Chapter 7: Shadows

A. INTRODUCTION

As described in Chapter 1, "Project Description," the Proposed Actions include the construction of several new buildings on the Development Site. As modeled under the reasonable worst-case development scenario for this analysis, these buildings would range in height between 350 feet and about 865 feet. The Proposed Actions would also result in residential development at the two Additional Housing Sites. It is anticipated that the building on the Tenth Avenue Site would be 99 feet in height. The Ninth Avenue Site is anticipated to be 115 feet in height where it fronts Ninth Avenue and approximately 66 feet in height along the midblock portion.

This chapter assesses whether the proposed buildings would result in new shadows that would create a significant adverse impact on any nearby shadow-sensitive resources, including publicly accessible open spaces, historic resources with sunlight-dependent architectural features, or important natural features.

PRINCIPAL CONCLUSIONS

The incremental shadows created by the full build out of the Proposed Actions on the Development Site in 2019 would cause a significant adverse shadow impact on the Eastern Rail Yard open space. In addition, shadows from the Tenth Avenue Site would be cast on the future open space adjacent to its east for several hours in all seasons. The design for this open space is still in development. However, the analysis conservatively assumes the entire open space would be heavily programmed with passive open space features, such as benches and other sitting areas. As such, the Proposed Actions would result in a significant adverse impact. The impact is described below and potential mitigation measures are described in Chapter 24, "Mitigation."

The proposed buildings at the Development Site would cast new shadows westward in the mornings throughout the year. Several hours of new shadows would fall on portions of the Hudson River, Hudson River Park, and the Route 9A Bikeway. Despite the long durations of new shadows, only small sections of these large resources would be affected overall. The new shadows would not create a significant adverse impact on the biota of the Hudson River, or on the Route 9A Bikeway, because it is an active linear recreation resource extending for miles north and south of the Development Site. Similarly, there would be no significant adverse impact on Hudson River Park from the incremental shadows, extending as it does for miles north and south of the site. All three of these resources would experience many hours of sun from around noon until sunset, providing both users and vegetation with substantial direct sunlight for much of the day all year.

The analysis also concluded that the planned Hudson Park and Boulevard would experience two to three hours of new shadows through the spring, summer, and fall. The incremental shadows would occur late in the afternoon and would generally be quite small in extent throughout the affected period. Further, Hudson Park and Boulevard would experience ample sunlight through

the morning and afternoon. As the design of this park is still in development, the City will take into consideration the location and duration of shadows to enhance the use and landscaping of the space. Given all these factors, the Proposed Actions would not result in a significant adverse impact on this space.

The analysis determined that incremental shadows would fall across portions of the Eastern Rail Yard open space for over four hours through the late spring and summer, and for two and a half hours on March 21 and September 21. The large areas of new shadow would remove most of the remaining sunlight for much of the affected period, and would therefore result in a significant adverse impact on this open space resource. Mitigation measures to reduce or fully mitigate the Proposed Actions' shadow impact on the Eastern Rail Yard open space are discussed in Chapter 24, "Mitigation."

The Proposed Actions at the Development Site would create several new publicly accessible open spaces, including a large central open space, an open space overlooking the waterfront on the west side of the site, and an open space in the southwest section of the site. In general, the new central spaces would be mostly shady in the mornings but at least partially sunny in the afternoons. The open space overlooking the waterfront and in the southwest portion of the site in particular would be mostly or totally in direct sun throughout the afternoons in the spring, summer and fall, and for much of the afternoon in winter. The High Line, the former freight rail viaduct that runs along the southern and western boundaries of the Development Site, would be adaptively reused as passive open space as part of the Proposed Actions. Like the other proposed open spaces on the Development Site, these sections of the High Line would generally be shady in the mornings and sunny during the afternoons.

The analysis found that the Additional Housing Site on Ninth Avenue would not cast a shadow long enough to reach any open spaces or historic resources with sun-sensitive features on any analysis day. Therefore, the development that would result at the Ninth Avenue Additional Housing Site from the Proposed Actions would not result in a significant adverse shadow impact.

B. METHODOLOGY

Shadows vary according to time of day and season. Morning and evening shadows, when the sun is low in the sky, are long, while midday shadows are shorter. Shadows in winter, when the sun arcs low across the southern sky, are longer throughout the day than at corresponding times in spring and fall, and in summer the high arc of the sun casts shorter shadows than at any other time of year. Early and late shadows in summer fall much farther towards the south than early and late shadows in winter.

In accordance with the criteria in the 2001 *City Environmental Quality Review (CEQR) Technical Manual ("CEQR Technical Manual"),* an analysis of shadows is conducted to determine whether a proposed action would cause a significant adverse impact on open spaces, natural features, or sun-sensitive historic resources. According to the *CEQR Technical Manual*, a shadows analysis is required for any action that would result in new structures or additions to existing structures that would be located near sun-sensitive resources (particularly actions that propose buildings 50 feet high or taller). As described in Chapter 1, "Project Description," building heights on the Development Site would range between 350 and 950 feet and the buildings heights for the Additional Housing Sites are anticipated to reach 99 feet and 115 feet,

for the Tenth Avenue and Ninth Avenue Sites, respectively. Therefore, the Proposed Actions could result in an increase in shadows falling on nearby sun-sensitive resources.

The next step in the assessment of a project's shadow impacts is to determine whether project-generated shadows would be long enough to reach any shadow-sensitive open spaces, natural features, or architectural resources at any time of year. If this preliminary or screening analysis indicates they might, then a detailed shadow analysis is warranted. The detailed analysis determines the extent and duration of project-generated incremental shadows on any sun-sensitive uses and vegetation of open spaces, or sunlight-sensitive features of architectural resources, and assesses the effects of new shadows on such resources.

Following the guidelines of the *CEQR Technical Manual*, this analysis considers shadows on four representative days of the year: March 21 (equivalent to September 21, the equinoxes); June 21, the summer solstice; May 6 (equivalent to August 6, the midpoints between the equinoxes and summer solstice); and December 21, the winter solstice.

The CEQR methodology does not consider shadows and incremental increases in shadows within 1½ hours of sunrise or sunset to be significant. Therefore, the analysis period on each of the four representative days is between 1½ hours after sunrise and 1½ hours before sunset. Additionally, CEQR does not consider shadows on City streets, sidewalks, and other buildings to be significant.

FRAMEWORK FOR ANALYSIS

The detailed analysis compares shadows generated by the Proposed Actions to a baseline condition representing the Future without the Proposed Actions. As described in Chapter 2, "Framework for Analysis," the year for the full build-out of this project is 2019. The Future without the Proposed Actions baseline condition assumes that none of the proposed discretionary actions are approved, and that all the existing structures on the project sites would remain. This analysis therefore compares shadows that would be cast by the Proposed Actions to those that would be cast by the existing structures in the 2019 Future without the Proposed Actions. The analysis takes into account shadows cast by other existing buildings, as well as those cast by additional developments in the study area expected to be completed by the 2019 analysis year. The study area for the shadow analysis is derived from a screening analysis, when the full extent of the area that could be reached by shadows generated by the Proposed Actions is calculated for each of the analysis days and delineated on a street map.

The reasonable worst-case development scenario massing used in this analysis for the Development Site represents a hybrid of the scenarios described in Chapter 2, "Framework for Analysis," analyzing the tallest of the possible building envelopes at each footprint location. This reasonable worst-case development scenario is not actually feasible, because if all buildings were at the maximum allowable heights, the total development on the site would exceed 10 FAR; thus, this scenario is assumed for conservative shadow analysis purposes only. Table 7-1 lists each proposed building on the Development Site and the reasonable worst-case development scenario height used in the shadow analysis, as well as the approximate height of buildings anticipated to be developed at the Additional Housing Sites.

Table 7-1
Height of Proposed Buildings Analyzed

Proposed Buildings	Approximate height in feet
Development Site	
WR-1	785*
WR-2	810*
WR-3	710*
WR-4	500*
WR-5	690*
WR-6	825*
WR-7	725*
WC-1	865*
Tenth Avenue Additional Housing Site	99
Ninth Avenue Additional Housing Site	115
Notes: *See Appendix A, "Proposed Zoning Text" for base elevation of building heights	

The Proposed Actions would create a large central area of publicly accessible open space and also adaptively reuse the High Line as passive open space on the Development Site. According to CEQR methodology, shadows cast on open spaces that are part of a proposed project are not considered impacts of an action because without the action, the open space would not exist. However, a qualitative assessment of shadows on these proposed open spaces is included in this analysis.

For the detailed analysis, shadows were modeled using the solar rendering capabilities of MicroStation V8 software. A three-dimensional model of existing buildings and topography around the project sites was provided by Fugro EarthData Inc. and augmented by AKRF, Inc. A three-dimensional model of the reasonable worst-case development scenario was provided by the New York City Department of City Planning (DCP) and was integrated into the existing conditions model. Other known development projects in the study area expected to be completed by 2019 in the Future without the Proposed Actions were added to the existing conditions model to model the future baseline conditions.

DETERMINATION OF IMPACT SIGNIFICANCE

According to the *CEQR Technical Manual*, a significant shadow impact may occur when there is substantial reduction in sunlight to a sun-sensitive use or feature, threatening the survival of vegetation or significantly reducing the usability of the open space, or in the case of an architectural feature, obscuring the elements or details that make that resource significant. The determination of impact significance is based on an assessment of how a project's incremental shadows specifically would affect sun-sensitive features of individual resources.

C. SCREENING ANALYSIS

A screening analysis was performed to determine which open spaces, sunlight-sensitive historic resources, or important natural features could be affected by shadows from the Proposed Actions at any time of year. To identify resources of concern, the maximum shadow length was calculated for the proposed development that would result on the three project sites from the Proposed Actions on the four analysis days, taking into account time of day as well as season. For example, on the December 21 analysis day a building has a maximum shadow length factor equal to 4.3 times its height at the beginning and end of the analysis period when shadows are

cast to the northwest and northeast, respectively. Toward midday, as the sun rises in the sky, the shadow length factor is reduced to 2.07 times the height of the building. Shadow length factors for the other analysis days throughout the calendar year are shorter than they are in December. However, the daylight hours are longer during the rest of the year, resulting in longer analysis periods and shadows that fall farther towards the southwest and southeast at the beginning and end of the day. During the December analysis day, shadows are cast up to 43 degrees east and west of true north, but in June shadows are cast up to 108 degrees east and west. Therefore open spaces in the southern portion of a study area that could be reached by shadows in June would not be affected in December.

DEVELOPMENT SITE

Using the proposed building heights and forms of the reasonable worst-case development scenario, the full extent of the area that could be reached by shadows from the Development Site was calculated for each of the analysis days and delineated on a street map (see Figure 7-1). In coordination with the open space and historic resource analyses presented in other chapters of this EIS, open spaces and historic resources were also shown on the map. All sun-sensitive resources that would fall fully or partially within the perimeter representing the maximum shadow length from the Development Site on the four analysis days were included in the more detailed analysis below.

ADDITIONAL HOUSING SITES

A similar screening analysis was performed to determine whether proposed development at the two Additional Housing Sites would cast a shadow long enough to reach any sun-sensitive resources. The screening analysis concluded that the Ninth Avenue Site would not cast a shadow long enough to reach any open spaces or historic resources with sun-sensitive features on any analysis day. The Sheffield residential plazas at 322 West 57th Street, northeast of the project site, and the P.S. 111 playground at 440 West 53rd Street, west of the Ninth Avenue Site, were the closest resources.

