APPENDIX 11.2:

TECHNICAL MEMORANDOM
IMPACT OF HUNTER'S POINT SOUTH DEVELOPMENT ON WET-WEATHER DISCHARGES

TECHNICAL MEMORANDUM
IMPACT OF THE HUNTER'S POINT SOUTH DEVELOPMENT
ON WET-WEATHER DISCHARGES
TO NEWTOWN CREEK AND THE EAST RIVER

INTRODUCTION

The Hunter's Point South Rezoning and Related Actions (the proposed actions) is an initiative of the City of New York (City) to facilitate the implementation of a large-scale, mixed-use development plan in the Hunter's Point neighborhood of Long Island City, Queens (see Figure 1). The project, known as the Hunter's Point South development project ("project"), provides a substantial amount of affordable housing on publicly owned land (Site A) and allows for the residential redevelopment of a privately owned adjacent site (Site B). The development of the project would be an integral part of the City's New Housing Marketplace plan for the provision of affordable housing. In addition to housing, the project would also include retail uses, community space, a public school, public parkland (including waterfront access) and other public and private open spaces, and accessory parking. Redevelopment of the privately owned site also would include public waterfront access.

This technical memorandum serves to summarize the results of analyses performed by HydroQual, Inc. to assess the potential impact of the proposed Hunter's Point South development project on wastewater flows generated at the project site, as well as annual discharges of combined-sewer overflows (CSOs) and stormwater to the adjacent waterbodies of the East River and Newtown Creek. Two distinct analyses were performed. First, the characteristics of the project site, both in the existing condition and with the proposed actions implemented, were analyzed to determine the flows that would be generated from the site for a variety of rainfall conditions. Second, a complete hydrologic/hydraulic modeling analysis of the Bowery Bay Water Pollution Control Plant (WPCP) low-level sewershed (within which the project site is located) was performed to determine the potential impact of the site on CSO and stormwater discharges. Together, the analyses presented herein show that the Hunter's Point South development project is anticipated to slightly reduce CSO discharges to Newtown Creek and the East River, and to slightly increase CSO discharges to Dutch Kills, for the proposed project build year of 2017. The expected CSO volume reductions to Newtown Creek and the East River are about 4.0 and 0.1 percent, respectively, while the expected CSO volume increase to Dutch Kills is about 1.0 percent.

DESCRIPTION OF EXISTING SITE CONDITION

Site A and Site B (together, the "project sites") cover about 37.5 acres and are located along the Hunter's Point waterfront (see Figure 1). The following subsections describe the specific location and the hydrologic characteristics of each site.

Site A (Existing Conditions)

Site A covers 29.9 acres in the area generally located between 50th Avenue, 2nd Street, Newtown Creek, and the East River, and Site B is the area located between 54th Avenue, the western side of the prolongation of 5th Street, Newtown Creek, and 2nd Street. Site A is currently owned by the Port Authority of New York and New Jersey (PANYNJ) and the Queens West Development Corporation (QWDC), a subsidiary of the Empire State Development Corporation (ESDC).

Site A is currently partially occupied by a variety of commercial uses. These uses include Tennisport, a private tennis club with accessory parking; the Water Taxi landing, Water Taxi Beach, and accessory and public parking; and temporary storage for a construction contractor, in addition to parking for off-site uses. Much of the area features open space. A ventilation structure for the Midtown Tunnel is within, but not included as part of, Site A (see Figure 1). This building is owned by Amtrak and is under construction on the west side of 2nd Street, between Borden and 54th Avenues.

As shown in Table 1, Site A is currently comprised of about 3.1 acres of roof areas, 9.4 acres of streets, sidewalks, recreational surfaces, and other paved areas, and 17.4 acres of grass, dirt, gravel, or other pervious areas. Runoff from impervious areas is tributary to the existing combined sewer system (CSS), while runoff from the pervious areas flows via direct drainage to the East River (AKRF, personal communication).

Approximately 19,962 gallons per day (gpd) of sanitary wastewater is generated from Site A (AKRF, DEIS). This flow is directed to the existing combined sewer system (see Figure 1), which also handles runoff during wet weather. As shown, the southern portion of Site A is not sewered. Runoff generated from this area, which characterized by bare and vegetated surfaces, currently flows overland to the adjacent East River.

Site B (Existing Conditions)

Site B covers 7.5 acres and is privately owned. It is bounded by 54th Avenue to the north, Newtown Creek to the south, the western side of the prolongation of 5th Street to the east, and 2nd Street to the west. This site is currently occupied by a complex of low-rise buildings primarily used by Anheuser Busch as a beverage distribution facility. A portion of one of the buildings on Site B is also occupied by NBC for storage, office, and studio-related uses.

As shown in Table 1, Site B is currently comprised entirely of impervious surfaces, including about 4.2 acres of roof and 3.4 acres of streets, sidewalks, and other paved surfaces. Runoff from these impervious surfaces is tributary to the existing combined sewer system (AKRF, personal communication).

AKRF estimated that 6,500 gpd of sanitary wastewater is generated from Site B (AKRF, DEIS). This flow is directed to the existing combined sewer system, which also handles all runoff during wet weather.

DESCRIPTION OF PROPOSED SITE

The Hunter's Point South project reflects an inter-agency planning effort to create a residential project with a new street network and park system featuring seven development parcels to be created on Site A and compatible residential development on Site B (see Figure 2). In addition to housing, the project would also include retail uses, community space, a public school, public parkland (including public waterfront access) and other public and private open spaces, and accessory parking. The development would be supported by a complete buildout of a separate sanitary and storm sewers that would eliminate rainfall runoff inflows to the combined sewer system from both Site A and Site B. The sanitary sewers would deliver approximately 1.53 MGD to the existing combined sewer system for conveyance to the Bowery Bay WPCP. Details of the proposed build scenario for each of these areas are presented below.

