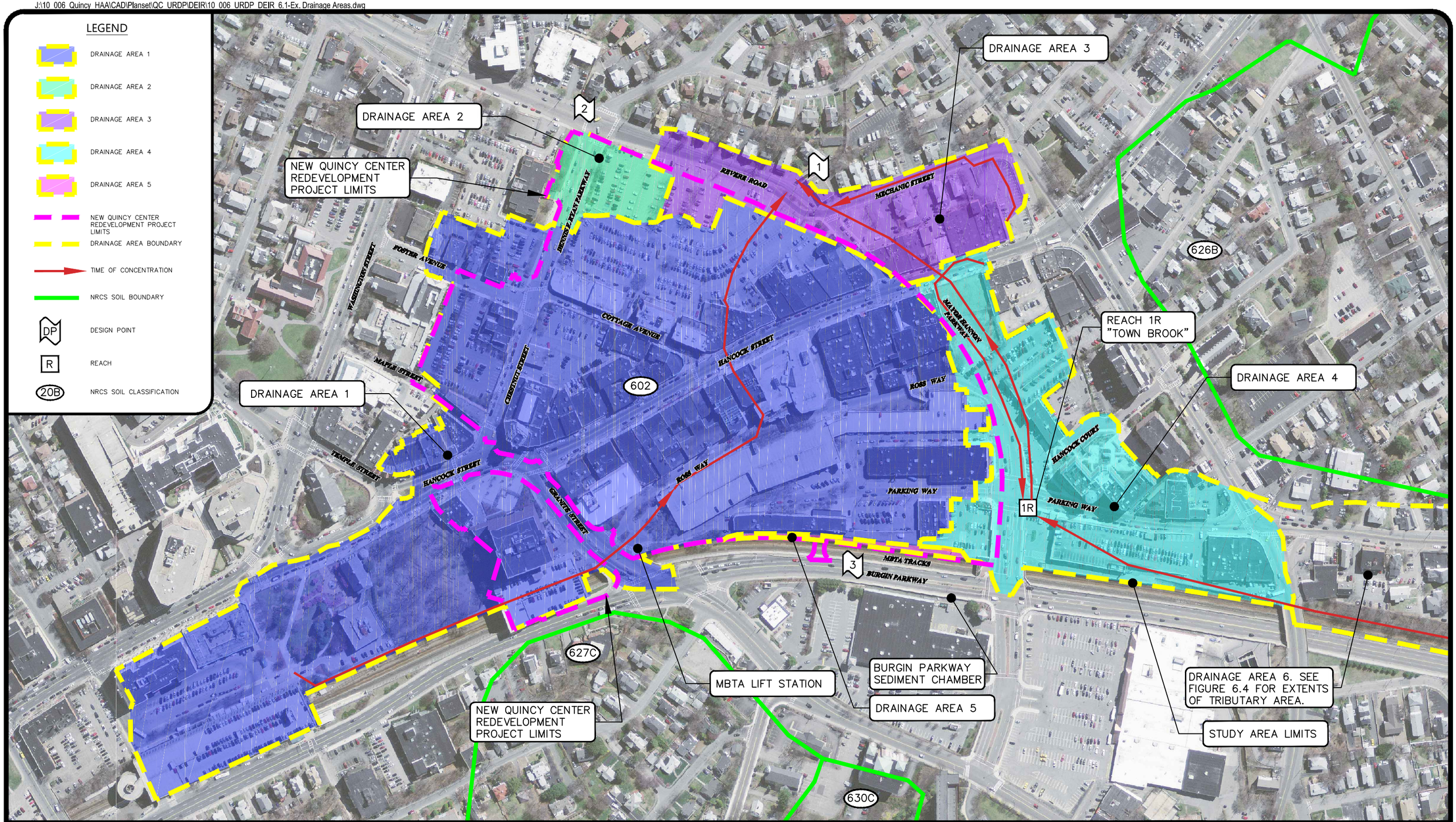
LEGEND

- DRAINAGE AREA 1
- DRAINAGE AREA 2
- DRAINAGE AREA 3
- DRAINAGE AREA 4
- DRAINAGE AREA 5
- NEW QUINCY CENTER REDEVELOPMENT PROJECT LIMITS
- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION
- NRCS SOIL BOUNDARY
- DP — DESIGN POINT
- R — REACH
- 20B — NRCS SOIL CLASSIFICATION



NOTES:

1. SEE DRAINAGE CHAPTER FOR INFORMATION REGARDING THE DELINEATION OF DRAINAGE AREAS.

0 125 250 Feet

This Figure Prepared in Coordination With:

City of Quincy
City Hall
1305 Hancock Street
Quincy, MA 02169

HancockAdamsAssociates
1400 Hancock Street
Quincy, MA 02169

SDG
Stephenson Design Group
51 Sleeper Street
Suite 600
Boston, MA 02210

Figure 6.1 April 30, 2012

Existing Conditions Drainage Areas
Draft Environmental Impact Report
New Quincy Center Redevelopment
Quincy, Massachusetts

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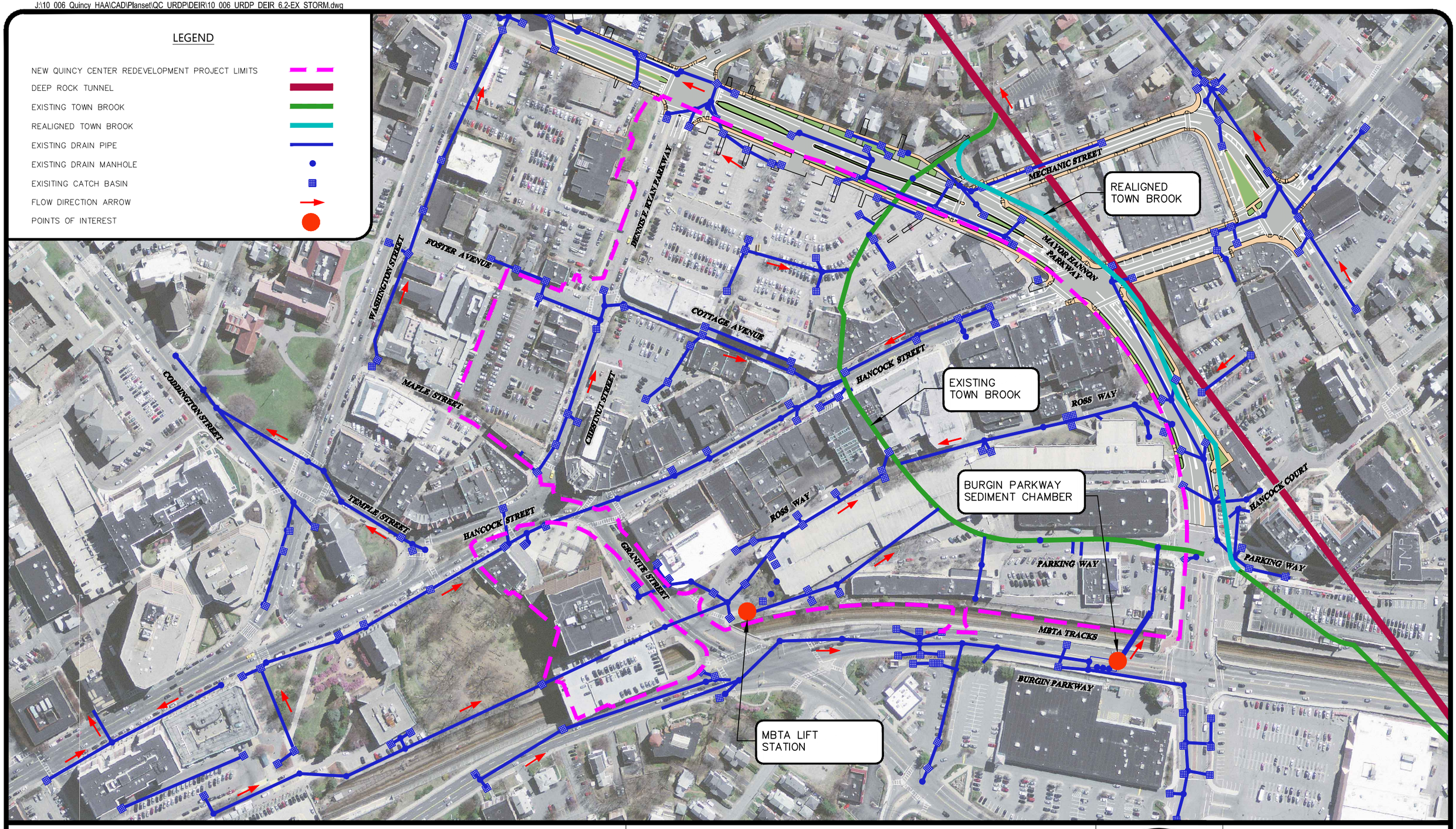
LEGEND