The Tenth Avenue Site would similarly not cast shadows long enough to reach any existing sun-sensitive resources. Hell's Kitchen Park and the Clinton Community Garden are located a block south of the project site, but too far south to be reached by project-generated shadows even on June 21 at 7:00 PM. The Gutenberg Playground, the next-closest resource, located a block to the west of the project site, would not be reached by shadows from the 99-foot tall proposed development on any analysis day.

However, the open space that will be built adjacent to the Tenth Avenue Site in the Future without the Proposed Actions, abutting it to its east, would experience project-generated shadows during the afternoon in all seasons, and is examined in more detail below.

D. ANALYSIS OF INCREMENTAL SHADOWS

DEVELOPMENT SITE

For the detailed analysis, computer software was used to compare the shadows cast by the proposed buildings with those cast by the existing and proposed buildings in the Future without the Proposed Actions condition on each of the four analysis days. For the Development Site, the analysis showed that four open spaces—two existing parks and two open spaces that are

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Preliminary Screening Analysis

Figure 7-1

WESTERN RAIL YARD

expected to be complete by 2019 in the Future without the Proposed Actions—would experience incremental shadows as a result of the Proposed Actions. Additionally, one historic resource would experience minimal incremental shadows, and the Hudson River would experience shadows in mornings throughout the year (see Table 7-2).

Table 7-2
Incremental Shadow Durations

Resource	Equinoxes (March 21 and Sept. 21) 8:36 AM-5:29 PM EDT	Midpoints between Summer Solstice and Equinoxes (May 6 and Aug. 6) 7:27 AM-6:18 PM EDT	Summer Solstice (June 21) 6:57 AM-7:01 PM EDT	Winter Solstice (December 21) 8:51 AM-2:53 PM EST
OPEN SPACES				
Hudson River Park / Route 9A Bikeway (portion)	8:36 AM–1:30 PM Total: 4h 54m	7:27 AM–12:45 PM Total: 5h 18m	6:57 AM–12:30 PM Total: 5h 33m	8:51 AM–1:15 PM Total: 4h 24m
River Place plaza (640 West 42nd St.)	—	—	—	1:40 PM–1:55 PM 2:10 PM–2:20 PM 2:35 PM–2:50 PM Total: 40m
Eastern Rail Yard open space (planned)	3:00 PM–5:29 PM Total: 2h 29m	2:15 PM–6:18 PM Total: 4h 3m	2:15 PM–7:01 PM Total: 4h 46m	2:40 PM–2:53 PM Total: 13m
Hudson Park and Boulevard (planned)	3:45 PM–5:29 PM Total: 1h 44m	4:00 PM–6:18 PM Total: 2h 18m	3:45 PM–7:01 PM Total: 3h 16m	—
HISTORIC RESOURCES				
St. Michael's R.C. Church (NYCL-eligible, S/NR-eligible)	—	5:55 PM–6:00 PM Total: 5m	—	—
NATURAL FEATURES				
Hudson River (portion)	8:36 AM–1:15 PM Total: 4h 39m	7:27 AM–12:00 PM Total: 4h 33m	6:57 AM–11:45 AM Total: 4h 48m	8:51 AM–1:00 PM Total: 4h 9m

Notes: EST = Eastern Standard Time.
EDT = Eastern Daylight Time.
March 21 is the equivalent of September 21.
May 6 is the equivalent of August 6.
NYCL-eligible = Eligible for New York City Landmark designation
S/NR-eligible = Eligible for listing on the State and National Registers of Historic Places

A number of open spaces and historic resources that were included in the detailed analysis would not receive any incremental shadows at any time of year, due to their distance (see Figure 7-1) from the Development Site and the presence of intervening structures already casting shadows on those resources during the times when shadows from the Proposed Actions would fall there. The P.S. 51 playground, Gregory J.M. Portley Plaza, One Penn Plaza, and the Farley Building steps are all too far away from the Development Site for shadows from the Proposed Actions to reach. Bob's Park, the planned Hudson Mews open space, and the planned Brookfield development open space would all be in existing shadows in the late afternoon when shadows from the Proposed Actions could otherwise fall on them.

St. Raphael's R.C. Church (NYCL-eligible, S/NR-eligible), located eight blocks to the northeast of the Development Site at West 40th Street between Tenth and Eleventh Avenues, is too far to be reached by shadows from the Proposed Actions. The arched windows of the Christ Church Memorial (S/NR-eligible) on West 36th Street face north, away from the Development Site, and would not be affected. The south façade of the West Side Jewish Center (S/NR-eligible) on West

34th Street would be in existing shadows from 6:45 PM to 7:01 PM on June 21, which would be the only time and analysis day that shadows from the Proposed Actions would be long enough to reach it. The extent, duration, and effects of incremental shadows from the Development Site are discussed below for each resource and depicted in the accompanying figures.

OPEN SPACES

Hudson River Park/Route 9A Bikeway (Portion)

A portion of Hudson River Park and the adjacent Route 9A Bikeway is located just west of the Development Site; the park and bikeway also extend south to Battery Park and north to West 59th Street. The area of the park that would be affected by shadows from the Proposed Actions currently contains a skate park and, just north of it, some single-story structures and a parking area. According to what is currently known about the future programming of Hudson River Park, this area will be redeveloped with some combination of passive recreation space, landscaping, and walkways. It is not currently know whether this redevelopment would be completed by 2019.

The Proposed Actions would cast new shadows on portions of the bikeway and park throughout the morning and mid-day hours in all seasons (see Figures 7-2 through 7-9). The incremental shadows would move northward and eastward through the mornings, falling primarily on areas of the bikeway and park west and northwest of the Development Site. The area currently occupied by the skate park and the area north of it are the only specific features in Hudson River Park that would be affected by shadows from the Proposed Actions. Southwest of the Development Site, part of the bikeway would experience incremental shadows early on late spring and summer mornings.

The bikeway is an active recreation resource, and its users would not be significantly impacted by the new shadows from the Proposed Actions despite the long durations. The portions of the bikeway and Hudson River Park affected by shadows from the Proposed Actions would continue to experience a great deal of direct sunlight throughout the early, middle and late afternoons of the spring, summer and fall, due to the open vistas above the river to their west, and therefore there would not be a significant adverse impact on the health of the landscaping along the bikeway, and the potential vegetation that may be present with the future redevelopment of the adjacent area of Hudson River Park.

River Place Plaza

Currently still under construction, a publicly accessible courtyard or plaza will be located between River Place I and River Place II, located between West 42nd and West 41st Streets between Eleventh and Twelfth Avenues.

Winter shadows are long, and during the afternoon on December 21, shadows cast by the proposed buildings on the Development Site along West 33rd Street would pass across this residential plaza. Each building's shadows would pass west to east across the plaza over a 10 to 15 minute span. Between 1:40 PM and 2:50 PM, a total incremental shadow duration of 40 minutes would fall on this plaza, with direct sun falling on the plaza between the brief periods of incremental shadows (see Figure 7-10). Due to the limited duration of incremental shadows and the presence of sunlight during the analysis day, there would not be a significant adverse impact.

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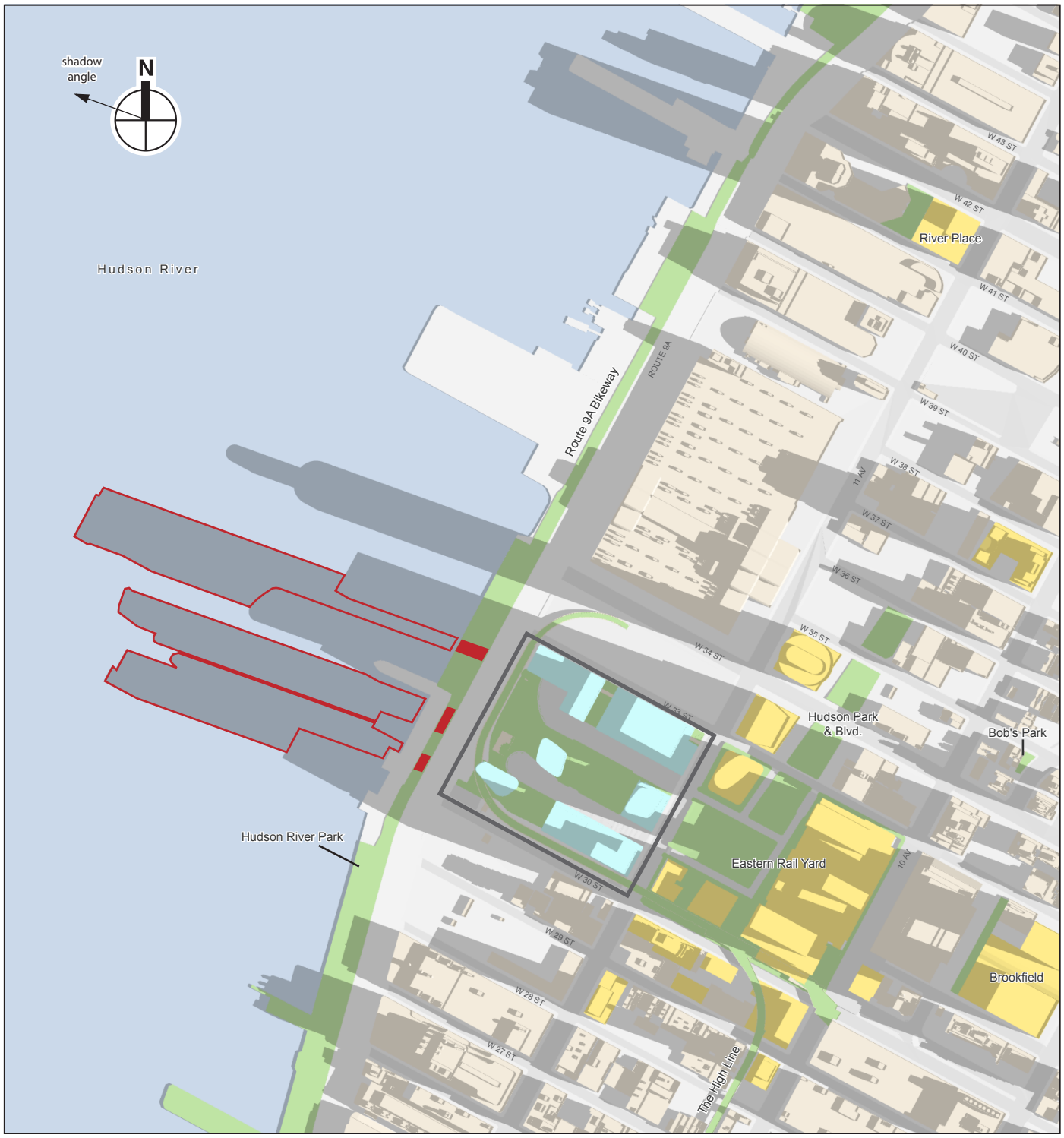


