A. INTRODUCTION

This chapter assesses the potential for the Proposed Action to result in incremental shadows long enough to reach any nearby publicly accessible open spaces or other sunlight-sensitive resources. According to the 2021 *City Environmental Quality Review* (CEQR) *Technical Manual*, a shadows assessment is required if a proposed action would result in structures (or additions to existing structures) of 50 feet in height or greater, or those that would be located adjacent to, or across the street from, a sunlight sensitive resource. As discussed in **Chapter 1, "Project Description,"** the Proposed Action would facilitate the development of a building that would be taller than 50 feet, located adjacent to several sunlight-sensitive resources. As such, a detailed shadows analysis was prepared in accordance with *CEQR Technical Manual* guidance to determine the potential for the Proposed Action to result in significant adverse impacts on sunlight-sensitive resources.

B. PRINCIPAL CONCLUSIONS

The Proposed Action would result in incremental shadow coverage (i.e., additional, or new, shadow coverage) on three open space resources: Roberto Clemente Ballfield, Epiphany Playground, and public housing grounds within the New York City Housing Authority's (NYCHA's) Independence Towers, and one natural resource, the East River including its associated waterbody Wallabout Channel. Project-generated shadows would not affect the utilization, enjoyment, or character of these sunlight-sensitive resources and all vegetation would continue to receive a minimum of six to eight hours of direct sunlight throughout the growing season. Additionally, project-generated shadows would not have any adverse impacts on the aquatic biota in the East River.

C. METHODOLOGY

According to the *CEQR Technical Manual*, the longest shadow a structure will cast in New York City, except for periods close to dawn or dusk, is 4.3 times its height. For projects or actions resulting in structures less than 50 feet tall, a shadow assessment is generally not necessary, unless the site is adjacent to a park, historic resource, or important natural feature (if the feature that makes the structure significant depends on sunlight).

First, a preliminary screening assessment must be conducted to ascertain whether shadows resulting from a project could reach any sunlight-sensitive resource at any time of year. The *CEQR Technical Manual* defines sunlight-sensitive resources as those resources that depend on sunlight or for which direct sunlight is necessary to maintain the resource's usability or architectural integrity. The following are considered to be sunlight-sensitive resources:

- *Public open space* (e.g., parks, playgrounds, plazas, schoolyards, greenways, and landscaped medians with seating). Planted areas within unused portions or roadbeds that are part of the Greenstreets program are also considered sunlight-sensitive resources. The use of vegetation in an open space establishes its sensitivity to shadows. This sensitivity is assessed for both (1) warm-weather dependent features, like wading pools and sandboxes, or vegetation that could be affected by loss of sunlight during the growing season (i.e., March through October); and (2) features, such as benches, that could be affected by a loss of winter sunlight. Uses that rely on sunlight include: passive use, such as sitting or sunning; active use, such as playfields or paved courts; and such activities as gardening, or children's wading pools and sprinklers. Where lawns are actively used, the turf requires extensive sunlight. Vegetation requiring direct sunlight includes the tree canopy, flowering plants, and plots in community gardens. Generally, six to eight hours a day of sunlight, particularly in the growing season, is a minimum requirement.

- *Features of historic architectural resources that depend on sunlight for their enjoyment by the public*. Only the sunlight-sensitive features are considered, as opposed to the entire architectural resource. Sunlight-sensitive features include the following: design elements that are part of a recognized architectural style that depends on the contrast between light and dark (e.g., deep recesses or voids, such as open galleries, arcades, recessed balconies, deep window reveals, and prominent rustication); elaborate, highly carved ornamentation; stained glass windows; exterior building materials and color that depend on direct sunlight for visual character (e.g., the polychromy [multicolored] features found on Victorian Gothic Revival or Art Deco façades); historic landscapes, such as scenic landmarks, including vegetation recognized as an historic feature of the landscape; and structural features for which the effect of direct sunlight is described as playing a significant role in the structure's importance as an historic landmark.

- *Natural resources where the introduction of shadows could alter the resource's condition or microclimate.* Such resources could include surface water bodies, wetlands, or designated resources, such as coastal fish and wildlife habitats.

The preliminary screening assessment consists of three tiers of analysis. The first tier determines a simple radius around the proposed building(s) representing the longest shadow that could be cast. If there are sunlight-sensitive resources within the radius, the analysis proceeds to the second tier, which reduces the area that could be affected by project-generated shadows by accounting for a specific range of angles that can never receive shade in New York City due to the path of the sun in the Northern Hemisphere. If the second tier of analysis does not eliminate the possibility of new shadows on sunlight-sensitive resources, a third tier of screening analysis further refines the area that could be reached by new shadows by looking at specific representative days of the year and determining the maximum extent of shadow over the course of each representative day. If the third tier of analysis does not eliminate the possibility of new shadows on sunlight-sensitive resources, a detailed shadow analysis is required to determine the extent and duration of the incremental shadow resulting from the project.

In accordance with the *CEQR Technical Manual*, shadows on sunlight-sensitive resources of concern are modeled for four representative days of the year. For the New York City area, the

months of interest for an open space resource encompass the growing season (i.e., March through October) and one month between November and February representing a cold-weather month (usually December). Representative days for the growing season are generally the March 21st vernal equinox (or the September 21st autumnal equinox, which is approximately the same), the June 21st summer solstice, and a spring or summer day halfway between the summer solstice and equinoxes, such as May 6th or August 6th (which are approximately the same). For the cold-weather months, the December 21st winter solstice is included to demonstrate conditions when open space users rely most heavily on available sunlight warmth. As these months and days are representative of the full range of possible shadows, they are also used for assessing shadows on sunlight-sensitive historic and natural resources.

The *CEQR Technical Manual* defines the temporal limits of a shadow analysis period to fall from an hour and a half after sunrise to an hour and a half before sunset.

The detailed analysis provides the data needed to assess the shadow impacts. The effects of the new shadows on the sunlight-sensitive resources are described, and their degree of significance is considered. The result of the analysis and assessment are documented with graphics, a table of incremental shadow durations, and narrative text. As described in the *CEQR Technical Manual*, an incremental shadow is generally not considered significant when its duration is no longer than ten minutes at any time of year and the resource continues to receive substantial direct sunlight. A significant shadow impact generally occurs when an incremental shadow of ten minutes or longer falls on a sunlight-sensitive resource and results in one of the following:

- *Vegetation:* a substantial reduction in sunlight available to sunlight-sensitive features of the resource to less than the minimum time necessary for its survival (when there would be sufficient sunlight in the future without the project), or a reduction in direct sunlight exposure where the sensitive feature of the resource is already subject to substandard sunlight (i.e., less than the minimum time necessary for its survival).

- *Historic and cultural resources:* a substantial reduction in sunlight available for the enjoyment or appreciation of the sunlight-sensitive features of an historic or cultural resource.

- *Open space utilization:* a substantial reduction in the usability of open space as a result of increased shadow, including information regarding anticipated new users and the open space's utilization rates throughout the affected time periods.

- *For any sunlight-sensitive feature of a resource:* complete elimination of all direct sunlight on the sunlight-sensitive feature of the resource, when the complete elimination results in substantial effects on the survival, enjoyment, or, in the case of open space or natural resources, the use of the resource.

In general, a significant adverse shadow impact occurs when the incremental shadow added by a proposed action falls on a sunlight-sensitive resource and substantially reduces or completely eliminates direct sunlight exposure, thereby significantly altering the public's use of the resource or threatening the viability of vegetation or other resources.

D. PRELIMINARY SCREENING

Tier I Screening Assessment

According to the *CEQR Technical Manual*, the longest shadow that a structure will cast in New York City, except for periods close to dawn or dusk, is 4.3 times its height. The Proposed Project's maximum shadow radius (1,686 feet) was determined using the Proposed Project's maximum height of approximately 392 feet, which includes a 40-foot tall rooftop bulkhead (Tier I Assessment).[1] Within this longest shadow study area, there are 11 potentially sunlight-sensitive open space resources and one sunlight-sensitive natural resource. Therefore, further screening was warranted in order to determine whether any resources could be affected by project-generated shadows.

Tier II Screening Assessment

Due to the path of the sun across the sky in the Northern Hemisphere, no shadow can be cast in a triangular area south of any given project site. In New York City, this area lies between -108 and +108 degrees from true north. The purpose of the Tier II screening is to determine whether the sunlight-sensitive resources identified in the Tier I screening are located within portions of the longest shadow study area that can receive shade from the Proposed Project.

Figure 5-1 provides a base map illustrating the results of the Tier I and Tier II screening assessments (i.e., the portion of the longest shadow study area lying within -108 degrees from the true north and +108 degrees from true north as measured from southernmost portion of the Project Site). A total of 12 resources were identified as sunlight-sensitive resources that warranted further assessment.[2] A list of these resources is provided in **Table 5-1**, located on the subsequent page.

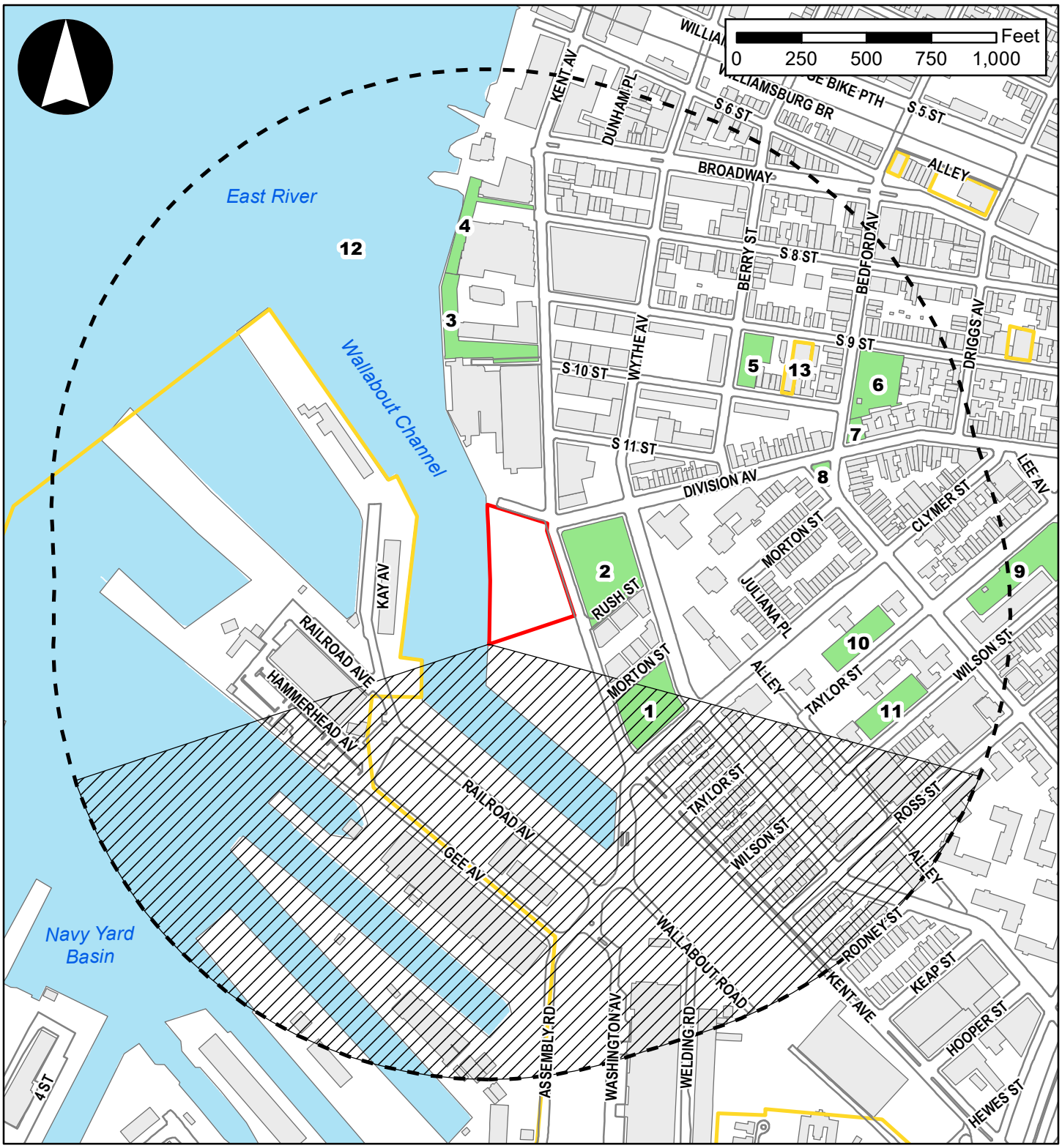
Tier III Screening Assessment

According to the *CEQR Technical Manual*, a Tier III screening assessment should be performed to determine if, in the absence of intervening buildings, shadows resulting from a proposed action

[1] In accordance with *CEQR Technical Manual* guidance, the maximum shadow radius was calculated by combining the maximum building height of the Proposed Project (inclusive of the rooftop bulkhead) (totaling approximately 392 feet), and multiplying that number by 4.3. Although the Proposed Project is intended to only include mechanical bulkheads reaching a height of approximately 375 feet, for conservative analysis purposes, the rooftop obstructions (bulkheads) were assumed to reach a maximum permitted height of 40 feet, per ZR Section 23-62 (g)(3)(ii), which states that, where the maximum permitted building height is 120 feet or greater, rooftop obstructions are limited to a maximum height of 40 feet.

[2] Within the longest shadow study area, there are numerous historic resources: (1) S/NR-eligible 134–136 Broadway (Block 2131, Lot 18); (2) S/NR-eligible 84–88 Broadway (Block 2130, Lot 17); (3) S/NR-eligible 54–82 Broadway (Block 2130, Lot 7501); (4) S/NR-eligible 31–45 Broadway (Block 2469, Lots 1, 22, 27, 28, 29, and 30); (5) S/NR-eligible Dunham and Broadway Historic District (Block 2469, Lots 1, 22, 27, 28, 29, and 30); (6) S/NR-eligible 18 – 22 Broadway (Block 2129, Lot 7508); (7) S/NR-eligible 16 Broadway (Block 2129, Lot 9); (8) S/NR-eligible 411 Kent Avenue (Block 2129, Lot 5); (9) S/NR-eligible 475 Kent Avenue (Block 2159, Lot 1); (10) S/NR-listed Brooklyn Navy Yard Historic District. However, it was determined that these historic resources do not contain any sunlight-sensitive features or rely on sunlight for their historic significance, and therefore, no further analysis of these historic resources is warranted.

Figure 5-1
Tier I & II Shadow Assessment



Legend

- Project Site
- Tier I : Longest Shadow Study Area
- Tier II: Area That Cannot Be Shaded
- Open Space Resources
- S/NR-Listed Historic Resources
- Building Footprints

can reach a sunlight-sensitive resource, thereby warranting a detailed shadow analysis. The Tier III screening assessment is used to determine if shadows resulting from a proposed action can reach a sunlight-sensitive resource at any time between 1.5 hours after sunrise and 1.5 hours before sunset on representative analysis dates.

