2.10 WATER AND SEWER INFRASTRUCTURE

2.10.1 INTRODUCTION

This chapter provides an evaluation of the potential effect of the Proposed Project on the City's water supply, wastewater treatment, and stormwater management infrastructure. Based on the methodology set forth in the *CEQR Technical Manual*, the Proposed Project would not result in significant adverse impacts to these infrastructure systems.

Included is a description of the existing water supply and wastewater infrastructure in the study area and identified changes to water supply, stormwater and wastewater conditions that would occur in the future with and without the Proposed Project. Other City infrastructure identified in the *CEQR Technical Manual*, including the waste and sanitation services and public transportation systems, are discussed in the other chapters of this document. The *CEQR Technical Manual* states that projects that would result in an incremental increase above 400 residential units or 150,000 square feet of commercial space in Staten Island warrant a preliminary analysis of water and sewer infrastructure. Accordingly, because the Charleston Mixed-Use Development would include more than 150,000 square feet of commercial space, a preliminary analysis was conducted which estimated the increases in sanitary and stormwater flows as compared to those under existing conditions.

2.10.2 EXISTING CONDITIONS

2.10.2.1 Water Supply

The New York City water supply system is comprised of a network of reservoirs, lakes and aqueducts extending into the Catskill region and a pipe network that distributes water within the City. New York City obtains nearly all of its water from the Delaware, Catskill and Croton watersheds located within 125 miles north of the City. Water from the watersheds is stored at 19 reservoirs and three control lakes, having a combined capacity of approximately 580 billion gallons. The water is then carried into the city by a number of aqueducts. It enters the City via City Tunnel 1, which runs through the Bronx, Manhattan and Queens, and City Tunnel 2, which runs through the Bronx, Queens and Brooklyn. City Tunnel 3, partially complete, currently serves the Bronx, Manhattan and Queens, and when fully complete, will serve Brooklyn. Staten Island obtains its water from the Richmond Tunnel, an extension of City Tunnel 2.

Once water arrives in the City, the three aqueducts distribute water into a network of water mains. Water mains up to 96-inches in diameter feed smaller mains that deliver water to a final destination. Nearly all of the water in New York City reaches its destination by gravity alone, although some areas, generally located at the outer limits of the system where pressure is low, require water to be pumped to its final destination. Pressure regulators throughout the City monitor and control the water pressure.

The New York City Department of Environmental Protection ~~(~~("NYCDEP~~)~~") estimates that New York City consumes approximately 1.3 billion gallons of water per day. Given this supply capacity, the *CEQR Technical Manual* notes the unlikelihood that any particular action would result in a significant adverse impact on the City's water supply or water pressure.

As discussed in **Chapter 2.1**, "Land Use, Zoning and Public Policy," the Project Area is primarily vacant, undeveloped and covered with vegetation (portions of the paved Bricktown Way and Tyrellan Avenue are located within the Project Area). The degree of vegetation varies across the Project Area, with the majority covered by trees and other vegetation. Open-field areas are located within the northern portion of the Project Area, parts of which were cleared between 2002 and 2004 under an earlier plan to create Fairview Park. The western portion of the ~~site~~Project Area contains some vacant open areas, with trees along the east side of Arthur Kill Road. As a result, since the Project Area is vacant, total water usage under existing conditions is estimated to be zero.

2.10.2.2 Wastewater Treatment

According to the *CEQR Technical Manual* wastewater is considered to include sanitary sewage, wastewater generated by industries, and stormwater. Water used for air conditioning generates a negligible amount of wastewater, as it is recirculated or evaporates in the cooling and heating process.

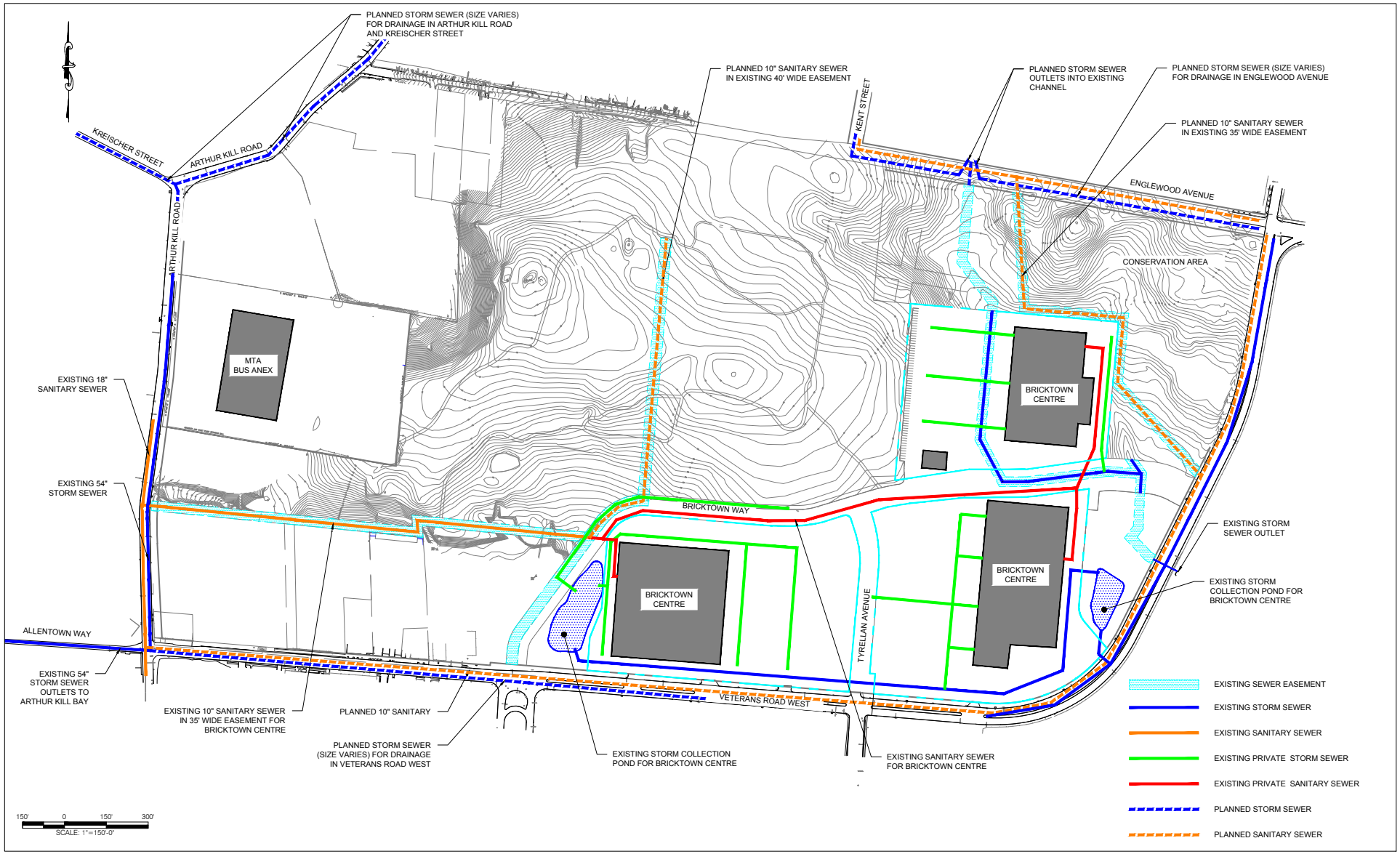
The majority of New York City's wastewater treatment system is comprised of the sewer network beneath the streets and the 14 water pollution control plants ~~(~~("WPCPs~~)~~") located throughout the City. The majority of the New York City sewers are combined sewers that receive sanitary wastewater and stormwater runoff. Wastewater generated in a "drainage basin," the area served by a WPCP, is conveyed through a network of combined sewers to the WPCP. In recent years, NYCDEP has initiated a plan by which the existing combined sewers are being replaced with separate storm drainage sewer and sanitary sewer systems. In locations where no existing sewers are located, such as low lying areas in the outer boroughs, separate sanitary and storm drainage systems are now being constructed to replace existing private sanitary systems such as septic systems.

