SOUTH STATION
EXPANSION

Appendix A - Stormwater Analysis Technical Report

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massDOT
Massachusetts Department of Transportation

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1. Introduction

This Stormwater Report has been prepared to outline the project's proposed stormwater management approach. This report also describes the plan to comply with the Massachusetts Stormwater Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and Water Quality Certification Regulations (314 CMR 9.00).

1.1 Site Description

The project consists of three sites: South Station (including Dorchester Avenue), Widett Circle layover facility, and Readville – Yard 2 layover facility, as shown in Figure 1. The project sites are currently covered in a combination of pervious and impervious surfaces, as shown in Table 1. They are also covered by ballast, which is a crushed stone trackbed with characteristics of both pervious and impervious surfaces.

Table 1 — Existing and Proposed Land Cover

Cover Type	Existing Cover (ac)	Proposed Cover (ac)	Change (ac)	% Change
South Station				
Impervious (pavement, buildings, etc.)	27.2	20.4	-6.8	-25%
Ballast	21.1	26.9	5.8	27%
Pervious (green space, BMPs, etc.)	0.7	1.7	1.0	143%
Total	**49.0**	**49.0**	**0.0**	
Widett Circle				
Impervious (pavement, buildings, etc.)	27.5	12.9	-14.7	-53%
Ballast	2.7	14.3	11.7	433%
Pervious (green space, BMPs, etc.)	0.0	3.0	3.0	N/A
Total	**30.2**	**30.2**	**0.0**	
Readville – Yard 2				
Impervious (pavement, buildings, etc.)	4.5	6.5	2.0	44%
Ballast	6.4	8.2	1.8	28%
Pervious (green space, BMPs, etc.)	6.6	2.8	-3.8	-58%
Total	**17.5**	**17.5**	**0.0**	

1.2 South Station

South Station occupies approximately 49 acres of land located near Chinatown, Fort Point Channel, and the South Boston Waterfront/Innovation District. The site includes the following: South Station Rail/Transit Terminal, South Station Bus Terminal, and the USPS GMF, including the portion of Dorchester Avenue fronting the site and running parallel to Fort Point Channel. The site consists of the following land cover:

- 27.2 acres of impervious buildings, parking lots, and roadways (Dorchester Avenue)
- 21.1 acres of ballasted track
- 0.7 acres of pervious open space (Rolling Bridge Park)

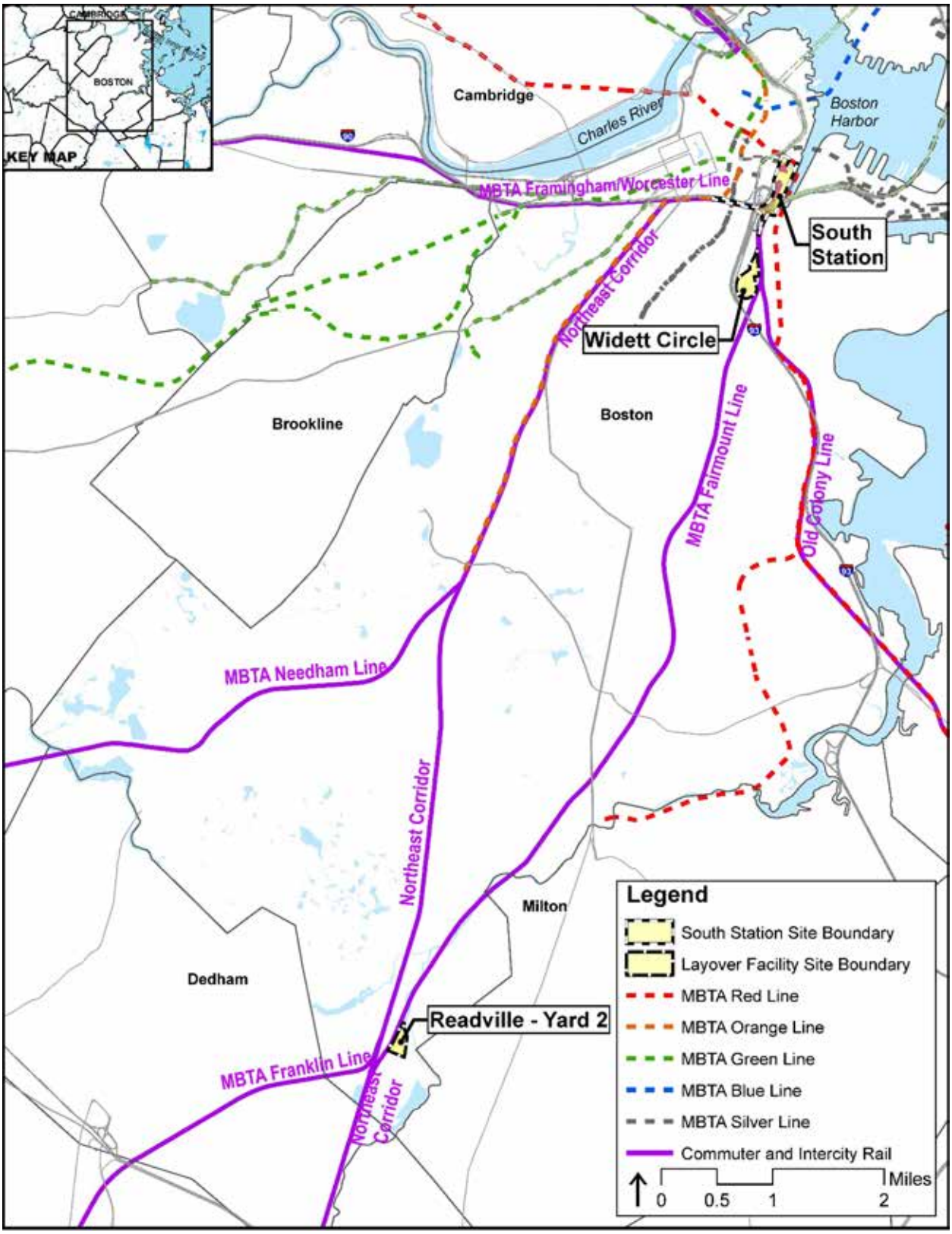


Figure 1 — Project Location Map – All Facilities

1.2.1 Layover Facilities

Widett Circle

The Widett Circle site, totaling approximately 30.2 acres, is located in South Boston along the MBTA's Fairmount Line, approximately one track-mile from South Station. It is primarily comprised of four parcels in private ownership: 100 Widett Circle (Cold Storage) and the 1 and 2 Foodmart Road parcels. The approximately 6.6 acre Cold Storage site currently houses a temperature-controlled food storage and distribution facility, owned by Art Mortgage Borrower Propco 2006 2 LP and used by Americold/Crocker & Winsor Seafoods. The building has an active rail siding served by CSX Transportation, Inc. (CSXT) with space for six freight cars. The New Boston Food Market Development Corporation, made up of approximately 30 units leased to multiple businesses in the food processing, food storage, and food logistics industry, owns 1 and 2 Foodmart Road. The fourth parcel is primarily a track easement for Amtrak under the ownership of the New Boston Food Market. The 30.2-acre site consists of the following land cover:

- 27.5 acres of impervious building, parking and storage areas
- 2.7 acres of ballasted track

Readville – Yard 2

The MBTA's Readville – Yard 2 is located in the Readville section of Hyde Park in Boston. It lies within the northeast quadrant of the intersection of the NEC and the MBTA Fairmount Line, approximately 8.8 track-miles south of South Station. Readville – Yard 2 is a maintenance repair facility and the largest layover yard used by the MBTA for its south side commuter rail service. The layover yard has a total of 12 tracks. The MBTA currently uses Readville – Yard 2 for midday layover storage of 10 trainsets of variable lengths. A portion of the adjacent property (0.7 acres) would be acquired to provide land for track expansion. The 17.5-acre site consists of the following land cover:

- 4.5 acres of impervious buildings, parking, and storage areas
- 6.4 acres of ballasted tracks
- 6.6 acres of other pervious areas

1.3 Existing Conditions

This section describes existing conditions, water resources and drainage for the three project sites.

1.3.1 South Station

The only surface water body within the South Station study area is Fort Point Channel, which is part of the Boston Harbor watershed. The Channel is located between Dorchester Avenue and the Fort Point neighborhood and extends from West Fourth Street to the south to the Evelyn Moakley Bridge to the north. The USPS GMF abuts Fort Point Channel to the west, separated from it by Dorchester Avenue.

Stormwater from the South Station site is collected into the sewer system. Based on existing plans and survey, there is no evidence of stormwater detention, infiltration, or treatment measures in place at the site. Along the western side of South Station, catch basins collect stormwater runoff along Atlantic Avenue, where it is then directed off the site through the sewer system. The station's ballasted train track area has characteristics of both pervious and impervious surfaces. Catch basins within the track area direct

stormwater to an existing six-foot, nine-inch BWSC Combined Sewer Overflow (CSO) (BOS 065) located under the tracks. Stormwater from the USPS parcel, including roof runoff, is collected by catch basins and flows through the sewer system before discharging to Fort Point Channel. In total, there are ten stormwater outfalls from the South Station site that discharge to the Fort Point Channel. It is notable that three CSOs (064, 065, and 068) are also in the immediate vicinity of the South Station site. Figure 2 depicts existing stormwater infrastructure and CSO connections.