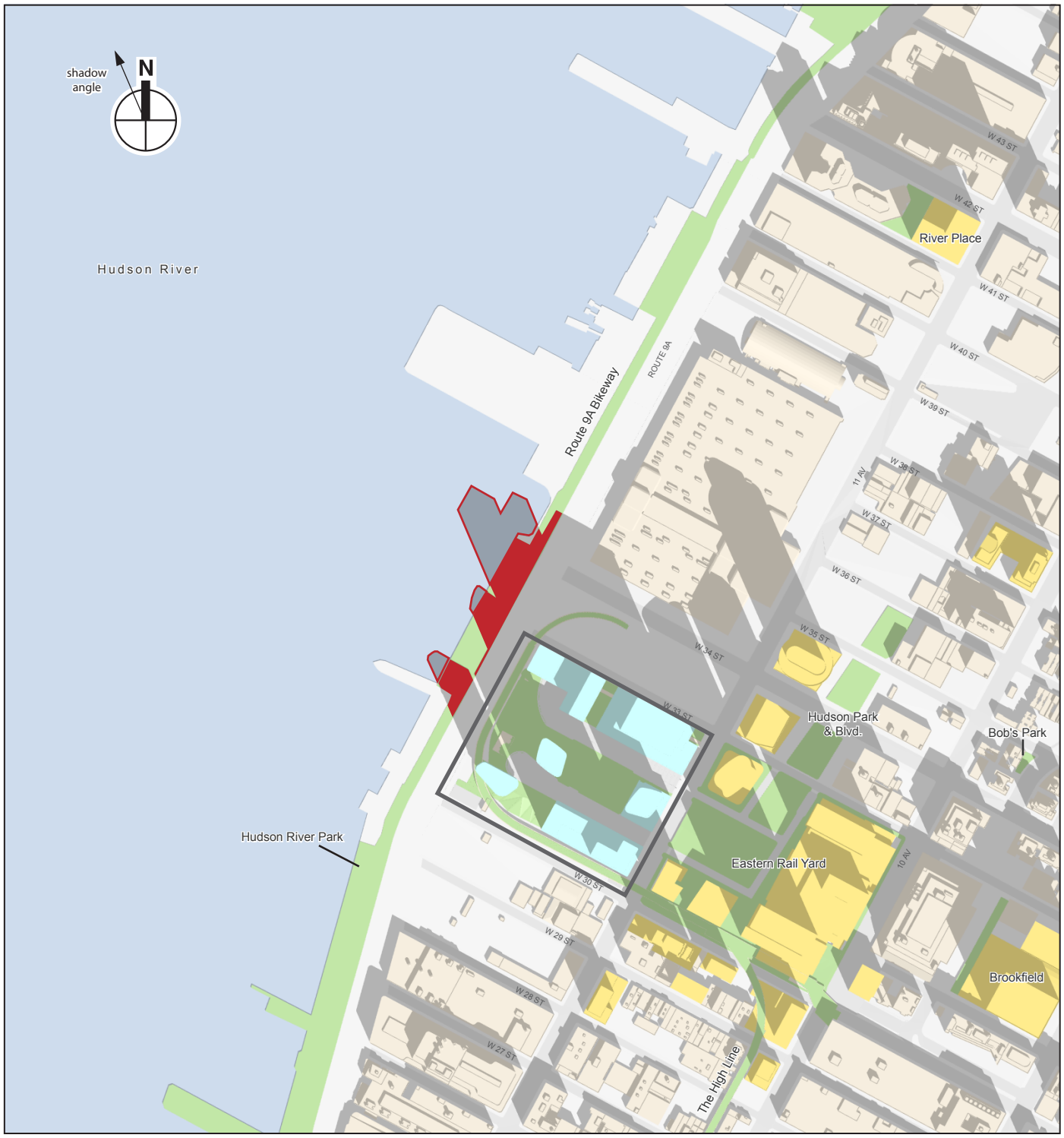
Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space
Incremental Shadow on River

0 400 1000 FEET
SCALE

Shadows
March 21 / Sept. 21 - 9:00 AM EDT

Figure 7-2

5.11.09



Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space
Incremental Shadow on River

0 400 1000 FEET
SCALE

Shadows
March 21 / Sept. 21 - 12:00 PM EDT

5.11.09



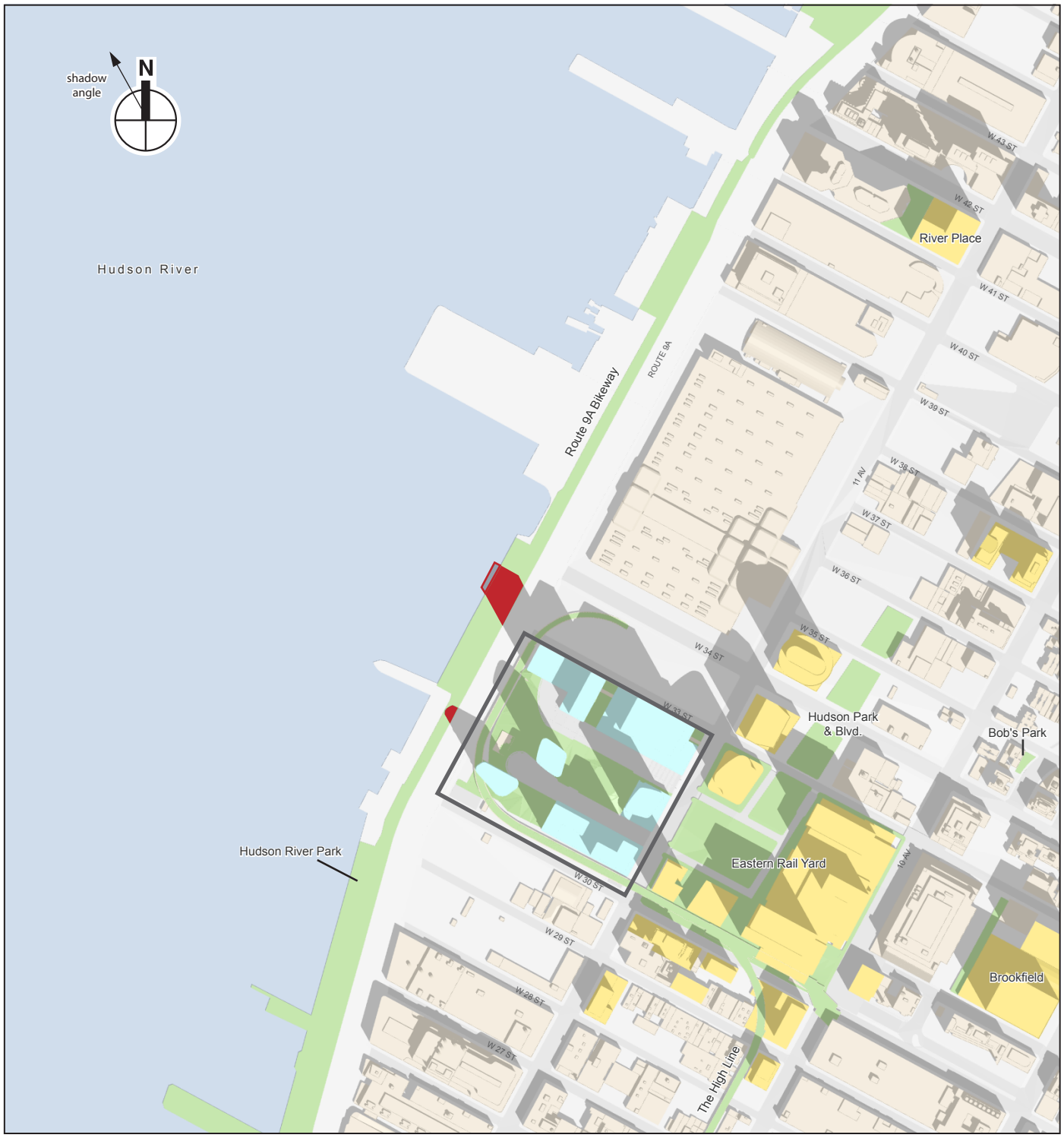
Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space
Incremental Shadow on River

0 400 1000 FEET
SCALE

Shadows
May 6 / August 6 - 9:00 AM EDT

Figure 7-4

5.11.09



Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space
Incremental Shadow on River

0 400 1000 FEET
SCALE

Shadows
May 6 / August 6 - 12:00 PM EDT

5.11.09



Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space
Incremental Shadow on River

0 400 1000 FEET
SCALE

Shadows
June 21 - 9:00 AM EDT
Figure 7-6

5.11.09

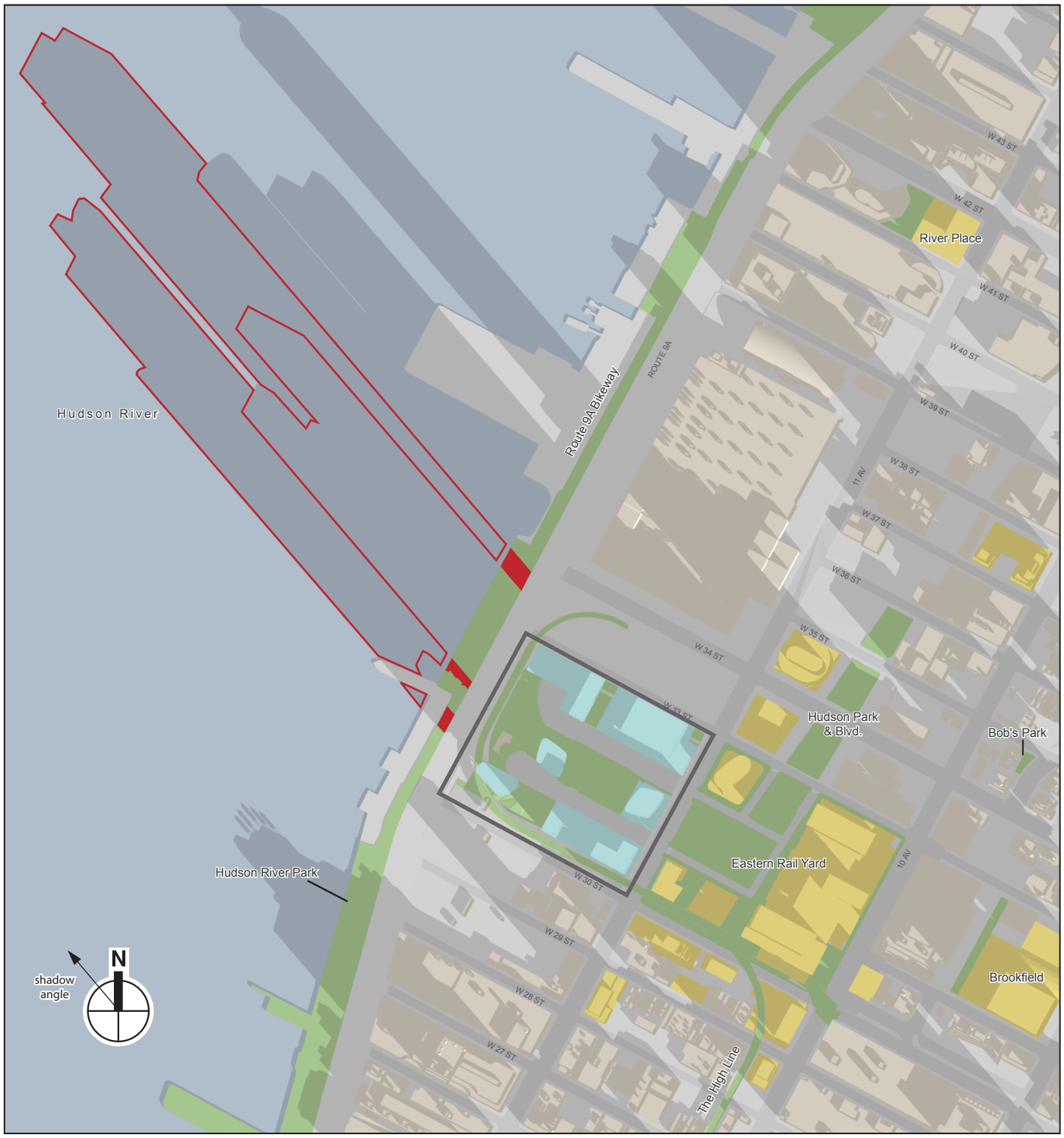


Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space

0 400 1000 FEET
SCALE

Shadows
June 21 - 12:00 PM EDT
Figure 7-7

5.11.09



Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space
Incremental Shadow on River

