6.0 Shadows

A. Introduction

This chapter assesses the potential for the Proposed Actions to result in incremental shadows long enough to reach any nearby publicly accessible open spaces or other sunlight-sensitive resources. Public open spaces, historic resources, and natural resources are all potentially sunlight-sensitive resources, and, thus, this chapter is closely linked to the information presented in other chapters of the EIS, particularly Chapter 5, "Open Space," and Chapter 7, "Historic and Cultural Resources."

According to the *CEQR Technical Manual*, a shadows assessment is required if a proposed action would result in structures (or additions to existing structures) of 50 feet in height or greater, or those that would be located adjacent to, or across the street from, a sunlight-sensitive resource. As discussed in Chapter 1, "Project Description," the RWCDS for the Proposed Actions identifies 61 projected development sites and 7 potential development sites in the Rezoning Area. The redevelopment of the projected development sites, and the less likely development of the potential development sites, is expected to result in new buildings greater than 50 feet in height over the No-Action condition at most development sites. As such, a detailed shadows analysis was prepared to determine the potential for the Proposed Actions to result in significant adverse impacts on sunlight-sensitive resources.

B. Principal Conclusions

A detailed shadows analysis was conducted and concluded that development resulting from the Proposed Actions would result in significant adverse shadow impacts on five sunlight-sensitive resources. The projected and potential development sites identified in the RWCDS would result in incremental shadow coverage on 21 sunlight-sensitive resources. The detailed shadows analysis identified significant adverse impacts at five sunlight-sensitive resources. The analysis determined that the POPS at 1185 Broadway would not receive adequate sunlight during the growing season (at least the six- to eight-hour minimum specified in the *CEQR Technical Manual*) as a result of incremental shadow coverage, and vegetation at this resource could be significantly impacted. The analysis determined that the Marble Collegiate Church, St. John the Baptist Roman Catholic Church, St. Francis of Assisi Roman Catholic Church, and the Trinity Chapel Complex would receive incremental shadow that may have the potential to affect the public's enjoyment of sunlight-sensitive features of these historic resources.

C. Methodology

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

(if the feature that makes the structure significant depends on sunlight). First, a preliminary screening assessment must be conducted to ascertain whether shadows resulting from a project could reach any sunlight-sensitive resource at any time of year. The *CEQR Technical Manual* defines sunlight-sensitive resources as those resources that depend on sunlight or for which direct sunlight is necessary to maintain the resource's usability or architectural integrity. The following areas, features, and resources are considered sunlight-sensitive resources[1]:

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

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

[1] According to the *CEQR Technical Manual*, city streets, sidewalks, and private open spaces (such as private residential front and back yards, stoops, and vacant lots) are not considered sunlight-sensitive resources.

water bodies; wetlands; or designated resources, such as coastal fish and wildlife habitats.

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

If the third tier of analysis does not eliminate the possibility of new shadows on sunlight-sensitive resources, then a detailed shadow analysis is required to determine the extent and duration of the incremental shadow (i.e. the additional, or new, shadow) resulting from the project. The detailed shadow analysis establishes a baseline condition (the No-Action condition) that is compared to the future condition resulting from the Proposed Actions (the With-Action condition) to illustrate the shadows cast by existing or future buildings and distinguish the additional (incremental) shadows cast by the development of projected and potential development sites. In accordance with the *CEQR Technical Manual*, shadows on sunlight-sensitive resources of concern were modeled for four representative days of the year. For the New York City area, the months of interest for an open space resource encompass the growing season (i.e., March through October) and one month between November and February representing a cold-weather month (usually December). Representative days for the growing season are generally the March 21 vernal equinox (or the September 21 autumnal equinox, which is approximately the same), the June 21 summer solstice, and a spring or summer day halfway between the summer solstice and equinoxes, such as May 6 or August 6 (which are approximately the same). For the cold- weather months, the December 21 winter solstice is included to demonstrate conditions when open space users rely most heavily on available sunlight warmth. As these months and days are representative of the full range of possible shadows, they are also used for assessing shadows on sunlight-sensitive historic and natural resources. The *CEQR Technical Manual* defines the temporal limits of a shadow analysis period to fall from an hour and a half after sunrise to an hour and a half before sunset.

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

when an incremental shadow of 10 minutes or longer falls on a sunlight-sensitive resources and results in one of the following:

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

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

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

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

D. Preliminary Screening Assessment

First, an assessment of the 61 projected and seven potential development sites was performed to determine which sites required a preliminary screening assessment. As noted above, pursuant to *CEQR Technical Manual* guidance, only new development or enlargement that would result in an incremental increase of 50 feet or more compared to the No-Action condition require assessment. In addition, any development site adjacent to, or across the street from, a sunlight-sensitive resource requires a preliminary screening, regardless of its height.

As shown in **Table 6-1**, new structures of greater than 50 feet in incremental height are anticipated on each of the 61 projected development sites and on each of the seven potential development sites, and therefore require a preliminary screening assessment.

Figure 6-1 shows the projected and potential development sites identified for analysis in **Table 6-1**, as well as all sunlight-sensitive resources (publicly accessible open spaces, architectural resources, natural resources, historic resources, and Greenstreets).

Figure 6-1: Tier I and II Shadow Screening

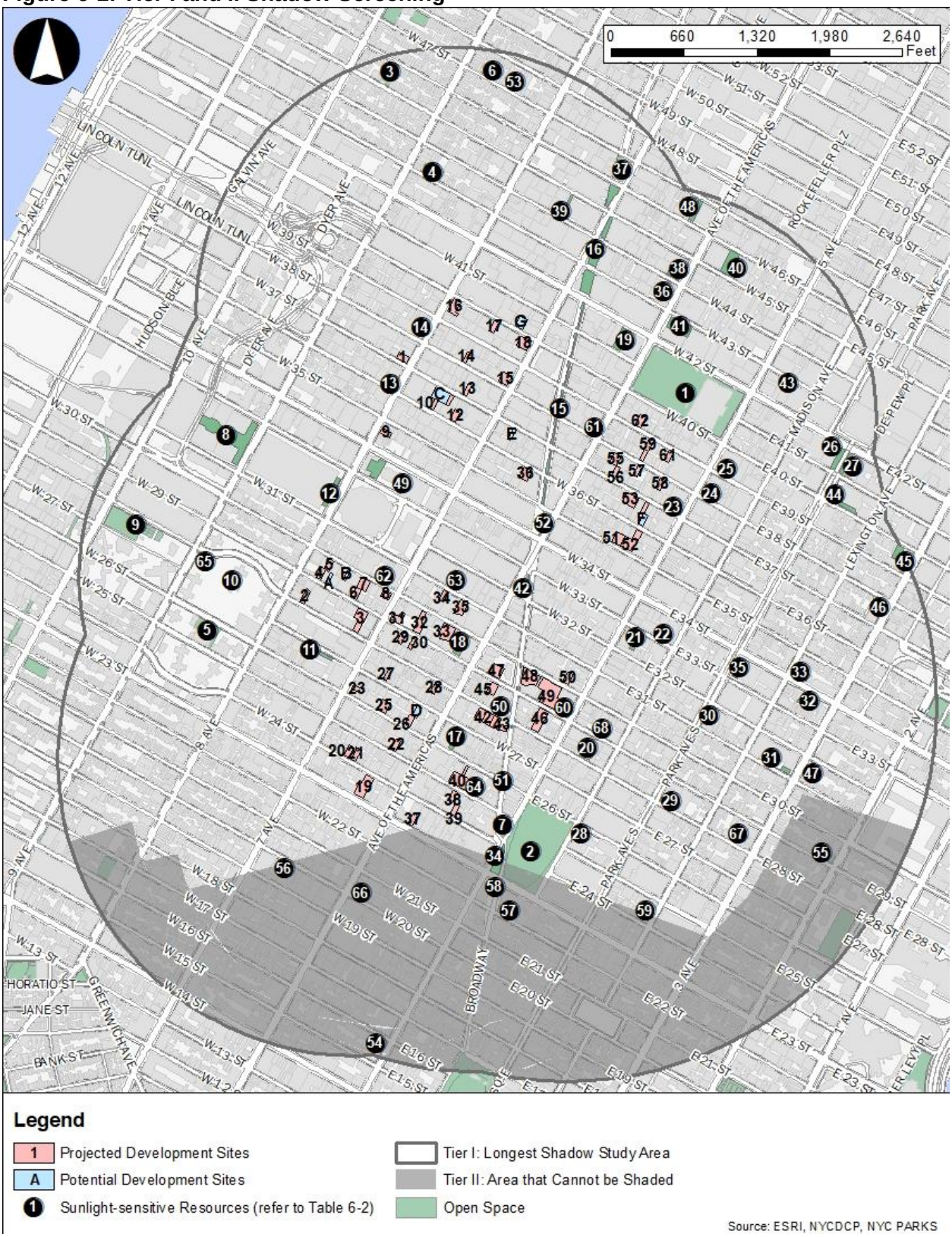


Table 6-1: RWCDS Sites Warranting Preliminary Shadows Analyses

Sites Warranting Preliminary Shadows Analyses		Sites Not Warranting Preliminary Shadows Analyses
Sites with 50-foot or Greater Height Increment[1]	**Sites with Less than 50-foot Height Increment Adjacent to Sunlight-Sensitive Resources**	**Sites with Less than 50-foot Height Increment Not Adjacent to Sunlight-Sensitive Resources**
Projected Development Sites		
1-61	None	None
Potential Development Sites		
A-G	None	None

[1] Based on maximum zoning envelopes.

Tier I Screening Assessment

According to the *CEQR Technical Manual*, the longest shadow that a structure will cast in New York City, except for periods close to dawn or dusk, is 4.3 times its height. The maximum shadow radius for each of the 68 projected/potential development sites warranting a preliminary shadows analysis was determined using each site's maximum zoning envelope. The maximum shadow radius for each development site was merged to form the longest shadow study area (Tier I Assessment).

Within this longest shadow study area, there are a number of potentially sunlight-sensitive open spaces. The Tier I screening area does not include any natural resources that would be considered sunlight-sensitive resources. Due to the presence of open space and historic resources within the Tier I screening area, further screening is warranted to determine whether any sunlight-sensitive resources could be affected by project-generated shadows.

Tier II Screening Assessment

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

Figure 6-1 provides a base map illustrating the results of the Tier I and Tier II screening assessments (i.e., the portion of the longest shadow study area lying within -108 degrees from true north and +108 degrees from true north as measured from the southernmost portions of the development sites). A total of 61 open space and historic resources were

identified as sunlight-sensitive resources that warranted further assessment. A list of all sunlight-sensitive resources that warrant further analysis is provided in **Table 6-2**.

Table 6-2: Sunlight-Sensitive Resources Warranting Further Analysis Based on Tier I and II Screening

Map No.[1]	Name	Tier I	Screen out in Tier II?
1	Bryant Park	X	
2	Madison Square Park	X	
3	Matthews - Palmer Playground	X	
4	McCaffery Playground	X	
5	Penn South Playground	X	
6	Ramon Aponte Park	X	
7	Worth Square	X	
8	Manhattan West POPS	X	
9	Chelsea Park	X	
10	Penn South	X	
11	230 West 27th Street POPS	X	
12	Moynihan Train Hall Steps	X	
13	525 Eighth Avenue POPS	X	
14	585 Eighth Avenue POPS	X	
15	Broadway Plazas	X	
16	Times Square Plaza	X	
17	776 Sixth Avenue POPS	X	
18	835 Sixth Avenue POPS	X	
19	1095 Sixth Avenue POPS	X	
20	10 East 28th Street POPS	X	
21	325 Fifth Avenue POPS	X	
22	172 Madison Avenue POPS	X	
23	420 Fifth Avenue POPS	X	
24	425 Fifth Avenue POPS	X	
25	445 Fifth Avenue POPS	X	
26	120 Park Avenue POPS	X	
27	Pershing Square Plaza	X	
28	41 Madison Avenue POPS	X	
29	407 Park Avenue South POPS	X	
30	475 Park Avenue South POPS	X	
31	155 East 31st Street POPS	X	
32	150 East 34th Street POPS	X	
33	243 Lexington Avenue POPS	X	
34	Madison/Worth Square Plaza	X	
35	3 Park Avenue POPS	X	
36	1133 Sixth Avenue POPS	X	
37	Father Duffy Square	X	
38	1155 Sixth Avenue POPS	X	
39	1515 Broadway/Shubert Alley	X	

Map No.[1]	Name	Tier I	Screen out in Tier II?
40	1166 Sixth Avenue (MMC Plaza)	X	
41	Grace Plaza	X	
42	Greeley Square	X	
43	6 East 43rd Street POPS	X	
44	101 Park Avenue POPS	X	
45	600 Third Avenue POPS	X	
46	160 East 38th Street POPS	X	
47	200 East 32nd Street POPS	X	
48	1185 Sixth Avenue POPS	X	
49	One Penn Plaza POPS	X	
50	1185 Broadway POPS	X	
51	Broadway Plazas South POPS	X	
52	Herald Square	X	
53	M408 Schoolyard	X	
54	108 Fifth Avenue POPS	X	X
55	Vincent F. Albano Jr. Playground	X	X
56	Chelsea Green	X	X
57	5 East 22nd Street POPS	X	X
58	Flatiron Plaza	X	X
59	50 Lexington Avenue POPS	X	X
60	Marble Collegiate Church	X	
61	Millinery Center Synagogue	X	
62	St. John the Baptist Roman Catholic Church	X	
63	St. Francis of Assisi Roman Catholic Church	X	
64	Trinity Church	X	
65	Church of the Holy Apostles	X	
66	Church of the Holy Communion	X	X
67	St. Stephen's Church	X	
68	Church of the Transfiguration	X	

[1] Numbers keyed to **Figure 6-1**.

Tier III Screening Assessment

According to the *CEQR Technical Manual*, a Tier III screening assessment should be performed to determine if, in the absence of intervening buildings, shadows resulting from a proposed action can reach a sunlight-sensitive resource, thereby warranting a detailed shadows analysis. The Tier III screening assessment is used to determine if shadows resulting from a proposed action can reach a sunlight-sensitive resource at any time between 1.5 hours after sunrise and 1.5 hours before sunset on representative analysis dates.

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

The Tier III analysis determines which of the sunlight-sensitive resources shown in **Table 6-2** would receive incremental shadow on at least one analysis day. **Table 6-3** presents a summary of the Tier III assessment, showing the 36 sunlight-sensitive resources that could, in the absence of intervening buildings, receive project-generated shadows, and on which analysis days the new shadows would occur. Further analysis is warranted and is provided following the table.

Table 6-3: Tier III Assessment Results

Map No.[1]	Name	March 21/ September 21	May 6/ August 6	June 21	December 21
		7:36 a.m. - 4:29 p.m.	6:27 a.m. - 5:18 p.m.	5:57 a.m. - 6:01 p.m.	8:51 a.m. - 2:53 p.m.
1	Bryant Park	X	X	X	X
2	Madison Square Park		X	X	
3	Matthews - Palmer Playground				
4	McCaffery Playground				
5	Penn South Playground		X	X	
6	Ramon Aponte Park				
7	Worth Square		X	X	
8	Manhattan West POPS				X
9	Chelsea Park				
10	Penn South	X	X	X	
11	230 West 27th Street POPS	X	X	X	X
12	Moynihan Train Hall Steps				X
13	525 Eighth Avenue POPS		X	X	X
14	585 Eighth Avenue POPS			X	X
15	Broadway Plazas	X	X	X	X
16	Times Square Plaza	X			X
17	776 Sixth Avenue POPS	X	X	X	X
18	835 Sixth Avenue POPS	X	X		X
19	1095 Sixth Avenue POPS		X	X	X
20	10 East 28th Street POPS	X		X	
21	325 Fifth Avenue POPS	X			
22	172 Madison Avenue POPS	X			
23	420 Fifth Avenue POPS	X	X	X	X
24	425 Fifth Avenue POPS	X	X	X	
25	445 Fifth Avenue POPS	X	X	X	

Map No.[1]	Name	March 21/ September 21	May 6/ August 6	June 21	December 21
		7:36 a.m. - 4:29 p.m.	6:27 a.m. - 5:18 p.m.	5:57 a.m. - 6:01 p.m.	8:51 a.m. - 2:53 p.m.
26	120 Park Avenue POPS				
27	Pershing Square Plaza				
28	41 Madison Avenue POPS			X	
29	407 Park Avenue South POPS				
30	475 Park Avenue South POPS		X		
31	155 East 31st Street POPS				
32	150 East 34th Street POPS				
33	243 Lexington Avenue POPS				
34	Madison/Worth Square Plaza				
35	3 Park Avenue POPS				
36	1133 Sixth Avenue POPS				
37	Father Duffy Square				
38	1155 Sixth Avenue POPS				
39	1515 Broadway/Shubert Alley				
40	1166 Sixth Avenue (MMC Plaza)				
41	Grace Plaza				X
42	Greeley Square	X	X	X	X
43	6 East 43rd Street POPS				
44	101 Park Avenue POPS				
45	600 Third Avenue POPS				
46	160 East 38th Street POPS				
47	200 East 32nd Street POPS				
48	1185 Sixth Avenue POPS				
49	One Penn Plaza POPS			X	X
50	1185 Broadway POPS	X	X	X	X
51	Broadway Plazas South POPS	X	X	X	X
52	Herald Square	X	X	X	X
53	M408 Schoolyard				
60	Marble Collegiate Church	X	X	X	X
61	Millinery Center Synagogue	X	X	X	X
62	St. John the Baptist Roman Catholic Church	X	X	X	X
63	St. Francis of Assisi Roman Catholic Church	X	X	X	X
64	Trinity Church	X	X	X	X
65	Church of the Holy Apostles	X			

Map No.[1]	Name	March 21/ September 21	May 6/ August 6	June 21	December 21
		7:36 a.m. - 4:29 p.m.	6:27 a.m. - 5:18 p.m.	5:57 a.m. - 6:01 p.m.	8:51 a.m. - 2:53 p.m.
67	St. Stephen's Church				
68	Church of the Transfiguration	X	X	X	

[1] Numbers keyed to **Figure 6-1**.

E. Detailed Analysis of Shadows Impacts

Shadows Analysis

Per *CEQR Technical Manual* guidance, shadow analyses were performed for the 36 sunlight-sensitive resources identified above on four representative days of the year: March 21/September 21, the equinoxes; May 6, the midpoint between the summer solstice and the equinox (and equivalent to August 6); June 21, the summer solstice and the longest day of the year; and December 21, the winter solstice and shortest day of the year. These four representative days indicate the range of shadows over the course of the year. *CEQR Technical Manual* guidance defines the temporal limits of a shadow analysis period to fall from 1.5 hours after sunrise to 1.5 hours before sunset. As discussed above, the results of the shadows analysis show the incremental difference in shadow impact between the No-Action and With-Action conditions (see **Table 6-4**). Per the *CEQR Technical Manual*, because existing buildings may already cast shadows on a sunlight-sensitive resource, the detailed analysis assesses whether a proposed project would cast new shadows, beyond what already occurs under existing conditions, on sunlight-sensitive resources.

As shown in **Table 6-4**, incremental project-generated shadows would reach 21 of the 36 sunlight-sensitive resources identified in the Tier III assessment. Increases in shadow coverage would occur at 14 resources on March 21/September 21; 12 resources on May 6/August 6; 13 resources on June 21; and 10 resources on December 21. **Figures 6-2** through **6-88**, provided at the end of this chapter, show representative shadow views for the 29 sunlight-sensitive resources of concern on each of the four representative analysis days.

Table 6-4: Duration of Shadows on Sunlight-Sensitive Resources (Increment Compared to No-Action Condition)

Map No.	Name	March 21/ September 21	May 6/ August 6	June 21	December 21
		7:36 a.m. - 4:29 p.m.	**6:27 a.m. - 5:18 p.m.**	**5:57 a.m. - 6:01 p.m.**	**8:51 a.m. - 2:53 p.m.**
1	Bryant Park	12:57 - 4:25 p.m. *3 hours 28 minutes*	1:33 - 3:52 p.m. *2 hours 19 minutes*		11:26 a.m. - 2:53 p.m. *3 hours 27 minutes*
2	Madison Square Park		4:43 - 5:18 p.m. *35 minutes*	5:19 - 5:58 p.m. 39 *minutes*	
5	Penn South Playground			6:32 - 6:46 a.m. *14 minutes*	
7	Worth Square				
8	Manhattan West POPS				
10	Penn South	7:36 - 9:14 a.m. *1 hour 38 minutes*	6:27 - 7:18 a.m. 7:55 - 9:21 a.m. *2 hours 17 minutes*	6:06 - 7:25 a.m. *1 hour 19 minutes*	
11	230 West 27th Street POPS				
12	Moynihan Train Hall Steps				9:57 -10:39 a.m. 11:19 a.m. - 1:01 p.m. *2 hours 24 minutes*
13	525 Eighth Avenue POPS				12:41 - 1:02 p.m. *21 minutes*
14	585 Eighth Avenue POPS				
15	Broadway Plazas (35th - 42nd Street)	8:09 - 8:16 a.m. *7 minutes*	1:45 - 3:39 p.m. *1 hour 54 minutes*	1:48 - 3:55 p.m. *2 hour 7 minutes*	
16	Times Square Plaza				
17	776 Sixth Avenue POPS	10:40 a.m. - 12:23 p.m. *1 hour 43 minutes*	4:23 - 5:00 p.m. *37 minutes*		
18	835 Sixth Avenue POPS	9:35 - 9:45 a.m. *10 minutes*			
19	1095 Sixth Avenue POPS				
20	10 East 28th Street POPS				
21	325 Fifth Avenue POPS				
22	172 Madison Avenue POPS				

Map No.	Name	March 21/ September 21	May 6/ August 6	June 21	December 21
		7:36 a.m. - 4:29 p.m.	**6:27 a.m. - 5:18 p.m.**	**5:57 a.m. - 6:01 p.m.**	**8:51 a.m. - 2:53 p.m.**
23	420 Fifth Avenue POPS	1:56 - 2:21 p.m. *25 minutes*	1:42 - 3:13 p.m. *1 hour 31 minutes*	2:33 - 4:03 p.m. *1 hour 30 minutes*	
24	425 Fifth Avenue POPS				
25	445 Fifth Avenue POPS				
28	41 Madison Avenue POPS			5:55 - 5:58 p.m. *3 minutes*	
30	475 Park Avenue South POPS				
41	Grace Plaza				1:45 - 2:05 p.m. *20 minutes*
42	Greeley Square				11:07 - 11:26 a.m. 19 *minutes*
49	One Penn Plaza POPS				
50	1185 Broadway POPS	10:51 a.m. - 2:32 p.m. *3 hours 41 minutes*	10:50 a.m. - 3:25 p.m. *4 hours 35 minutes*	11:25 a.m. - 3:05 p.m. *3 hours 40 minutes*	
51a	Broadway (25th-28th St)	2:28 - 2:53 PM *25 minutes*	7:53 - 8:38 AM 1:06 - 3:07 PM 3:52 - 4:26 PM 3 hours 20 minutes	8:28 - 9:02 AM 12:58 - 2:44 PM 3:18 - 4:32 PM *3 hours 34 minutes*	
51b	Broadway (29th - 32nd St.)	7:53 - 8:12 AM 8:50 - 9:15 AM 9:28 AM - 12:03 PM *3 hours 19 minutes*	7:16 - 8:35 AM 9:13 - 11:36 AM 4:00 - 4:35 PM *4 hours 17 minutes*	7:48 - 11:36 AM 2:44 - 2:51 PM 2:55 - 3:12 PM 3:29 - 4:37 PM *5 hours 20 minutes*	11:50 AM - 12:15 PM 12:50 - 1:00 PM *35 minutes*
52	Herald Square	7:58 - 8:23 a.m. *25 minutes*			
60	Marble Collegiate Church	1:25 - 4:29 PM *3 hours 4 minutes*	12:47 - 4:45 PM *3 hours 58 minutes*	12:40 - 4:19 PM *3 hours 39 minutes*	2:01 - 2:53 PM *52 minutes*

Map No.	Name	March 21/ September 21	May 6/ August 6	June 21	December 21
		7:36 a.m. - 4:29 p.m.	**6:27 a.m. - 5:18 p.m.**	**5:57 a.m. - 6:01 p.m.**	**8:51 a.m. - 2:53 p.m.**
61	Millinery Center Synagogue	7:54 - 8:11 AM 17 minutes		6:23 - 7:15 AM *52 minutes*	8:51 - 9:20 AM *29 minutes*
62	St. John the Baptist Roman Catholic Church	10:12 AM - 12:30 PM 1:57 - 4:29 PM *4 hours 50 minutes*	11:41 AM - 12:10 PM 1:22 - 5:18 PM *4 hours 25 minutes*	1:20 - 6:01 PM *4 hours 41 minutes*	10:21 AM - 12:04 PM 1:24 - 2:52 PM *3 hours 11 minutes*
63	St. Francis of Assisi Roman Catholic Church	10:19 AM - 12:11 PM 12:23 - 3:56 PM *5 hours 25 minutes*	11:00 AM - 11:18 AM 12:06 - 2:55 PM *3 hours 7 minutes*	12:13 - 2:07 PM *1 hour 54 minutes*	10:21 - 10:58 AM 11:41 AM - 12:08 PM *1 hour 4 minutes*
64	Trinity Chapel (Western/Southern Facades)	1:42 - 3:26 PM *1 hour 44 minutes*	12:58 - 4:38PM *3 hours 40 minutes*	12:49 - 6:01 PM *5 hours 12 minutes*	
65	Church of the Holy Apostles				
68	Church of the Transfiguration				

[1] Numbers keyed to **Figure 6-1.**
Note: Cells in gray indicate the sunlight-sensitive resource would not receive incremental shadow on that analysis day.

Note that, per the *CEQR Technical Manual*, all times reported herein are Eastern Standard Time and do not reflect adjustments for Daylight Saving Time that is in effect from mid-March to early November. As such, add one hour to the times reported in this chapter for March 21/September 21, May 6/August 6, and June 21 to reflect the Eastern Daylight Saving Time.

Sunlight-Sensitive Resources

Bryant Park

Bryant Park is a 9.6-acre open space. Bryant Park is located on the block bounded by West 42nd Street to the north, Fifth Avenue to the east, West 40th Street to the south, and Sixth Avenue to the west. The park contains a large lawn, multiple concession areas, and passive seatings areas with moveable café tables and chairs. Areas to play pétanque are located along Sixth Avenue just north of the 41st Street entrance and are open from 11:00 a.m. to 7:00 p.m. daily. In the summer months, the lawn is used for film screenings. In the winter months, the lawn is used for a “Winter Village” with an ice-skating rink, pop-up shops, and concessions.

This open space resource would be cast in incremental shadow on three of the four representative analysis days (March 21/September 21, May 6/August 6, and December 21). The incremental shadow would range between two hours and 19 minutes on the May 6/August 6 analysis day and three hours and 28 minutes on the March 21/September 21 analysis day (see **Table 6-4**).

On the March 21/September 21 analysis day, incremental shadow cast by projected development site 62 would enter the open space resource at 12:57 p.m. and continue to 4:25 p.m. (three hours and 28 minutes). As shown in **Figures 6-2** and **6-3**, incremental shadow would first occur towards the southwestern corner of the open space. Incremental shadow would move eastward over the course of the afternoon. Between 12:57 p.m. and approximately 3:15 p.m., the extent of the incremental shadow would grow as it moves eastward. From approximately 3:15 p.m. to 4:25 p.m. (when incremental shadow would no longer occur over Bryant Park), incremental shadow would decrease in size moving eastward across the open space. The area cast in incremental shadow on this analysis day includes benches, vegetation, a lawn, and tables and chairs.

On the May 6/August 6 analysis day, incremental shadow cast by projected development site 62 would enter the open space at 1:33 p.m. and exit at 3:52 p.m. (two hours and 19 minutes). Incremental shadow would be located along the southern edge of the open space and would move eastward over the course of the afternoon (see **Figures 6-4** and **6-5**). From 1:33 p.m. until approximately 2:45 p.m., the size of the incremental shadow would grow as it moves eastward. From approximately 2:45 p.m. to 3:52 p.m. (when incremental shadow would no longer occur over Bryant Park), incremental shadow would decrease in size moving eastward across the open space. The area cast in incremental shadow on this analysis day includes vegetation, tables, and chairs.

On the December 21 analysis day, incremental shadow from projected development sites 59, 61, and 62 would enter the open space at 11:26 a.m. and continue to the end of the analysis day at 2:53 p.m. (three hours and 27 minutes). As shown in **Figures 6-6** and **6-7**, incremental shadow would move eastward throughout the afternoon. Incremental shadow would be limited in extent. As described above, during the winter months, Bryant Park includes a “Winter Village” with an ice-skating rink, pop-up shops, and concessions. Incremental shadow would be cast on portions of the ice rink and areas with table and chairs north of the rink. From 2:36 to 2:53 p.m., the park would be cast entirely in shadow (see **Figure 6-7**).

Assessment

Incremental shadows generated by the Proposed Actions are not expected to result in significant adverse impacts to Bryant Park. The open space would continue to receive direct sunlight during the morning and early afternoon hours during the growing season. During the growing season, incremental shadow would generally be limited to the southern half of the open space and would not occur during the June 21 analysis day. On the December 21 analysis day, outside the growing season, incremental shadow would be limited in size. As mentioned above, the open space would be completely cast in shadow from 2:36 p.m. to

2:53 p.m. (see **Figure 6-7**). During this time period, the area cast by incremental shadow is occupied by winter kiosk structures and tables. The ice rink would be completely cast in shadow by existing structures during this time period.

Therefore, because the extent and duration of the incremental shadows would not significantly alter the public's use of the open space or threaten the viability of vegetation or other resources, incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

Madison Square Park

Madison Square Park is a 6.24-acre open space. Madison Square Park is located on the block bounded by East 26th Street to the north, Park Avenue South to the east, East 23rd Street to the south, and Fifth Avenue to the west. Madison Square Park includes lawns, playgrounds, passive seating areas, walking paths, moveable café tables and chairs, a dog run, and a restaurant. The lawn hosts seasonal art installations.

This open space resource would be cast in incremental shadow on two of the four representative analysis days (May 6/August 6 and June 21). The incremental shadow would range between 35 minutes on the May 6/August 6 analysis day and 39 minutes on the June 21 analysis day (see **Table 6-4**).

On the May 6/August 6 analysis day, incremental shadow cast by projected development site 39 would enter the open space at 4:43 p.m. and would remain until the end of the analysis day at 5:18 p.m. (35 minutes). Incremental shadow would be in the northwestern corner of the open space and would move eastward towards the northeastern corner during the 35 minutes in which incremental shadow would occur (see **Figure 6-8**). The size of incremental shadow would grow until the end of the analysis day. The area cast in incremental shadow on this analysis day includes vegetation, lawn area, and benches.

On the June 21 analysis day, incremental shadow cast by projected development sites 38 and 39 would enter the open space at 5:19 p.m. and would exit the open space at 5:58 p.m. (39 minutes). Incremental shadow would be in the northern half of the open space and would move eastward during the 39 minutes in which incremental shadow would occur (see **Figure 6-9**). The area cast in incremental shadow on this analysis day includes vegetation, lawn area, playground, and benches.

Assessment

Incremental shadow would be cast on Madison Square Park between 35 minutes and 39 minutes in the late afternoon of the May 6/August 6 and June 21 analysis days. As shown in **Figures 6-8** and **6-9**, incremental shadow would be limited in size and would not be concentrated on any area. The open space would continue to receive direct sunlight during the morning and early afternoon.

Therefore, because the extent and duration of the incremental shadows would not significantly alter the public's use of the open space or threaten the viability of vegetation or

other resources, incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

Penn South Playground

Penn South Playground is a 0.6-acre open space located within the Penn South co-op development located on West 26th Street between Eighth and Ninth Avenues. The open space contains trees, play equipment, basketball courts, and benches.

Incremental shadow from projected development site 2 would reach the open space on one of the analysis days (June 21) for 14 minutes. As shown in **Figure 6-10**, incremental shadow would be in the northwestern corner starting at 6:32 a.m. and would decrease in extent until exiting the open space at 6:46 a.m. The area cast in incremental shadow includes trees and a basketball court.

Assessment

Based on the limited duration of incremental shadow and the time of day in which they would occur, the Proposed Actions would not significantly alter the public's use of the open space or threaten the viability of vegetation or other resources. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

Penn South

Penn South is a co-operative housing complex bounded by West 29th Street to the north, West 23rd Street to the south, Eighth Avenue to the east, and Ninth Avenue to the west. The complex is built in the "tower in the park" style, with tall building set back from the property line with open space surrounding the buildings. Between West 28th and West 26th Streets are two areas containing benches, trees, a playground (separate from sunlight-sensitive resource #5, Penn South Playground, discussed above), and two half-court basketball courts.

This open space resource would be cast in incremental shadow on three of the four representative analysis days (March 21/September 21, May 6/August 6, and June 21) and would range between 35 minutes on the May 6/August 6 analysis day and 39 minutes on the June 21 analysis day (see **Table 6-4**).

On the March 21/September 21 analysis day, incremental shadow cast by projected development site 2 would occur from the beginning of the analysis day at 7:36 a.m. until exiting the open space at 9:14 a.m. (one hour and 38 minutes). Incremental shadow would be in the eastern half of the open space and would move northeast before exiting the open space (see **Figures 6-11 and 6-12**). The area cast in incremental shadow on this analysis day includes vegetation and benches.

On the May 6/August 6 analysis day, incremental shadow cast by projected development site 2 would occur from the beginning of the analysis day at 6:27 a.m. until exiting the open space at 7:18 a.m. Incremental shadow would also occur between 7:55 a.m. to 9:21 a.m. (a total of

two hours and 17 minutes). Incremental shadow would be in the eastern half of the open space and would move northeast before exiting the open space (see **Figures 6-13 and 6-14**). The area cast in incremental shadow on this analysis day includes vegetation and benches.

On the June 21 analysis day, incremental shadow cast by projected development site 2 would enter the open space at 6:06 a.m. and would exit the open space at 7:25 a.m. (one hour and 19 minutes). Incremental shadow would be limited in size and would occur in the eastern half of the open space, decreasing in size until exiting the open space (see **Figure 6-15**). The area cast in incremental shadow on this analysis day includes vegetation and benches.

Assessment

Based on the limited duration of incremental shadows and the time of day in which they would occur, the Proposed Actions would not significantly alter the public's use of the open space or threaten the viability of vegetation or other resources. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

Moynihan Train Hall Steps

The Moynihan Train Hall Steps are located along the west side of Eighth Avenue between West 33rd and West 31st Streets. The steps provide passive open space with visitors typically using the steps as seating.

Incremental shadow from projected development sites 2, 5, and 7 would reach the open space on one of the four analysis days (December 21) for a total of two hours and 24 minutes (9:57 – 10:39 a.m. and 11:19 a.m. – 1:01 p.m.). As shown in **Figures 6-16** and **6-17**, incremental shadow would be limited in size and located in the southern half of the open space.