1.3.2 Layover Facilities

Widett Circle

Widett Circle consists of existing warehouse and transportation uses. The development was constructed prior to the promulgation of the Massachusetts Stormwater Regulations, and currently does not provide water quality treatment on-site. Stormwater from Widett Circle site is currently collected in a series of catch basins within existing parking areas and along Widett Circle and Foodmart Road. Runoff from the catch basins is collected in a 36-inch storm drain. It then flows into the overflow portion of a large combined sewer that runs north to south, adjacent to the Cold Storage facility. The ultimate discharge point for overflows from the combined sewer is Fort Point Channel at CSO 070. Based on existing aerial survey, no stormwater detention, infiltration, or treatment measures are in place at Widett Circle. Based on available information, there is no stormwater quality treatment currently provided at Widett Circle.

Readville – Yard 2

Drainage from the Readville – Yard 2 site discharges to Segment ID MA73-02 of the Neponset River, an impaired Category 5 waterbody, which runs south to north just east of the site. In the northern part of the site, stormwater from the ballasted track area flows from underdrains to an existing 12-inch pipe that drains to the Neponset River. In the southern portion of the site, a 54-inch storm drain runs just east of the existing track, with stormwater traveling north to south on the abutting property to be acquired, and then turns to the east and discharges into the Neponset River. While the drain is known to collect stormwater from the neighborhood directly south of the Readville yard, the stormwater contributions of the layover site to the storm drain are unknown. Drip pans are positioned to collect any incidental drips from trains. The mixture of stormwater and drippings passes through oil/water separators before discharging to a sanitary sewer system. Based on existing aerial survey, besides the oil/water separators, no stormwater detention, infiltration, or treatment measures are in place at the Readville – Yard 2 site.

1.4 Proposed Drainage Conditions

MassDOT is proposing a robust stormwater management system that would increase stormwater quality and decrease storm event peak flow rates through the development of a comprehensive stormwater management system. This system would include structural and non-structural Best Management Practices (BMPs) designed to reduce volume and peak runoff rates and improve water quality. Examples of structural BMPs include “green infrastructure” such as infiltration basins, bioretention areas, and porous pavement, as well as traditional brick-and-mortar measures such as dry wells, deep sump catch basins, and oil/grit separators. Non-structural BMPs are institutional, educational or pollution prevention practices designed to limit the amount of stormwater runoff or pollutants that are generated in the landscape, and include practices such as requirements for routine inspections and maintenance of structural BMPs, street sweeping schedules, and snow disposal plans. The Massachusetts Department of Environmental Protection’s (MassDEP) Stormwater Handbook categorizes a subset of BMPs as Low Impact Development (LID) measures. They include impervious area reduction, bioretention areas, treebox filters, and water quality swales, among others.

The Stormwater Handbook details ten Stormwater Management Standards that are aimed at encouraging recharge and preventing stormwater discharges from causing or contributing to the pollution of the surface waters and groundwaters of the Commonwealth. As described in Section 2.2 of this document, Standard 7 states that a redevelopment project is required to meet certain Stormwater Management Standards only to the maximum extent practicable. Under these standards, two of the three project sites would qualify as redevelopment projects. The following sections describe the proposed stormwater management practices for the three project locations.

1.4.1 South Station

Improvements to the existing stormwater management system would be designed based on BWSC's *Regulations Governing the Use of Sanitary and Combined Sewers and Storm Drains of The Boston Water and Sewer Commission* (1998).

The existing sewer system at the USPS Facility location would be retained and potentially used to convey roof drainage from the proposed South Station headhouse expansion and platforms to Fort Point Channel. If it is possible to disconnect the proposed roof drains from the closed system, their flow would be routed to one of the Best Management Practices (BMP's) described below. If this is not possible, it would connect to the closed system, as it currently does in the existing condition. The existing pipe network could then be used as an outlet for the track subsurface system, abandoned or removed. If site conditions allow, flow could also be routed through a small diameter water quality structure prior to discharging into the channel. The two existing CSO pipes at the site would be retained and used for drainage connections. Measures to treat stormwater runoff would be employed to remove total suspended solids (TSS) and other pollutants from stormwater runoff. Due to site limitations and the vertical separation between the Fort Point Channel and the site, many BMPs are not practical to employ. Measures that would be practical to employ include deep sump catch basins, water quality structures and proprietary separators.

As shown in Table 1, the proposed project would reduce impervious coverage at the South Station site by 25%. Proposed permeable cover may include LID measures such as pervious pavers with underdrains for the sidewalks and the Harborwalk, vegetated open spaces, bioretention areas, green roofs and/or tree box filters. Figure 3 shows the potential location for a large bioretention area, while Figures 4 and 5 depict typical details for LID strategies including surface basins, porous asphalt, tree box filters, and permeable pavers. These features would be implemented, as appropriate, to promote water quality treatment prior to discharging into the sewer system and ultimately into Fort Point Channel.

Since some LID features would be above ground, they would provide aesthetic benefits to the public in addition to water quality benefits. The more creative water quality measures used in the public spaces could also prove to be an opportunity for public education with signage detailing the design features and their role in the water quality process.

The proposed stormwater management practices along the redeveloped Dorchester Avenue, as shown in Figures 6 and 7, would consist of deep sump catch basins with hoods to collect stormwater and reinforced concrete pipes and manholes to convey runoff to existing outfalls along Fort Point Channel. No new outfalls are proposed.

Stormwater management for the tracks and platforms would be designed based on the MBTA *Commuter Rail Design Standards Manual*. Drainage for the track area would consist of ballast underlain with a relatively impervious subgrade crowned at each track centerline. A ditch or perforated subdrain on either side of the tracks would collect stormwater and convey it to a catch basin or manhole and sewer system.