During dry weather, a WPCP primarily treats sanitary sewage. The average daily flow during dry weather is known as the average "dry-weather flow." WPCPs have treatment capacities set at twice their dry-weather design flow for a limited amount of time. However, because the majority of New York City sewers are combined sewers, the sewers also receive stormwater and rainwater runoff from impermeable surfaces that generally contain pollutants such as oil and floatable debris. During wet weather, stormwater enters the combined sewer system along with sanitary sewage, and are both treated at a WPCP. During wet weather, rainfall runoff can reach 10 to 50 times the dry weather flow, sometimes well above the WPCP design capacity. To avoid flooding the WPCPs, built-in regulators act as relief valves to direct the excess water to an outfall. During storm events, sanitary sewage entering or already in the combined sewer system, stormwater, and debris can be discharged (or overflowed) untreated into the nearest body of water. This untreated overflow is known as "combined sewer overflow" ~~(~~("CSO~~).~~"). To reduce the release of CSO into local waters, the NYCDEP is currently actively separating combined sewers with individual sanitary and storm drainage systems. Although storm drainage will still be discharged into local waters during severe rainfall events, the separated sanitary sewers will not be impacted by increased storm flows and will flow directly into the WPCPs in a separate closed system.

Existing and Planned Sanitary Systems

The Project Area is located within the Charleston neighborhood of Staten Island, and is generally bounded to the north by the future northern limit of Englewood Avenue and Clay Pit Ponds State Park Preserve ~~(~~("CPPSPP~~),~~"), to the south and east by Veterans Road West, to the west by Arthur Kill Road, and to the south by the shopping center known as the Bricktown Centre at Charleston Mall ("Bricktown Centre").

Although the Project Area is vacant, existing sanitary wastewater generated in this area of Staten Island is collected through a sanitary sewer pipe ranging in size between a 12-inch and 18-inch diameter running south along Arthur Kill Road for eventual connection into the Oakwood Beach WPCP for treatment. The Project Area, as per the latest amended NYCDEP Drainage Plan for the Mill Creek Watershed, dated February 2005 ("the 2005 Drainage Plan"), has two mapped sanitary sewer easements that: (1) bisects the Project Area through a north-south 40-foot wide easement within the Development Area (between Fairview Park and Retail Site "A"); and (2) an east-west 35-foot wide easement connecting Bricktown Way to Arthur Kill Road. The 40-foot wide north-south easement has a planned 10-inch diameter sanitary sewer while the 35-foot wide east-west easement contains an existing 10-inch diameter sanitary sewer constructed previously to connect the existing Bricktown Centre's sanitary system into an 18-inch NYCDEP sanitary system located in Arthur Kill Road. The location of the existing sanitary and stormwater lines and easements noted above are presented in **Figure 2.10-1**.



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Charleston Mixed-Use Development

Figure 2.10-1

Existing Sanitary & Stormwater Lines

In addition to this internal network of sanitary system easements, the 2005 Drainage Plan also includes mapped plans for a 10-inch diameter sanitary system to be constructed under the mapped but un-built Englewood Avenue right-of-way between its intersection with the mapped but un-built Kent Street and the existing topographic low lying point of Englewood Avenue approximately 200 feet west of Veterans Road West. From there, a 35-foot wide sanitary sewer easement is mapped from the Englewood Avenue right-of-way, running southeast through the Conservation Area past the northeast corner of Bricktown Centre to Veterans Road West. From there, the NYCDEP has a planned 10-inch diameter sanitary sewer that would travel south and west under Veterans Road West to connect into the existing 18-inch sanitary sewer under Arthur Kill Road for eventual discharge into the Oakwood Beach WPCP. The location of these easements and proposed sanitary lines are presented in **Figure 2.10-1.**