- NEW QUINCY CENTER REDEVELOPMENT PROJECT LIMITS
- DEEP ROCK TUNNEL
- EXISTING TOWN BROOK
- REALIGNED TOWN BROOK
- EXISTING DRAIN PIPE
- EXISTING DRAIN MANHOLE
- EXISITING CATCH BASIN
- FLOW DIRECTION ARROW
- POINTS OF INTEREST



NOTES:

1. EXISTING DRAINAGE CONFIGURATION COMPILED FROM AVAILABLE RECORD INFORMATION, CITY OF QUINCY GIS INFORMATION, DISCUSSIONS WITH CITY OF QUINCY STAFF, AND IN THE FIELD SURVEY.
2. REFERENCES TO TOWN BROOK AND ASSOCIATED RESOURCE AREAS ARE BASED ON THE CITY'S PREFERRED RELOCATION ALTERNATIVE PRESENTED IN THE TOWN BROOK ENHANCEMENT PROJECT PERMITTING DOCUMENTS.

0 100 200 Feet

This Figure Prepared in Coordination With:

City of Quincy
City Hall
1305 Hancock Street
Quincy, MA 02169

Hancock Adams Associates
1400 Hancock Street
Quincy, MA 02169

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Suite 600
Boston, MA 02210

Figure 6.2 April 30, 2012

Existing Storm Drainage System
Draft Environmental Impact Report
New Quincy Center Redevelopment
Quincy, Massachusetts

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TOWN OF BRAINTREE

CITY OF QUINCY

CENTRE STREET JUNCTION STRUCTURE

OLD QUINCY RESERVOIR OUTLET

TOWN BROOK CHANNEL

REALIGNED SEGMENT OF TOWN BROOK CHANNEL

NEW QUINCY CENTER REDEVELOPMENT PROJECT LIMITS

TUNNEL INTAKE & FLOW DIVERSION STRUCTURE

BURGIN PARKWAY CULVERT

APPROX. LOCATION OF SMELT SPAWNING AREA

USGS GAUGING STATION NO. 1105585

DEEP ROCK TUNNEL

DEEP ROCK TUNNEL OUTLET

SOUTHERN ARTERY CULVERT

CITY OF QUINCY

TOWN OF BRAINTREE

LEGEND

- POINTS OF INTEREST
- EXISTING DEEP ROCK TUNNEL/BURGIN PARKWAY CULVERT
- OPEN CHANNEL
- CLOSED CONDUIT

NOTES:

1. REFERENCES TO TOWN BROOK AND ASSOCIATED RESOURCE AREAS ARE BASED ON THE CITY'S PREFERRED RELOCATION ALTERNATIVE PRESENTED IN THE TOWN BROOK ENHANCEMENT PROJECT PERMITTING DOCUMENTS.

0 500 1,000 Feet

This Figure Prepared in Coordination With:

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Quincy, MA 02169

Hancock Adams Associates
1400 Hancock Street
Quincy, MA 02169

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Boston, MA 02210

Figure 6.3 April 30, 2012

Town Brook/Deep Rock Tunnel Watershed
Drainage Features
Draft Environmental Impact Report
New Quincy Center Redevelopment
Quincy, Massachusetts