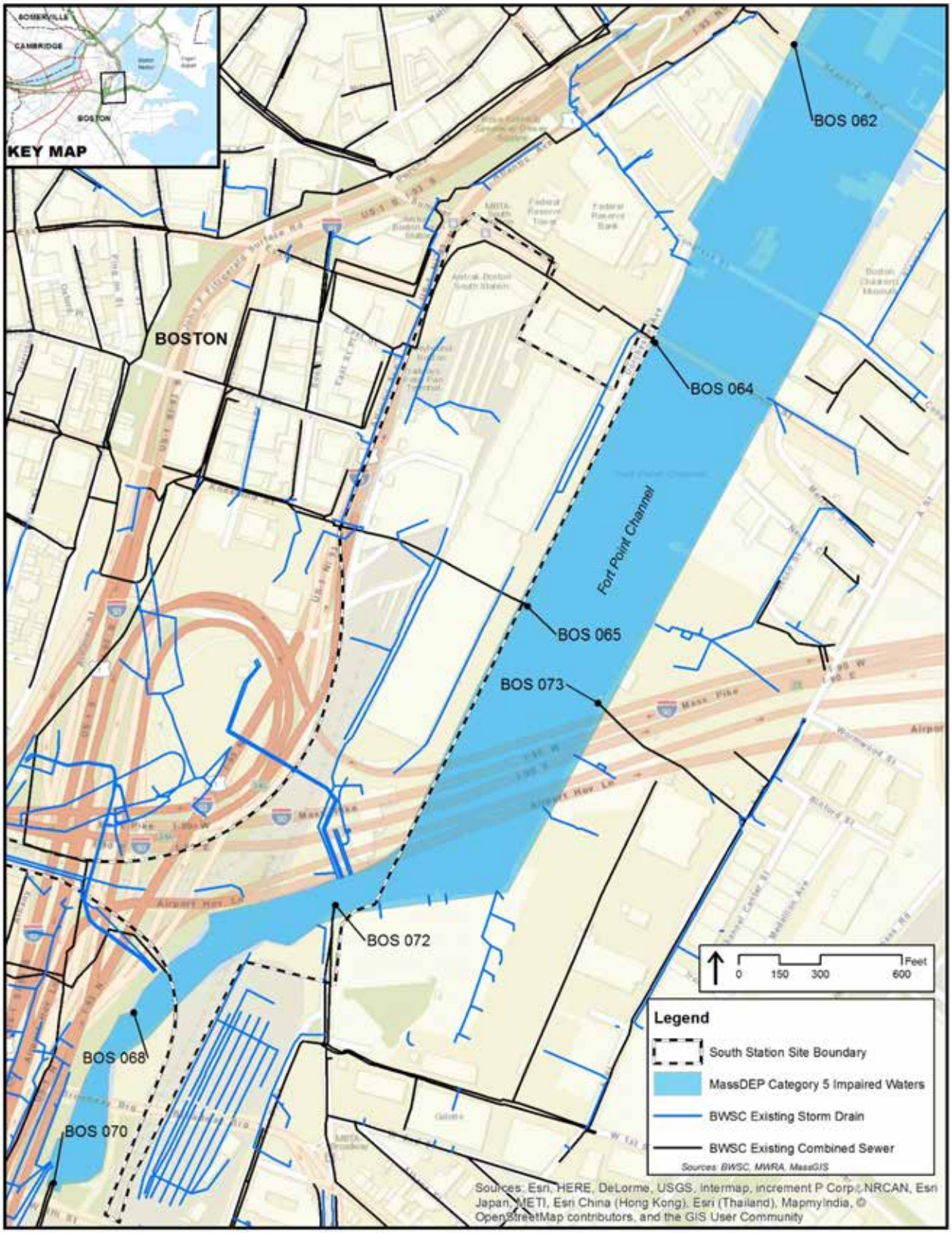


Figure 2 — Existing Stormwater Infrastructure – South Station

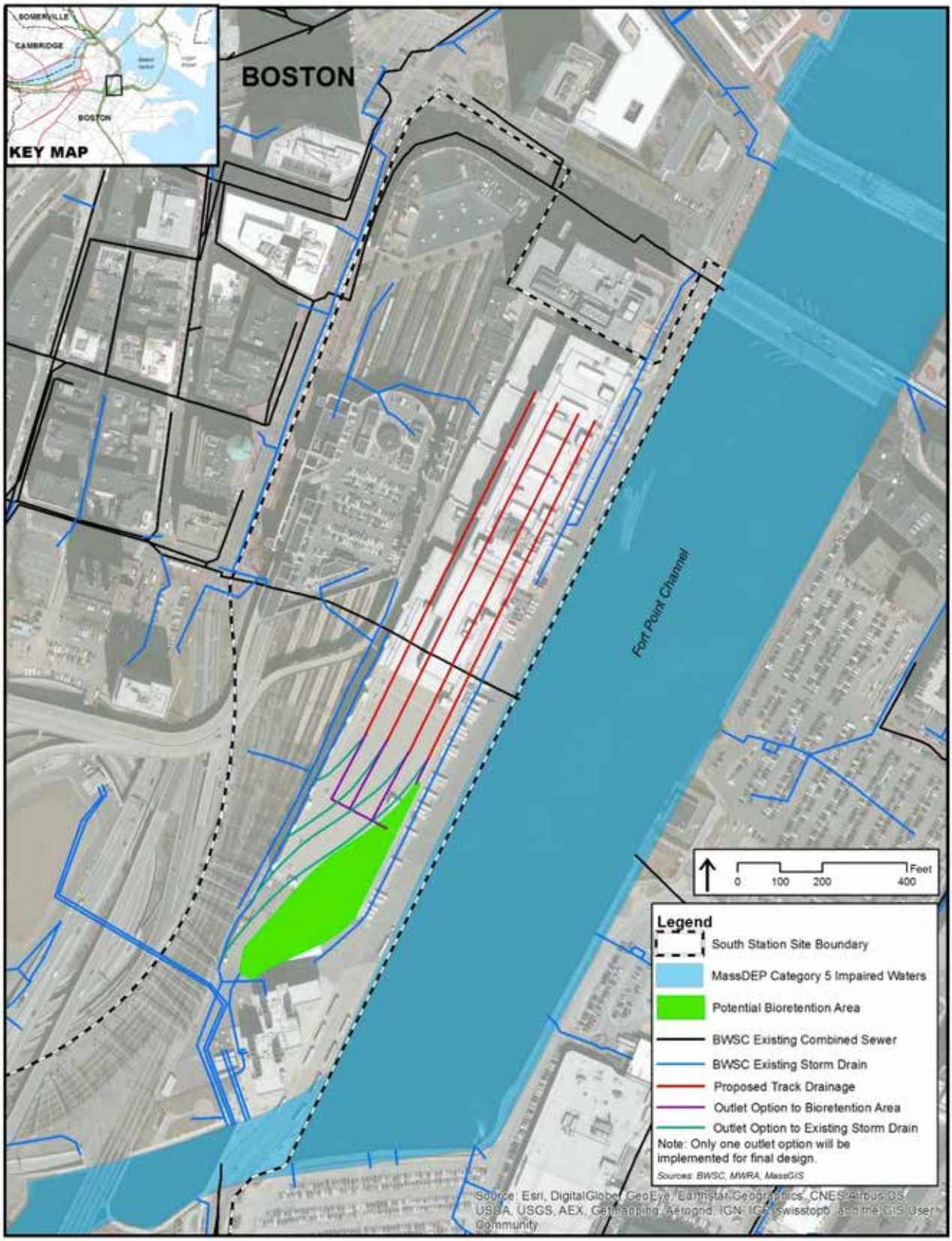