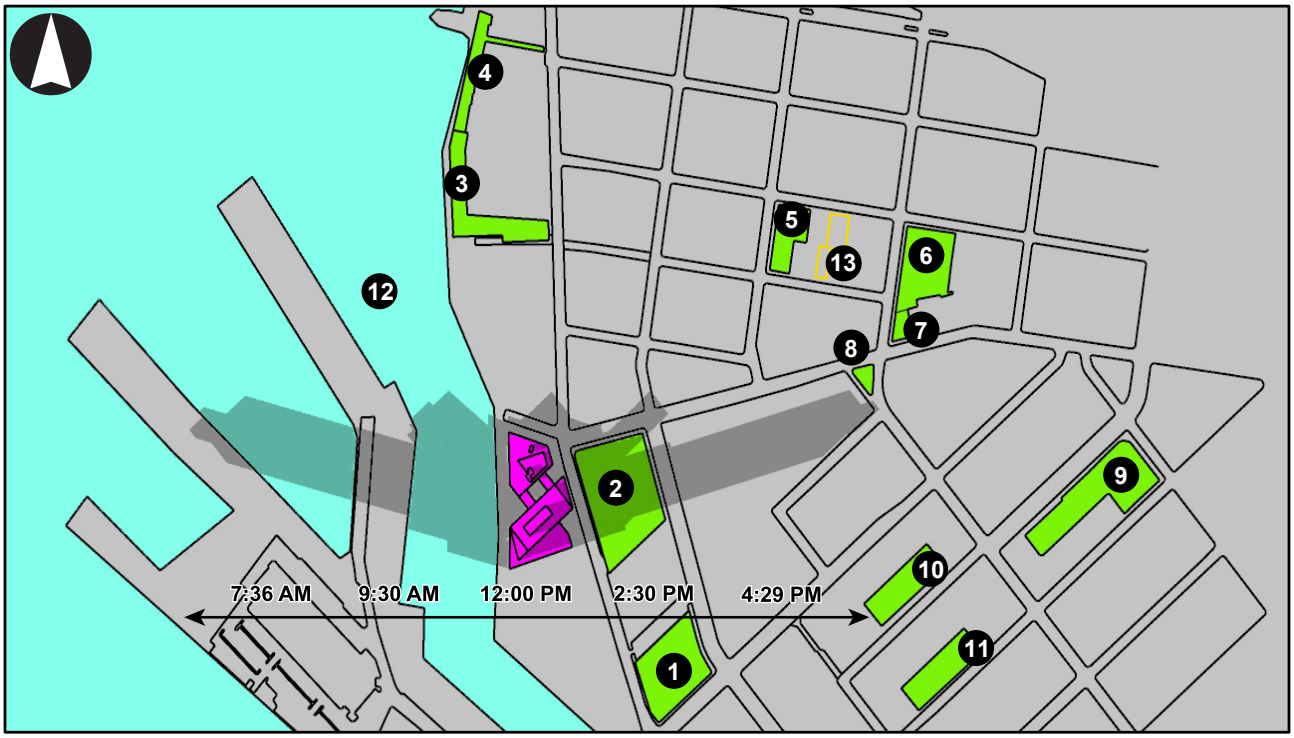
TABLE 5-1:
Sunlight-Sensitive Resources Warranting Further Assessment Based on Tier 1 and 2 Screening

No.[1]	Sunlight-Sensitive Resources
1	Jacob's Ladder Playground (Open Space Resource)
2	Roberto Clemente Ballfield (Open Space Resource)
3	Schaefer Landing Esplanade (Open Space Resource)
4	420 Kent Avenue Esplanade (Open Space Resource)
5	Epiphany Playground (Open Space Resource)
6	Bedford Playground (Open Space Resource)
7	La Casita Verde Community Garden (Open Space Resource)
8	Cohn Triangle (Open Space Resource)
9	Roebling Playground (Open Space Resource)
10	NYCHA Independence Towers Grounds 1 (Open Space Resource)
11	NYCHA Independence Towers Grounds 2 (Open Space Resource)
12	East River (Natural Resource)
13	Epiphany Roman Catholic Church (S/NR-eligible Historic and Cultural Resource)

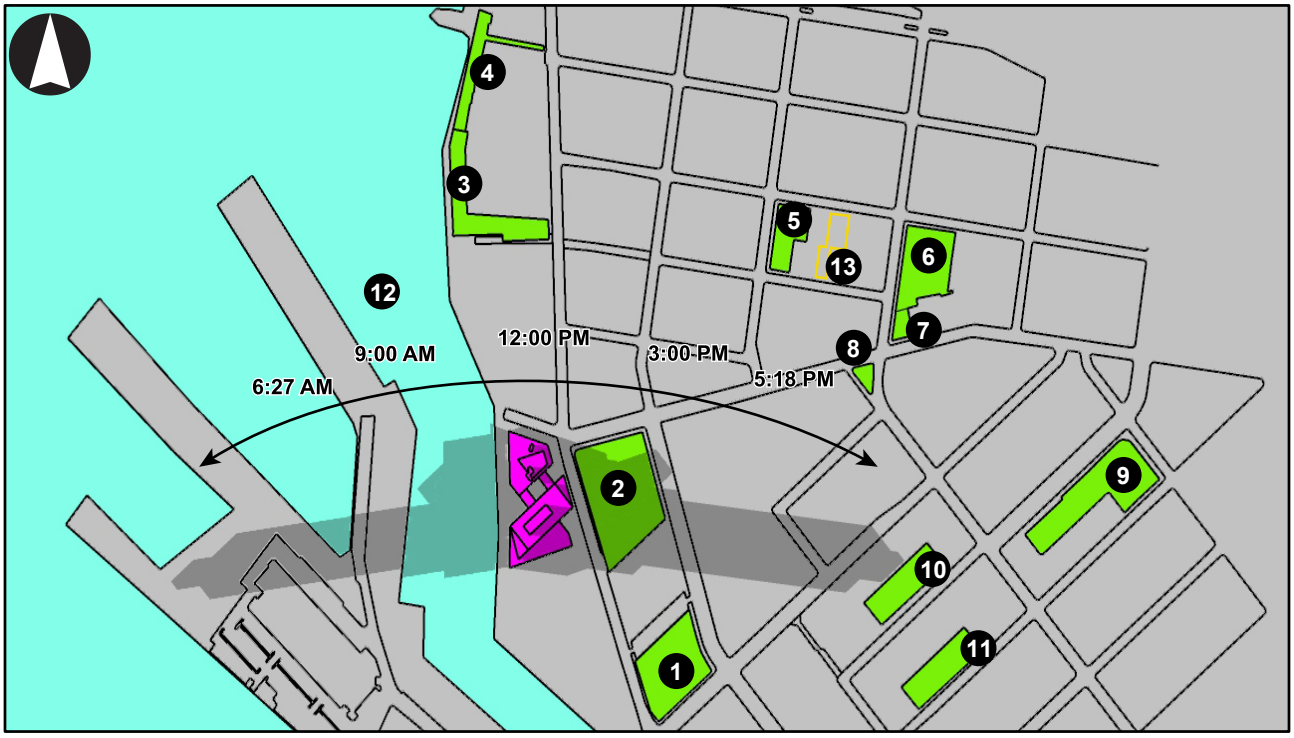
Note:
[1] Numbers keyed to **Figure 5-1**.

As project-generated shadows could reach a number of sunlight-sensitive resources, a Tier III assessment was performed using three-dimensional (3D) computer mapping software. A 3D model was used to calculate and display project-generated shadows on individual representative analysis dates. The model contained 3D representations of the elements in the base map used in the preceding assessments and a 3D model of the projected development. Per *CEQR Technical Manual* guidance, at this stage of the assessment, surrounding buildings within the study area were not included in the model so that it may be determined whether project-generated shadows would reach any sunlight sensitive resources.

As indicated in **Figures 5-2a** and **5-2b**, five sunlight-sensitive resources would receive project-generated shadows on at least one of the four analysis days. **Table 5-2** (located on the next page) presents a summary of the Tier III assessment, showing the four sunlight-sensitive open space resources and one natural resource that could, in the absence of intervening buildings, receive project-generated shadows, and on which analysis days the new shadows would occur. As also shown in **Table 5-2**, the eight remaining sunlight-sensitive resources would not, in the absence of intervening buildings, receive project-generated shadows. These eight resources include Jacob's Ladder Playground, Schaefer Landing Esplanade, 420 Kent Avenue Esplanade, Bedford Playground, La Casita Verde Community Garden, Cohn Triangle, Roebling Playground, and the Epiphany Roman Catholic Church.



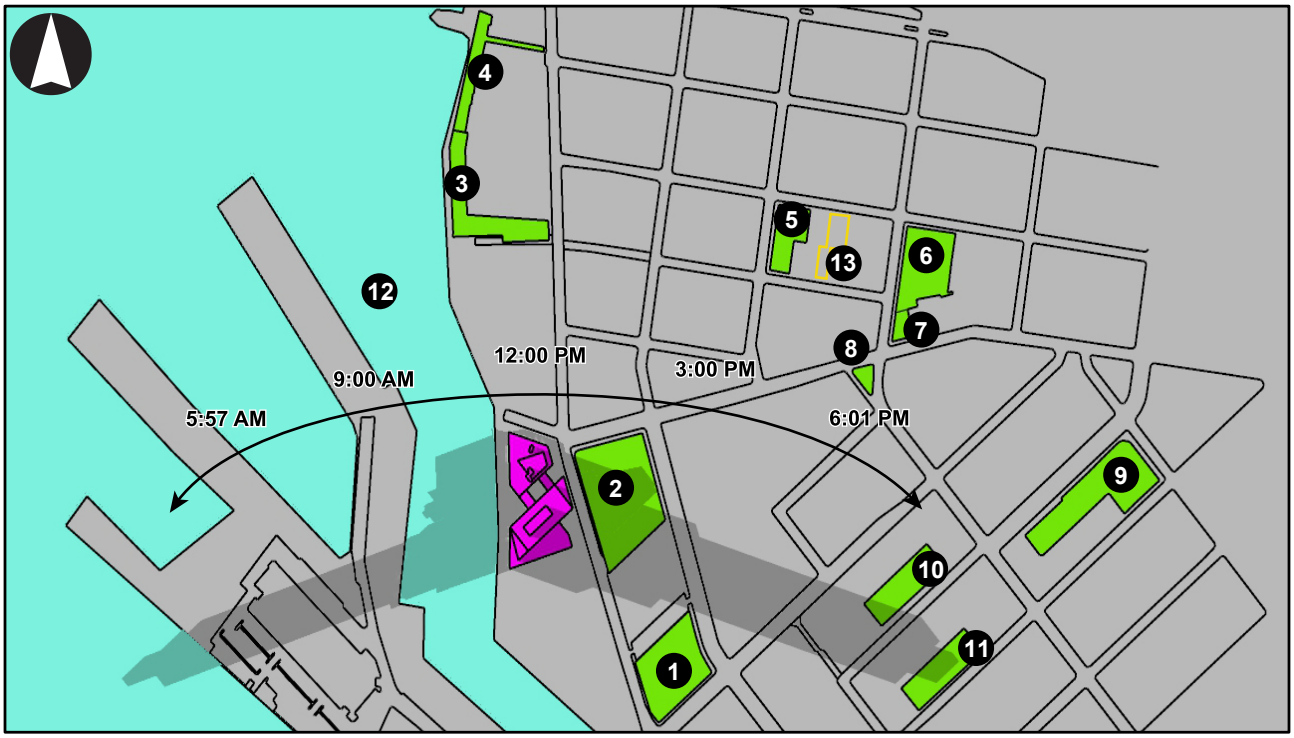
MARCH 21/SEPTEMBER 21



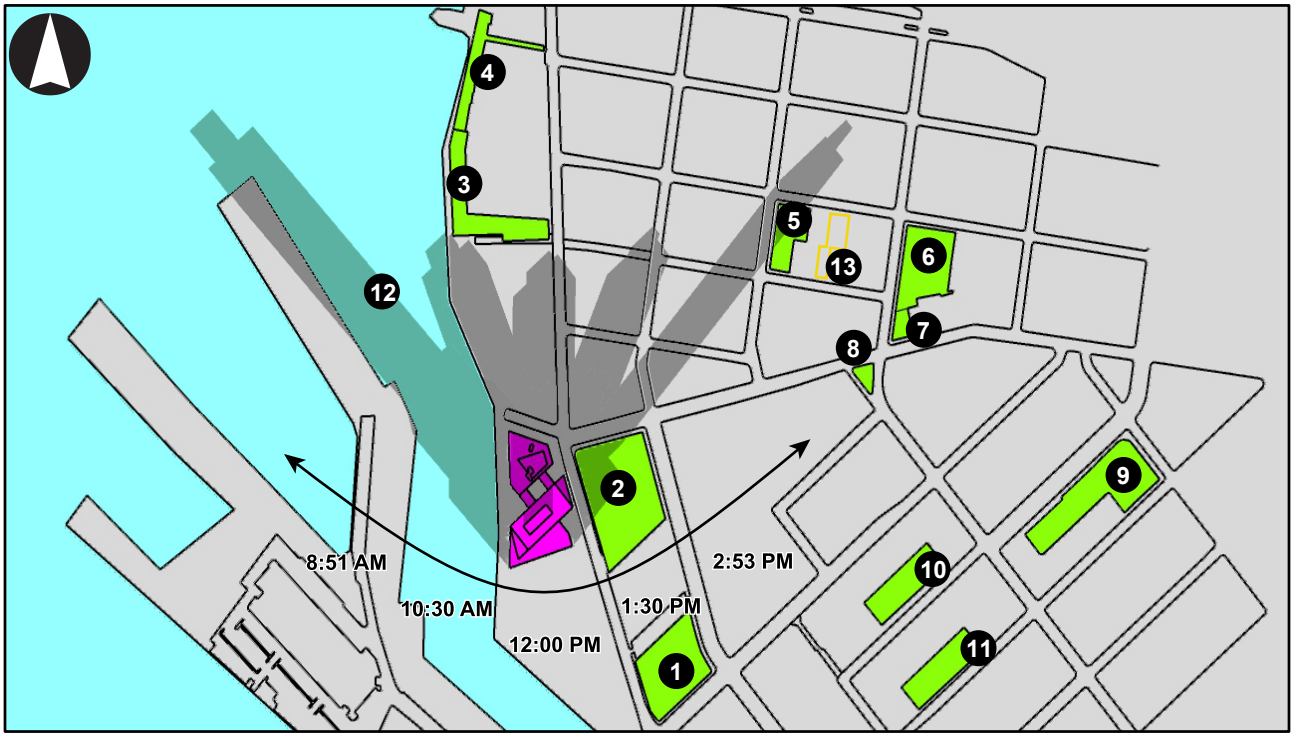
MAY 6/AUGUST 6

Proposed Project
Open Space
Incremental Shadow
Waterbody

Note: Resources keyed to Table 5-1



JUNE 21



DECEMBER 21

Proposed Project
Open Space
Incremental Shadow
Waterbody

Note: Resources keyed to Table 5-1

TABLE 5-2: Tier III Assessment Results

No.[1, 2]	Resource Name	Mar. 21st/Sep. 21st 7:36 AM – 4:29 PM	May 6th/Aug. 6th 6:27 AM – 5:18 PM	June 21st 5:57 AM – 6:01 PM	Dec. 21st 8:51 AM – 2:53 PM	Number of Analysis Days
1	Jacob's Ladder Playground	**NO**	**NO**	**NO**	**NO**	**0**
2	Roberto Clemente Ballfield	**YES**	**YES**	**YES**	**YES**	**4**
3	Schaefer Landing Esplanade	**NO**	**NO**	**NO**	**NO**	**0**
4	420 Kent Avenue Esplanade	**NO**	**NO**	**NO**	**NO**	**0**
5	Epiphany Playground	**NO**	**NO**	**NO**	**YES**	**1**
6	Bedford Playground	**NO**	**NO**	**NO**	**NO**	**0**
7	La Casita Verde Community Garden	**NO**	**NO**	**NO**	**NO**	**0**
8	Cohn Triangle	**NO**	**NO**	**NO**	**NO**	**0**
9	Roebling Playground	**NO**	**NO**	**NO**	**NO**	**0**
10	NYCHA Independence Towers Grounds 1	**NO**	**NO**	**YES**	**NO**	**1**
11	NYCHA Independence Towers Grounds 2	**NO**	**NO**	**YES**	**NO**	**1**
12	East River	**YES**	**YES**	**YES**	**YES**	**4**
13	Epiphany Roman Catholic Church	**NO**	**NO**	**NO**	**NO**	**0**

Notes:
[1] Numbers keyed to **Figure 5-1**.
[2] Refer to **Figures 5-2a** and **5-2b**.

E. DETAILED ASSESSMENT

Resources of Concern

Roberto Clemente Ballfield

Roberto Clemente Ballfield is an approximately 1.93-acre park. The park, located directly east of the Project Site, is bound by Division Avenue to the north, apartment buildings to the south, Kent Avenue to the west, and Wythe Avenue to the east. Roberto Clemente Ballfield features a ballfield, paved walking paths, benches, landscaping, and trees. The park also offers panoramic views of Manhattan and Downtown Brooklyn. Roberto Clemente Ballfield is open to the public daily from 6:00 AM to 9:00 PM.

Epiphany Playground

Epiphany Playground is an approximately 0.50-acre park. The park, located to the northeast of the Project Site, is bound by S. 9th Street to the north, S. 10th Street to the south, private properties to

the east, and Berry Street to the west. Epiphany Playground features a playgrounds, spray showers, basketball and handball courts, benches, landscaping, and trees. Epiphany Playground is open to the public daily from 6:00 AM to 9:00 PM.

NYCHA Independence Towers Grounds 1 and 2

NYCHA's Independence Towers contain approximately 0.20 acres of public housing grounds. These two open spaces, located to the southeast of the Project Site, are located within NYCHA's Independence Towers Development; the development is bound by Clymer Street to the north, Wilson Street to the south, Bedford Avenue to the east, and Wythe Place to the west. The Independence Towers open spaces feature paved areas, playgrounds, spray showers, benches, landscaping, and trees. The Independence Towers open spaces are generally open to NYCHA residents, their guests, and members of the public on a daily basis, however, no public hours are provided for these two open spaces.

East River

The lower portion of the East River, part of the greater Hudson/East River Watershed, is located to the west of the Project Site. This portion of the East River is a degraded natural resource and does not consistently meet standards for adequate ecological health. According to the New York State Department of Environmental Conservation (NYSDEC), the lower portion of the East River is assessed as an impaired waterbody ("Class I") due to recreational uses and fish consumption that are considered to be impaired by floatable debris, as well as PCBs and other toxins. Urban stormwater runoff, combined sewer overflows (CSOs), contaminated sediment, and the industrial use of the waterway result in conditions that negatively impact recreational use. However, recent data shows dissolved oxygen levels in this segment of the East River typically meet applicable water quality standards to support aquatic life.[3] The East River as defined herein encompasses associated waterbodies formed by variations in the alignment of the Brooklyn shoreline including Wallabout Channel, an artificial inlet located immediately west of the Project Site.

