APPENDIX D
Infrastructure

APPENDIX D.1

Technical Memorandum

Impact of the Proposed Domino Sugar Rezoning on Wet-Weather Discharges

TECHNICAL MEMORANDUM

IMPACT OF THE PROPOSED DOMINO SUGAR REZONING ON WET-WEATHER DISCHARGES

A. BACKGROUND

The Domino Sugar Rezoning (the proposed project) includes actions to facilitate the redevelopment of a vacant waterfront industrial site with public open space, a restored and adaptively used historic building, and new residential buildings with a substantial amount of affordable housing. The project site is located along the East River in the Williamsburg neighborhood of Brooklyn, New York (see Figure 1). As part of the project, a new sewer system would be constructed on the project site that would separate stormwater and sanitary sewage flow. The proposed project would also include the construction of two new stormwater outfalls to the East River on South 2nd and South 3rd Streets.

This technical memorandum summarizes the results of analyses performed by HydroQual to assess the potential impact of the proposed project on local sewers, as well as annual discharges of combined-sewer overflows (CSOs) and stormwater to the adjacent waterbodies, namely, the East River and Newtown Creek and its tributaries. Two analyses were performed for this assessment. The first analyzed the characteristics of the project site in existing conditions and in the future without ("No Build") and with the proposed project ("Build") implemented, to determine the flows that would be generated from the site for a variety of rainfall conditions. A second hydrologic/hydraulic modeling analysis of the Brooklyn portion of the Newtown Creek Water Pollution Control Plant (WPCP) sewershed (within which the project site is located) was undertaken to determine the potential impact on CSO and stormwater discharges.

The analyses conclude that the proposed project's new sanitary wastewater generation is anticipated to slightly increase CSO discharges to the East River and tributaries of Newtown Creek and but would result in reduced stormwater discharges into the City's combined sewer system. With the new storm sewers in place, a portion of stormwater from the site currently reaching the combined sewers would discharge directly to the river after receiving treatment from stormceptor units installed at the end of storm outfalls.

B. DESCRIPTION OF EXISTING SITE CONDITION

The project site, a total of approximately 11 acres, comprises Block 2414, Lot 1, which is located along the East River waterfront between Grand and South 5th Streets ("the waterfront parcel"), and Block 2428, Lot 1, which is located on the east side of Kent Avenue between South 3rd and South 4th Streets ("the upland parcel"). The project site (see Figure 1) is located entirely within Brooklyn Community District 1.

The project site is currently vacant and only a small security office contributes a negligible amount of sanitary wastewater to the combined sewer system. As described in Chapter 14, "Infrastructure," the majority of stormwater generated on the project site reaches the East River as overland runoff. Small portions of Sites A and D along with roof leaders draining towards Kent Avenue are tributary areas to the combined sewers, which constitute an estimated total drainage area of 1.09 acres.

C. DESCRIPTION OF PROPOSED PROJECT

For the proposed project, the 11-acre project site would be redeveloped as five separate blocks or parcels, Sites A through E, as well as the Refinery (see Figure 2). The proposed project would include the construction of new buildings along the waterfront on Sites A through D and on the upland parcel on Site E, as well as the restoration and adaptive reuse of the Refinery (see Figure 2). The proposed project would include the following uses: residential, retail, commercial, community facility, public open space, and accessory parking. It is anticipated that the project site would be developed with up to 2.44 million gross square feet (gsf) of residential space containing up to 2,400 dwelling units, 128,000 gsf of retail space, 99,000 gsf of commercial office space, and approximately 147,000 gsf of community facility space. The proposed project would provide approximately 4.06 acres of public open space that would include an esplanade along the water's edge, a large open lawn between the esplanade and Refinery that would highlight this restored historic structure, and new connections from the Kent Avenue that provide visual and physical access to the waterfront from all streets leading to the project site.

The proposed project would also include the construction of privately owned separate sanitary and storm sewers and two new stormwater outfalls to the East River on South 2nd and South 3rd Streets. Stormwater best management practices (BMPs) would also be implemented as part of the project. Runoff from impervious and pervious areas would be discharged via the proposed separate storm sewers to the East River after treatment. Drainage areas tributary to the two new outfalls are shown in Figure 3. Table 1 summarizes the distribution of pervious and impervious areas under existing/No Build and Build conditions, and the associated connectivity to combined sewers or overland pathways to the East River under existing conditions or to the future storm sewers under Build conditions.

D. ASSESSMENT OF EXPECTED CSO AND STORMWATER DISCHARGES

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 Newtown Creek Brooklyn WPCP service area. The Newtown Creek model was further modified to provide higher resolution of the buildings and sewer layout in the vicinity of project site. The InfoWorks model accounts for hydraulic considerations such as storage, travel time, head losses, and overflows from regulators. Therefore, it 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. The proposed project is currently anticipated for completion by 2020. 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 in Table 2 and described herein.