Assessment

Based on the limited duration of incremental shadow, the Proposed Actions would not significantly alter the public's use of the open space. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

525 Eighth Avenue POPS

The POPS at 525 Eighth Avenue, on the west side of Eighth Avenue north of West 36th Street, is a 0.06-acre passive open space that provides seating and includes vegetation.

Incremental shadow from projected development site 9 would occur on one of the four analysis days (December 21) for 21 minutes (12:41p.m. to 1:02 p.m.). As shown in **Figure 6-18**, incremental shadow would be limited in size.

Assessment

Based on the limited duration of incremental shadow, the Proposed Actions would not significantly alter the public's use of the open space. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

Broadway Plazas (Between 35th and 42nd Streets)

Between 35th and 42nd Streets on the eastern side of Broadway are seven separate plazas that contain planters and public seating. This sunlight-sensitive resource would be cast in incremental shadow on three of the four representative analysis days (March 21/September 21, May 6/August 6, and June 21). The incremental shadow would range between seven minutes on the March 21/September 21 analysis day and two hours and seven minutes on the June 21 analysis day (see **Table 6-4**).

On the March 21/September 21 analysis day, incremental shadow cast by projected development site 56 would occur from 8:09 a.m. to 8:16 a.m. (seven minutes). As shown in **Figure 6-19**, incremental shadow would be limited to one of the seven plazas, specifically the northernmost portion of the plaza between West 36th and 37th Streets. The area cast in incremental shadow on this analysis day includes planters and seating.

On the May 6/August 6 analysis day, incremental shadow cast by projected development site 36 would occur from 1:45 p.m. to 3:39 p.m. (one hour and 54 minutes). As shown in **Figure 6-20**, incremental shadow would be limited to one of the seven plazas, specifically the northernmost portion of the plaza between West 36th and 37th Streets. The area cast in incremental shadow on this analysis day includes a Citi Bike station and planters.

On the June 21 analysis day, incremental shadow cast by projected development site 36 would occur from 1:48 p.m. to 3:55 p.m. (two hours and seven minutes). As shown in **Figure 6-21**, incremental shadow would be limited to one of the seven plazas, specifically the southern half of the plaza between West 36th and 37th Streets. The area cast in incremental shadow on this analysis day includes a Citi Bike station and planters.

Assessment

Based on the limited size of incremental shadow, the Proposed Actions would not significantly alter the public's use of the open space or threaten the viability of vegetation or other resources. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

776 Sixth Avenue POPS

The POPS at 776 Sixth Avenue is located on a through lot between West 27th and 26th Streets between several buildings. The POPS includes tables and chairs, vegetation, trees, and benches.

The POPS would experience incremental shadow on two of the four analysis days (March 21/September 21 and May 6/August 6). Incremental shadow would range between 37

minutes on May 6/August 6 and one hour 43 minutes on March 21/September 21 (see **Table 6-4**).

On March 21/September 21, incremental shadow from projected development site 40 would be cast on the POPS from 10:40 a.m. to 12:23 p.m. (one hour 43 minutes). As shown in **Figure 6-22**, incremental shadow would be limited to a small portion of the eastern side of the POPS. The area cast in incremental shadow includes seating and vegetation.

On May 6/August 6, incremental shadow from projected development site 22 would be cast on the POPS from 4:23 p.m. to 5:00 p.m. (37 minutes). As shown in **Figure 6-23**, incremental shadow would be limited to the southeastern corner of the POPS. The area cast in incremental shadow includes seating and vegetation.

Assessment

Based on the limited size of incremental shadow, the Proposed Actions would not significantly alter the public's use of the open space or threaten the viability of vegetation or other resources. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

835 Sixth Avenue POPS

The POPS at 835 Sixth Avenue is located on a through lot between West 30th and 29th Streets between several buildings. The POPS includes tables and chairs, vegetation, trees, and a water feature. Incremental shadow would be cast on this POPS on one of the four analysis days (March 21/September 21).

On the March 21/September 21 analysis day, incremental shadow from projected development site 45 would occur for 10 minutes (9:35 a.m. to 9:45 a.m.). As shown in **Figure 6-24**, incremental shadow would be cast in the southeastern corner of the POPS. The area cast in incremental shadow is a paved area with no vegetation or seating.

Assessment

Based on the limited duration and size of incremental shadow, the Proposed Actions would not significantly alter the public's use of the open space or threaten the viability of vegetation or other resources. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

420 Fifth Avenue POPS

420 Fifth Avenue contains a small POPS along West 37th Street west of Fifth Avenue. The POPS contains benches, planters, and trees.

This open space resource would be cast in incremental shadow on three of the four representative analysis days (March 21/September 21, May 6/August 6, and June 21). The incremental shadow would range between 25 minutes on the March 21/September 21 analysis day and one hour 31 minutes on the May 6/August 6 analysis day (see **Table 6-4**).

On the March 21/September 21 analysis day, incremental shadow cast by projected development site 52 would occur from 1:56 p.m. to 2:21 p.m. (25 minutes). As shown in **Figure 6-25**, incremental shadow would be in the northeastern portion of the open space. The area cast in incremental shadow on this analysis day is a paved area with no vegetation or seating.

On the May 6/August 6 analysis day, incremental shadow cast by projected development site 52 and potential development site F would occur from 1:42 p.m. to 3:13 p.m. (one hour and 31 minutes). As shown in **Figure 6-26**, incremental shadow would enter in the southeastern corner of the open space and move eastward before exiting. The area cast in incremental shadow on this analysis day is a paved area with vegetation and seating.

On the June 21 analysis day, incremental shadow cast by projected development site 53 would enter the open space at 2:33 p.m. and would exit the open space at 4:03 p.m. (one hour and 30 minutes). Incremental shadow would be limited in size and would decrease in size until exiting the open space (see **Figure 6-27**). The area cast in incremental shadow on this analysis day includes vegetation and benches.

Assessment

Incremental shadow would not significantly alter the public's use of the open space or threaten the viability of vegetation or other resources. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

41 Madison Avenue POPS

The POPS at 41 Madison Avenue is located on the northeast corner of the intersection of East 26th Street and Madison Avenue. Incremental shadow from projected development site 40 would be cast on this POPS for three minutes (5:55 p.m. to 5:58 p.m.) on the June 21 analysis day (see **Figure 6-28**). The POPS includes seating and vegetation.

Assessment

Based on the limited duration and size of incremental shadow, the Proposed Actions would not significantly alter the public's use of the open space or threaten the viability of vegetation or other resources. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

Grace Plaza

Grace Plaza is located on the southeastern corner of the intersection of West 43rd Street and Sixth Avenue. Incremental shadow from projected development site 62 would be cast on this open space for 20 minutes (1:45 p.m. to 2:05 p.m.) on the December 21 analysis day (see **Figure 6-29**). The POPS includes seating and vegetation.

Assessment

Based on the limited duration and size of incremental shadow, the Proposed Actions would not significantly alter the public's use of the open space or threaten the viability of vegetation

or other resources. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

Greeley Square

Greeley Square is located at the intersection of West 33rd Street, Sixth Avenue, and Broadway. Incremental shadow from projected development site 48 would be cast on this open space for 19 minutes (11:07 a.m. to 11:26 a.m.) on the December 21 analysis day (see **Figure 6-30**). The POPS includes seating and vegetation.

Assessment

Based on the limited duration and size of incremental shadow, the Proposed Actions would not significantly alter the public's use of the open space or threaten the viability of vegetation or other resources. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

1185 Broadway POPS

1185 Broadway contains a small POPS along West 28th Street west of Broadway. The POPS contains benches, planters, and trees. Incremental shadow would be cast on this POPS on three of the four analysis days (March 21/September 21, May 6/August 6, and June 21). Incremental shadow duration would range between three hours 40 minutes on the June 21 analysis day and four hours and 35 minutes on the May 6/August 6 analysis day (see **Table 6-4**).

On the March 21/September 21 analysis day, incremental shadow from projected development site 42 would be cast on the POPS for three hours and 41 minutes (10:51 a.m. to 2:32 p.m.). As shown in **Figures 6-31** and **6-32**, incremental shadow from projected development site 42 would result in the POPS being completely cast in shadow during the mid-afternoon. The POPS would be cast in shadow from existing building for the remainder of the afternoon after incremental shadow exits the POPS.

On the May 6/August 6 analysis day, incremental shadow from projected development site 42 would be cast on the POPS for four hours and 35 minutes (10:50 a.m. – 3:25 p.m.). As shown in **Figures 6-33** through **6-35,** incremental shadow from projected development site 42 would result in the POPS being completely cast in shadow during the mid-afternoon. The POPS would cast a large amount of incremental shadow during the late morning and early afternoon (see **Figures 6-33** and **6-34**).

On the June 21 analysis day, incremental shadow from projected development site 42 would be cast on the POPS for three hours and 40 minutes (11:25 a.m. to 3:05 p.m.). As shown in **Figures 6-36** and **6-37,** incremental shadow from projected development site 42 would result in the POPS being completely cast in shadow during the mid-afternoon.

Assessment

Incremental shadow from projected development site 42 would nearly eliminate direct sunlight to the 1185 Broadway POPS during the afternoon hours on three analysis days (see

Figures 6-31 through **6-37**). Vegetation within the POPS would not receive adequate sunlight during the growing season (at least six to eight hours as specified in the *CEQR Technical Manual*). The lack of direct sunlight during the late morning and early afternoon hours may affect the public's use and enjoyment of this resource. Therefore, the Proposed Actions are expected to result in a significant adverse impact to the 1185 Broadway POPS. Potential mitigation measures are discussed in Chapter 21, "Mitigation."

Broadway Plaza/Greenstreets (25th to 28th Streets)

On Broadway between 25th and 28th Streets are two plazas that contain planters and seating and several greenstreets. Incremental shadow would be cast on the March 21/September 21, May 6/August 6, and June 21 analysis days ranging in length between 25 minutes on the March 21/September 21 analysis day and three hours and 34 minutes on the June 21 analysis day.

On March 21/September 21, incremental shadow would be cast for a total of 25 minutes (2:28 p.m. to 2:53 p.m.). As shown in **Figure 6-38**, incremental shadow would be cast in the northeast corner of the plaza. The area cast in incremental shadow includes moveable tables and chairs.

On May 6/August 6, incremental shadow would be cast for a total of three hours and 20 minutes (7:53 a.m. to 8:38 a.m., 1:06 p.m. to 3:07 p.m., and 3:52 p.m. to 4:26 p.m.). As shown in **Figure 6-39** and **6-40** incremental shadow would be cast on the northernmost greenstreet during the morning hours and the northernmost plaza during the afternoon hours. The greenstreet contains vegetation and the plaza contains planters, moveable tables and chairs.

On June 21, incremental shadow would be cast for a total of three hours and 34 minutes (8:28 a.m. to 9:02 a.m., 12:58 p.m. to 2:44 p.m., 3:18 p.m. to 4:32 p.m.,). As shown in **Figures 6-41** and **6-42**, incremental shadow would be cast on the northernmost greenstreet during the morning and early afternoon hours. During the late afternoon hours, incremental shadow would be cast on the southeast corner of the northernmost plaza.

Assessment

Incremental shadow from the Proposed Actions would be cast over this resource between 25 minutes and three hours 34 minutes on three of the four analysis days. Incremental shadow would be cast on a pedestrian plaza and greenstreets with vegetation, moveable tables and chairs, and trees. The trees planted here are shade tolerant species. The herbaceous plants are replanted annually, so they could be replaced with shade tolerant species. The pedestrian plazas are generally cast in shadow during the day (refer to **Figures 6-38** through **6-42**). As the incremental shadow would not threaten the use or enjoyment of the pedestrian plazas nor threaten the viability of vegetation, the Proposed Actions would not result in significant adverse impacts to this sunlight-sensitive resource.

Broadway Greenstreets (29th to 32nd Streets)

On Broadway between 29th and 32nd Streets are several greenstreets. Incremental shadow would be cast on each of the four analysis days ranging between 35 minutes on December 21 and five hours and 20 minutes on June 21 (refer to **Table 6-4**).

On March 21/September 21, incremental shadow would be cast for a total of three hours and 19 minutes (7:53 a.m. to 8:12 a.m., 8:50 a.m. to 9:15 a.m., 9:28 a.m. to 12:03 p.m.). As shown in **Figure 6-43 and 44**, incremental shadow would be cast on two greenstreets between West 29th and West 30th Streets. These greenstreets contain vegetation.

On May 6/August 6, incremental shadow would be cast for a total of four hours and 17 minutes (7:16 a.m. to 8:35 a.m., 9:13 a.m. to 11:36 a.m., and 4:00 p.m. to 4:35 p.m.). As shown in **Figure 6-45** and **6-46** incremental shadow would be cast on two greenstreets between West 29th and West 30th Streets. These greenstreets contain vegetation.

On June 21, incremental shadow would be cast for a total of five hours and 20 minutes (7:48 a.m. to 11:36 a.m., 2:44 p.m. to 2:51 p.m., 2:55 p.m. to 3:12 p.m., and 3:29 p.m. to 4:37 p.m.). As shown in **Figures 6-47** through **6-50**, incremental shadow would be cast throughout the majority of the morning and during the midafternoon.

On December 21, incremental shadow would be cast for approximately 35 minutes (11:50 a.m. to 12:15 p.m., and 12:50 p.m. and 1:00 p.m.). As shown in **Figure 6-51**, incremental shadow would cover large portions of two greenstreets between West 29th and West 32nd Streets.

Assessment

Incremental shadow from the Proposed Actions would be cast over this resource between 35 minutes and five hours 20 minutes on each of the four analysis days. Incremental shadow would be cast on several greenstreets containing vegetation. The trees planted here are shade tolerant species. The herbaceous plants are replanted annually, so they could be replaced with shade tolerant species. Since the shaded condition of Manhattan was contemplated in these planting choices, the Proposed Actions would not result in significant adverse impacts to this sunlight-sensitive resource.

Herald Square

Herald Square is located at the intersection of Sixth Avenue, Broadway, and West 34th Street. The 0.21-acre open space includes seating and a monument. Incremental shadow would be cast on one of the four analysis days (March 21/September 21) for 25 minutes (7:58 am. to 8:23 a.m.). As shown in **Figure 6-49**, incremental shadow would occur over the northern portion of the open space, moving eastward and exiting the open space at 8:23 a.m.

Assessment

Based on the limited duration of incremental shadow, the Proposed Actions would not significantly alter the public's use of the open space or threaten the viability of vegetation or

other resources. Incremental shadows would not be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology.

Marble Collegiate Church

At 272 Fifth Avenue is the LPC-designated and S/NR-listed Marble Collegiate Church. The church is located at the northwest corner of the intersection of West 29th Street and Fifth Avenue. According to the LPC 1967 designation report, the church resembles a New England wooden church but has a façade made of marble. The church is Romanesque in style but uses Gothic forms in details of the building. The buildings southern façade includes stained glass windows. Incremental shadow would be cast on this sunlight-sensitive historic resource on each of the four analysis days, ranging from 52 minutes (2:01 p.m. to 2:53 p.m.) on the December 21 analysis day and three hours and 58 minutes (12:47 p.m. to 4:45 p.m.) on the May 6/August 6 analysis day.

On the March 21/September 21 analysis day, incremental shadow would be cast for three hours and four minutes (1:25 p.m. to 4:29 p.m.). As shown in **Figures 6-53** and **6-54**, incremental shadow would be primarily cast on the roof of the church and small portions of the building's southern façade. By the end of the analysis day, a small amount of incremental shadow would be cast on the church's tower along Fifth Avenue.

On the May 6/August 6 analysis day, incremental shadow would be cast for three hours and 58 minutes (12:47 p.m. to 4:45 p.m.). As shown in **Figures 6-55** and **6-56**, incremental shadow would be primarily cast on the roof and portions of the southern façade. At 3:30 p.m., incremental shadow on the building's southern façade would be at its largest in size. As the afternoon progresses, incremental shadow would move eastward along the building's roof and southern façade, decreasing in size before exiting this sunlight-sensitive resource at 4:45 p.m.

On the June 21 analysis day, incremental shadow would be cast for three hours and 39 minutes (12:40 p.m. to 4:19 p.m.). As shown in **Figures 6-57** and **6-58**, incremental shadow would be primarily cast on the on the roof and portions of the southern façade. As the afternoon progresses, incremental shadow would move eastward along the building's roof and southern façade, decreasing in size before exiting this sunlight-sensitive resource at 4:45 p.m.

On December 21, incremental shadow would be cast for 52 minutes (2:01 p.m. to 2:53 p.m.). Incremental shadow generated by the Proposed Actions would primarily be cast on the roof. Incremental shadow would be cast on the southern façade for less than 30 minutes (refer to **Figure 6-59**).

Assessment

Incremental shadow would be cast on each of the four analysis days. Incremental shadow would be on portions of the southern façade for two to three hours on the May 6/August 6 and June 21 analysis days (refer to **Figures 6-55** through **6-58**).

As these incremental shadows may have the potential to affect the public's enjoyment of this resource's sunlight-sensitive features, this is being considered a significant adverse shadow impact. Potential mitigation measures are discussed in Chapter 21, "Mitigation."

Millinery Center Synagogue

At 1025 Sixth Avenue is the LPC-eligible and S/NR-eligible Millinery Center Synagogue. This sunlight-sensitive historic resource included stained glass windows on the building's eastern façade. Incremental shadow would be cast on this sunlight-sensitive historic resource on three of the four analysis days, ranging from 17 minutes (7:54 a.m. to 8:11 a.m.) on the March 21/September 21 analysis day and 52 minutes (6:23 a.m. to 7:15 a.m.) on the June 21 analysis day.

On the March 21/September 21 analysis day, incremental shadow would be cast for 17 minutes (7:54 a.m. to 8:11 a.m.). As shown in **Figure 6-60**, incremental shadow would primarily be cast on the roof and would not reach the stained-glass windows.

On the June 21 analysis day, incremental shadow would be cast for 52 minutes (6:23 a.m. to 7:15 a.m.). Incremental shadow would be cast on the building's eastern façade during this period (refer to **Figure 6-61**).

On the December 21 analysis day, incremental shadow would be cast for 29 minutes (8:51 a.m. to 9:20 a.m.). Incremental shadow would be cast on the building's eastern façade during this period (refer to **Figure 6-62**).

Assessment

Incremental shadow would be limited in duration and would occur between 17 minutes and 52 minutes on three of the four representative analysis days. As such, the Proposed Actions would not alter the public's enjoyment of the sunlight sensitive resources and would therefore not result in any significant adverse impacts to the Millinery Center Synagogue.

St. John the Baptist Roman Catholic Church

At 213 West 30th Street is the LPC-eligible and S/NR-eligible St. John the Baptist Roman Catholic Church. Incremental shadow would be cast on each of the four analysis days between three hours and 11 minutes (10:21 a.m. to 12:04 p.m. and 1:24 p.m. to 2:52 p.m.) on the December 21 analysis day and four hours 50 minutes (10:12 a.m. to 12:30 p.m. and 1:57 to 4:29 p.m.) on the March 21/September 21 analysis day. Stained glass windows are located on the western, eastern, and southern facades of the building. There is a building adjacent to the east of the church.

Incremental shadow would be cast on the church for four hours and 50 minutes (10:12 a.m. to 12:30 p.m. and 1:57 to 4:29 p.m.) on the March 21/September 21 analysis day. As shown in **Figures 6-63** through **6-65**, incremental shadow would be limited in the late morning hours to small portions of the southern façade. Incremental shadow in the afternoon would be located on the roof and western façade of the church.

Incremental shadow would be cast on the church for four hours and 25 minutes (11:41 a.m. to 12:10 p.m. and 1:22 to 5:18 p.m.) on the May 6/August 6 analysis day. As shown in **Figures 6-66** through **6-68**, incremental shadow would be limited in the late morning hours to small portions of the southern façade. Incremental shadow in the afternoon would be located on the roof and western façade of the church.

Incremental shadow would be cast on the church for four hours and 41 minutes (1:20 p.m. to 6:01 p.m.) on the June 21 analysis day. As shown in **Figures 6-69** through **6-71**, incremental shadow would be concentrated along the southwestern portion of the building.

Incremental shadow would be cast on the church for three hours and 11 minutes (10:21 a.m. to 12:04 p.m. and 1:24 p.m. to 2:52 p.m.) on the December 21 analysis day. As shown in **Figures 6-72** and **6-73**, incremental shadow would be limited in size and would generally be limited to the southern façade of the building and portions of the roof.

Assessment

Incremental shadow would be cast on each of the four analysis days. Incremental shadow would be on portions of the western and southern façade during the afternoon hours on the March 21/September 21, May 6/August 6, and June 21 analysis days.

As these incremental shadows may have the potential to affect the public's enjoyment of this resource's sunlight-sensitive features, this is being considered a significant adverse shadow impact. Potential mitigation measures are discussed in Chapter 21, "Mitigation."

St. Francis of Assisi Roman Catholic Church

At 129 West 31st Street is the LPC-eligible and S/NR-eligible St. Francis of Assisi Roman Catholic Church. Incremental shadow would be cast on each of the four analysis days between one hour and four minutes (10:21 a.m. to 10:58 a.m. and 11:41 a.m. to 12:08 p.m.) on the December 21 analysis day and five hours 25 minutes (10:19 a.m. to 12:11 p.m. and 12:23 p.m. to 3:56 p.m.) on the March 21/September 21 analysis day. Stained glass windows are located on the western, southern, and eastern facades of the building.

Incremental shadow would be cast for approximately five hours and 25 minutes on the March 21/September 21 analysis day (10:19 a.m. to 12:11 p.m. and 12:23 p.m. to 3:56 p.m.). As shown in **Figures 6-74** through **6-76**, incremental shadow would be primarily cast on the roof and the southern façade of the building.

Incremental shadow would be cast for approximately three hours and seven minutes on the May 6/August 6 analysis day (11:00 a.m. to 11:18 a.m. and 12:06 p.m. to 2:55 p.m.). As shown in **Figures 6-77** and **6-78**, incremental shadow would be primarily cast on the roof and the southern façade of the building. From 12:30 p.m. to 2:00 p.m., incremental shadow would be cast on the southern façade.

Incremental shadow would be cast for approximately one hour and 54 minutes on the June 21 analysis day (12:13 p.m. to 2:07 p.m.). As shown in **Figure 6-79**, incremental shadow would be primarily cast on the southern façade.

Incremental shadow would be cast for approximately one hour and four minutes on the December 21 analysis day (10:21 a.m. to 10:58 a.m. and 11:41 a.m. to 12:08 p.m.). As shown in **Figure 6-80**, incremental shadow would be cast on the roof and not on any of the building's facades.

Assessment

Incremental shadow would be cast on each of the four analysis days and would be cast on the southern façade during three of the four analysis days. As building are located on the western and eastern sides of this building, the southern façade receives the most direct sunlight through the building's stained-glass windows.

As these incremental shadows may have the potential to affect the public's enjoyment of this resource's sunlight-sensitive features, this is being considered a significant adverse shadow impact. Potential mitigation measures are discussed in Chapter 21, "Mitigation."

Trinity Chapel

At 15 West 25th Street is the LPC-designated Trinity Chapel. According to the LPC designation report, the building was constructed between 1850-1855 and was built in the English Gothic Revival style. In 2016, a fire occurred in the church and destroyed a large portion of the building. Since 2016, the building has been under reconstruction. When renovated, the building would contain stained-glass windows on the western, southern and eastern facades. As shown in **Table 6-4**, incremental shadow would occur on three of the four analysis days on the western and southern facades, ranging between one hour 44 minutes (1:42 p.m. to 3:26 p.m.) on the March 21/September 21 day to five hours 12 minutes (12:49 p.m. to 6:01 p.m.) on the June 21 analysis day.

On the March 21/September 21 analysis day, incremental shadow would occur for one hour 44 minutes (1:42 p.m. to 4:29 p.m.). During the early afternoon hours, small portions of the building's western façade would be cast in incremental shadow, by the late afternoon incremental shadow would be limited to the roof (refer to **Figures 6-81** and **6-82**).

On the May 6/August 6 analysis day, incremental shadow would be cast on the building for three hours 40 minutes (12:58 p.m. to 4:38.). During the mid-afternoon hours, portions of the building's western façade would be cast in incremental shadow, by the late afternoon incremental shadow would be limited to the roof (refer to **Figures 6-83** through **6-85**).

On the June 21 analysis day, incremental shadow would be cast on the building for five hours 12 minutes (12:49 p.m. to 6:01 p.m.). As shown in **Figures 6-86** through **6-88**, small portions of the western façade would be cast in shadow during the early afternoon. As the afternoon progresses, incremental shadow would be concentrated on the roof.

Assessment

Incremental shadow would be cast on three of the four analysis days. Though incremental shadow would be primarily concentrated on the roof on these three analysis days, the sunlight-sensitive features on the western façade are the only features that receive direct sunlight under existing and No-Action conditions. Under the With-Action condition, thes sunlight-sensitive features on the western façade would be cast in incremental shadow and would no longer receive direct sunlight during the early afternoon hours. As such, the Proposed Actions would result in significant adverse impacts to Trinity Chapel. Potential mitigation measures are discussed in Chapter 21, “Mitigation.”