Site A (Proposed Build Condition)

The existing 29.9-acre area would be redeveloped under the proposed Build Condition. It is anticipated that up to 5 million gross square feet (gsf) of residential space or 5,000 dwelling units would be developed on Site A. In addition, the project would also include retail space of up to 90,500 gsf, a new public school of approximately 180,000 gsf, community facility space of approximately 45,000 gsf and open space including a new 10-acre waterfront park.

As shown in Table 2, Site A in the proposed Build Condition would be comprised of roughly 9.6 acres of roof areas, 8.9 acres of streets, sidewalks, and other paved areas, and 11.4 acres of mostly landscaped areas.

Approximately 1.17 MGD of sanitary sewage would be generated from Site A under reasonable worst-case conditions in the 2017 Build scenario. This sanitary flow would be directed to the existing sewer along 2nd Street via new separate sanitary sewers to be installed as part of the project. Because the project would also provide separate storm sewers, attenuated runoff from impervious and pervious areas would be discharged via storm sewers and direct drainage to adjacent waterbodies. Elimination from the Bowery Bay combined sewer system of the existing inputs of rainfall runoff generated from the project sites would help to reduce CSOs from the combined system.

Site B (Proposed Build Condition)

The existing 7.5-acre area would be redeveloped under the proposed Build Condition. Site B would be redeveloped to feature up to 1.65 million gsf of residential space or 1,650 dwelling units, and retail space of up to 36,000 gsf .

As shown in Table 2, Site B in the proposed Build Condition would be comprised of roughly 3.9 acres of roof area, 1.0 acre of streets, sidewalks, and other paved areas, and 2.6 acres of mostly landscaped areas.

Approximately 0.3 MGD of sanitary sewage would be generated from Site B under reasonable worst-case conditions in the 2017 Build scenario. This sanitary flow would be directed to the existing combined sewer system via a new, separate sanitary-sewer system to be installed as part of the project. Rainfall runoff inflows to the combined sewer system would be eliminated. Runoff would discharge to Newtown Creek via overland runoff or via the new, separate storm-sewer system that would discharge at the foot of 2nd Street.

Site C: Offsite Areas Tributary To Project Storm Sewer System (Proposed Build Condition)

As mentioned above, the proposed project would involve the installation of a new, separate storm sewer system to service the project site. Through connection of catch basins along the eastern side of 2nd Street to these storm sewers, the proposed storm sewers will also be able to convey rainfall runoff from a small area beyond the project site. This area will consist primarily of the street and sidewalk areas along the eastern edge of 2nd Street.

An estimated 2.7 acres of streets and sidewalks along 2nd Street, adjacent to (but not within the project area) would be tributary to the proposed storm sewer serving Site A's northeastern portion. This acreage is tributary to the combined sewer system in the Existing / No Build scenarios.

ASSESSMENT OF WASTEWATER FLOW GENERATED FROM PROJECT SITE

An analysis of the hydrologic characteristics of the project sites for the No Build and Build (reasonable worst case) Conditions was performed to compare the wastewater flow rates generated from the project site with and without the proposed project. Given a range of rainfall intensities of between 0.00 and 5.95 in/hr (peak 6-minute duration), which correspond to return periods of up to 5 years, sanitary and runoff flows to the combined sewer system and to the waterbody were estimated. Sanitary flows were taken according to the estimated flow rates discussed above, while runoff was determined by application of characteristic runoff coefficients with each rainfall. Runoff coefficients of 1.00, 0.85, and 0.20 were associated with roof, paved, and pervious areas, respectively. Runoff was directed either to the waterbody or to the combined sewer system, as appropriate.

Table 3 presents the results of this analysis for both the No-Build and Build scenarios. The table presents the peak wastewater flow rate (runoff or sanitary sewage) to either the combined sewer system (CSS) or to the waterbody ("river") from Sites A, B and C for a range of rainfall intensities (with return period noted where available). The total peak wastewater flow rate (runoff and sanitary sewage) to the CSS is also shown for Sites A and B, and at the extreme right for Sites A, B and C.

For the No-Build scenario, with zero rainfall, there is no runoff generated, only sanitary flow: about 0.02 MGD from Site A and 0.01 from Site B, both of which are tributary to the CSS, so that the total flow to the CSS from the project sites is 0.03 MGD. Since the sanitary flow is not dependent on rainfall, it remains a constant in the No-Build scenario. However, with additional rainfall, additional runoff is generated. With 0.10 inches per hour, peak runoff (from Site A pervious areas) increases to 0.22 MGD to the waterbody, while peak runoff from Site A (impervious areas) to the CSS is 0.72 in/hr and peak runoff from Site B to the CSS is 0.46 in/hr. Adding in the always present sanitary flow gives a total flow to the CSS from Sites A and B of

1.20 MGD. For the 5-year return period storm defined by DEP, the peak flow from Sites A and B to the CSS is 69.84 MGD.

For the Build scenario, the total generated sanitary flow increases to 1.17 MGD and 0.37 MGD, respectively for Sites A and B, totaling 1.53 MGD. However, in the Build scenario, wet-weather runoff is eliminated from the combined sewer system, so the total inflows remain constant regardless of rainfall. Comparison between the Build and No-Build scenario results shows that for rainfall intensities higher than about 0.13 in/hr, the project would *reduce* the overall rate that wastewater is introduced to the CSS versus the No-Build scenario; for rainfall intensities less than 0.13 in/hr, the project would *increase* the overall rate that wastewater is introduced to the CSS versus the No-Build scenario. Because the rainfall intensities vary widely over the course of the year, with smaller intensities occurring more frequently than higher intensities, the net impact of the project could be either a reduction or an increase in flows to the sewer system, depending on the actual rainfall conditions encountered.

