Chapter 6: Shadows

A. INTRODUCTION

This chapter examines whether the Proposed Action would cast new shadows on any sunlight-sensitive resources and assesses the possible impacts of any such new shadows. Public open spaces, historic, cultural, and natural resources are all potentially sunlight-sensitive resources, and, therefore, this chapter is closely linked to the information presented in other sections of this environmental impact statement (EIS), particularly Chapter 5, "Open Space" and Chapter 7, "Historic and Cultural Resources."

According to the 2012 *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 or more, or be located adjacent to, or across the street from, a sunlight-sensitive resource. The proposed Rezoning Area contains 22 projected development and enlargement sites and 17 potential development and enlargement sites. With the Proposed Action, a number of these sites would be developed with new buildings greater than 50 feet in height.

PRINCIPAL CONCLUSIONS

The Proposed Action would cause significant adverse shadow impacts to Trump SoHo Plaza and SoHo Square, two open space resources in the Rezoning Area. A number of other sunlight-sensitive resources in or near the Rezoning Area would receive new shadows resulting from the Proposed Action, but none of large enough extent or duration to result in significant adverse shadow impacts.

Trump SoHo Plaza would receive from three hours to three hours and 40 minutes of new shadows in the spring, late summer, and fall, primarily from Projected Development Site 2. Given the long durations and the fact that all remaining sunlight would be eliminated for an hour or more in some seasons, and that the plaza already experiences periods of existing shadows, the Proposed Action would result in a significant adverse shadow impact to this resource.

SoHo Square would receive from two hours and 20 minutes to two hours and 39 minutes of new shadows in the spring, summer and fall, and 30 minutes in the winter, primarily from Projected Development Site 2. The incremental shadow would occur in the afternoons, when the square already would be in some existing shadows. On March 21/September 21 in particular, the incremental shadow would remove the remaining area of sunlight for about an hour. For these reasons, the Proposed Action would result in a significant adverse shadow impact to this resource.

It should be noted that although the reasonable worst-case development scenario (RWCDS) for the future without the Proposed Action (the No-Action condition) assumes a development on Projected Development Site 2 with a height of only 30 feet, there is no height restriction under the current zoning in the Rezoning Area. Therefore, in the No-Action condition Projected Development Site 2 could be constructed to heights as tall or taller than the 320 foot height limit in the future with the Proposed Action (the With-Action condition), which would result in similar shadows on Trump SoHo Plaza and SoHo Square.

Potential mitigation for these significant adverse impacts is discussed in Chapter 20, "Mitigation."

B. DEFINITIONS AND METHODOLOGY

DEFINITIONS

Incremental shadow is the additional, or new, shadow that a structure resulting from a proposed action would cast on a sunlight-sensitive resource.

Sunlight-sensitive resources are those resources that depend on sunlight or for which direct sunlight is necessary to maintain the resource's usability or architectural integrity. Such resources generally include:

- *Public open space* (e.g., parks, beaches, playgrounds, plazas, schoolyards, greenways, landscaped medians with seating). Planted areas within unused portions of roadbeds that are part of the Greenstreets program are also considered sunlight-sensitive resources.
- *Features of architectural resources that depend on sunlight for their enjoyment by the public.* Only the sunlight-sensitive features need be considered, as opposed to the entire resource. Such sunlight-sensitive features might include design elements that depend on the contrast between light and dark (e.g., recessed balconies, arcades, deep window reveals); elaborate, highly carved ornamentation; stained-glass windows; historic landscapes and scenic landmarks; and features for which the effect of direct sunlight is described as playing a significant role in the structure's importance as a 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.

Non-sunlight-sensitive resources, for the purposes of CEQR, include:

- *City streets and sidewalks* (except Greenstreets);
- *Private open space* (e.g., front and back yards, stoops, vacant lots, and any private, non-publicly accessible open space);
- *Project-generated open space* cannot experience a significant adverse shadow impact from the project, according to CEQR, because without the project the open space would not exist. However, a qualitative discussion of shadows on a project-generated open space should be included in an analysis.

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, thereby significantly altering the public's use of the resource or threatening the viability of vegetation or other resources. Each case must be considered on its own merits based on the extent and duration of new shadow and an analysis of the resource's sensitivity to reduced sunlight.

METHODOLOGY

Following the guidelines of the *CEQR Technical Manual,* a preliminary screening assessment must first be conducted to ascertain whether a project-generated shadow could reach any sunlight-sensitive resources at any time of year. The preliminary screening assessment consists

of three tiers of analysis. The first tier determines a simple radius around the project-generated development that represents the longest shadow that could be cast. If there are sunlight-sensitive resources within this radius, the analysis proceeds to the second tier, which reduces the area that could be affected by project-generated shadow by accounting for the fact that shadows can never be cast between a certain range of angles south of the project-generated development due to the path of the sun through the sky at the latitude of New York City.

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 project-generated shadow 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 proposed action, taking into account existing buildings and their shadows. 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 results of the analysis and assessment are documented with graphics, a table of incremental shadow durations, and narrative text.

REASONABLE WORST-CASE DEVELOPMENT SCENARIO

As discussed in Chapter 1, two RWCDS have been developed to represent potential development scenarios that could result from the Proposed Action. However, both scenarios would result in the same overall floor area and massing on the same sites, and therefore this assessment considers the potential effects of either scenario.