Figure 6-2: Bryant Park – March 21/September 21

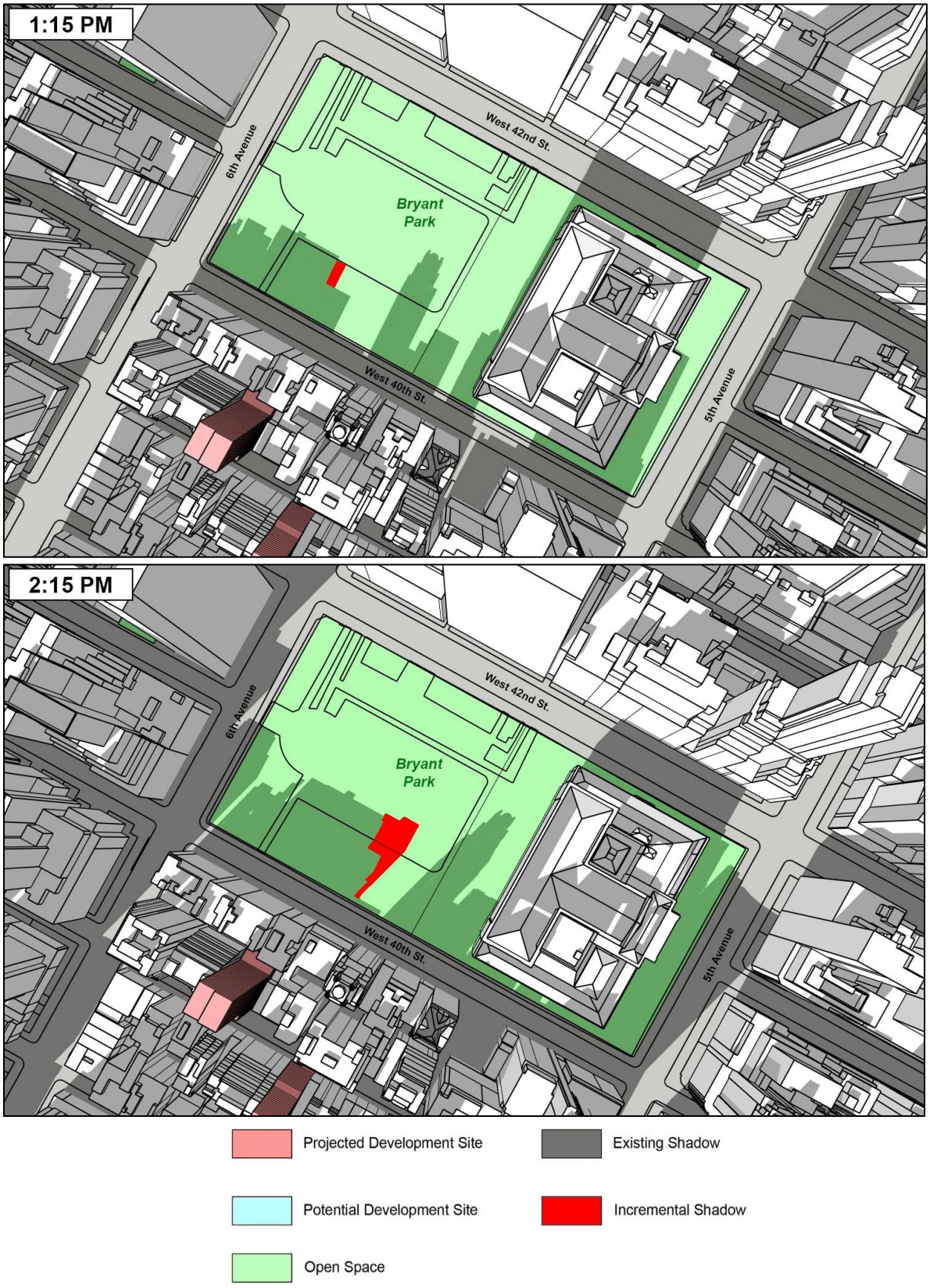


Figure 6-3: Bryant Park – March 21/September 21

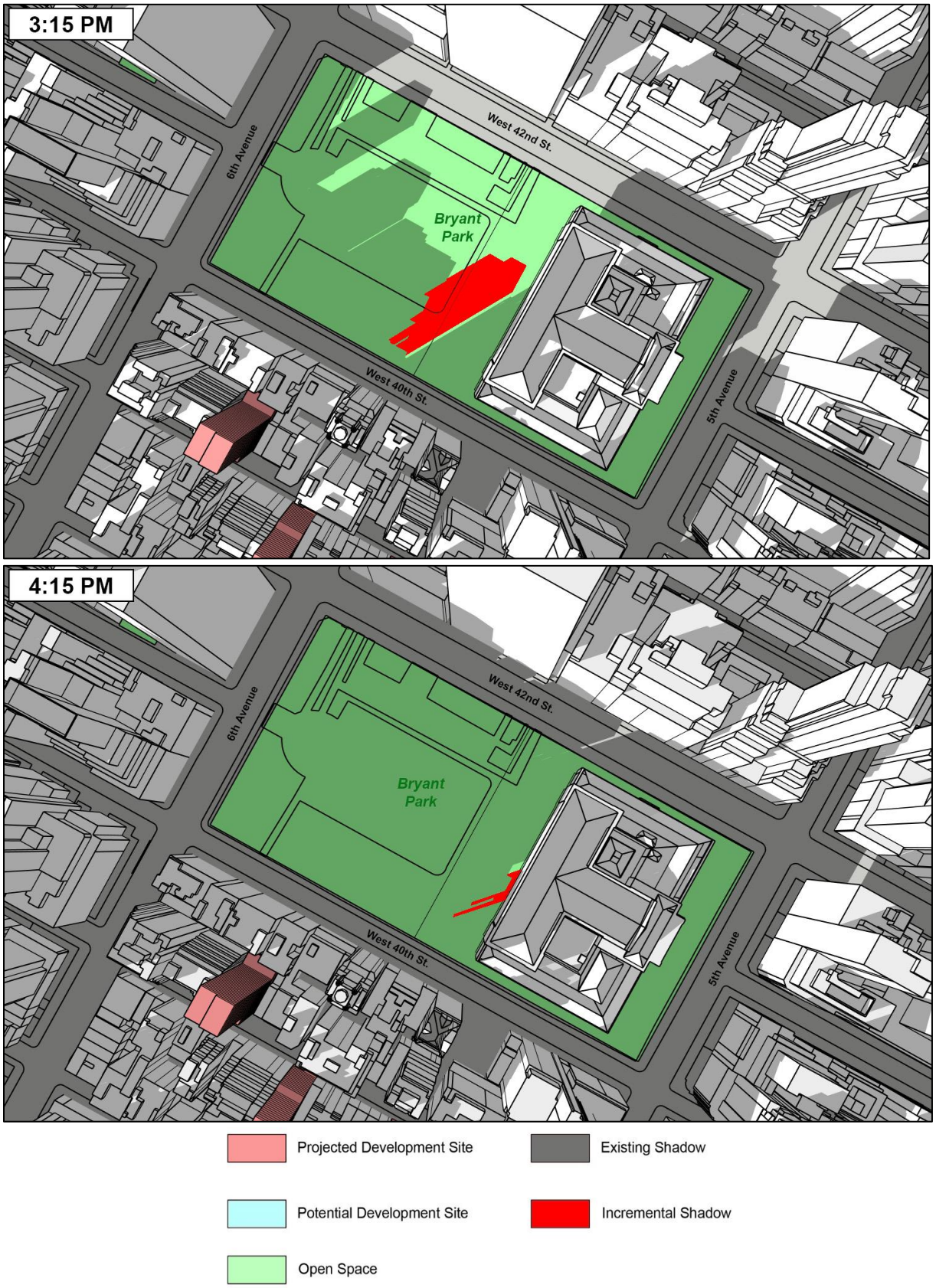


Figure 6-4: Bryant Park – May 6/August 6

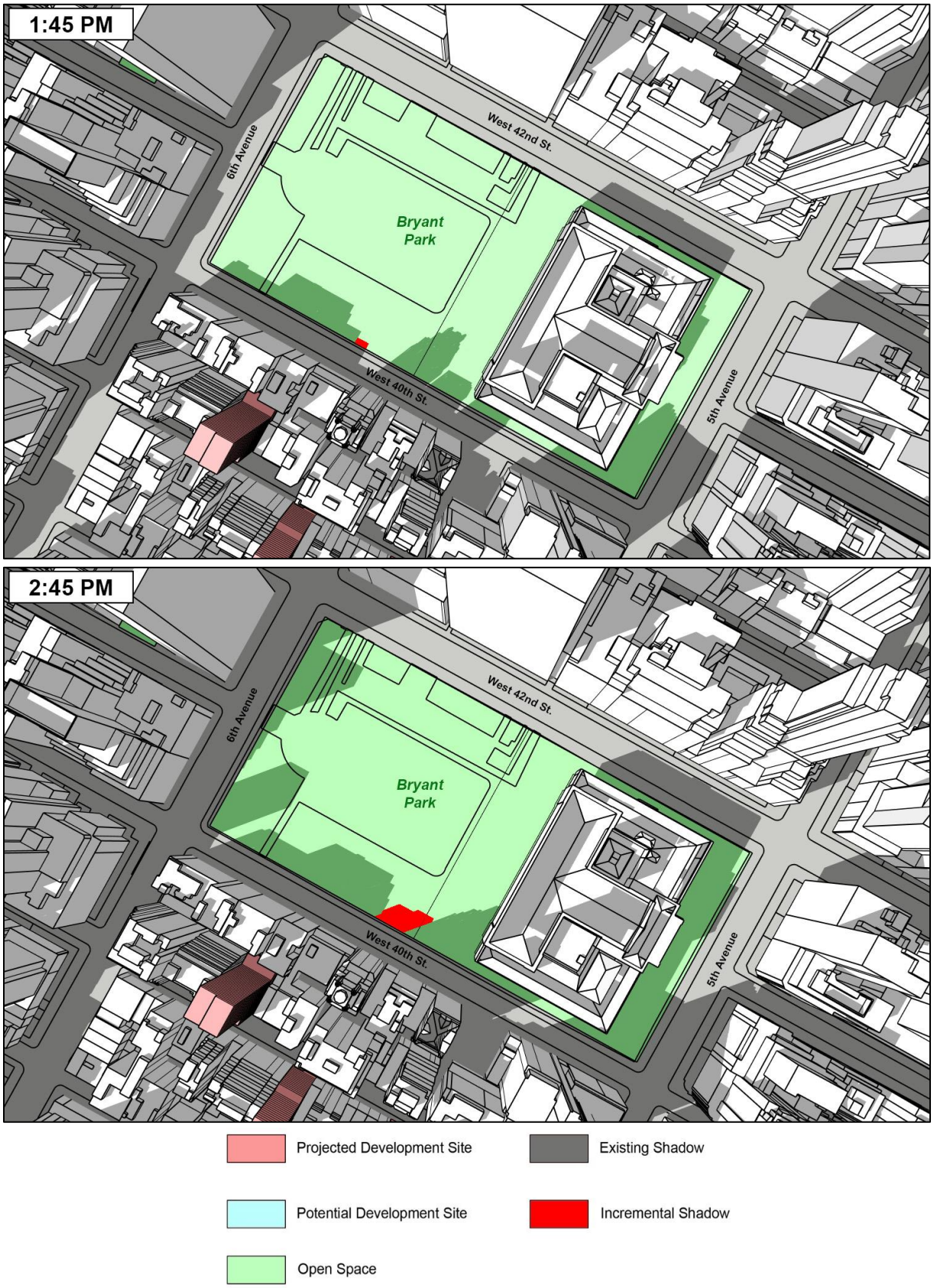


Figure 6-5: Bryant Park – May 6/August 6

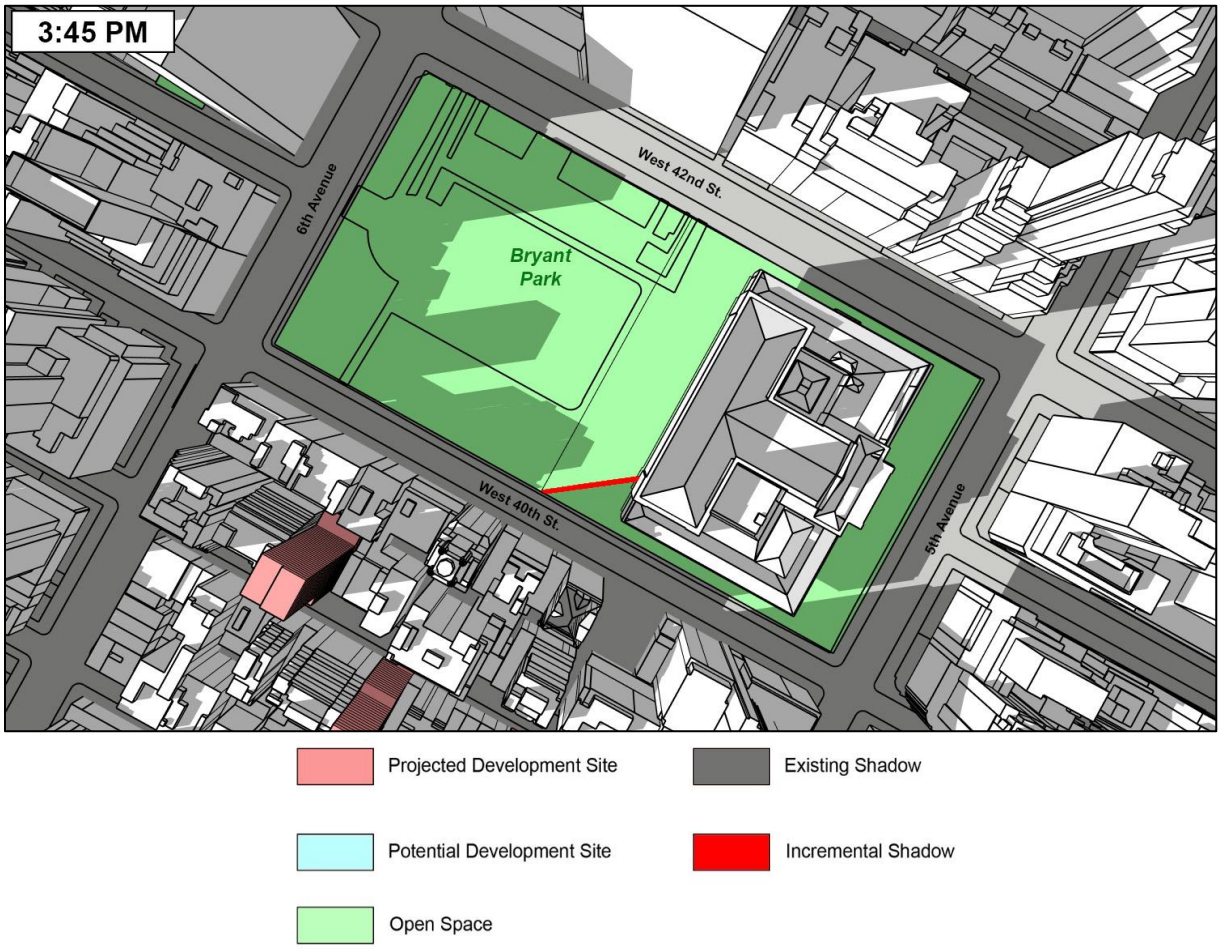


Figure 6-6: Bryant Park – December 21

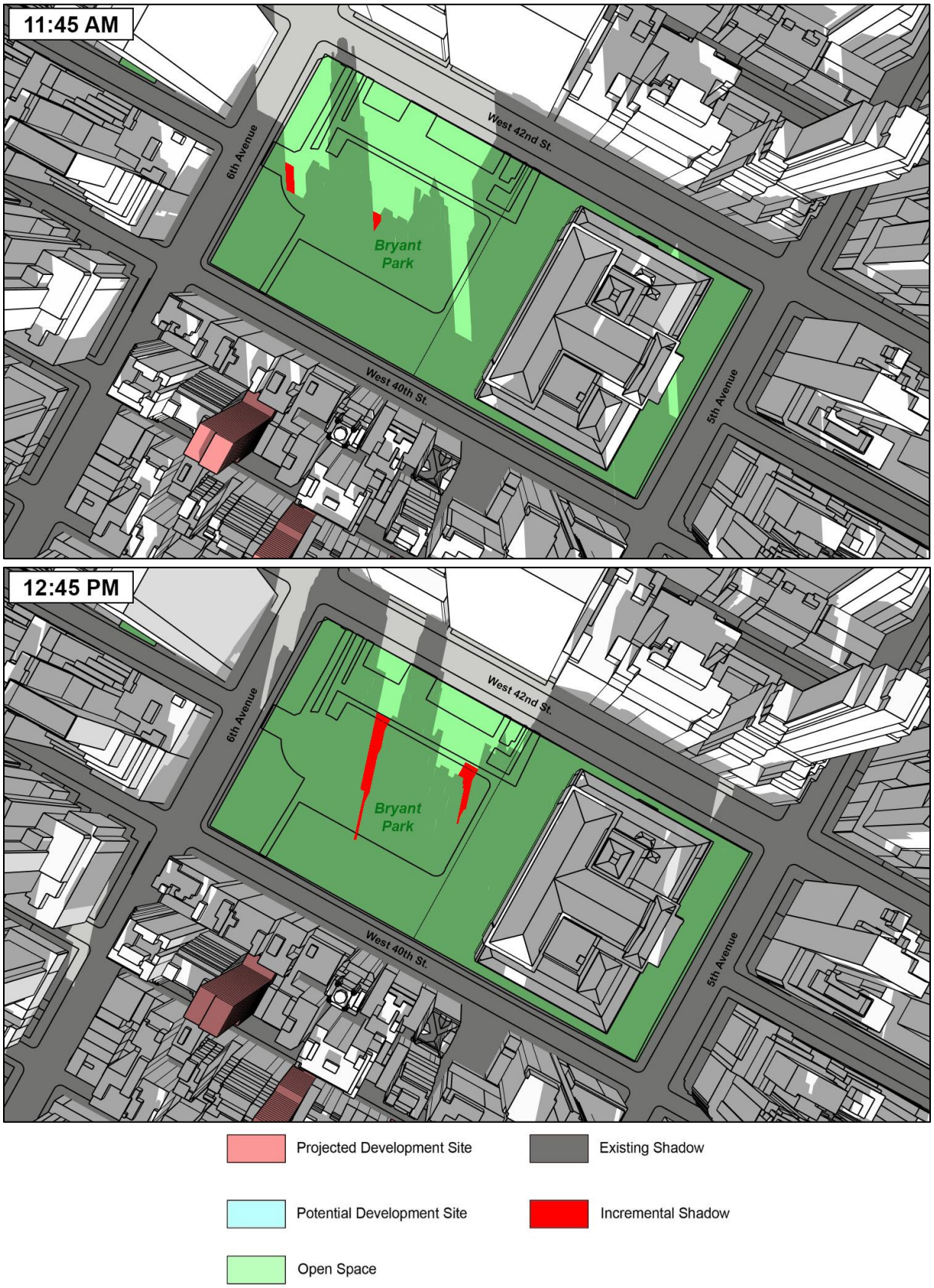


Figure 6-7: Bryant Park – December 21

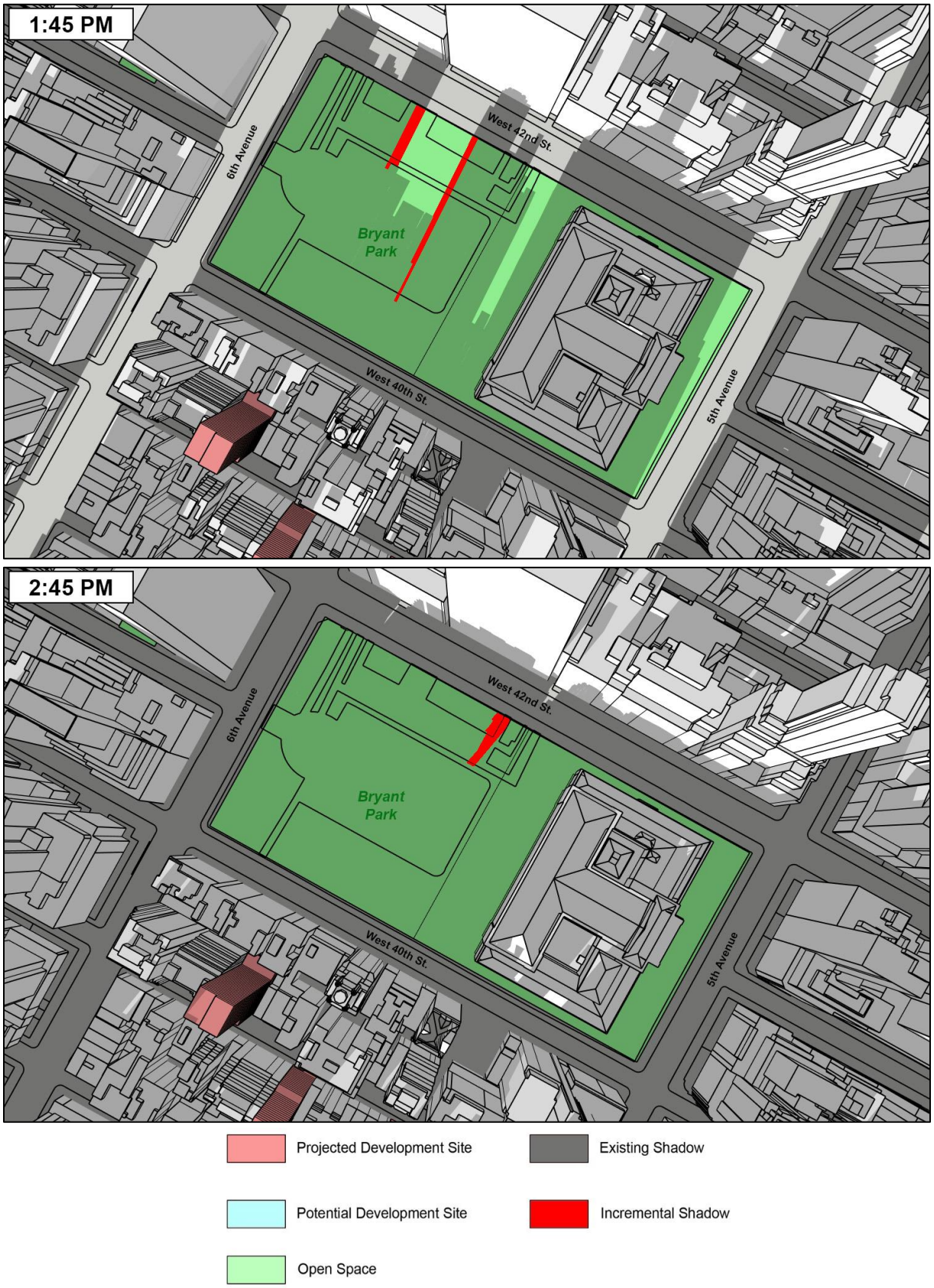


Figure 6-8: Madison Square Park – May 6/August 6

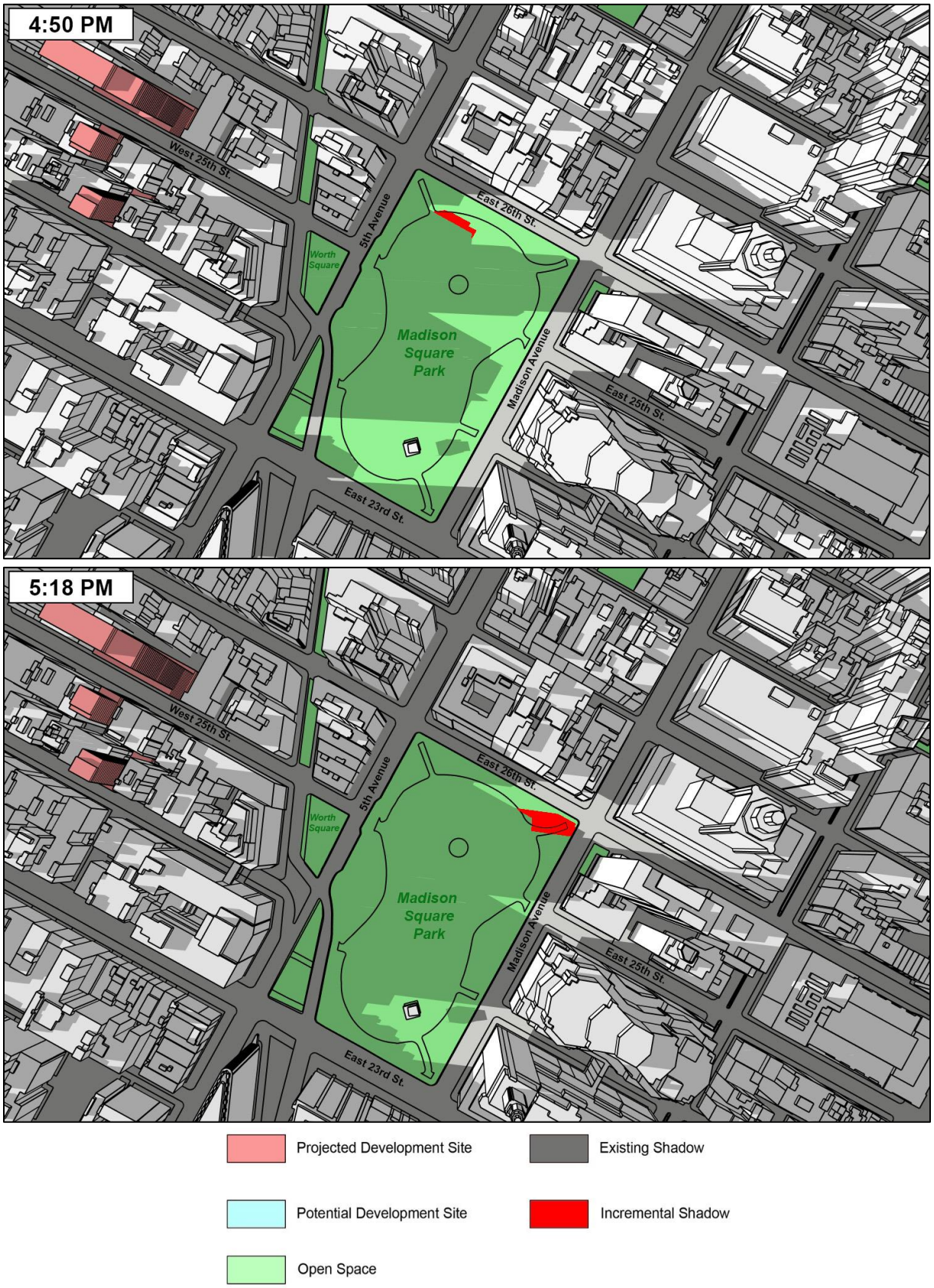


Figure 6-9: Madison Square Park – June 21

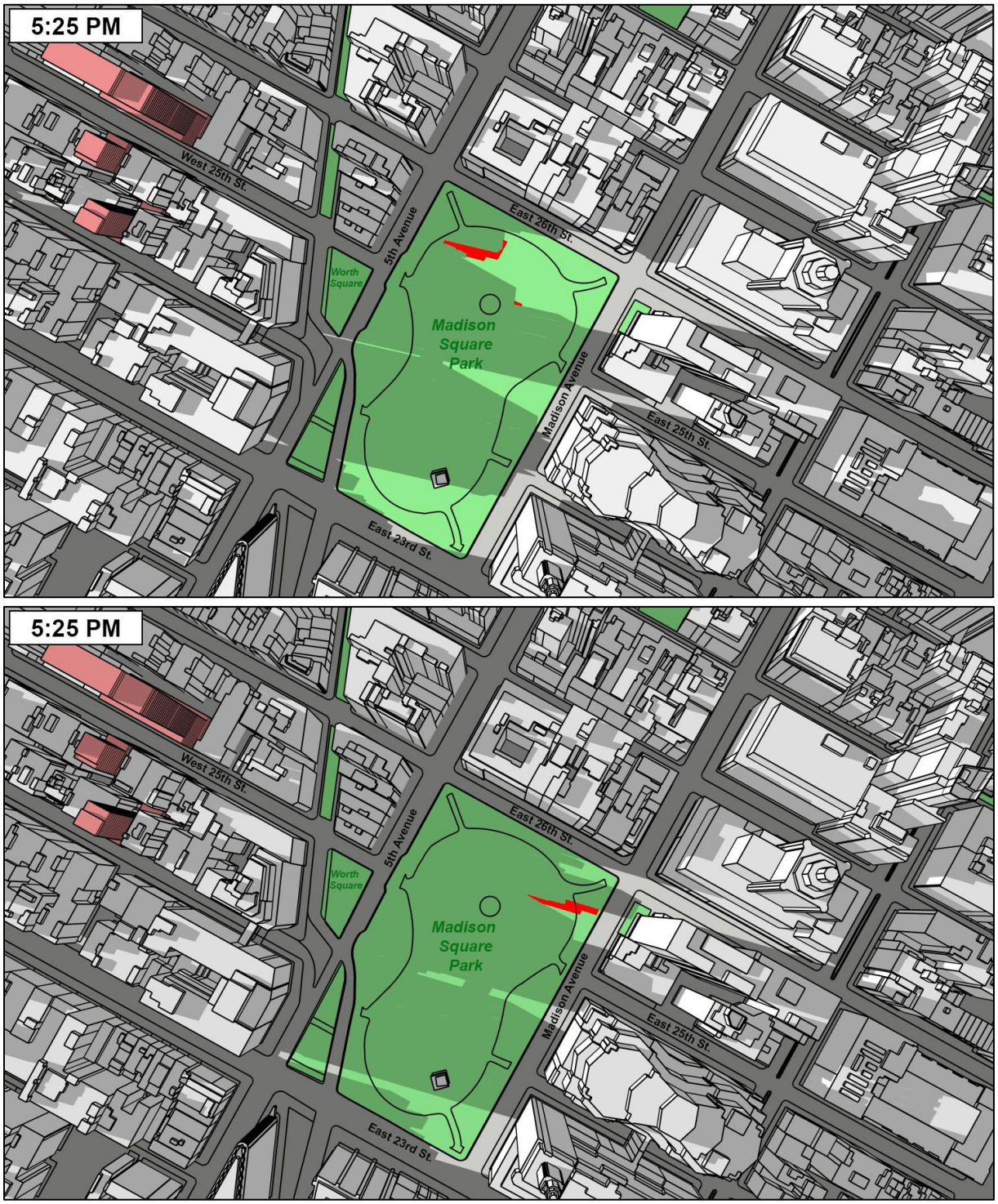


Figure 6-10: Penn South Playground – June 21



Figure 6-11: Penn South – March 21/September 21

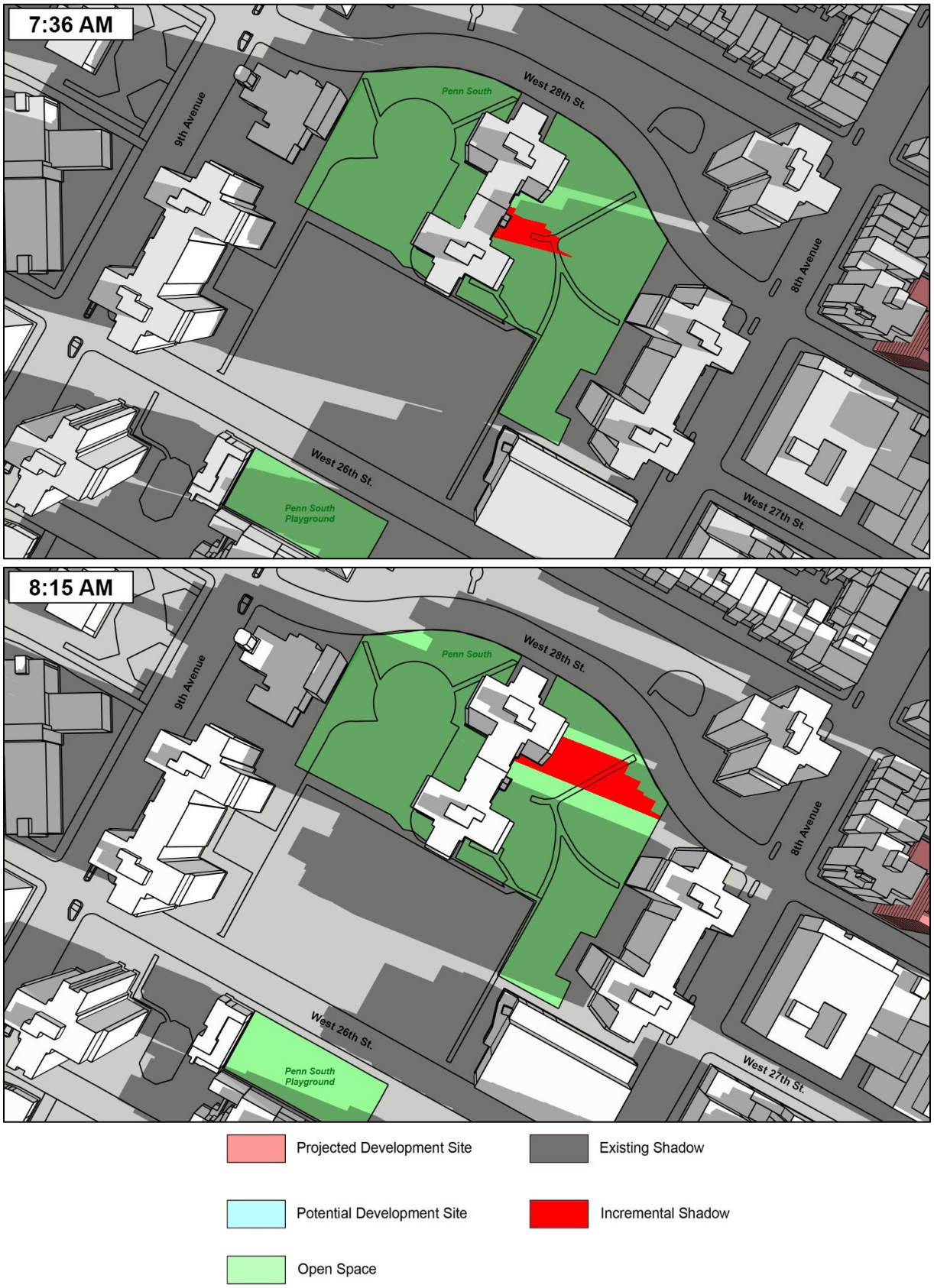


Figure 6-12: Penn South – March 21/September 21



Figure 6-13: Penn South – May 6/August 6

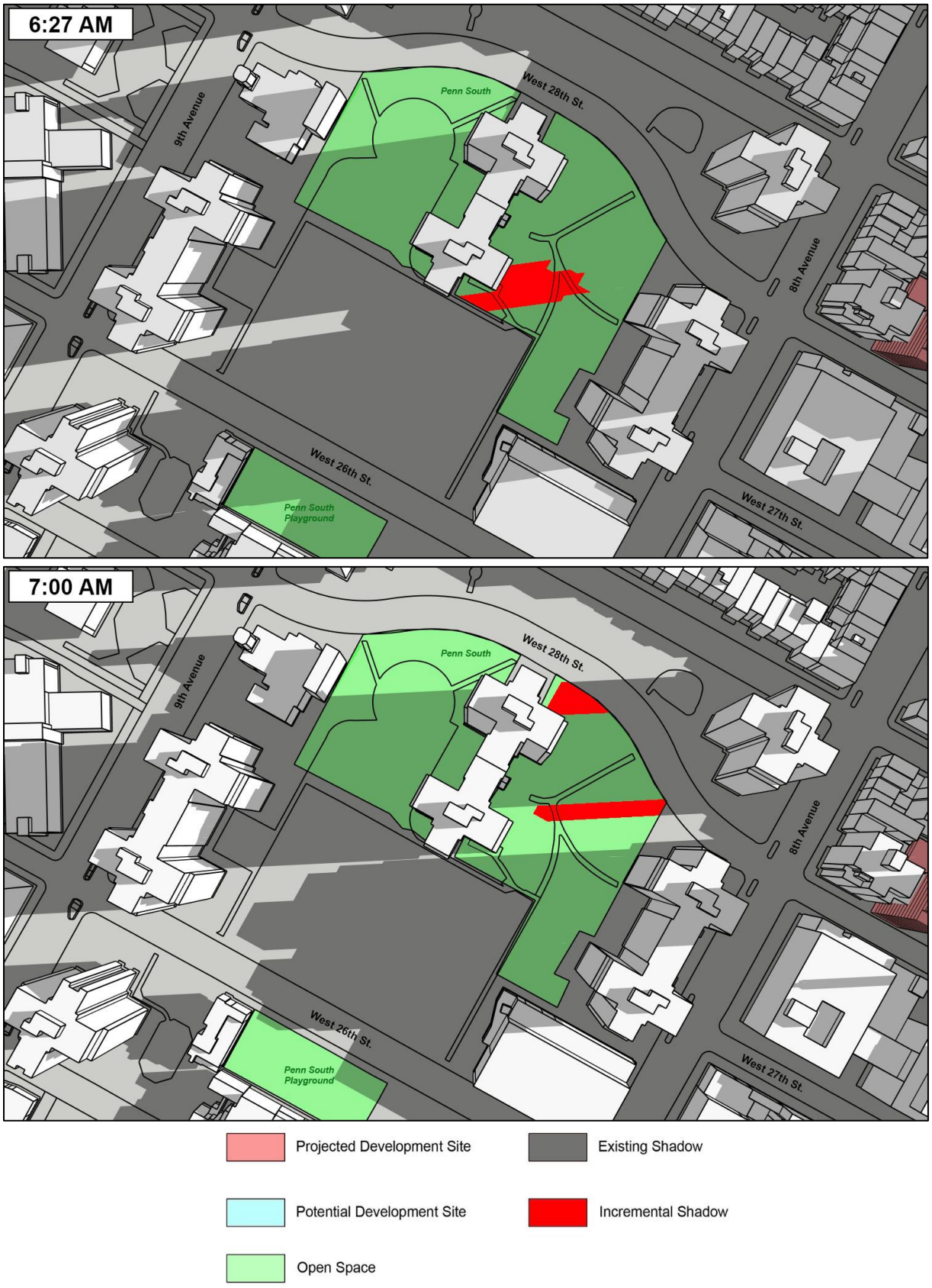


Figure 6-14: Penn South – May 6/August 6

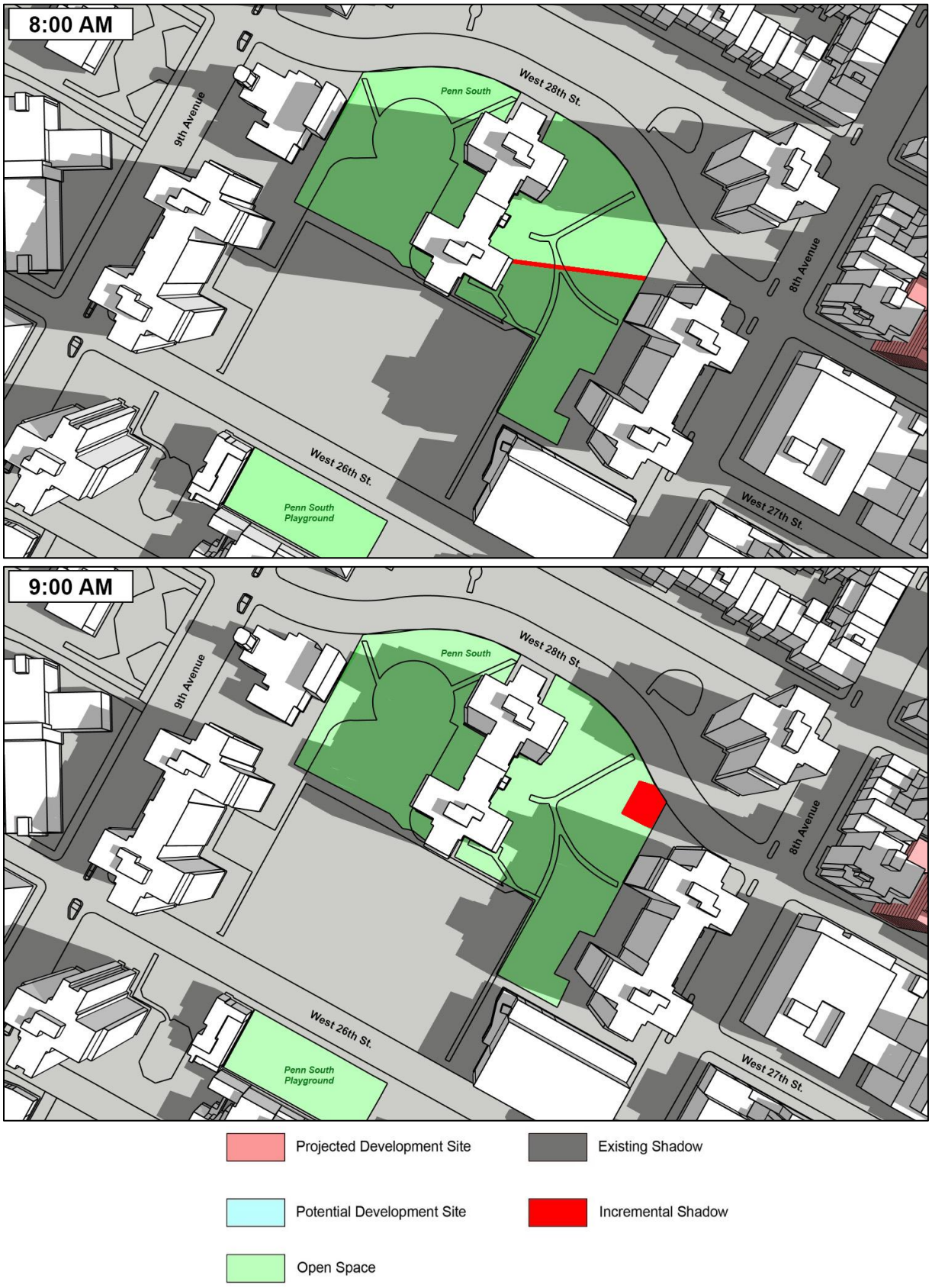


Figure 6-15: Penn South – June 21