As mentioned above, in the Build condition an area adjacent to (but not included in) the project site will drain to catch basins that will be connected to a new storm sewer servicing a portion of the project site. This site, referred to herein as "Site C," is comprised of 2.7 acres of streets and sidewalks along the opposite side of 2nd Street from Site A. Site C generates no sanitary flow. Because runoff generated from this paved area will be eliminated from the CSS in the Build scenario, the actual project benefit in terms of reduction of runoff to the CSS is actually slightly greater than described above. As shown in Table 3, accounting for Site C reduces the rainfall intensity for which the project provides a net benefit to the sewer system to 0.11 in/hr (instead of 0.13 in/hr), so the project will reduce inflows to the CSS for slightly more of the wet-weather hours that occur each year.

ASSESSMENT OF EXPECTED CSO AND STORMWATER DISCHARGES

The previous section presented a simple analysis of wastewater flow generation and potential inflow to the existing combined sewer system. An analysis of the potential impact of such flows on hydraulics in and discharges from the combined sewer system requires consideration of other factors, such as the hydraulic characteristics of the sewer system both upstream and downstream of the subject area, dry- and wet-weather inputs throughout the sewer system, and other factors. Hydraulic models are typically required to assess how these complex factors interact and impact system performance. This section describes the results of the hydraulic modeling analyses performed herein.

Using a typical hourly precipitation record (1988 at JFK Airport), hourly wet-weather discharges were developed using the latest available InfoWorks CS model of the Bowery Bay lower level WPCP service area, which features 44 regulators and 37 combined-sewer outfalls. The Bowery Bay model was further modified to provide higher resolution in the project area. The InfoWorks model accounts for hydraulic considerations such as storage, travel time, head loss, overflows from regulators, etc. and therefore can provide a realistic assessment of the project's impact on the sewer system and the resulting impacts on wet-weather discharges of CSO and stormwater.

InfoWorks modeling was performed for each of the following cases:

1. **2007 Existing Condition** – infrastructure and operation of the sewer system in its current state. The project site is specifically modeled in its existing condition, as shown on Figure 1 and in Table 1, and described herein.

2. **2017 No Build** – similar to the above, except that sanitary flow rates are adjusted upward to account for projected population increases. The flow rate for 2017 was taken as 120 MGD for the Bowery Bay WPCP; this increase was projected throughout the Bowery Bay low-level sewershed as described herein.

3. **2017 Build** – similar to item 2) above, except that site conditions are updated to reflect completion of the project as shown on Figure 2 and in Table 2, with an additional 1.53 MGD sanitary sewage flow contribution from the project. This scenario includes the complete elimination of wet-weather runoff from the project site to the existing combined sewer system.

<u>Discussion of Results of Landside (Sewer System) Modeling</u>

The results of the sewer-system modeling analyses are presented in Table 4. For each of the three modeled scenarios, this table shows the annual CSO volume and number of events at each of the 37 outfall locations in the Bowery Bay low-level sewershed, with totals shown by receiving waterbody and overall for the sewershed. As noted above, all simulations use the same rainfall conditions (the 1988 JFK rainfall record, which the City has adopted for CSO planning simulations in the CSO Long Term Control Planning project and other studies). Table 5 presents the incremental differences between the modeled cases. The incremental difference from the 2007 Existing scenario to the 2017 No-Build scenario shows the impact of the projected general population increase, while the incremental difference from the 2017 No-Build to the 2017 Build scenario shows the impact of the Hunter's Point South project.

Inspection of Tables 4 and 5 shows the projected general population increase from 2007 to 2017 is expected to increase overall CSO volume by 104 MG/yr (an 8.5 percent increase from the 2007 Existing scenario) and to increase the overall number of CSO events by 1 per year (to 55 from 54 events per year). Of the 37 outfalls in the sewershed, 14 are expected to increase by at least 0.5 MG/yr, and two outfalls to Dutch Kills represent over half of the overall increase.

The impact of the Hunter's Point South project is less pronounced. As shown in Table 5, the difference between the 2017 No-Build and 2017 Build shows that CSO volumes are expected to increase by 1 MG/yr (a 0.1 percent increase), and to increase the number of CSO events by one per year (to 56 from 55 events per year). Of the 37 outfalls in the sewershed, only 2 (both discharging to Dutch Kills) are expected to have increased CSO volume of more than 0.5 MG/yr, and the total increase to Dutch Kills is about 4 MG/yr. CSO volumes to Newtown Creek and the East River are expected to decrease by about 2.4 MG/yr (4 percent) and 0.1 MG/yr, respectively, with no change to the overall number of CSO events impacting these waterbodies.

The incremental impact of the project on CSOs at individual outfalls varies (see Table 5). Due to the particular hydraulics of the sewer system, the largest impacts do not necessarily occur at the outfalls located within the project area. The largest difference occurs at outfall BB-026, where the CSO volume is expected to increase by 3.46 MG/yr (a 1.0 percent change). The other location with a relatively large impact was BB-015, a CSO outfall discharging to Newtown Creek from Site B of the project area. CSO discharges at this outfall are expected to decrease by 1.74 MG/yr (a 39 percent reduction). At all other CSO locations, the impact of the project on anticipated discharge volume is expected to be well less than 1.0 MG/yr.

While the project is expected to increase sanitary inflows to the sewer by 1.53 MGD, it would also eliminate roof connections to the sewer, which would alleviate the burden on the sewer's capacity during wet weather. Though the increased sanitary flows would be relatively constant, the reduced stormwater inflows would occur only during wet weather and would vary depending upon the amount of runoff. Since more runoff is generated during larger storms, the greatest benefit would occur during the largest storms, with lesser benefits occurring during smaller storms. Whether the project represents a net burden or a net benefit to sewer capacity and CSOs depends both on the amount of additional sanitary flow and the size of the storms that are experienced.