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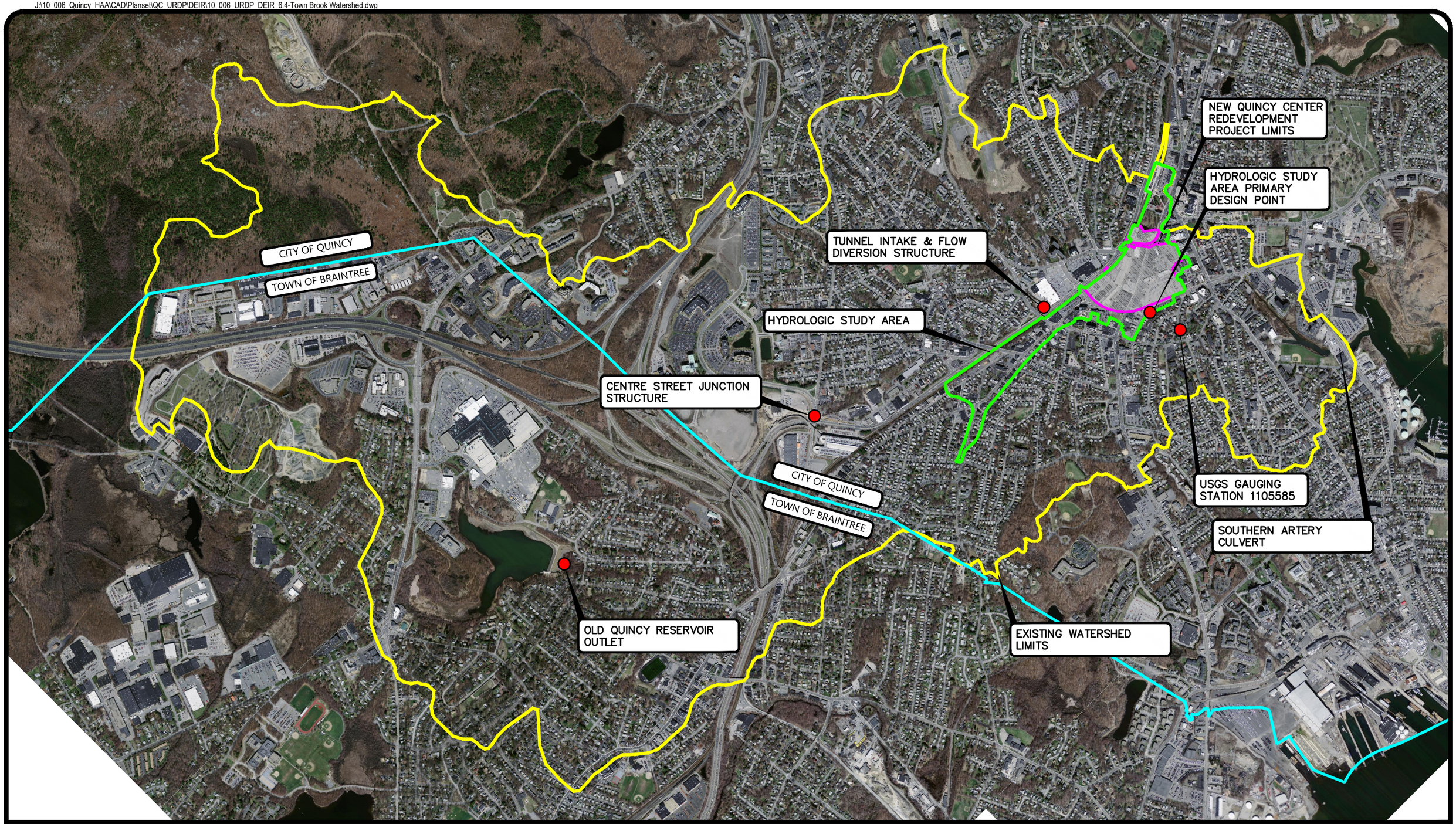

0 750 1,500 Feet

NOTES:

1. REFERENCES TO TOWN BROOK AND ASSOCIATED RESOURCE AREAS ARE BASED ON THE CITY'S PREFERRED RELOCATION ALTERNATIVE PRESENTED IN THE TOWN BROOK ENHANCEMENT PROJECT PERMITTING DOCUMENTS.

This Figure Prepared in Coordination With:

City of Quincy
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Boston, MA 02210

Figure 6.4 April 30, 2012

Existing Town Brook Watershed
Draft Environmental Impact Report
New Quincy Center Redevelopment
Quincy, Massachusetts

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LEGEND

- AREA SUBJECT TO TIDAL INFLUENCE
- 100 YEAR FLOOD ZONE
- 500 YEAR FLOOD ZONE
- OPEN CHANNEL
- CLOSED CHANNEL
- DEEP ROCK TUNNEL
- NEW QUINCY CENTER REDEVELOPMENT PROJECT LIMTS

NOTES:

1. LIMITS OF TIDAL INFLUENCE AS DESCRIBED IN THE FEMA FLOOD INSURANCE STUDY FOR THE CITY OF QUINCY, MASSACHUSETTS, DATED MAY 16, 2006.
2. 100 AND 500 YEAR FLOODPLAIN LIMITS AS DEPICTED ON THE FEMA FLOOD INSURANCE RATE MAPS 2552190019D, 2552190057D, 2552190038D, 2552190076D, DATED MAY 16, 2006, NAVD 1988, AND MODIFIED WITH FIELD SURVEY WHERE AVAILABLE.
3. REFERENCES TO TOWN BROOK AND ASSOCIATED RESOURCE AREAS ARE BASED ON THE CITY'S PREFERRED RELOCATION ALTERNATIVE PRESENTED IN THE TOWN BROOK ENHANCEMENT PROJECT PERMITTING DOCUMENTS.