2. **2020 No Build** – the sanitary flow rates are adjusted upward from existing conditions to account for the Department of Environmental Protection (DEP) projected population increases. In addition, an incremental increase in sanitary flow rate of 2.4 million gallons per day (mgd) is included, to account for the recent Greenpoint-Williamsburg rezoning project approved by the Department of City Planning for construction completion by 2013. The flow rate for 2020 was taken as 234.8 mgd for the entire Newtown Creek WPCP; this increase was projected throughout the Manhattan and Brooklyn portions of the Newtown Creek drainage area. The flow corresponding to the Brooklyn portion, approximately 91.6 mgd, was used in the analysis presented herein. See Section G, "Additional Modeling Backup," for more information regarding the No Build assumptions.

3. **2020 Build** – similar to Item 2 above with conditions updated to reflect completion of the proposed project (as shown in Figure 2). As noted in Chapter 14, "Infrastructure," an additional 0.8 mgd of sanitary sewage would result from the proposed project. To be consistent with the analyses in Chapter 14, "Infrastructure," air conditioning load of approximately 0.4 mgd is not included in this analysis. As part of the proposed project, an estimated 1.09 acres of the project site currently discharging to the combined sewer system would be directed to the new storm sewers to be constructed along South 2nd and South 3rd Streets.

E. DISCUSSION OF SEWER SYSTEM MODELING

The project site is located in the Newtown Creek Brooklyn drainage area. Combined sewers in this drainage area are controlled by 22 regulators. In addition, there is a sanitary pump station in Maspeth on 49th Street and another storm pump station in the Glendale area in the Brooklyn portion. There are no pumping stations between the project site and WPCP influent location, along the Kent Avenue Interceptor. The outfalls are located along the banks of the East River, Newtown Creek, and its tributary waterbodies—English Kills, Maspeth Creek, and Wallabout Channel. Given the existing (2007) infrastructure and operations and an annual rainfall pattern causing average CSO discharges across New York City (the 1988 JFK rainfall record, which the City has adopted for planning simulations in the CSO Long Term Control Planning [LTCP] project and other studies), these CSOs are projected to discharge during 64 wet-weather CSO "events" a total of 178.4 million gallons per year (mg/yr) to the East River, 588.6 mg/yr to Newtown Creek, 240.1 mg/yr to English Kills, 243.4 mg/yr to Maspeth Creek, and 308.9 mg/yr to the Wallabout Channel.

While the proposed project would increase sanitary flows by 0.8 mgd, it would also divert stormwater from the 1.09 acre drainage area to the two new outfalls and, therefore, would alleviate some burden on the combined sewer's capacity during wet weather. Though the increased sanitary flows would be relatively constant, the reduced stormwater flows 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 during smaller storms. The incremental change to sewer capacity and CSOs depends both on the amount of additional sanitary flow and the size of the storms that are experienced.

Table 2 provides the model-calculated discharge volumes and frequencies for each CSO in the Newtown Creek Brooklyn service area, for each scenario. CSO outfalls are grouped by receiving waterbody, for which overall total volume and frequency discharge information is summarized. The relevant incremental differences between scenarios are provided in Table 3.

As shown in Table 3, the 2020 Build scenario would increase CSO volume from the entire Brooklyn sewershed by a total of 2.3 mg/yr versus the No Build scenario. CSO discharges to the East River, Newtown Creek, English Kills, Maspeth and Wallabout channel are expected to increase by 1.3 mg/yr, 0 mg /yr, 0.1 mg /yr, 0 mg /yr and 0.9 mg /yr, respectively. These predicted changes are very small relative to the total annual discharge—an overall increase of about 0.1 percent in CSO volume from the Newtown Creek Brooklyn sewershed, 0.69 percent change for East River, 0.04 percent change for English Kills, less than 0.3 percent change for Wallabout Channel and no change at all for Newtown Creek and Maspeth Creek.

The incremental impact of the proposed project on CSOs at individual outfalls varies (see Table 3). Due to the specific hydraulic conditions in the sewer system, one of the largest impacts does not necessarily occur at the outfall located closest to the project site. The largest difference occurs at outfall NC-014, located approximately 0.5-miles south of the project site (see Figure 4), where the CSO volume is expected to increase by 0.8 mg /yr (a 0.27 percent change).

Table 2 also presents the number of CSO events that are expected to occur annually in each modeled scenario at each outfall. As shown in Table 3, some outfalls are expected to discharge one more time during the year in the Build scenario versus the No Build scenario. Overall, the number of CSO events affecting the East River, Newtown Creek, English Kills, Maspeth and Wallabout Channel are expected to remain the same at 39/yr, 66/yr, 31/yr, 47/yr, and 28/yr, respectively, between the No Build and Build scenarios.

The analyses also indicate that there would be a slight decrease in the amount of stormwater entering the East River, of 0.2 mg /yr as a result of a decrease in impervious cover under the Build condition. Impervious cover for 96% of the site was assumed for the Existing/No Build scenarios; 83% was estimated for the Build scenario. Due to the proposed landscaped areas and tree pits, pervious cover of the project site increased from 4% to 17% in the Build scenario.

Table 4 presents the other wet weather discharges—stormwater discharges—and indicates that the overall stormwater volume discharged to the receiving waters through separate storm outfalls is approximately 460.8 mg /yr.

F. SUMMARY OF RESULTS

The modeling analysis indicates that, given the hourly rainfall record (JFK 1988) that is consistent with an average annual hydrologic conditions in the New York City metropolitan area, the proposed project would increase discharged CSO volumes by 2.3 mg /yr overall, a small change of approximately 0.1 percent versus the No Build scenario.