Existing and Planned Stormwater Drainage Systems

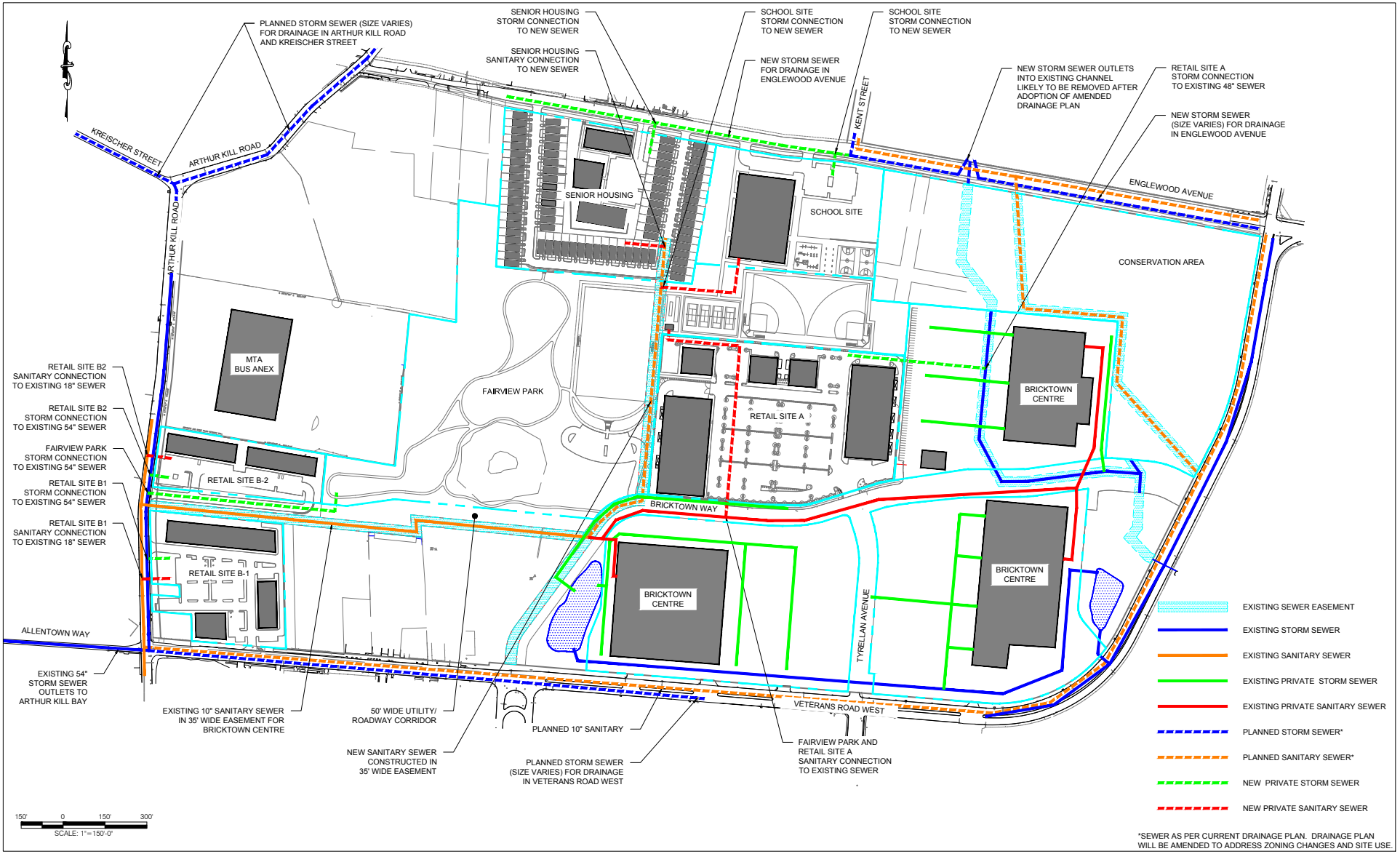
In terms of the Project Area's existing stormwater drainage, the area includes the high point from which stormwater either flows to the southwest or to the east and southeast, along with a small area where stormwater would flow to the north. The 2005 Drainage Plan indicates how planned storm drainage in this area would be handled. Stormwater flowing off site to the north and northeast would be collected into the proposed future Englewood Avenue stormwater collection system, consisting of catch basins and a 36~~"~~-inch diameter trunk sewer under the proposed Englewood Avenue segment west of Kent Street. This system would flow east to the future anticipated topographical low point along Englewood Avenue and discharge into the existing south flowing watercourse within the CPPSPP. This water course would then flow south back under the future Englewood Avenue via a proposed planned 36-inch culvert into an existing open stormwater channel south to a 48~~"~~-inch diameter pipe under the parking lot of Bricktown Centre's northeast parcel. From that point, this 48~~"~~-inch pipe system bends east under Bricktown Way into the existing natural watercourse and eventual release under Veterans Road West to a large watershed south of the West Shore Expressway for final discharge to points south. This route south from Englewood Avenue is mapped as a 35-foot wide easement when under Bricktown Centre and as a ~~45'~~45-foot wide easement when an open channel. These systems are shown in **Figure 2.10-2**.

Stormwater flows traveling east, southeast, and south from the Project Area would either collect directly into the channel flow water course described above or drain into the existing Bricktown Centre stormwater collection system. The Bricktown Centre's drainage system consists of catch basins and a trunk sewer collection system that discharges into two linked ponds and eventually drains into an existing stormwater sewer under Veterans Road West that outlets into the large watershed south of the West Shore Expressway as noted above.

Stormwater flowing southwest would eventually drain onto Veterans Road West. The current 2005 Drainage Plan calls for a new ~~24'"~~24-inch' to 30~~"~~-inch diameter storm drainage sewer system with catch basins to be constructed west along Veterans Road West, connecting directly into the existing Arthur Kill Road 54-inch diameter storm drainage system that was constructed during the MTA Bus Garage expansion off Arthur Kill Road in 2010. From there, as per the existing drainage plan, stormwater would drain directly into the Arthur Kill via the new 54-inch diameter sewer outfall under Allentown Lane. The relevant State Pollution Discharge Elimination System ("SPDES") permitting processes will be followed, as applicable under state and local permitting regulations to satisfy effluent limits for any planned storm drainage sewer system.

For storm drainage flowing north and northwest from the Project Area, stormwater would flow via sheet flow into the last amended 2005 Drainage Plan system consisting of various sized storm sewers under the western portion of Englewood Avenue, Arthur Kill Road and Kreischer Street for eventual discharge into the Arthur Kill.

~~-~~All 14 WPCPs in New York City have ~~a State Pollution Discharge Elimination System (~~an SPDES~~)~~ permitted capacity of 1.8 billion gallons per day. The Oakwood Beach WPCP serving this area of Staten Island is regulated by a SPDES permit to treat and discharge up to 40 million gallons per day



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Charleston Mixed-Use Development

Figure 2.10-2

Proposed Sanitary & Stormwater Lines

~~(~~("mgd~~)~~") of wastewater. In 2012, the Oakwood Beach WPCP treated an average daily flow of 28 mgd, with 12 mgd of available capacity.

As discussed in Section 2.10.2 above, virtually all of the Project Area is vacant, undeveloped and covered with vegetation, with total existing water use and sanitary wastewater generation estimated to be zero.

2.10.2.3 Stormwater Management

The Project Area is primarily vacant, undeveloped and covered with vegetation. The vacant and undeveloped portion of the Project Area is approximately 95 percent (~~3,772,786 square feet~~86.61 acres) covered in permeable grass/softscape. The only impermeable surfaces in the Project Area under existing conditions are the paved Bricktown Way and Tyrellan Avenue, which account for five percent (~~191,664 square feet~~4.40 acres) of the total Project Area. **Table 2.10-1** presents a breakdown of surface area and runoff coefficient calculations for the Project Area. The total stormwater and sanitary wastewater flows generated in the Project Area under existing conditions, during different storm events, are presented in million gallons ~~(~~("MG~~)~~") in **Table 2-10-2**.

Table 2.10-1

Existing Conditions - Surface Calculations

Existing Conditions					
Weighted Runoff Coefficient (C)					
Surface Type	**Roof**	**Pavt & Walks**	**Other**	**Grass & Soft Scape**	**Total**
Area %	0%	5%	0%	95%	100%
~~Surface~~Drainage Area (SF)	0	191,664	0	3,772,786	3,964,450
Runoff Coefficient	1.00	0.85	0.85	0.20	0.23

Note: Runoff coefficients for each surface type as per NYCDEP.

Table 2.10-2

Existing Conditions - Stormwater and Sanitary Generation from Project Area During Different Storm Events

Rainfall, (In)	Duration, (Hr)	Total Area (Acre)	Weighted Runoff Coefficient (C)	Stormwater Runoff (MG)	Daily Sanitary Sewage Generation (MGD)	Sanitary to *Sewer* (MG)
0	3.8	91.01	0.23	0.00	0.00	0.00
0.4	3.8	91.01	0.23	0.20	0.00	0.00
1.2	11.3	91.01	0.23	0.59	0.00	0.00
2.5	19.5	91.01	0.23	1.23	0.00	0.00

Water Conservation and WPCP Load Reduction

During the 1990s, the City instituted a range of water conservation measures in response to excess flow to the City's WPCPs that exceeded the dry weather flow allowed in their respective SPDES permits. Measures included equipping fire hydrants with locks to prevent illegal use and requiring that all new plumbing fixtures in the City, including replacements in existing structures and new fixtures in new structures, be of a low-flow design (Local Law No. 29, 1989). The City also implemented a metering program, installing water meters at thousands of properties where water fees had previously been based on property frontage rather than usage. This metering provided a new financial incentive for consumers to conserve. The City also implemented leak detection programs to identify and repair leaks in the water distribution system.