0 150 300 Feet

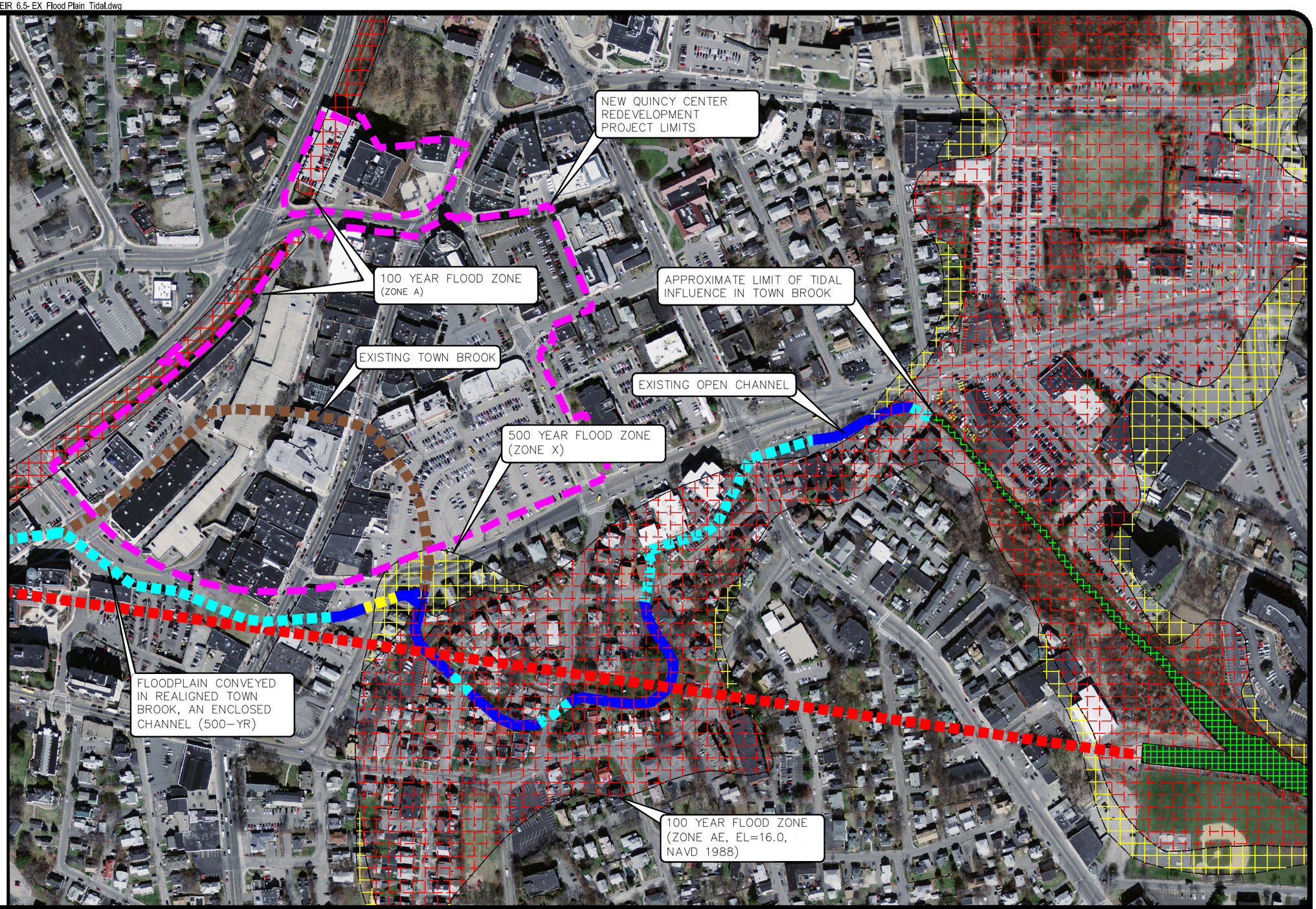

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Figure 6.5 April 30, 2012

Existing Floodplain and Limit of Tidal Influence
Draft Environmental Impact Report
New Quincy Center Redevelopment
Quincy, Massachusetts