0 400 1000 FEET
SCALE

Shadows
December 21 - 9:00 AM EST
Figure 7-8

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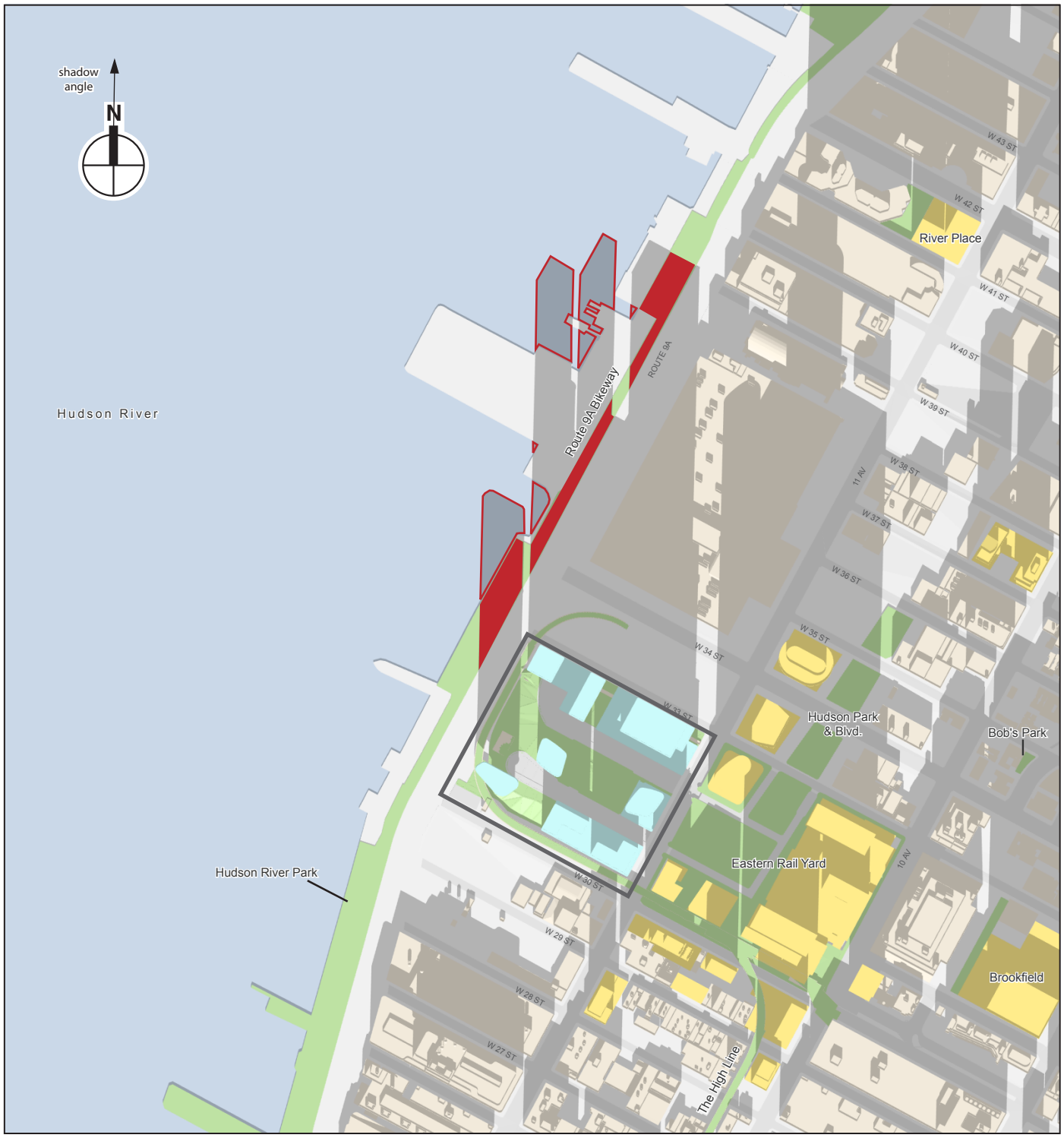

Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space
Incremental Shadow on River

0 400 1000 FEET
SCALE

Shadows
December 21 - 12:00 PM EST

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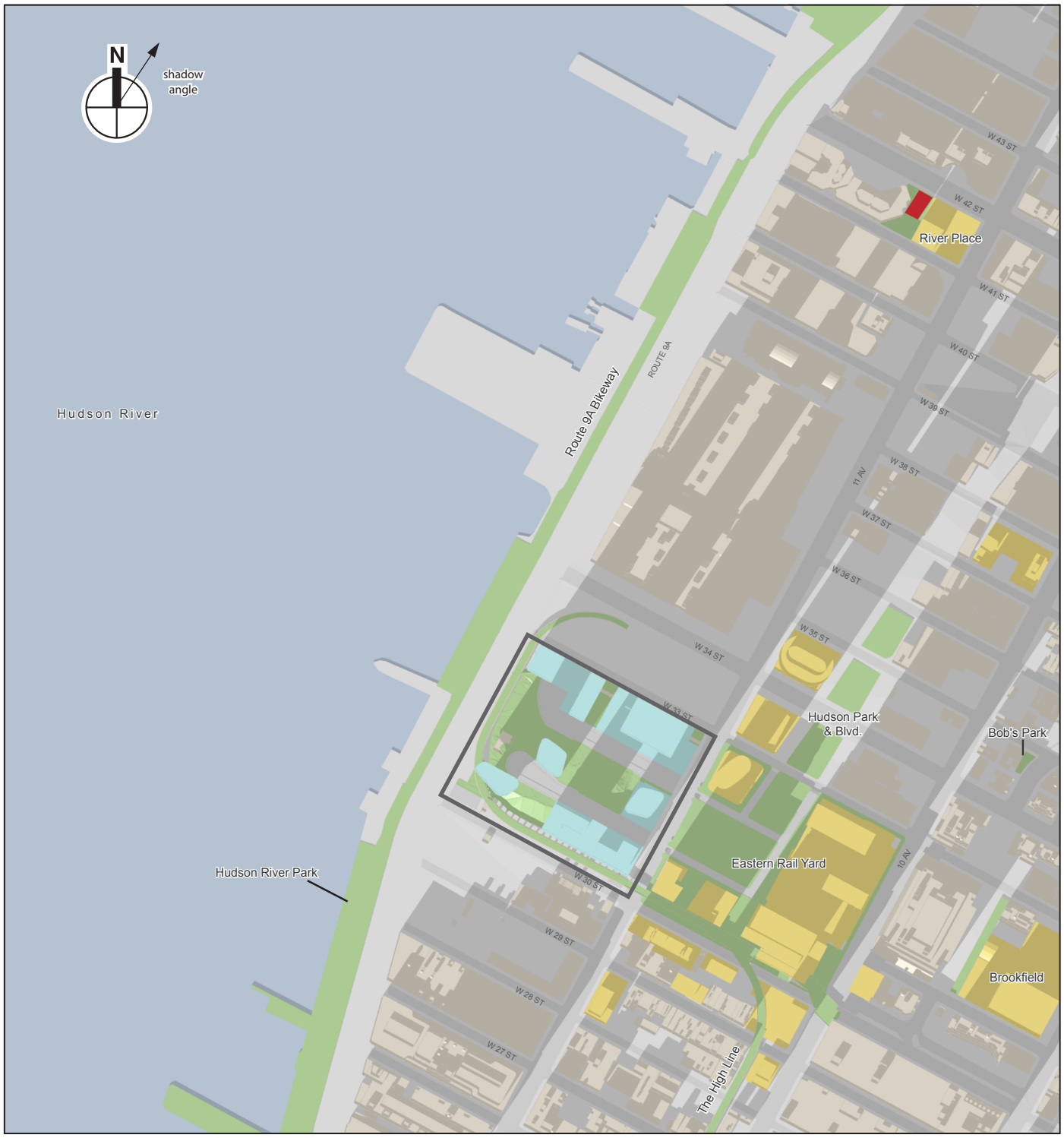


Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space

0 400 1000 FEET
SCALE

Shadows
December 21 - 2:15 PM EST
Figure 7-10

Hudson Park and Boulevard

The City is planning to construct a 4.0-acre mid-block park and boulevard system in the midblocks between Tenth and Eleventh Avenues from West 33rd Street to West 39th Street with a pedestrian bridge connecting to West 42nd Street. The open space is expected to be built in two phases. The first segment, consisting of approximately 2.12 acres of passive space, will extend from West 33rd to West 36th Streets and will be completed by 2013. As described in Chapter 2, "Framework for Analysis," the remaining segment between West 36th and West 39th Streets and the pedestrian bridge will be completed in the future (beyond 2019), and is not considered in this analysis. The open space is not designed yet, but is expected to contain a variety of amenities, including, but not limited to benches, plantings, and walkways.

In the spring, summer and fall, shadows from the Proposed Actions would fall towards the Hudson Park and Boulevard open spaces in the late afternoon. These open spaces would already be fairly heavily shaded at this time from the planned high rise buildings lining the west side of Hudson Park and Boulevard in the Future without the Proposed Actions. However, small areas of incremental shadow would fall between these high rise buildings onto portions of the open spaces. In winter, shadows from the Proposed Actions would not fall far enough to the east to reach Hudson Park and Boulevard.

On March 21 and September 21, the three blocks of Hudson Park and Boulevard would be mostly in existing and No Build shadows in the morning (see Figure 7-2), but by noon more than half the space would be in sun (see Figure 7-3). During the early afternoon the park would be mostly or completely in direct sunlight. Incremental shadows from buildings on the Development Site would begin to fall on small areas of the spaces between West 33rd and West 35th Streets from 3:45 PM to the end of the analysis day at 5:29 PM (see Figures 7-11 and 7-12). For most of this duration, some sun would continue to reach small areas within these mostly-shaded spaces, but for a period around 5:00 PM incremental shadows would remove the remaining sunlight on Hudson Park and Boulevard.

On May 6 and August 6, Hudson Park and Boulevard would be mostly or completely in sun from mid-morning until mid-afternoon (see Figures 7-4 and 7-5), at which point baseline shadows from No Build buildings west of the park would enter the spaces. Incremental shadows would begin to fall on Hudson Park and Boulevard from 4:00 PM to the end of the analysis day at 6:18 PM (see Figures 7-13 through 7-15). Hudson Park and Boulevard would be heavily shaded at this time from existing buildings just west of the Hudson Park and Boulevard, and the incremental shadows from the Development Site, though quite small in extent for most of their two hour-18 minute duration, would remove all or most of what little direct sun would otherwise remain on the open spaces between West 33rd and West 35th Streets.