Shadows Analysis

Per *CEQR Technical Manual* guidance, shadow analyses were performed for the five sunlight-sensitive resources identified above on four representative days of the year: March 21st/September 21st, the equinoxes; May 6th, the midpoint between the summer solstice and the equinox (and equivalent to August 6th); June 21st, the summer solstice and the longest day of the year; and December 21st, the winter solstice and shortest day of the year. CEQR guidance defines the temporal limits of a shadow analysis period to fall from 1.5 hours after sunrise to 1.5 hours before sunset. As discussed above, the results of the shadows analysis show the incremental difference in shadow impact between the No-Action and With-Action conditions (refer to **Table 5-3**, located on the subsequent page). Per the *CEQR Technical Manual*, all times reported herein are Eastern Standard Time and do not reflect adjustments for daylight savings time that is in effect from mid-March to early November.

[3] NYSDEC. 2017. "Waterbody Inventory/Priority Waterbodies List: Hudson/East River Watershed."

As shown in **Table 5-3**, incremental project-generated shadows would reach four of the five sunlight-sensitive resources identified in the Tier III assessment. Increases in shadow coverage would occur at Roberto Clemente Ballfield on the March 21st/September 21st, May 6th/August 6th, June 21st, and December 21st representative analysis days. Increases in shadow coverage would occur at Epiphany Playground on the December 21st representative analysis day. Increases in shadow coverage would occur at NYCHA's Independence Towers Grounds 1 on the June 21st representative analysis day. Increases in shadow coverage would occur at the East River on the March 21st/September 21st, May 6th/August 6th, June 21st, and December 21st representative analysis days. No incremental shadow coverage would occur at NYCHA's Independence Towers Grounds 2 on the four representative analysis days. **Figures 5-3** through **5-6**, provided at the end of this chapter, show representative shadow views for each sunlight-sensitive resource of concern on each of the four representative analysis days mentioned above.

March 21st/September 21st

On March 21st/September 21st, the time period for shadows analysis begins at 7:36 AM and continues until 4:29 PM. March is considered the beginning of the growing season in New York City, and September 21st, which has the same shadow patterns as March 21st, is also within the growing season. On the March 21st/September 21st analysis day, incremental shadows from the Proposed Project would reach portions of Roberto Clemente Ballfield and the East River.

TABLE 5-3: Duration of Shadows on Sunlight Sensitive Resources (Increment Compared to the No-Action Condition)

Resource	Analysis Day	Mar. 21st/Sep. 21st 7:36 AM – 4:29 PM	May 6th/Aug. 6th 6:27 AM – 5:18 PM	June 21st 5:57 AM – 6:01 PM	Dec. 21st 8:51 AM – 2:53 PM
Roberto Clemente Ballfield	Shadow enter-exit time	12:09 – 4:29 PM	11:59 AM – 5:18 PM	12:15 – 6:01 PM	12:05 – 12:53 PM
	Incremental shadow duration	4 hours 20 minutes	5 hours 19 minutes	5 hours 46 minutes	48 minutes
Epiphany Playground	Shadow enter-exit time	N/A	N/A	N/A	2:42 – 2:53 PM
	Incremental shadow duration	N/A	N/A	N/A	11 minutes
NYCHA Independence Towers Grounds 1	Shadow enter-exit time	N/A	N/A	5:37 – 6:01 PM	N/A
	Incremental shadow duration	N/A	N/A	24 minutes	N/A
NYCHA Independence Towers Grounds 2	Shadow enter-exit time	N/A	N/A	N/A	N/A
	Incremental shadow duration	N/A	N/A	N/A	N/A
East River	Shadow enter-exit time	7:36 – 11:39 AM	6:27 – 11:25 AM	5:57 – 11:29AM	8:51 – 11:24 AM
	Incremental shadow duration	4 hours 2 minutes	4 hours 58 minutes	5 hours 32 minutes	2 hours 33 minutes

Notes:
[A] All times are Eastern Standard Time.
[B] Table indicates the entry and exit times and total duration of incremental shadow for each sunlight-sensitive resource.

The Proposed Project would cast incremental shadows on portions of Roberto Clemente Ballfield beginning at 12:09 PM and continuing until 4:29 PM, for a duration of approximately four hours and 20 minutes. Prior to 12:09 PM, the open space would not experience any incremental shadow coverage as a result of the Proposed Project for approximately four hours and 33 minutes; between the hours of 9:00 AM and 3:00 PM (totaling six hours), a majority of the open space would experience direct sunlight. As indicated in **Figures 5-3a** and **5-3b**, incremental shadows would enter the open space from the west before moving in an easterly direction across the park towards Wythe Avenue. As also indicated in the two figures, the extent of incremental shadow coverage would be minimal, as a majority of the open space that would receive shadow coverage as a result of the Proposed Project also would be cast in shadow under the No-Action condition. In addition, certain areas of the park (highlighted in yellow) that would be cast in shadow under the No-Action condition would not be cast in shadow under the With-Action condition, in other words a negative incremental (decrement) change in shadow coverage. The areas of Roberto Clemente Ballfield that would experience new incremental shadow coverage as a result of the With-Action condition contain a ballfield, paved walking paths, landscaping, and trees.

The Proposed Project would cast incremental shadows on portions the East River beginning at 7:36 AM and continuing until 11:39 AM, for a duration of approximately four hours and three minutes. After 11:39 AM, the resource would not experience any incremental shadow coverage as a result of the Proposed Project. As indicated in **Figures 5-3c** and **5-3d**, a majority of the East River would receive direct sunlight as incremental shadows move from west to east throughout the representative analysis day. As also indicated in the two figures, portions of the East River that would receive shadow coverage as a result of the Proposed Project would be cast in shadow under the No-Action condition. In addition, certain areas of the East River (highlighted in yellow) that would be cast in shadow under the No-Action condition would not be cast in shadow under the With-Action condition.

May 6th/August 6th

On May 6th/August 6th, the time period for shadows analysis begins at 6:27 AM and continues until 5:18 PM. On the midpoint between the equinoxes and the solstices, incremental shadows from the Proposed Project would reach portions of Roberto Clemente Ballfield and the East River.

The Proposed Project would cast incremental shadows on portions of Roberto Clemente Ballfield beginning at 11:59 AM and continuing until 5:18 PM, for a duration of approximately five hours and 19 minutes. Prior to 11:59 AM, the open space would not experience any incremental shadow coverage as a result of the Proposed Project for approximately five hours and 32 minutes; between the hours of 8:00 AM and 2:00 PM (totaling six hours), a majority of the open space would experience direct sunlight. As indicated in **Figures 5-4a** through **5-4c**, incremental shadows would enter the open space from the west before moving in an easterly direction across the park towards Wythe Avenue. As also indicated in the three figures, the extent of incremental shadow coverage would be minimal, as a majority of the open space that would receive shadow coverage as a result of the Proposed Project would be cast in shadow under the No-Action condition. In addition, certain areas of the park (highlighted in yellow) that would be cast in shadow under the No-Action condition would not be cast in shadow under the With-Action condition. The areas of Roberto

Clemente Ballfield that would experience new incremental shadow coverage as a result of the With-Action condition contain a ballfield, paved walking paths, landscaping, and trees.

The Proposed Project would cast incremental shadows on portions of the East River beginning at 6:27 AM and continuing until 11:25 AM, for a duration of approximately four hours and 58 minutes. After 11:25 AM, the resource would not experience any incremental shadow coverage as a result of the Proposed Project. As indicated in **Figures 5-4d** and **5-4f**, a majority of the East River would receive direct sunlight as incremental shadows move from west to east throughout the representative analysis day. As also indicated in the three figures, portions of the East River that would receive shadow coverage as a result of the Proposed Project would be cast in shadow under the No-Action condition. In addition, certain areas of the East River (highlighted in yellow) that would be cast in shadow under the No-Action condition would not be cast in shadow under the With-Action condition.

June 21st

On June 21st, the time period for shadows analysis begins at 5:57 AM and continues until 6:01 PM. On the summer solstice, which is the day of the year with the longest period of daylight, the sun is most directly overhead and generally shadows are shortest and move across the widest angular range from west to east. On this date, incremental shadows from the Proposed Project would reach portions of Roberto Clemente Ballfield, NYCHA Independence Towers Grounds 1, and the East River.

The Proposed Project would cast incremental shadows on portions of Roberto Clemente Ballfield beginning at 12:15 PM and continuing until 6:01 PM, for a duration of approximately five hours and 46 minutes. Prior to 12:15 PM, the open space would not experience any incremental shadow coverage as a result of the Proposed Project for approximately seven hours and 18 minutes; between the hours of 7:30 AM and 2:30 PM (totaling seven hours), a majority of the open space would experience direct sunlight. As indicated in **Figures 5-5a** through **5-5c**, incremental shadows would enter the open space from the west before moving in an easterly direction across the park towards Wythe Avenue. As also indicated in the three figures, the extent of incremental shadow coverage would be minimal, as a majority of the open space that would receive shadow coverage as a result of the Proposed Project would be cast in shadow under the No-Action condition. In addition, certain areas of the park (highlighted in yellow) that would be cast in shadow under the No-Action condition would not be cast in shadow under the With-Action condition. The areas of Roberto Clemente Ballfield that would experience new incremental shadow coverage as a result of the With-Action condition contain a ballfield, paved walking paths, landscaping, and trees.

The Proposed Project would cast incremental shadows on portions of NYCHA Independence Towers Grounds 1 beginning at 5:37 PM and continuing until 6:01 PM, for a duration of approximately 24 minutes. Prior to 5:37 PM, the open space would not experience any incremental shadow coverage as a result of the Proposed Project. As indicated in **Figure 5-5d**, incremental shadows would enter the open space from the west before moving in an easterly direction across the park towards Taylor Street. The areas of NYCHA Independence Towers Grounds 1 that would experience new incremental shadow coverage as a result of the With-Action condition contain paved areas, a playground, a spray shower, benches, landscaping, and trees.

The Proposed Project would cast incremental shadows on portions of the East River beginning at 5:57 AM and continuing until 11:29 AM, for a duration of approximately five hours and 32 minutes. After 11:29 AM, the resource would not experience any incremental shadow coverage as a result of the Proposed Project. As indicated in **Figures 5-5e** through **5-5g**, a majority of the East River would receive direct sunlight as incremental shadows move from west to east throughout the representative analysis day. As also indicated in the three figures, portions of the East River that would receive shadow coverage as a result of the Proposed Project would be cast in shadow under the No-Action condition. In addition, certain areas of the East River (highlighted in yellow) that would be cast in shadow under the No-Action condition would not be cast in shadow under the With-Action condition.

December 21st

On December 21st, the time period for shadows analysis begins at 8:51 AM and continues until 2:53 PM. On the winter solstice, which is the day of the year with the shortest period of daylight, the sun is low in the sky and shadows are at their longest but move rapidly. On this date, incremental shadows from the Proposed Project would reach portions of Roberto Clemente Ballfield, Epiphany Playground, and the East River.

The Proposed Project would cast incremental shadows on portions of Roberto Clemente Ballfield beginning at 12:05 PM and continuing until 12:53 PM, for a duration of approximately 48 minutes. Prior to 12:05 PM, the open space would not experience any incremental shadow coverage as a result of the Proposed Project for approximately five hours and 14 minutes; between the hours of 11:30 AM and 2:30 PM (totaling three hours), a majority of the open space would experience direct sunlight. As indicated in **Figure 5-6a**, incremental shadows would enter the open space from the west before moving in an easterly direction across the park towards Division Avenue. As also indicated in the figure, the extent of incremental shadow coverage would be minimal, as a majority of the open space that would receive shadow coverage as a result of the Proposed Project would be cast in shadow under the No-Action condition. In addition, certain areas of the park (highlighted in yellow) that would be cast in shadow under the No-Action condition would not be cast in shadow under the With-Action condition. The areas of Roberto Clemente Ballfield that would experience new incremental shadow coverage as a result of the With-Action condition contain a paved walking path and several trees.

The Proposed Project would cast incremental shadows on portions of Epiphany Playground beginning at 2:42 PM and continuing until 2:53 PM, for a duration of approximately 11 minutes. Prior to 2:42 PM, the open space would not experience any incremental shadow coverage as a result of the Proposed Project. As indicated in **Figure 5-6b**, incremental shadows would enter the open space from the west before moving in an easterly direction across the park towards S. 9th Street. The areas of Epiphany Playground that would experience new incremental shadow coverage as a result of the With-Action condition contain playgrounds, spray showers, handball courts, benches, landscaping, and several trees.

The Proposed Project would cast incremental shadows on portions of the East River beginning at 8:51 AM and continuing until 11:24 AM, for a duration of approximately two hours and 33

minutes. After 11:24 AM, the resource would not experience any incremental shadow coverage as a result of the Proposed Project. As indicated in **Figures 5-6c** and **5-6d**, a majority of the East River would receive direct sunlight as incremental shadows move from west to east throughout the representative analysis day. As also indicated in the two figures, portions of the East River that would receive shadow coverage as a result of the Proposed Project would be cast in shadow under the No-Action condition. In addition, certain areas of the East River (highlighted in yellow) that would be cast in shadow under the No-Action condition would not be cast in shadow under the With-Action condition.

Assessment

As described above, a shadow impact occurs when the incremental shadow from a proposed project falls on a sunlight sensitive resource or feature and reduces its direct sunlight exposure. Determining whether this impact is significant or not depends on the extent and duration of the incremental shadow and the specific context in which the impact occurs. For sunlight-sensitive open space resources, the uses and features of the space indicate its sensitivity to shadows. Shadows occurring during the cold-weather months of interest generally do not affect the growing season of outdoor vegetation; therefore, this sensitivity is assessed for both (1) warm-weather-dependent features or vegetation that could be affected by a loss of sunlight during the growing season; and (2) features, such as benches, that could be affected by a loss of winter sunlight. Uses that rely on sunlight include: passive use, such as sitting or sunning; active use, such as playfields or paved courts; and such activities as gardening, or children's wading pools and sprinklers. Generally, six to eight hours a day of sunlight, particularly in the growing season, is often a minimum requirement. Consequently, the assessment of an open space resource's sensitivity to increased shadow focuses on identifying the existing conditions of its facilities, plantings, and uses, and the sunlight requirements for each.

Roberto Clemente Ballfield

The Proposed Project would cast incremental shadows on Roberto Clemente Ballfield on each of the four representative analysis days: March 21st/September 21st, May 6th/August 6th, June 21st, and December 21st. Incremental shadow duration would range from 48 minutes on December 21st to five hours and 46 minutes on June 21st and would be limited to the afternoon and early evening hours after 12:00 PM. Incremental shadow coverage would generally be limited in scope and would not be cast on any single area of Roberto Clemente Ballfield for an extended period of time, as shadows move from west to east throughout the day. This would allow the open space's sunlight-sensitive features, a ballfield, landscaping, and trees, to receive adequate direct sunlight (at least six to eight hours) throughout the analysis day, throughout the March to October growing season. In addition, certain areas of the open space that would be cast in shadow under the No-Action condition would not experience shadow coverage under the With-Action condition.

Therefore, as the extent and duration of the incremental shadows would: (1) not significantly reduce or completely eliminate direct sunlight exposure on any of the sunlight-sensitive features found within the open space; and (2) would not significantly alter the public's use of the open space resource or threaten the viability of vegetation or other sunlight-sensitive features,

incremental shadows from the Proposed Project on Roberto Clemente Ballfield would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* guidance.

Epiphany Playground

The Proposed Project would cast incremental shadows on Epiphany Playground on one of the four representative analysis days: December 21st. Cumulative incremental shadow duration would occur for approximately 11 minutes on December 21st and would be limited to the late afternoon hours after 2:42 PM. Incremental shadow coverage would generally be limited in scope and would not be cast on any single area of Epiphany Playground for an extended period of time, as shadows move from west to east throughout the day. This would allow the open space's sunlight-sensitive features, playgrounds, spray showers, handball courts, benches, landscaping, and several trees, to receive adequate direct sunlight (at least six to eight hours) throughout the analysis day.

Therefore, as the extent and duration of the incremental shadows would: (1) not significantly reduce or completely eliminate direct sunlight exposure on any of the sunlight-sensitive features found within the open space; and (2) would not significantly alter the public's use of the open space resource or threaten the viability of vegetation or other sunlight-sensitive features, incremental shadows from the Proposed Project on Epiphany Playground would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* guidance.

NYCHA Independence Towers Grounds 1

The Proposed Project would cast incremental shadows on NYCHA Independence Towers Grounds 1 on one of the four representative analysis days: June 21st. Cumulative incremental shadow duration would occur for approximately 24 minutes on June 21st and would be limited to the early evening hours after 5:30 PM. Incremental shadow coverage would be limited in scope and would not be cast on any single area of NYCHA Independence Towers Grounds 1 for an extended period of time, as shadows move from west to east throughout the day. This would allow the open space's sunlight-sensitive features, a playground, a spray shower, benches, landscaping, and trees, to receive adequate direct sunlight (at least six to eight hours) throughout the analysis day.