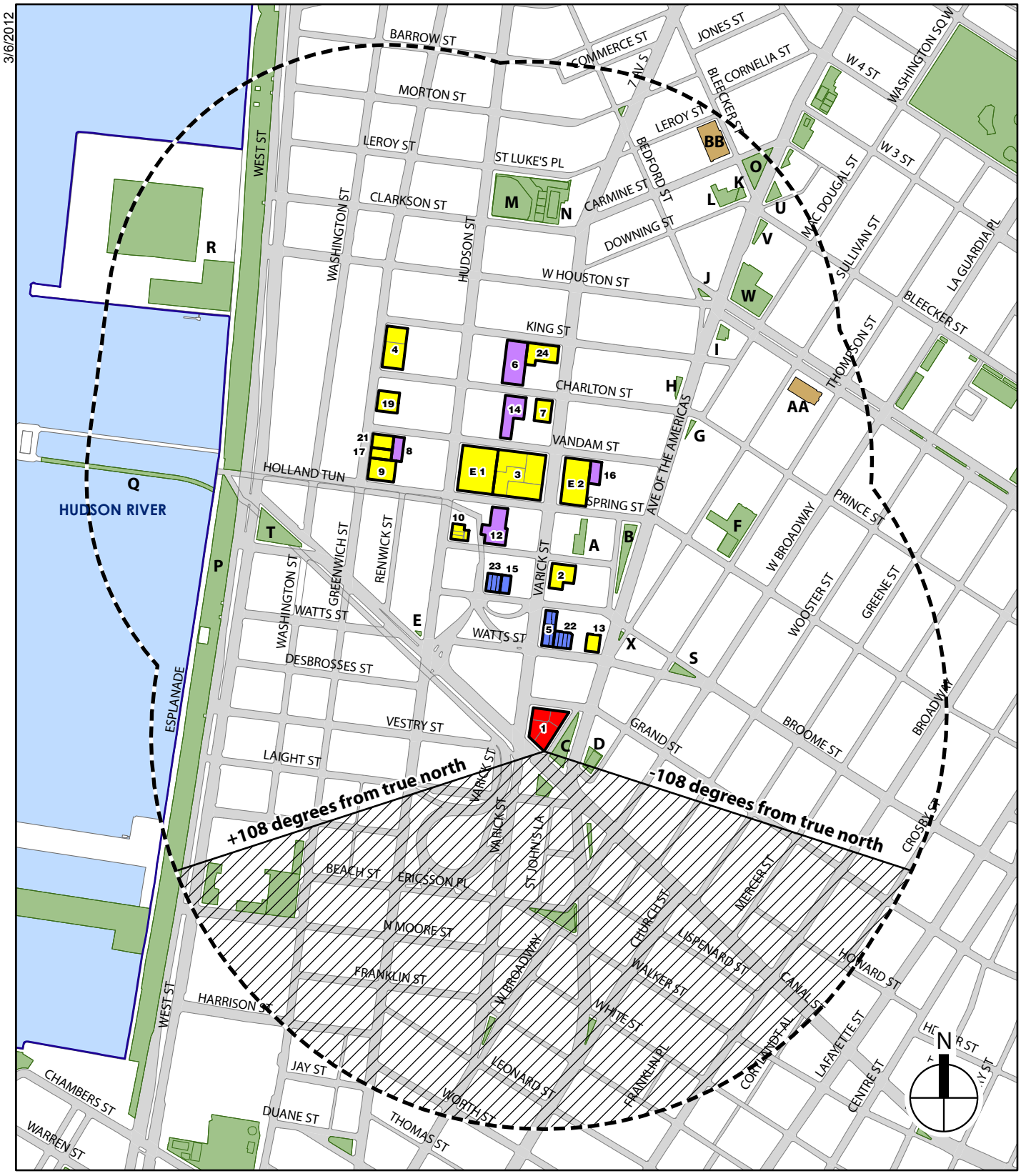
The RWCDS contains new construction and enlargement sites located throughout the Rezoning Area as described in Chapter 1, "Project Description," and shown in Figure 1-11. Both projected and potential development sites must be considered in the shadows assessment, since shadow impacts would be site-specific. In the development of the RWCDS, new construction sites were assumed to be constructed to the maximum allowable building envelope. With respect to enlargement sites, most residential buildings in the Special District would not be able, due to structural limitations, to enlarge to the maximum allowable building envelope, but would instead be expected to construct 1 to 2 additional penthouse levels.

C. PRELIMINARY SCREENING ASSESSMENT

A base map was developed using Geographic Information Systems (GIS)[1] showing the Rezoning Area and the surrounding street layout (see **Figure 6-1**). In coordination with the information regarding open space, historic and natural resources presented in other sections of this EIS, potentially sunlight-sensitive resources were identified and shown on the map.

The 22 projected development and enlargement sites and the 17 potential development and enlargement sites were first assessed to determine which sites required a preliminary screening assessment. The *CEQR Technical Manual* provides that only new development or enlargement that would result in structures more than 50 feet taller than the building at that location in the No-Action

[1] Software: Esri ArcGIS 10; Data: New York City Department of Information Technology and Telecommunications (DoITT) and other City agencies.



Note: Where RWCDS sites would be subject to both wide street and narrow street regulations, the wide street height limit was used for this assessment.

HUDSON SQUARE REZONING

Tier 1 and Tier 2 Assessment

Figure 6-1

condition require any assessment. In addition, any development site adjacent to a sunlight-sensitive resource required a screening assessment regardless of its height, per CEQR methodology.

Table 6-1 summarizes this initial screen. Sixteen of the 19 projected development sites, two of the three projected enlargement sites, four of the five potential development sites, and none of the potential enlargement sites would result in new structures of greater than 50 feet in incremental height, and consequently required further analysis. Of the remaining sites that would be developed with structures less than 50 feet tall, none were adjacent to sunlight-sensitive resources, and therefore required no further analysis.

TIER 1 SCREENING ASSESSMENT

A Tier 1 assessment was conducted for the 22 projected and potential development sites that required additional analysis.

For the Tier 1 assessment, the longest shadow that the maximum zoning envelope on each of the development sites could cast was calculated, and using this length as the radius, a perimeter was drawn around each site. Anything outside this perimeter representing the longest possible shadow could never be affected by project-generated shadow, while anything inside the perimeter would need additional assessment.

According to the *CEQR Technical Manual*, the longest shadow that a structure can cast at the latitude of New York City occurs on December 21, the winter solstice, at the start of the analysis day at 8:51 AM, and is equal to 4.27 times the height of the structure.

Multiplying 4.27 times the maximum height of each development site as listed in Table 6-1, a perimeter was generated around each site using GIS, representing each site's longest shadow study area. All the perimeters were merged into one overall perimeter around the RWCDS, representing the longest shadow study area; anything outside this perimeter could never be affected by project-generated shadow (see **Figure 6-1**). Since a number of sun-sensitive resources were located within the combined perimeter, a Tier 2 screening assessment was conducted.

TIER 2 SCREENING ASSESSMENT

Because of the path that the sun travels 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. **Figure 6-1** illustrates this triangular area south of the southernmost RWCDS site. The complementing area to the north within the combined longest shadow study area represents the remaining area that could potentially experience new project-generated shadow.

A number of publicly accessible open spaces are located within the remaining shadow study area, as shown in **Figure 6-1** and listed in **Table 6-2**.

Table 6-1
RWCDS Sites

Site	No-Action Building Height	With-Action Building Height[1]	50 foot or more height increment?	Adjacent to Sunlight-Sensitive Resource?
Projected 1	492	430	YES[2]	YES - Duarte Square
Projected 2	30	320	YES	YES – Trump Soho Plaza
Projected 3	453	320	YES[2]	NO
Projected 4	30	320	YES	NO
Proj. Enlargement 1	105	320	YES	NO
Projected 5	222	120	NO	NO
Projected 6	37	185	YES	NO
Projected 7	75	320	YES	NO
Projected 8	80	185	YES	NO
Projected 9	65	320	YES	NO
Projected 10	48/36/0	320	YES	NO
Projected 11	72	97	NO	NO
Projected 12	0	185	YES	NO
Projected 13	25/0	320	YES	YES - Greenstreet
Projected 14	0	185	YES	NO
Projected 15	40	120	YES	NO
Projected 16	72	185	YES	NO
Projected 17	166	320	YES	NO
Projected 18[3]	111	111	NO	YES - Soho Square
Projected 19	80	320	YES	NO
Proj. Enlargement 2	134	320	YES	YES - Trump Soho Plaza
Proj. Enlargement 3	72	97	NO	NO
Potential 20	75	100	NO	NO
Potential 21	80	320	YES	NO
Potential 22	35	120	YES	NO
Potential 23	52	120	YES	NO
Potential 24	88	320	YES	NO
Pot. Enlargement 4	60	85	NO	NO
Pot. Enlargement 5	62	87	NO	NO
Pot. Enlargement 6	62	87	NO	NO
Pot. Enlargement 7	57	82	NO	NO
Pot. Enlargement 8	48	73	NO	NO
Pot. Enlargement 9	60	85	NO	NO
Pot. Enlargement 10	48	73	NO	NO
Pot. Enlargement 11	75	100	NO	NO
Pot. Enlargement 12	60	85	NO	NO
Pot. Enlargement 13	60	85	NO	NO
Pot. Enlargement 14	60	85	NO	NO
Pot. Enlargement 15	80	105	NO	NO

Notes: Sites that are shaded do not require analysis.