These programs have reduced water demand and the load on the City's WPCPs. At many WPCPs this reduction has been in an order of magnitude of several million gallons per day. NYCDEP projects that savings from the continued implementation of these conservation measures over the next decade would exceed any increase in water demand from consumers over that period.

2.10.3 FUTURE NO-ACTION CONDITIONS

2.10.3.1 Water Supply

Under the Future No-Action Condition, the Project Area is expected to remain in its existing vacant condition. No other projected development is planned or considered likely to occur in the Project Area by the 2015 or 2020 analysis years of the Proposed Project. Therefore, total water consumption in the Project Area under the Future No-Action Condition is estimated to be zero, similar to the total water consumption estimated under existing conditions.

2.10.3.2 Wastewater Treatment

As the Project Area would remain vacant under the Future No-Action Condition, there would be no increase in sanitary wastewater generation to the Oakwood Beach WPCP by the 2015 or 2020 analysis years of the Proposed Project. The Oakwood Beach WPCP would continue to operate within its design capacity.

2.10.3.3 Stormwater Management

As the Project Area would remain vacant and unchanged under the Future No-Action Condition, total stormwater flows generated in the Project Area are expected to be similar to the stormwater flows generated under existing conditions.

2.10.4 FUTURE WITH-ACTION CONDITIONS

The Proposed Project would result in changes to the land uses within the Project Area by promoting the development of City-owned parcels along with the construction of a new public street (Englewood Avenue).

The development occurring as a result of the Proposed Project is expected to occur over several years. Construction of Retail Site "A" and Fairview Park are expected to be completed by the year 2015. Construction of the remainder of the Project Area is expected to be completed by the year 2020, including Retail Site "B," the proposed school, the senior housing site and Englewood Avenue.

2.10.4.1 Water Supply

Year 2015

As part of the Proposed Project, by the year 2015, the Project Area would have a new 23-acre Fairview Park and Retail Site "A.~~"~~, along with the mapping of the adjacent Conservation Area. The 11-acre Retail Site "A" would include up to approximately 195,000 square feet of commercial space for medium- and large-format retail stores, plus a 15,000-square-foot branch of the New York Public Library. As the proposed 23-acre park is expected to have a negligible demand for water, the focus of the water demand for the 2015 analysis year is the demand generated by Retail Site "A."

The Proposed Project would not result in significant adverse impacts on the City's water supply system. As shown in **Table 2.10-3**, the proposed development by the year 2015 would generate a water supply demand of approximately 86,100 gallons per day ~~(~~("gpd"~~)~~) or 0.09 mgd, which represent less than 0.1 percent of the City's water supply demand. The incremental demand with the Proposed Project by the year 2015 would, therefore, not adversely impact the City's water supply.

Table 2.10-3

Future With-Action Conditions (Year 2015) - Water Consumption and Wastewater Generation

Land Use	Rate	2015 - Water Consumption and Wastewater Generated		
		Area (SF)/ Dwelling Units	Water/ Wastewater Generation (GPD)	Air Conditioning (GPD)
Residential	Domestic: 100 gpd/person (270 gpd/DU) Air Conditioning: 0 gpd/sf	-	-	-
Retail/ Public Use	Domestic: 0.24 gpd/sf Air Conditioning: 0.17 gpd/sf	210,000	50,400	35,700
Office	Domestic: 0.10 gpd/sf Air Conditioning: 0.17 gpd/sf	-	-	-
Hotel	Domestic: 120 gpd/rm/occup 0.60 gpd/sf) Air Conditioning: 0.17 gpd/sf	-	-	-
Community Facility	Domestic: 0.17 gpd/sf Air Conditioning: 0.17 gpd/sf	-	-	-
Industrial/ Manufacturing	Domestic: 2,000 gpd/acre (0.46 gpd/sf Air Conditioning: 0.17 gpd/sf	-	-	-
Water Consumption Subtotals			50,400	35,700
Sewage Generation Subtotal		50,400		
Total Water Consumption		86,100		
Total Wastewater Generation		50,400		

Note: Refer to *CEQR Technical Manual* Table 13-2 for consumption rate assumptions.

Year 2020

By the year 2020, the remainder of the Project Area would be developed with additional retail space, a combined public elementary/intermediate school and senior housing site, along with construction of Englewood Avenue. Along Arthur Kill Road, the approximately 7.3-acre Retail Site "B" is anticipated to

have approximately 90,000 square feet of neighborhood retail space. Along Englewood Avenue, the approximately 9.1-acre senior housing site would have up to 162 age-restricted units, while the proposed school on its approximately 5.9-acre site would have a 750-seat capacity for kindergarten through 8th grade.

The Proposed Project would not result in significant adverse impacts on the City's water supply system. As shown in **Table 2.10-4**, the proposed development by the year 2020 would generate a water supply demand of approximately 189,400 gpd (0.19 mgd), which represent less than 0.1 percent of the City's water supply demand. The incremental demand with the Proposed Project would therefore not adversely impact the City's water supply or system water pressure.

Table 2.10-4

Future With-Action Conditions (Year2020) - Water Consumption and Wastewater Generation

Land Use	Rate	2020 - Water Consumption and Wastewater Generated		
		Area (SF)/ Dwelling Units	Water/ Wastewater Generation (GPD)	Air Conditioning (GPD)
Residential	Domestic: 100 gpd/person (270 gpd/DU) Air Conditioning: 0 gpd/sf	162	32,400	-
Retail/ Public Use	Domestic: 0.24 gpd/sf Air Conditioning: 0.17 gpd/sf	300,000	72,000	51,000
Office	Domestic: 0.10 gpd/sf Air Conditioning: 0.17 gpd/sf	-	-	-
Hotel	Domestic: 120 gpd/rm/occup 0.60 gpd/sf) Air Conditioning: 0.17 gpd/sf	-	-	-
Community Facility	Domestic: 0.17 gpd/sf Air Conditioning: 0.17 gpd/sf	100,000	17,000	17,000-
Industrial/ Manufacturing	Domestic: 2,000 gpd/acre (0.46 gpd/sf Air Conditioning: 0.17 gpd/sf	-	-	-
Water Consumption Subtotals			121,400	68,000
Sewage Generation Subtotal		121,400		
Total Water Consumption		189,400		
Total Wastewater Generation		121,400		

Note: Refer to CEQR Technical Manual Table 13-2 for consumption rate assumptions.

2.10.4.2 Wastewater Treatment

Year 2015

In the 2015 Future No-Action condition, wastewater generated from the study area would be treated by the Oakwood Beach WPCP, which would continue to have a SPDES permitted capacity of 40 mgd. As shown in **Table 2.10-3**, the Proposed Project would generate approximately 50,400 gpd of sanitary sewage. This increase represents 0.42 percent of the reserve capacity of the Oakwood Beach WPCP. Since the wastewater generated by the Proposed Project is well within the capacity of the treatment plant, no significant adverse impacts to the City's wastewater treatment services would occur as a result of the Proposed Project, by the 2015 analysis year.