Therefore, as the extent and duration of the incremental shadows would: (1) not significantly reduce or completely eliminate direct sunlight exposure on any of the sunlight-sensitive features found within the open space; and (2) would not significantly alter the public's use of the open space resource or threaten the viability of vegetation or other sunlight-sensitive features, incremental shadows from the Proposed Project on NYCHA Independence Towers Grounds 1 would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* guidance.

East River

The Proposed Project would cast incremental shadows on portions of the East River on each of the four representative analysis days: March 21st/September 21st, May 6th/August 6th, June 21st, and December 21st. Incremental shadow duration would range from two hours and 33 minutes on December 21st to five hours and 32 minutes on June 21st. Incremental shadow coverage would

generally be limited in scope, primarily affecting areas along the Brooklyn Navy Yard waterfront. While the extent of shadow coverage would be greatest on June 21st, shadow coverage would be limited to relatively small areas on the other three representative analysis days (refer to **Figures 5-3** through **5-6**). The areas that would receive the longest durations of new shadows would continue to receive several hours of sunlight over the course of each analysis day, as shadows are not static and move from west to east throughout the day. As such, no area of the East River would be permanently cast in shade or shaded to a degree that would impact aquatic biota as a result of incremental shadow coverage. It is important to note that this area of the East River is a degraded natural resource and does not consistently meet standards for good ecological health. The East River currently retains a "Class I, Impaired designation" under NYSDEC regulations regarding recreational uses and fish consumption, meaning communities surrounding the river cannot fully utilize this natural resource. Furthermore, any wildlife present in the area is tolerant of urban conditions and low-quality habitat.

Therefore, as the extent and duration of the incremental shadows would: (1) not significantly reduce or completely eliminate direct sunlight exposure on any of the sunlight-sensitive features found within the natural resource; and (2) would not significantly alter the public's use of the natural resource or threaten the viability of vegetation or other sunlight-sensitive features, incremental shadows from the Proposed Project on the East River would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* guidance.

Project-Generated Open Space

Pursuant to *CEQR Technical Manual* guidance, shadows on project-generated open space are not considered significant. However, as future project-generated open space is included as part of the analysis presented in **Chapter 4, "Open Space,"** a discussion of how shadows could affect the new open space planned as part of the Proposed Project is provided below.

As discussed in **Chapter 4, "Open Space,"** the Proposed Project is expected to include approximately 0.53 acres of publicly accessible open space. Consistent with waterfront zoning regulations, the new open space would comprise an approximately 528-foot-long waterfront esplanade spanning from Division Avenue (to the north) to the southern edge of the Project Site and supplemental public access area. Several active and passive recreation areas would be located along the esplanade including several seating and gathering areas and a shore public walkway.

On the March 21st/September 21st, May 6th/August 6th, June 21st, and December 21st representative analysis days, project-generated shadow coverage on future open space is expected to be greatest during the early to late morning hours (several hours after the start of the analysis period). However, it is anticipated that the majority of the future open space would receive adequate direct sunlight throughout the day (at least the six to eight hour minimum specified in the *CEQR Technical Manual*) during the growing season, March to September, and vegetation would not be affected. As the programming for the project-generated open space is not yet finalized, it is difficult to project what types of features and amenities would experience incremental shadow coverage. However, it is expected that the future open space would be designed to account for project-generated shadows.

Figure 5-3a

Incremental Shadows on March 21st/September 21st - Roberto Clemente Ballfield



1:00 PM



2:00 PM

Proposed Project

Area of Resource in Direct Sunlight

Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

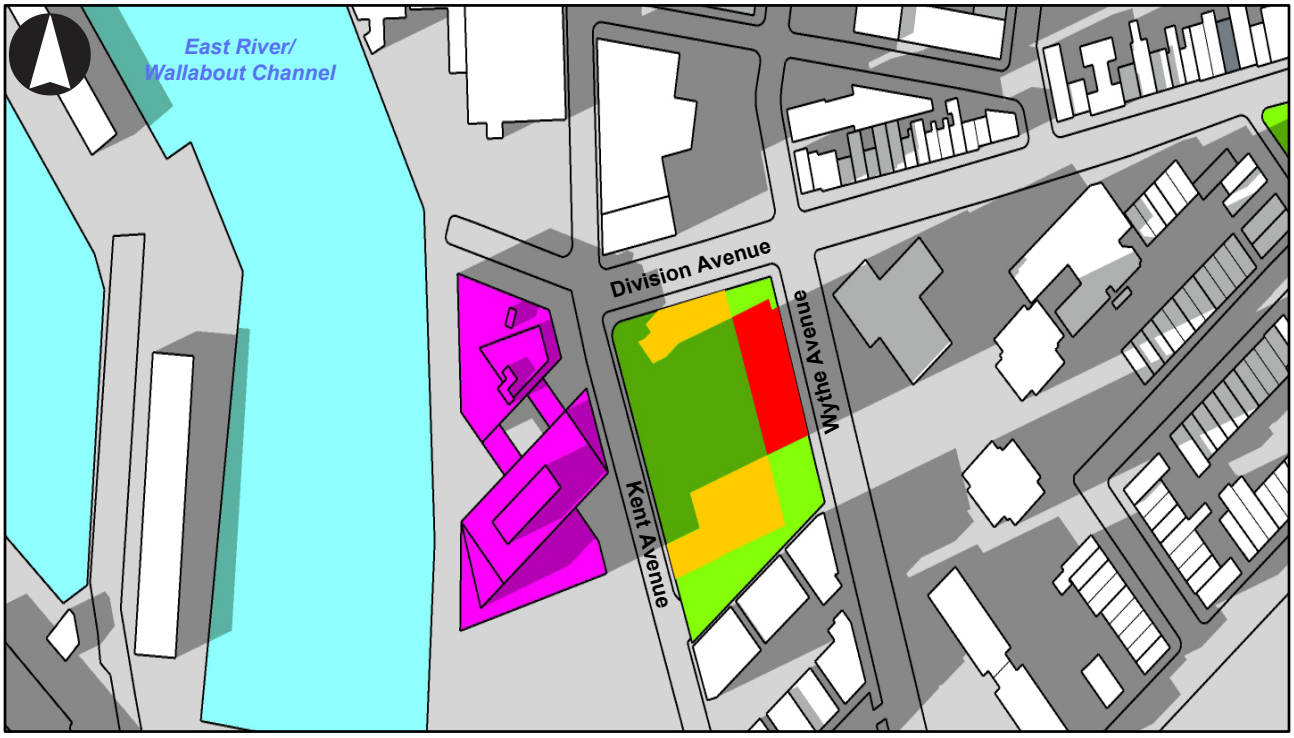
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-3b

Incremental Shadows on March 21st/September 21st - Roberto Clemente Ballfield



3:00 PM



4:00 PM

Proposed Project

Area of Resource in Direct Sunlight

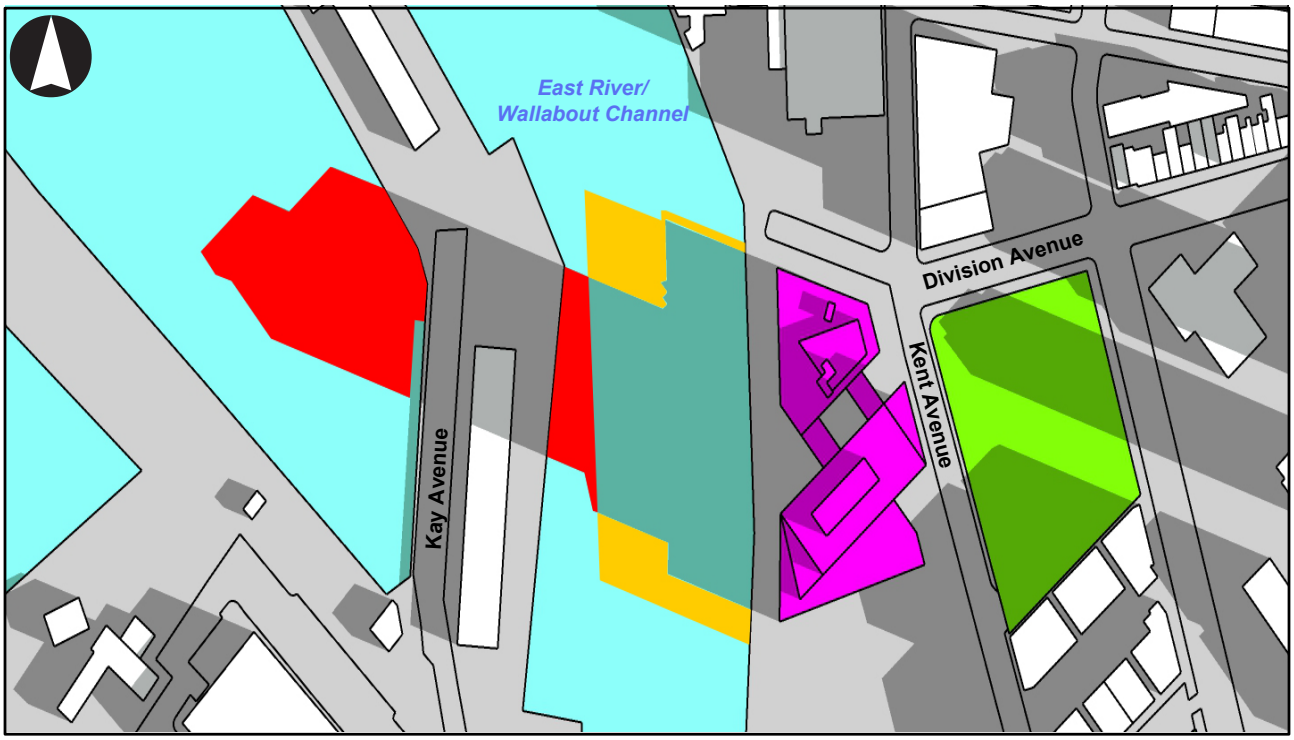
Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

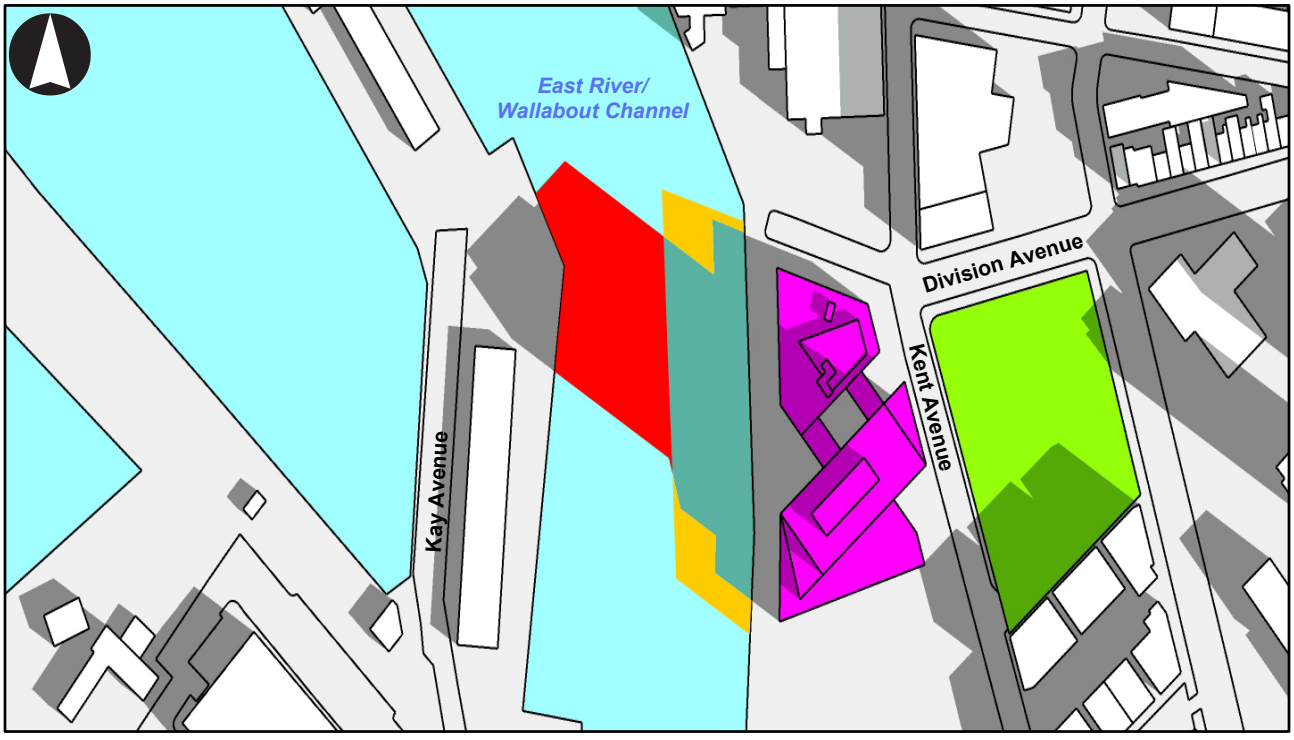
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-3c

Incremental Shadows on March 21st/September 21st - East River



8:00 AM



9:00 AM

Proposed Project

Area of Resource in Direct Sunlight

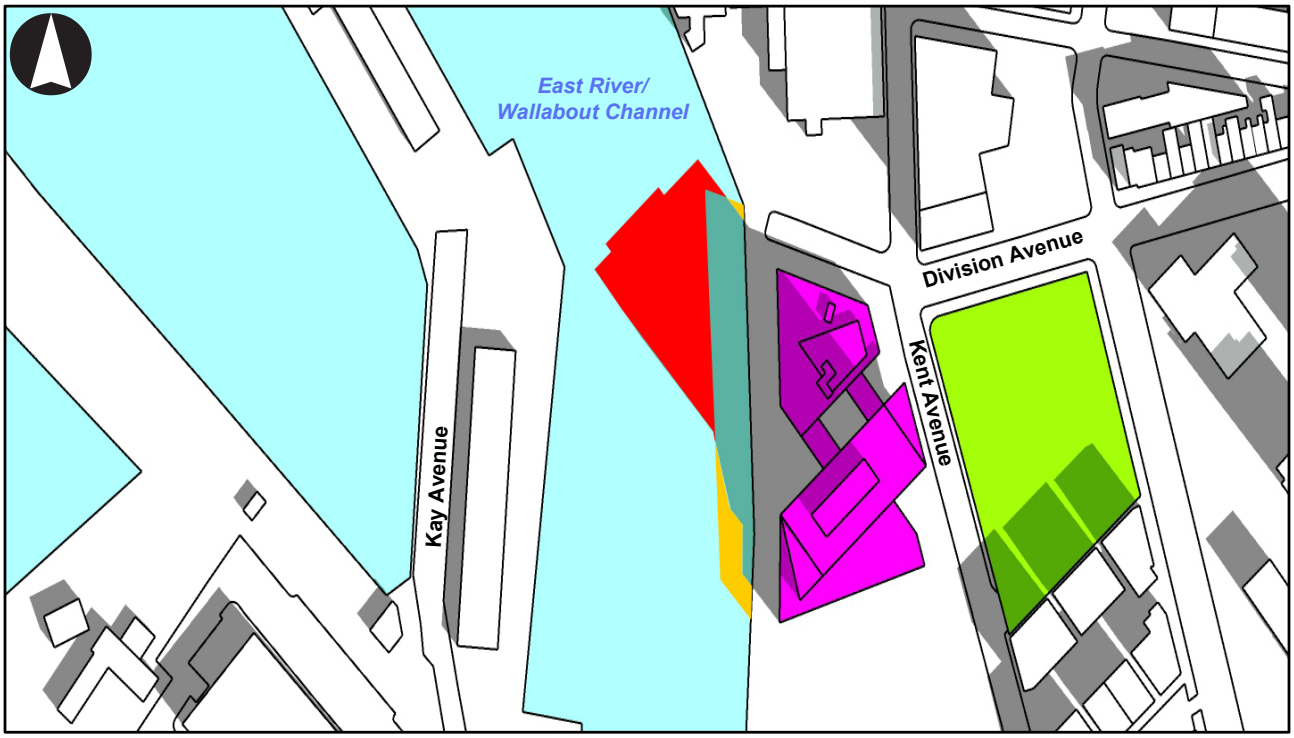
Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