[1] Height of maximum zoning envelope.

[2] While maximum height of RWCDS envelope would be shorter than that of No-Action condition at this site, portions of the generally bulkier RWCDS envelope would be more than 50 feet taller than corresponding portion of No-Action.

[3] Projected Site 18 would be a use conversion only with the Proposed Action, with no structural change; therefore no incremental shadow could occur.

Table 6-2
Open Space Resources in Longest Shadow Study Area

Map No.[1]	Name/Location	Owner or Agency	Features	Condition/ Utilization
A	Trump SoHo Plaza Spring St between Varick St and Ave of Americas	Trump Org.	Benches, landscaping and trees	Excellent/Moderate
B	Soho Square Ave of Americas and Spring St	DPR	Gen. Jose Artigas Monument, benches, trees	Fair/Moderate
C	Duarte Square Ave of Americas, Canal and Grand Sts	DPR	Statue of Juan Pablo Duarte and benches	Fair/Moderate
D	Grand Canal Court Thompson and Canal Sts, Ave of Americas	DPR	Basketball courts	Fair/Low
E	Greenstreets space NW corner Canal and Hudson Sts	DPR	Planting/landscaping	--
F	Vesuvio Playground Spring St and Thompson St	DPR	Spray shower, playground equipment, athletic courts (basketball, handball, bocce), pool, benches, tables, chess, plantings, landscaping	Excellent/Heavy
G	Father Fagan Park East side of Ave of Americas at Prince St	DPR	Benches and trees	Fair/Moderate
H	Charlton Plaza Ave of Americas at Charlton St	DPR	Benches, game tables, landscaping and mural artwork	Excellent/Low
I	Playground of the Americas Ave of Americas and W Houston St	DPR	Playground, trees, bench, landscaping	Excellent/Low
J	Greenstreets triangle at W Houston St, Bedford St, and Ave of Americas	DPR	Benches and landscaping	Excellent/Low
K	Winston Churchill Square Downing St and the west side of Ave of Americas	DPR	Benches, landscaping, sculpture	Excellent/Moderate
L	Downing Street Playground Downing St and the west side of Ave of Americas	DPR	Playground, spray shower, bathrooms	Excellent/Heavy
M	James J. Walker Park Hudson, Leroy, Clarkson Sts, Seventh Ave	DPR	Benches, trees, soccer field, playground, bocce court, baseball field, handball courts	Excellent/Heavy
N	Tony Dapolito Recreation Center (formerly the Carmine Recreational Center) Clarkson and Leroy Sts, Seventh Ave	DPR	Gymnasium and swimming pool	Excellent/Heavy
O	Father Demo Square Ave of Americas, Bleecker and Carmine Sts	DPR	Fountain, landscaping, benches	Excellent/Heavy
P	Hudson River Park – Upland and Route 9A Bikeway (from N. Moore St to Barrow St)	NYSDOT/ HRPT	Esplanade (pedestrian path and seating), passive lawns, tables, greenway (bike and pedestrian path)	Excellent/Heavy
Q	Hudson River Park - Pier 34	HRPT	Esplanade with benches	Excellent/Moderate
R	Hudson River Park - Pier 40	HRPT	Dog Run, fishing, kayaking, rowing, four athletic fields	Excellent/Moderate
S	Greenstreets triangle at Broome and Thompson Sts	DPR	Benches and landscaping	Excellent/Low
T	Canal Park Canal St between West St and Washington St	DPR	Benches, trees, and landscaping	Excellent/Low
U	Minetta Triangle NE corner Ave of Americas and Bleecker St	DPR	Benches and landscaping	Excellent/Low
V	Little Red Square NE corner Ave of Americas and Bleecker St	DPR	Benches and trees	Good/Moderate
W	Passannante Ballfield W Houston St, Ave of Americas, MacDougal St	DPR	Athletic fields (baseball, softball), athletic courts (basketball), drinking fountain	Excellent/Moderate
X	Greenstreets triangle Ave of Americas, Broome and Sullivan Sts	DPR	Planting/landscaping	--

Notes: See Figure 6-1 for open space resources.
DPR= New York City Department of Parks and Recreation
NYSDOT=New York State Department of Transportation
HRPT= Hudson River Park Trust
Source: New York City Department of City Planning (DCP), PLUTO 11v2 © 2011 and other city agency sources, AKRF site visits.

In addition, two historic resources that have sunlight-dependent architectural features are located within the longest shadow study area, as described in **Table 6-3**.

Table 6-3
Historic Resources with Sun-Sensitive Features

Map Key	Name/Location	Features
AA	St. Anthony of Padua 154 Sullivan St	Stained-glass windows
BB	Our Lady of Pompei 25 Carmine St	Stained-glass windows
Source: DCP, PLUTO 11v2 © 2011 and other city agency sources, AKRF site visits.		

Finally, a portion of the **Hudson River**, an important natural resource and habitat, is located in the longest shadow study area.

TIER 3 SCREENING ASSESSMENT

The direction and length of shadows vary throughout the course of the day and also differ depending on the season. In order to determine when project-generated shadow could fall on a sunlight-sensitive resource, three-dimensional (3D) computer mapping software[1] is used in the Tier 3 assessment to calculate and display the project-generated shadow on individual representative days of the year.

A 3D computer model was developed representing the topography and sun-sensitive resources contained in the Tier 1/Tier 2 base map. A 3D model containing the RWCDS maximum zoning envelopes was provided by the Applicant and integrated into the base topographic model.

REPRESENTATIVE DAYS FOR ANALYSIS

Shadows on the summer solstice (June 21), winter solstice (December 21) and spring and fall equinoxes (March 21 and September 21, which are approximately the same in terms of shadow patterns) are modeled, to represent the range of shadows over the course of the year. An additional representative day during the growing season is also modeled, generally the day halfway between the summer solstice and the equinoxes, i.e., May 6 or August 6, which have approximately the same shadow patterns.

TIMEFRAME WINDOW OF ANALYSIS

The shadow assessment considers shadows occurring between one and a half hours after sunrise and one and a half hours before sunset. At times earlier or later than this window of analysis, the sun is down near the horizon and the sun's rays reach the Earth at tangential angles, diminishing the amount of solar energy and producing shadows that are long, move fast, and generally blend with shadows from existing structures until the sun reaches the horizon and sets. Consequently, shadows occurring outside the timeframe window of analysis are not considered significant under CEQR, and their assessment is not required.

[1] MicroStation V8i.

TIER 3 SCREENING ASSESSMENT RESULTS

Figures 6-2 to 6-5 illustrate the range of shadows that would occur, absent intervening structures, from the project-generated development sites requiring analysis on the four representative days. The shadows are shown occurring approximately every two to three hours from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset), from each development site. The Tier 3 assessment serves to illustrate the daily path or "sweep" of each site's shadow across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow. Those resources that would be located within the shadow sweep of development sites on one of more analysis days required a detailed analysis, which considers existing and buildings anticipated to be built in the No-Action condition.