SUMMARY OF RESULTS

An analysis of the hydrologic characteristics of the No Build and Build scenarios indicate that for rainfall intensities of more than about 0.11 in/hr, the project is expected to *reduce* the peak wastewater flow rates to the combined sewer system. During dry weather and for rainfall intensities of less than 0.11 in/hr, the project is expected to *increase* the peak wastewater flow rates to the combined sewer system. The overall impact of the project on wastewater inflows to the sewer system will depend on the particular distribution of rainfall over any given period.

To estimate the overall impact of the project on expected *discharges* from the sewer system requires analyses of hydraulics as well as hydrology. The InfoWorks model of the Bowery Bay WPCP low-level sewershed was used for this purpose. Modeling analyses were performed for the Existing (2007) condition, a future 2017 No-Build condition, and a future 2017 Build condition. Comparison of the 2017 Build to the 2017 No-Build condition provides an appropriate basis to assess the impact of the project on wet-weather discharges.

The modeling analysis indicates that, given the hourly rainfall record (JFK 1988) that is consistent with an average annual CSO condition, the project will increase discharged CSO volumes by 1.48 MG/yr overall, a small change of approximately 0.11 percent versus the No-Build scenario. On a waterbody-by-waterbody basis, CSO volumes to the East River and Newtown Creek are expected to decrease by 0.08 and 2.43 MG/yr, respectively, and to increase by 3.98 MG/yr to Dutch Kills. In each case, these predicted changes are very small relative to the total annual discharge (an overall change of about 0.11 percent in CSO volume from the Bowery Bay low-level sewershed, less than a 1 percent change for Dutch Kills and the East River, and a 4 percent reduction for Newtown Creek.) On an outfall-by-outfall basis, only two outfalls differed by more than 1 MG/yr between the No-Build and Build conditions. CSO from outfall BB-015 (located near Site B of the project area and discharging to Newtown Creek) would be expected to decrease 1.74 MG/yr, while CSO from outfall BB-026 (discharging to Dutch Kills) would be expected to increase by 3.47 MG/yr. At all other locations, incremental changes in CSO volume were well less than 1.0 MG/yr.

With respect to the number of CSO events that are expected to occur annually, modeling indicates that in the Build scenario some outfalls are expected to discharge fewer times during the year compared to the No-Build scenario, while other outfalls are expected discharge more times. Outfall BB-044 is expected to discharge 3 fewer times under the Build scenario, while outfall BB-026 is expect to increase 1 additional time. Overall, the numbers of CSO events affecting the East River and Newtown Creek are expected to remain the same, while one additional CSO event is expected in Dutch Kills (due to BB-026).

ADDITIONAL MODELING BACKUP

The remainder of this document provides additional discussion of the modeling frameworks used, the methods employed, and the model inputs that were used in the analyses summarized above. Discussions are provided below for sewer-system modeling.

Sewer-System Modeling Methodology and Modeling Inputs

This section presents the methodology and inputs used for the sewer-system modeling conducted herein. The modeling framework, model versions used, and modifications made to enable assessment of project impacts are discussed. Inputs presented include future dry-weather (sanitary) sewage flow rates in the Bowery Bay WPCP sewer system, estimates of the project dry-weather (sanitary) sewage flow contributions, without-project and with-project wet-weather inputs to the combined sewer system, and project-area characteristics (such as roof area, paved area, and non-paved areas) are shown for the without-project and with-project conditions.

Modeling Framework

InfoWorks CS ("InfoWorks") is a commercially available modeling package developed by Wallingford Software. DEP has adopted InfoWorks for all of its current facility-planning projects, notably the ongoing CSO Long-Term Control Plan project.

The InfoWorks modeling framework includes components for both hydrology (rainfall-runoff) and hydraulics (pipe flow). For hydrology, InfoWorks uses specified rainfall information together with land-surface characteristics such as imperviousness and slope, as well as evaporation and infiltration to generate runoff from land surfaces on the project site and in the entire sewer system drainage area. The model uses appropriate equations for representing the hydrologic processes to generate the runoff volumes that reach the sewer system.

For hydraulics, InfoWorks uses Saint Venant's equations of continuity and momentum to route the flows within a sewer system and to account for virtually all sewer elements, including weirs, orfices, pumping stations, force mains, regulators, tide gates, outfalls, branch interceptors and interceptors. In dry weather, the diurnally varying sanitary flows are simulated throughout the sewer system. In wet weather, InfoWorks combines these sanitary flows with the runoff calculated in the hydrology component of the model, and routes the total flow through the combined sewer system. When the capacity of individual regulators to divert flow into the interceptor system is exceeded, the combined sanitary and runoff in excess of this capacity is discharged through a CSO outfall. The frequency and volume of CSOs in the Bowery Bay WPCP service area are dependent on both regulator /branch interceptor capacities and on the hydraulic gradient line (HGL) in the interceptors.

InfoWorks allows for long-term simulations with a high-resolution time step. In this investigation, full-year (12-month) simulations were performed with 5-minute raw output condensed into hourly flows and discharges. Post processing of the InfoWorks output was performed to provide annual total discharge volumes and frequencies by outfall. In addition, since InfoWorks output can keep track of the sanitary sewage versus rainfall runoff fractions in discharges, the output is well suited for developing pollutant loadings.

Application of InfoWorks to the Bowery Bay WPCP Drainage Area and Project Area

As noted above, DEP has selected InfoWorks for all facility-planning analyses being performed as part of the CSO Long Term Control Plan (LTCP) project. As part of that process, InfoWorks models were constructed and calibrated for each of the City's WPCP sewer systems. As ongoing changes to the City's sewer systems are made and new monitoring data becomes available, these models are continuously being updated and upgraded. Complete descriptions of the latest available calibrations are described in the Landside Modeling Reports created for each WPCP drainage area model as part of the LTCP project. This analysis employed the latest available version of Bowery Bay lower level model (March 2008, as calibrated to calendar year 2007 flows at the Bowery Bay WPCP.). The 2007 Existing condition simulations were based upon this model.