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LEGEND

- DRAINAGE AREA 1
- DRAINAGE AREA 2
- DRAINAGE AREA 3
- DRAINAGE AREA 4
- DRAINAGE AREA 5
- NEW QUINCY CENTER REDEVELOPMENT PROJECT LIMITS
- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION
- NRCS SOIL BOUNDARY
- DP — DESIGN POINT
- R — REACH
- 20B — NRCS SOIL CLASSIFICATION

DRAINAGE AREA 1
DRAINAGE AREA 2
DRAINAGE AREA 3
DRAINAGE AREA 4
DRAINAGE AREA 5
NEW QUINCY CENTER REDEVELOPMENT PROJECT LIMITS
REACH 1R "TOWN BROOK"
DRAINAGE AREA 6. SEE FIGURE 6.4 FOR EXTENTS OF TRIBUTARY AREA
STUDY AREA LIMITS
BURGIN PARKWAY SEDIMENT CHAMBER
MBTA LIFT STATION
NEW QUINCY CENTER REDEVELOPMENT PROJECT LIMITS
1
2
3
1R
602
626B
627C
630C
REVERE ROAD
MECHANIC STREET
FOSTER AVENUE
WASHINGTON STREET
LEXTON PLACE
CRESCENT STREET
COTTAGE AVENUE
HANCOCK STREET
MAYOR RAINNEY PARKWAY
ROSS WAY
TEMPLE STREET
GRANITE STREET
BLACK MARKET SQUARE CONNECTOR
HANCOCK COURT
PARKING WAY
MBTA TRACKS
BURGIN PARKWAY

NOTES:

1. SEE DRAINAGE CHAPTER FOR INFORMATION REGARDING THE DELINEATION OF DRAINAGE AREAS.

0 125 250 Feet

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Figure 6.6 April 30, 2012

Proposed Conditions Drainage Areas
Drainage Report
New Quincy Center Redevelopment
Quincy, Massachusetts

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LEGEND

- PROJECT AREA
- DEEP ROCK TUNNEL
- EXISTING TOWN BROOK
- RELOCATED TOWN BROOK
- PROPOSED DRAIN LINE
- EXISTING DRAIN LINE
- EXISTING CATCH BASIN
- MAINTAIN/RELOCATE EXISTING SERVICE/CONNECTION
- FLOW DIRECTION ARROW
- GREEN ROOF
- WATER QUALITY UNIT

GREEN ROOF
TREE BOX FILTER
REVERE ROAD
MECHANIC STREET
TOWN BROOK
BIOFILTRATION BASIN
DEEP ROCK TUNNEL
WASHINGTON STREET
FOSTER AVENUE
DENNIS F. RYAN PARKWAY
18" D
48" x 84" CULVERT
18" D
18" D
30" D
COTTAGE AVENUE
CHESTNUT STREET
48" x 72" CULVERT
HANCOCK STREET
MAYOR RANNEY PARKWAY
18" D
12" D
24" D
36" D
36" x 60" CULVERT
24" x 48" CULVERT
HANCOCK / MARKET SQUARE CONNECTOR
ROSS WAY
24" D
HANCOCK COURT
TEMPLE STREET
HANCOCK STREET
ROSS WAY
30" D
48" D
GRANITE STREET
PARKING WAY
36" D
24" D
42" D
MBTA TRACKS
BURGIN PARKWAY
MBTA LIFT STATION
BURGIN PARKWAY SEDIMENT CHAMBER

NOTES:

1. EXISTING DRAINAGE CONFIGURATION COMPILED FROM AVAILABLE RECORD INFORMATION, CITY OF QUINCY GIS INFORMATION AND DISCUSSIONS WITH CITY OF QUINCY STAFF.
2. SEE DRAINAGE CHAPTER FOR DETAILED INFORMATION REGARDING THE PROPOSED STORM DRAIN SYSTEM AND FLOW QUANTITIES.
3. LOCATIONS AND TYPES OF STORMWATER BMPS SHOWN IN THIS FIGURE ARE CONCEPTUAL AND ARE SUBJECT TO REVIEW, FINAL DESIGN, AND FEASIBILITY.

0 100 200 Feet

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Figure 6.7 April 30, 2012

Proposed Storm Drainage System
Draft Environmental Impact Report
New Quincy Center Redevelopment
Quincy, Massachusetts