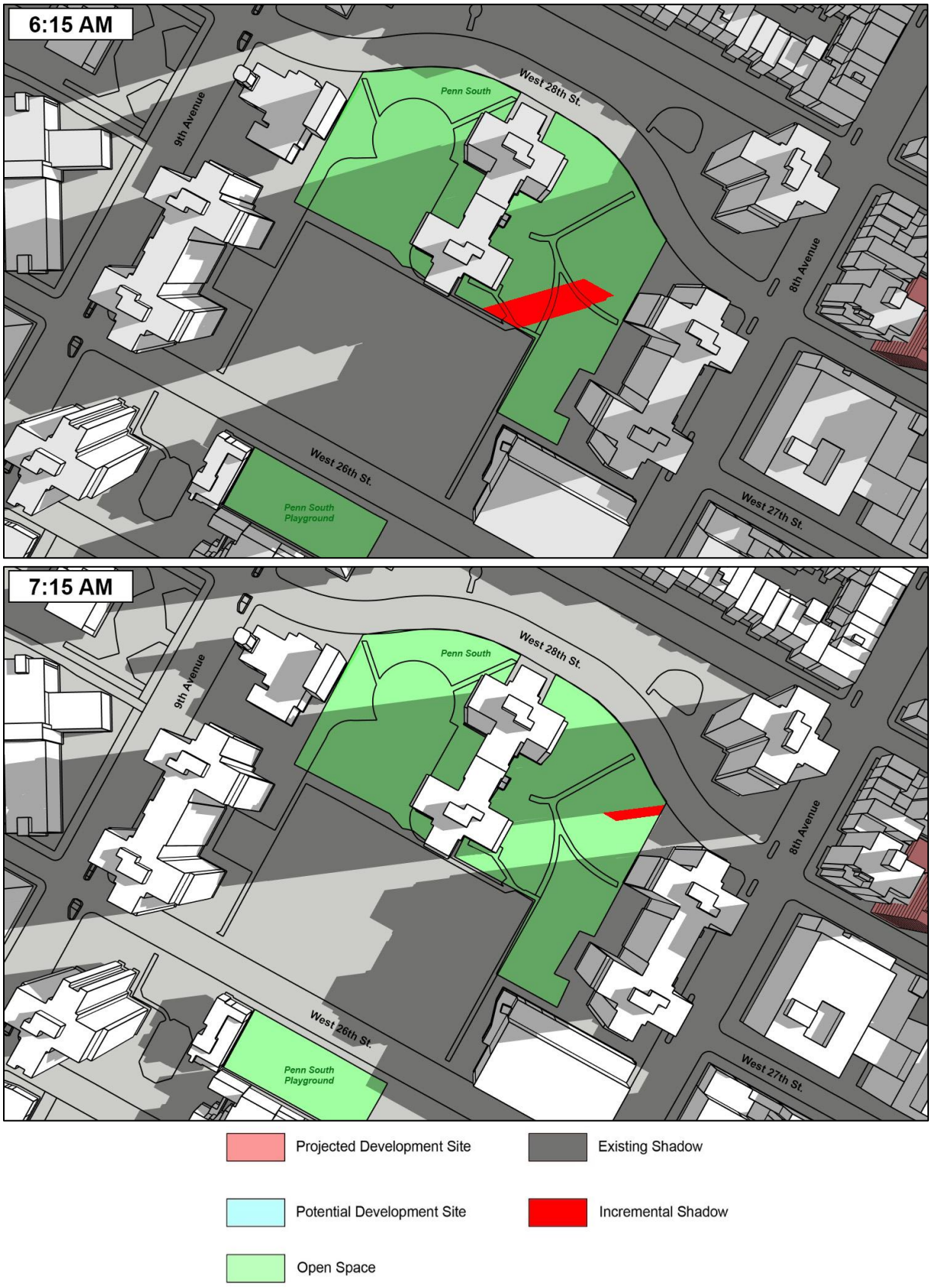


Figure 6-16: Moynihan Train Hall Steps – December 21

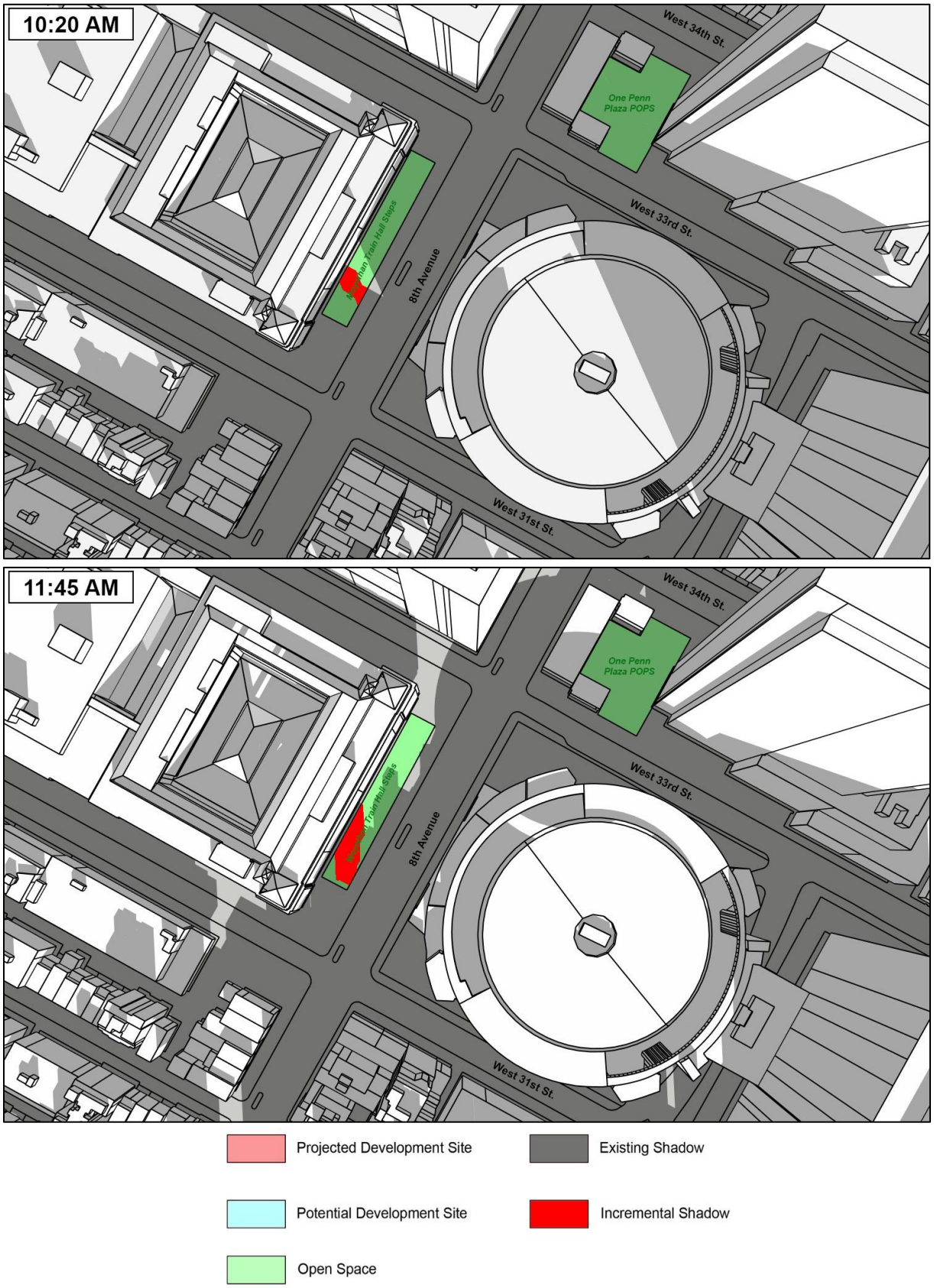


Figure 6-17: Moynihan Train Hall Steps – December 21

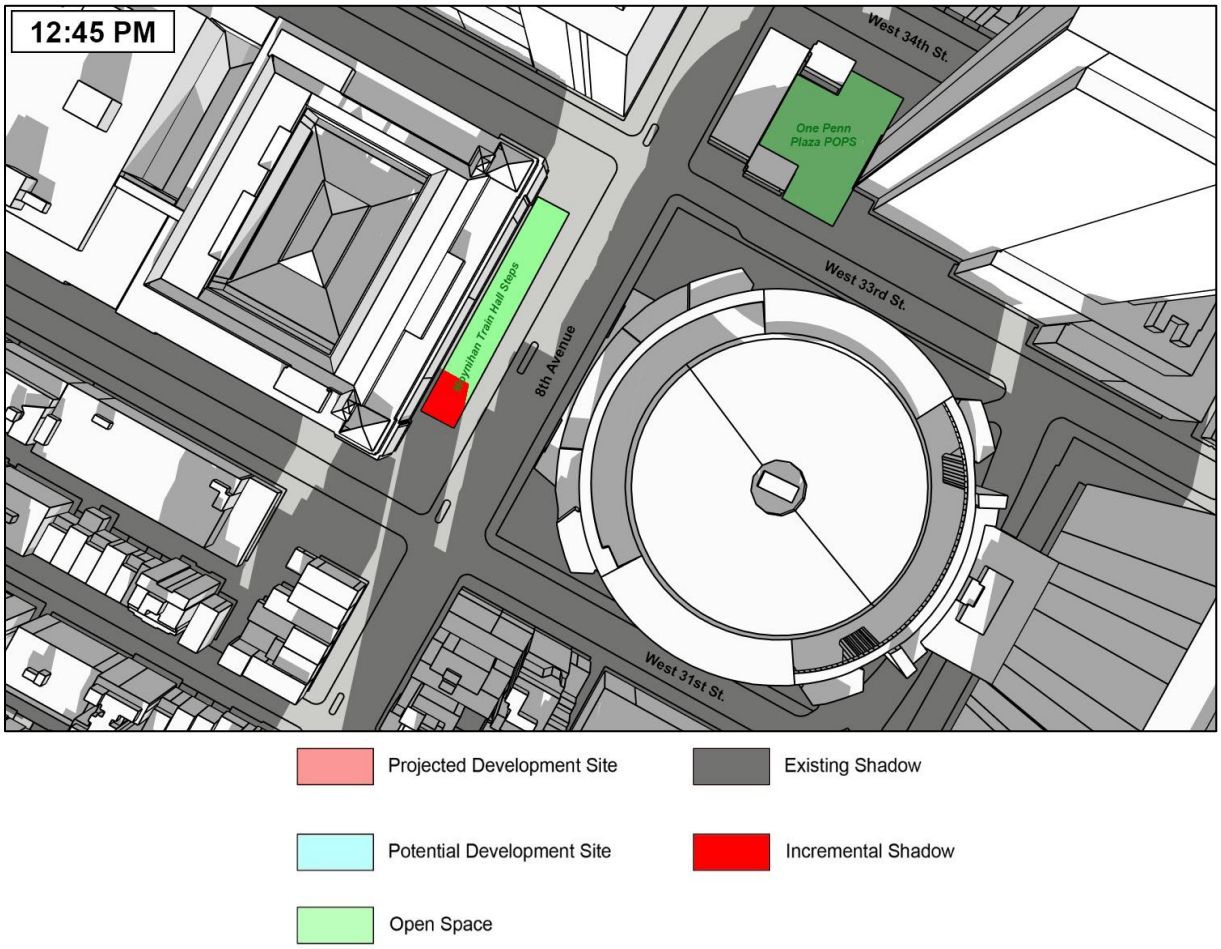


Figure 6-18: 525 Eighth Avenue POPS – December 21

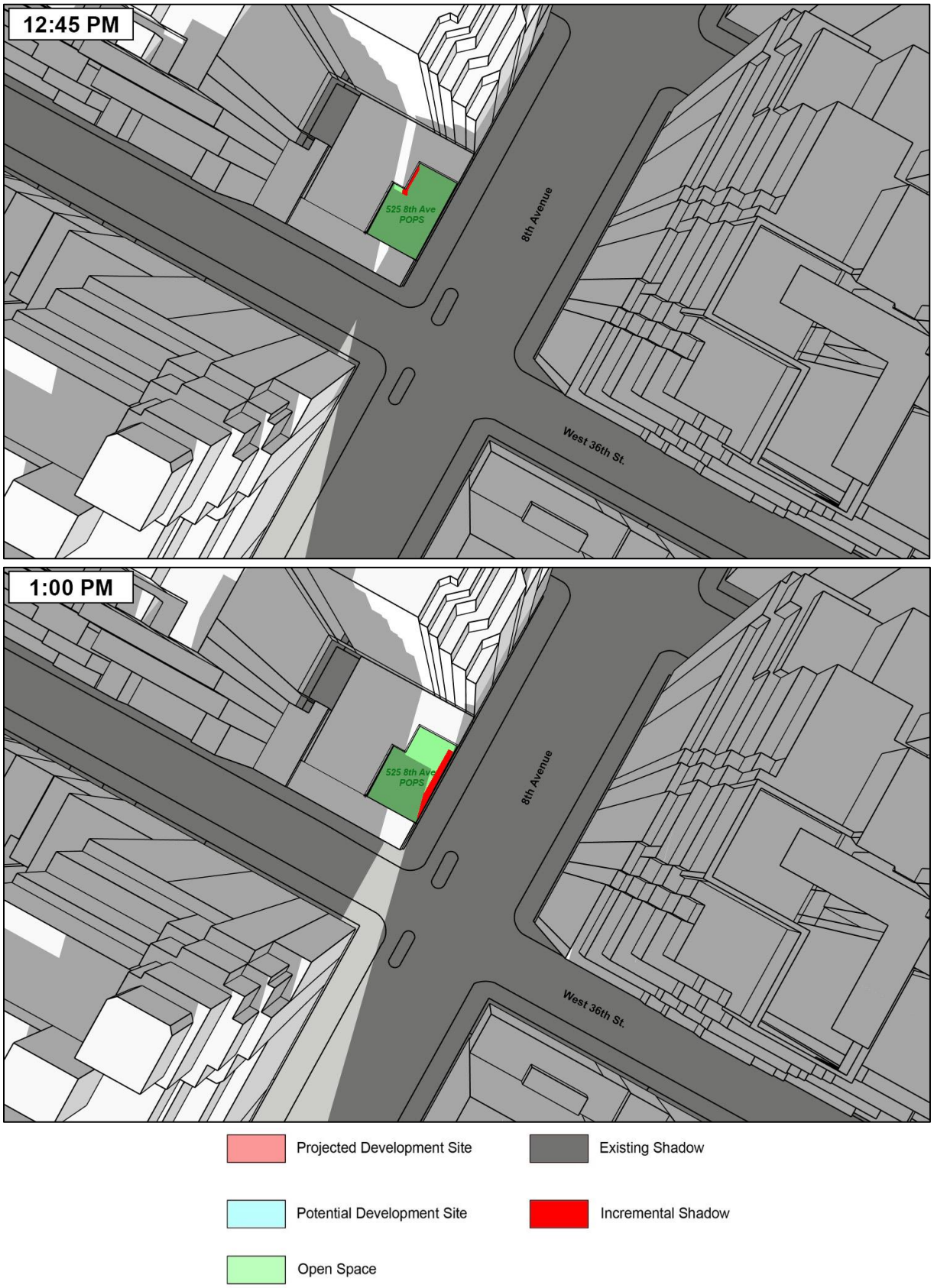


Figure 6-19: Broadway Plazas (35th – 42nd Streets) – March 21/September 21

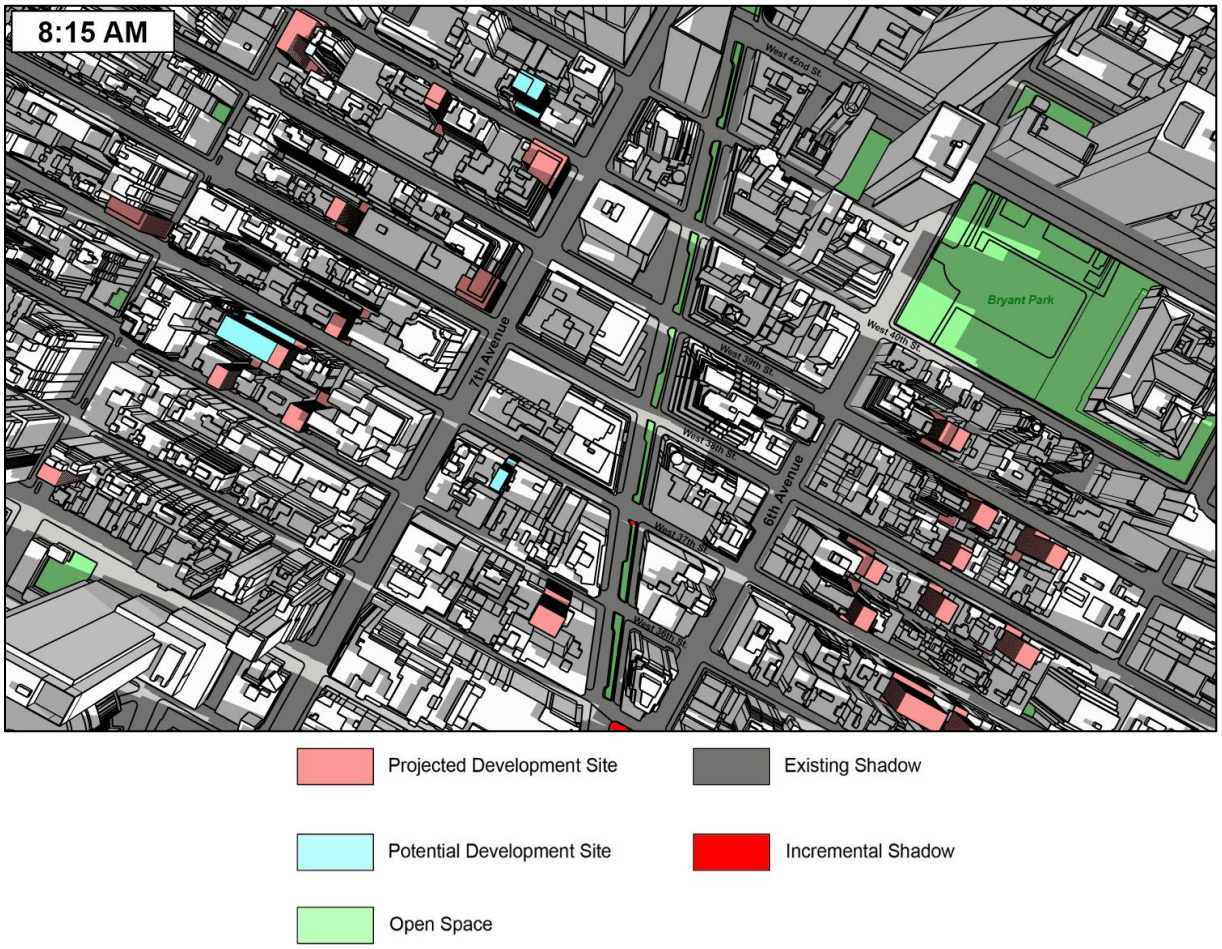


Figure 6-20: Broadway Plazas (35th – 42nd Streets) – May 6/August 6



Figure 6-21: Broadway Plazas (35th – 42nd Streets) – June 21

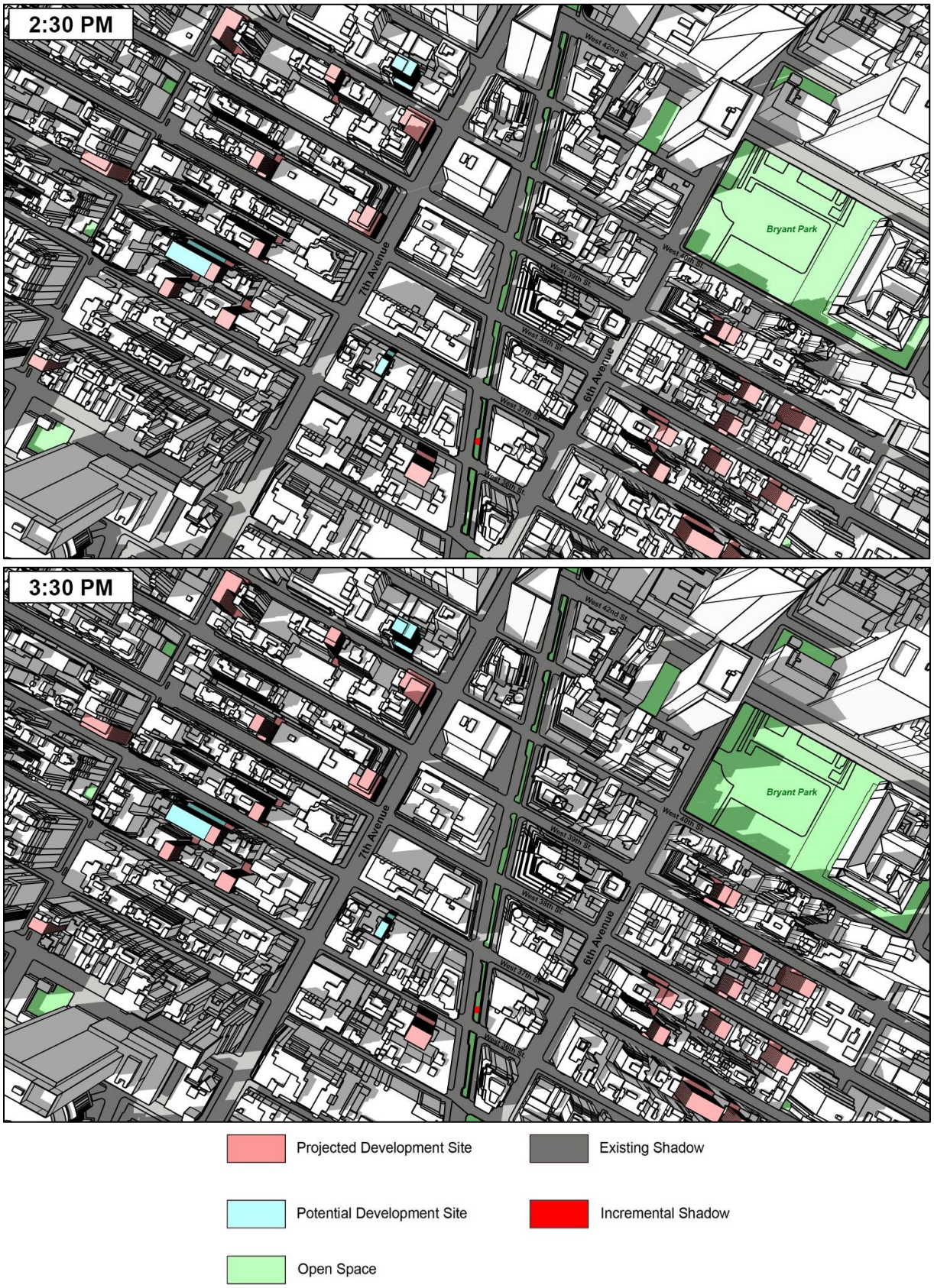


Figure 6-22: 776 Sixth Avenue POPS – March 21/September 21

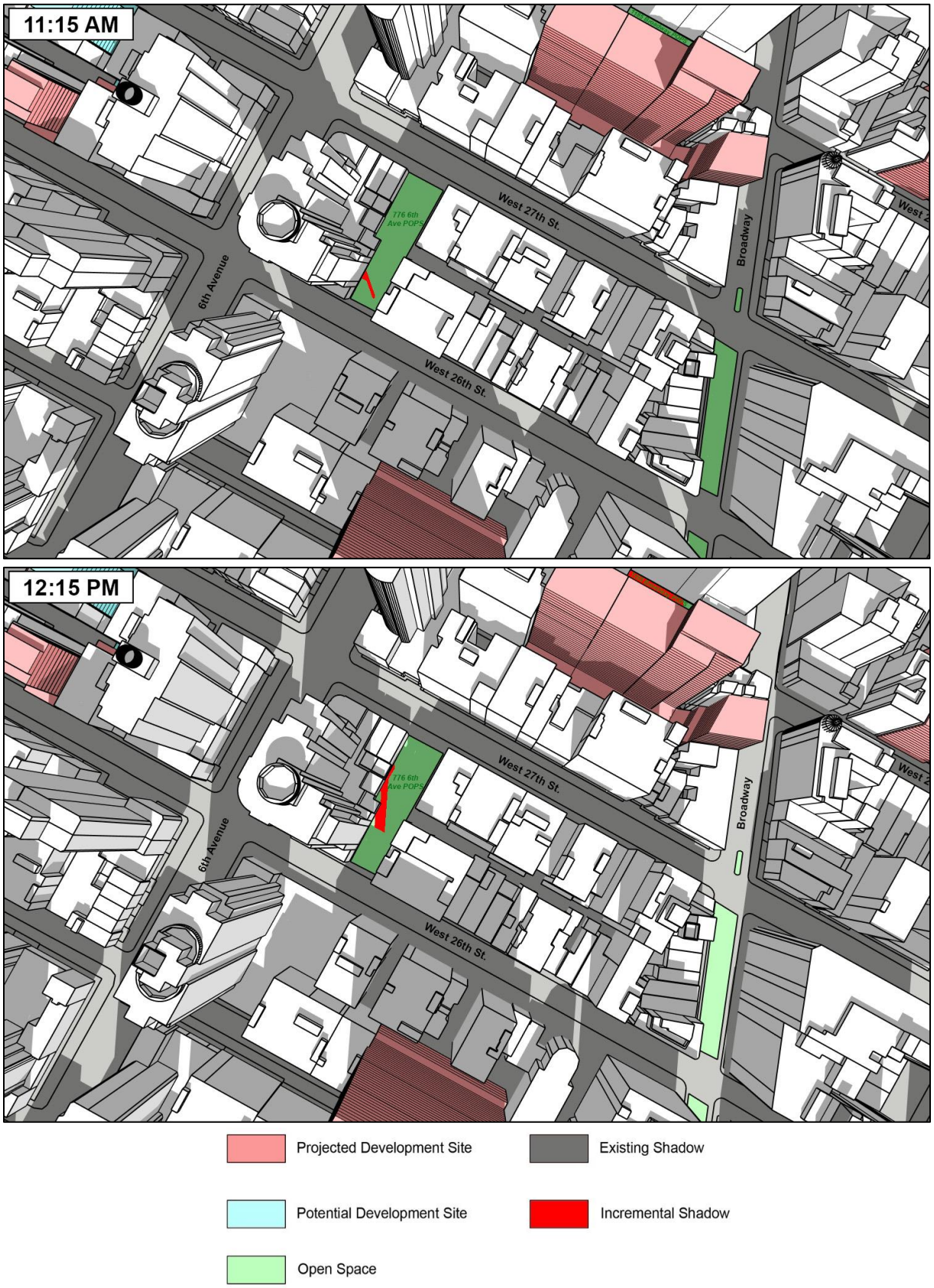


Figure 6-23: 776 Sixth Avenue POPS – May 6/August 6

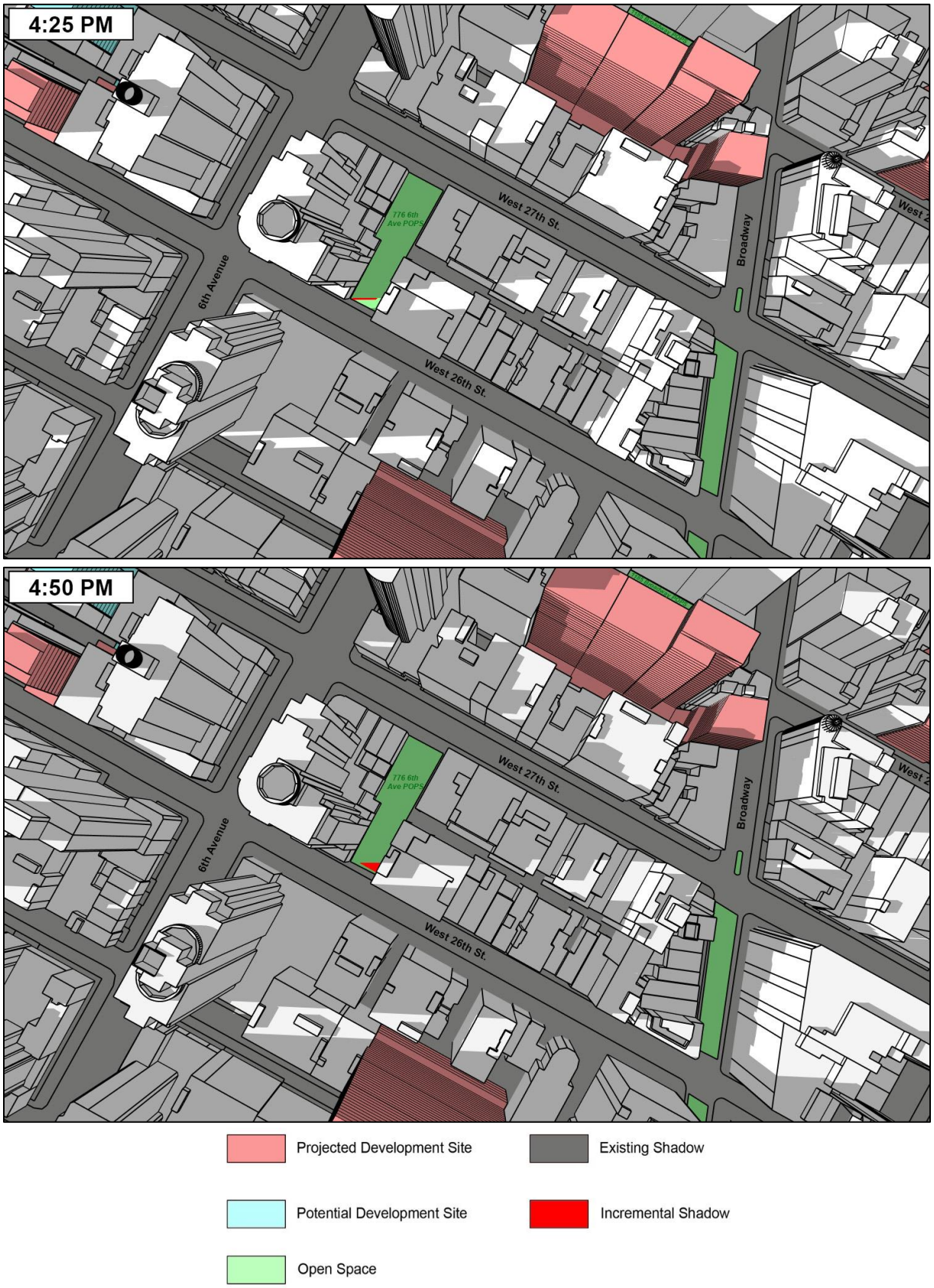


Figure 6-24: 835 Sixth Avenue POPS – March 21/September 21

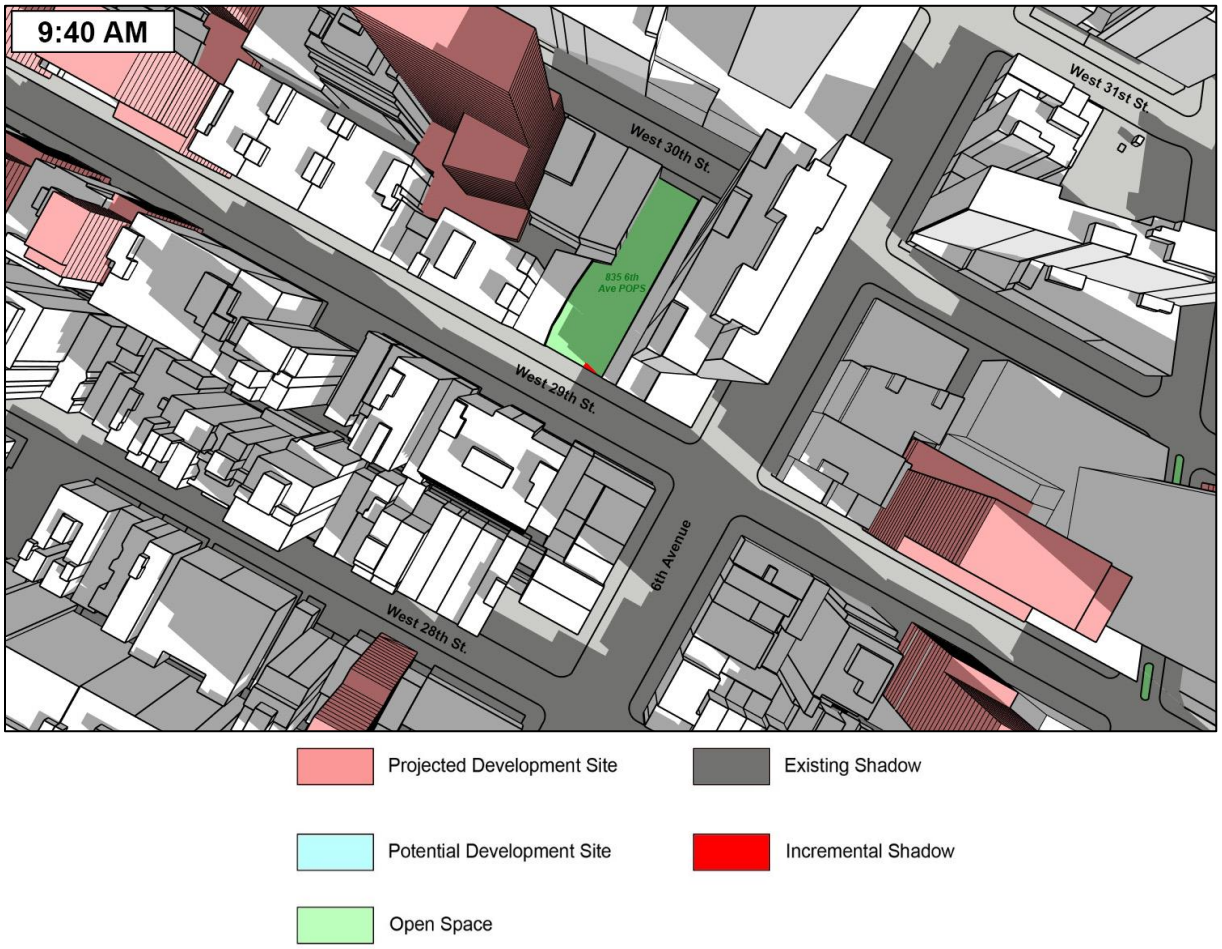


Figure 6-25: 420 Fifth Avenue POPS – March 21/September 21

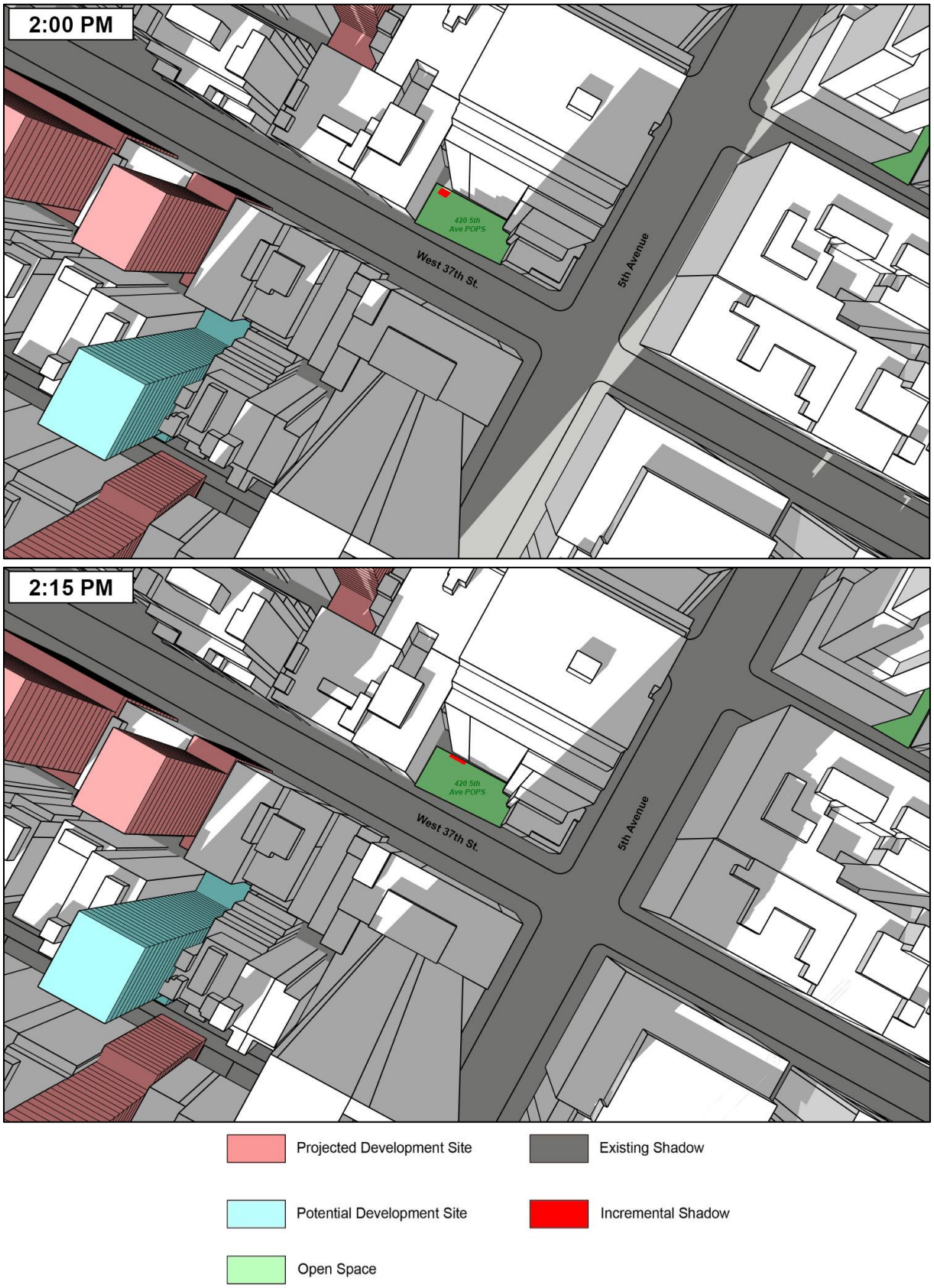


Figure 6-26: 420 Fifth Avenue POPS – May 6/August 6