To project the future dry-weather sanitary flow rates for the 2017 build year, expected increases in dry-weather (sanitary sewage) flow rates from current rates (96 MGD in calendar year 2007) were determined based on planning-level population and water-use projections made by the New York City Department of City Planning.[1] A dry-weather flow rate of 120 MGD was used herein for the average year 2017 value, which compares to a average dry-weather flow rate of 96 MGD observed in calendar year 2007. Because the low-level sewershed represents about 34 percent of the total inflow to Bowery Bay, the dry-weather flow in the sewershed was taken to be 40.8 MGD for 2017, compared to about 32.6 MGD for calendar year 2007.

Incorporation of Project Site into the InfoWorks Model

The Hunter's Point South development project is comprised of two sites, designated Site A and Site B, as shown in Figure 1. The entire project site is 37.5 acres and lies within the Bowery Bay low-level sewershed. To analyze the impacts of the proposed project on the sewer system and on the receiving water bodies, the resolution of the existing model of the Bowery Bay low-level sewershed was modified to explicitly include the project site. Four existing subcatchments were discretized into a higher-resolution representation of five subcatchments to represent the project area.

Sites A and B are served by combined and interceptor sewers that flow toward the Bowery Bay WPCP. During wet-weather events, excess flow in the system is diverted as CSO to the East River and Newtown Creek by Regulators L-10, L-11, L-12, and L-22. Site A, which is approximately 29.9 acres, currently consists of buildings, vegetated area, paved areas, and roadways. Stormwater runoff from these areas of the site flow overland to the East River or infiltrate the subsurface soils in the undeveloped portions of Site A. Site B is approximately 7.6 acres consisting entirely of building roofs and roadway surfaces, with virtually no vegetated or pervious areas. All runoff from Site B is thought to drain to Regulator L-10 via a 12-inch combined sewer beneath 54th Avenue.

[1] "Population Projections for NYC Neighborhoods: 2010 and 2030," prepared by the NYC Department of City Planning for the Mayor's Strategic Planning Initiative, presented 11/16/2005 and distributed by Angela Sung, Office of the Deputy Mayor for Economic Development and Rebuilding, on November 18, 2005.

In the 2017 No-Build scenario, the landuses and generated sanitary sewage rates in place in the Existing condition are assumed to remain for the project area. In the 2017 No-Build condition the project site would generate an estimated sanitary flow of 24,462 gpd (0.03 MGD), including 19,962 gpd from Site A and 6,500 gpd from Site B. Landuses in the rest of the sewershed are also assumed to be the same in the 2017 No-Build condition as in the Existing Condition, but sanitary (dry-weather) flow is assumed to increase by the same proportion as the increase in dry-weather flow at the WPCP between 2007 and 2017 (as discussed above). At 120 MGD, the 2017 dry-weather flow rate at the WPCP is well below the permitted limit of 150 MGD.

In the 2017 Build scenario, the total project site remains 37.5 acres, but landuses and the drainage plan would change due to the proposed actions. With the project, there would be a total of 13.6 acres of roof, 9.9 acres of streets, sidewalks and other paved areas such as driveways, parking areas, and walking paths. The remaining 14.0 acres would be non-paved, consisting primarily of landscaped, vegetated areas. The proposed infrastructure and drainage plan would include separate storm and sanitary sewer systems so that all runoff would be eliminated from the CSS. Stormwater runoff generated on Site A would be collected from individual parcels, park areas, and roadways and discharged into Newtown Creek and the East River via two existing and two new storm sewer outfalls. Stormwater from the northernmost portion of Site A would be collected on-site, conveyed through a network of separate storm sewers to be located in adjacent streets and discharged into the East River via a new storm outfall to be located between 50th and 51st Streets on the waterfront. (Notably, this portion of the project's separate storm sewer would also collect runoff from an adjacent area of approximately 2.7 acres featuring streets and sidewalks that drained to the CSS in the Existing condition.) Stormwater from the central portion of Site A would be collected on-site and conveyed by separate storm sewers and discharged into the East River via the existing outfall in 54th Avenue. Stormwater from the southern portion of Site A would also be collected on-site, conveyed by separate storm sewers and discharged via a new stormwater outfall in 2nd Street into Newtown Creek. Stormwater runoff generated on Site B would be diverted to Newtown Creek via overland flow or via the new storm sewer system, which would provide a storm sewer discharge at the foot of 2nd Avenue. All runoff draining to the combined sewer system would be eliminated.