Figure 6-2 depicts the daily shadow sweeps from the project-generated development sites requiring analysis on March 21/September 21, representing early spring and fall. Portions of the Hudson River and Hudson River Park could be reached by several of the development sites located on Greenwich Street at the start of the analysis day. The privately owned, publicly accessible Trump Soho Plaza could be affected by project-generated shadow, primarily from Projected Development Site 2 just south of it. Duarte Square could be shaded by the adjacent Projected Development Site 1 in the afternoon. Later in the afternoon, Soho Square, the Greenstreets triangle at Avenue of the Americas and Broome Street, Father Fagan Park, the Greenstreets triangle at Thompson and Broome Streets, and possibly the Greenstreets triangle at Avenue of the Americas, West Houston, and Bedford Streets could be affected by project-generated shadow. At the end of the analysis day, portions of Vesuvio Playground, Passannante Playground, and Charlton Plaza could be reached by project-generated shadow.

On May 6/August 6, shadows are shorter throughout most of the day than on March 21/September 21 and fall farther south at the beginning and end of the analysis period (see **Figure 6-3**). No sun-sensitive resources north of King Street or West Houston Street could be reached by project-generated shadow. Early in the morning, shadow from the development sites requiring analysis on Greenwich Street could reach small portions of the Hudson River and Hudson River Park. Also in the morning, small parts of Canal Park could potentially be reached by project-generated shadow. Beginning in the early afternoon, Trump SoHo Plaza and Duarte Square could be shaded by adjacent development sites. Later in the afternoon, Grand Canal Court (across Avenue of the Americas from Duarte Square), SoHo Square, and the Greenstreets triangle at Avenue of the Americas and Broome Street could potentially be shaded by project-generated shadow. Near the end of the analysis day, project-generated shadow could reach Vesuvio Playground, Father Fagan Park and a very small portion of Charlton Plaza.

On June 21, shadows are shortest, move most slowly across the landscape, and fall farthest to the south at the start and end of the analysis period (see **Figure 6-4**). On this day, no sun-sensitive resources north of King Street or West Houston Street could be reached by project-generated shadow. Early in the morning, project-generated shadow could reach small portions of the Hudson River and Hudson River Park, Canal Park, and the Greenstreets space at Canal and Hudson Streets. Beginning in the early afternoon, Trump SoHo Plaza and Duarte Square could be shaded by adjacent development sites. Later in the afternoon, Grand Canal Court (across Avenue of the Americas from Duarte Square), SoHo Square, and the Greenstreets triangle at Avenue of the Americas and Broome Street could potentially be shaded by project-generated shadow. Near the end of the analysis day, project-generated shadow could reach Vesuvio



Note: Daylight Saving Time not used.

0 200 1000 FEET
SCALE

Publicly-Accessible Open Space (see Figure 6-1/Table 6-2)

Historic Resource with Sun-Sensitive Features (see Figure 6-1/Table 6-3)

Shadow

This figure illustrates the range of shadows that would occur, absent intervening structures, from the projected and potential development and enlargement sites requiring analysis on this representative day. The shadows are shown occurring approximately every two to three hours from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset), from each projected and potential development and enlargement site. The Tier 3 assessment serves to illustrate the daily path or "sweep" of each site's shadow across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow.

Tier 3 Assessment - March 21/Sept. 21

Figure 6-2



Note: Daylight Saving Time not used.

0 200 1000 FEET
SCALE

Publicly-Accessible Open Space (see Figure 6-1/Table 6-2)

Historic Resource with Sun-Sensitive Features (Figure 6-1/Table 6-3)

Shadow

This figure illustrates the range of shadows that would occur, absent intervening structures, from the projected and potential development and enlargement sites requiring analysis on this representative day. The shadows are shown occurring approximately every two to three hours from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset), from each projected and potential development and enlargement site. The Tier 3 assessment serves to illustrate the daily path or "sweep" of each site's shadow across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow.

Tier 3 Assessment - May 6/August 6

Figure 6-3



Note: Daylight Saving Time not used.

0 200 1000 FEET
SCALE

Publicly-Accessible Open Space (see Figure 6-1/Table 6-2)

Historic Resource with Sun-Sensitive Features (see Figure 6-1/Table 6-3)

Shadow

This figure illustrates the range of shadows that would occur, absent intervening structures, from the projected and potential development and enlargement sites requiring analysis on this representative day. The shadows are shown occurring approximately every two to three hours from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset), from each projected and potential development and enlargement site. The Tier 3 assessment serves to illustrate the daily path or "sweep" of each site's shadow across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow.

Tier 3 Assessment - June 21

Figure 6-4

3.6.12



Note: Daylight Saving Time not used.

0 200 1000 FEET

SCALE

Publicly-Accessible Open Space (see Figure 6-1/Table 6-2)

Historic Resource with Sun-Sensitive Features (see Figure 6-1/Table 6-3)

Shadow

This figure illustrates the range of shadows that would occur, absent intervening structures, from the projected and potential development and enlargement sites requiring analysis on this representative day. The shadows are shown occurring approximately every two to three hours from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset), from each projected and potential development and enlargement site. The Tier 3 assessment serves to illustrate the daily path or "sweep" of each site's shadow across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow.

Tier 3 Assessment - December 21

Figure 6-5

Playground, the Greenstreets triangle at Broome and Thompson Streets, Charlton Plaza, and possibly Father Fagan Park.

On December 21, shadows are longest and move relatively quickly from northwest to northeast over the course of the analysis day (see **Figure 6-5**). On this day, no sun-sensitive resources south of Watts Street could be reached by project-generated shadow. Early in the morning, shadow from the development sites requiring analysis on Greenwich Street could reach small portions of the Hudson River and Hudson River Park. North of the Rezoning Area, James J. Walker Park and Tony Dapolito Recreation Center could potentially be reached by shadow from development sites three blocks to the south and southwest. Trump SoHo Plaza could be shaded in the early afternoon by project-generated shadow. In the afternoon, near the end of the analysis day eight open spaces on Avenue of the Americas could potentially be reached by project shadow: the Greenstreets triangle at Broome Street, SoHo Square, Father Fagan Park, Charlton Plaza, Playground of the Americas, the Greenstreets space at West Houston and Bedford Streets, Passannante Playground, and a small portion of Downing Street Playground. Vesuvio Playground could be shaded by Projected Development Site 1 at the end of the analysis day. Finally, shadow from Projected Development Site 7 would be long enough to reach the footprint of Our Lady of Pompei at the very end of the analysis day.

Summary of Tier 3 Assessment by Resource

The Tier 3 assessment concluded that the following resources from the Tier 1/Tier 2 assessment could not be affected by project-generated shadow on any representative analysis day and required no further analysis: Winston Churchill Square, Father Demo Square, Minetta Triangle and Little Red Square (all located at Avenue of the Americas and Bleecker Street); and the Saint Anthony of Padua Church on West Houston and Sullivan Streets.

The following open space resources could potentially be reached by project-generated shadow on all four analysis days: Trump SoHo Plaza, SoHo Square, the Greestreets triangle on Avenue of the Americas and Broome Street, Vesuvio Playground, Father Fagan Park, Charlton Plaza, and portions of Hudson River Park. In addition, the Hudson River could receive project-generated shadow during the mornings of all four analysis days.