On June 21, shadows are shortest but fall farthest to the south late in the afternoon. The proposed buildings on the Development Site would cast small areas of incremental shadow on Hudson Park and Boulevard for more than three hours at the end of the analysis day (see Figures 7-16 through 7-18). For most of this period, the new shadows would remove some but not all of the remaining sunlit areas on the two southern blocks of Hudson Park and Boulevard. Earlier in the day, similar to the May 6/August 6 analysis day, most or all of the park would be in sun from mid-morning until nearly 3:00 PM when No Build shadows would begin to move across parts of the northern areas (see Figures 7-6 and 7-7).

Two to three hours of new shadows through the spring, summer and fall is a fairly substantial duration. However, the incremental shadows would occur late in the afternoon and would

5.11.09



Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space

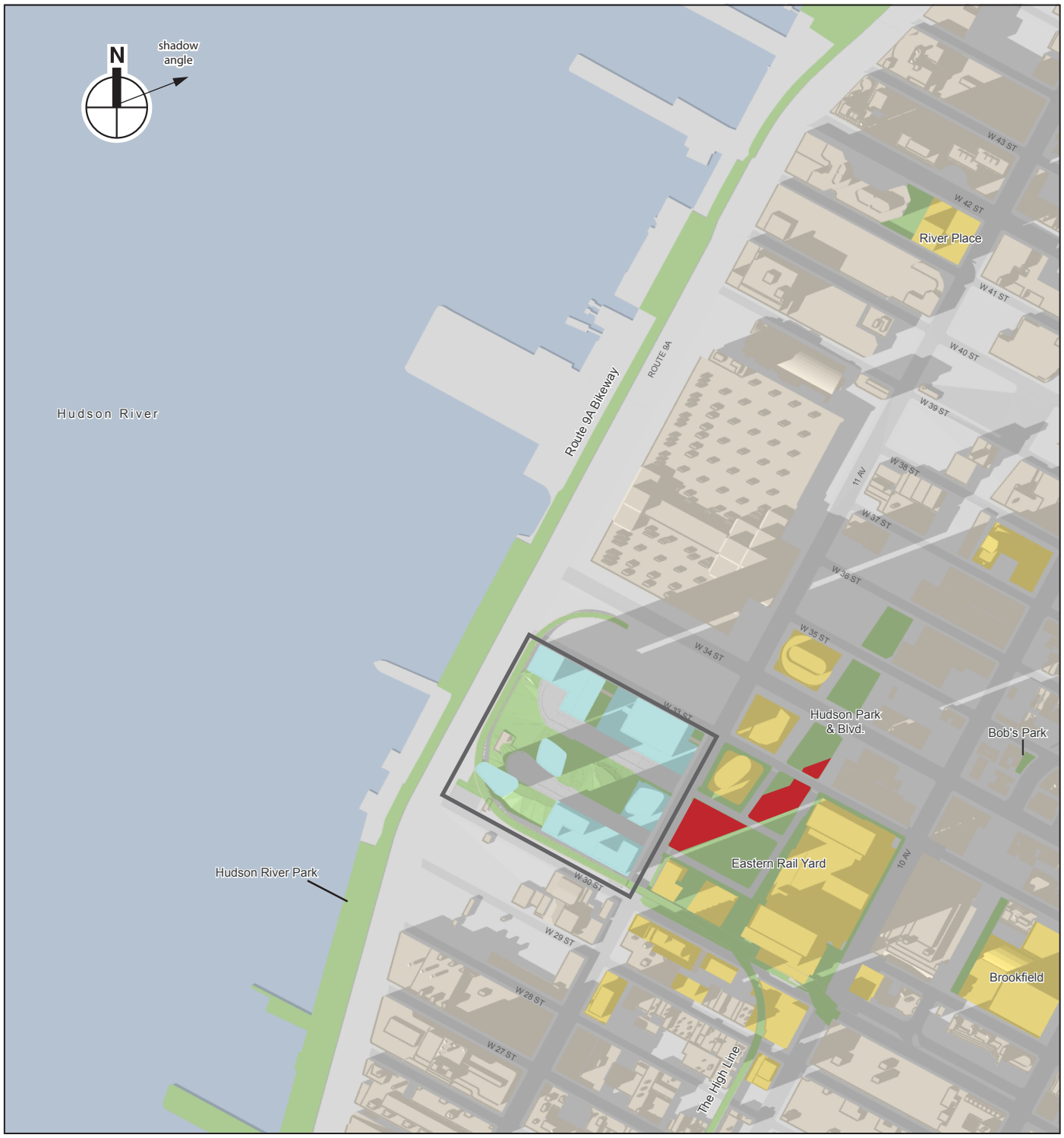
0 400 1000 FEET
SCALE

Shadows
March 21 / Sept. 21 - 4:00 PM EDT

WESTERN RAIL YARD

Figure 7-11

5.11.09



Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space

0 400 1000 FEET
SCALE

Shadows
March 21 / Sept. 21 - 5:00 PM EDT

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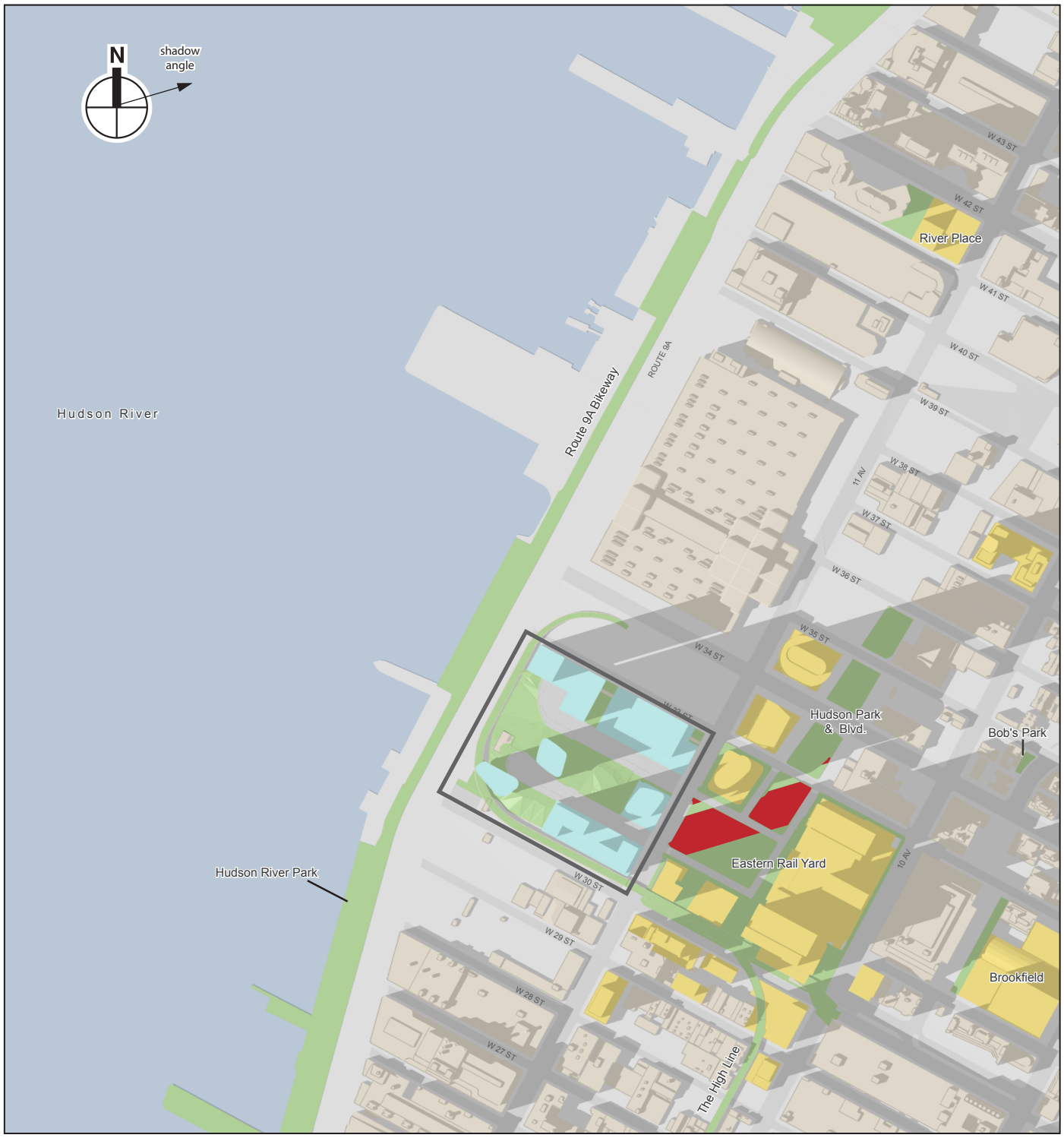


Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space

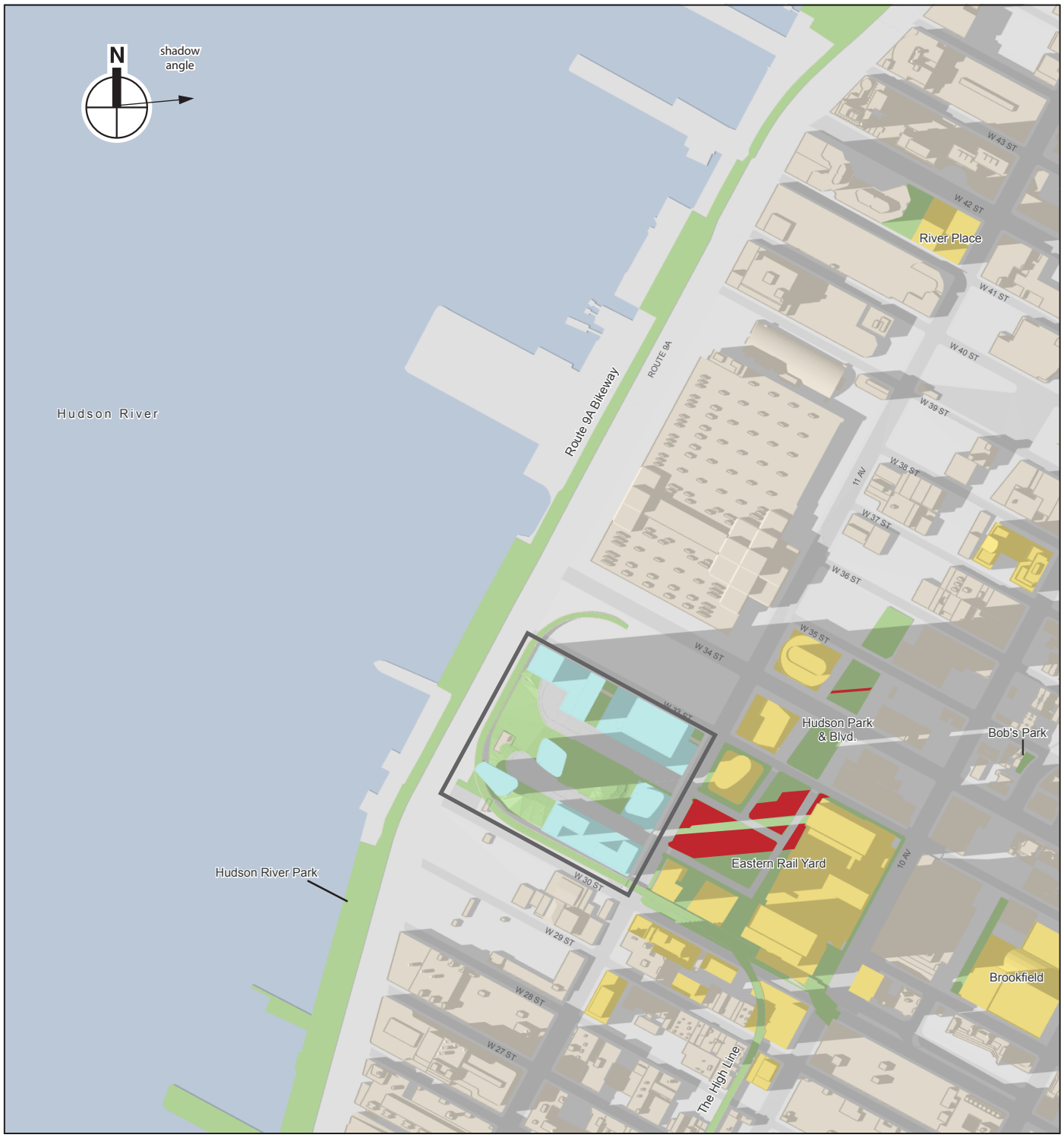
0 400 1000 FEET
SCALE

Shadows
May 6 / August 6 - 4:00 PM EDT

WESTERN RAIL YARD

Figure 7-13

5.11.09



Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space

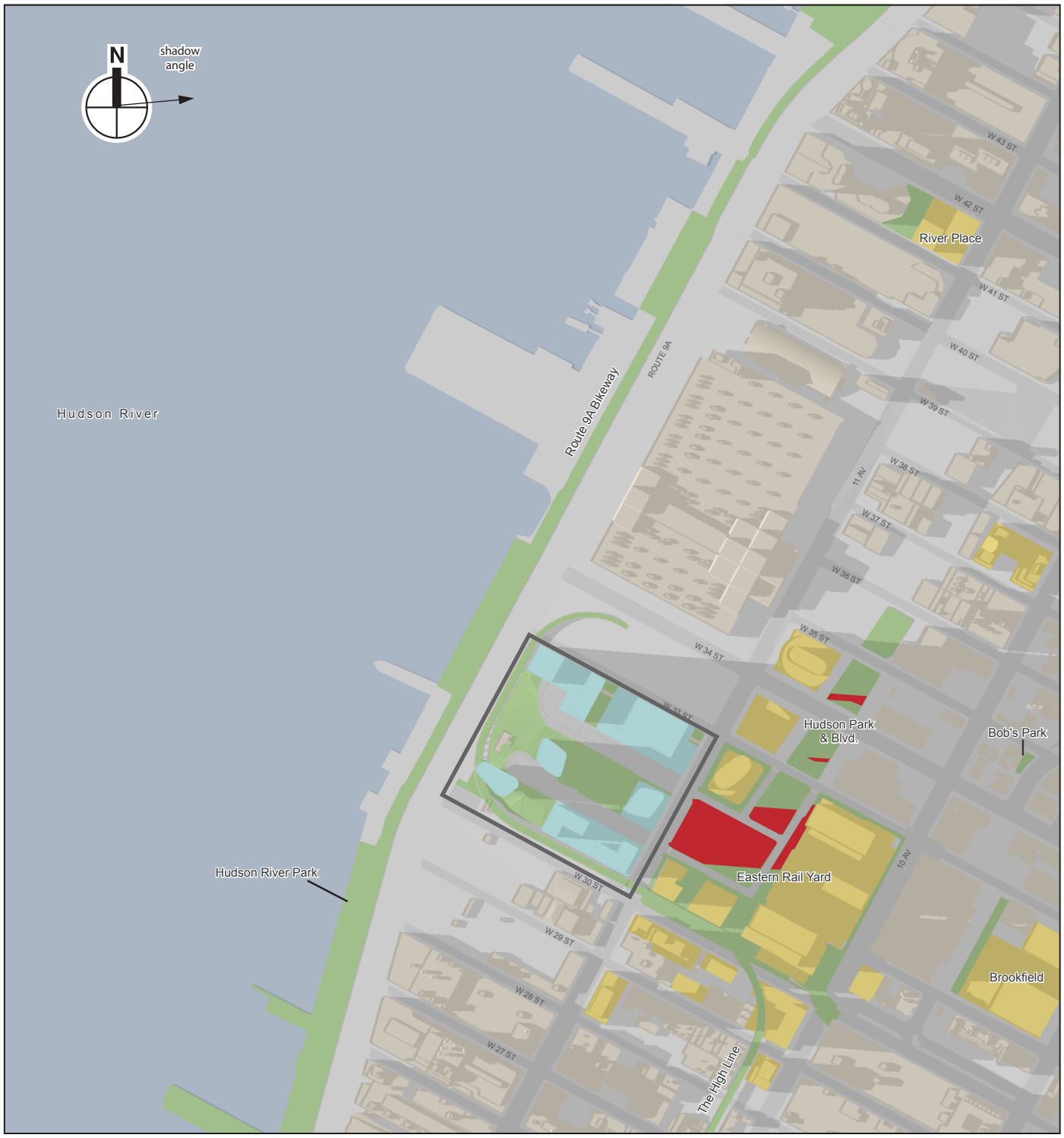
0 400 1000 FEET
SCALE

Shadows
May 6 / August 6 - 5:00 PM EDT

WESTERN RAIL YARD

Figure 7-14

5.11.09



Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space

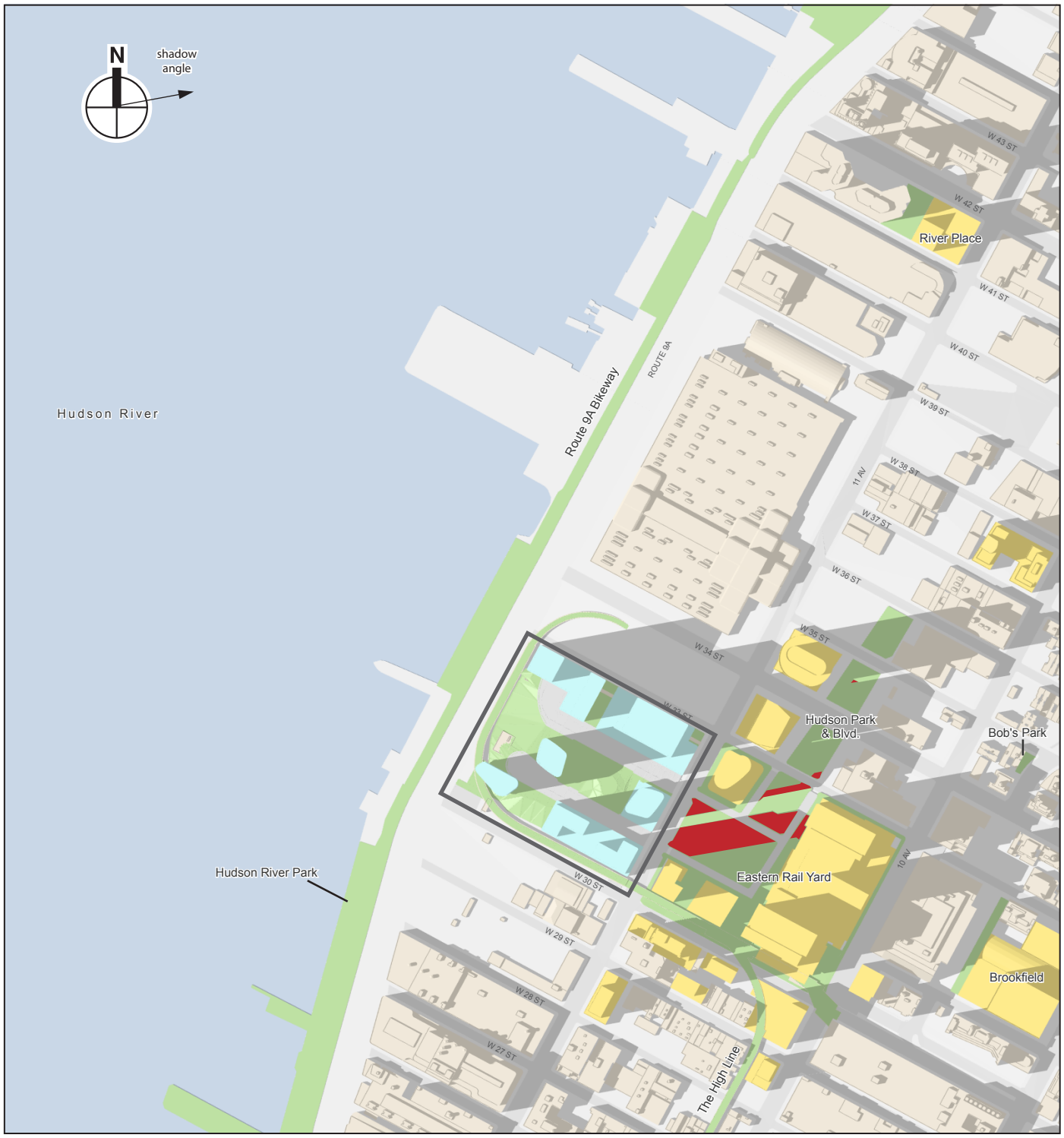
0 400 1000 FEET
SCALE

Shadows
May 6 / August 6 - 6:00 PM EDT

WESTERN RAIL YARD

Figure 7-15

5.11.09



Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space

0 400 1000 FEET
SCALE

Shadows
June 21 - 4:00 PM EDT
Figure 7-16

5.11.09

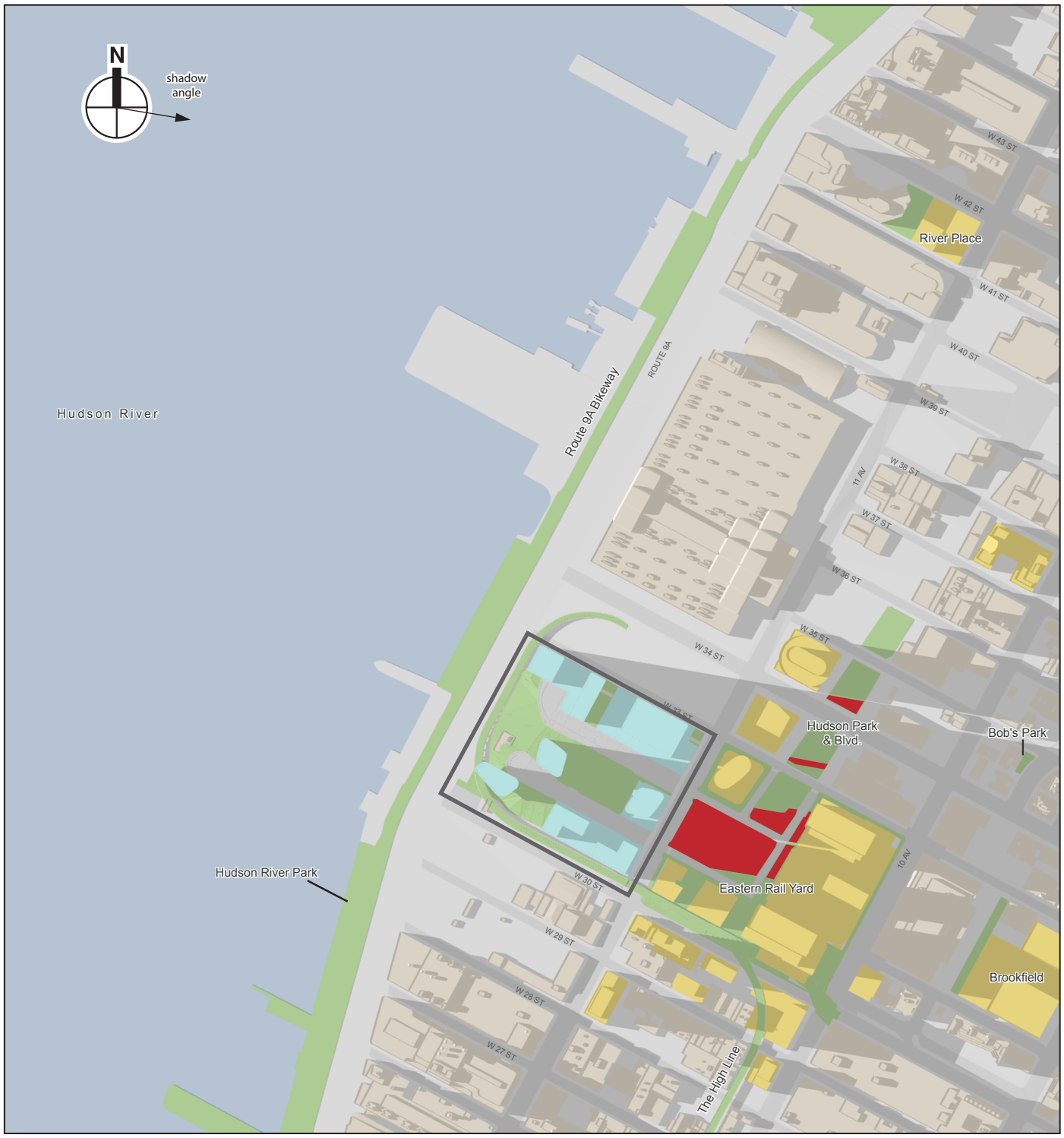


Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space

0 400 1000 FEET
SCALE

Shadows
June 21 - 5:00 PM EDT
Figure 7-17

5.11.09



Development Site
Proposed Buildings
Planned Buildings in 2019 Without the Proposed Actions
Incremental Shadow on Publicly Accessible Open Space

0 400 1000 FEET
SCALE

Shadows
June 21 - 6:00 PM EDT
Figure 7-18

generally be quite small in extent throughout the affected period, and the Hudson Park and Boulevard would get ample sunlight through the morning and afternoon. As the design of this park is still in development, the City will take into consideration the location and duration of shadows to enhance the use and landscaping of the space. Therefore the Proposed Actions would not result in a significant adverse shadow impact on Hudson Park and Boulevard.

Eastern Rail Yard Open Space

A large public square and two urban plazas are expected to be located above the Eastern Rail Yard from West 30th to West 33rd Streets between Tenth and Eleventh Avenues. The largest area will be the central open space, which will be surrounded by buildings with ground-floor retail uses. The design of this open space is still in development; however it is conservatively assumed that this public square will be programmed as passive open space, although some space could potentially be programmed for active use.

On March 21 and September 21, the Eastern Rail Yard development would cast shadows on its own open space throughout the day. In the morning and the middle of the day, most of the space would be in shadow (see Figures 7-2 and 7-3). During the early afternoon, when the sun casts shadows directly along the axis of the Manhattan street grid, more than half the space would be in sun. Incremental shadows from the reasonable worst-case development scenario on the Development Site would move onto the strip of open space at the northwest corner of the Eastern Rail Yard development at 3:00 PM. At 3:15 PM it would move onto the corner of the large central open space as well, and would remain there for the remainder of the analysis day (see Figures 7-11 and 7-12). The incremental shadows would expand eastward and remove most of the remaining sunlit area during the affected period.

On May 6 and August 6, shadows from the Eastern Rail Yard would shade most of its own open space from early through mid-morning (see Figure 7-4). Shadows shrink as the sun climbs higher in the sky, and by noon large areas of the space would be in sun (see Figure 7-5). In the early afternoon more than half the space would be in direct sunlight. Incremental shadows from the reasonable worst-case development scenario on the Development Site would move onto the strip of open space at the northwest corner of the Eastern Rail Yard at 2:15 PM, and at 2:30 PM it would move onto the central open space. The incremental shadows would spread westward across the space and remain until the end of the analysis day at 6:18 PM, covering much (though never all) of the remaining sunlit area (see Figures 7-13 through 7-15).

On June 21, similar to May 6 and August 6, the open space would be shaded in the morning by its own development (see Figure 7-6). The space would get substantial sun from late morning through early afternoon (see Figure 7-7). Incremental shadows from the Development Site would move onto the western edges of the space at 2:15 PM and slowly spread westward. However, substantial areas of the open space would remain sunlit despite the incremental shadows until about 4:00 PM, after which only small areas of the space would remain sunlit. At no point during the analysis day would the space be completely in shadow (see Figures 7-16 through 7-18).

On December 21, when shadows are longest, Eastern Rail Yard buildings would shade the open space for much of the day (see Figures 7-8 through 7-10). Incremental shadows from the Development Site would fall on the strip of open space at the northwest corner of the Eastern Rail Yard for the final 13 minutes of the analysis day.

Incremental shadows would fall across portions of the Eastern Rail Yard open space for over four hours through the late spring and summer, and for two and a half hours on March 21 and

September 21. The large areas of new shadow would also remove most of the remaining sunlight for much of the affected period, and would therefore cause a significant adverse shadow impact on this resource. Mitigation measures to reduce or fully mitigate the Proposed Actions' shadow impact on this open space are discussed in Chapter 24, "Mitigation."

HISTORIC RESOURCES

St. Michael's R.C. Church