FIGURES

Figure 1. Hunter's Point South Project Site – Existing Condition

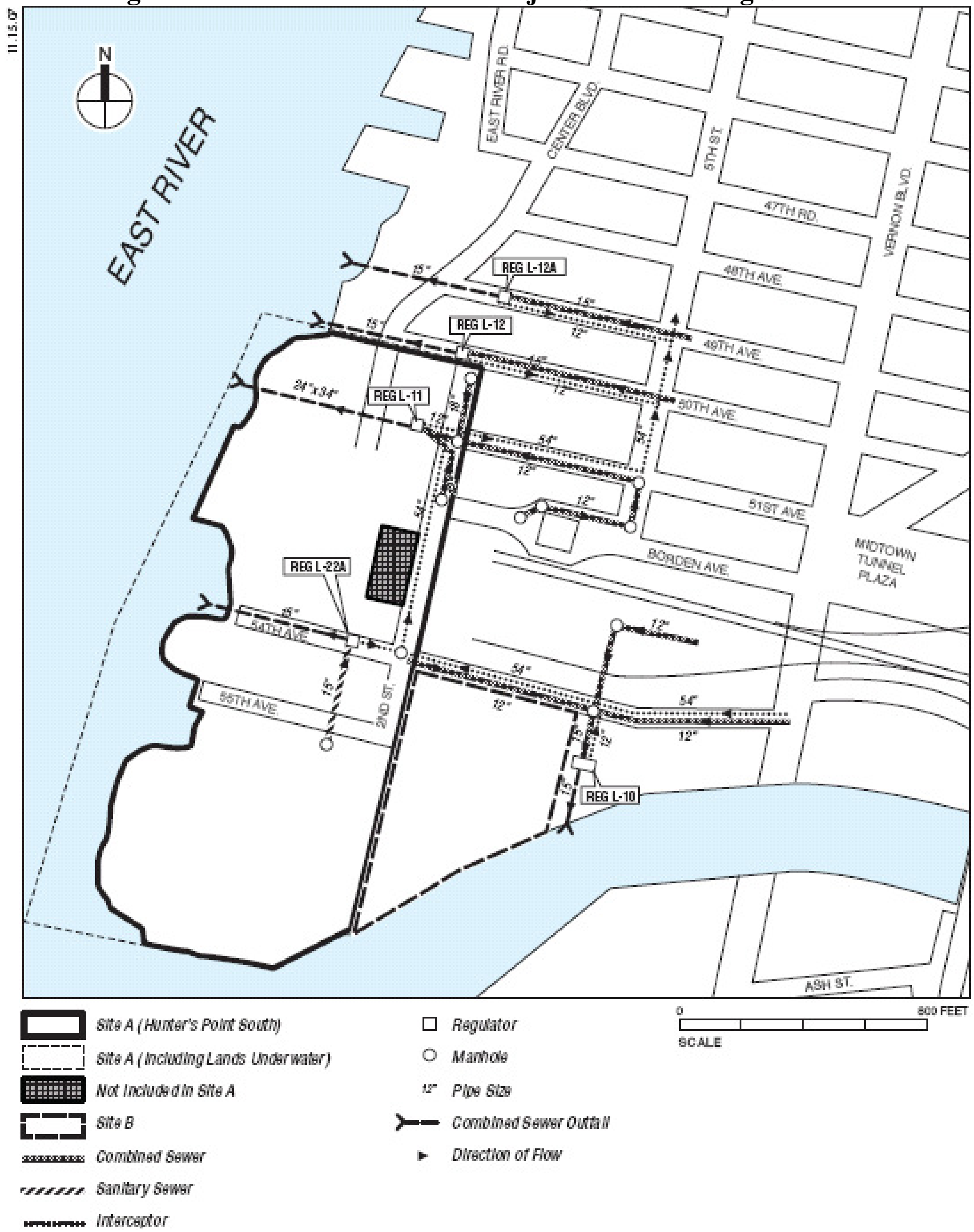

Figure 2. Hunter's Point South Project Site – Proposed Condition

TABLES

Table 1. Drainage Area Characterization – Existing (No-Build) Conditions

SITE	VARIABLES	NO BUILD ROOF	PAVED	PERVIOUS	TOTAL
SITE A	Area (acres)	3.1	9.4	17.4	29.9
	Area, (%)	10.5	31.3	58.2	100.0
	Runoff Coefficient	1.00	0.85	0.20	0.49
	Sanitary Flow (gpd)	19,962			
SITE B	Area (acres)	4.2	3.4	0.0	7.5
	Area, (%)	55.8	44.2	0.0	100.0
	Runoff Coefficient	1.00	0.85	0.20	0.07
	Sanitary Flow (gpd)	6,500			
SITE C	Area (acres)	0.0	2.7	0.0	2.7
	Area, (%)	0.0	100.0	0.0	100.0
	Runoff Coefficient	1.00	0.85	0.20	0.02
	Sanitary Flow (gpd)	0			
Note: values may not sum precisely due to rounding					

Table 2. Drainage Area Characterization – Proposed (Build) Conditions

SITE	VARIABLES	BUILD ROOF	PAVED	PERVIOUS	TOTAL
SITE A	Area (acres)	9.6	8.9	11.4	29.9
	Area, (%)	32.2	29.8	38	100
	Runoff Coefficient	1.00	0.85	0.20	0.65
	Sanitary Flow (gpd)	1,168,435			
SITE B	Area (acres)	3.9	1.0	2.6	7.5
	Area, (%)	52.3	13.2	34.5	100
	Runoff Coefficient	1.00	0.85	0.20	0.05
	Sanitary Flow (gpd)	366,536			
SITE C	Area (acres)	0.0	2.7	0.0	2.7
	Area, (%)	0.0	100.0	0.0	100
	Runoff Coefficient	1.00	0.85	0.20	0.02
	Sanitary Flow (gpd)	0			
Note: values may not sum precisely due to rounding					