Duarte Park could receive project-generated shadow in the spring, summer, and fall representative days, but not the winter analysis day.

Grand Canal Court and Canal Park could receive project-generated shadow on the late spring and summer analysis days (May 6/August 6 and June 21). The Greenstreets space at Broome and Thompson Streets could experience shadow from Projected Development Site 1 on March 21/September 21 and from Projected Development Site 13 and Potential Development Site 22 on June 21. The Greenstreets space on Canal and Hudson Streets could be shaded by development sites to its east on the June analysis morning only. North of the Rezoning Area, Passannante Playground and the Greenstreets triangle at West Houston Street and Avenue of the Americas could be reached by project-generated shadow on the March/September and December analysis days.

North of the Rezoning Area, the following resources could be reached by project-generated shadow on only the December 21 analysis day: The Playground of the Americas, Downing Street Playground, Our Lady of Pompei Church, James J. Walker Park, and the Tony Dapolito Recreation Center.

The resources that could potentially be affected by new shadow resulting from the Proposed Action on one or more analysis days required additional analysis to determine whether they would actually experience incremental shadow attributed to the Proposed Action, given the shadows already cast by existing buildings and by buildings expected to be built in the No-Action condition.

D. DETAILED SHADOW ANALYSIS

The purpose of the detailed analysis is to determine the extent and duration of new incremental shadows that fall on a sunlight-sensitive resource as a result of the Proposed Action, and to assess their effects. The detailed analysis establishes a baseline condition (the No-Action condition) that is compared to the With-Action condition to illustrate the additional (incremental) shadow that may be cast by the Proposed Action. Because existing buildings or buildings in the No-Action condition may already cast shadows on a sun-sensitive resource, the Proposed Action may not result in additional, or incremental, shadows upon that resource.

In order to carry out the detailed shadow analysis, the 3D computer model used for the Tier 3 screening assessment was augmented by adding the existing buildings and buildings in the No-Action condition in the study area. A combination of data sources was used to develop the three-dimensional existing structures, including New York City GIS data, and Fugro EarthData Inc. **Figure 6-6** shows views of the computer model used in the detailed analysis. Shadow analyses were performed for each of the representative days and analysis periods indicated in the Tier 3 assessment.

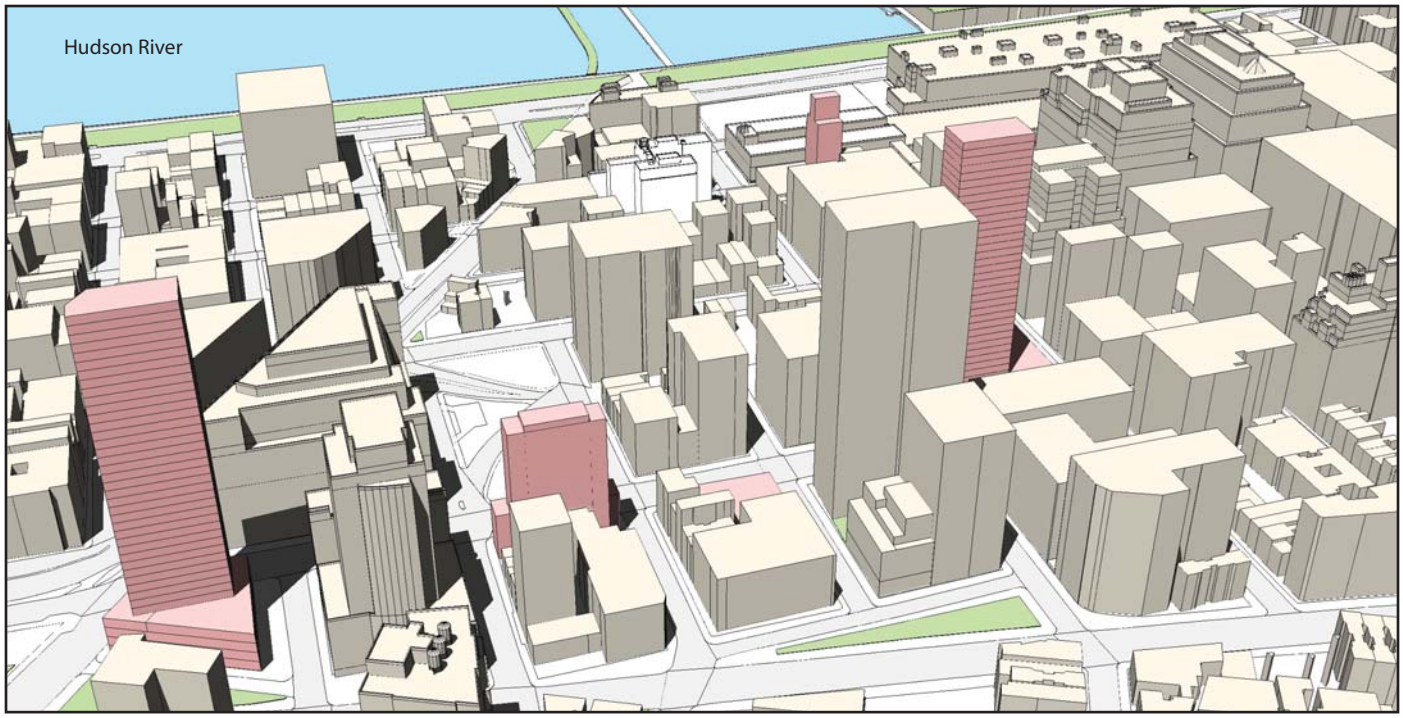
The analysis results are described below for each analysis day. **Table 6-4** summarizes the results of the detailed analysis. It shows the entry and exit times and total duration of project-generated incremental shadow on each affected resource. **Figures 6-7** through **6-16** document the results of the analysis by providing graphic representations or "snapshots" of times when incremental shadow would fall on a sun-sensitive resource. The figures illustrate the extent of additional, incremental shadow at that moment, highlighted in red, and also show existing shadow and remaining areas of sunlight.