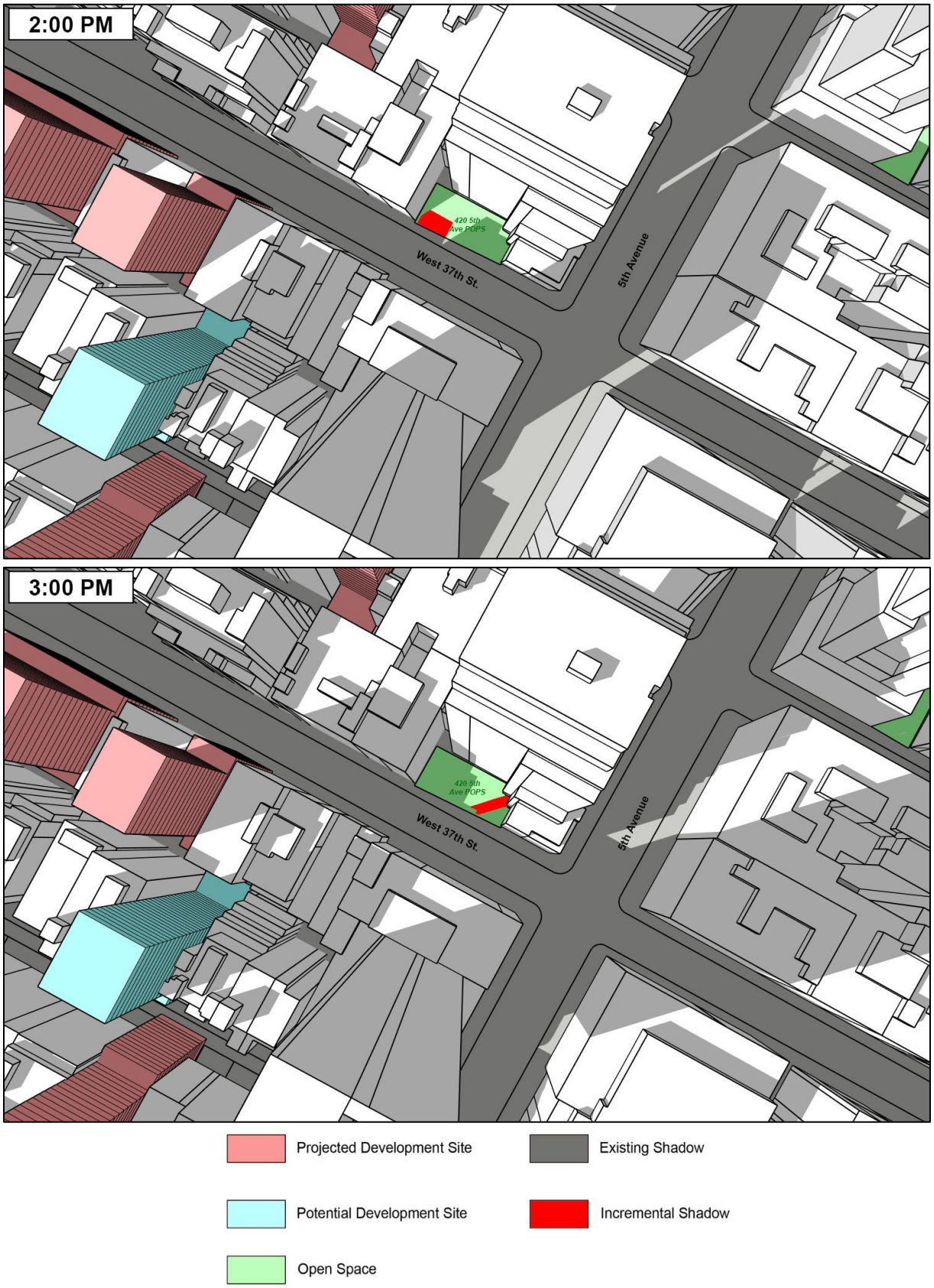


Figure 6-27: 420 Fifth Avenue POPS – June 21

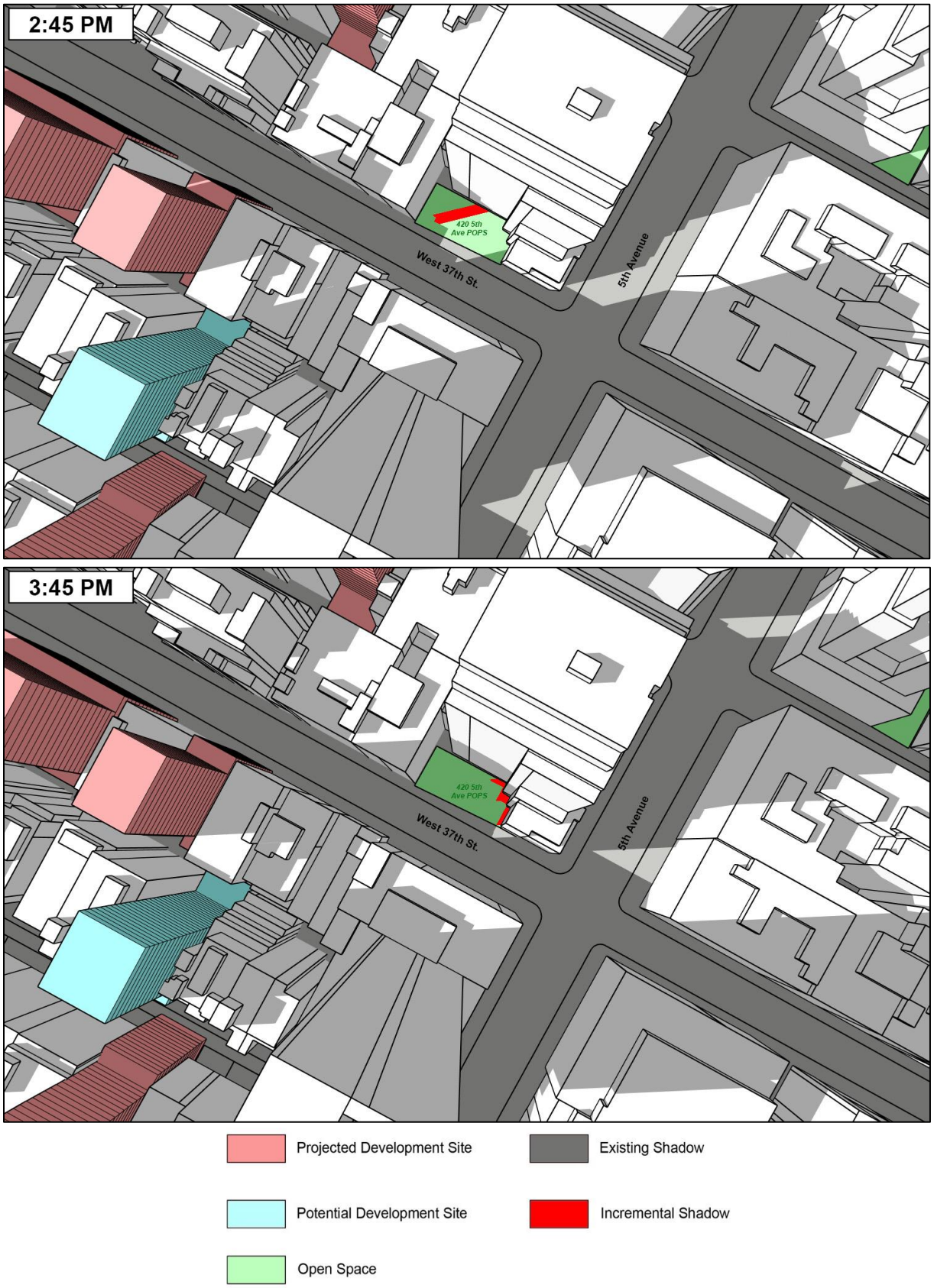


Figure 6-28: 41 Madison Avenue POPS – June 21

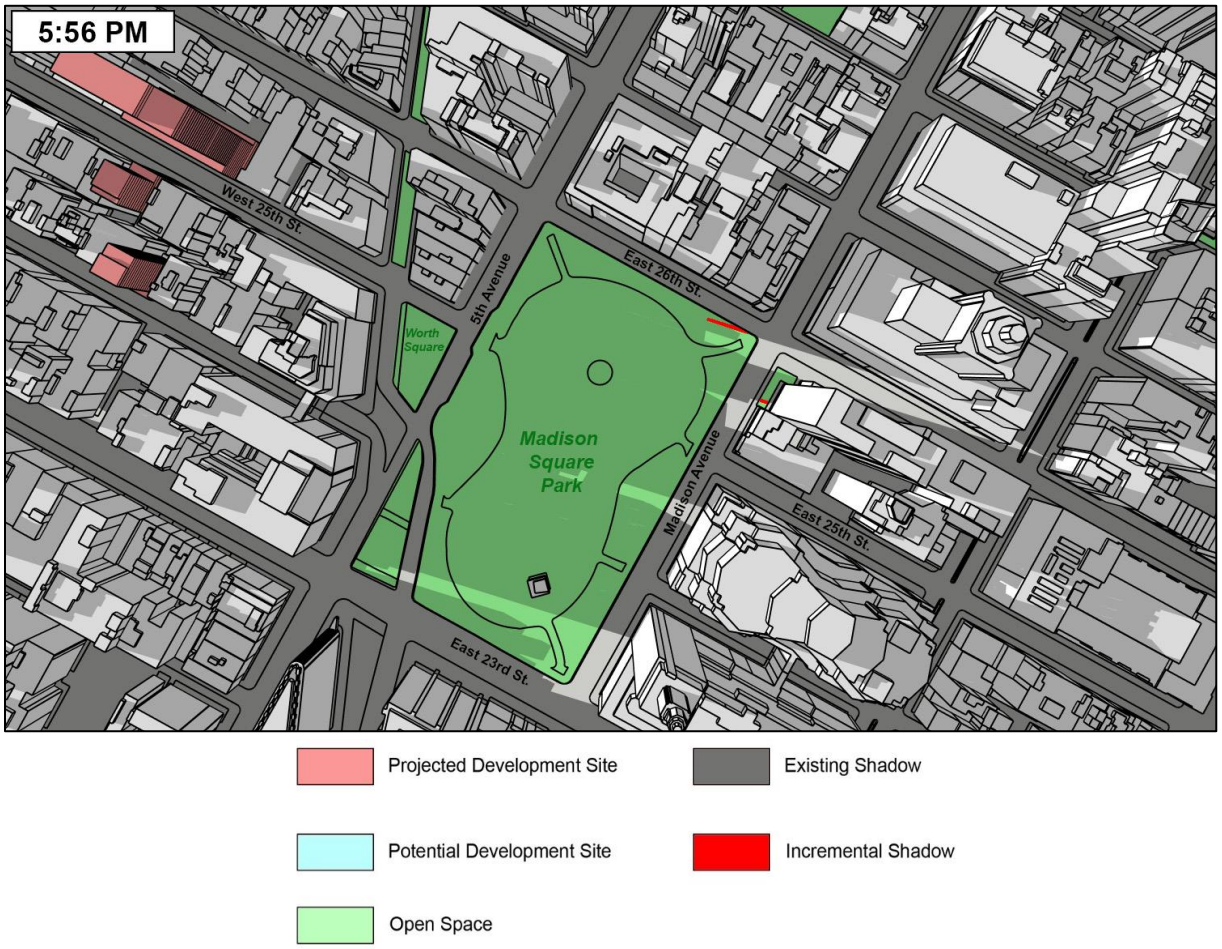


Figure 6-29: Grace Plaza – December 21



Figure 6-30: Greeley Square – December 21

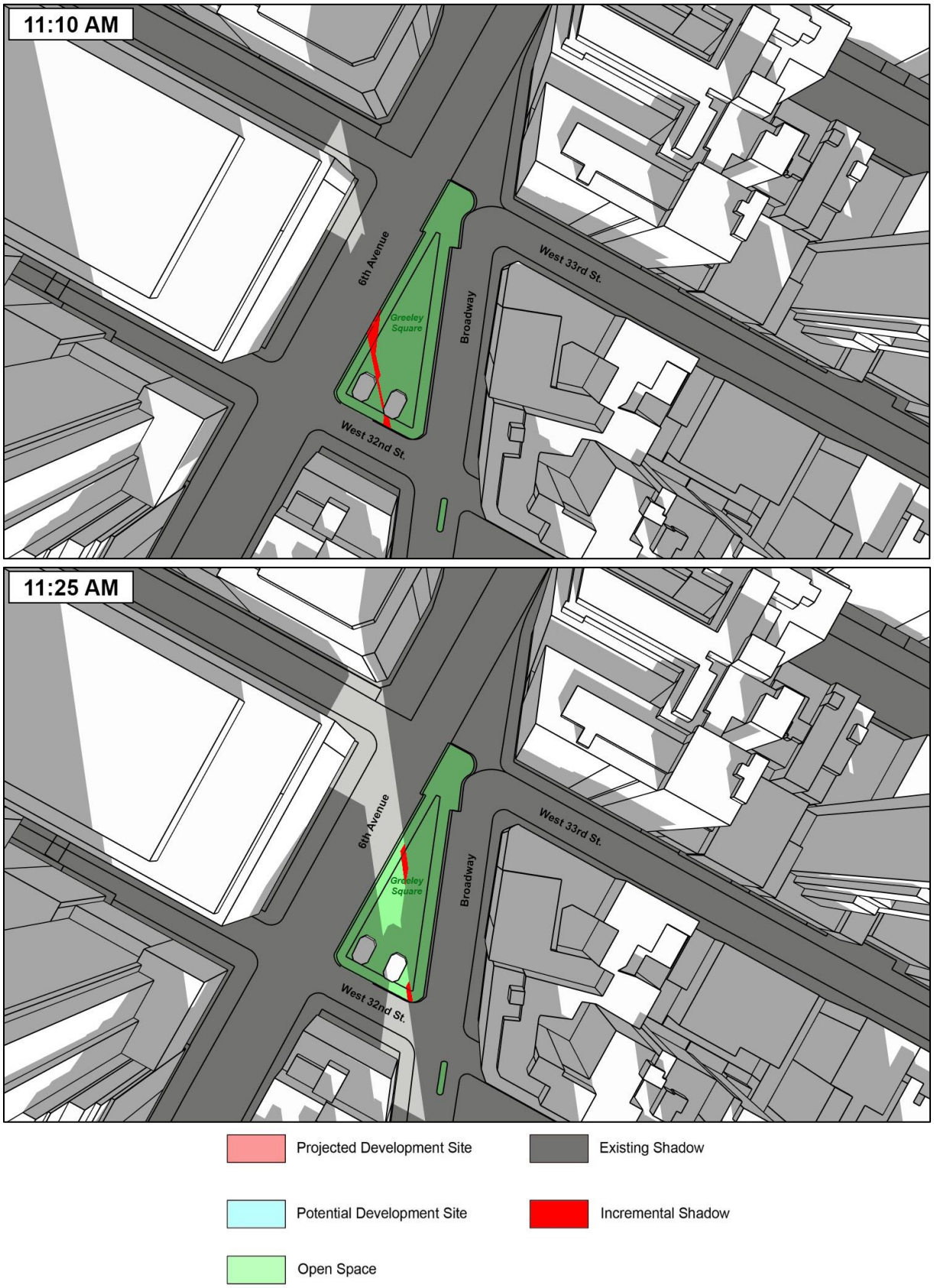


Figure 6-31: 1185 Broadway POPS – March 21/September 21

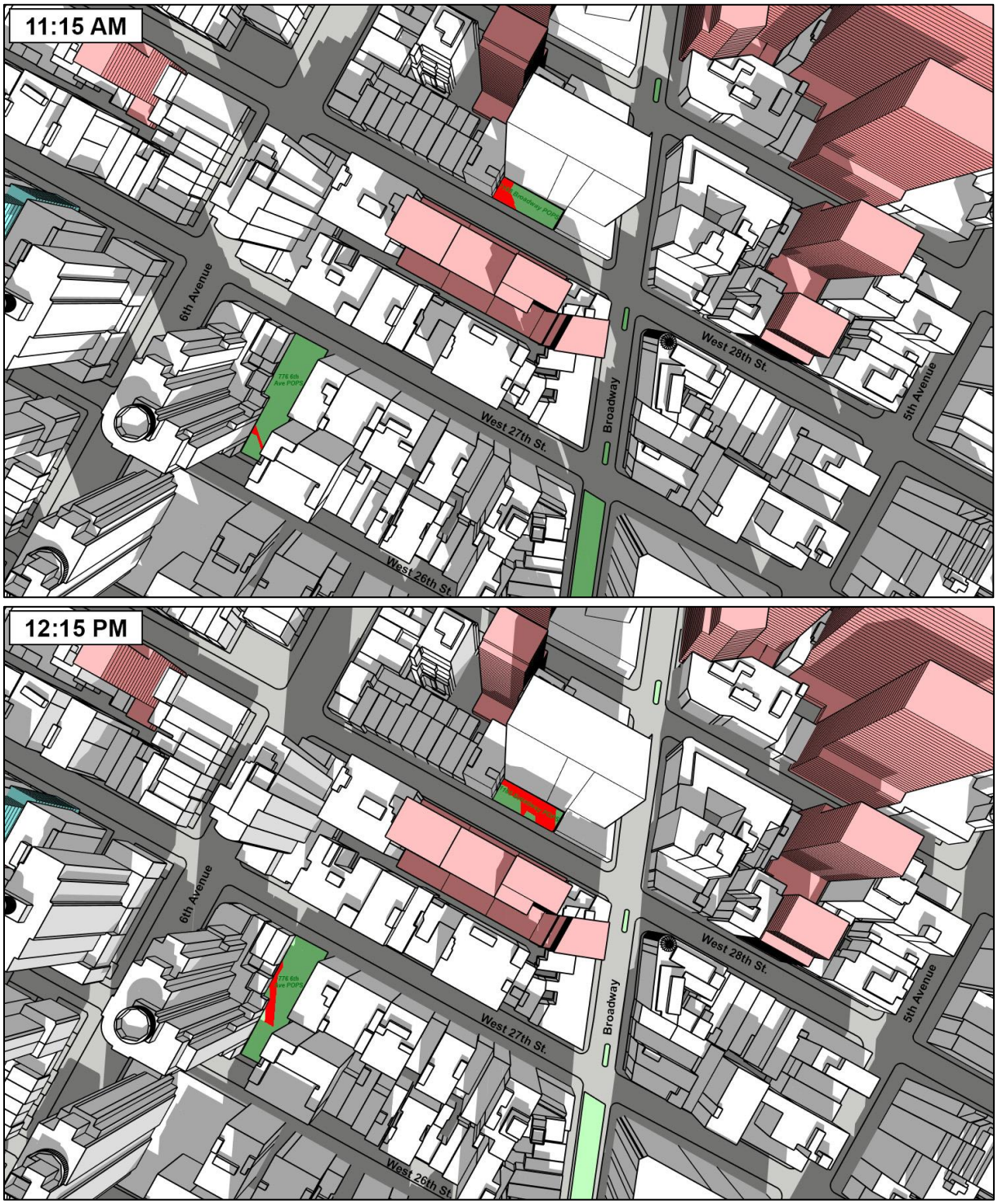


Figure 6-32: 1185 Broadway POPS – March 21/September 21

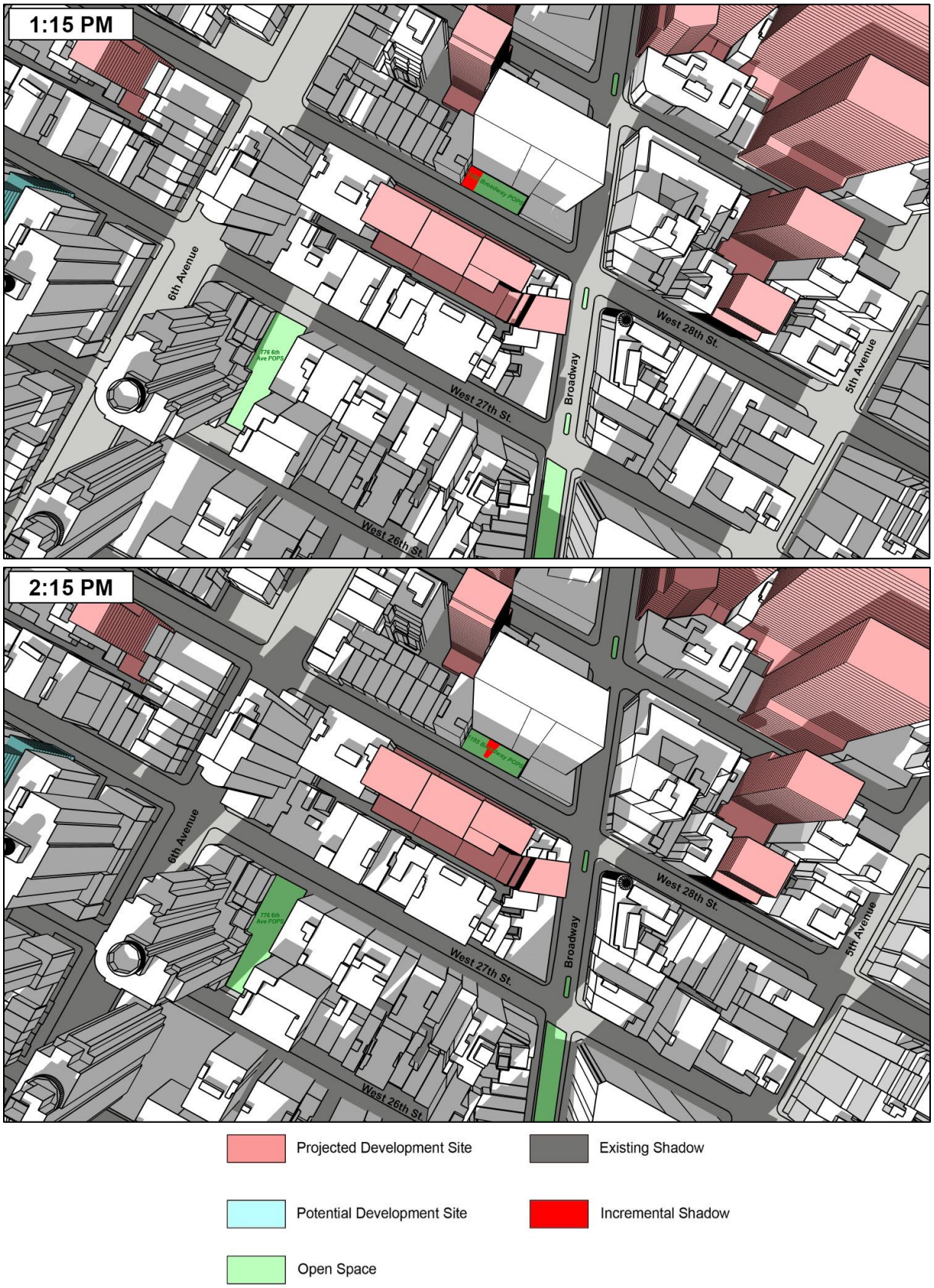


Figure 6-33: 1185 Broadway POPS – May 6/August 6

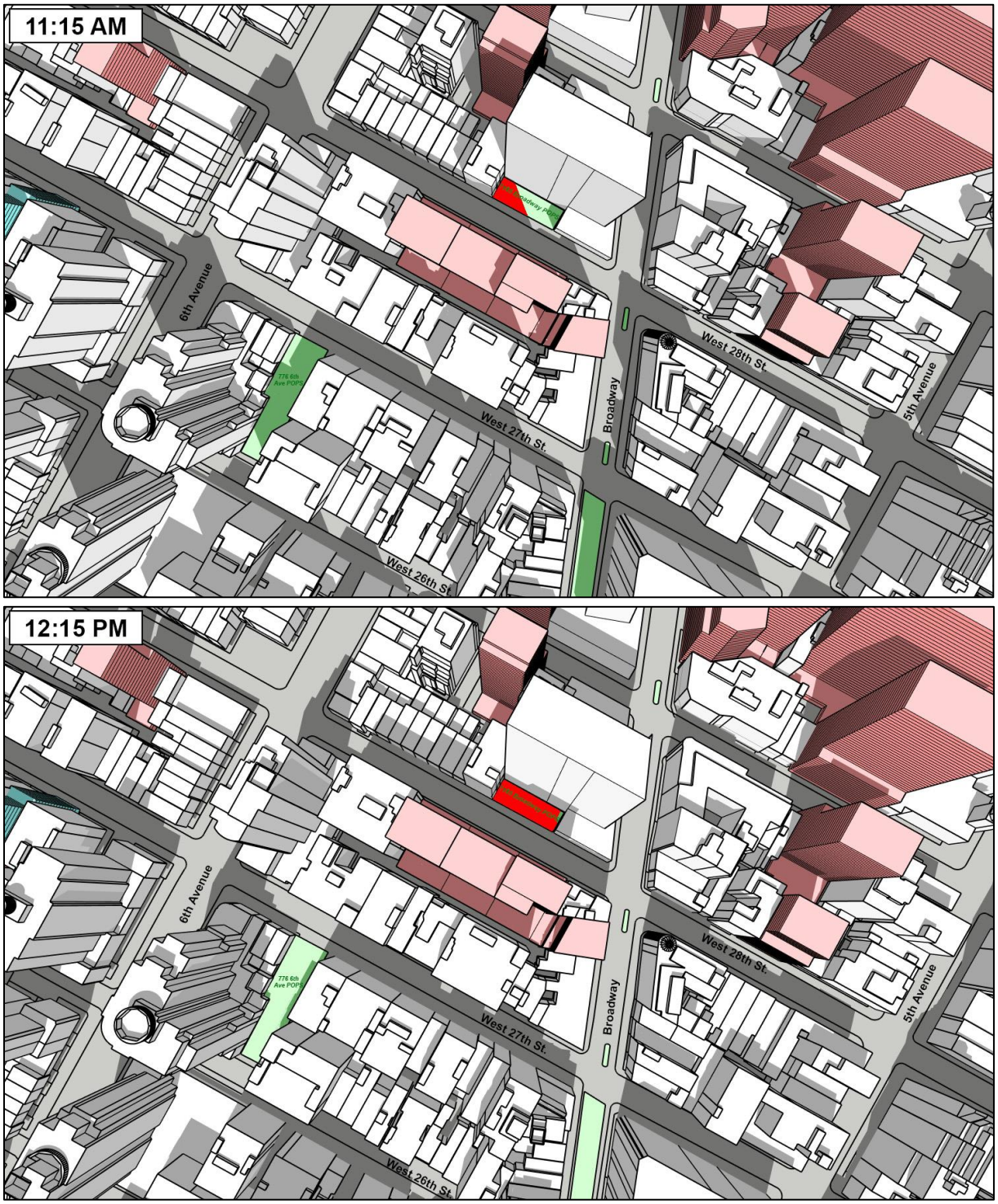


Figure 6-34: 1185 Broadway POPS – May 6/August 6

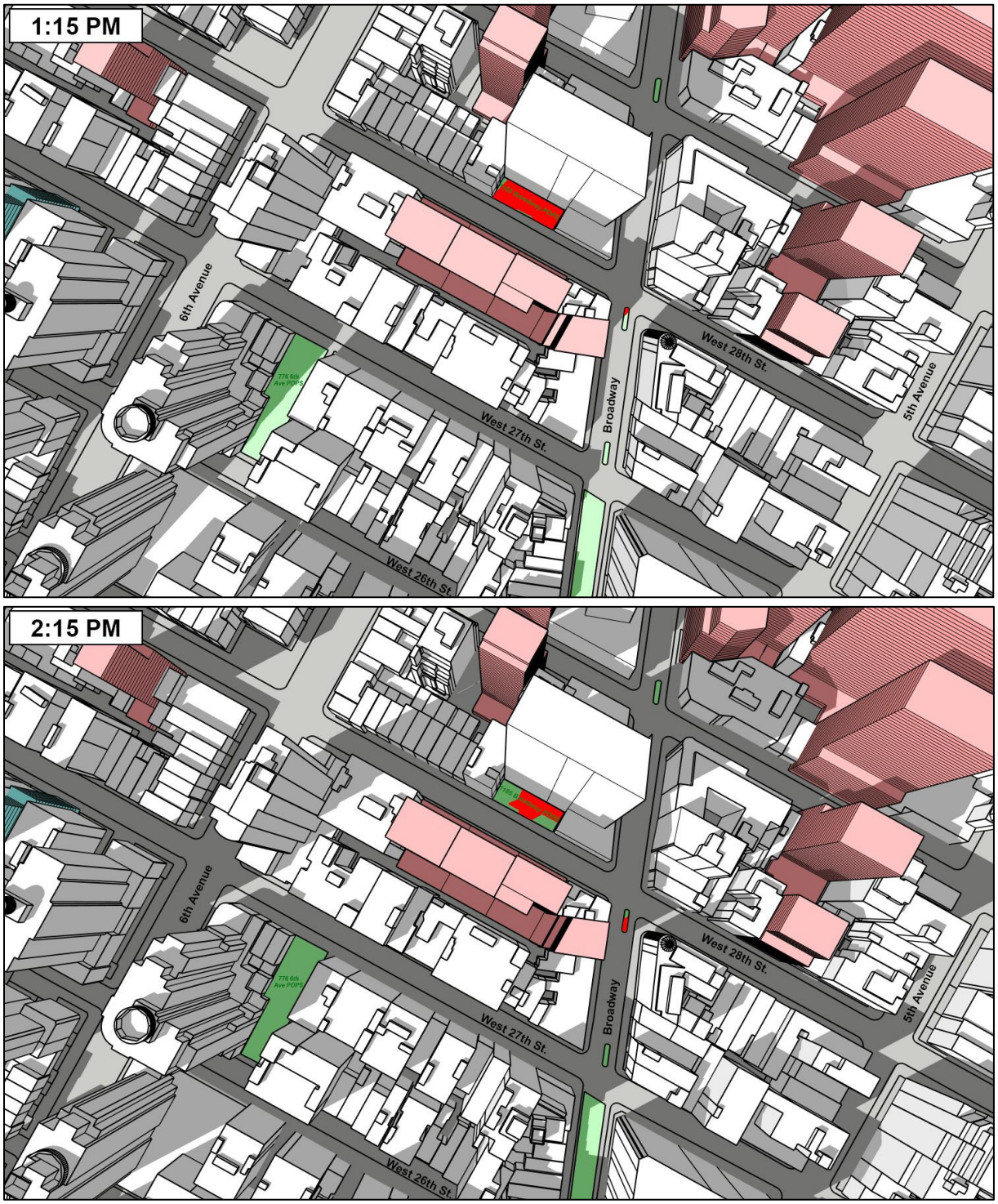


Figure 6-35: 1185 Broadway POPS – May 6/August 6



Figure 6-36: 1185 Broadway POPS – June 21

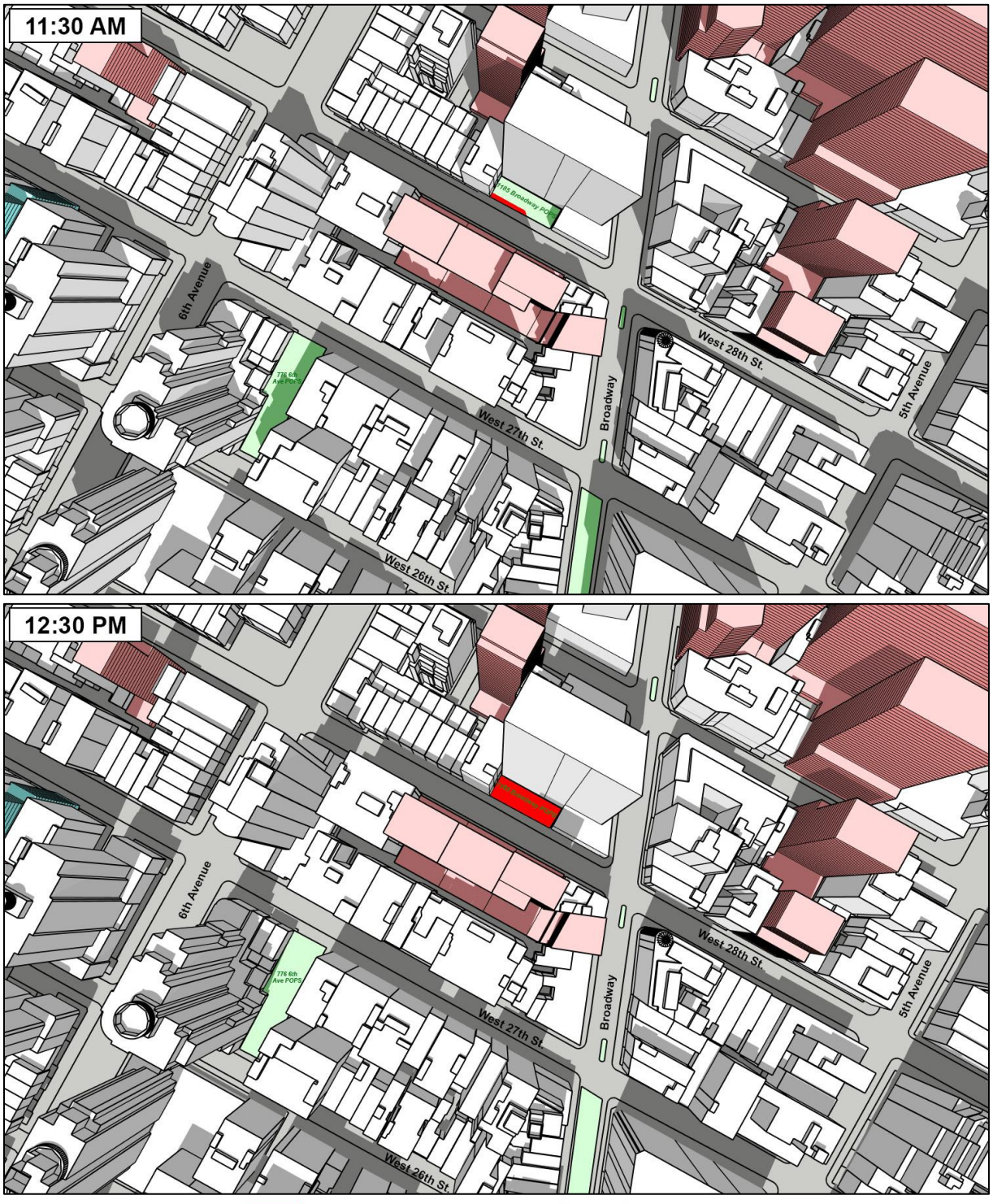


Figure 6-37: 1185 Broadway POPS – June 21

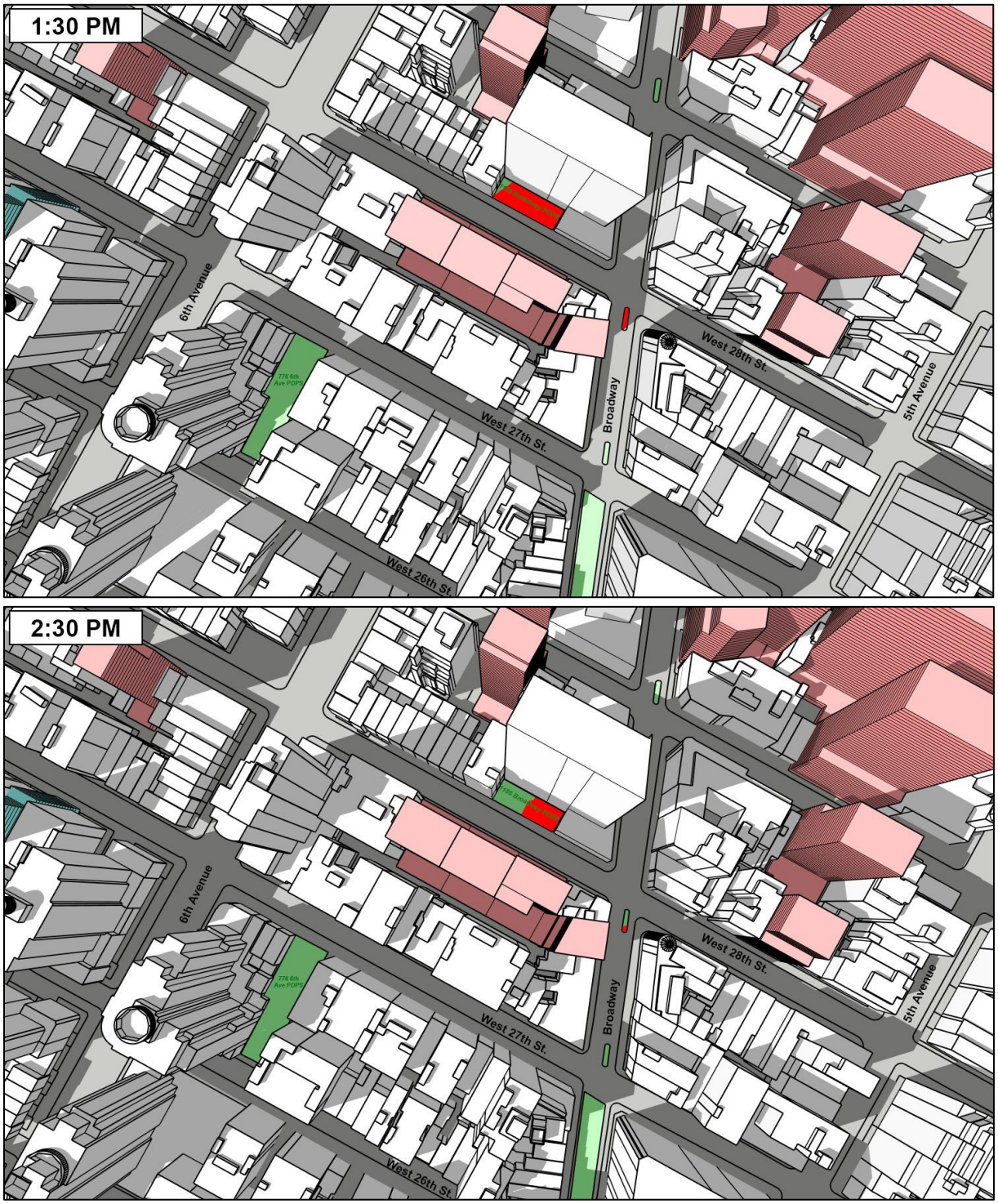


Figure 6-38: Broadway between 25th and 28th Streets – March 21/September 21