On a waterbody-by-waterbody basis, CSO volumes to Newtown Creek and Maspeth Creek are expected to remain the same, and to increase by 1.3 mg /yr, 0.1 mg /yr, and 0.9 mg /yr to the East River, English Kills, and Wallabout Channel, respectively. In each case, the changes between the No Build and Build conditions are very small relative to the total annual discharges. On an outfall-by-outfall basis, the CSO from outfall NC-008 located immediate downstream of the project site (see Figure 4) discharging to the East River would be expected to increase by 0.6 mg /yr. Another outfall adjacent to the project site, NC-012, would experience an annual increase of 0.6 mg. The annual overflow increases at the outfalls are very marginal, with NC-014 being the biggest with 0.8 mg/yr difference between the No Build and Build conditions.

In addition, as noted in Table 3, the analyses indicate that there would be a slight decrease in the amount of stormwater entering the East River—0.2 mg /yr as a result of a decrease in impervious cover for the Build condition.

G. ADDITIONAL MODELING BACKUP

The following provides detailed information regarding the sewer system modeling framework and methodology used in the analyses summarized above.

Sewer-System Modeling Methodology and Modeling Inputs

This section describes the methodology and inputs used for the sewer-system modeling. The modeling framework, model versions used, and modifications made to assess the proposed project are discussed. Inputs to the model include future dry-weather (sanitary) sewage flow rates in the Newtown Creek Brooklyn sewer system, estimates of the project dry-weather (sanitary) sewage flow contributions, and wet-weather inputs to the combined sewer system for conditions with and without the.

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 (LTCP) project. The version 7.5 used in the LTCP project was also used in this analysis.

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, orifices, 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 Newtown Creek WPCP service area are dependent on both regulator /branch interceptor capacities and on the hydraulic gradient line (HGL) in the interceptors. The HGLs represent the estimated maximum water levels at individual manholes or pipe segments, and reflect the extent of surcharging conditions in the sewer infrastructure.

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.

<u>Application of InfoWorks to the Newtown Creek WPCP Drainage Area</u>

As noted above, the DEP had selected InfoWorks for all facility-planning analyses performed as part of the CSO LTCP project. During 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 ("City-Wide Long Term CSO Control Planning Project, Landside Modeling Report, Volume 6, Newtown Creek WPCP, Final, October 2007, NYC DEP") created for each WPCP drainage area model. This analysis employed the latest available version of Newtown Creek Brooklyn model (March 2008, as calibrated to calendar year 2007 flows at the Newtown Creek WPCP). The 2007 existing condition simulations are based upon this model.

To project the future dry-weather sanitary flow rates for the 2020 build year, expected increases in flow rates from current (calendar year 2007) rates were determined based on planning-level population and water-use projections made by the New York City Department of City Planning.[1] Based on these values, the 2020 average dry-weather (sanitary) sewage flow rate used in this analysis is 234.8 mgd for the entire Newtown Creek WPCP drainage area. The Newtown Creek Brooklyn sewershed represents 39 percent of the total, or 91.57 mgd. This compares to approximately 87 mgd in calendar year 2007.

[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.

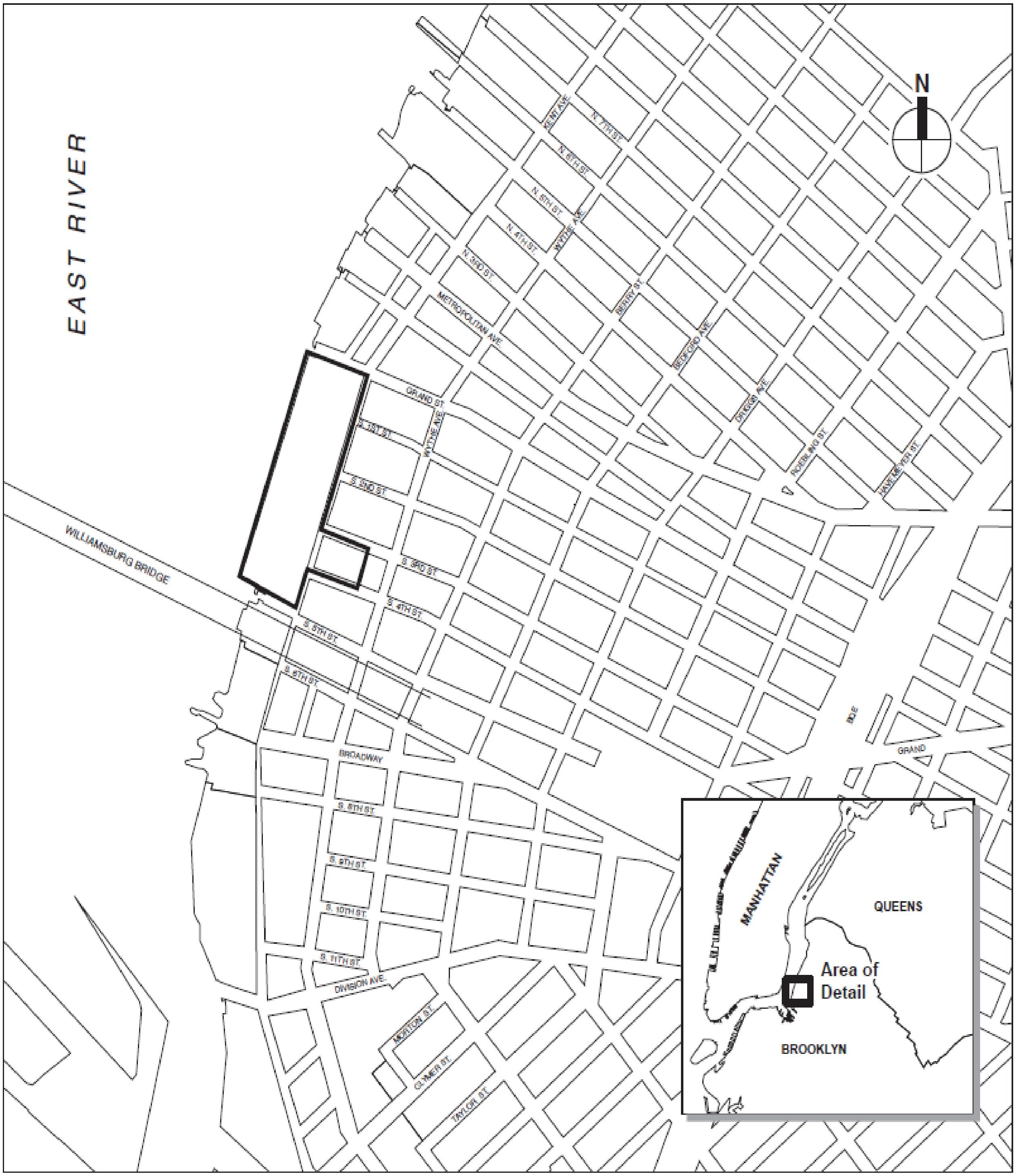
Incorporation of Project Site into the InfoWorks Model