Year 2020

In the 2020 Future No-Action condition, wastewater generated from the study area would continue to be treated by the Oakwood Beach WPCP, which would still have a SPDES permitted capacity of 40 mgd. As shown in **Table 2.10-4**, the Proposed Project would generate approximately 121,400 gpd of sanitary sewage. This increase represents 1.01 percent of the reserve capacity of the Oakwood Beach WPCP. Since the wastewater generated by the Proposed Project is well within the capacity of the treatment plant, no significant adverse impacts to the City's wastewater treatment services would occur as a result of the Proposed Project, by the 2020 analysis year.

2.10.4.3 Stormwater Management

Year 2015

In the future with the Proposed Project, the ~~3,964,450 square-foot~~ 91.01 acre Project Area would have a total of ~~716,552 square feet~~16.45 acres of impervious surface area by the 2015 analysis year, which represents a 274 percent increase over existing conditions. Consequently, the stormwater runoff in the Future With-Action condition would be greater than under existing conditions. **Table 2.10-5** below contains a breakdown of surface area and runoff coefficient calculations for the 2015 analysis year. **Table 2.10-6** contains a ~~review~~summary of stormwater and sanitary generation from Project Area for the 2015 analysis year during four different storm events. The 24-hour rainfall volume is based on average rainfall intensity over a 24-hour period

Table 2.10-5

Future With-Action Conditions (2015 & 2020) – Surface Calculations

Analysis Year	Future With The Proposed Project					
	Weighted Runoff Coefficient (C)					
	Surface Type	Roof	Pavt & Walks	Other	Grass & Soft Scape	Total
2015	Area %	3%	15%	0%	82%	100%
	Surface Area (SF)	134,439	582,113	0	3,247,898	3,964,450
	Runoff Coefficient	1.00	0.85	0.85	0.20	0.32
2020	Area %	10%	31%	0%	59%	100%
	Surface Area (SF)	391,717	1,215,552	0	2,357,181	3,964,450
	Runoff Coefficient	1.00	0.85	0.85	0.20	0.48

Note: Runoff coefficients for each surface type as per NYCDEP.

Year 2020

In the Future With-Action condition, the ~~3,964,450 square-foot~~91.01 acre Project Area would have a total of ~~1,607,269 square feet~~36.90 acres of impervious surface area by the 2020 analysis year, which represents a 739 percent increase over existing conditions. **Table 2.10-5** above contains a breakdown of surface area and runoff coefficient calculations for the 2020 analysis year. **Table 2.10-7** contains a ~~review~~summary of stormwater and sanitary generation from Project Area for the 2020 analysis year during different storm events.

A comparison of stormwater runoff and sanitary wastewater flows in the Future With-Action Conditions in the 2015 and 2020 analysis years to those under existing conditions is provided in **Table 2.10-8**.

Table 2.10-6

Future With-Action Condition (2015) - Stormwater and Sanitary Generation from Project Area During Different Storm Events

Rainfall, (In)	Duration, (Hr)	Total Area (Acre)	Weighted Runoff Coefficient (C)	Stormwater Runoff (MG)	Daily Sanitary Sewage Generation (MGD)	Sanitary to *Sewer* (MG)
0.0	3.8	91.01	0.32	0.00	0.05	0.008
0.4	3.8	91.01	0.32	0.32	0.05	0.008
1.2	11.3	91.01	0.32	0.96	0.05	0.024
2.5	19.5	91.01	0.32	1.99	0.05	0.041

Table 2.10-7
Future With-Action Condition (2020) - Stormwater and Sanitary Generation from Project Area During Different Storm Events

Rainfall, (In)	Duration, (Hr)	Total Area (Acre)	Weighted Runoff Coefficient (C)	Stormwater Runoff (MG)	Daily Sanitary Sewage Generation (MGD)	Sanitary to *Sewer* (MG)
0.0	3.8	91.01	0.48	0.00	0.12	0.019
0.4	3.8	91.01	0.48	0.47	0.12	0.019
1.2	11.3	91.01	0.48	1.42	0.12	0.057
2.5	19.5	91.01	0.48	2.96	0.12	0.099

Table 2.10-8

Stormwater and Sanitary Volumes from Project Area during Different Storm Events – Comparison of Existing Conditions to Future With-Action Conditions (2015 & 2020)

		Area =3,964,450 SF (91.01 ACRES)				Area =3,964,450 SF (91.01 ACRES)				Area =3,964,450 SF (91.01 ACRES)			
		Existing Conditions				**Future With-Action (2015)**				**Future With-Action (2020)**			
Rainfall Volume (In)	**Rainfall Duration (Hr)**	**Runoff Volume Direct Drainage (MG)**	**Runoff Volume To Sewer (MG)**	**Sanitary Volume To Sewer (MG)**	**Total Volume To Sewer (MG)**	**Runoff Volume Direct Drainage (MG)**	**Runoff Volume To Sewer (MG)**	**Sanitary Volume To Sewer (MG)**	**Total Volume To Sewer (MG)**	**Runoff Volume Direct Drainage (MG)**	**Runoff Volume To Sewer (MG)**	**Sanitary Volume To Sewer (MG)**	**Total Volume To Sewer (MG)**
0.00	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.008	0.008	0.00	0.00	0.019	0.019
0.40	3.80	0.20	0.00	0.00	0.00	0.32	0.00	0.008	0.008	0.47	0.00	0.019	0.019
1.20	11.30	0.59	0.00	0.00	0.00	0.96	0.00	0.024	0.024	1.42	0.00	0.057	0.057
2.50	19.50	1.23	0.00	0.00	0.00	1.99	0.00	0.041	0.041	2.96	0.00	0.099	0.099

Note: 1- Based on *Intensity/duration/Frequency Rainfall Analysis, New York City and the Catskill Mountain Water Supply Reservoirs,* Vieux & Associates, Inc., April 4, 2006. The 24-hour rainfall volume is based on average rainfall intensity over 24-hours (inch/per) times 24 hrs. (Duration information provided by T. Newman & P. Jadhav, HydroQual).

2.10.4.4 Proposed Sanitary and Stormwater Sewage Systems (With-Action Conditions)

As shown, the stormwater and sanitary wastewater flows would increase compared to the existing conditions, during a range of storm events. The following presents how these projected sanitary and stormwater demands would be handled under the 2015 and 2020 analysis years. The approximate location of the proposed connections and systems are shown in **Figure 2.10-2**.

The full mapping and construction of Englewood Avenue from Arthur Kill Road to Veterans Road West and the proposed rezoning within the Development Area require an amendment to applicable NYCDEP Drainage Plans to address the effects of these changes on sanitary and stormwater flows and the system changes required to manage them. The following section presents the proposed methods of managing the sanitary and stormwater flows generated by the Proposed Project in the 2015 and 2020 analysis years. The elements required to amend the NYCDEP Drainage Plans and the procedures to be followed are discussed below in Section 2.10.4.6 of this chapter.