St. Michael's Roman Catholic Church is located at 424 West 34th Street. The church is a known architectural resource; it is eligible for New York City Landmark designation (NYCL-eligible) and listing on the State and National Registers of Historic Places (S/NR-eligible). The church has arched windows along its west façade that face northwest toward the Development Site. Shadows from the Proposed Actions would not reach far enough in the fall, winter and early spring to affect this resource. On the May 6/August 6 analysis day, shadows from the Proposed Actions would fall far enough to the southeast to reach the church after 5:45 PM, but the church is mostly or completely in shadow during existing conditions and in the Future without the Proposed Actions at this time; only for about five minutes around 6:00 PM would a small area on the west side of the roof or façade experience incremental shadows. On June 21, the church would be entirely shaded by existing and new structures developed in the Future without the Proposed Actions from 6:15 PM to 7:01 PM when shadows from the Proposed Actions could otherwise fall on it**.** Therefore, the Proposed Actions would not result in a significant adverse shadow impact on this resource.

NATURAL RESOURCES

Hudson River

The Proposed Actions would cast new shadows on portions of the Hudson River throughout the morning and mid-day hours in all seasons (see Figures 7-2 through 7-9). While the total duration ranges between four and a half and five and a half hours depending on the season, most affected areas of the river would receive shorter durations as the shadows move eastward and northward during the morning. The areas that would receive the longest durations of new shadows on summer mornings would continue to receive more than six hours of sunlight in the afternoon, because there are no intervening structures to the west.

The current flows swiftly in the Hudson River and would move phytoplankton and other natural elements quickly through the shaded areas. Therefore, shadows generated by the Development Site would not be expected to affect primary productivity. Incremental shadows would therefore not be likely to have a significant adverse impact on aquatic resources (plankton or fish) in the Hudson River.

ON-SITE OPEN SPACES

The Proposed Actions at the Development Site would include the creation of several publicly accessible open spaces, including a large central open space, an open space overlooking the waterfront on the west side of the site, and an open space in the southwest section of the site between WR-3 and WR-4. The High Line, the former freight rail viaduct that runs along the southern and western boundaries of the Development Site, would be adaptively reused as passive open space as part of the Proposed Actions.

On March 21 and September 21, the central and waterfront open spaces and the western section of the High Line would be in shadow from a combination of proposed buildings and buildings that would be developed in the Future without the Proposed Actions through the morning and mid-day hours (see Figures 7-2 and 7-3). The southern section of the High Line would be in shade in the morning as well, but would be in sun by mid-day. In the early afternoon portions of the on-site open spaces would be in sun, and other portions in project- generated shadows. From 3:00 PM to the end of the analysis day the waterfront space and both sections of the High Line would be mostly in sun, while the central open space would continue to be partially in sun and partially in shade (see Figures 7-11 and 7-12). The southwest open space would be shaded in the morning, partially in sun at noon, and mostly or completely in sun during much of the afternoon due to the lack of structures to its south.

From May through August, the on-site open spaces would be in shadow for most of the morning (see Figures 7-4 and 7-6). By 12:30 PM most of the waterfront and southwestern open spaces, including the High Line, would be in sun, while the central open space would continue to be in shadow. The waterfront and southwestern open spaces would be mostly or totally in sun from early afternoon to the end of the analysis day, while the central open space would continue to experience substantial areas of shadow (see Figures 7-13 through 7-18).

In the winter, the central open space would be in shadow for virtually the entire day (see Figures 7-8 through 7-10). The waterfront space would start the day in shadow but would experience some sunlight in the late morning. It would be mostly shaded in the early afternoon by proposed building WR-4 but would again experience sun in the middle of the afternoon, just before the end of the analysis day. The open space in the southwest would be half in shadow at the start of the analysis day but would be mostly in sun from late morning through the end of the analysis day.

ADDITIONAL HOUSING SITES

Table 7-3 shows the duration of incremental shadows cast by the Tenth Avenue Site on the adjacent planned open space. Figures 7-19 through 7-28 depict the extent of these new shadows at representative times on each analysis day.

Table 7-3
Incremental Shadow Durations

Resource	March 21 8:36 AM-5:29 PM EDT	May 6 7:27 AM-6:18 PM EDT	June 21 6:57 AM-7:01 PM EDT	December 21 8:51 AM-2:53 PM EST
Future open space	2:00 PM–5:29 PM Total: 3h 29m	1:45 PM–6:18 PM Total: 4h 33m	1:45 PM–7:01 PM Total: 5h 16m	1:30 PM–2:53 PM Total: 1h 23m

Notes: EST = Eastern Standard Time.
EDT = Eastern Daylight Time.
March 21 is the equivalent of September 21.
May 6 is the equivalent of August 6.