The proposed project is located within and could impact the Newtown Creek WPCP sewer system service area. The project site is shown in Figure 1. To analyze the potential impacts of the proposed project on the sewer system and the receiving water bodies, the resolution of the Newtown Creek Brooklyn sewer system model was modified to include the project site and individual roof areas as well as other impervious and pervious areas in detail. Four original subcatchments were discretized into a higher-resolution representation of 23 subcatchments, with the project site modeled as its own subcatchment. The project site is approximately 11 acres. It is served by combined and interceptor sewers that flow toward the Newtown Creek WPCP. During wet weather events, CSO is diverted by Regulator RO6A into the East River. The site currently includes buildings, vegetated area, paved areas, and roadways. Stormwater runoffs from these areas of the site currently flow overland to the East River or infiltrate into the subsurface soils in the undeveloped portions.

Therefore, water consumption, sewage generation, waste water flows, stormwater runoff, and CSO volumes at the outfalls are not expected to change significantly from existing conditions to the future No Build scenario. Assuming a nominal commercial and industrial use in the project site, approximately 42,905 gpd of sanitary flow is assumed to be generated in 2020 in the future No Build condition (see Table 14-1 in Chapter 14, “Infrastructure.”)

The NYCDEP wastewater dry weather flows to the Newtown Creek WPCP are projected to be approximately 234.8 mgd in 2020. In the Build scenario, the project site remains 11 acres. The proposed infrastructure and drainage design plan would include separate storm and sanitary sewer systems. Stormwater generated on the project site would be collected from individual parcels, sidewalks, park areas, waterfront area and roadways and discharged into the East River via the two new proposed storm sewer outfalls. Figure 3 shows the project site delineation, with the drainage areas for two storm outfalls on South 2nd and 3rd Streets including the pervious and impervious covers. All stormwater from Sites A, B, C, D and the Refinery building would be connected to the proposed stormwater outfalls in South 2nd and South 3rd Streets (referred to as North and South outfalls, respectively). Stormwater from Sites A, B and part of the Refinery area, which is the north portion of the site, shown in blue cross-hatch in Figure 3, would drain to the South 2nd Street outfall. Stormwater from Site C, D, and remaining part of the Refinery area, which is the south portion of the site, shown in red cross-hatch in Figure 3, would drain to the South 3rd Street outfall. The two new outfalls would be privately owned by the developer and designed with stormceptor units to provide pollutant capture for solids, floatables and other particulate pollutants. All sanitary flow from these sites would be connected to the existing combined sewers in Kent Avenue, Grand Street and/or South 5th Street.

Site E along with the sidewalks on Kent Avenue currently drain to the combined sewer system and would continue to drain to the combined system in the future No Build and Build conditions. For Site E, the essential differences in stormwater runoff between No Build and Build scenarios include tree pits that provide a very small pervious cover and detention in accordance with the DEP requirements. Finally, the evapotranspiration (ET) provided by evergreen and other tree canopies can vary seasonally and has not been explicitly included in the analysis. During non-winter months, this loss can be significantly higher than the annual average pan evaporation of 0.1 inches/day in the New York City metropolitan area.