Figure 3 — Stormwater Management – South Station

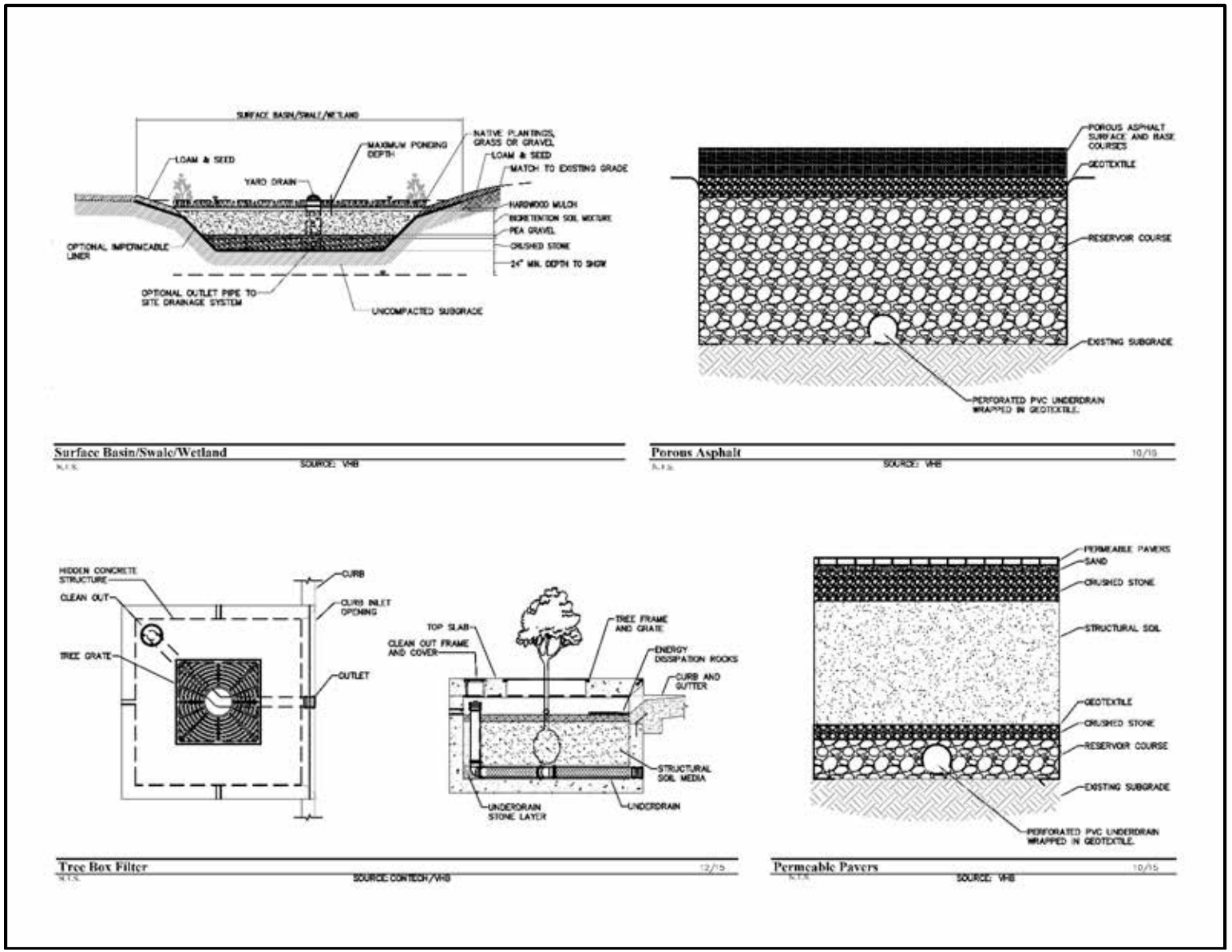
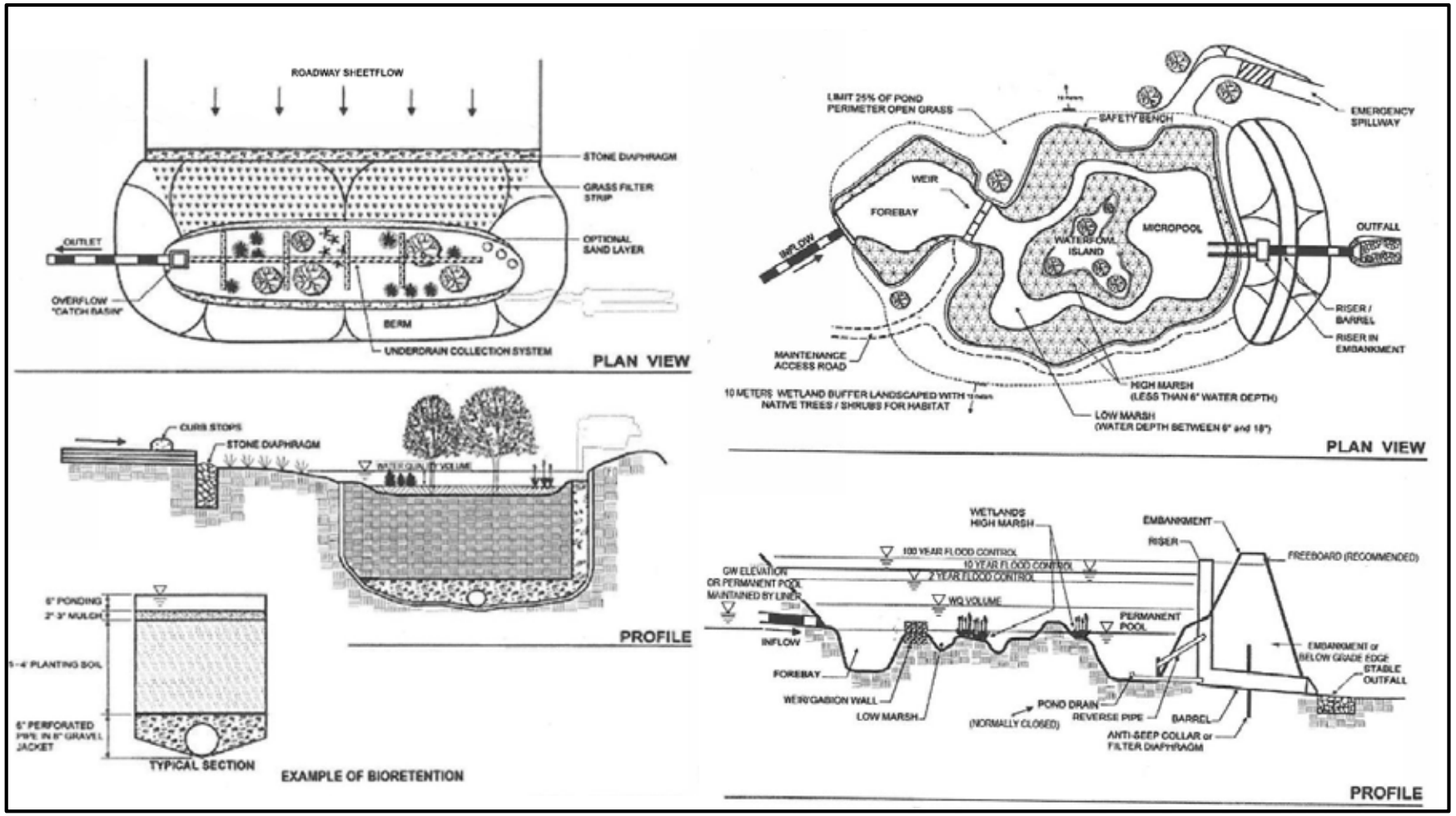