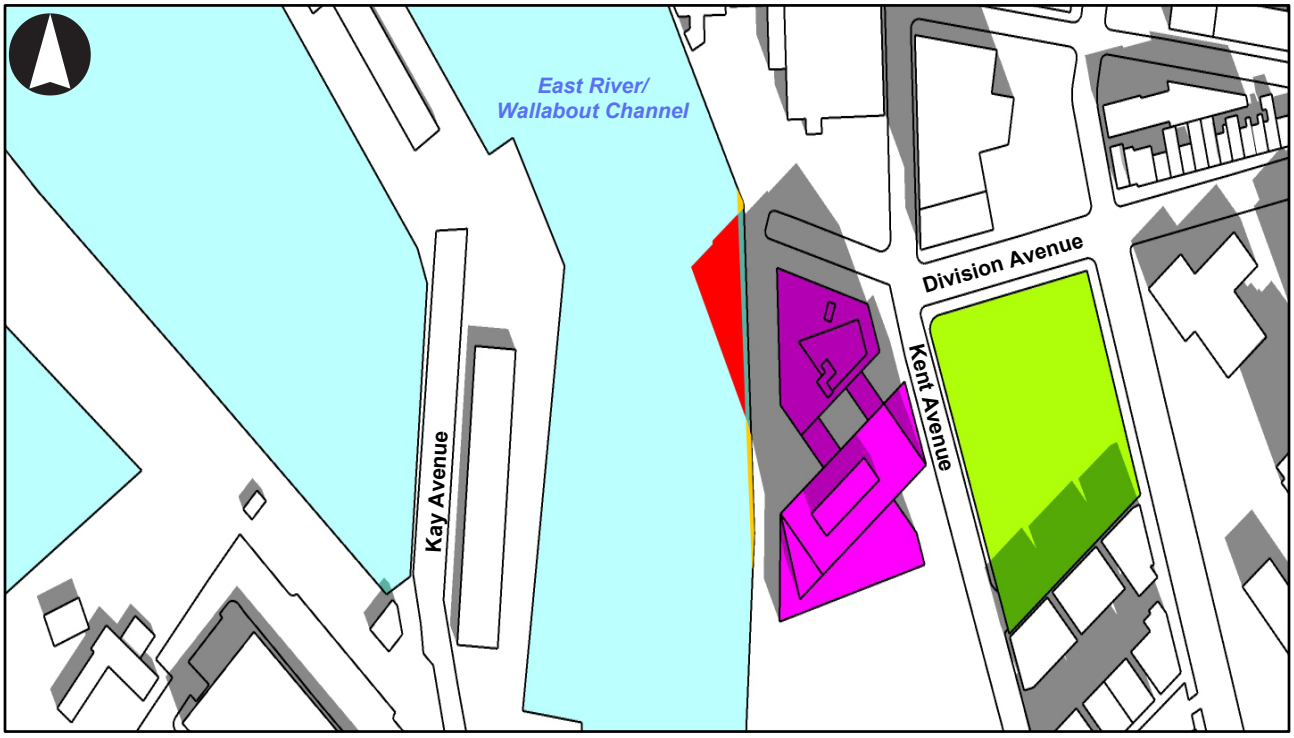
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-3d

Incremental Shadows on March 21st/September 21st - East River



10:00 AM



11:00 AM

Proposed Project

Area of Resource in Direct Sunlight

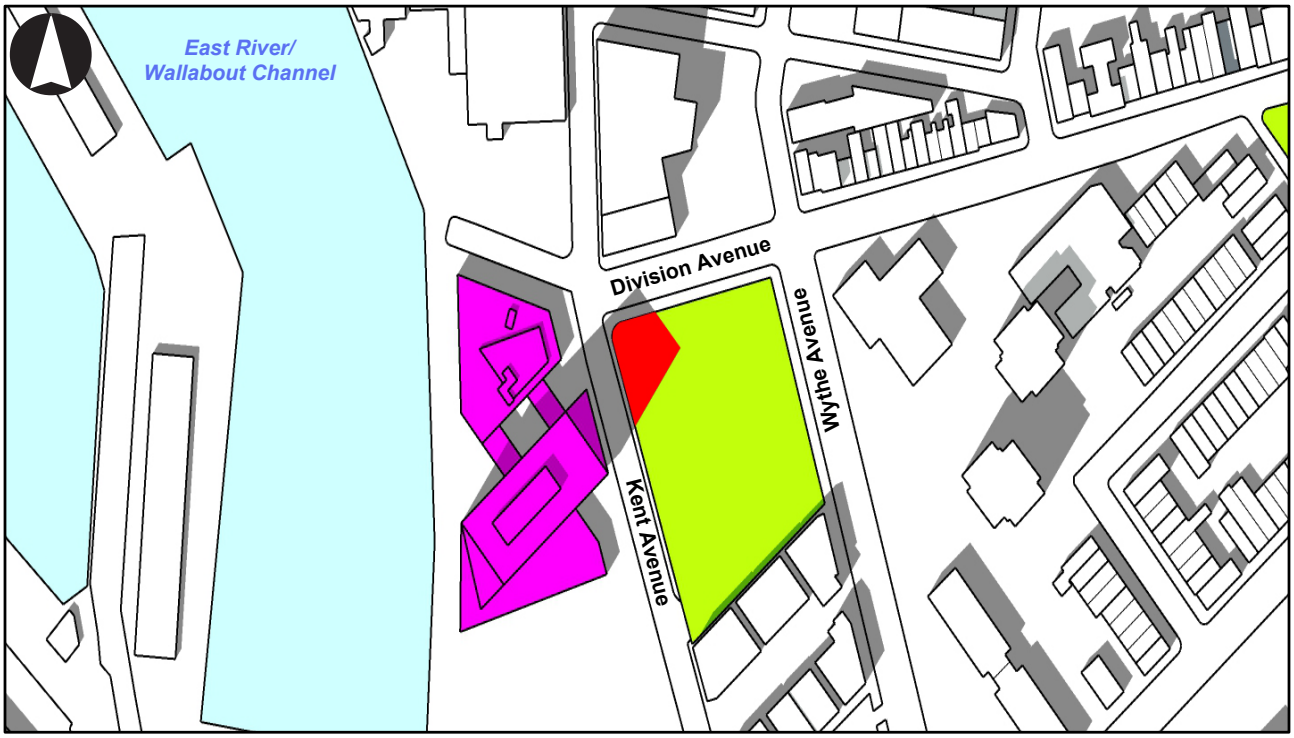
Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

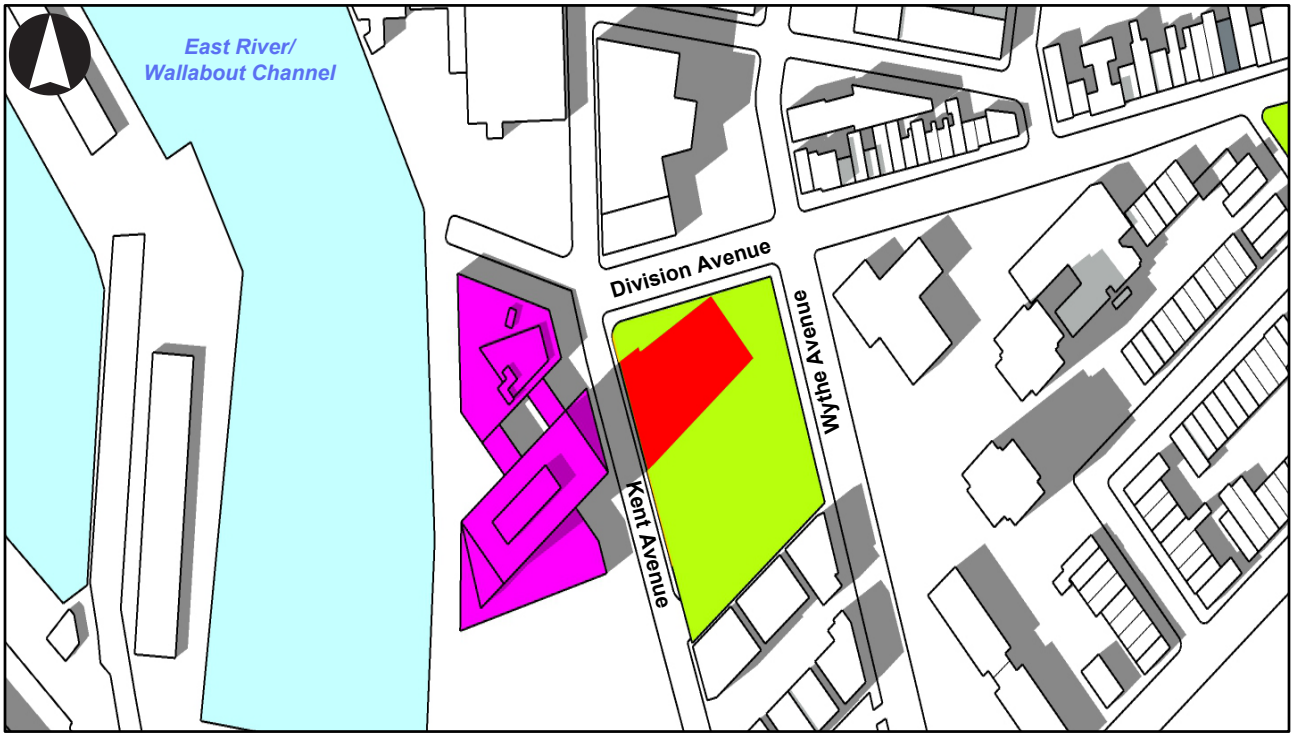
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-4a

Incremental Shadows on May 6th/August 6th - Roberto Clemente Ballfield



1:00 PM



2:00 PM

Proposed Project

Area of Resource in Direct Sunlight

Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-4b

Incremental Shadows on May 6th/August 6th - Roberto Clemente Ballfield



3:00 PM



4:00 PM

Proposed Project

Area of Resource in Direct Sunlight

Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-4c

Incremental Shadows on May 6th/August 6th - Roberto Clemente Ballfield



5:00 PM

Proposed Project

Area of Resource in Direct Sunlight

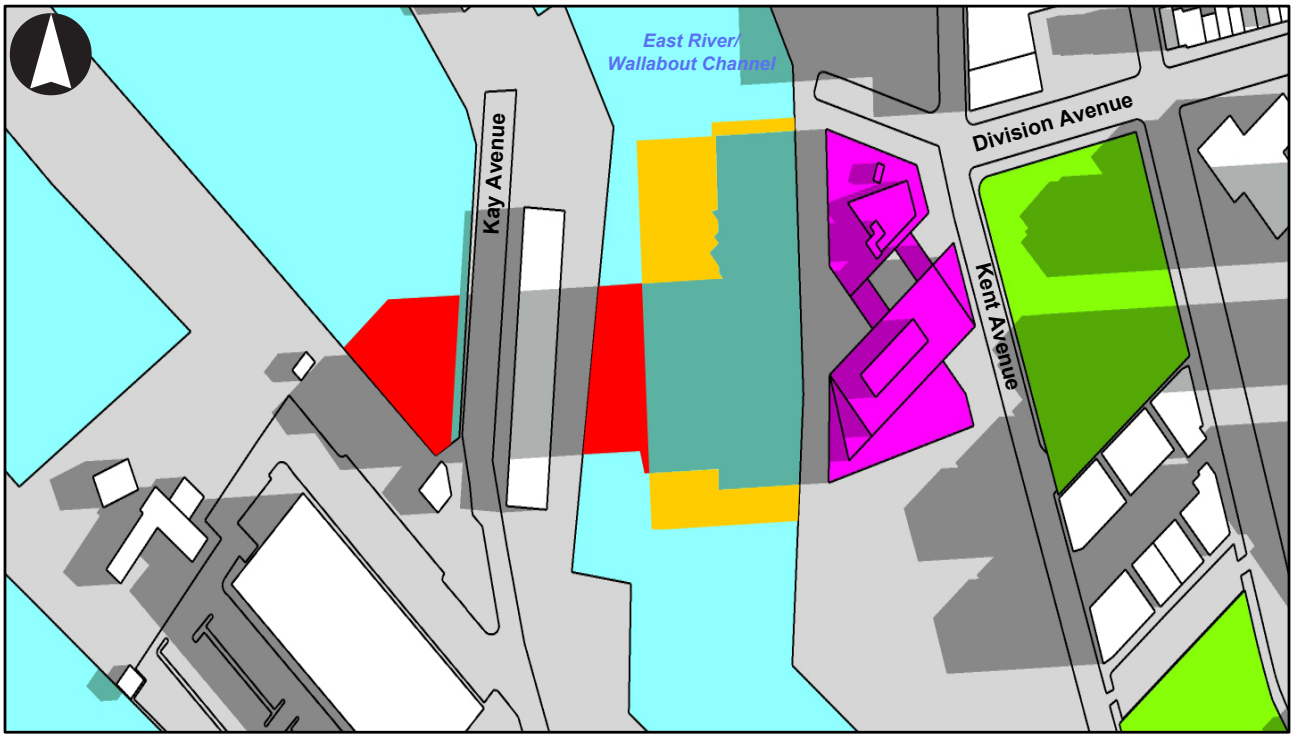
Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

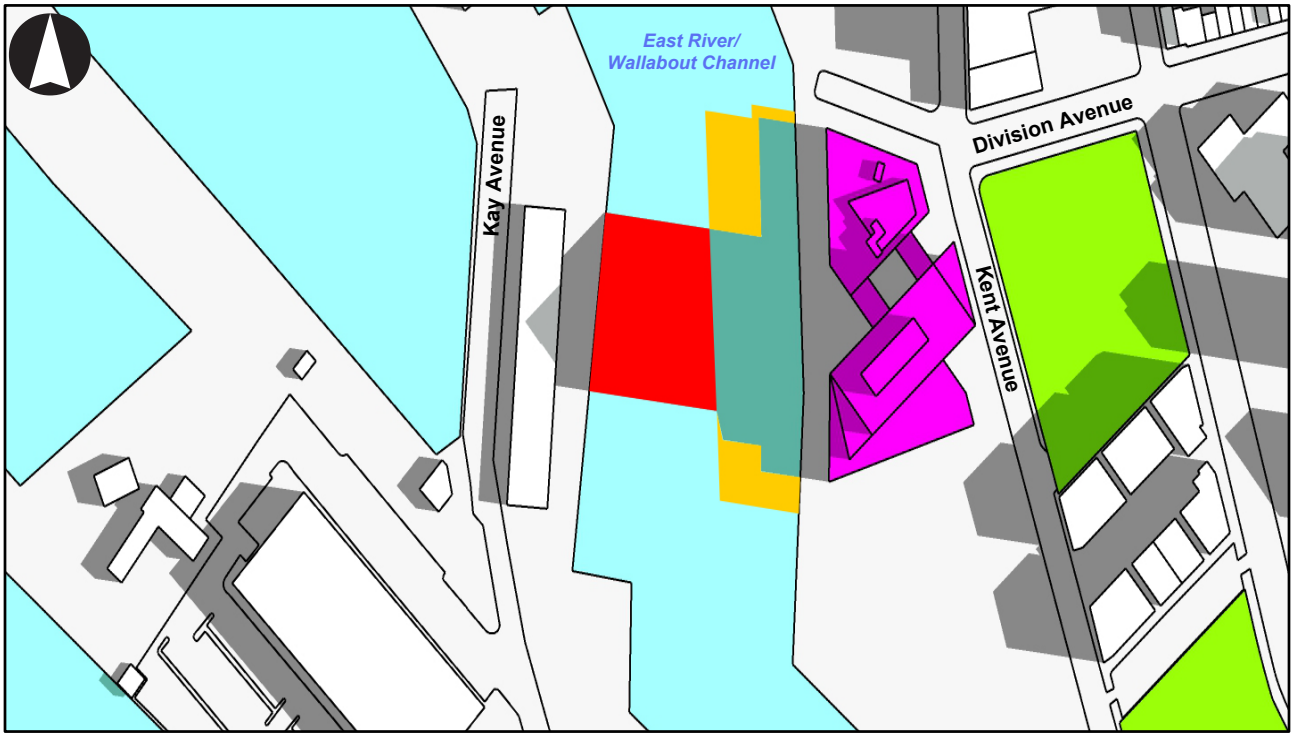
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-4d