Project Site Boundary and Area of General Large Scale Plan

Figure 1. Domino Sugar Project Site – Existing and Future No Build Conditions

Figure 2. Domino Sugar rezoning Project Site – Proposed (Future Build) Condition

Figure 3: Delineation of the Proposed Site Development

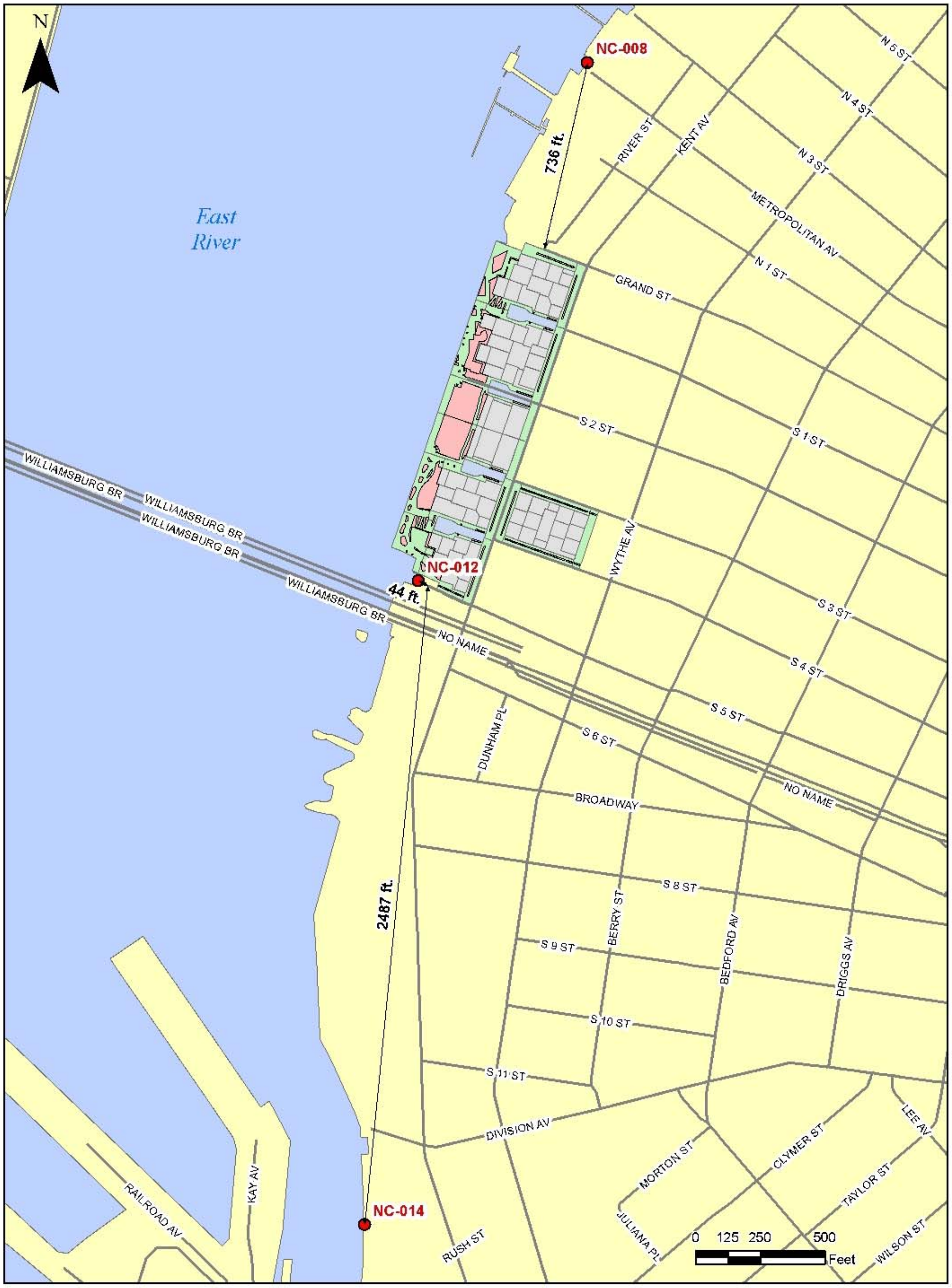


Figure 4: Locations of Outfalls Nearest to the Project Site

Table 1. Site-scale Drainage Areas and Connectivity to Combined/Separate Sewers

Site ID/ Description	Total Area (acres)	Existing 2007/Nobuild 2020						Build 2020				
		Pervious (ac)	Impervious (ac)	% Pervious	% Impervious	Combined Sewered Area (ac)	Overland Flow Area (ac)	Combined Sewered Area (ac)	Pervious to 2 New Outfalls (ac)	Impervious to 2 New Outfalls (ac)	% Pervious	% Impervious
A	1.90	0.01	1.89	4	96	0.39	1.51	0	0.16	1.74	8	92
B	2.25	0.01	2.24	4	96	0.18	2.07	0	0.33	1.93	14	86
C	1.94	0.00	1.94	4	96	0.13	1.81	0	0.25	1.70	13	87
D	1.46	0.00	1.46	4	96	0.18	1.29	0	0.14	1.32	10	90
E	1.74	0.00	1.74	4	96	1.74	0.00	1.74	0.00	0.00	3	97
Refinery	2.25	0.00	2.25	4	96	0.22	2.03	0	0.79	1.46	35	65
Sidewalks Along Kent Avenue	1.57	0.00	1.57	4	96	1.57	0	1.57	0	0	6	94
Sidewalk Along Grand Avenue	0.2	0.00	0.20	4	96	0.2	0	0.2	0	0	9	91
Sidewalk Along So. 5th Street	0.09	0.00	0.09	4	96	0.09	0	0.09	0	0	13	87