Figure 4 — Stormwater BMP Details



Source: Adapted from Massachusetts Stormwater Handbook, Volume 2 Chapter 2

Figure 5 — Stormwater Bioretention BMP Details

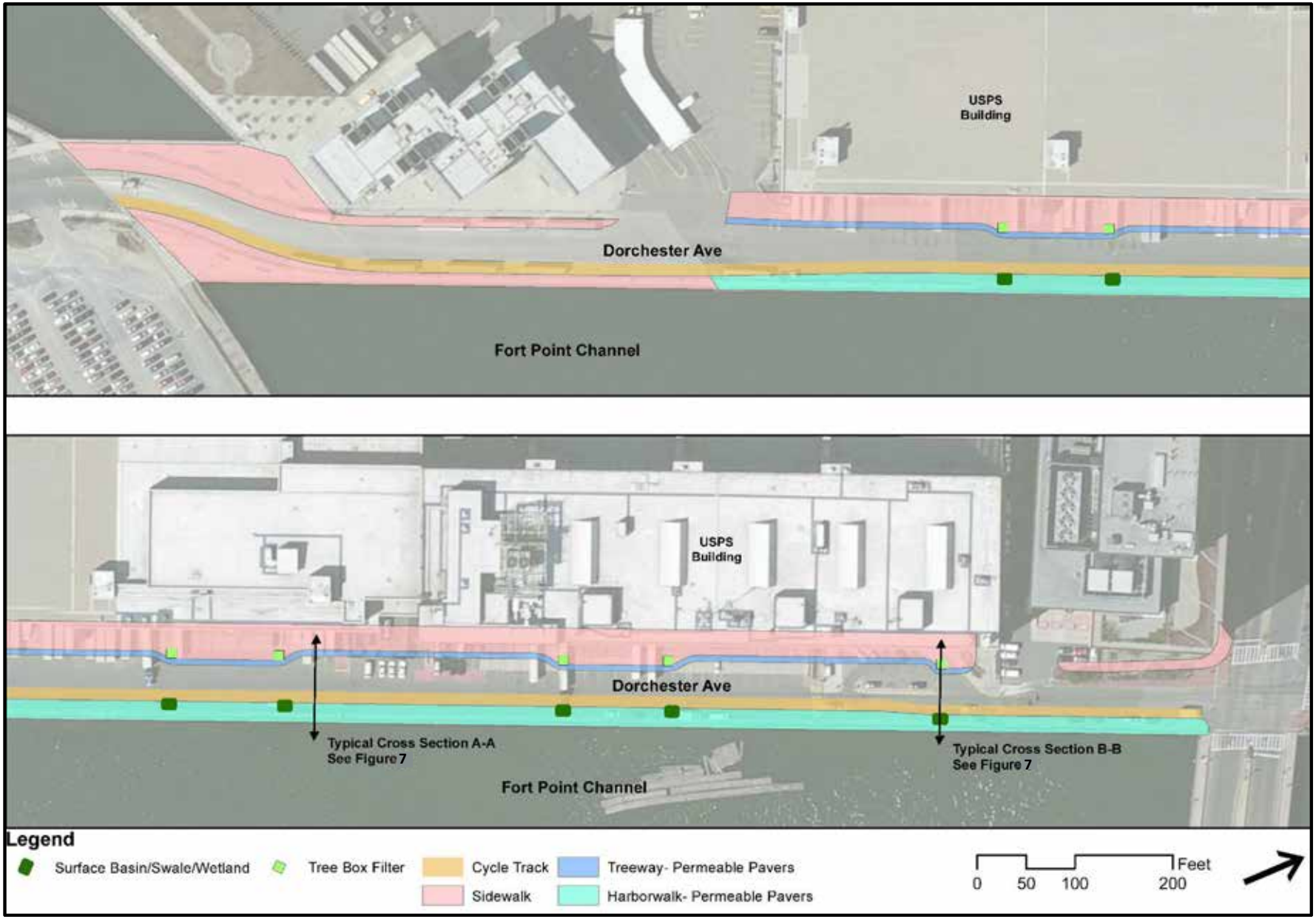


Figure 6 — Stormwater Management – Dorchester Avenue Plan View

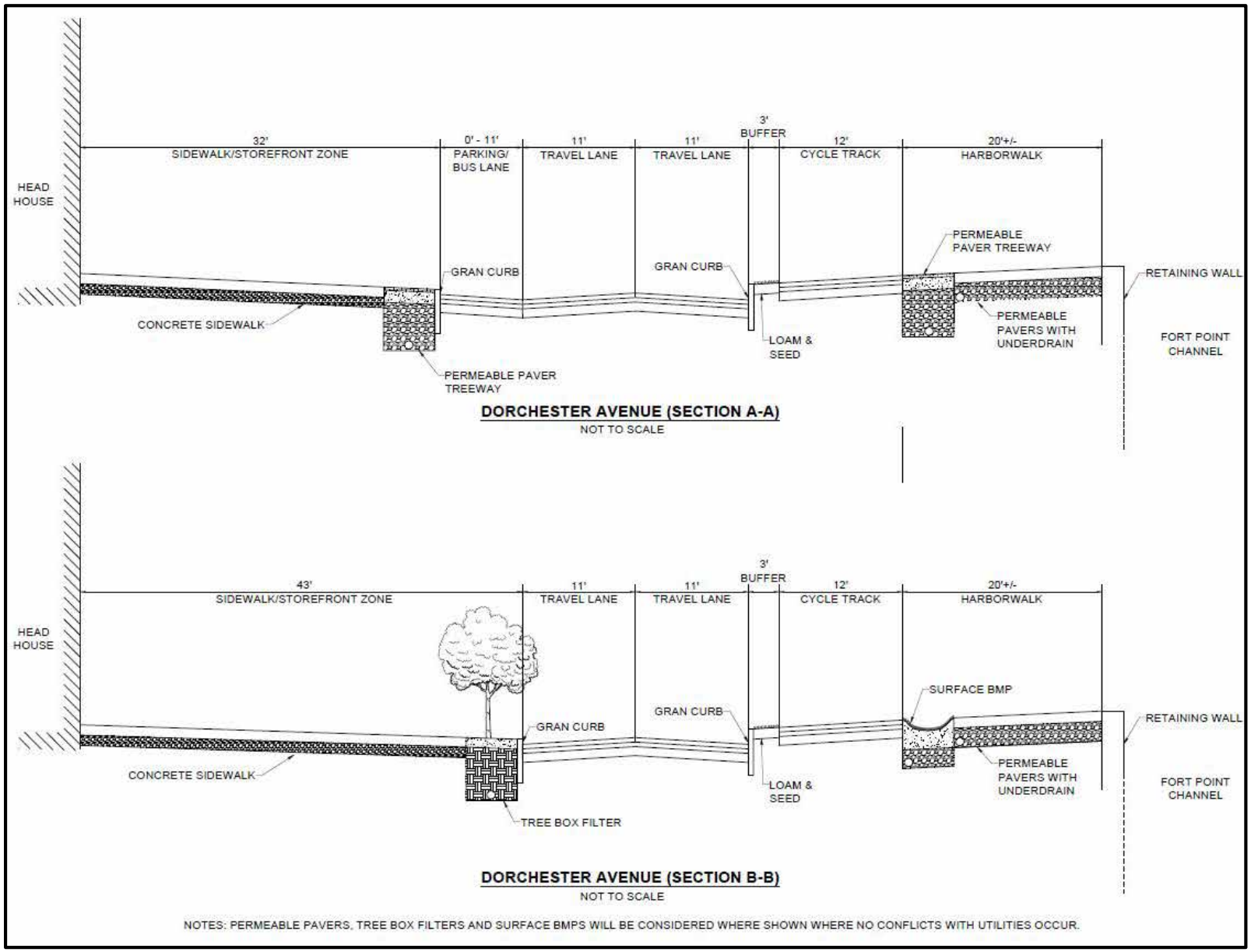


Figure 7 — Stormwater Management – Dorchester Avenue Section

1.4.2 Layover Facilities

The project would be designed to promote infiltration where possible, to increase groundwater recharge and to provide water quality treatment at the layover facility sites. Infiltration BMPs typically offer more pollutant removal over non-infiltration BMPs. However, where infiltration would not be appropriate on contaminated sites, it would be restricted.

While infiltration may be restricted at Readville – Yard 2 due to existing soil/groundwater contamination, subsequent testing may allow for site-wide infiltration or pockets of infiltration. Additionally, due to the site's proximity to the Neponset River, and as indicated by visible pockets of standing water on portions of the site, high groundwater and poor draining soils may further restrict infiltration opportunities. Test pits and borings would be completed during the final design phases to determine the hydraulic conductivity and groundwater elevation at the potential BMP locations.

Because of the potential restrictions on stormwater infiltration, MassDOT is proposing multiple approaches to BMP design at both layover facility sites:

- Approach #1: Infiltration for all proposed stormwater BMPs;
- Approach #2: A combination of infiltration and non-infiltration stormwater BMPs if pockets of clean/well-draining soils are located on-site; and
- Approach #3: No infiltration stormwater BMPs. All BMPs would include impermeable liner and underdrain to prevent infiltration.

Table 2 includes a summary of the BMPs proposed for layover facilities.

Table 2 — Stormwater BMP Approaches for Widett Circle and Readville – Yard 2

Potential BMP		Approach 1 + 2	Approach 3	TSS Removal *	Description
Pretreatment BMPs					
Catch Basins with Deep Sumps		x	x	25%	Catch basin with 4 - foot sump and oil/debris trap
Drip Pans		x	x	NA	Pans to be placed at locations to catch drips from locomotives
Oil/Water Separators		x	x	25%	Concrete chambers to separate oil and floatables from stormwater. Required by plumbing code
Treatment BMPs					
Porous Pavement	Unlined	x		80%	Consists of four layers - (porous asphalt, stone choker course, sand/gravel layer, filter blanket, reservoir course).
	Lined		x	80%	
Surface BMP	Unlined	x		80%	Surface BMP that filtrates stormwater through the soil media such as basin, swale, or gravel wetland. If infiltration is not feasible, the surface bmp can be lined or underdrained. Swale can be planted with grass/limited vegetation.
	Lined		x	80%	
Leaching Basins		x		80%	Open pit leaching catch basin
Infiltration Basins		x		80%	Infiltrating vegetated basin
Green Roofs		x	x	NA	Vegetated garden on building roofs

* TSS Removal Rates from Massachusetts Stormwater Handbook

Level of Design

Currently the proposed layover facilities have been developed to a conceptual design level based upon record existing conditions information. Project design is ongoing, and as such, the project and stormwater BMPs presented in the FEIR are preliminary only. The final locations and design would be determined as design progresses. MassDOT would confirm the locations of existing utilities and constraints located at the project sites by completing a ground field survey. Additionally the project would complete Phase II environmental testing, which would inform the final design of the stormwater management system prior to construction. The stormwater management systems would be designed based on the MBTA *Commuter Rail Design Standards Manual*. The BMPs selected would be designed to comply with the Stormwater Management Regulation as listed below, and would provide an improvement in stormwater quality over existing conditions.

Widett Circle

Track drainage at Widett Circle would consist of track ballast underlain with a relatively impervious subgrade crowned at each track centerline. A ditch or subdrain on either side of the tracks would collect stormwater and convey it to a catch basin or manhole and sewer system. Each locomotive storage area, at the end of each track, would be equipped with a drip pan to collect potential contaminants. The drip pans would connect to an oil/water separator for stormwater pre-treatment before entering the sewer system. Stormwater from the pavement areas and buildings would be directed into stormwater BMPs where feasible before connecting into the sewer system.

Stormwater from the Widett Circle site would be directed off-site via an existing connection to the 17-foot by 13.5-foot BWSC CSO that runs under the Widett Circle roadway and discharges into Fort Point Channel. MassDOT would coordinate with BWSC during the design of connections to the existing CSO or drainage system.

Pervious areas on the eastern and western sections of the site, around the proposed buildings, and to the west of the existing Cold Storage building may be suitable for surface stormwater management BMPs. Since the project would reduce the impervious area on-site, there would be an improvement over existing conditions by reducing the pollutant loading from the project site. Existing soils at the Widett Circle site are classified as urban land.

Figure 8 shows the proposed land covers and the potential BMP types and locations available at the Widett Circle site. As design development progresses the project would select final BMP type and locations that work within the projects constraints. In addition to the areas shown, porous pavement and green roofs may be incorporated into the new pavement and building design.

Readville – Yard 2

Track drainage at Readville – Yard 2 would be similar to the existing stormwater management in place for the existing tracks. This would consist of a centerline crown on each track and a ditch or subdrain on either side of the tracks to collect stormwater and convey it to a catch basin and sewer system. Each locomotive storage area, located at the end of each track, would be equipped with a drip pan to collect any potential contaminants. The drip pans would connect to an oil/water separator for stormwater pre-treated before entering the sanitary sewer system. MassDOT would inspect the existing on-site storm drains described in Section 1.3.2 of this document and assess their condition to determine if the pipes should be relocated, replaced or if a structural liner could be installed. Drainage from the site would connect to one or both of these pipes.

Figure 9 shows the proposed land covers and the potential BMP types and locations available at the Readville – Yard 2 site. In addition to the areas shown, porous pavement and green roofs may be incorporated into the new pavement and building design.

2. Regulatory Compliance

2.1 Clean Water Act

Section 401 of the federal Clean Water Act (CWA) (33 USC 1251-1376), and the regulations that implement the Act, require the enhancement and protection of surface waters from pollution to ensure they are capable of supporting their designated uses. Under the CWA, the U.S. Environmental Protection Agency (EPA) in partnership with MassDEP administers the National Pollutant Discharge Elimination System (NPDES) permit program, which regulates point source discharges to waters of the United States to control water pollution. The City of Boston and BWSC are authorized to discharge stormwater in accordance with the NPDES Municipal Separate Storm Sewer System (MS4) General Permit. The MS4 General Permit includes numerous requirements to improve stormwater management through public education, upgraded infrastructure, and municipal bylaws. The permit also requires cities to locate and correct any unauthorized sewage discharges into the stormwater system. The project would be subject to approval from the BWSC, and they would ensure the project complies with the City's MS4 General Permit and would not result in any new discharges specifically regulated under the CWA.

2.1.1 Neponset River TMDL

Under Section 303(d) of the CWA, the Neponset River has been determined to be impaired as it does not meet the established water quality standards. A total maximum daily load (TMDL) of bacteria for the Neponset River has been developed. The TMDL report identifies major contributors to the bacteria impairment including illicit discharges to storm drains, leaking sanitary sewers, failing septic systems, and stormwater runoff. It specifies both general and specific discharge limits that must be met in order to reduce the bacteria loading and improve the health of the Neponset River.