MARCH 21/SEPTEMBER 21

MORNING

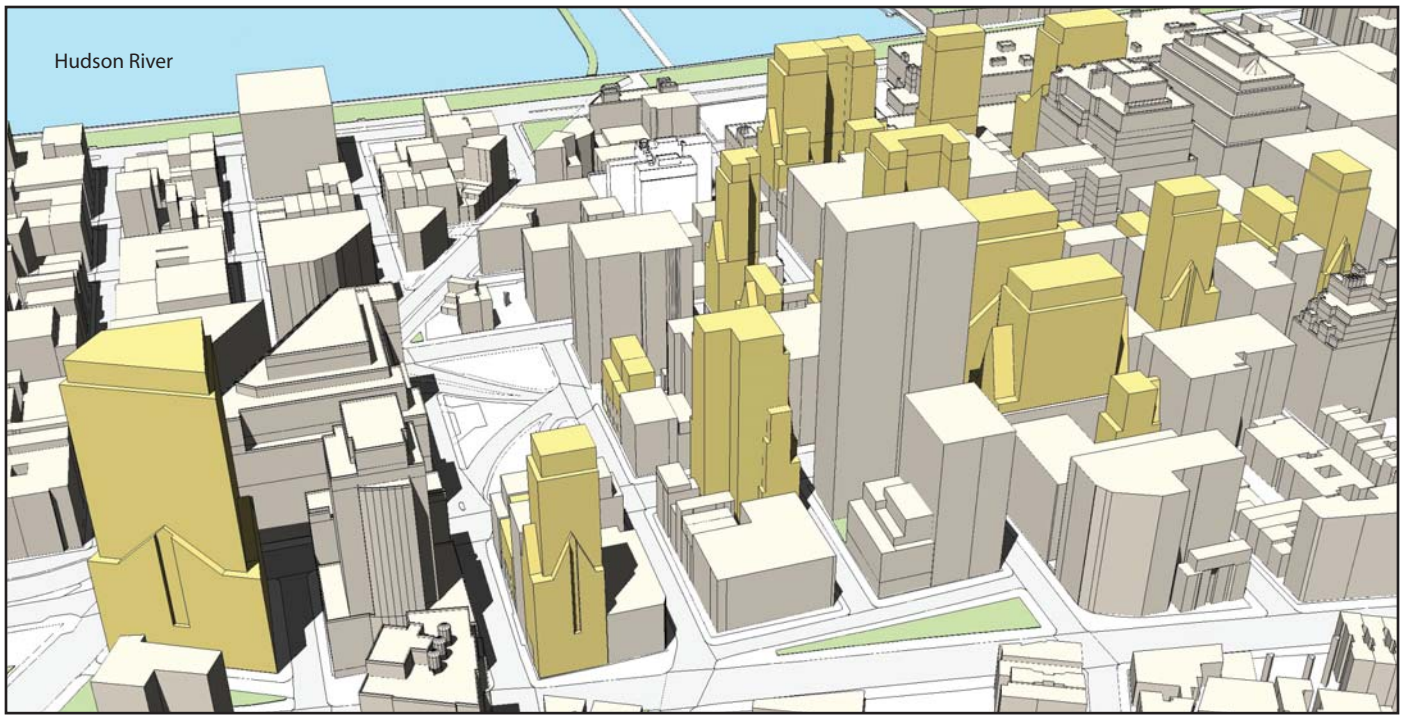
Projected Development Sites 19, 17, and 9 and Potential Development Site 21 would cast new shadows on portions of the Hudson River from the start of the analysis day at 7:36 AM until 8:00 AM. These same sites plus Projected Development Site 4 would cast shadows on parts of Hudson River Park from 7:36 AM until 8:05, when the shadows from Sites 4 and 19 would exit. Sites 9, 17 and 21 would continue to cast small shadows for 15 more minutes, until 8:20 AM. The new shadows would fall on areas of the park containing the bikeway, landscaping, lawn, and the tennis courts south of Pier 40 during this time. A small, new shadow would also fall on the Pier 40 rooftop fields from 7:36 AM until 7:42 AM.

4.5.12



Publicly-Accessible Open Space (for names see Figure 6-1/Table 6-2)

Future No-Action Buildings on Development Sites



Publicly-Accessible Open Space

Future With-Action Projected and Potential Development Sites for Detailed Analysis

Note: For illustrative purposes only. Massings on development sites illustrate maximum zoning bulk envelopes.

Three-Dimensional Computer Model for Detailed Analysis - View West

Figure 6-6

3.7.12



Note: Daylight Saving Time not used.

Publicly-Accessible Open Space

1 Projected and Potential Development Maximum Zoning Envelopes Requiring Detailed Analysis (with site number)

Incremental Shadow on Sun-Sensitive Resource

March 21/Sept. 21 - 1:30 PM

Figure 6-7

3.7.12



Note: Daylight Saving Time not used.

Publicly-Accessible Open Space

1 Projected and Potential Development Maximum Zoning Envelopes Requiring Detailed Analysis (with site number)

Incremental Shadow on Sun-Sensitive Resource

March 21/Sept. 21 - 3:30 PM

Figure 6-8

3.7.12



Note: Daylight Saving Time not used.

Publicly-Accessible Open Space

1 Projected and Potential Development Maximum Zoning Envelopes Requiring Detailed Analysis (with site number)

Incremental Shadow on Sun-Sensitive Resource

May 6/August 6 - 1:30 PM

HUDSON SQUARE REZONING

Figure 6-9



Note: Daylight Saving Time not used.

Publicly-Accessible Open Space

1 Projected and Potential Development Maximum Zoning Envelopes Requiring Detailed Analysis (with site number)

Incremental Shadow on Sun-Sensitive Resource

May 6/August 6 - 3:30 PM

Figure 6-10

3.7.12



Note: Daylight Saving Time not used.

Publicly-Accessible Open Space

1 Projected and Potential Development Maximum Zoning Envelopes Requiring Detailed Analysis (with site number)

Incremental Shadow on Sun-Sensitive Resource

May 6/August 6 - 5:00 PM

Figure 6-11

3.7.12



Note: Daylight Saving Time not used.

Publicly-Accessible Open Space

1 Projected and Potential Development Maximum Zoning Envelopes Requiring Detailed Analysis (with site number)

Incremental Shadow on Sun-Sensitive Resource

June 21 - 1:30 PM

3.7.12



Note: Daylight Saving Time not used.

Publicly-Accessible Open Space

1 Projected and Potential Development Maximum Zoning Envelopes Requiring Detailed Analysis (with site number)

Incremental Shadow on Sun-Sensitive Resource

June 21 - 3:30 PM

HUDSON SQUARE REZONING

Figure 6-13

3.7.12



Note: Daylight Saving Time not used.

Publicly-Accessible Open Space

1 Projected and Potential Development Maximum Zoning Envelopes Requiring Detailed Analysis (with site number)

Incremental Shadow on Sun-Sensitive Resource

June 21 - 5:30 PM

Figure 6-14

4.5.12



Note: Daylight Saving Time not used.

Publicly-Accessible Open Space

1 Projected and Potential Development Maximum Zoning Envelopes Requiring Detailed Analysis (with site number)

Incremental Shadow on Sun-Sensitive Resource

December 21 - 1:00 PM

Figure 6-15



Note: Daylight Saving Time not used.