Table 2. Results from Hydraulic Analyses

WaterBody	Outfall	Volume (MG) 2007 Existing	Volume (MG) 2020 NoBuild	Volume (MG) 2020 Build	CSO events (number/year) 2007 Existing	CSO events (number/year) 2020 NoBuild	CSO events (number/year) 2020 Build
East River Outfalls	**NC-012**	24.4	25.0	25.6	25	25	25
	NC-010	0.0	0.0	0.0	0	0	0
	NC-006	84.3	90.0	90.1	25	26	26
	NC-007	8.7	9.5	9.5	33	34	34
	NC-008	22.5	23.7	24.3	35	36	37
	NC-082	0.0	0.0	0.0	0	0	0
	NC-004	17.4	18.3	18.3	39	39	39
	NC-003	0.4	0.4	0.4	8	8	8
	NC-027	19.9	20.2	20.2	36	36	36
	NC-026	0.3	0.3	0.3	5	5	5
	NC-025	0.6	0.6	0.6	14	14	14
	NC-024	0.0	0.0	0.0	0	0	0
	Total CSO	***178.4***	***188.0***	***189.3***	***39***	***39***	***39***
Newtown Creek outfalls	**NC-021**	0.0	0.0	0.0	0	0	0
	NC-019	0.5	0.5	0.5	5	5	5
	NC-029	18.9	19.0	19.0	45	46	46
	NC-083	562.1	569.1	569.1	64	66	66
	NC-023	0.3	0.3	0.3	5	5	5
	NC-022	6.8	7.1	7.1	34	35	35
	Total CSO	***588.6***	***596.0***	***596.0***	***64***	***66***	***66***
English Kills	**NC-015**	240.1	243.8	243.9	31	31	31
	Total CSO	**240.1**	**243.8**	**243.9**	**31**	**31**	**31**
Maspeth	**NC-077**	243.4	245.9	245.9	47	47	47
	Total CSO	**243.4**	**245.9**	**245.9**	**47**	**47**	**47**
Wallabout Channel	**NC-014**	279.7	288.9	289.7	27	28	28
	NC-013	29.1	29.9	30.0	24	25	26
	Total CSO	**308.9**	**318.8**	**319.7**	**27**	**28**	**28**
Newtown Creek (Brooklyn) Total CSO		1559.4	1592.5	1594.8	64	66	66
Newtown Creek (Brooklyn) Flow to WPCP		35286.3	37812.8	38104.7	-	-	-

NOTES:

1) Totals may not appear to sum exactly due to rounding.

2) "CSO events" reflect a 12-hour interevent time and a minimum hourly flow of 0.004167 MG

Table 3. Results of Hydraulic Analyses - Incremental Changes					
WaterBody	Outfall	CSO Volume		Overflow Events	
		2007 Existing to 2020 No Build	2020 NoBuild to 2020 Build	2007 Existing to 2020 No Build	2020 NoBuild to 2020 Build
East River Outfalls	**NC-012**	0.6	0.6	0	0
	NC-010	0.0	0.0	0	0
	NC-006	5.7	0.1	1	0
	NC-007	0.8	0.0	1	0
	NC-008	1.2	0.6	1	1
	NC-082	0.0	0.0	0	0
	NC-004	0.8	0.0	0	0
	NC-003	0.0	0.0	0	0
	NC-027	0.4	0.0	0	0
	NC-026	0.0	0.0	0	0
	NC-025	0.0	0.0	0	0
	NC-024	0.0	0.0	0	0
	Total CSO	9.6	1.3	0	0
Newtown Creek outfalls	**NC-021**	0.0	0.0	0	0
	NC-019	0.0	0.0	0	0
	NC-029	0.1	0.0	1	0
	NC-083	7.0	0.0	2	0
	NC-023	0.0	0.0	0	0
	NC-022	0.3	0.0	1	0
	Total CSO	7.4	0.0	2	0
English Kills	**NC-015**	3.7	0.1	0	0
	Total CSO	3.7	0.1	0	0
Maspeth	**NC-077**	2.4	0.0	0	0
	Total CSO	2.4	0.0	0	0
Wallabout Channel	**NC-014**	9.2	0.8	1	0
	NC-013	0.7	0.1	1	1
	Total CSO	9.9	0.9	1	0
Newtown Creek (Brooklyn) Total CSO		33.1	2.3	2	0
Newtown Creek (Brooklyn) Flow to WPCP		2526.5	291.8	-	-

NOTES:

1) Totals may not appear to sum exactly due to rounding.