Stormwater at Readville – Yard 2 discharges to the Neponset River. Bacteria sources from the Readville – Yard 2 site are expected to be negligible. Wastewater from the site would be discharged to a separate sanitary sewer system. Wastewater impacts are discussed in DEIR Appendix 8 - *Water Supply and Wastewater Technical Report*. On-board sanitary facilities and on-site sanitary sewer systems would be designed to eliminate the potential for pathogens to reach the Neponset River. Stormwater BMPs designed to treat urban pollutants would treat ambient bacteria, such as from birds and other wildlife, on the site.

2.1.2 National Pollutant Discharge Elimination System

Industrial activities such as material handling and storage, equipment maintenance and cleaning, and storage of vehicles can be exposed to stormwater and therefore regulated under the NPDES Multi-Sector General Permit (MSGP). Layover facilities are included in the Industrial Sector P: *Land Transportation and Warehousing* and therefore regulated under the NPDES MSGP. Layover facilities fall under the standard industrial classification (SIC) 4011 and 4013 which includes rail transportation facilities. A permit via EPA's NPDES program would be required for the layover facility sites and could include stormwater effluent limits, monitoring requirements, and other conditions related to post-construction operations at the facility.

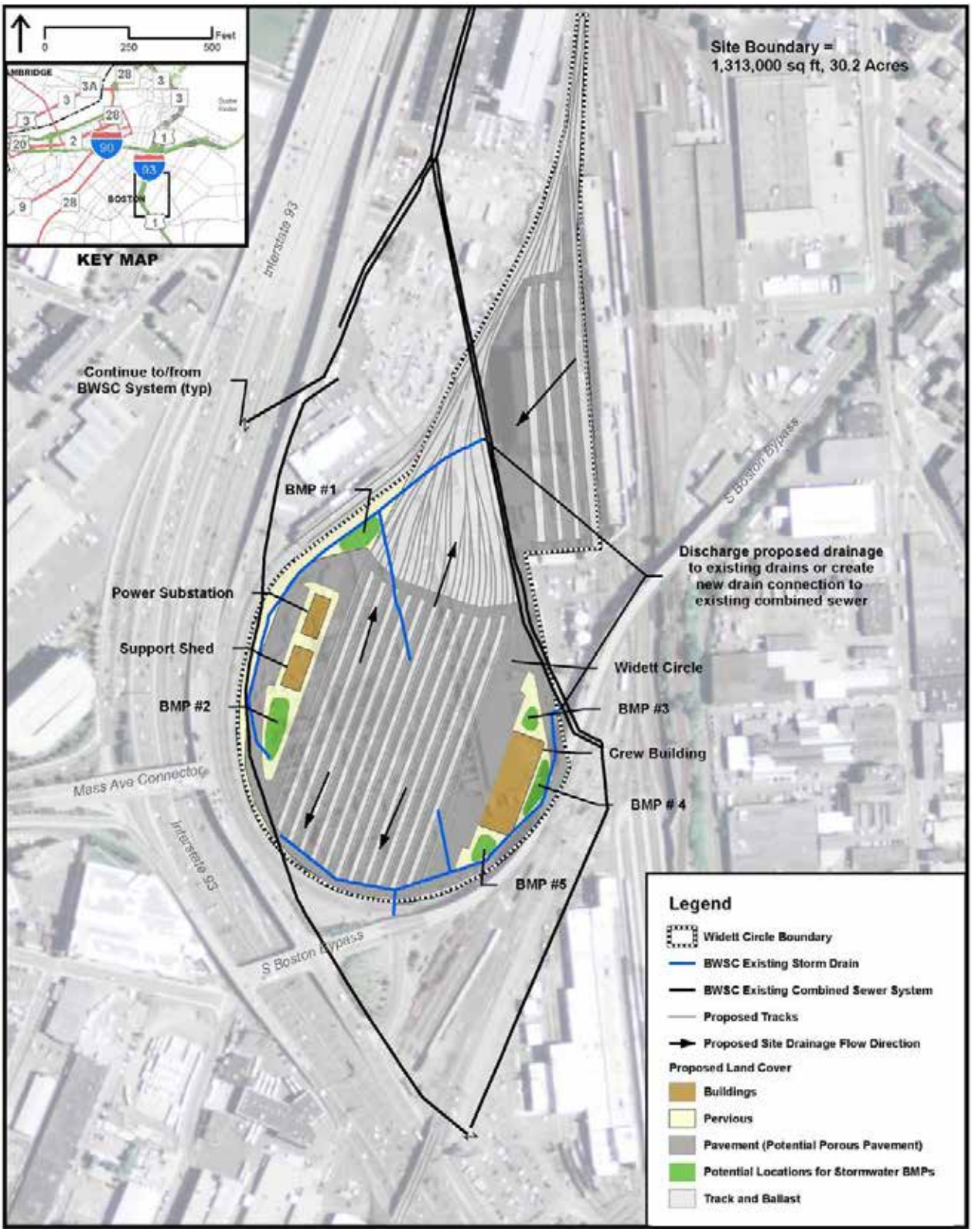


Figure 8 — Stormwater Management – Widett Circle Layover Facility

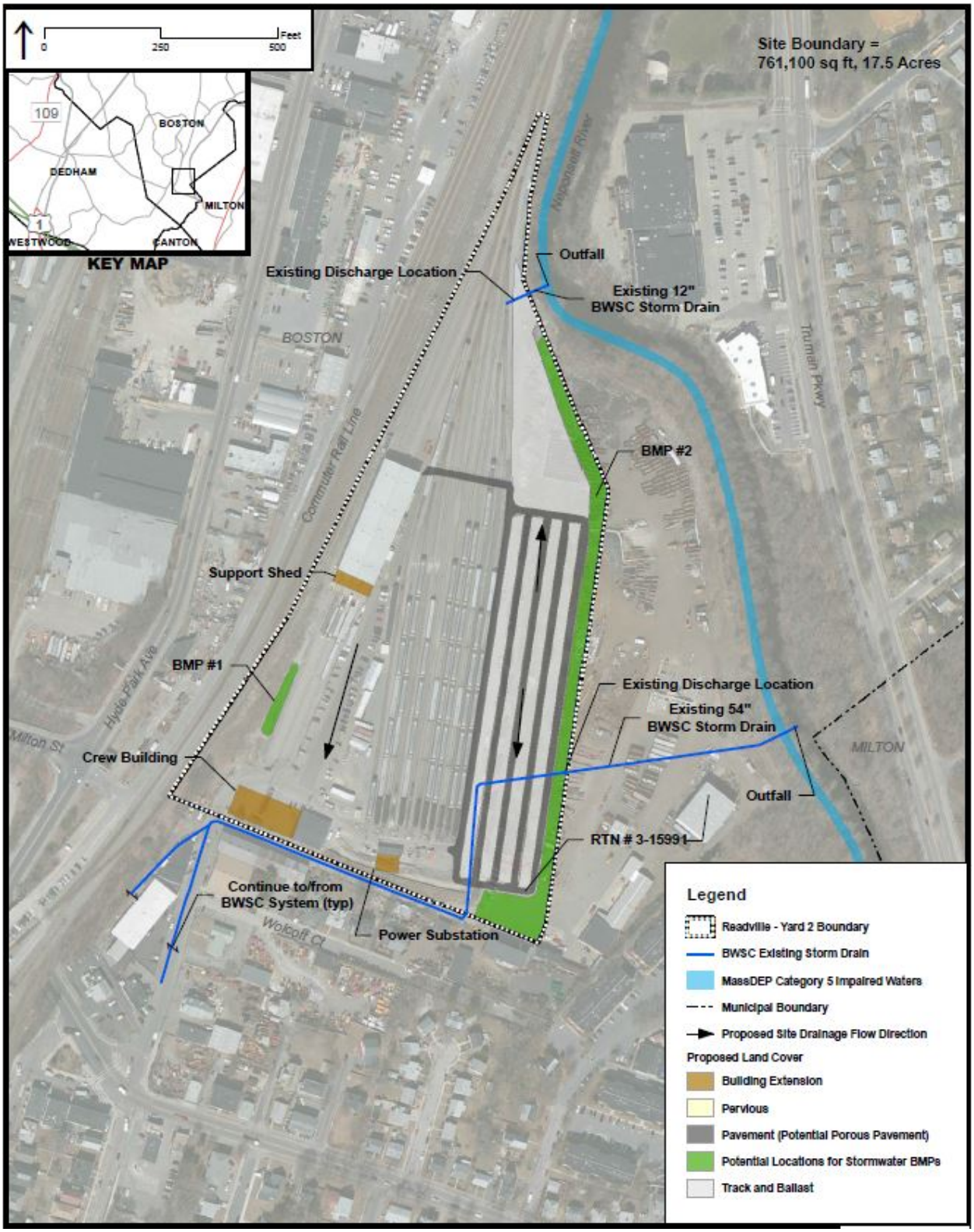


Figure 9 — Stormwater Management – Readville — Yard 2 Layover Facility

Construction at all SSX project sites would require a NPDES Construction General Permit, which regulates erosion control, pollution prevention, and stormwater management (including construction dewatering) at construction sites larger than one acre. A Stormwater Pollution Prevention Plan (SWPPP) is required by the NPDES Construction General Permit and must identify potential pollutant source areas and describe measures to be employed for erosion and sedimentation control, temporary stormwater management, dust control, and winter stabilization. The SWPPP would be completed during the final design phase and would be implemented by the project contractor.