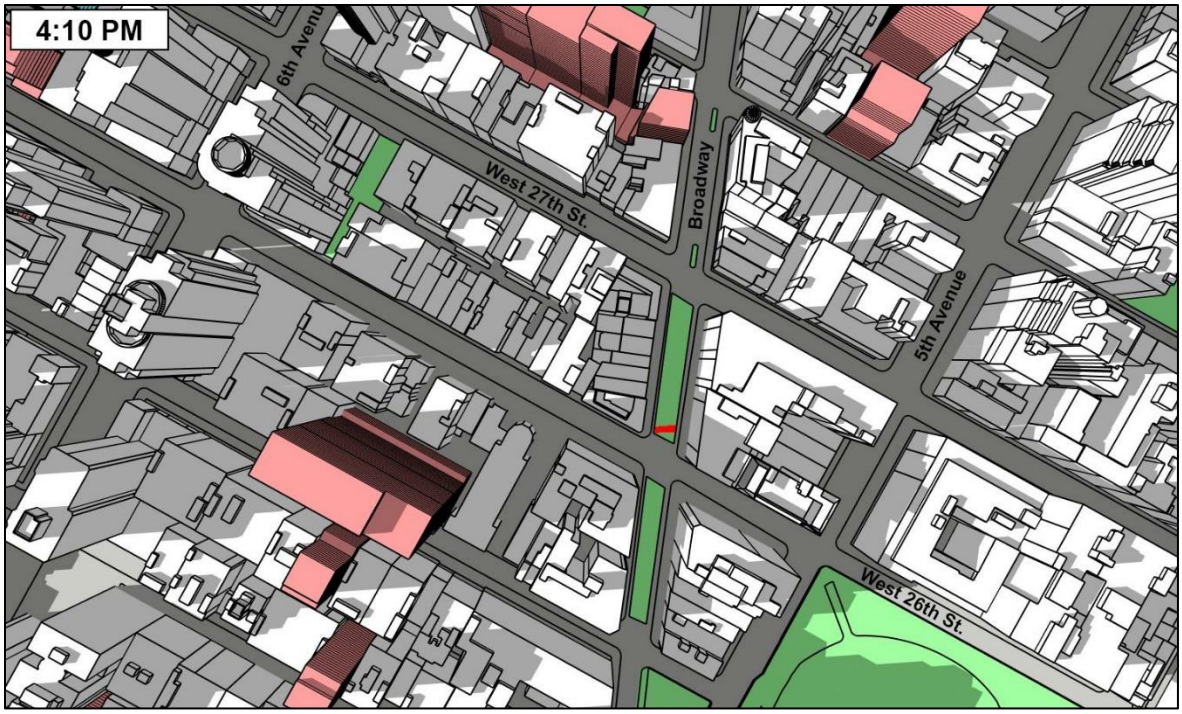


Figure 6-39: Broadway between 25th and 28th Streets – May 6/August 6



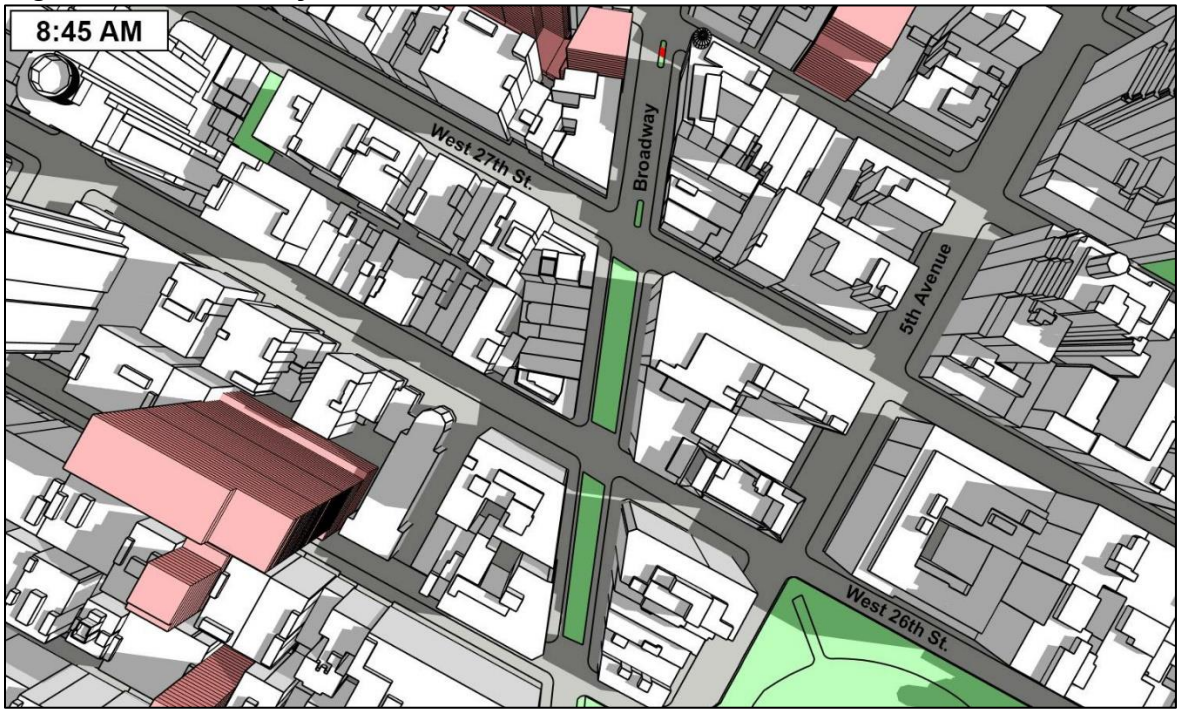
Figure 6-40: Broadway between 25th and 28th Streets – May 6/August 6

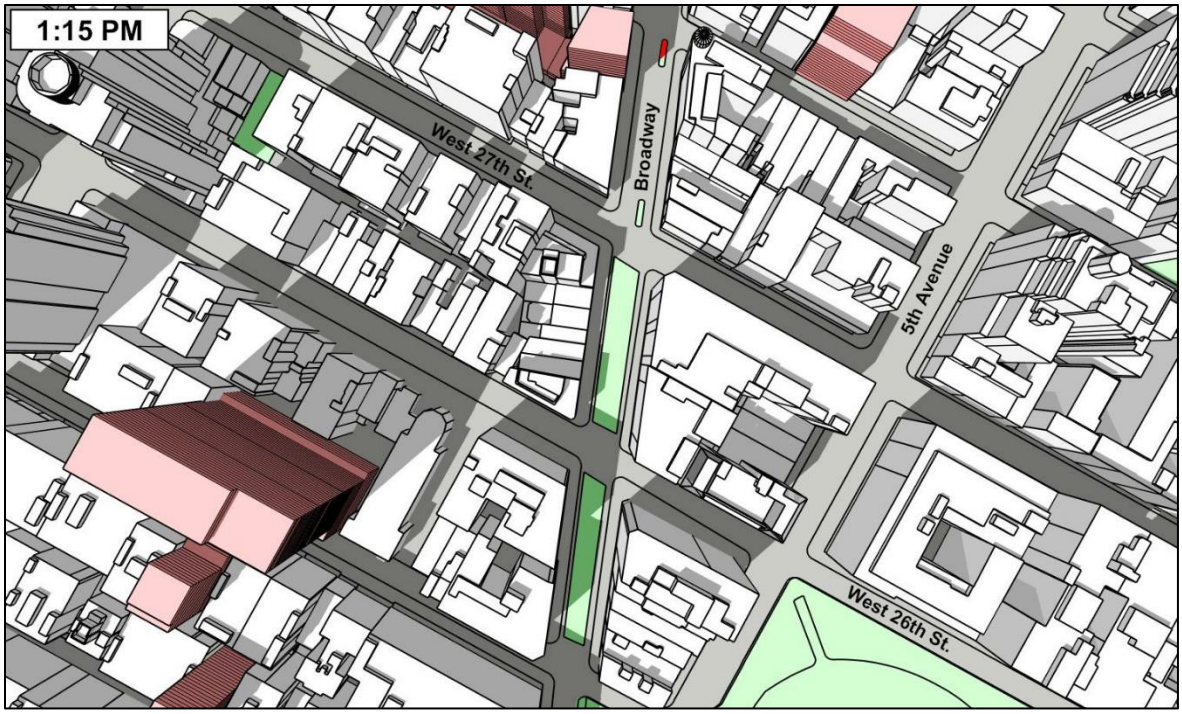




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space

Figure 6-41 – Broadway between 25th and 28th Streets – June 21





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space

Figure 6-42 – Broadway between 25th and 28th Streets – June 21

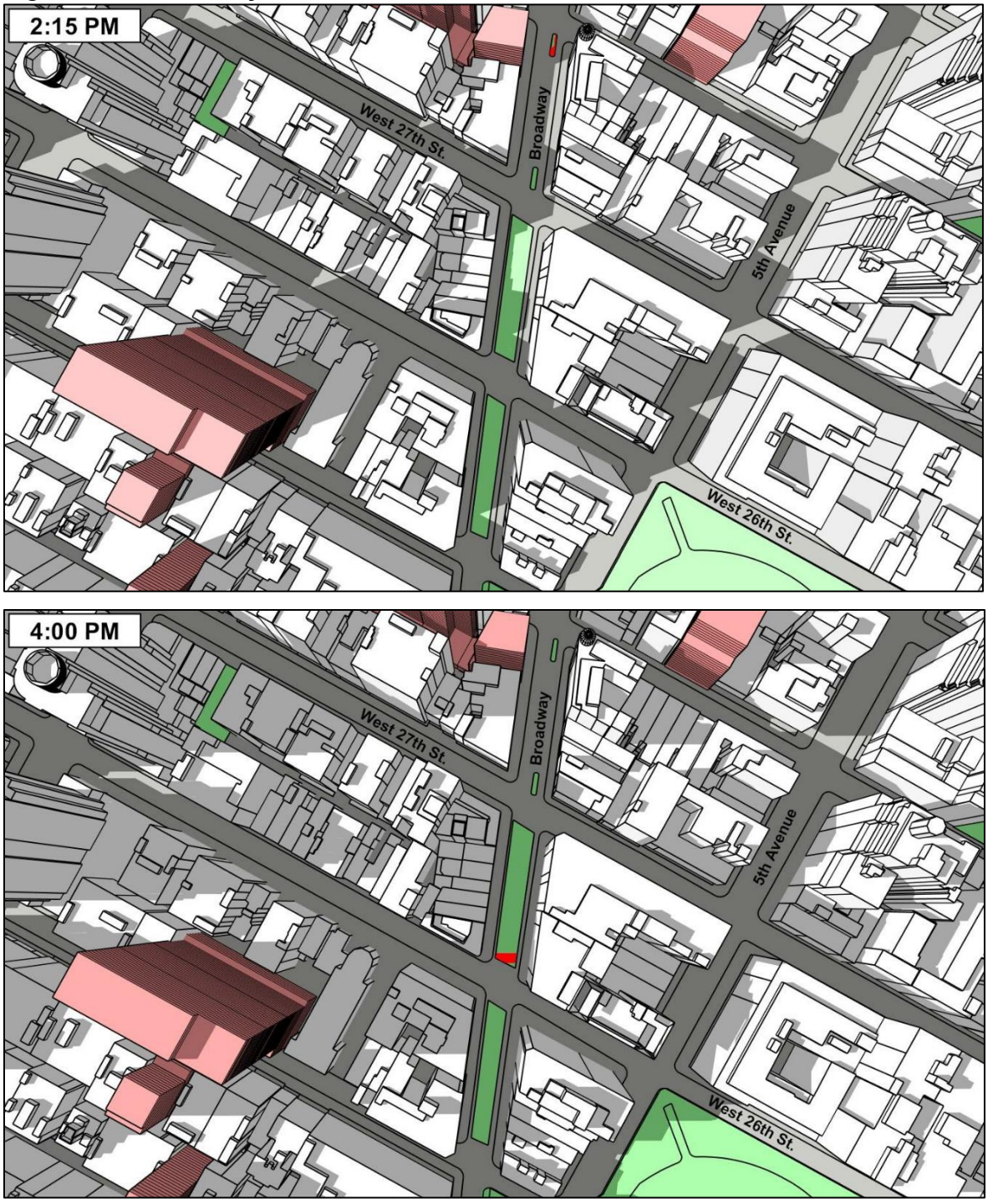


Figure 6-43 – Broadway between 29th and 32nd Streets – March 21/September 21

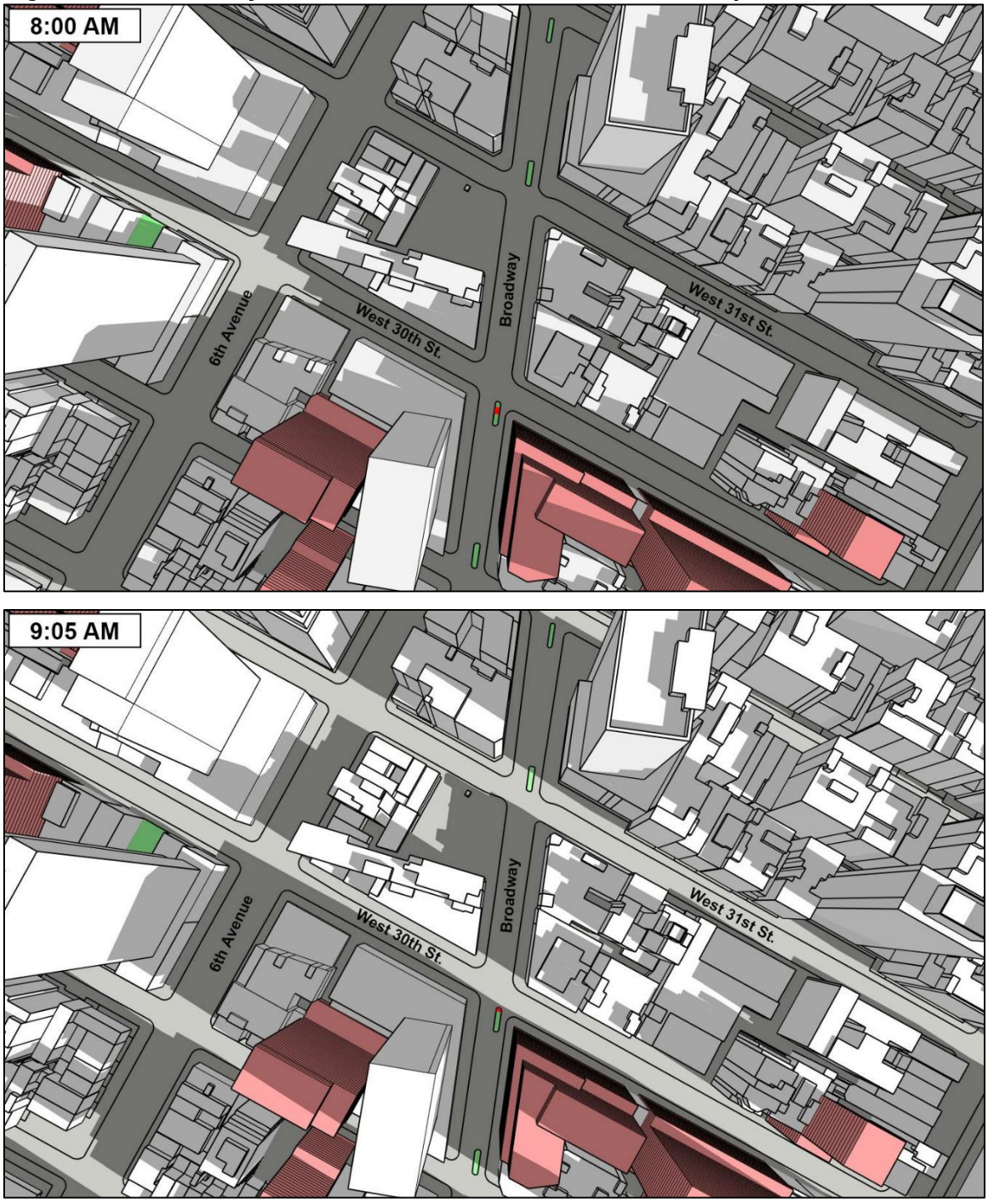


Figure 6-44 – Broadway between 29th and 32nd Streets – March 21/September 21

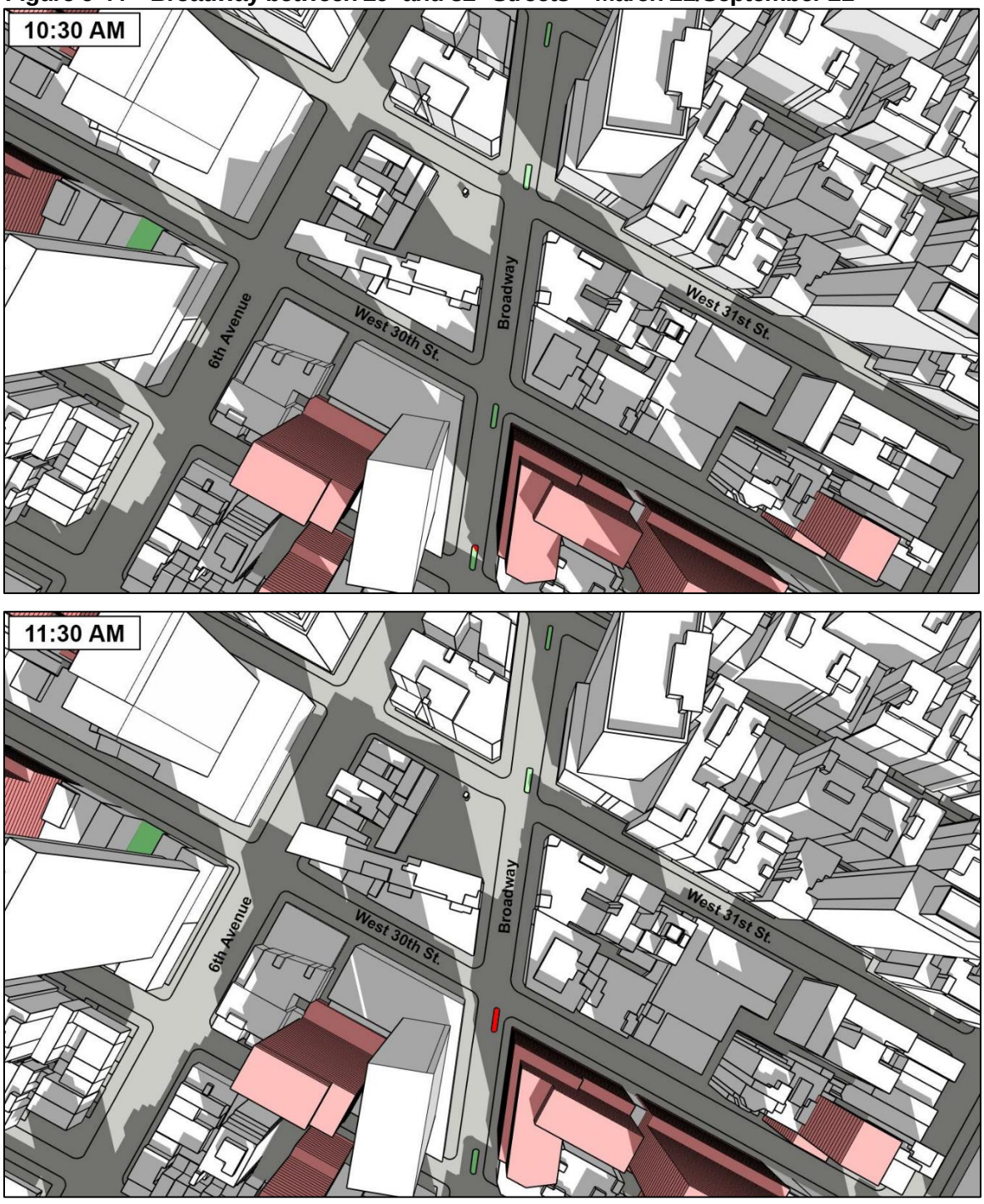
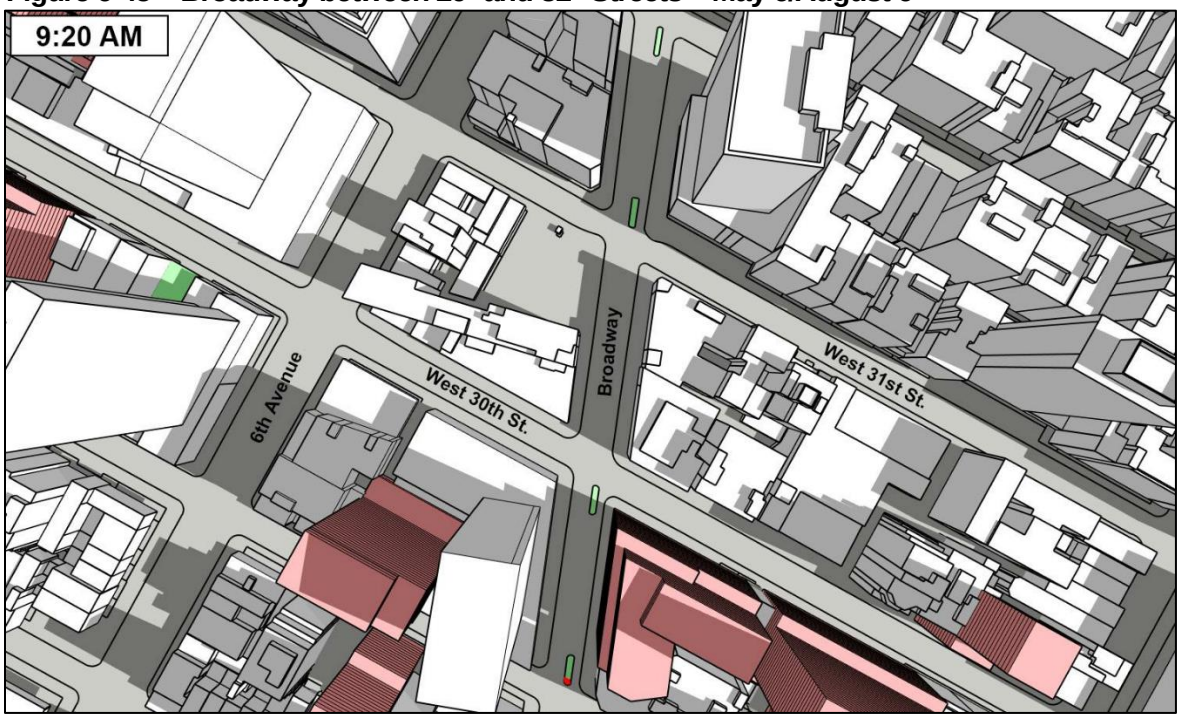


Figure 6-45 – Broadway between 29th and 32nd Streets – May 6/August 6





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space

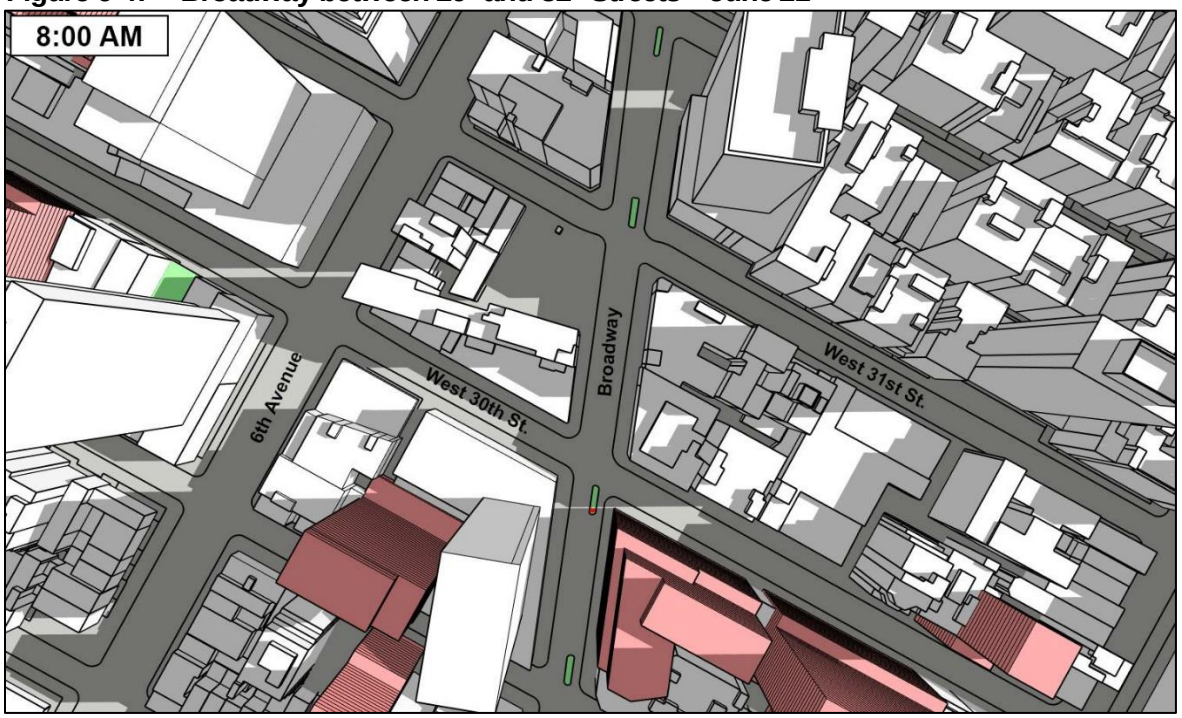
Figure 6-46 – Broadway between 29th and 32nd Streets – May 6/August 6