Throughout the afternoon in all seasons, the proposed building on the Tenth Avenue Site would cast incremental shadows eastward onto the adjacent open space that would be developed in the Future without the Proposed Actions (see Figures 7-19 to 7-28). Beginning in the early afternoon, between 1:30 PM and 2:00 PM depending on the season, shadows from the Proposed Actions would move onto the western edge of the space. The extent of new shadows would remain small for more than an hour while the remaining area of the space would continue to be

4.23.09



Tenth Avenue Site

Incremental shadow on Publicly Accessible Open Space

WESTERN RAIL YARD

Shadows
March 21 / Sept. 21 - 2:30 PM EDT
Figure 7-19

4.23.09



Tenth Avenue Site

Incremental shadow on Publicly Accessible Open Space

WESTERN RAIL YARD

Shadows
March 21 / Sept. 21 - 4:00 PM EDT
Figure 7-20

4.23.09



Tenth Avenue Site

Incremental shadow on Publicly Accessible Open Space

WESTERN RAIL YARD

Shadows
March 21 / Sept. 21 - 5:00 PM EDT
Figure 7-21

4.23.09



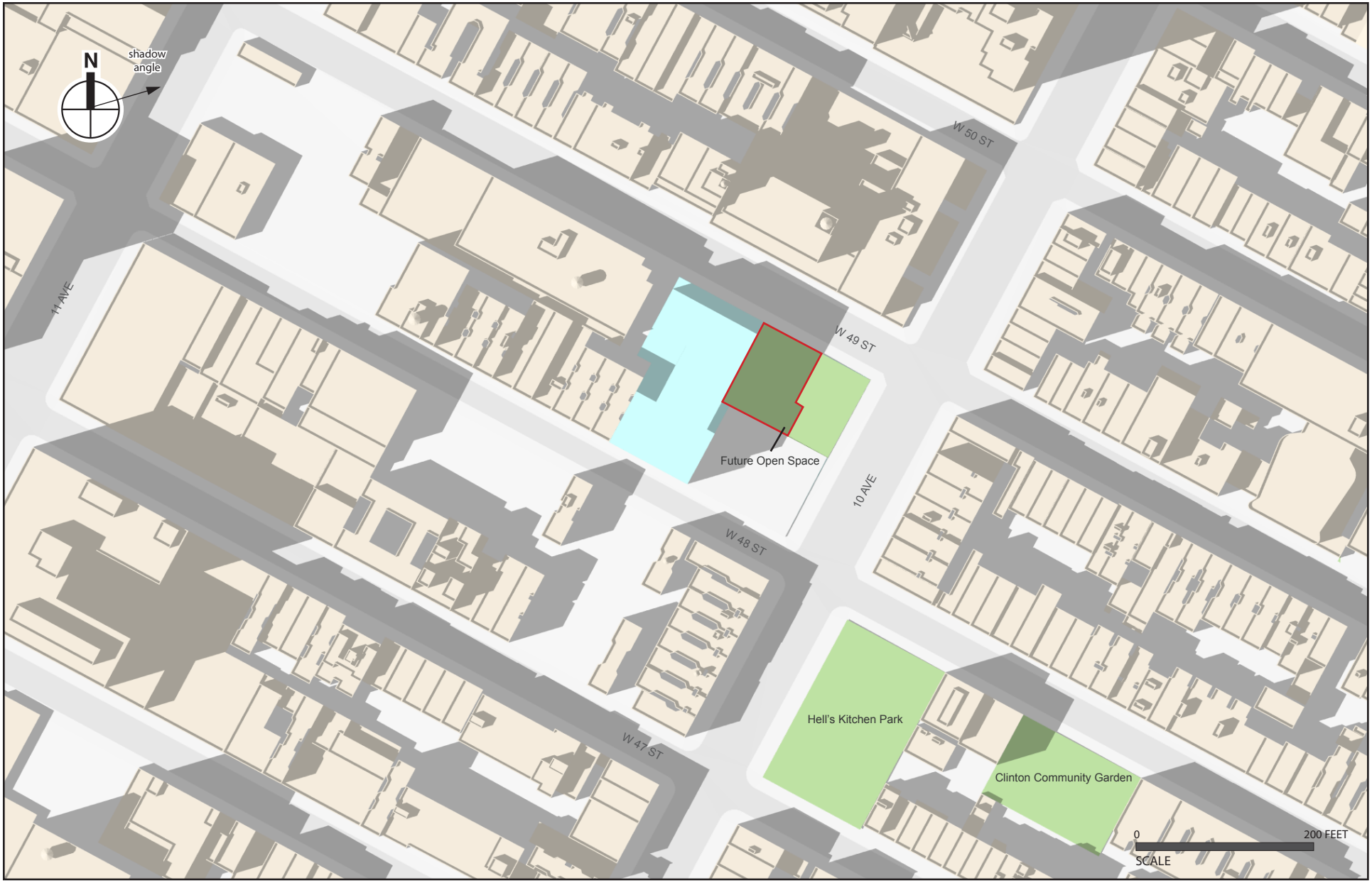
Tenth Avenue Site

Incremental shadow on Publicly Accessible Open Space

WESTERN RAIL YARD

Shadows
May 6 / August 6 - 2:30 PM EDT
Figure 7-22

4.23.09



Tenth Avenue Site

Incremental shadow on Publicly Accessible Open Space

WESTERN RAIL YARD

Shadows
May 6 / August 6 - 4:00 PM EDT
Figure 7-23

4.23.09



Tenth Avenue Site

Incremental Shadow on Publicly Accessible Open Space

WESTERN RAIL YARD

Shadows
May 6 / August 6 - 5:00 PM EDT
Figure 7-24

4.23.09



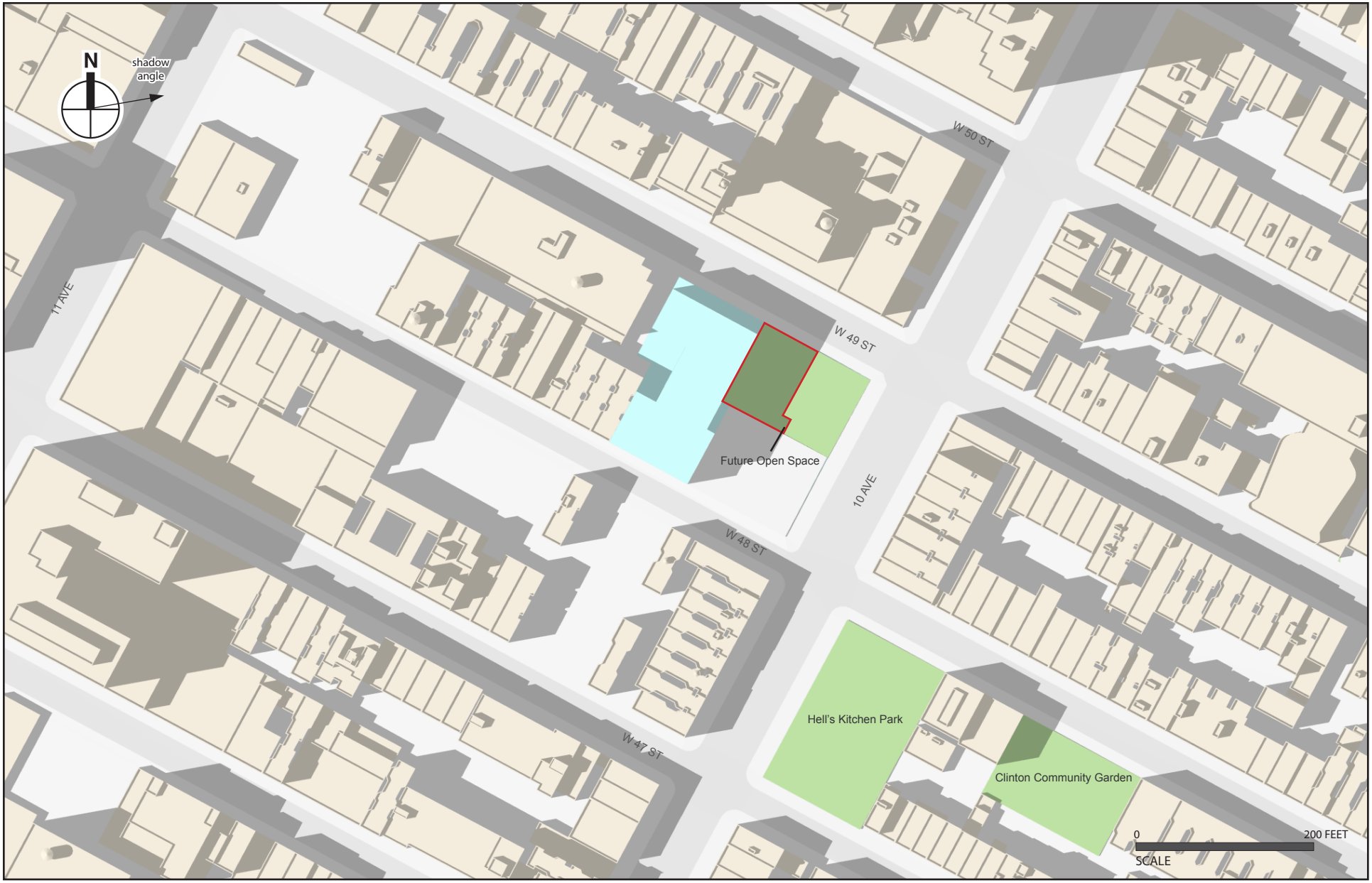
Tenth Avenue Site

Incremental Shadow on Publicly Accessible Open Space

WESTERN RAIL YARD

Shadows
June 21 - 2:30 PM EDT
Figure 7-25

4.23.09



Tenth Avenue Site

Incremental shadow on Publicly Accessible Open Space

WESTERN RAIL YARD

Shadows
June 21 - 4:00 PM EDT
Figure 7-26

4.23.09



Tenth Avenue Site

Incremental Shadow on Publicly Accessible Open Space

WESTERN RAIL YARD

Shadows
June 21 - 5:00 PM EDT
Figure 7-27

4.23.09



Tenth Avenue Site

Incremental Shadow on Publicly Accessible Open Space

WESTERN RAIL YARD

Shadows
December 21 - 2:30 PM EDT
Figure 7-28

in sun. In winter the analysis day ends at 2:53 PM, and incremental shadows would still be limited to less than half the space at that hour. In spring, summer and fall, analysis days are longer, and by 4:00 PM about half the open space would be shaded by shadows from the Proposed Actions, with the eastern half still in sun. The incremental shadows would continue to spread eastward and from 5:00 PM to the end of each analysis day, most or all of the space would be in shadow generated by the Proposed Actions.

The future open space would continue to be completely in sun from mid-morning to early afternoon in all seasons, and even in the early morning most of the space would be in sun. The design for this open space resource is still in development. As this future open space will be located above the New York City Department of Environmental Protection (DEP) Water Tunnel No. 3, the New York City Department of Parks and Recreation (DPR) and DEP will determine the specific program for this future open space. If it is determined that the entire open space would indeed be heavily programmed with passive open space features, such as benches and other sitting areas, then the shadows that would result from the Proposed Actions could cause a significant adverse impact. However, if the design of the open space results in a layout where the features requiring sunlight would be located in areas of the open space where shadows are cast for a shorter duration, which maximizes the usability of the space, then a significant adverse impact could be avoided. However, since the design of the open space is not known at this time, it is conservatively assumed that the Proposed Actions would result in a significant adverse shadow impact on the Tenth Avenue open space. Mitigation measures to reduce or fully mitigate the Proposed Actions' shadow impact on this open space are discussed in Chapter 24, "Mitigation." As noted above, careful design of this open space to take into consideration the shadows from the Proposed Actions would partially mitigate the potential significant adverse impact. ✷