2.2 Massachusetts Department of Environmental Protection Stormwater Management Standards

The Massachusetts Stormwater Management Standards became applicable under the Massachusetts Wetlands Protection Act (WPA) regulations (310 CMR 10.00) in 2008. MassDEP ensures compliance with the Massachusetts Stormwater Management Standards as part of its review of projects subject to the WPA. The SSX project would be subject to the WPA because there are jurisdictional wetland resource areas on two of the three project sites. For a full description and graphic depiction of the jurisdictional wetland resource areas see FEIR Section 3.4, Wetlands.

Under the Massachusetts Stormwater Management Standards, most elements of the SSX project would qualify as redevelopment projects, which are defined as: "development, rehabilitation, expansion and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area." SSX project activities at the South Station and Widett Circle sites would be considered redevelopment projects as they would occur on previously developed sites and would result in no net increase in impervious cover. SSX project activities at the Readville – Yard 2 site would not constitute redevelopment as track expansion would convert permeable land to impervious tracks and ballast.

Below is a summary of how the SSX project would comply with the Massachusetts Stormwater Management Standards.

2.2.1 Standard 1: No New Untreated Discharges or Erosion to Wetlands

Standard 1 states that no new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. All three project sites would be designed to fully comply with Standard 1. The BMPs included in the proposed stormwater management system would be designed in accordance with the Massachusetts Stormwater Handbook. All project elements would drain to existing municipal storm sewers.

2.2.2 Standard 2: Peak Rate Attenuation

Standard 2 states that stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

South Station Site

At South Station, due to the reduction in impervious area, all peak flows and peak runoff volumes in the post-development condition would be less than the pre-development condition, resulting in an improvement over existing conditions (shown in Table 3). However, due to the presence of land subject to coastal storm flowage on the project site, MassDOT would request a waiver from Standard 2 requirements.

Table 3 — South Station Existing Peak Flow Rates and Runoff Volumes

Storm Event	24-Hour Rainfall Depth (in)	Peak Flow (ft^3/sec)	Runoff Volume (ft^3)
2-year	3.3	165	463,000
10-year	4.9	233	749,000
50-year	7.4	327	1,189,000
100-year	8.8	377	1,444,000

Widett Circle

The Widett Circle project site is considered as redevelopment under Standard 7 (described in Section 2.2.7), and is required to meet Standard 2 to the maximum extent practicable. Although the project is a redevelopment, based on current information the site could be designed to fully comply with Standard 2 by providing a reduction in peak flow rates from existing conditions.

The rainfall-runoff response of the site under existing and proposed conditions was analyzed for storm events with recurrence intervals of 2, 10, 50 and 100-years. Table 4 summarizes the results of the analysis. Additionally the project was conservative in its peak flow and volume calculation and did not account for the expected reductions due to the volume of storage provided by the proposed BMPs and potentially feasible infiltration.

Table 4 — Widett Circle Peak Flow Rates and Runoff Volumes

Storm Event	24-Hour Rainfall Depth(in)	Existing Peak Flow (ft^3/sec)	Existing Runoff Volume (ft^3)	Proposed Peak Flow (ft^3/sec)	Proposed Runoff Volume (ft^3)
2-yr	3.3	73.8	319,000	65.3	263,400
10-yr	4.9	104.5	497,500	97.9	436,700
50-yr	7.4	147.4	770,400	142.5	705,700
100-yr	8.8	171.4	927,700	167.2	861,700

At the Widett Circle site, the project would result in a reduction in peak flow rates and runoff volume for each storm events due to the decrease of impervious cover. Once design is finalized and BMP type, location, and sizing are determined, the peak flow rates would be recalculated to include additional peak rate attenuation from the BMPs and possible infiltration. The inclusion of the BMPs would further reduce the peak flow rates and volumes from existing conditions.

Readville – Yard 2

The Readville – Yard 2 project site would be designed to comply with Standard 2. Stormwater BMPs would be installed to ensure peak flow rates are reduced to pre-development rates.

The rainfall-runoff response of the site under existing and proposed conditions was analyzed for storm events with recurrence intervals of 2, 10, 50 and 100-years. Table 5 summarizes the results of the analysis.

Table 5 — Readville – Yard 2 Peak Flow Rates and Runoff Volumes

Storm Event	24-Hour Rainfall (in)	Existing Peak Flow (ft^3)	Existing Runoff Volume (ft^3)	Proposed Peak Flow (ft^3/sec)	Proposed Runoff Volume (ft^3)
2-yr	3.3	35.5	141,100	36.7	146,800
10-yr	4.9	54.6	239,700	55.7	246,400
50-yr	7.4	81.0	394,200	81.8	401,600
100-yr	8.8	95.4	484,200	96.2	491,800

As a result of the project the proposed peak flow and runoff volumes are estimated to increase from existing conditions. Similar to Widett Circle, peak flow rates and volumes presented in Table 5 do not include stormwater BMPs and potential infiltration that would reduce both peak flow rates and volumes. During the design development phase, the BMPs would be designed to meet Standard 2, and reduce peak flow rates from existing conditions.

2.2.3 Standard 3: Stormwater Recharge

Standard 3 states that 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, stormwater BMPs, 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.

The project would meet this standard to the maximum extent practicable in accordance with Standard 7 for the South Station and Widett Circle sites. If infiltration is deemed feasible based on soil information, groundwater elevation, and potential contamination, the Readville – Yard 2 site would be designed to fully comply with Standard 3.

South Station

Due to the reduction in impervious coverage, the South Station site would only be required to provide infiltration to meet Standard 3 to the maximum extent practicable, therefore there is no required recharge volume. Table 6 shows the result of the application of the Static Method to calculate the potential recharge volume provided by the bio-retention area, which would be designed to drain completely within 72 hours.

Table 6 — Potential BMP Recharge Volume for South Station

Infiltration BMP	Potential Recharge Volume (ft^3)
Bioretention Area	41,800

Several different BMPs are proposed along Dorchester Avenue including permeable pavers, treebox filters, and surface BMPs such as basins, swales, or gravel wetlands (see Figure 8). The South Station site abuts Fort Point Channel, where it is supported by a granite block sea wall. Infiltration stormwater BMPs in this location could result in the creation of hydrostatic pressure against the retaining wall, and stormwater could move horizontally and breakout through the wall. In order to avoid potential structural issues caused by the movement of infiltrated groundwater, the project would include an underdrain and impermeable liner beneath the stormwater BMPs. The BMPs would be designed to provide water quality improvements only.

Widett Circle

Due to the reduction in impervious coverage, the Widett Circle site would only be required to provide infiltration to meet Standard 3 to the maximum extent practicable, therefore there is no required recharge volume. Table 7 shows the result of the application of the Static Method to calculate the potential approximate recharge volume from BMPs located in the designated areas shown in Figure 8. Additional subsurface soil/groundwater investigation would determine the feasibility of infiltration at this project site, which may be limited due to poorly draining soils, soil/groundwater contamination, and/or high groundwater levels.

Table 7 — Potential BMP Recharge Volume for Widett Circle

Infiltration BMP Location	Potential Recharge Volume (ft^3)
Widett BMP #1	12,300
Widett BMP #2	16,300
Widett BMP #3-5	19,600
Total	**48,200**

Readville – Yard 2

Unlike at South Station and Widett Circle, the project would result in an increase in impervious area at the Readville – Yard 2 site, making it a new development under the Stormwater Management Standards, which would require full compliance with Standard 3. A preliminary analysis was conducted to determine the required recharge volume, which is based on the assumption that the soils are in hydrologic soil group "C" and the project site has an additional 2.0 acres of impervious cover over existing conditions. In accordance with the Stormwater Handbook, the required recharge volume for the site is 1,820 cubic feet.

Additional subsurface soil/groundwater investigation would determine the feasibility of infiltration at the project site, which may be limited due to soil/groundwater contamination and high groundwater levels. As shown in Table 8, if the project is able to utilize infiltration within all of the proposed BMPs, it would meet the required water quality volume for the project. Additionally, if porous pavement is selected rather than a surface BMP during design development, the project would infiltrate all of the stormwater from the porous pavement surfaces.