Proposed Sanitary Systems

Year 2015

- Retail Site "A" has an agreement with the existing Bricktown Centre to connect directly into the existing 10-inch diameter sanitary sewer within Bricktown Way, which connects to an existing 10-inch sanitary line within the 35-foot wide east-west easement, finally connecting to the existing 18-inch diameter NYCDEP sanitary sewer under Arthur Kill Road. The proposed library branch will also connect to the existing 10-inch diameter sanitary sewer within Bricktown Way. NYCDEP does not own the infrastructure under Bricktown Way and Tyrellan Avenue. In the future, NYCDEP's ownership and maintenance obligations will not change unless the infrastructure is built out to NYCDEP specifications and pursuant to an approved drainage plan and NYCDEP accepts the infrastructure into its portfolio.
- The proposed Fairview Park would connect into the sanitary system within Retail Site "A" and its flows (from the planned comfort station) would represent a relatively small portion of the overall sanitary demand from Retail Site "A."

Making the proposed sanitary sewage connections requires demonstration to NYCDEP that the existing private and public system could handle the increased sanitary flows. The NYCDEP would require a formal connection permit approval for this action.

In addition to the Proposed Project's 2015 sanitary flows (i.e., from Retail Site "A," the library and Fairview Park), a supermarket proposed for development by 2015 on a parcel at the northwest corner of Bricktown Way and Veterans Road West also plans to connect to the existing 10-inch sewer line that connects Bricktown Center's sanitary system to NYCDEP's existing 18-inch sanitary sewer in Arthur Kill Road. Preliminary analyses prepared by the developer of Retail Site "A" and presented to NYCDEP for review indicate the following:

- ~~the~~The on-site sanitary sewer systems within Bricktown Centre have sufficient capacity to handle the Proposed Project's 2015 sanitary demand (from Retail Site "A," the library and Fairview Park);
  ~~the~~
- The 10-inch east-west sanitary line connecting Bricktown Centre's system west to Arthur Kill Road has sufficient capacity to handle the Proposed Project's 2015 sanitary demands plus the wastes generated by the proposed supermarket; and
  ~~the~~
- The existing 18-inch diameter NYCDEP sanitary sewer in Arthur Kill Road into which this 10-inch east-west sanitary line connects has adequate capacity to handle the additional sanitary flows generated by the Proposed Project and the proposed supermarket by 2015.

Year 2020

- Englewood Avenue would not generate any sanitary sewage, but under the 2005 Drainage Plan its construction would require installation of NYCDEP's planned sanitary sewers under the presently mapped sections of Englewood Avenue. However, this may be revised under the amended Drainage Plan. It is possible, for example, that due to environmental concerns and with no planned developments in that area, the sanitary system in the eastern segment of Englewood Avenue and through the Conservation Area would not be constructed. The eventual design of the sanitary and stormwater sewers in Englewood Avenue and connecting elements off of them will be included in the amended Drainage Plan, as discussed in Section 2.10.4.6~~.~~ of this chapter.
- Retail Site "B" would connect directly into the existing NYCDEP 18-inch sanitary sewer under Arthur Kill Road. As this site (which is bisected by the existing 35-foot wide sanitary easement) includes two separate parcels, the site's eventual developer could request two separate sanitary sewer connection permits from NYCDEP, either to the existing 10-inch diameter sanitary sewer within the 35-foot wide easement that divides Retail Site "B" or to the 18-inch sewer line in Arthur Kill Road.
- The senior housing component would require design and construction of the planned 10~~"~~ inch diameter sanitary sewer line within the presently mapped 35-foot wide north-south easement running along the western edge of Retail Site "B" down to Bricktown Way. This sewer line would connect into the existing 10-inch sanitary system within the existing 35-foot east-west sanitary easement between Bricktown Way and Arthur Kill Road.
- The proposed school, to be developed by the NYC School Construction Authority (SCA), would require a connection into the same north-south 10-inch sanitary sewer line system noted above for the senior housing complex. An easement may be required for this connection. However, sewage from the school ~~and~~ and the senior housing site discussed above may be handled by a sanitary line included in the proposed Englewood Avenue that would connect to a north-south collector sewer in Arthur Kill Road. The eventual plans for the handling of these sanitary flows will be defined by the analyses included in the eventually amended drainage plans (see Section 2.10.4.6).

All of the proposed methods of handling sanitary sewage from the proposed school and senior housing sites would require sewer connection permits from NYCDEP, which require demonstrations that the existing sanitary system could handle the increased sanitary flows. The NYCDEP would eventually require a formal connection permit approval for each of those sites and for Retail Site "B." If the system could not handle these loads, changes to the sanitary system sufficient to meet those demands would be included within the amended Drainage Plan, as discussed in Section 2.10.4.6 of this chapter. Alterations to the concept presented could include direct drainage into the storm drain sewer under Arthur Kill Road, or other such alterations as required to handle increased sanitary flows.

Proposed Storm Drainage Systems

Year 2015

- Retail Site "A" has an agreement with the existing Bricktown Centre to connect directly into its existing storm drainage system. Special care will be needed to demonstrate the existing storm drainage system could handle the additional storm flows, after accounting for on-site detention, as required under current regulations~~.~~ described in the NYCDEP document "Criteria for Determination of Detention Facility Volume" (June 2002). The eventual end point of this storm drainage would be the large watershed area south of the West Shore Expressway (see **Figure 2.10-2**). These connections would need a stormwater connection permit from NYCDEP. The proposed library branch will also connect to Bricktown Centre's existing storm drainage system.

- For Fairview Park, its proposed drainage system will endeavor to capture all storm water on site through the creation of bio-swales and detention areas as done at other active recreation sites. If it is determined that an overflow connection is needed, the park will connect to the City storm sewer at a location to be determined.

Preliminary drainage analyses prepared by the developer of Retail Site "A" and submitted to NYCDEP indicate that the existing Bricktown Center stormwater management system has adequate capacity with appropriate adjustments to handle those projected stormwater flows not handled on-site from Retail Site "A" (including the proposed library) and Fairview Park.

Year 2020

- Under the 2005 Drainage Plan, construction of Englewood Avenue would require installation of NYCDEP's planned stormwater sewers under the presently mapped sections of Englewood Avenue. However, this may be revised under the amended Drainage Plan. These sewers would be needed for drainage of the road itself as well as the Proposed Project's senior housing and school elements discussed below, both of which would front onto Englewood Avenue
- The senior housing component would connect into the new storm drainage system installed under Englewood Avenue.
- The proposed school would connect into the new storm drainage system installed under Englewood Avenue.
- Retail Site "B" would connect directly into the existing NYCDEP 54-inch storm drain sewer under Arthur Kill Road. As this site is divided into two parcels by the existing 35-foot wide sanitary easement, the future developers of Retail Site "B" could require two drainage sewer connection permits from NYCDEP.

All of the proposed methods of handling stormwater would require sewer connection permits from NYCDEP, which require demonstrations that the existing stormwater system, after accounting for required on-site detention, could handle the increased flows. The NYCDEP would require a formal connection permit approval for each site. If it is determined that the system could not handle these loads, changes to the stormwater system sufficient to meet those demands would be included within the amended Drainage Plan. For example, alternate plans could include drainage into the storm drain sewer under Arthur Kill Road. The amended Drainage Plan will recognize the sensitivity of directing runoff into natural areas. The required elements for an amended Drainage Plan are discussed in Section 2.10.4.6 of this chapter.