Incremental Shadows on May 6th/August 6th - East River



7:00 AM



8:00 AM

Proposed Project

Area of Resource in Direct Sunlight

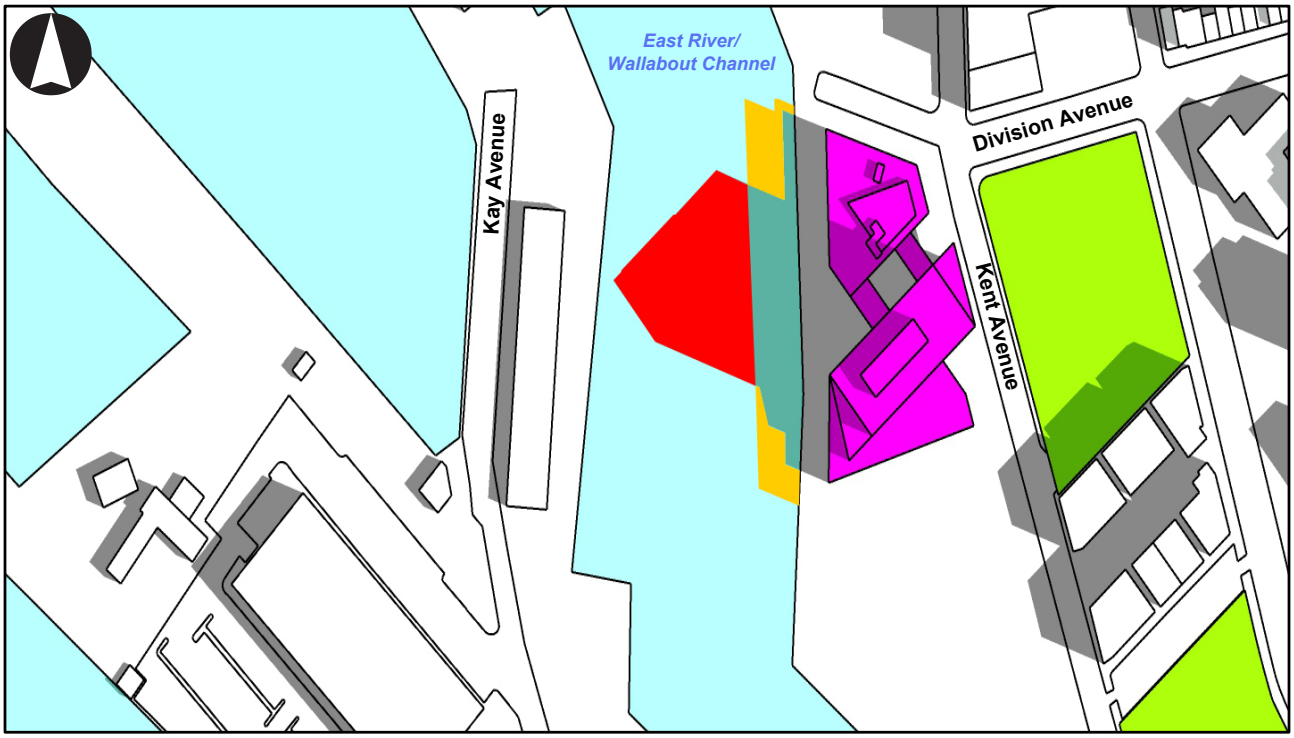
Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

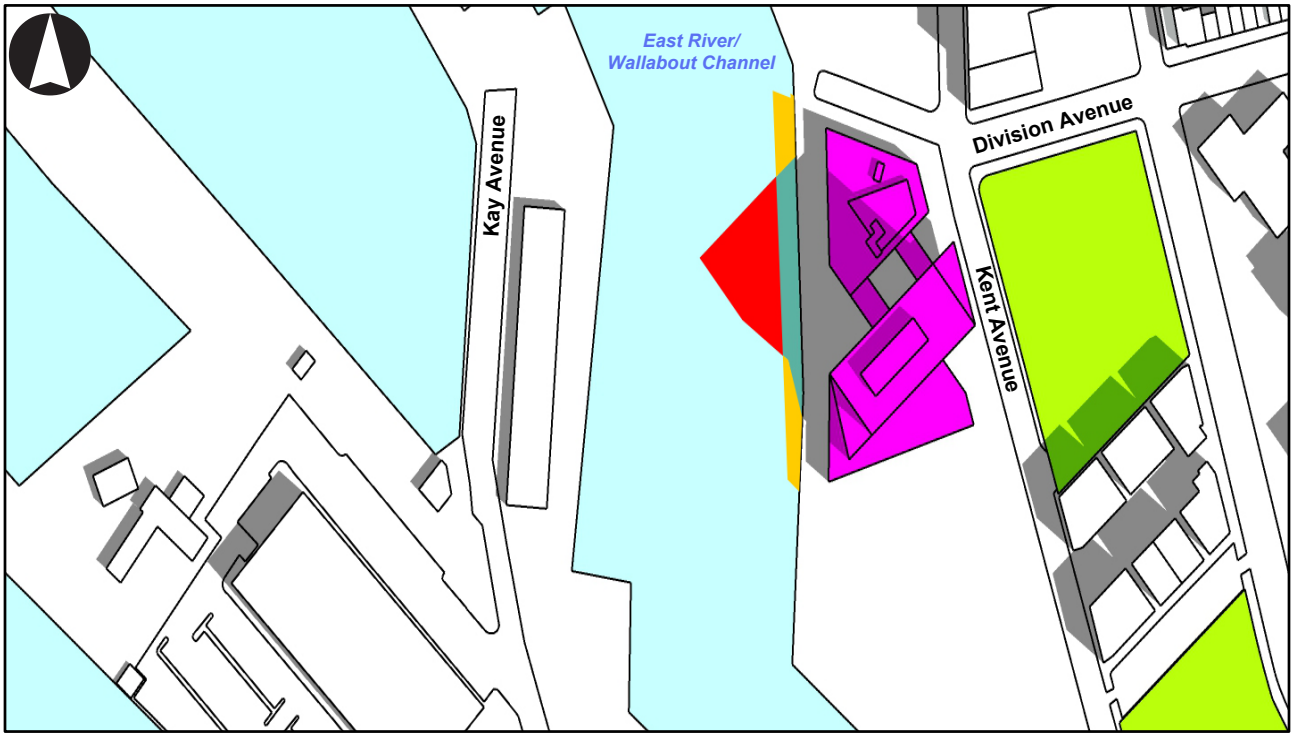
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-4e

Incremental Shadows on May 6th/August 6th - East River



9:00 AM



10:00 AM

Proposed Project

Area of Resource in Direct Sunlight

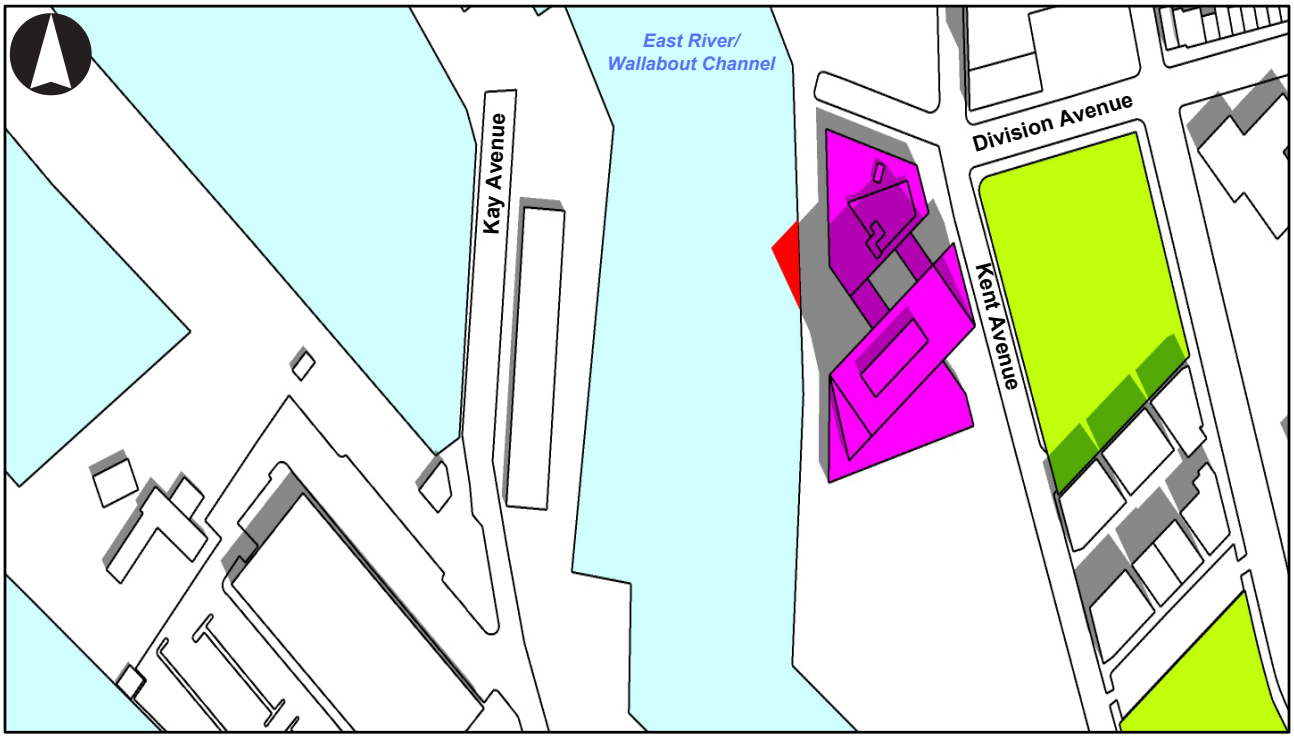
Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-4f

Incremental Shadows on May 6th/August 6th - East River



11:00 AM

Proposed Project

Area of Resource in Direct Sunlight

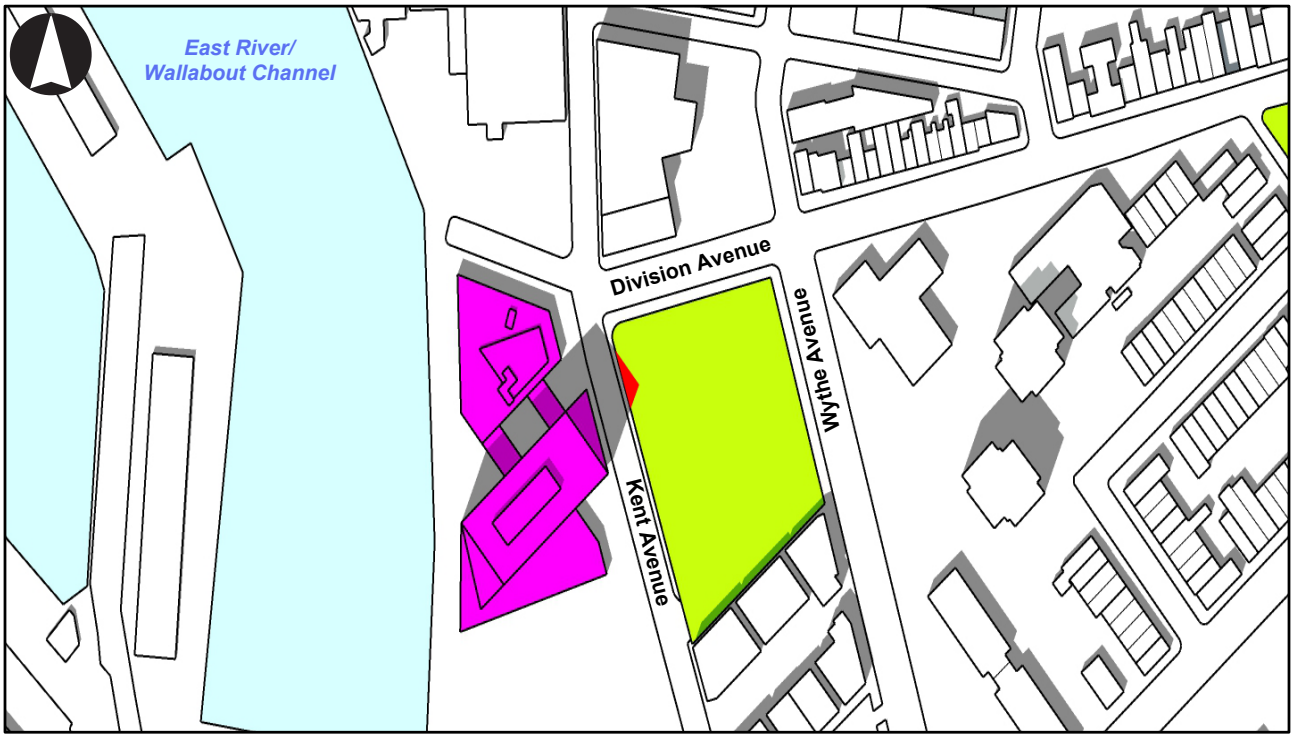
Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

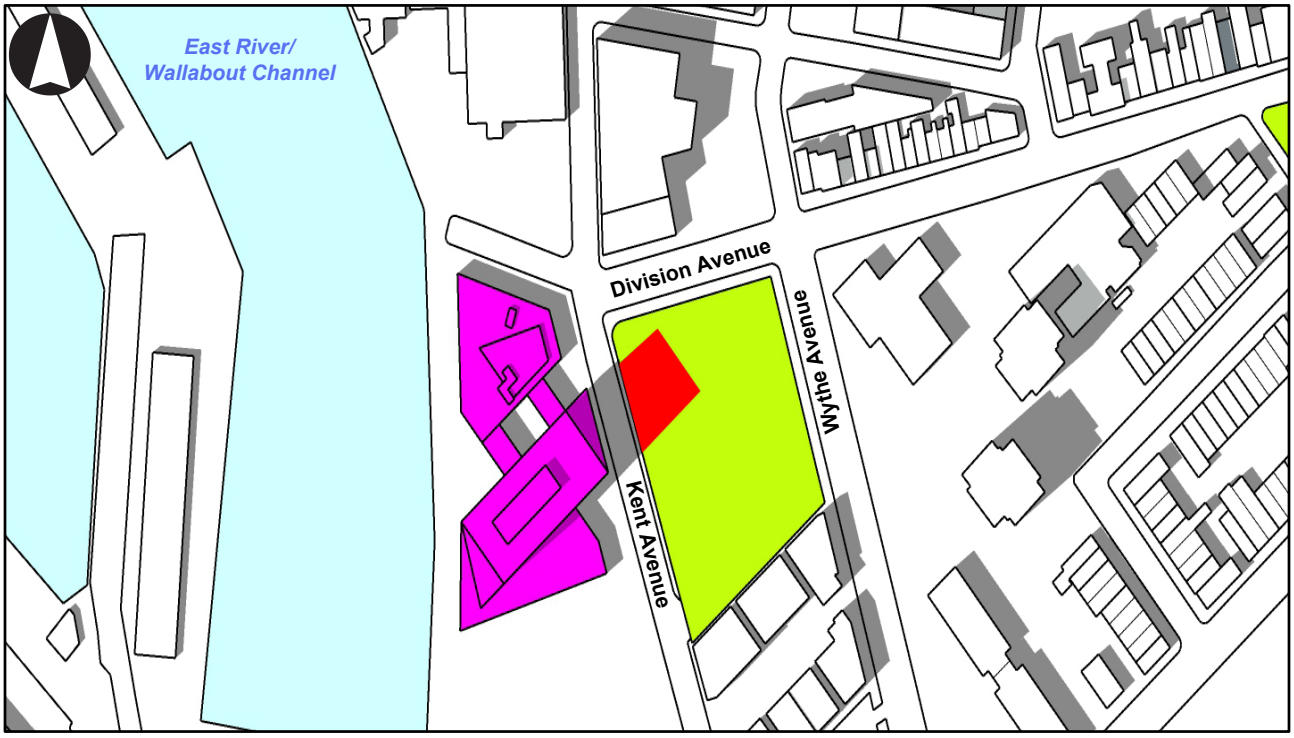
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-5a

Incremental Shadows on June 21st - Roberto Clemente Ballfield



12:30 PM



1:30 PM

Proposed Project

Area of Resource in Direct Sunlight

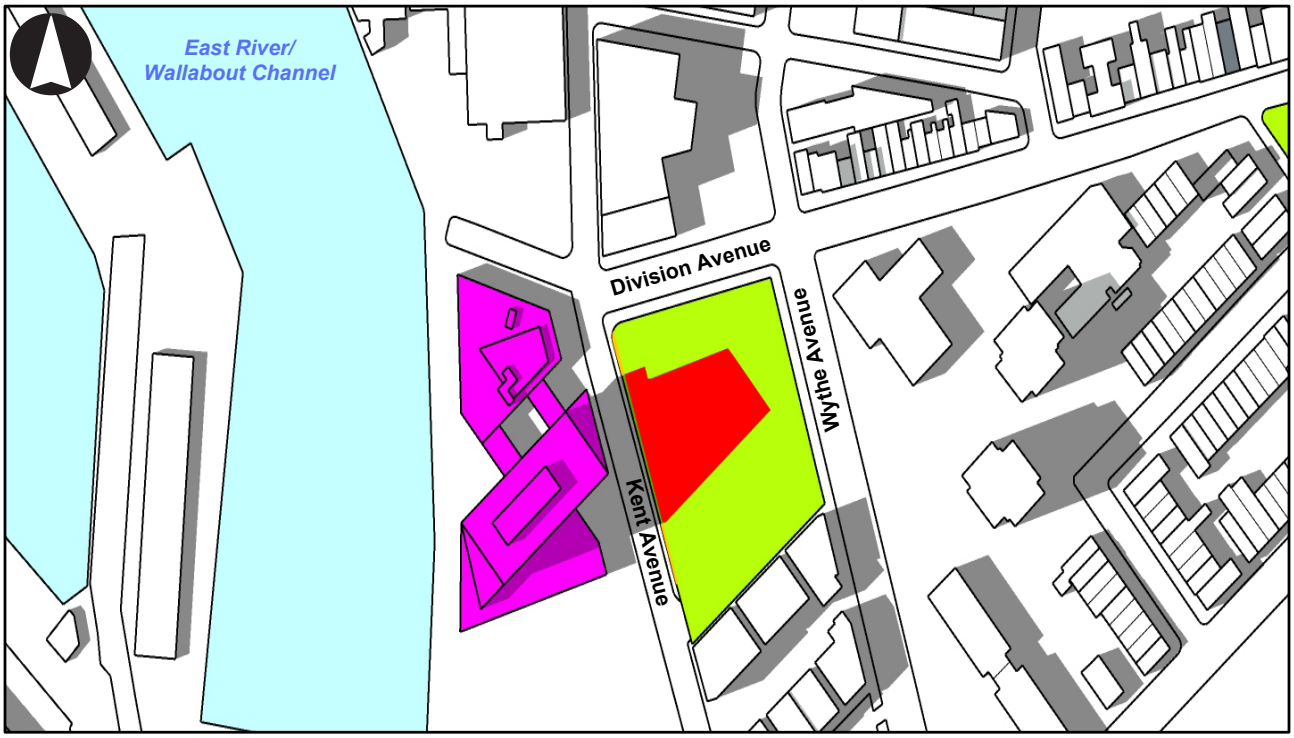
Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-5b