Table 8 — Potential BMP Recharge Volume for Readville – Yard 2

Infiltration BMP Location	Potential Recharge Volume (ft^3)
Readville BMP #1	55,000
Readville BMP #2	4,000
Total	**59,000**

2.2.4 Standard 4: Water Quality

Standard 4 states that 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 stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and
- Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

If necessary, the project may seek relief under Stormwater Management Standard 7 for the South Station and Widett Circle sites, and would comply with Standard 4 to the maximum extent practicable. The Readville – Yard 2 site would be designed to fully comply with Standard 4.

As required by Stormwater Standards 4 and 6, once design development is complete, MassDOT would develop a Long-Term Pollution Prevention Plan for all project sites (with the exception of Dorchester Avenue, which would be maintained under a Long-Term Pollution Prevention Plan developed by the City of Boston or its designee). The statuary basis for this is the Stormwater Management Regulations and Wetlands Protection Act.

South Station Site

Structural stormwater BMPs would be installed at the South Station site to provide as close to 80% TSS removal of stormwater runoff from all proposed impervious surfaces as possible. Table 9 presents a list of the potential BMPs and their independent removal efficiencies.

Table 9 — Summary of TSS BMP Calculations

Potential BMP	TSS Removal Efficiency (%)
Bioretention Area (with pretreatment)	90
Tree Box Filter (with pretreatment)	80
Deep Sump Catch Basin	25
Porous Pavement	80
Green Roof	0

When BMP measures are used sequentially, the removal rate of the combined system increases. Prior to final design the TSS removal efficiencies of the combined BMPs would be calculated using the "TSS Removal Calculation Worksheet" to arrive at a final TSS removal efficiency at the South Station site.

Water quality storage of stormwater would be provided through the installation of the bioretention area. There is potentially 1.0 acre of land between the rail yard and Dorchester Avenue to accommodate the bioretention area. Site limitations would dictate the ultimate size and depth of the bioretention area.

Table 10 presents a summary of the infiltration BMPs proposed for the site. If the bioretention area does exceed the volumetric requirements for groundwater storage in accordance with the Stormwater Management Standards, the additional space could be applied to handling excess volume from extreme rain events.

Table 10 — Potential Water Quality Storage Volume for South Station

Infiltration BMP	Potential Storage Volume (ft^3) (1 ft vertical ponding)
Bioretention Area	41,800

Several potential stormwater BMPs are proposed along Dorchester Avenue. These BMPs would utilize low impact development and Boston Complete Streets techniques in its design. The potential BMPs would improve water quality over existing conditions by providing a comprehensive stormwater management system and a reduction in impervious cover. Figures 3 through 7 highlight the potential BMP types, locations, and details proposed at the project site. While there is no required storage volume due to the site's status as a redevelopment project, Table 11 shows the approximate potential storage volume for four BMP measures.

Table 11 — Potential Water Quality Storage Volumes for Dorchester Avenue

BMP	Potential Storage Volume (ft^3)
Treeway - Permeable Pavers	3,500*
Harborwalk - Permeable Pavers	13,000*
Surface BMPs - approx. 7	300
Tree Boxes	NA
Total	**16,800**

* Assumes 1.0 ft reservoir course and 40% voids.

Widett Circle

Table 2, Stormwater BMP Approaches for Widett Circle and Readville – Yard 2, identifies treatment and pretreatment BMPs proposed for TSS removal. These BMPs could potentially be constructed at various locations within the Widett Circle site, as indicated in Table 12 and Figure 8.

The project would result in a reduction in impervious surfaces (pavement and buildings) of 14.5 acres, with a corresponding reduction in the pollutant load as compared to existing conditions. As design progresses, additional opportunities would be sought to further reduce the footprint of the impervious area. The project would improve the water quality at Widett Circle with the incorporation of a comprehensive stormwater management system by reducing impervious cover and providing stormwater BMPs.

While there is no required storage volume due to the site's status as a redevelopment project, Table 12 shows the approximate potential storage and treatment volumes at BMP locations.

Table 12 — Potential Water Quality Storage Volumes for Widett Circle

BMP Location	Potential Storage Volume (ft^3)
Widett BMP #1	12,300
Widett BMP #2	16,300
Widett BMP #3-5	19,600
Total	**48,200**

Readville – Yard 2

As indicated in Table 2, Stormwater BMP Approaches for Widett Circle and Readville – Yard 2, stormwater BMPs would be installed at the Readville – Yard 2 site to provide 80% final TSS removal, and 44% pretreatment prior to infiltration of stormwater runoff from all proposed impervious surfaces. These BMPs could potentially be constructed at various locations within the Readville – Yard 2 site, as indicated in Table 13 and Figure 9.

A preliminary analysis was conducted to determine the water quality treatment volume necessary for full compliance with the Stormwater Management Standards. The required volume is based on the assumption that the project site has an additional 2.0 acres of impervious cover (buildings and pavement) over existing conditions. The calculated water quality volume is 7,260 cubic feet for full compliance.

2.0 acres of impervious cover
Water Quality Depth =1.0 inch per impervious acre

$$[2.0 \text{ (acre)} \times 43{,}560 \text{ (ft}^2\text{/acre)}] \times [1 \text{ (in)} / 12 \text{ (in/ft)}] = 7{,}260 \text{ ft}^3$$

Table 12 presents the potential storage volume of BMPs and compares to the required water quality volume. If permeable pavement is selected during design development, the proposed infiltration volume would be larger than the surface volumes reported in Table 13.

Table 13 — Potential Water Quality Storage Volumes for Readville – Yard 2

BMP Location	Potential Storage Volume (ft^3)
Readville BMP #1	55,000
Readville BMP #2	4,000
Total	**59,000**

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

Standard 5 states that for land uses with higher potential pollutant loads, 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 stormwater runoff, the proponent shall use the specific structural stormwater 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, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

South Station Site

This site is considered a LUHPPL and therefore would be designed with suitable BMPs sized to treat the one-inch Water Quality Volume and provide the pretreatment requirement of 44% TSS removal prior to infiltration. See Standard 4 for a full description of the BMPs and potential storage volumes provided.

Layover Facility Sites

The layover sites are considered to be LUHPPLs and therefore would be designed with suitable BMPs sized to treat the one-inch Water Quality Volume and provide the pretreatment requirement of 44% TSS removal prior to infiltration. See Standard 4 for a full description of the BMPs and potential storage volumes provided.

2.2.6 Standard 6: Critical Areas

Standard 6 states that stormwater discharges within the Zone II or Interim Wellhead Protection Area[1] of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater 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 sites would not discharge stormwater within a Wellhead Protection Area or near any other critical area. Therefore, all three project sites would fully comply with Standard 6.

2.2.7 Standard 7: Redevelopment Projects

Standard 7 states that 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 best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges would comply with Standard 1 only to the maximum extent practicable. A redevelopment project would also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

[1] Under 310 CMR 22, Zone II is the area of an aquifer, which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated. An Interim Wellhead Protection Area is a regulated area around a public well system.

South Station

As a result of the project, there would be a reduction in impervious area at the South Station site. It is therefore considered to be a redevelopment project, and would be designed to comply with Stormwater Management Standards 2-6 to the maximum extent practicable. Standards 8-10 would be met in full.

Widett Circle

As a result of the project, there would be a reduction in impervious area at the Widett Circle site. It is therefore is considered to be a redevelopment, and would be designed to comply with Stormwater Management Standards 2-6 to the maximum extent practicable. Standards 8-10 would be met in full.

Readville – Yard 2

As a result of the project there would be an increase in impervious area at the Readville – Yard 2 Site. Therefore the Readville – Yard 2 site would be designed to fully comply with all ten of the Stormwater Management Standards.

2.2.8 Standard 8: Construction - Period Pollution Prevention and Erosion and Sedimentation Controls

Standard 8 states that 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.

All three project sites would be designed to fully comply with Standard 8. All project sites would obtain coverage under the Massachusetts NPDES Construction General Permit. As required under this permit, a SWPPP would be developed and submitted before land disturbance begins. The SWPPP would include the following:

- Construction period pollution prevention measures;
- Erosion and sedimentation control plan drawings;
- Detailed drawings and specifications for erosion control BMPs, including sizing calculations;
- An operation and maintenance plan for erosion and sedimentation controls;
- An inspection schedule; and
- A maintenance schedule.

2.2.9 Standard 9: Operation and Maintenance Plan

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

In compliance with Standard 9, MassDOT would develop a Post Construction Stormwater Operation and Maintenance (O&M) Plan by MassDOT for all project sites, except Dorchester Avenue, during the final design. The City of Boston would develop the Post Construction Stormwater Operation and Maintenance (O&M) Plan for the Dorchester Avenue portion of the South Station site.

The O&M plan would include the following:

- Schedule for implementation of routine and non-routine maintenance tasks;
- Plan showing the location of all stormwater BMPs, and maintenance access area (if necessary);
- Party responsible for O&M; and
- O&M log form.

2.2.10 Standard 10: Prohibition of Illicit Discharges

Standard 10 states that all illicit discharges to the stormwater management system are prohibited.

All three project sites would be designed to fully comply with Standard 10. The proposed project elements would be designed to be in full compliance with current standards. Any identified illicit connections would be removed.

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