2) "CSO events" reflect a 12-hour interevent time and a minimum hourly flow of 0.004167 MG

Table 4. Annual Stormwater Discharges (MG)

Outfall	Water Body	2020 No Build	2020 Build
Discharges from Outfalls with SPDES Permits in the NC Brooklyn Drainage Area			
NC-631	Newtown Creek	46.5	46.5
NC-632	Newtown Creek	43.2	43.2
NC-506	Newtown Creek	8.9	8.9
NC-513	East River	12.9	12.9
NC-510	Newtown Creek	13.9	13.9
NC-511	Newtown Creek	20.0	20.0
NC-514	Newtown Creek	20.3	20.3
NC-624	Newtown Creek	1.5	1.5
NC-629	English Kills	52.0	52.0
NC-625	English Kills	7.1	7.1
Discharges from Other Direct Drainage Areas (drainage infrastructure is unknown) in NC Brooklyn Drainage Area			
Direct Drainage		225.4	225.4
Domino Sugar Redevelopment Site			
NC--61*	East River	9.4	-
New outfalls on So. 2nd and So. 3rd Streets	East River	-	9.2
Total Stormwater		461.0	460.8
*Overland flow from this site into East River under existing conditions is shown with this arbitrary outfall number			

APPENDIX D.2

Technical Memorandum

Impact of the Domino Sugar Rezoning Receiving Water Impacts

TECHNICAL MEMORANDUM

**IMPACT OF THE DOMINO SUGAR REZONING
RECEIVING WATER IMPACTS**

A. BACKGROUND

The Domino Sugar Rezoning (the proposed project) includes actions to facilitate the redevelopment of a vacant waterfront industrial site with public open space, a restored and adaptively used historic building, and new residential buildings with a substantial amount of affordable housing. The project site is located along the East River in the Williamsburg neighborhood of Brooklyn, New York. This technical memorandum summarizes the results of analyses performed by HydroQual to assess the potential impacts on water quality of the proposed project's sanitary wastewater flows, as well as annual discharges of combined-sewer overflows (CSOs) to the adjacent waterbodies, namely, the East River and Newtown Creek. The water quality analysis incorporates results of other analyses conducted by HydroQual to assess the potential increase in amount of CSOs and stormwater discharges from the proposed project, which is summarized in the technical memorandum "THE IMPACT OF DOMINO SUGAR REZONING ON WET-WEATHER DISCHARGES."

B. ASSESSMENT OF WATER-QUALITY IMPACTS

Changes in pollutant loadings can impact water quality in the receiving waters in proximity to the discharge point and/or at locations that are removed from the discharge points. The interaction of the many physical, chemical, and biological factors can be complex, and water-quality impacts can be assessed most accurately using water-quality modeling methods. As part of New York City Department of Environmental Protection (DEP) projects such as the CSO Long-Term Control Plan, HydroQual has developed a number of water-quality models that focus on various geographical regions. One of these models, the Newtown Creek Model (NCM), is well suited to assess the potential water-quality impacts associated with the proposed project. NCM was used to simulate water-quality for the three scenarios: 2007 existing conditions, future conditions without the proposed project ("No Build"), and future conditions with the proposed project implemented ("Build").

C. NEWTOWN CREEK WATER QUALITY MODEL

NCM is a high-resolution model grid encompassing Newtown Creek and a portion of the East River. (See inset in Page 1). NCM's hydrodynamic capabilities enable it to determine the circulation of water throughout the regions by incorporating the effects of tidal interactions and freshwater inputs from WPCPs, CSOs, storm sewers, and natural tributaries, and its water-quality capabilities allow us to determine the additional effects of chemical and biological processes on concentrations of dissolved oxygen, phytoplankton, nutrients, pathogens, and a host of other pollutants. Conditions at NCM's boundaries are assigned based on calculations using the System-Wide Eutrophication Model (SWEM), which is similar to NCM in many respects, but covers a larger geographic area and has lower-resolution internal segmentation.

NCM is currently configured to represent ambient conditions (e.g., circulation, flow, temperature, and stratification) for the accepted baseline rainfall conditions (JFK -1988). In addition to representing an average year with respect to CSO discharges as described above, 1988 also includes significant storms in both the critical summer and winter seasons. The JFK - 1988 rainfall pattern has been chosen as the base year for DEP's Use and Standards Attainment and Long Term CSO Control Plan projects for all of New York City; has been used as the base year for the Long Island Sound Total Maximum Daily Load (TMDL); and is being used as the base year for New York Harbor nutrient and pathogen TMDLs. As part of these projects, NCM inputs have been developed for a number of different scenarios, representing both existing and projected future conditions.

Using the pollutant discharge information developed by the InfoWorks landside modeling framework as input for the Newtown Creek WPCP and Bowery Bay Low Level drainage areas, the NCM model was used to determine the potential impacts of incremental changes in the pollutant loads associated with the proposed project on water quality in the receiving waters of Newtown Creek and tributaries and the East River.

D. IMPACT ASSESSMENT

The potential impacts of the proposed project on water quality in the receiving waterbodies (the East River and Newtown Creek/tributaries) were assessed using the NCM water-quality model described above. Based on the pollutant loadings described in a separate technical memorandum (The Impacts of Domino Sugar Rezoning on Wet-Weather Discharges), NCM was used to calculate the incremental change in water quality throughout the receiving waterbodies as the difference in calculated water quality projected for the No Build and the Build conditions. For all parameters of concern, including dissolved oxygen, an indicator pathogen, nutrients (i.e., total nitrogen and total phosphorus), and selected metals (copper, lead, and zinc), the project-induced incremental changes in water quality was then assessed relative to the existing water-quality conditions as measured in ambient sampling studies to determine whether the changes are significant.