Publicly-Accessible Open Space

1 Projected and Potential Development Maximum Zoning Envelopes Requiring Detailed Analysis (with site number)

Incremental Shadow on Sun-Sensitive Resource

December 21 - 2:00 PM

Figure 6-16

Table 6-4
Incremental Shadow Durations

Sun-sensitive Resources	March 21 / Sept. 21 7:36 AM-4:29 PM	May 6 / August 6 6:27 AM-5:18 PM	June 21 5:57 AM-6:01 PM	December 21 8:51 AM-2:53 PM
Hudson River	7:36 AM–8:00 AM Total: 24 min	6:27 AM–6:55 AM Total: 28 min	5:57 AM–6:35 AM Total: 38 min	8:51 AM–9:10 AM Total: 19 min
Hudson River Park	7:36 AM–8:20 AM Total: 44 min	6:27 AM–7:15 AM Total: 48 min	5:57 AM–6:55 AM Total: 58 min	8:51 AM–9:20 AM Total: 29 min
Greenstreets space – Canal & Hudson Sts	—	—	5:57 AM–6:05 AM Total: 8 min	—
Trump SoHo Plaza	12:00 PM–3:40 PM Total: 3 hr 40 min	12:00 PM–3:00 PM Total: 3 hr	12:20 PM–2:10 PM Total: 1 hr 50 min	11:20 AM–11:40 AM 12:10 PM–12:20 PM 12:45 PM–2:15 PM Total: 1 hr 45 min[1]
SoHo Square	1:00 PM–1:40 PM 2:30 PM–4:29 PM Total: 2 hr 39 min	2:30 PM–4:50 PM Total: 2 hr 20 min	2:50 PM–4:40 PM 5:20 PM–5:50 PM Total: 2 hr 20 min	12:50 PM–1:20 PM 1:45 PM–1:50 PM Total: 30 min
Duarte Square	2:20 PM–3:50 PM Total: 1 hr 30 min	1:30 PM–4:20 PM Total: 2 hr 50 min	1:20 PM–4:40 PM Total: 3 hr 20 min	—
Greenstreets triangle – Ave of Americas & Broome St	3:10 PM–4:00 PM Total: 50 min	2:00 PM–2:50 PM 4:20 PM–5:18 PM Total: 1 hr 48 min	1:40 PM–5:10 PM Total: 3 hr 30 min	—
Grand Canal Court	—	4:20 PM–5:18 PM Total: 58 min	4:10 PM–6:01 PM Total: 1 hr 51 min	—
Greenstreets triangle – Thompson & Broome Sts	—	—	5:20 PM–5:30 PM Total: 10 min	—
Passannante Playground	4:25 PM–4:29 PM Total: 4 min	—	—	2:40 PM–2:53 PM Total: 13 min
Playground of the Americas	—	—	—	2:50 PM–2:53 PM Total: 3 min

Notes: Table indicates entry and exit times and total duration of incremental shadow for each sunlight-sensitive resource. Daylight saving time is not used.
[1] From 12:35 PM to 12:50 PM there would be a reduction in shadow compared with the No-Action condition, due to the shorter With-Action development at Projected Development Site 1; therefore the net duration of incremental shadow would be one hour and 45 minutes.

AFTERNOON

Beginning at 12:00 PM shadow from Projected Development Site 2 would move onto the western side of Trump SoHo Plaza. From 1:10 PM until 3:40 PM, the incremental shadow would eliminate the remaining triangle of sunlight on the plaza (see **Figures 6-7 and 6-8**). After 3:40 PM, the plaza would be completely in existing shadows.

Two sites would cast new shadows on SoHo Square in the March 21/September 21 afternoon. Projected Development Site 13 would cast new shadows from 1:00 PM to 1:40 PM, but this

shadow would only pass across a small section in the south of the space (see **Figure 6-8**). Projected Development Site 2 would cast new shadows on the space from 2:30 PM until the end of the analysis day at 4:29 PM (see **Figure 6-8**); from 3:40 PM to 4:29 PM this new shadow would remove the small remaining area of sun.

Projected Development Site 1 would cast a small area of incremental shadow, compared with the No-Action building on that site, on Duarte Square from 2:20 PM to 3:50 PM (see **Figure 6-8**). The southern portion of Duarte Square would remain in sun during this time.

Shadow from Projected Development Site 13 would move across the small Greenstreets triangle at Avenue of the Americas and Broome Street from 3:10 PM to 4:00 PM (see **Figure 6-8**).

At the very end of the analysis day, Potential Development Site 24 would cast four minutes of new shadow on a portion of Passannante Playground.

MAY 6/AUGUST 6

MORNING

Projected Development Sites 19, 17, and 9 and Potential Development Site 21 would cast new shadows on portions of the Hudson River from the start of the analysis day at 6:27 AM until 6:55 AM. Incremental shadow would also fall on Hudson River Park from 6:27 AM until 7:15 AM, shading areas of the bikeway, landscaping, lawn, and the tennis courts.

AFTERNOON

Incremental shadow from Projected Development Site 2 would move onto the southwestern portion of Trump SoHo Plaza at 12:00 PM. It would remain on the southern portion of the plaza until 3:00 PM, eliminating the remaining triangle of sunlight from 1:20 PM to 2:00 PM (see **Figure 6-9**).

Projected Development Site 2 would cast incremental shadow on SoHo Square for two hours and 20 minutes in the afternoon, from 2:30 PM to 4:50 PM, removing much but never all of the small remaining sunlit area of the square (see **Figure 6-10**).

Projected Development Site 1 would cast a small area of incremental shadow, compared with the No-Action building on that site, on Duarte Square from 1:30 PM to 4:20 PM (see **Figures 6-9 and 6-10**). The area of new shadow would remain limited and the southern portion of the square would remain in sun throughout this period.

New shadows from Projected Development Site 13 would pass across the small Greenstreets triangle at Avenue of the Americas and Broome Street from 2:00 PM to 2:50 PM, and again later in the afternoon from 4:20 PM to the end of the analysis day at 5:18 PM (see **Figure 6-11**)

Shadow from Projected Development Site 1 would fall on a portion of Grand Canal Court for the final hour of the analysis day (4:20 PM to 5:18 PM); most of the space—which is entirely a hard-surface basketball court—would remain in sun during this period (see **Figure 6-11**).

JUNE 21

MORNING

Similar to May 6/August 6, on June 21 Projected Development Sites 19, 17, and 9 and Potential Development Site 21 would cast new shadows on portions of the Hudson River from the start of the analysis day at 5:57 AM until 6:35 AM. Incremental shadow would also fall on Hudson River Park from 6:27 AM until 6:55 AM, shading areas of the bikeway, landscaping, lawn and the tennis courts.

Early in the morning, shadow from Projected Development Site 2 would briefly shade the small Greenstreets space at Canal and Hudson Streets from 5:57 AM to 6:05 AM.

AFTERNOON

Projected Development Site 2 would cast incremental shadows on the southern portion of Trump SoHo Plaza from 12:20 PM to 2:10 PM, but would not remove all the remaining sunlight during this time (see **Figure 6-12**).

Projected Development Site 1 would cast a small area of incremental shadow on Duarte Square from 1:20 PM to 4:40 PM (see **Figures 6-12 and 6-13**). The area of new shadow would be small and the southern portion of the square would remain in sun throughout the afternoon.

New shadows from Projected Development Site 13 would fall on the small Greenstreets triangle at Avenue of the Americas and Broome Street from 1:40 PM to 5:10 PM (see **Figure 6-13**).

Projected Development Site 2 would cast new shadow on SoHo Square from 2:50 PM to 4:40 PM. The area of incremental shadow would be limited in extent during this period (see **Figure 6-13**). Near the end of the analysis day, incremental shadow from Projected Development Sites 10 and 12 would fall on a small area of the square, from 5:20 PM to 5:40 PM (see **Figure 6-14**), and from Projected Development Site 3 and Projected Enlargement Site 1 from 5:35 PM to 5:50 PM, also covering only a small area of the square.

Shadow from Projected Development Site 1 would fall on a portion of Grand Canal Court for nearly two hours (4:10 PM to 6:01 PM); most of the space—which is entirely a hard-surface basketball court—would remain in sun during this period (see **Figure 6-14**).

Incremental shadow from Projected Development Site 13 would fall on the Greenstreets triangle at Broome and Thompson Streets from 5:20 PM to 5:30 PM (see **Figure 6-14**).