Incremental Shadows on June 21st - Roberto Clemente Ballfield



2:30 PM



3:30 PM

Proposed Project

Area of Resource in Direct Sunlight

Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

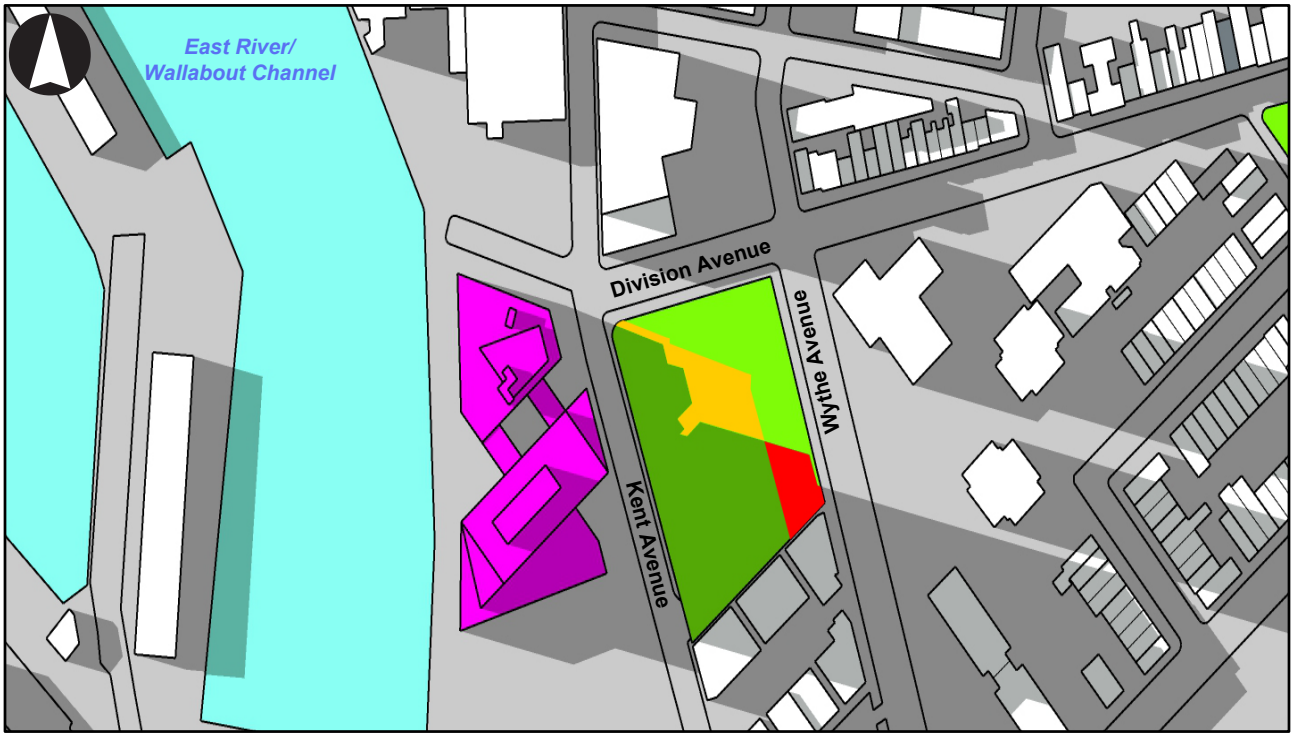
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-5c

Incremental Shadows on June 21st - Roberto Clemente Ballfield



4:30 PM



5:30 PM

Proposed Project

Area of Resource in Direct Sunlight

Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-5d

Incremental Shadows on June 21st - NYCHA Independence Towers Grounds 1



5:45 PM



6:00 PM

Proposed Project (Not shown in this figure)

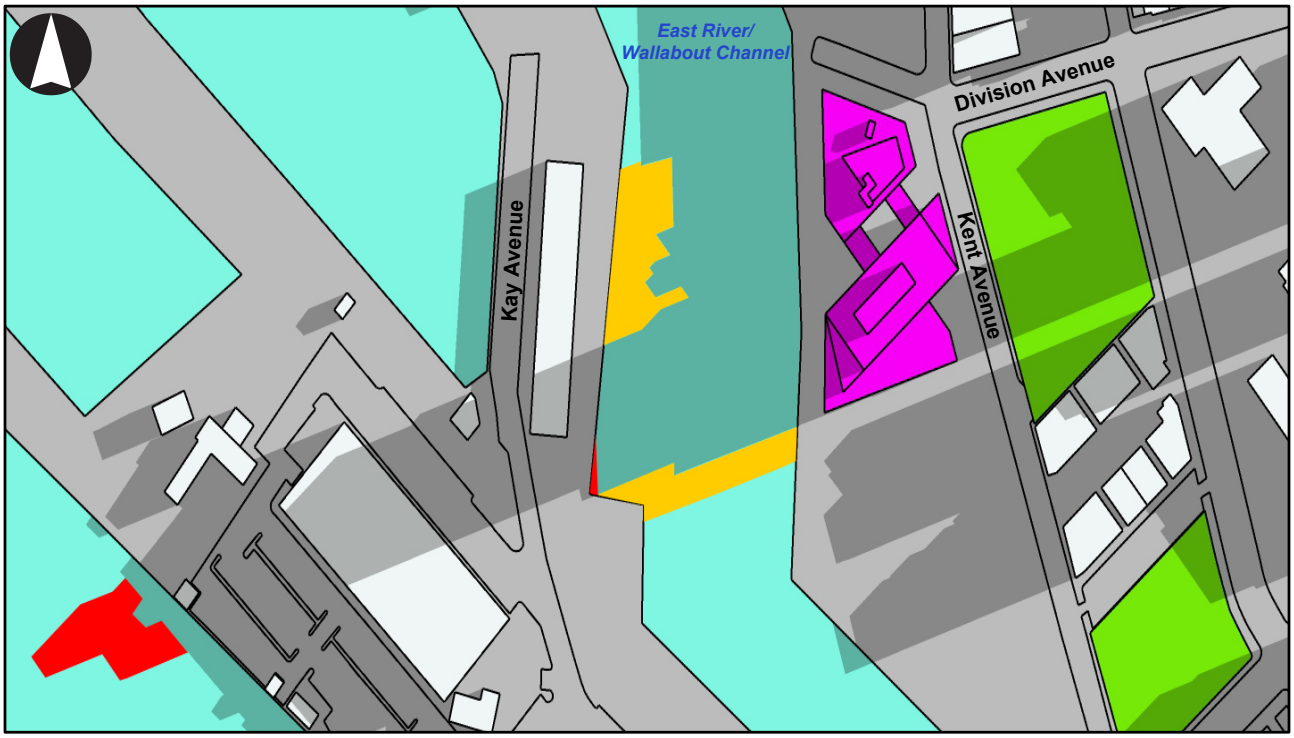
Area of Resource in Direct Sunlight

Area of Resource in New Shadow

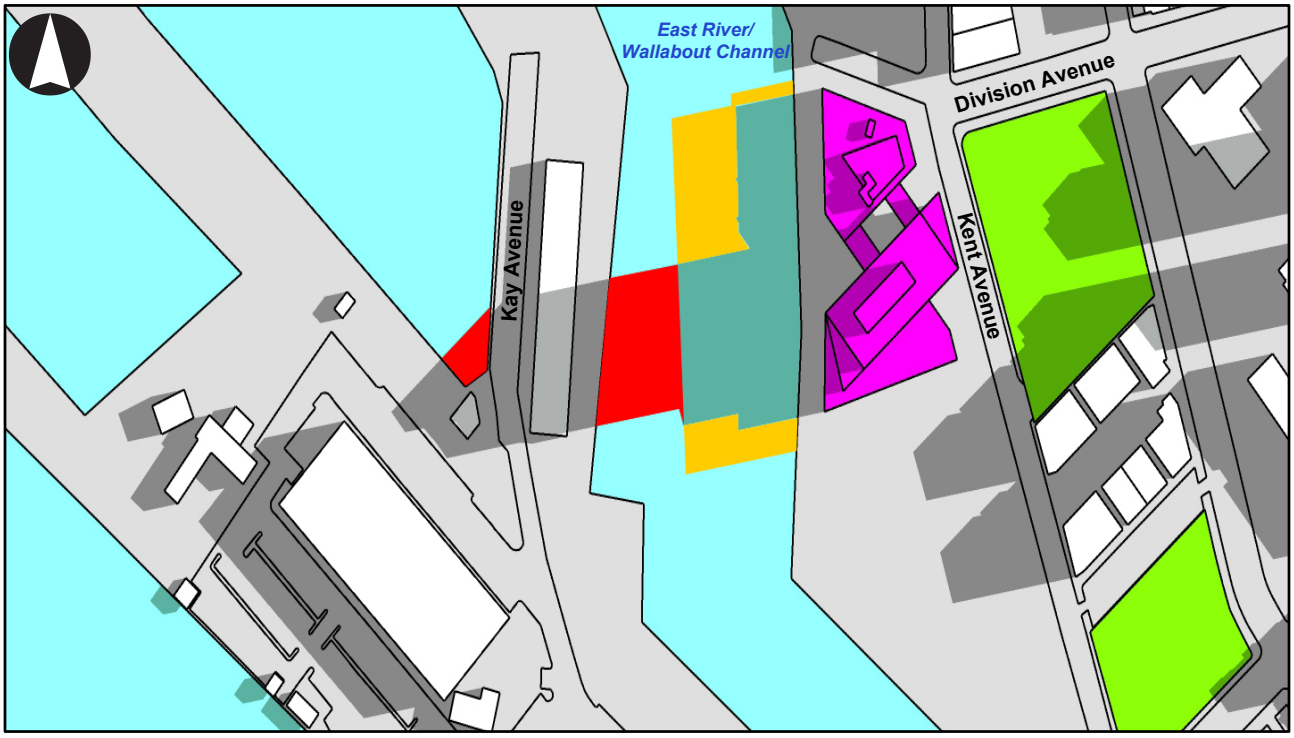
Area of Resource in No-Action Condition Shadow

Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-5e
Incremental Shadows on June 21st - East River



6:00 AM



7:00 AM

Proposed Project

Area of Resource in Direct Sunlight

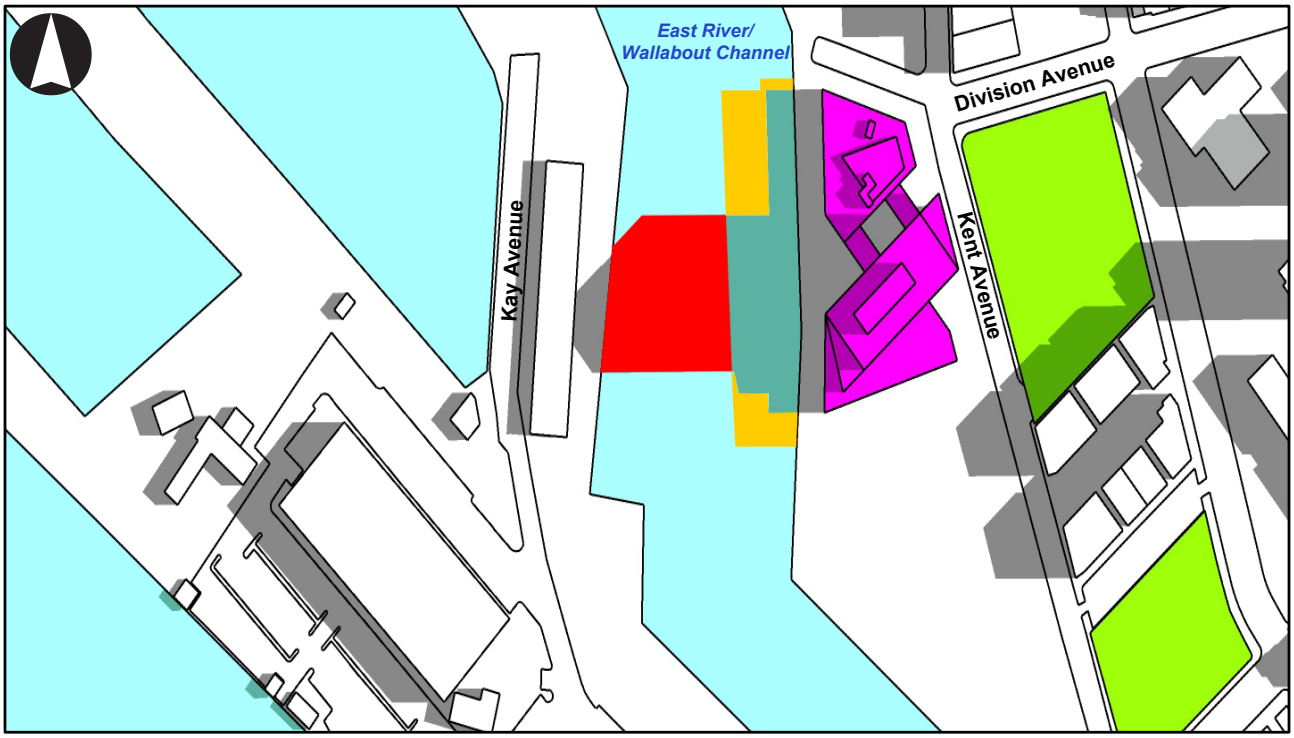
Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

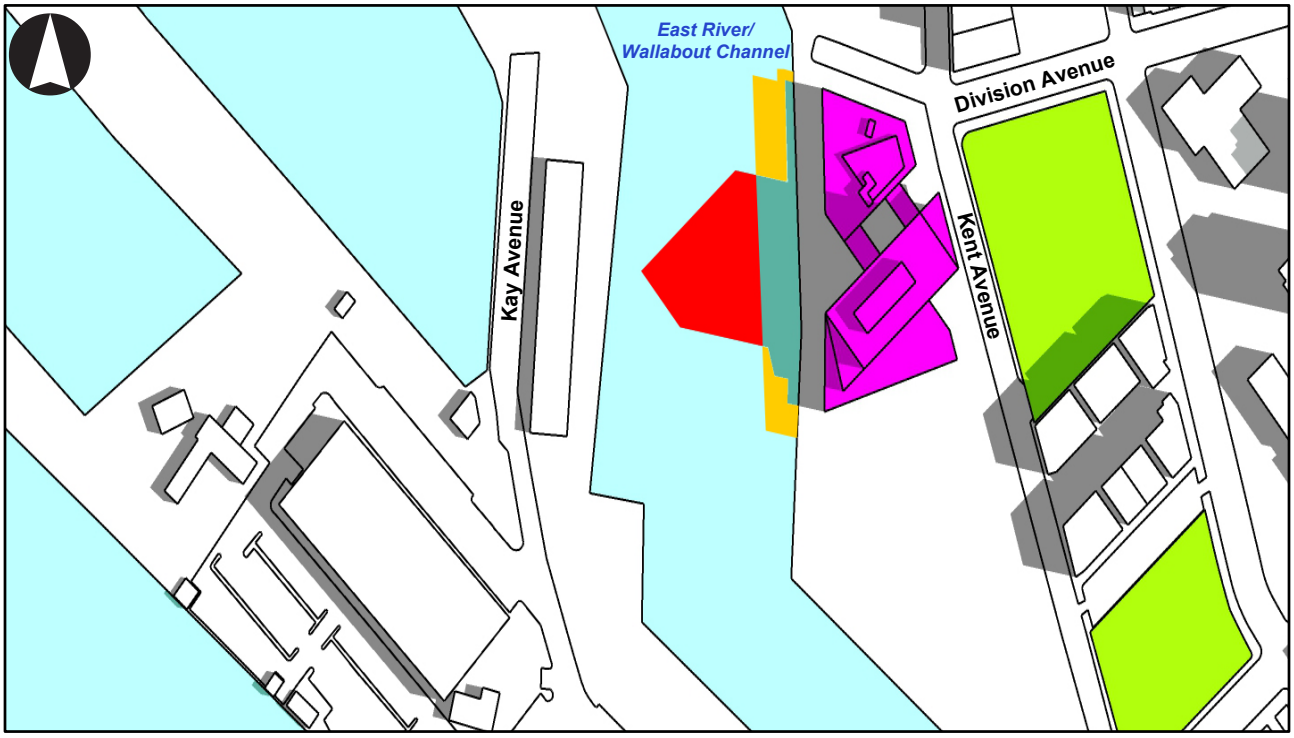
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-5f