2.10.4.5 On-Site Stormwater Management Requirements

New York City has regulations and practice requirements in place to control the flow of stormwater. Self-certification of sewer connection applications is not permitted by the New York City Department of Buildings or NYCDEP in connection with any proposed development or enlargement of buildings for which sewer connection approval is required. Prior to filing a House or Site Connection application, applicants may be required to submit a site-specific hydraulic analysis and a stormwater and water conservation best management practices concept plan to the NYCDEP for its review and approval, to establish the adequacy of existing sanitary and storm sewers to serve the proposed development or enlargement.

Enhanced stormwater management throughout the City to improve water quality in adjacent waterways is consistent with recent policies including the *NYC Green Infrastructure Plan* and Mayor Bloomberg's *PlaNYC 2030* and *Sustainable Stormwater Management Plan*. The *NYC Green Infrastructure Plan*, released September 2010, includes a goal of capturing the first inch of rainfall on 10 percent of the impervious areas in combined sewer watersheds through detention or infiltration

techniques over 20 years. Generally, *PlaNYC* calls for water quality improvements through stormwater source controls to expand recreation opportunities adjacent to and in the City's waterways. The *Sustainable Stormwater Management Plan*, which describes a framework for meeting this water quality goal, identified new development and redevelopment as a cost effective and feasible means of implementing greater source controls. In addition, NYCDEP has released *Guidelines for the Design and Construction of Stormwater Management Systems*, which is utilized for new and redevelopment projects in ~~Combined Sewer Outfall (~~CSO~~)~~ watersheds. In all watersheds, new and redevelopment projects must meet the requirements in New York State Department of Environmental Conservation's (NYSDEC) *Management Design Manual* (August 2010).

The NYSDEC stormwater guidelines would be used to properly select and design stormwater management Best Management Practices ~~(~~("BMPs~~)~~") to control water quantity ~~&~~and quality, as well as promote groundwater recharge/infiltration. BMPs can include blue and green roofs, subsurface detention, porous pavement, enhanced tree pits, rain gardens or infiltration swales and rain barrels. Each new area developed would be required to design and select one or more BMP measures to meet NYSDEC stormwater management requirements, as applicable. The project designs for the Development Area would be required to follow a five-step planning process, in accordance with the NYSDEC stormwater manual. Required percent reductions and water quality improvements are based on existing conditions. The five steps include:

1. Site planning to preserve natural features and reduce impervious cover;
2. Calculation of the water quality volume for the site;
3. Incorporation of green infrastructure techniques and standard Stormwater Management ~~Plans (~~Practices ("SMPs~~)~~") with Runoff Reduction Volume (RRv) capacity;
4. Use of standard SMPs, where applicable, to treat the portion of water quality volume not addressed by green infrastructure techniques and standard SMPs with RRv capacity; and
5. Design of volume and peak rate control practices where required.

Specific design criteria for completing the stormwater analysis and design are detailed in NYCDEP's *Guidelines for the Design and Construction of Stormwater Management Systems* and the NYSDEC's *New York State Stormwater Management Design Manual*. BMP measures will be designed to meet these standards.

Stormwater Best Management Practices Concepts for Proposed Project Components

The following are ~~Best Management Practices (~~BMPs~~)~~ that illustrate the ways that BMPs could be integrated into the proposed development expected to occur in the ~~Project~~Development Area which would help to achieve the required stormwater release rate~~.~~ and water quality treatment objectives. The exact ~~BPMs~~BMPs that would be incorporated on any of these sites would be determined during final design and permitting, subject to site constraints, zoning requirements, soil conditions, and other factors.

For impervious areas draining to Englewood Avenue and Veterans Road West, the design objectives for BMPs will focus on volume and peak rate control, as erosion is the largest threat to habitat. Water quality treatment BMPs will be designed in areas that discharge directly to the Arthur Kill.As discussed in **Chapter 2.1**, "Land Use, Zoning, Public Policy," under the Future With-Action Condition, two new zoning districts would replace portions of the existing M1-1 district in the Project Area. An R3-2 district would be mapped along the northern edge of the Project Area, while two C4-1 districts would be mapped over the proposed ~~retail sites (~~Retail Sites "A" and "B"). Retail Site "A" is located at the southeastern corner of the Project Area and Retail Site "B" is located at its southwestern corner.

R3-2

The R3-2 district would be mapped over an approximately 15-acre portion of the Project Area, running approximately 1,440 feet along the centerline of the proposed Englewood Avenue and having an approximate proposed depth ranging from 500 to 600 feet. The district would encompass the senior housing and school sites, and is intended to accommodate those developments. R3-2 districts are the lowest-density zones in which multiple dwellings are allowed. These range over a variety of housing types, including garden apartments, row-houses and single-family detached homes.

As stated, R3-2 districts are general residential districts that allow a variety of housing types. BMPs suitable for development in R3-2 districts include rain gardens, infiltration swales or subsurface open bottom detention systems where open space and yards are required. These could include subsurface vaults/tanks, stone beds, stormwater chambers, and perforated pipes to allow storm water to seep into the ground, where site conditions allow, and store water for gradual release during rain events freeing up capacity in combined and separate storm sewers. Walkways and other paved areas onsite could be constructed with permeable concrete or porous asphalt. In addition, rain barrels and cisterns could be connected to external downspouts where overflow is connected to the sewer system and stored water could be used to irrigate landscaped and grassed areas onsite.

The R3-2 districts result in buildings with ground-level open spaces as a result of yard requirements or maximum lot coverage requirements. R3-2 districts also have a planting requirement for the front yards which facilitates use of storm-water planter or planting strips. These buildings will allow for BMPs which utilize ground-level open space for infiltration or detention. Buildings in R3-2 districts typically have 35% lot coverage.

C4-1

The C4-1 zoning districts would be mapped in two areas of the Project Area covering Retail Sites “A” and “B” and would facilitate the planned retail development. C4 districts are mapped in regional commercial centers located outside of central business districts. In these areas, specialty and department stores, theaters and other commercial and office uses serve a larger region. Residential uses are not allowed as-of-right within C4-1 districts. The C4-1 district in particular is typically mapped in outlying areas, such as the Staten Island Mall, that require large amounts of parking. C4-1 district regulations permit commercial buildings up to a maximum FAR of 1.0, residential buildings up to a maximum FAR of 1.25 (R5 residential district equivalent) and community facility buildings up to a maximum FAR of 2.0.

Storm Water BMPs potentially suitable for this type of development include green roofs and blue roofs, which would retain or detain and release with slowed discharge rates storm water to control peak runoff rates. Tree plantings to capture stormwater as well as porous pavement for walkways, courtyards or other paved surfaces could also be utilized within the residential and commercial uses developed in these zoning lots.