Table 3. Comparison of Peak Flow Rates for No-Build and Build Conditions

NO-BUILD[1]		SITE A				SITE B				TOTAL SITE A&B	SITE C (Offsite)				TOTAL SITES A&B&C
RAINFALL RETURN PERIOD (month)*	RAINFALL INTENSITY PEAK 6 min DURATION (in/hr)*	RUNOFF TO RIVER (MGD)	RUNOFF TO CSS (MGD)	SANITARY TO CSS (MGD)	TOTAL TO CSS (MGD)	RUNOFF TO RIVER (MGD)	RUNOFF TO CSS (MGD)	SANITARY TO CSS (MGD)	TOTAL TO CSS (MGD)	TOTAL TO CSS (MGD)	RUNOFF TO RIVER (MGD)	SANITARY TO CSS (MGD)	RUNOFF TO CSS (MGD)	TOTAL TO CSS (MGD)	TOTAL TO CSS (MGD)
-	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.01	0.01	0.03	0.00	0.00	0.00	0.00	0.03
-	0.10	0.22	0.72	0.02	0.74	0.00	0.46	0.01	0.46	1.20	0.00	0.00	0.15	0.15	1.35
-	0.11	0.26	0.82	0.02	0.84	0.00	0.52	0.01	0.53	1.36	0.00	0.00	0.17	0.17	1.53
-	0.13	0.29	0.92	0.02	0.94	0.00	0.59	0.01	0.59	1.53	0.00	0.00	0.19	0.19	1.73
-	0.20	0.45	1.43	0.02	1.45	0.00	0.91	0.01	0.92	2.37	0.00	0.00	0.30	0.30	2.67
-	1.00	2.25	7.17	0.02	7.19	0.00	4.57	0.01	4.57	11.76	0.00	0.00	1.51	1.51	13.27
-	2.00	4.50	14.33	0.02	14.35	0.00	9.14	0.01	9.14	23.49	0.00	0.00	3.01	3.01	26.50
3	2.15	4.83	15.41	0.02	15.43	0.00	9.82	0.01	9.83	25.25	0.00	0.00	3.24	3.24	28.49
6	2.89	6.50	20.71	0.02	20.73	0.00	13.20	0.01	13.21	33.94	0.00	0.00	4.35	4.35	38.29
12	3.61	8.11	25.87	0.02	25.89	0.00	16.49	0.01	16.50	42.38	0.00	0.00	5.43	5.43	47.82
24	4.39	9.87	31.46	0.02	31.48	0.00	20.05	0.01	20.06	51.54	0.00	0.00	6.61	6.61	58.15
60	5.12	11.51	36.69	0.02	36.71	0.00	23.39	0.01	23.39	60.10	0.00	0.00	7.71	7.71	67.81
60 - DEP	5.95	13.38	42.64	0.02	42.66	0.00	27.18	0.01	27.19	69.84	0.00	0.00	8.96	8.96	78.80

BUILD[2]		SITE A				SITE B				TOTAL SITE A&B	SITE C (Offsite)				TOTAL SITES A&B&C
RAINFALL RETURN PERIOD (month)*	RAINFALL INTENSITY PEAK 6 min DURATION (in/hr)*	RUNOFF TO RIVER (MGD)	RUNOFF TO CSS (MGD)	SANITARY TO CSS (MGD)	TOTAL TO CSS (MGD)	RUNOFF TO RIVER (MGD)	RUNOFF TO CSS (MGD)	SANITARY TO CSS (MGD)	TOTAL TO CSS (MGD)	TOTAL TO CSS (MGD)	RUNOFF TO RIVER (MGD)	SANITARY TO CSS (MGD)	TOTAL RUNOFF TO CSS (MGD)	TOTAL TO CSS (MGD)	TOTAL TO CSS (MGD)
-	0.00	0.00	0.00	1.17	1.17	0.00	0.00	0.37	0.37	1.53	0.00	0.00	0.00	0.00	1.53
-	0.10	1.26	0.00	1.17	1.17	0.34	0.00	0.37	0.37	1.53	0.15	0.00	0.00	0.00	1.53
-	0.11	1.43	0.00	1.17	1.17	0.39	0.00	0.37	0.37	1.53	0.17	0.00	0.00	0.00	1.53
-	0.13	1.62	0.00	1.17	1.17	0.44	0.00	0.37	0.37	1.53	0.19	0.00	0.00	0.00	1.53
-	0.20	2.52	0.00	1.17	1.17	0.69	0.00	0.37	0.37	1.53	0.30	0.00	0.00	0.00	1.53
-	1.00	12.58	0.00	1.17	1.17	3.45	0.00	0.37	0.37	1.53	1.51	0.00	0.00	0.00	1.53
-	2.00	25.16	0.00	1.17	1.17	6.89	0.00	0.37	0.37	1.53	3.01	0.00	0.00	0.00	1.53
3	2.15	27.04	0.00	1.17	1.17	7.41	0.00	0.37	0.37	1.53	3.24	0.00	0.00	0.00	1.53
6	2.89	36.35	0.00	1.17	1.17	9.96	0.00	0.37	0.37	1.53	4.35	0.00	0.00	0.00	1.53
12	3.61	45.41	0.00	1.17	1.17	12.44	0.00	0.37	0.37	1.53	5.43	0.00	0.00	0.00	1.53
24	4.39	55.22	0.00	1.17	1.17	15.13	0.00	0.37	0.37	1.53	6.61	0.00	0.00	0.00	1.53
60	5.12	64.40	0.00	1.17	1.17	17.64	0.00	0.37	0.37	1.53	7.71	0.00	0.00	0.00	1.53
60 - DEP	5.95	74.84	0.00	1.17	1.17	20.50	0.00	0.37	0.37	1.53	8.96	0.00	0.00	0.00	1.53

ASSUMPTIONS:

1) NO-BUILD: The CSS receives all sanitary flow generated from Sites A & B
The CSS receives all runoff from impervious areas in Sites A, B, & C.
The runoff from alll pervious areas flows directly to the waterbody.

2) BUILD: The CSS receives all sanitary flow generated from Sites A & B, but no runoff from Sites A , B, & C.
The runoff from Sites A, B, & C flows to the waterbody either directly or via the new storm sewer system.