Incremental Shadows on June 21st - East River



8:00 AM



9:00 AM

Proposed Project

Area of Resource in Direct Sunlight

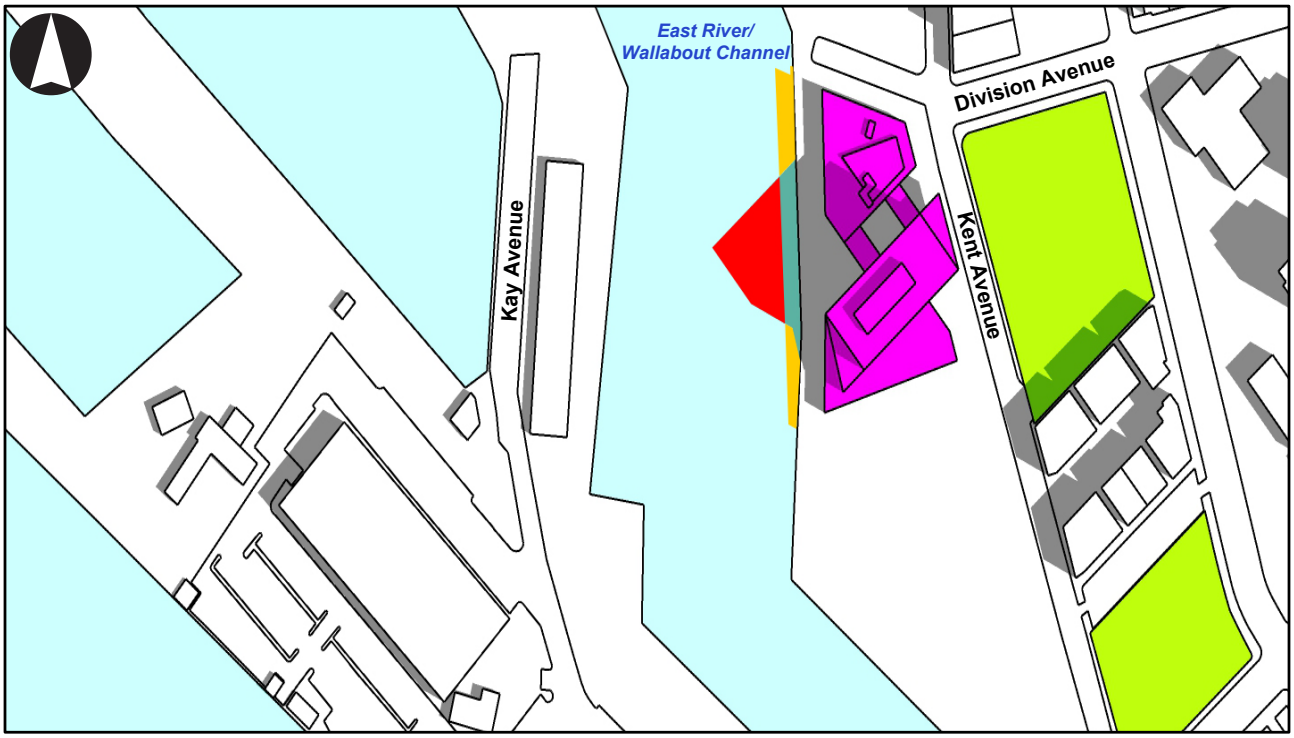
Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

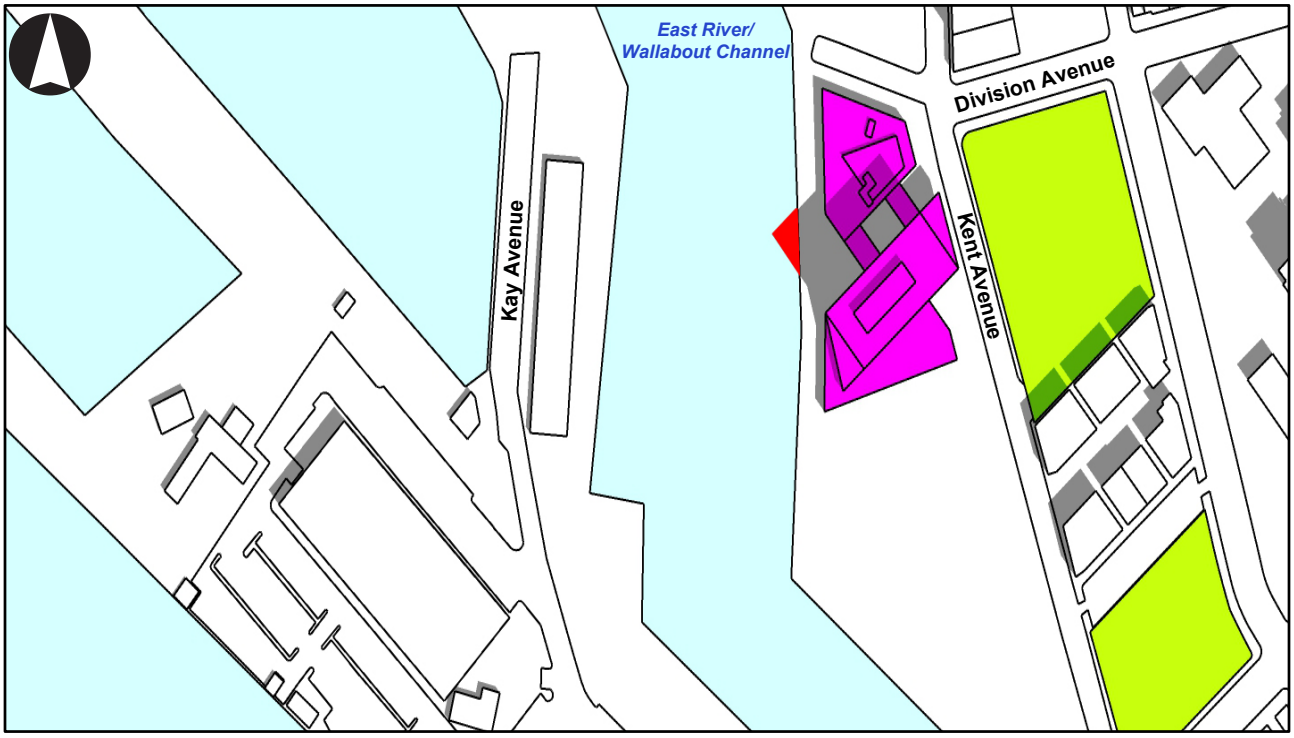
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-5g

Incremental Shadows on June 21st - East River



10:00 AM



11:00 AM

Proposed Project

Area of Resource in Direct Sunlight

Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

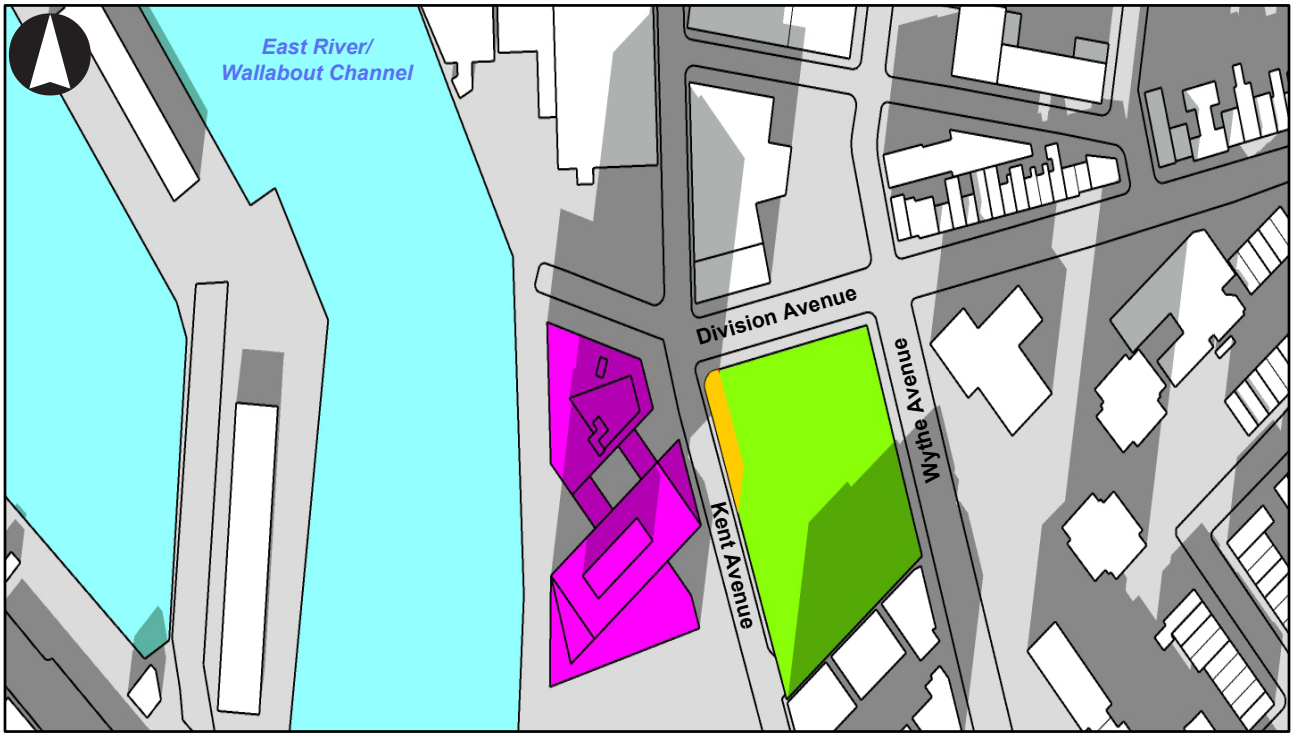
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-6a

Incremental Shadows on December 21st - Roberto Clemente Ballfield



12:15 PM



12:30 PM

Proposed Project

Area of Resource in Direct Sunlight

Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-6b

Incremental Shadows on December 21st - Epiphany Playground



2:53 PM

Proposed Project (Not shown in this figure)

Area of Resource in Direct Sunlight

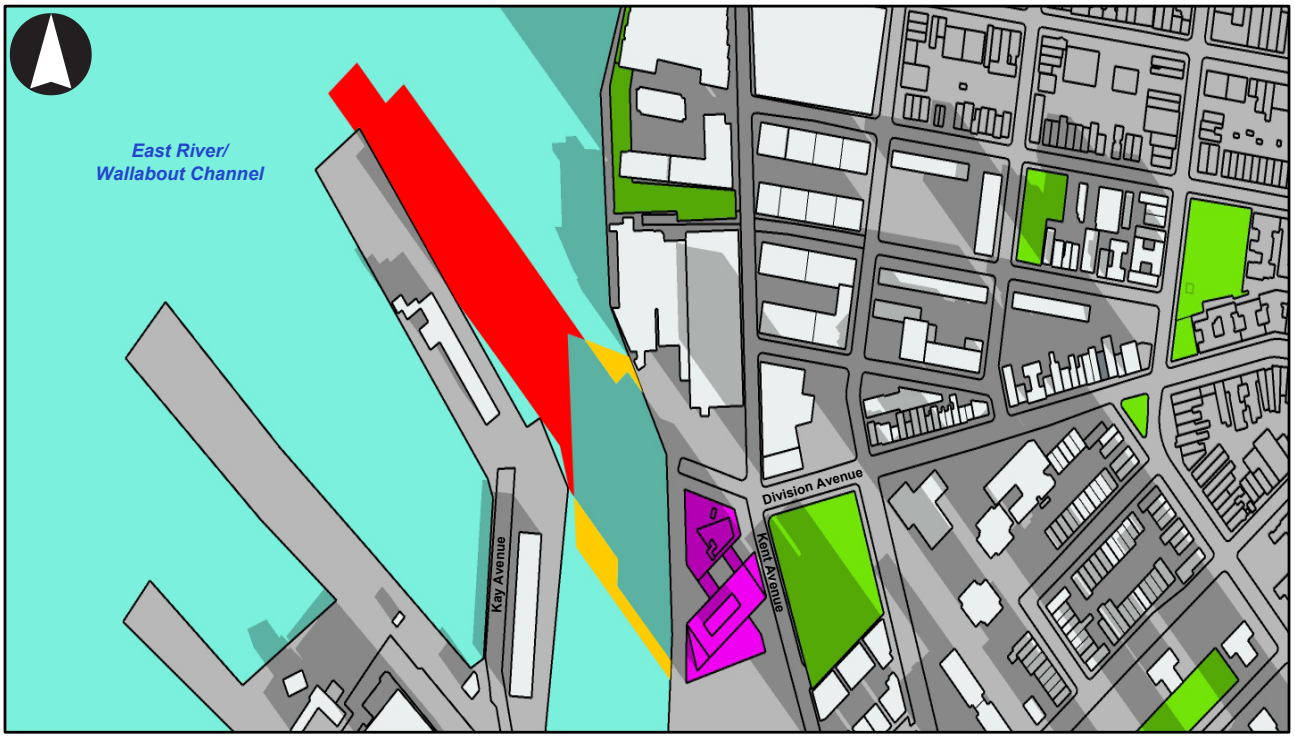
Area of Resource in No-Action Condition Shadow

Area of Resource in New Shadow

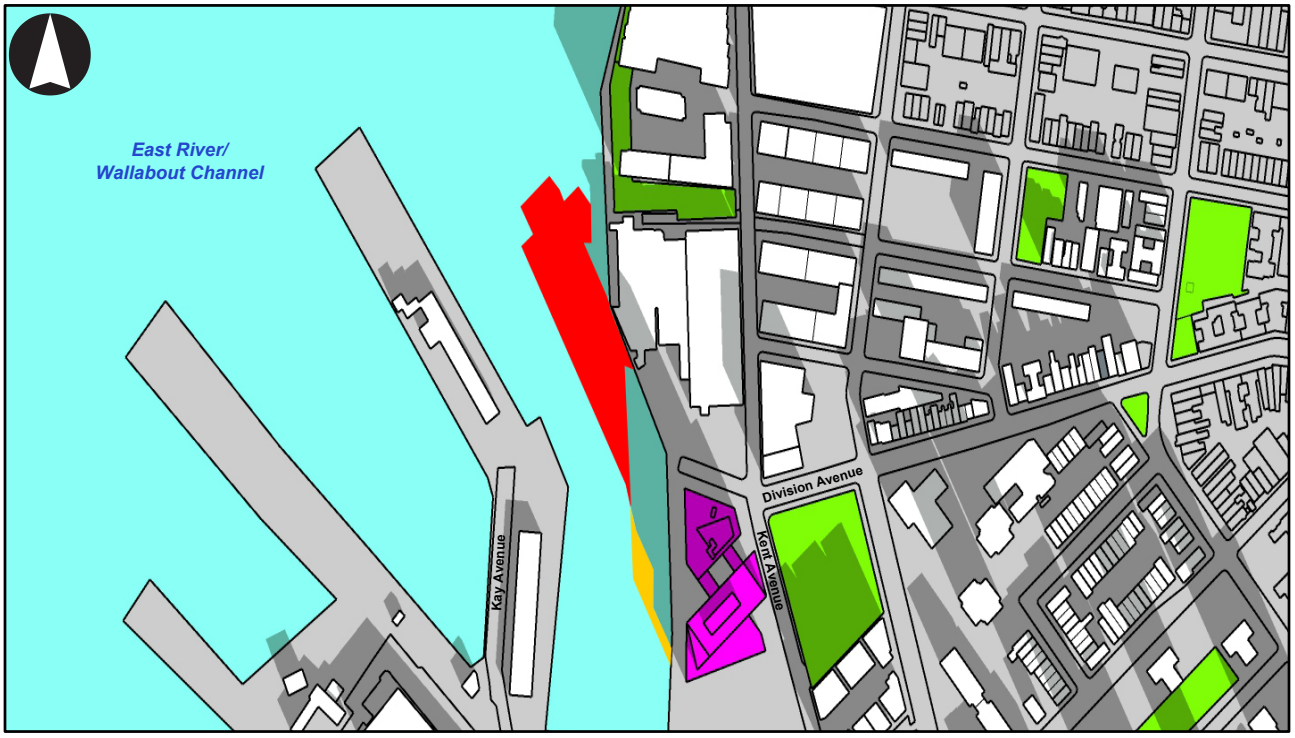
Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-6c

Incremental Shadows on December 21st - East River



9:00 AM



10:00 AM

Proposed Project

Area of Resource in Direct Sunlight

Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition

Figure 5-6d

Incremental Shadows on December 21st - East River



11:00 AM

Proposed Project

Area of Resource in Direct Sunlight

Area of Resource in New Shadow

Area of Resource in No-Action Condition Shadow

Area of Resource Cast in Shadow in the No-Action Condition but not in With-Action Condition