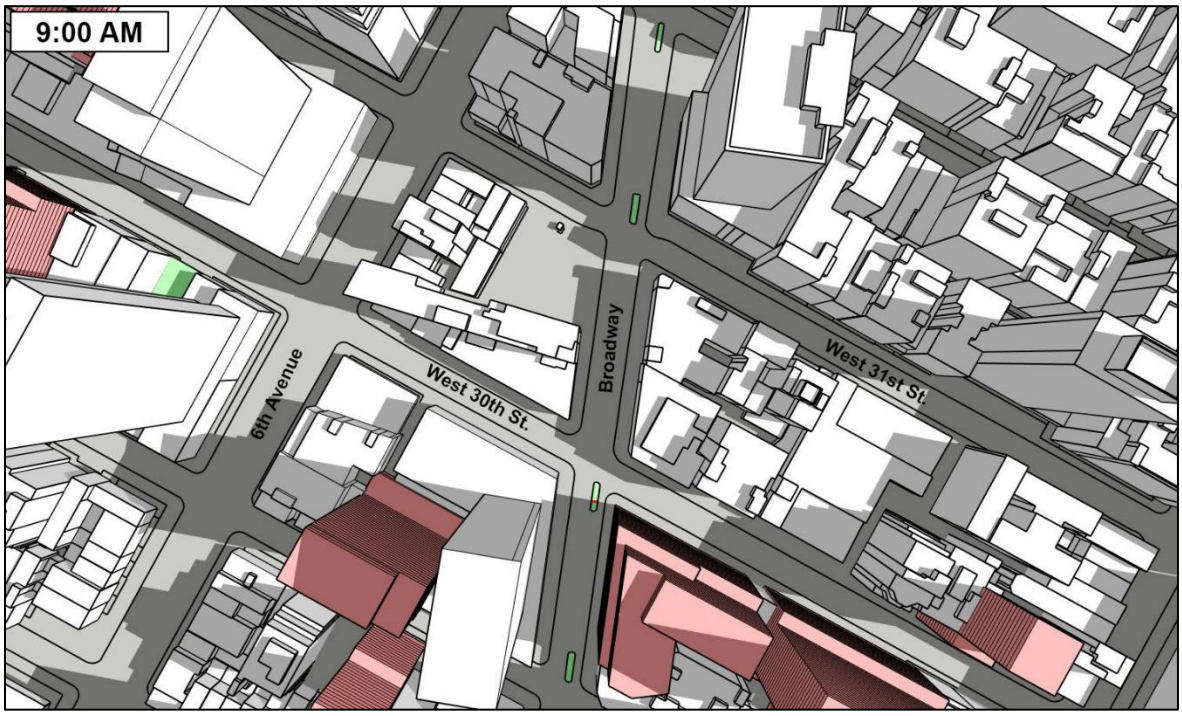




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space

Figure 6-47 – Broadway between 29th and 32nd Streets – June 21





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space

Figure 6-48 – Broadway between 29th and 32nd Streets – June 21

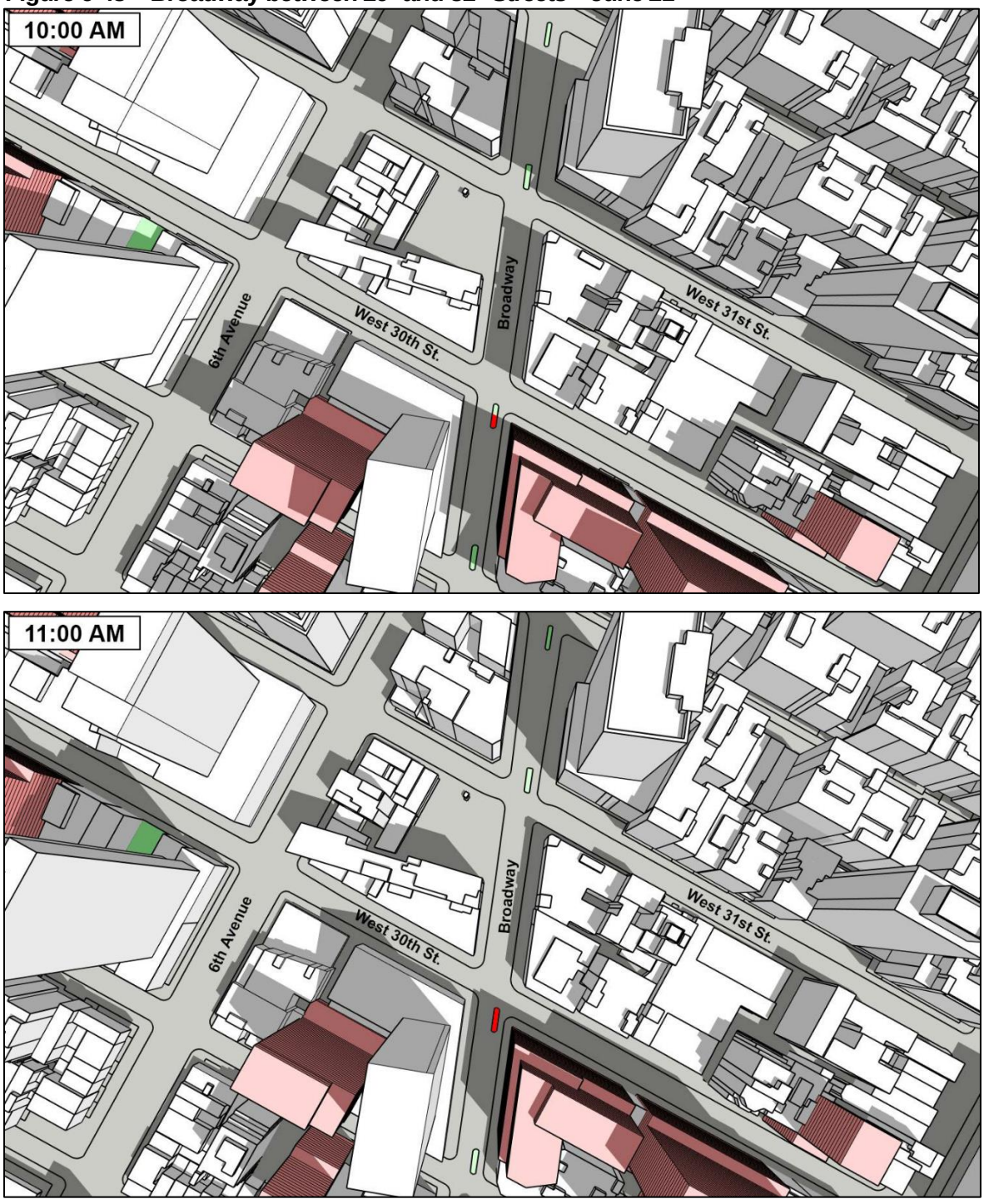
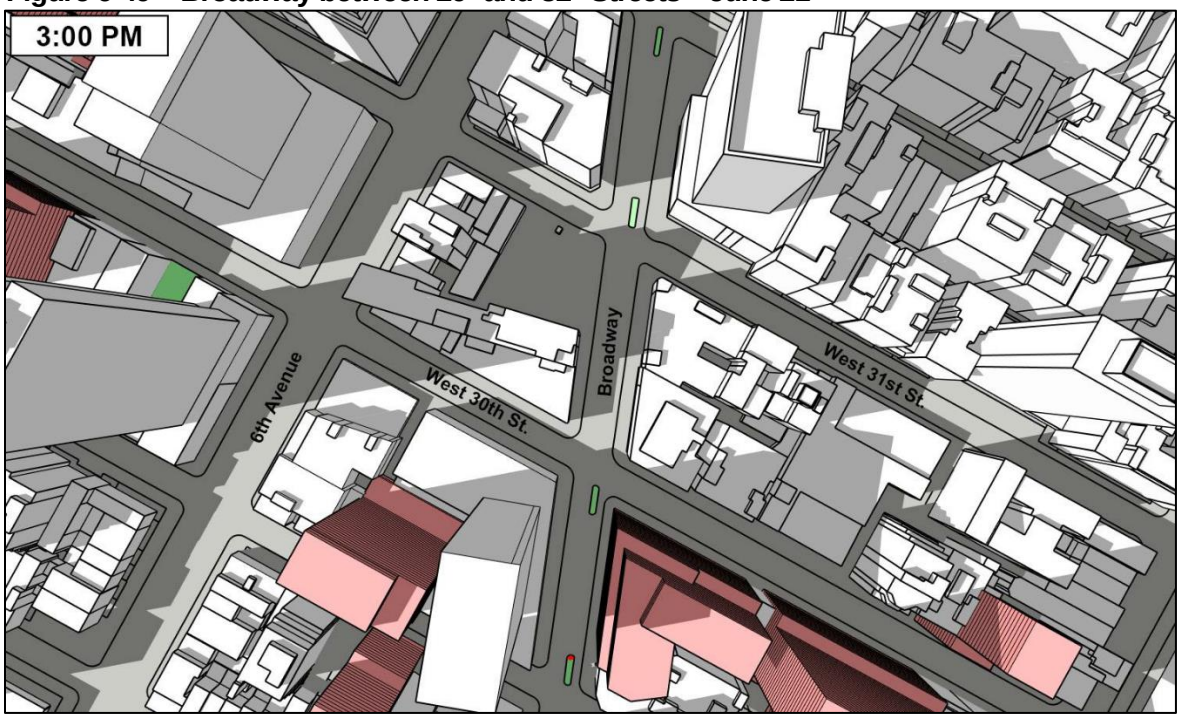
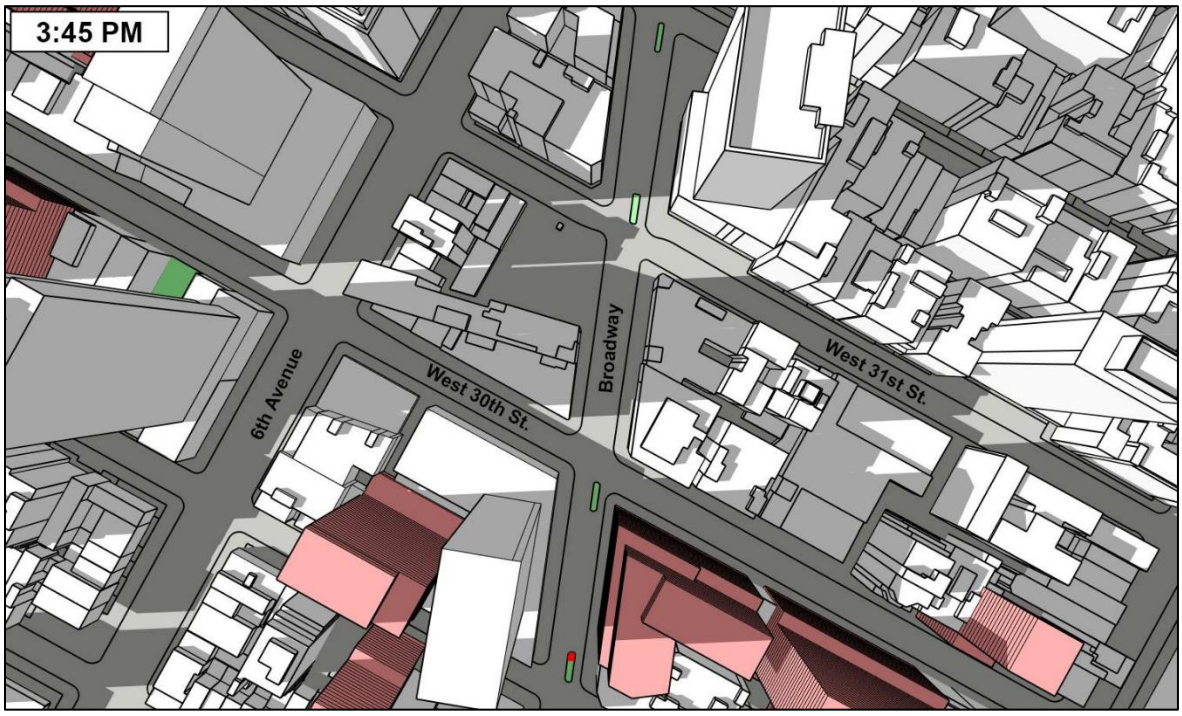


Figure 6-49 – Broadway between 29th and 32nd Streets – June 21





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space

Figure 6-50 – Broadway between 29th and 32nd Streets – June 21



Figure 6-51 – Broadway between 29th and 32nd Streets – December 21

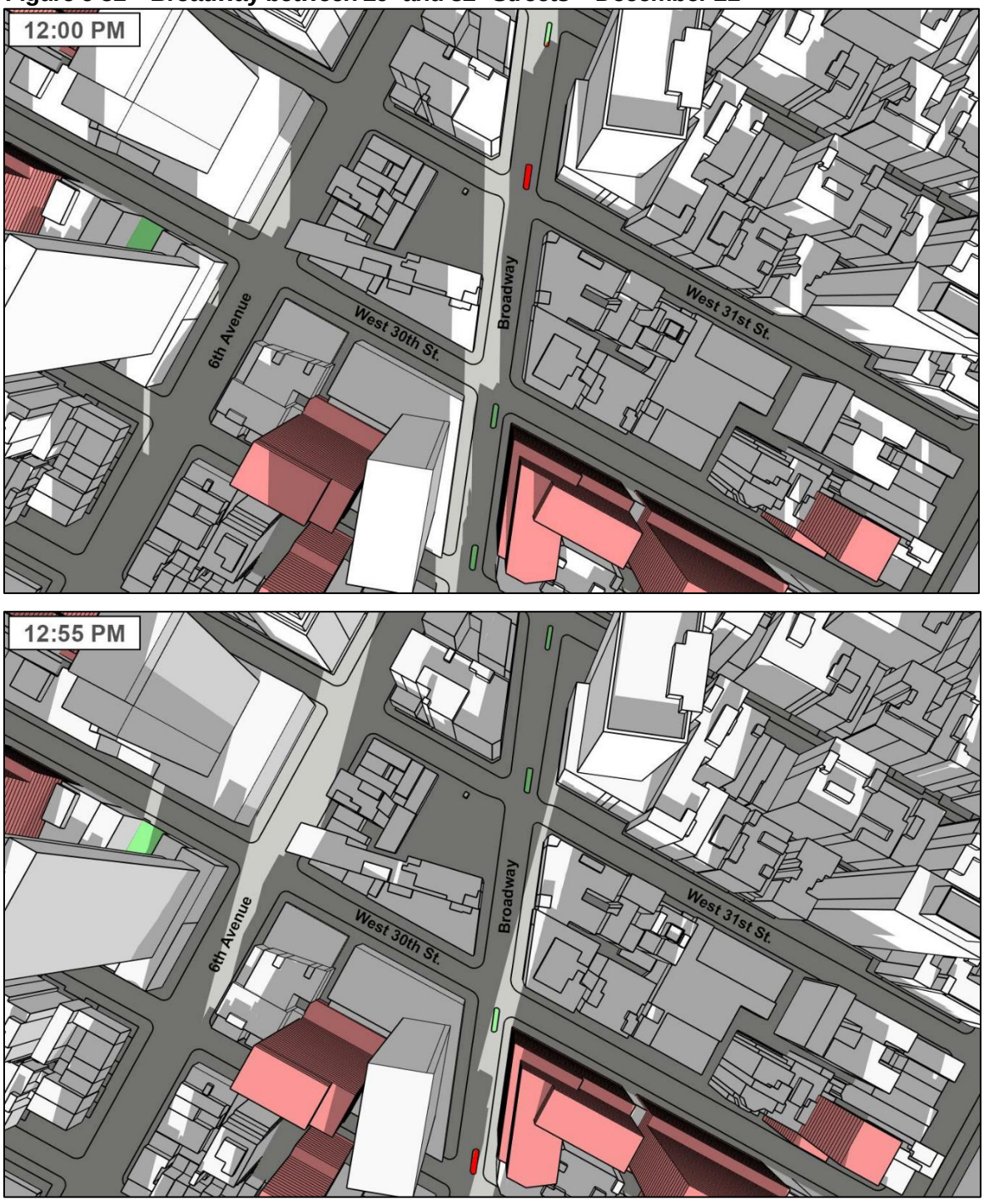
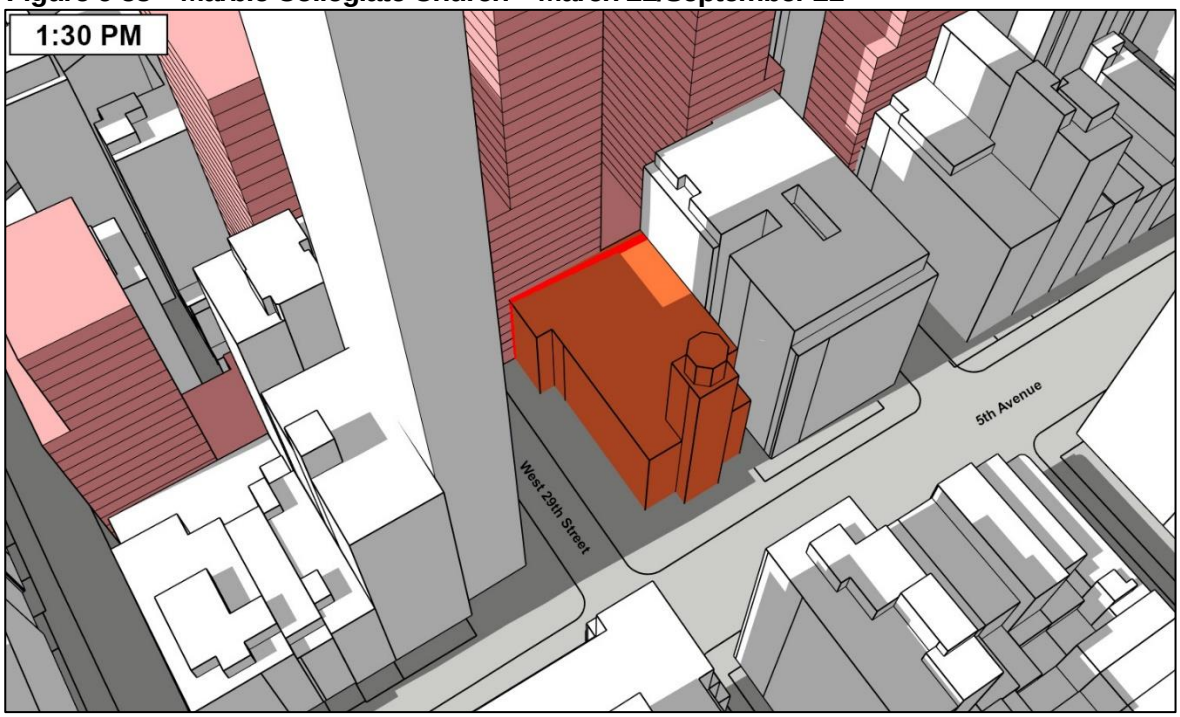
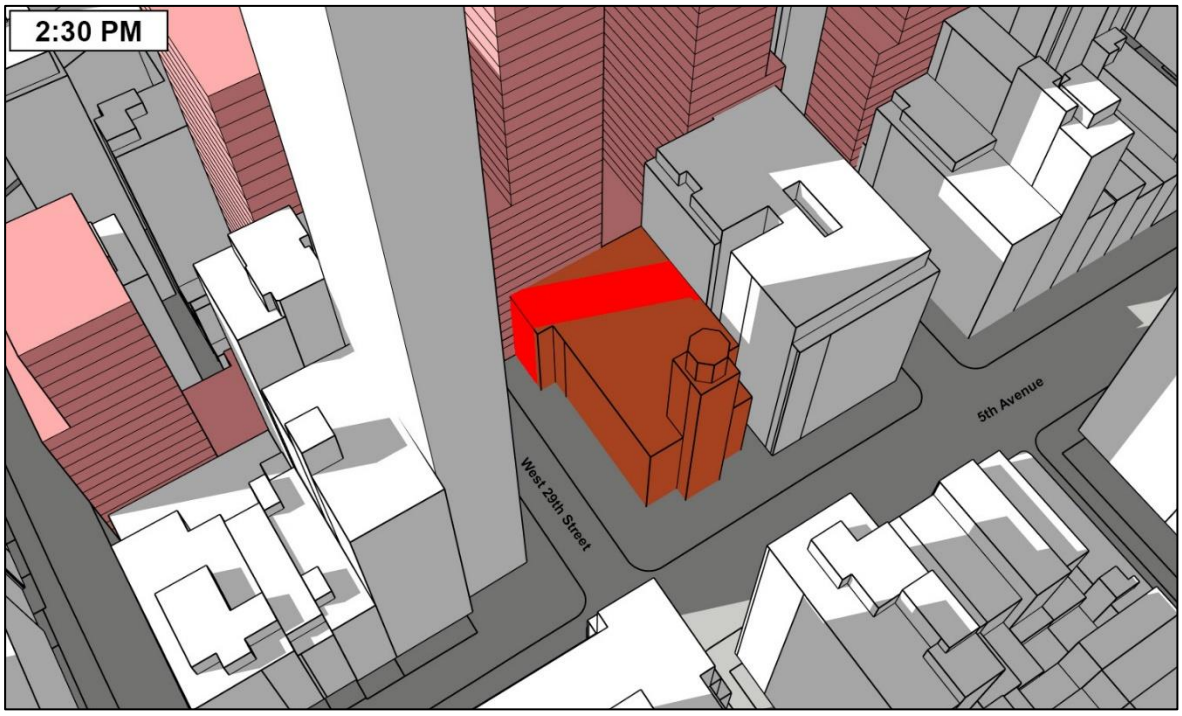


Figure 6-52: Herald Square – March 21/September 21



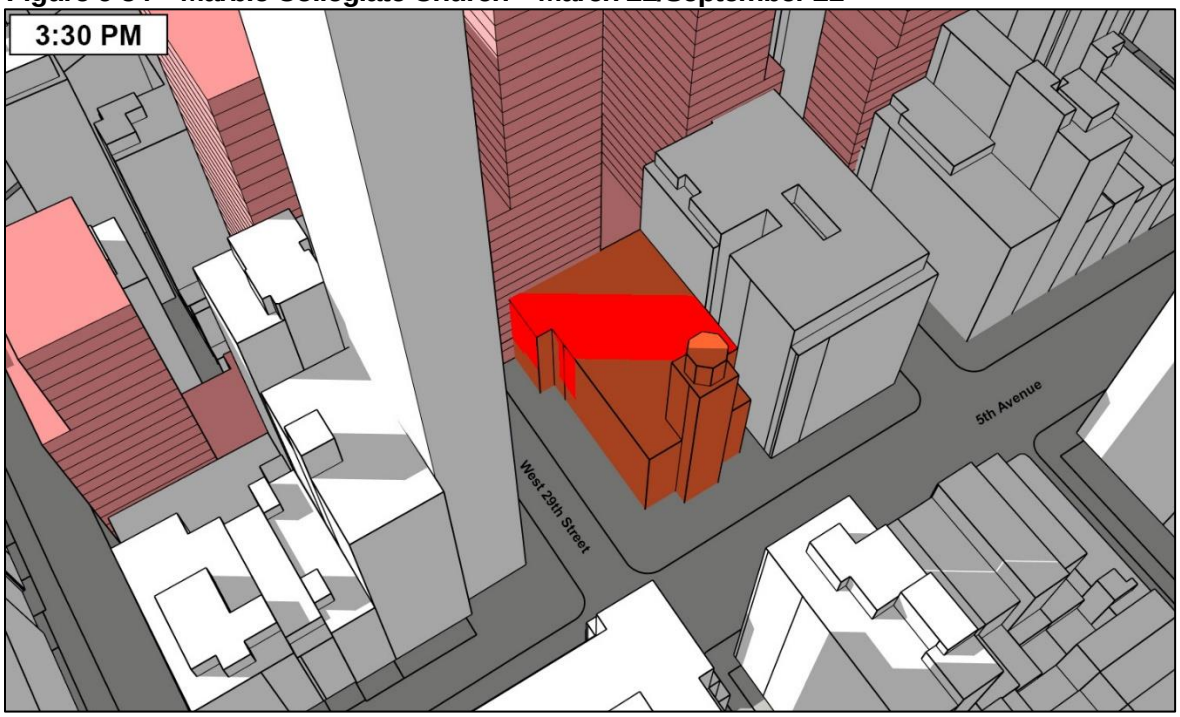
Figure 6-53 – Marble Collegiate Church – March 21/September 21

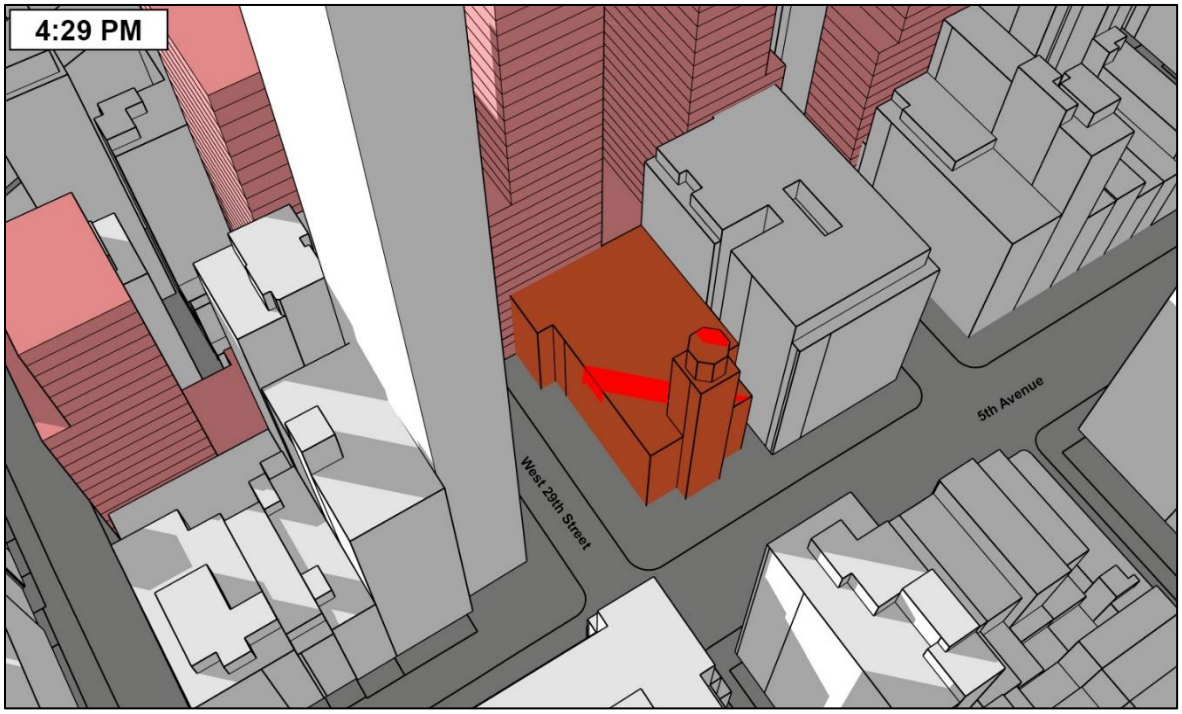




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

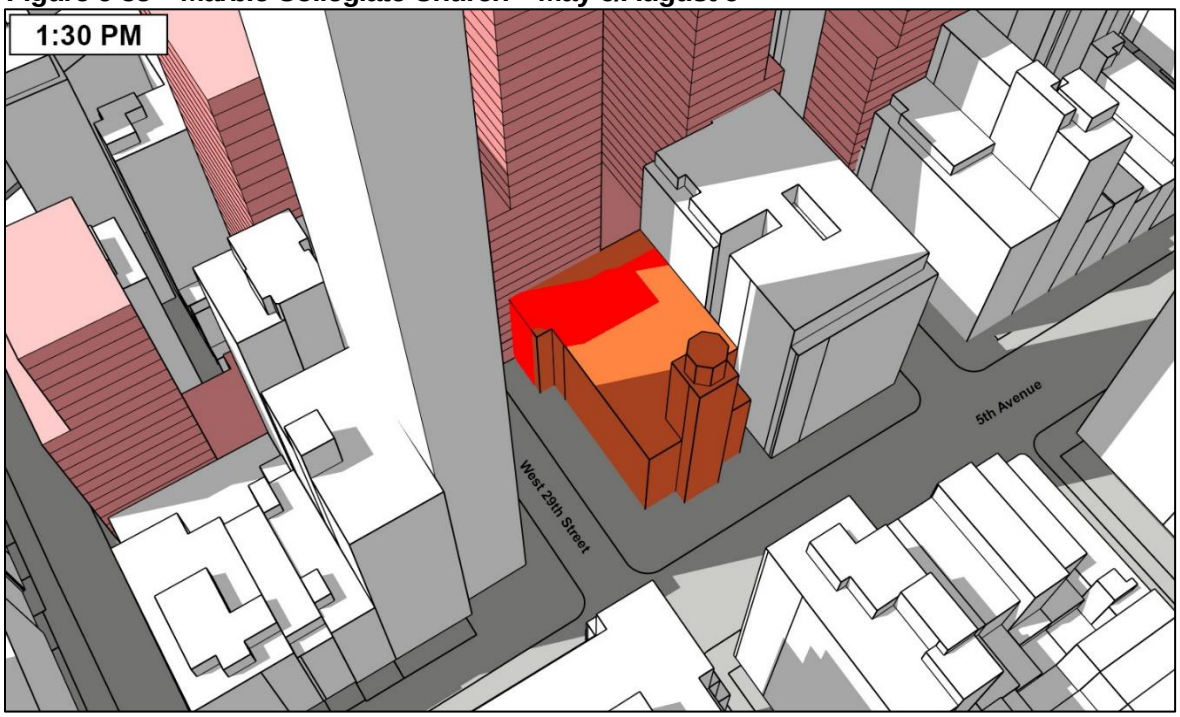
Figure 6-54 – Marble Collegiate Church – March 21/September 21

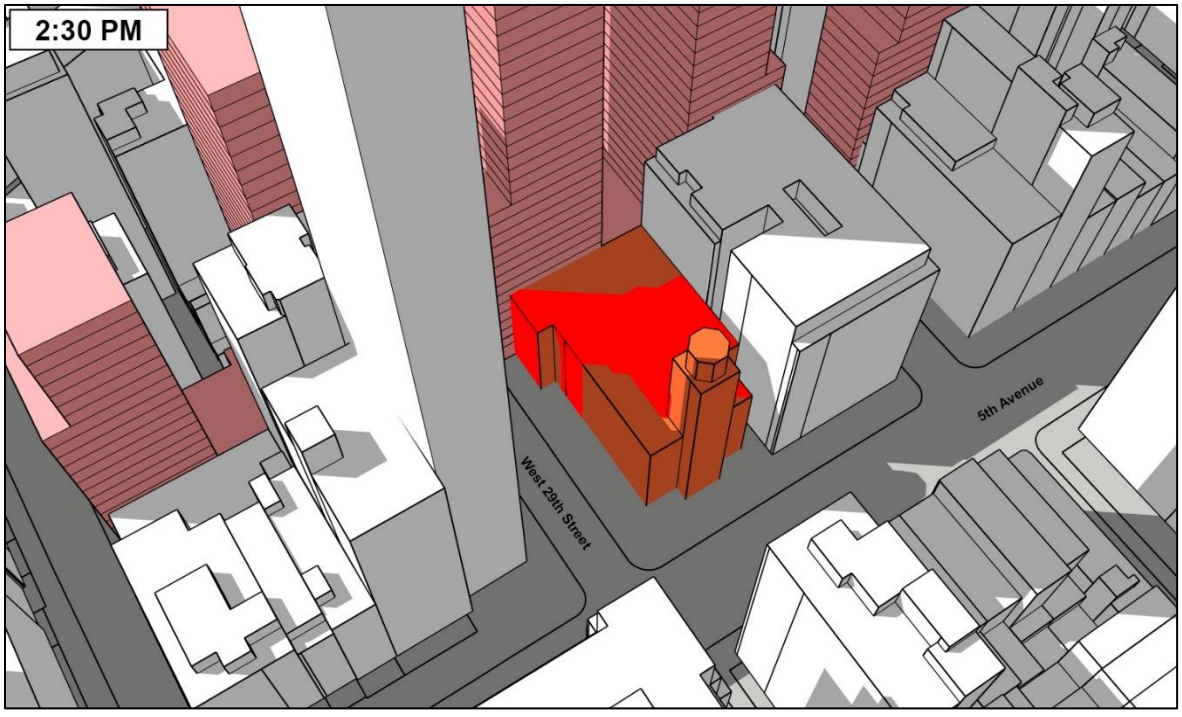




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

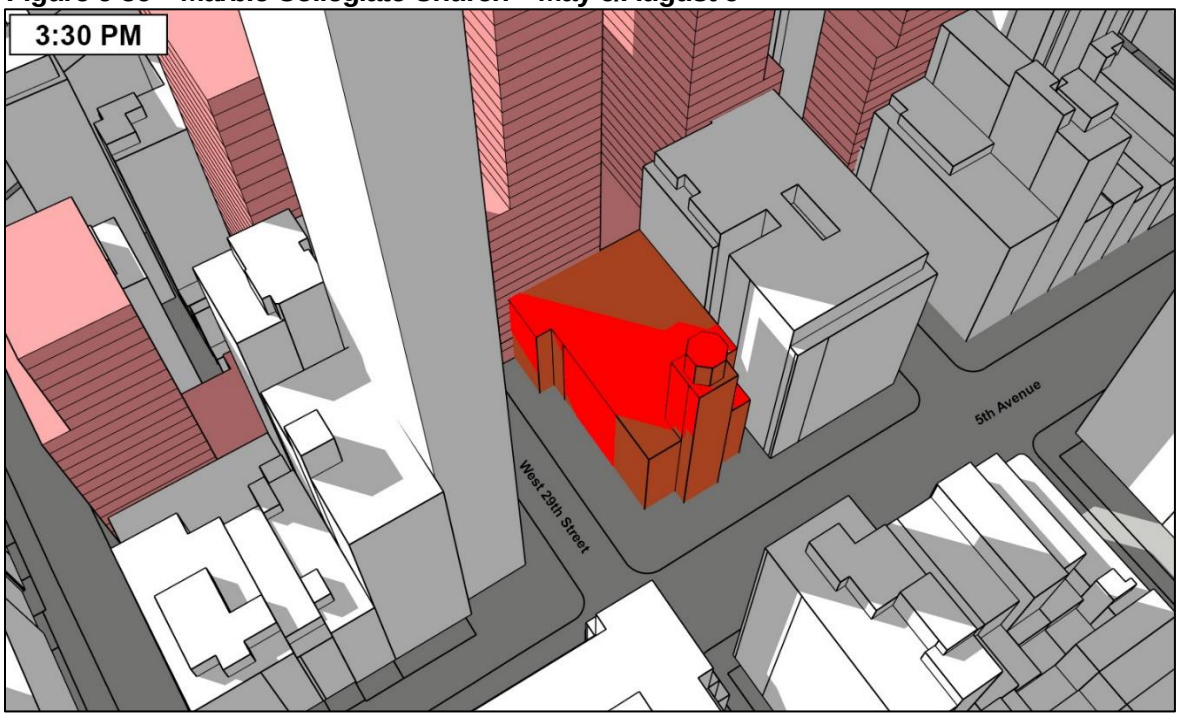
Figure 6-55 – Marble Collegiate Church – May 6/August 6

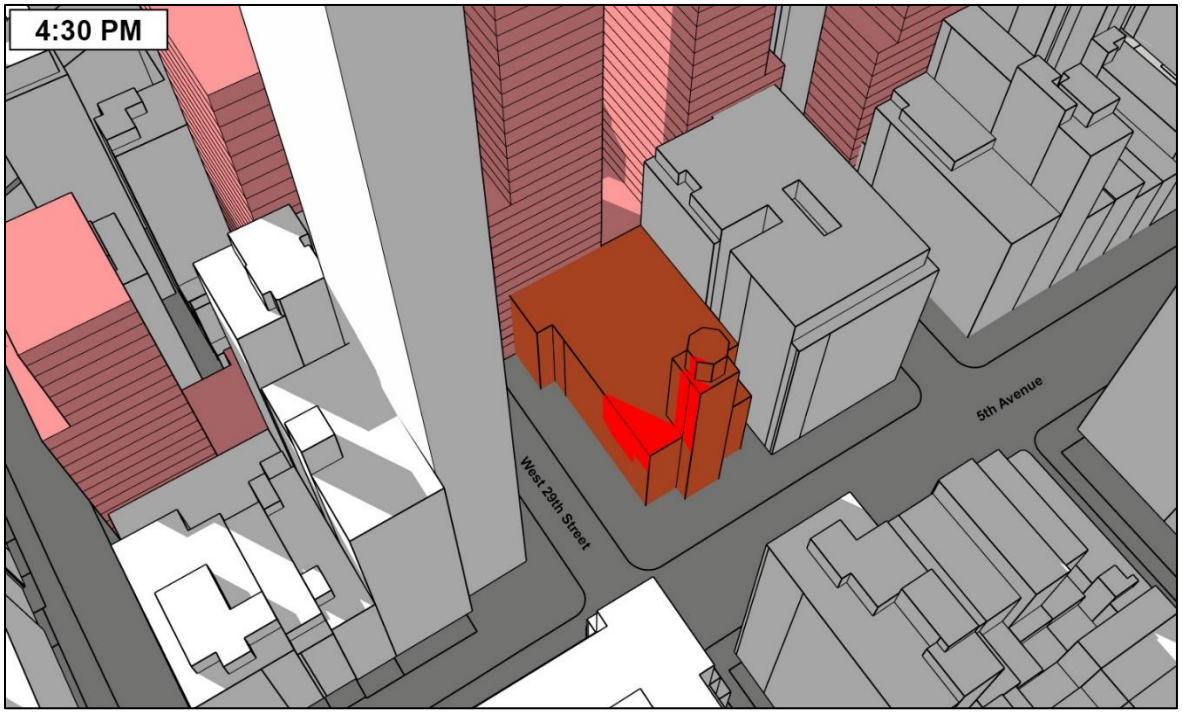




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

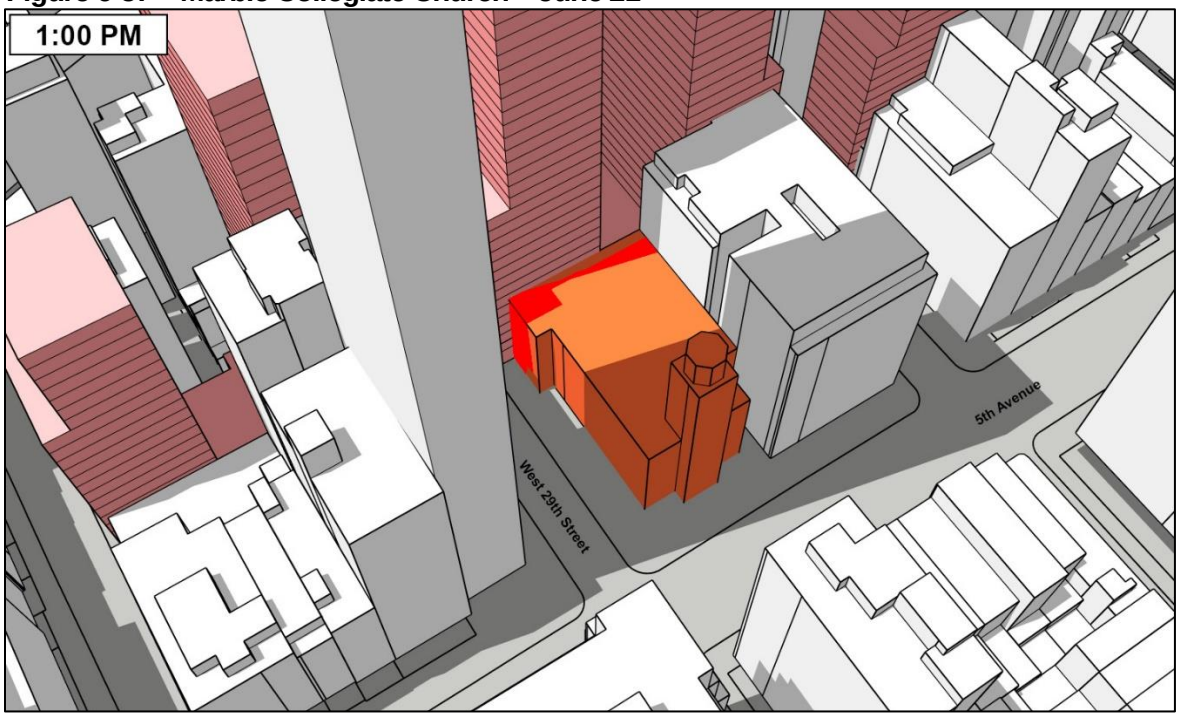
Figure 6-56 – Marble Collegiate Church – May 6/August 6