*Ref: *Intensity/Duration/Frequency Rainfall Analysis, New York City and the Catskill Mountain Water Supply Reservoirs*, Vieux & Associates, Inc., April 4, 2006

Table 4. Hydraulic Modeling Results		**Volume (MG/yr)**			**CSO Events (Number/year)**		
Water Body	**Outfall**	**2007 Existing**	**2017 NoBuild**	**2017 Build**	**2007 Existing**	**2017 NoBuild**	**2017 Build**
Dutch Kills	BB-004	0.02	0.03	0.03	1	1	1
	BB-009	101.83	138.02	138.67	40	46	46
	BB-010	1.84	1.86	1.86	14	14	14
	BB-026	304.05	332.95	336.42	54	55	56
	BB-040	1.05	1.23	1.20	16	16	16
	BB-042	1.04	2.54	2.44	20	27	27
	Total CSO	***409.83***	***476.63***	***480.61***	***54***	***55***	***56***
Newtown Creek	BB-011	2.69	2.71	2.71	20	20	20
	BB-015	3.66	4.49	2.74	29	29	28
	BB-012	0.19	0.19	0.19	4	4	4
	BB-043	15.22	17.50	17.55	31	36	36
	BB-013	19.76	28.30	27.81	29	34	35
	BB-014	2.67	3.77	3.53	24	27	27
	Total CSO	***44.18***	***56.97***	***54.54***	***31***	***36***	***36***
East River	BB-016	1.18	1.87	1.73	18	22	22
	BB-017	1.58	1.68	1.65	20	20	20
	BB-044	0.11	0.44	0.32	2	11	8
	BB-018	0.92	0.99	0.96	16	16	16
	BB-019	0.05	0.09	0.07	2	3	2
	BB-020	0.02	0.02	0.02	0	1	0
	BB-021	25.77	27.14	27.12	32	33	34
	BB-022	0.47	0.61	0.55	8	9	8
	BB-023	20.00	21.16	21.08	25	26	26
	BB-024	43.90	45.56	45.50	27	27	28
	BB-025	8.63	9.09	9.07	27	28	28
	BB-027	7.87	8.11	8.11	29	30	30
	BB-028	305.30	313.33	313.71	36	36	36
	BB-029	92.26	95.65	95.72	28	29	29
	BB-030	11.67	11.84	11.85	36	36	36
	BB-031	24.25	24.62	24.66	37	37	37
	BB-045	0.00	0.00	0.00	0	0	0
	BB-046	8.57	8.84	8.85	33	33	33
	BB-033	6.79	6.93	6.94	31	31	31
	BB-032	4.30	4.45	4.45	25	28	28
	BB-034	179.20	184.50	184.50	46	47	47
	BB-035	3.63	3.75	3.75	33	33	33
	BB-036	8.44	8.57	8.57	31	31	31
	BB-037	1.10	1.13	1.13	9	9	9
	BB-038	6.92	7.21	7.22	35	36	36
	Total CSO	***762.92***	***787.58***	***787.50***	***46***	***47***	***47***
Bowery Bay low-level Total CSO		*1,217*	*1,321*	*1,323*	*54*	*55*	*56*
Bowery Bay low-level Flow to WPCP		13,285	16,168	16,695			

NOTES:
1) 2017 No-Build and Build scenarios sanitary flow is based on 120 MGD DWF for BB WPCP.
2) Totals may not appear to sum exactly due to rounding.
3) "CSO events" reflect a 12-hour interevent time and a minimum hourly flow of 0.004167 MG

Table 5. Hydraulic Modeling Results - Incremental Changes		Volume (MG/yr)		CSO Events (Number/year)	
Water Body	Outfall	2007 Existing to 2017 No Build	2017 Nobuild to 2017 Build	2007 Existing to 2017 No Build	2017 Nobuild to 2017 Build
Dutch Kills	BB-004	0.01	0.00	0	0
	BB-009	36.19	0.65	6	0
	BB-010	0.02	0.00	0	0
	BB-026	28.90	3.47	1	1
	BB-040	0.18	-0.04	0	0
	BB-042	1.50	-0.10	7	0
	Total CSO	***66.80***	***3.98***	***1***	***1***
Newtown Creek	BB-011	0.02	0.00	0	0
	BB-015	0.83	-1.74	0	-1
	BB-012	0.00	0.00	0	0
	BB-043	2.29	0.05	5	0
	BB-013	8.54	-0.49	5	1
	BB-014	1.10	-0.24	3	0
	Total CSO	***12.78***	***-2.43***	***5***	***0***
East River	BB-016	0.69	-0.13	4	0
	BB-017	0.11	-0.04	0	0
	BB-044	0.33	-0.13	9	-3
	BB-018	0.08	-0.04	0	0
	BB-019	0.04	-0.02	1	-1
	BB-020	0.00	0.00	1	-1
	BB-021	1.38	-0.02	1	1
	BB-022	0.13	-0.06	1	-1
	BB-023	1.16	-0.08	1	0
	BB-024	1.66	-0.06	0	1
	BB-025	0.46	-0.03	1	0
	BB-027	0.25	0.00	1	0
	BB-028	8.03	0.38	0	0
	BB-029	3.39	0.07	1	0
	BB-030	0.18	0.01	0	0
	BB-031	0.37	0.03	0	0
	BB-045	0.00	0.00	0	0
	BB-046	0.27	0.01	0	0
	BB-033	0.14	0.01	0	0
	BB-032	0.14	0.01	3	0
	BB-034	5.30	0.00	1	0
	BB-035	0.12	0.00	0	0
	BB-036	0.13	0.00	0	0
	BB-037	0.03	0.00	0	0
	BB-038	0.29	0.01	1	0
	Total CSO	***24.66***	***-0.08***	***1***	***0***
Bowery Bay low-level Total CSO		*104.25*	*1.48*	*1*	*1*
Bowery Bay low-level flow to WPCP		2,883.31	527.24		

NOTES:

1) 2017 No-Build and Build scenarios sanitary flow based on 120 MGD DWF for BB WPCP.
2) Totals may not appear to sum exactly due to rounding.
3) "CSO events" reflect a 12-hr interevent time and a minimum hourly flow of 0.004167 MG