DECEMBER 21

MORNING

Incremental shadow would fall on a very small area of the Hudson River, north of Pier 40, for the first 20 minutes of the analysis day. New shadows would also fall on the rooftop ball fields of Pier 40 for the first nine minutes of the analysis day, and on the bikeway in front of Pier 40 from 9:00 AM to 9:20 AM; these shadows would be small.

AFTERNOON

New shadow from Projected Development Site 13 would move across Trump SoHo Plaza from 11:20 AM to 11:40 AM. A small shadow from Projected Development Site 2 would fall on the

space from 12:10 PM to 12:20 PM. From 12:35 PM to 12:50 PM there would be less shadow on the northeast part of the space compared with the No Action scenario due to the shorter With-Action development on Projected Development Site 1. From 12:45 PM to 2:15 PM shadow from Projected Development Site 2 would move across the plaza, removing the remaining sunlight for much of this period (see **Figures 6-15 and 6-16**). After 2:15 PM the space would be entirely in existing shadows.

Incremental shadow from Projected Development Site 13 would move across portions of SoHo Square in the afternoon, from 12:50 PM to 1:20 PM (see **Figure 6-15**). New shadow from Projected Development Site 1 would fall on a small area of the square from 1:45 PM to 1:50 PM.

Incremental shadow would fall on Passannante Playground for the final 13 minutes of the analysis day, and on Playground of the Americas for the final three minutes of the analysis day.

E. THE FUTURE WITH THE PROPOSED ACTION

Trump SoHo Plaza is a recently developed public space that contains benches, trees, and landscaping. This plaza would receive at least an hour and 45 minutes of new shadows, primarily from Projected Development Site 2 located just south across Dominick Street, throughout the year. In the spring, late summer, and fall the plaza would receive from three hours to three hours and 40 minutes of new shadows, at times eliminating all the remaining sunlight during these periods. The plaza would already be largely in existing shadows in the mornings and late afternoons from the buildings to its east and west. However, during some periods when all remaining sunlight would be eliminated from Trump SoHo Plaza, there would be ample sunlight at nearby SoHo Square, which contains similar amenities (e.g., benches and trees), available for residents and workers to use. (**Appendix 3** provides a more detailed graphic representation of times when incremental shadow would fall on Trump SoHo Plaza and SoHo Square, including specific locations of vegetation and seating areas.) Given the long durations and the fact that all remaining sunlight would be eliminated for an hour or more in some seasons, and that the plaza already experiences periods of existing shadows, the Proposed Action would result in significant adverse shadow impacts to the users of this resource. Potential mitigation for this significant adverse impact is discussed in Chapter 20, "Mitigation."

With respect to the vegetation of Trump SoHo Plaza, with the exception of the bulb, Autumn crocus (*Colchicum autumnale* 'Nancy Lindsey'), which prefers full sun, the rest of the plants and trees in the plaza are shade tolerant.[1] Autumn crocus is located in beds at the southern end of the plaza, near Dominick Street, and near the northern end of the site, closer to Spring Street. The southern end of the plaza would receive an additional one to three hours of shadows during the growing season as a result of the Proposed Action; the northern end of the plaza would receive only a minimal amount of additional shadows as a result of the Proposed Action. However, the Autumn crocus beds would receive sunlight at times in the morning and afternoon through most of the growing season. Although the project-generated shadows would have an adverse effect on the Autumn crocus bed in the vicinity of Dominick Street, overall, the Proposed Action would not result in a significant adverse impact on the vegetation of the plaza given that the majority of the landscaping is suited for partially shaded areas.

[1] Species information provided in ULURP application filed in March 2012 pursuant to certifications for plaza modifications (N110 273ZCM and N110274ZCM).

SoHo Square spans two blocks north to south and contains benches and trees. This square would receive approximately two and a half hours of new shadows, primarily from Projected Development Site 2, in the spring, summer and fall, and 30 minutes in the winter. The incremental shadow would occur in the afternoons, when the square already would be in some existing shadows. On March 21/September 21 in particular, the incremental shadow would last for two hours and 39 minutes and would remove the remaining area of sunlight for about an hour. (As noted above, **Appendix 3** provides a more detailed graphic representation of times when incremental shadow would fall on Trump SoHo Plaza and SoHo Square, including specific locations of vegetation and seating areas.) Therefore, the Proposed Action would result in a significant adverse shadow impact to the users of this resource. Potential mitigation for this significant adverse impact is discussed in Chapter 20, "Mitigation."

It should be noted that although the RWCDS for the No-Action condition assumes a development on Projected Development Site 2 with a height of only 30 feet, there is no height restriction under the current zoning in the Rezoning Area. Therefore, in the No-Action condition Projected Development Site 2 could be constructed to heights as tall or taller than the 320 foot height limit in the With-Action condition, which would result in similar shadows on Trump SoHo Plaza and SoHo Square.

Duarte Square, adjacent and east of Projected Development Site 1, would experience long durations of incremental shadow in the spring, summer, and fall, ranging from an hour and a half in early spring and fall to three hours and 20 minutes on the summer solstice. However, as compared with the No-Action development at this site, the extent of incremental shadow would remain small throughout these durations. Therefore, the Proposed Action would not result in a significant adverse shadow impact to this resource.

The **Greenstreets** triangle at the intersection of Avenue of the Americas and Broome and Sullivan Streets, which contains flowers and trees (but no benches or other amenities), would receive 50 minutes of new shadow in March and September, nearly two hours on May 6 and August 6, and three and a half hours on June 21. However, the triangle would continue to receive at least four to five hours of direct sunlight in the mornings and mid-day of these analysis days. Therefore, the Proposed Action would not result in a significant adverse shadow impact to this resource.

Small areas of the **Hudson River** would receive incremental shadows in the early morning throughout the year, ranging in duration from approximately 25 to 40 minutes. The limited extent and duration of these new shadows would not adversely impact the biota of the river. Therefore, the Proposed Action would not result in a significant adverse shadow impact to this resource.

New shadows would fall on small areas of **Hudson River Park** at the start of each analysis day, lasting in duration from about a half-hour to an hour. These shadows would not significantly impact the park or its users, because large areas of the park adjacent to the small affected areas would be in sun, and after the new shadows exit these affected areas they would be in sun for the rest of the day. Therefore, the Proposed Action would not result in a significant adverse shadow impact to this resource.

Grand Canal Court is a basketball court with no benches or other amenities. The court would not receive incremental shadows in winter or on March 21/September 21. It would receive between an hour and an hour and a half of new shadow in late spring and summer, late in the afternoon. Areas of the court would remain in sun even during the period when incremental shadow would occur. The Proposed Action would not result in shadows large enough or long enough in duration to cause significant adverse impacts to the space.

The **Greenstreets** space located at Canal and Hudson Streets would receive 8 minutes of new shadow on June 21. The triangle would receive many hours of sunlight during the remainder of this analysis day, and would not be significantly and adversely impacted by the incremental shadow.

Passannante Playground, the **Playground of the Americas**, and the **Greenstreets** triangle at Broome and Thompson Streets would each receive 13 minutes or less of incremental shadow on one or two analysis days only, and would not be significantly impacted by project-generated shadow.

No other resources would be affected by project-generated shadow at any time of year. ✷