2.10.4.6 Amended Drainage Plan Requirements

Amended Plan Requirements

The mapping of Englewood Avenue, along with the rezoning for Retail Sites “A” and “B” and the school and senior housing sites, mandate an amendment to the NYCDEP Drainage Plans for this area. There are two applicable Drainage Plans that would be affected by the Proposed Project – the Mill Creek Watershed TD-2 and the Clay Pit Ponds Park Watershed TD-7. These plans were recently updated in connection with the development of the MTA Bus Facility and the Bricktown Centre projects.

Amendments to these Drainage Plans would include the following elements:

- Calculating the tributary area of the watersheds (for stormwater);

- Developing the hydraulic calculations for:
  - Storm sewer in Englewood Avenue;
  - Sanitary sewer running north/south serving the school and senior housing sites;
  - Sanitary sewer upgrades for the east/west sewer running from Bricktown Way to Arthur Kill Road that will serve all proposed project elements except Retail Site "B;"
  - Storm sewer for the proposed mapped Bricktown Way and Tyrellan Avenue within the Project Area;
- Developing the profiles for the proposed sewers;
- Developing the Amended Drainage Plan and Maps.

The proposed amendment to these Drainage Plans would be consistent with the *NYCDEP Guidelines for Amended Drainage Plans*.[1]

Projected Elements

Sewer Easements

Existing easements would be maintained and possibly modified, with new easements potentially added. ~~For example, an easement may be required to connect the school parcel to the existing north-south easement presently ending within the adjacent senior housing parcel. This connection~~New connections could be made either through the senior housing parcel or the Fairview Park parcel.

Sanitary and Stormwater Sewers

The Amended Drainage Plans will provide the basic conceptual design (size, slope, manhole locations) of the sewers. Responsibility for the design and construction of the sewers among the private site developers and City agencies would be determined later in the development process. With the necessary sewers in place, developers would have to submit private drain plans to NYCDEP for review and approval, and construction would be monitored by NYCDEP, with the intent of turning ownership of the sewers over to NYCDEP in the future.

As discussed in Section 2.10.4.4 of this chapter, it is projected that sanitary sewage associated with the Proposed Project elements completed by 2015 – Retail Site "A" and Fairview Park – will be handled by connecting to existing infrastructure presently serving Bricktown Centre. Stormwater needs for Retail Site "A" will also be met by connecting to existing Bricktown Centre systems, while stormwater flows from Fairview Park not handled by on-site detention systems will be handled through an overflow connection to the City storm sewer system at a location to be determined. Preliminary analyses prepared by the Retail Site "A" developer indicate that the receiving sewer systems have sufficient capacity to receive these additional flows.

It should be noted that NYCDEP does not presently own the sewer infrastructure under Bricktown Way and Tyrellan Avenue. In the future, NYCDEP's ownership and maintenance obligations will not change unless the existing infrastructure is re-built to NYCDEP specifications and pursuant to an approved Drainage Plan, after which time NYCDEP can accept this infrastructure into its portfolio.

As noted above, the Proposed Project elements to be completed by 2020 – Englewood Avenue and the Senior Housing, School and Retail Site "B" sites – will require an ADP for the Mill Creek Watershed TD-2 and the Clay Pit Ponds Park Watershed TD-7. NYCEDC will begin work on the ADPs for these areas between the Proposed Project's Draft and Final EIS in consultation with NYCDEP. These ADPs must be submitted to and approved by NYCDEP before (1) any required sewer infrastructure can be

[1] ~~http://www.nyc.gov/html/dep/html/forms_and_permits/drainage.shtml~~
http://www.nyc.gov/html/dep/html/forms_and_permits/drainage.shtml

constructed (e.g., those likely needed under portion of the proposed Englewood Avenue or portions of existing streets~~))~~), and (2) sewer connection permits for any of these proposed uses can be granted.

2.10.4.7 Conclusion

Water Supply

In the future with the Proposed Project, by the year 2015 the Development Area would generate a water supply demand of approximately 86,100 ~~gallons per day (~~gpd~~)~~ or (0.09 mgd), which represent less than 0.1 percent of the City's water supply demand. The demand with the Proposed Project by the year 2015 would, therefore, not adversely impact the City's water supply. Further, by the year 2020, the Development Area would generate a water supply demand of approximately 189,400 gpd (0.19 mgd), which represent less than 0.1 percent of the City's water supply demand. The incremental demand with the Proposed Project by the year 2020 would, therefore, not adversely impact the City's water supply. The total demand of the Proposed Project represents less than 0.1 percent of the City's overall water supply demand of 1.3 billion gallons per day. Therefore, since the Proposed Project would not result in development that consumes an exceptional amount of water, the Proposed Project would not result in a significant adverse impact on the City's water supply.

Wastewater Treatment

In the future with the Proposed Project, wastewater generated from the study area would be treated by the Oakwood Beach WPCP. The capacity of the Oakwood Beach WPCP would continue to have a SPDES permitted capacity of 40 mgd. By the year 2015 the Proposed Project would generate approximately 50,400 gpd of sanitary sewage. The increase represents 0.42 percent of the reserve capacity of the Oakwood Beach WPCP. Since the wastewater generated by the Proposed Project is well within the capacity of the treatment plant, no significant adverse impacts to the City's wastewater treatment services would occur as a result of the Proposed Project by the 2015 analysis year. Further, by the year 2020, the Proposed Project would generate approximately 121,400 gpd of sanitary sewage. The increase represents 1.01 percent of the reserve capacity of the Oakwood Beach WPCP. Since the wastewater generated by the Proposed Project is well within the capacity of the treatment plant, no significant adverse impacts to the City's wastewater treatment services would occur as a result of the Proposed Project.

Sanitary and Stormwater Drainage and Management

The Proposed Project would increase the amount of runoff above the amount that would occur in the existing condition due to the increase in impervious surfaces (roofs, pavement, roadways, etc) within the Project Area. BMPs would be incorporated into the site plans for each of the project components to the extent practicable to meet the requirements for on-site detention of stormwater.

Amended Drainage Plans

The mapping of Englewood Avenue, along with the rezoning of portions of the Development Area, create an obligation to amend the NYCDEP Drainage Plans for this area. There are two applicable Drainage Plans that would be affected by the Proposed Project – the Mill Creek Watershed TD-2 and the Clay Pit Ponds Park Watershed TD-7. NYCEDC ~~will begin~~has begun work on the ADPs for these areas between the Draft and Final EIS. These ADPs must be submitted to and approved by NYCDEP before (1) any required sewer infrastructure can be constructed (e.g., those likely needed in portions of the proposed Englewood Avenue or portions of existing streets~~))~~), and (2) any sewer connection permits for these proposed uses can be granted by NYCDEP.

The sanitary sewer needs of Retail Site "A" and Fairview Park, to be completed by 2015, are proposed to be handled by the existing infrastructure presently serving the Bricktown Centre, Stormwater needs for Retail Site "A" will also be met by connecting to existing Bricktown Centre systems, while

stormwater flows from Fairview Park not handled by on-site detention systems will be handled through an overflow connection to the City storm sewer system at a location to be determined. Preliminary analyses prepared by the Retail Site "A" developer indicate that the receiving sewer systems have sufficient capacity to receive these additional flows.

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