Water-quality data included sampling recently performed by DEP as part of the Harbor Survey and other special studies at locations in the East River and Newtown Creek. In addition to DEP's Harbor Survey ambient sampling data, metals concentrations collected in the vicinity as part of the U.S. Environmental Protection Agency (EPA) sampling program in 1991 (the most recent extensive study of heavy metals) is tabulated. Because the simulations were continuous over a 12-month simulation period, incremental changes were based upon critical times during the simulation.

The incremental changes for the constituents were based on unit responses of the models from the potential sources that are impacted by the proposed project. These sources include the Newtown Creek WPCP effluent, the combined sewer sanitary fraction, the combined sewer stormwater fraction, and the stormwater discharges (from direct runoff and/or separate storm sewers). Each of these components has a certain discharge rate for both baseline and future conditions. For this analysis, these substances is assumed to be conservative and not subject to losses associated with settling, decay, reaction, or partitioning. As a result, the unit response to a source may be linearly interpolated to any desired concentration.

Impacts of Newtown Creek WPCP on Water Quality

After analyzing the changes in the Newtown Creek WPCP mass discharges for the expected No Build and Build flow increases, model inputs were developed for the water quality model. Table 1 shows the assumed effluent concentrations used in the analysis based on 2007 Newtown Creek effluent data.

Table 1 Newtown Creek Effluent Quality

Effluent Constituent	Newtown Creek WPCP Effluent Constituent Concentration
BOD-5	27 mg/L
Total Suspended Solids (TSS)	27 mg/L
Total Nitrogen (TN)	19 mg/L
Total Phosphorus (TP)	2.5 mg/L
Copper (Cu)	28 g/l
Zinc (Zn)	72 g/l
Lead (Pb)	3.7 g/l

The water quality model was executed to identify the unit impacts of an increase in the effluent flow for the No Build and Build conditions. The model was run for a 365-day period so that a range of environmental conditions could be experienced in the East River and the rest of NY/NJ Harbor. The effluent concentrations were held constant as noted in the table above during this simulation period. The model output was then searched to find the day of the year that showed the highest impact of the increased loading. These incremental values are shown in Table 2 below with the existing water quality. All water quality constituents show an increase in concentration except for dissolved oxygen concentration, which decreases, as expected.

Table 2 Calculated Changes in East River Water Quality

Water Quality Constituent	Change in East River Concentrations (No Build – Existing)	Change in East River Concentrations (Build – No Build)	Approximate Existing Water Quality
Dissolved Oxygen	-0.0016 mg/L	-0.0004 mg/L	0.3 – 8.5 mg/L
BOD-5	+0.0098 mg/L	+0.0022 mg/L	2.3 mg/L
Enterococci	+0.0091 No./100mL	+0.0021 No./100mL	100 – 1000 No./100mL
Total Suspended Solids (TSS)	+0.0098 mg/L	+0.0022 mg/L	10.0 mg/L
Total Nitrogen (TN)	+0.0069 mg/L	+0.0015 mg/L	1.0-1.5 mg/L
Total Phosphorus (TP)	+0.0009 mg/L	+0.0002 mg/L	0.1- 0.2 mg/L
Copper (Cu)	+0.0101 g/l	+0.0022 ug/L	2 – 5 ug/L
Zinc (Zn)	+0.0262 g/l	+0.0058 ug/L	8 – 10 ug/L
Lead (Pb)	+0.0013 g/l	+0.0003 ug/L	0.1 – 2.0 ug/L

The results of the analyses indicate water quality concentrations changes associated with the increase dry weather sewage effluent flow are small and likely undetectable using current water quality measuring techniques; the changes that are calculated are generally three orders of magnitude (a factor of 1000) below existing conditions. It would not be expected that changes this small would cause or contribute to violations of water quality standards.

Impact of CSO/SW Changes on Water Quality

The sewer system modeling analysis indicates that the proposed project would increase discharged CSO volumes by 2.3 million gallons (mg)/yr overall, a small change of approximately 0.1 percent versus the No Build scenario. On a waterbody-by-waterbody basis, CSO volumes to the Newtown Creek and Maspeth are expected to remain same, and are expected to increase by 1.3 mg/yr, 0.1 mg/yr and 0.9 mg/yr to East River, English Kills, and Wallabout Channel, respectively. In each case, these predicted changes are very small relative to the total annual discharge. On an outfall-by-outfall basis, there are a few CSO outfalls where the annual overflows will increase marginally, with NC-014 being the biggest with 0.8 mg/year difference between the No Build and Build conditions.

In addition, the analyses indicate that there would be a slight reduction in the amount of stormwater entering the East River in the amount of 0.2 mg/yr as a result of the fact that more pervious area is being planned as part of the proposed project.

The water quality assessment applied these small incremental flow increases to NCM to calculate potential water quality impacts at the No Build and Build scenarios. For all parameters considered, the calculated incremental impacts were less than *six* orders of magnitude (a factor of one million) below existing conditions and therefore are not considered measurable or significant. Therefore, the proposed project would not result in a significant adverse impact in terms of water quality in East River, Newtown Creek and its tributaries.