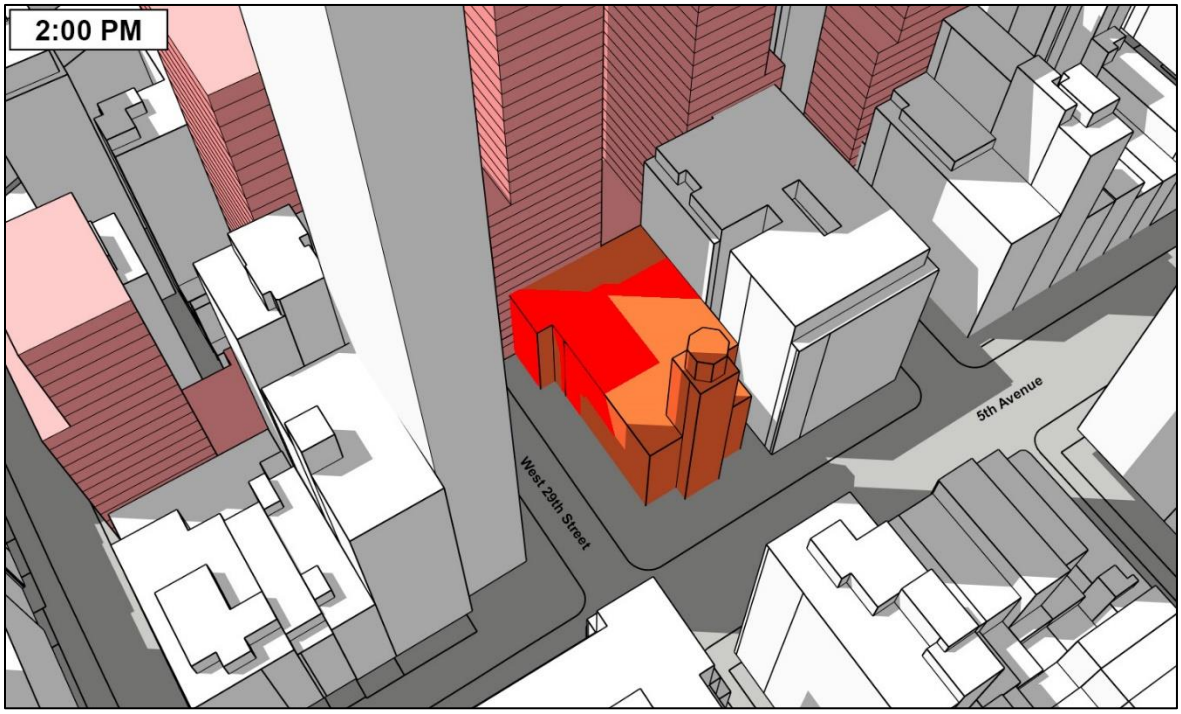




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

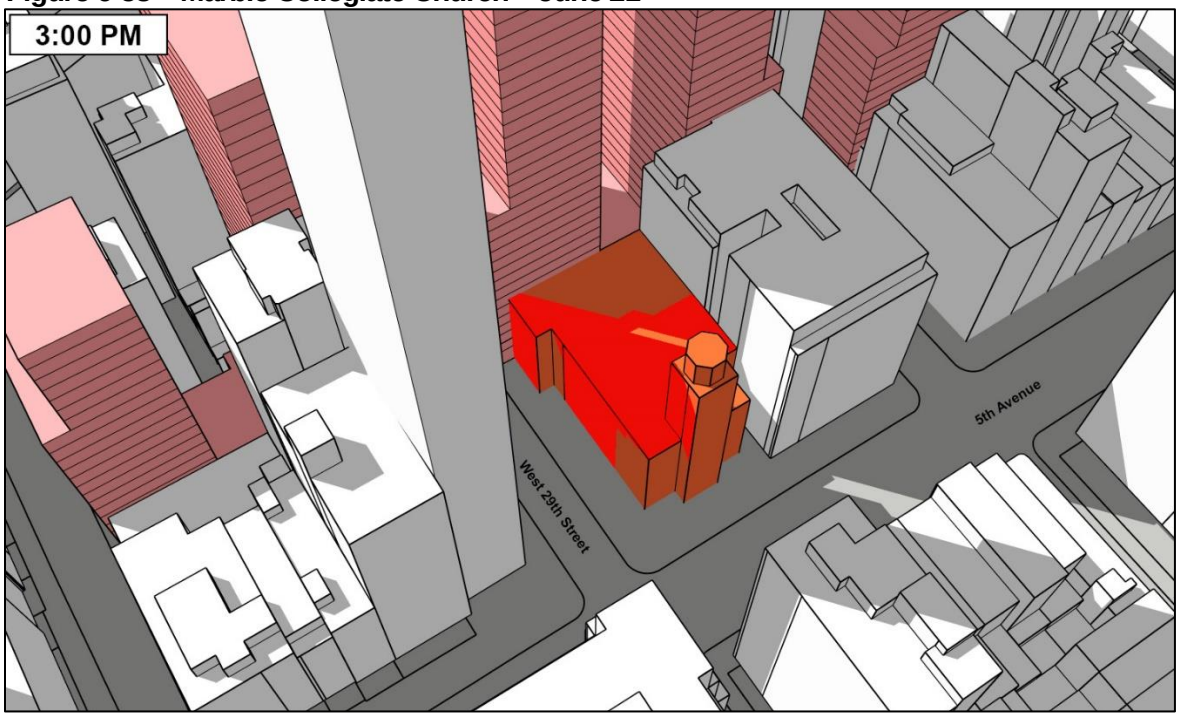
Figure 6-57 – Marble Collegiate Church – June 21

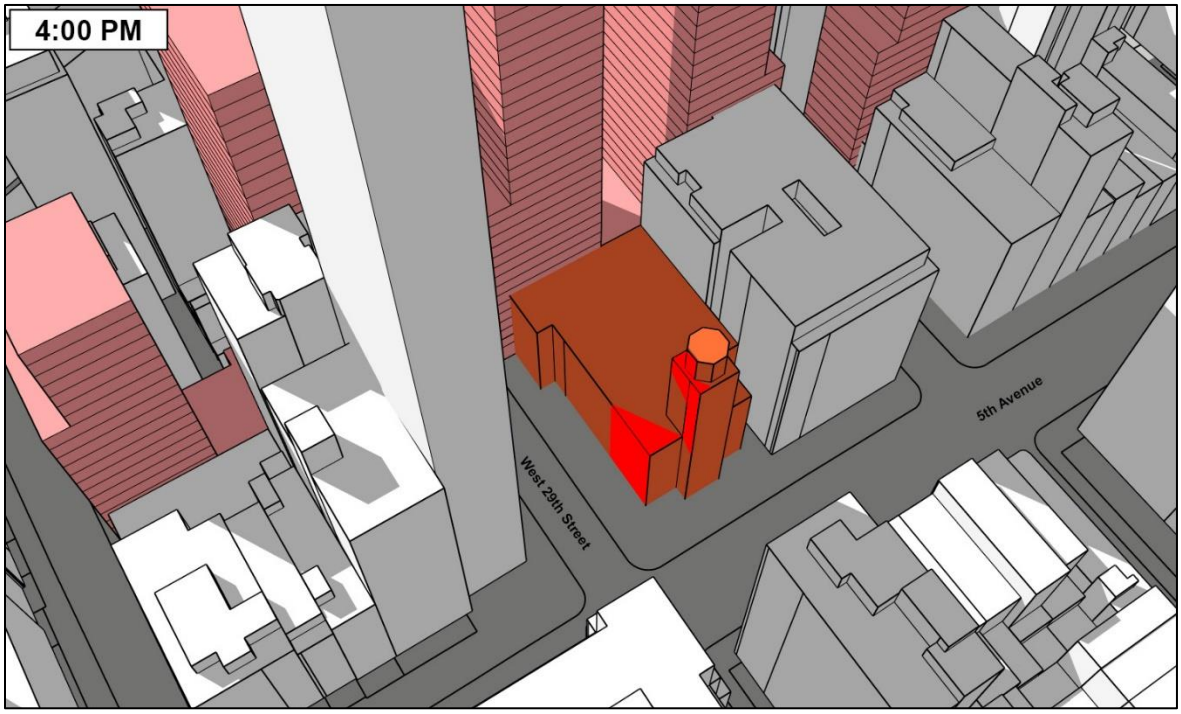




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

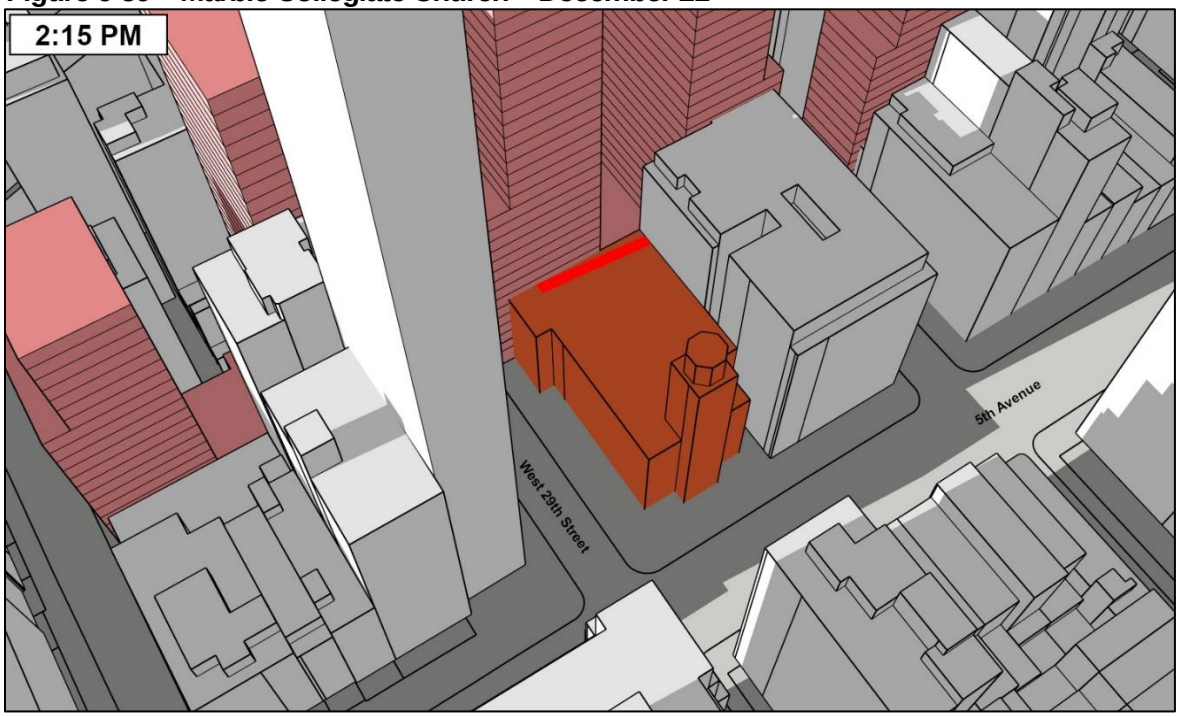
Figure 6-58 – Marble Collegiate Church – June 21

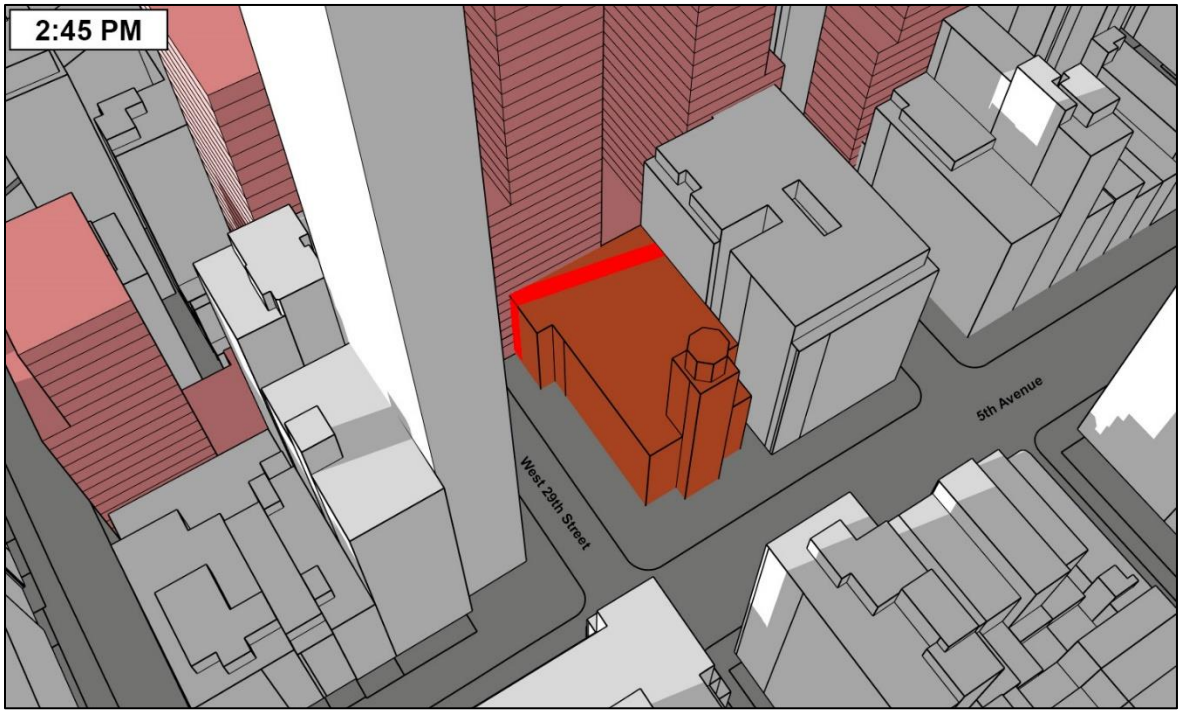




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-59 – Marble Collegiate Church – December 21





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-60 – Millinery Center Synagogue – March 21/September 21

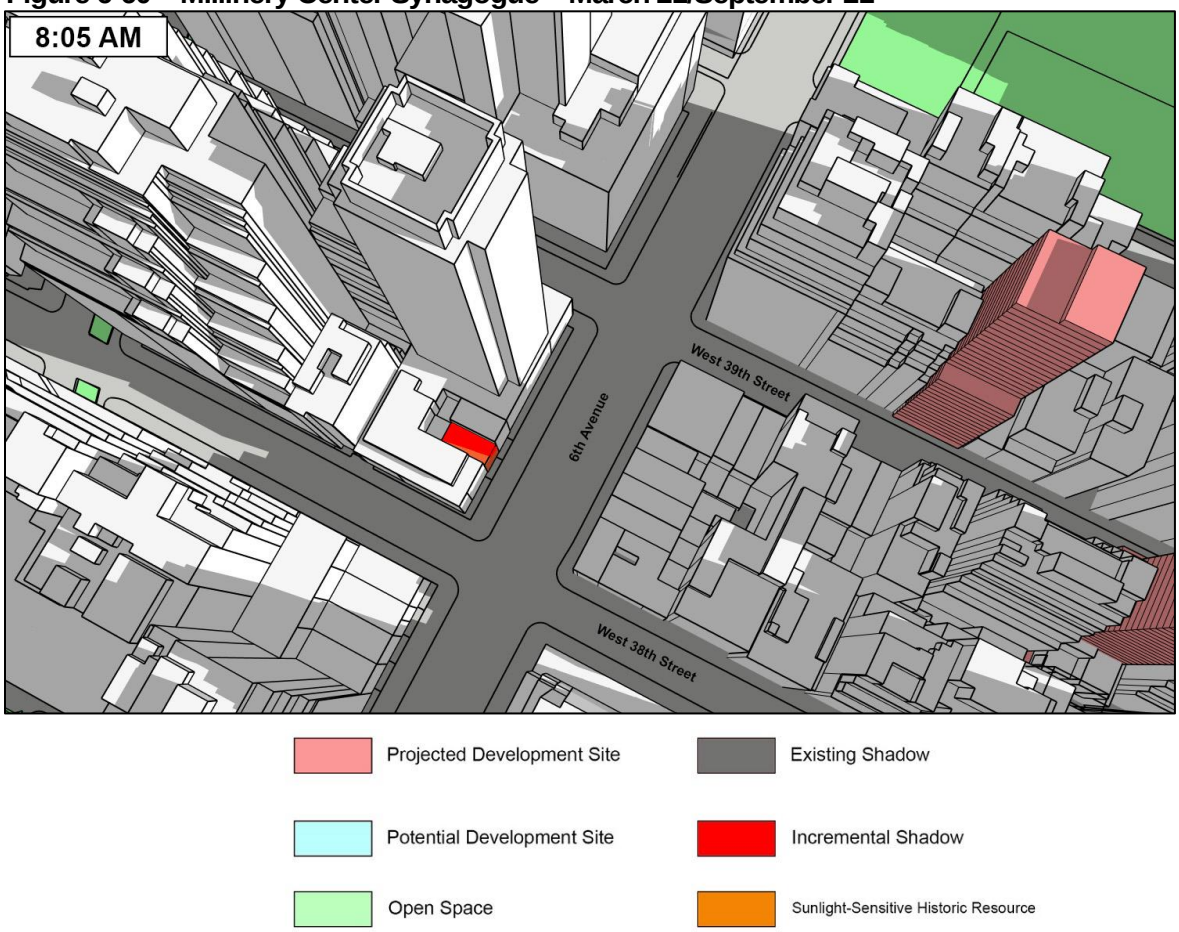
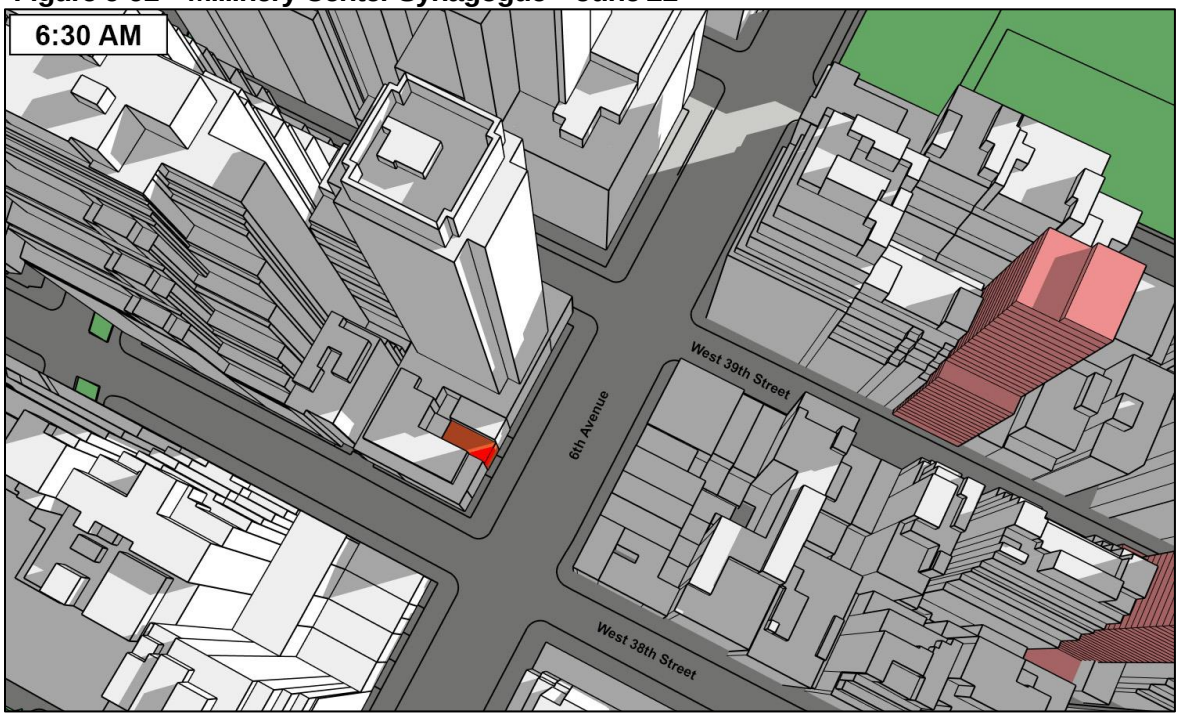
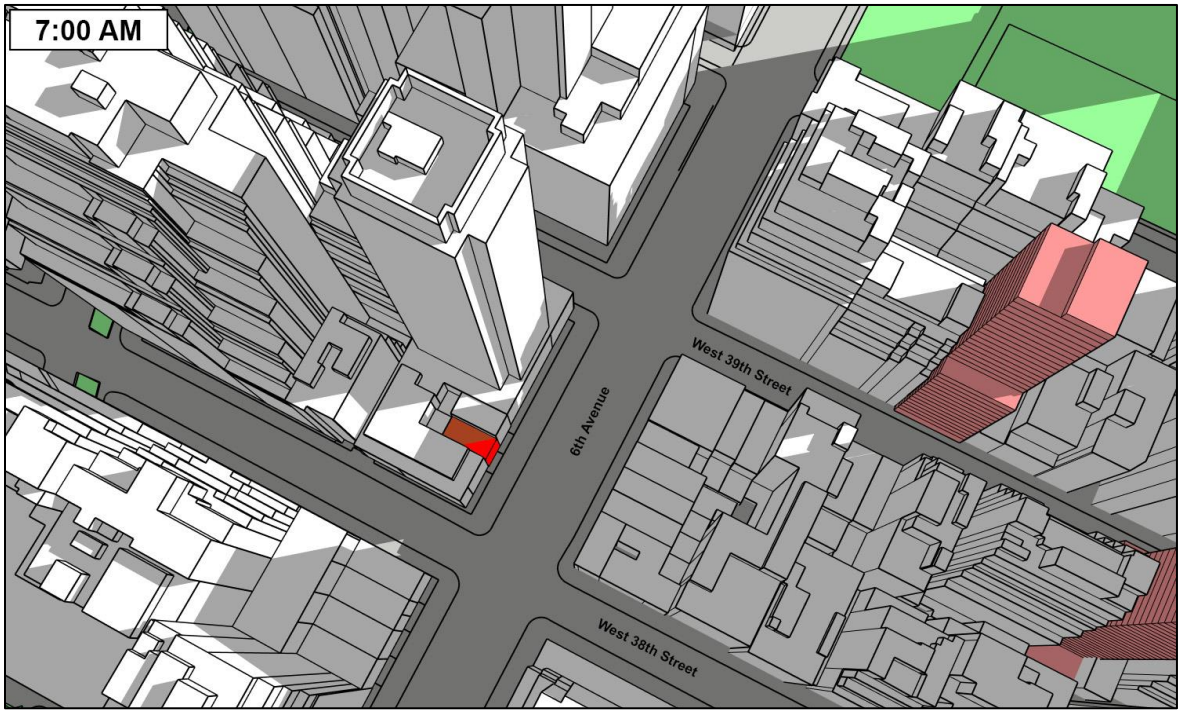


Figure 6-61 – Millinery Center Synagogue – June 21



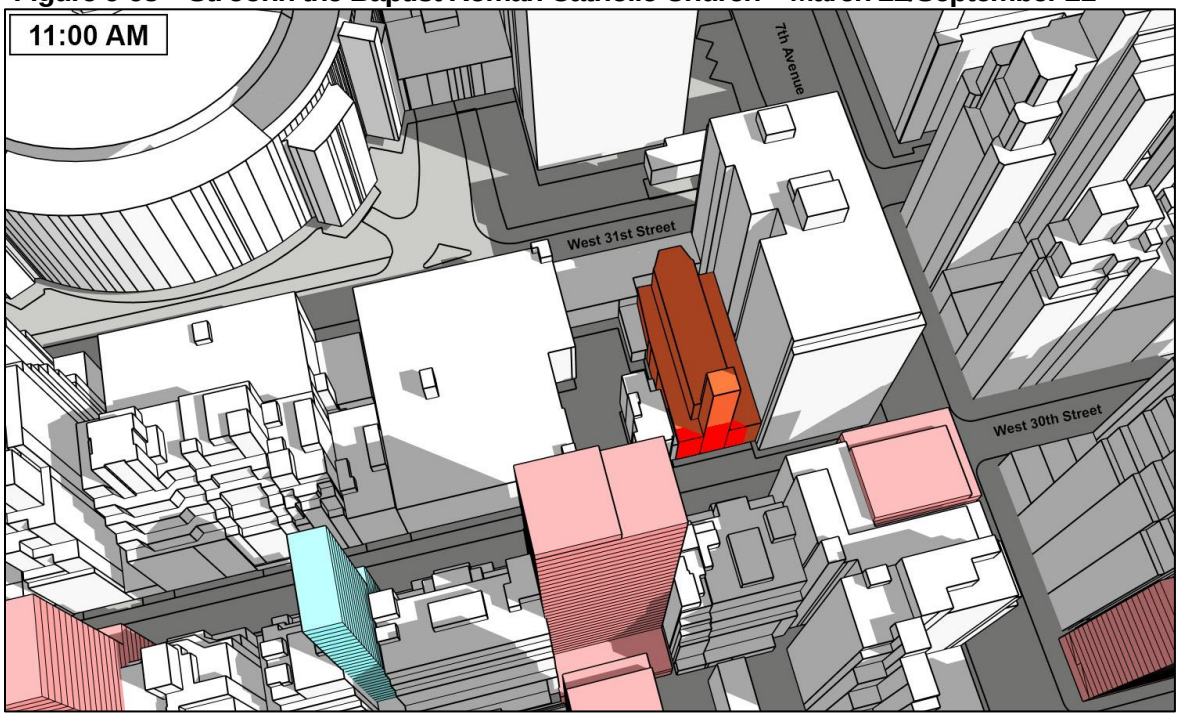


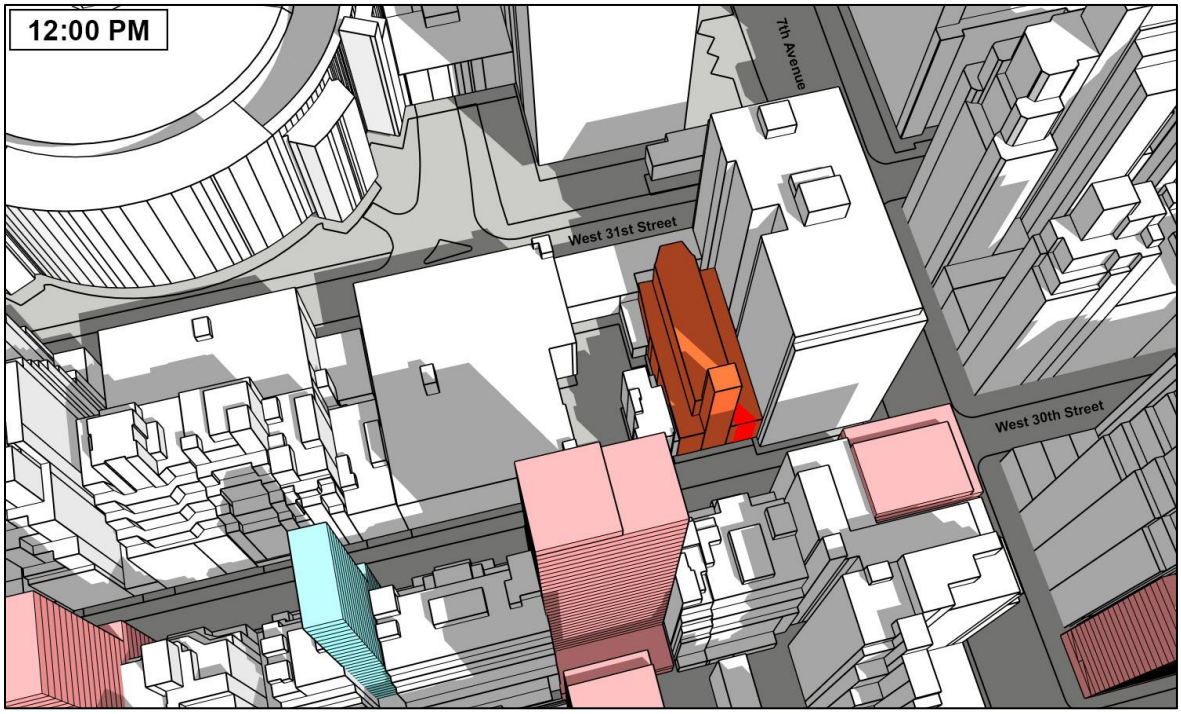
Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-62 – Millinery Center Synagogue – December 21



Figure 6-63 – St. John the Baptist Roman Catholic Church – March 21/September 21

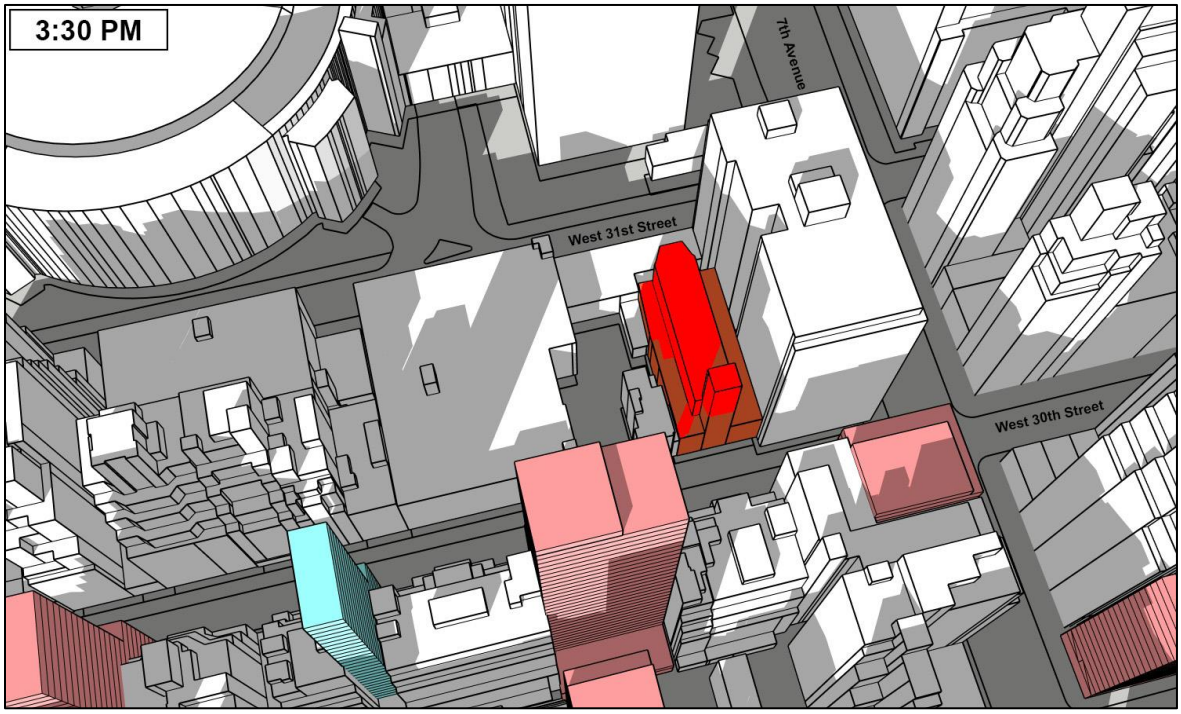




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-64 – St. John the Baptist Roman Catholic Church – March 21/September 21





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-65 – St. John the Baptist Roman Catholic Church – March 21/September 21



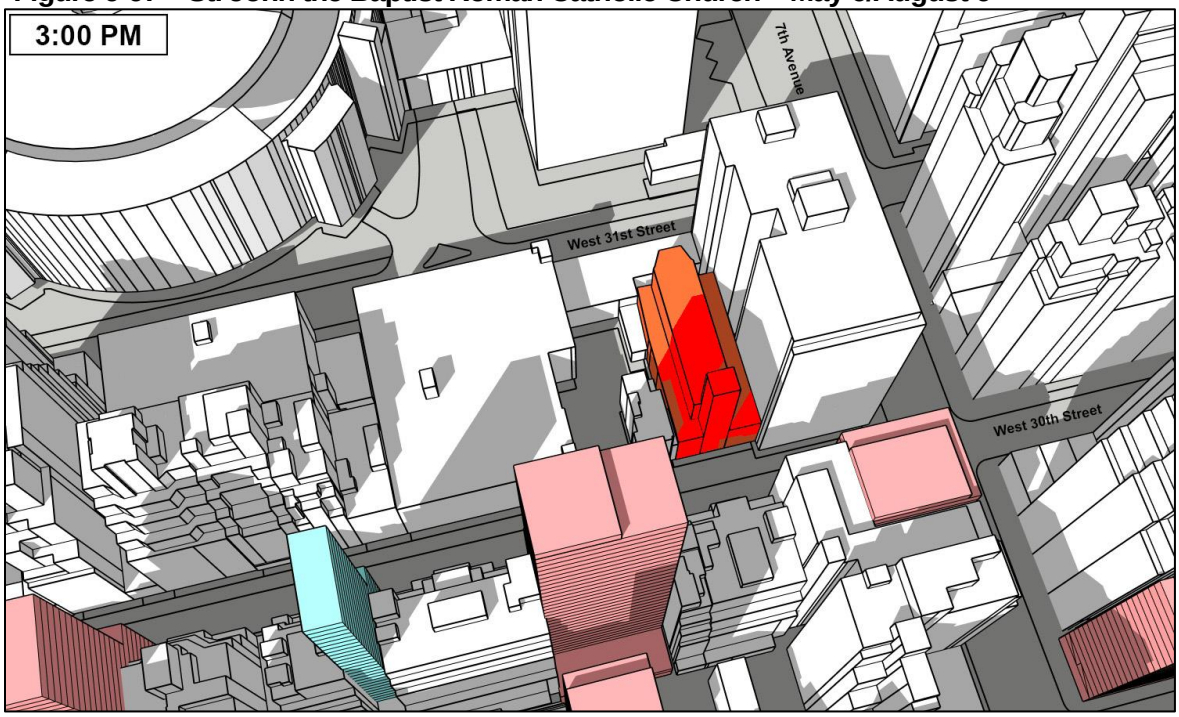
Figure 6-66 – St. John the Baptist Roman Catholic Church – May 6/August 6

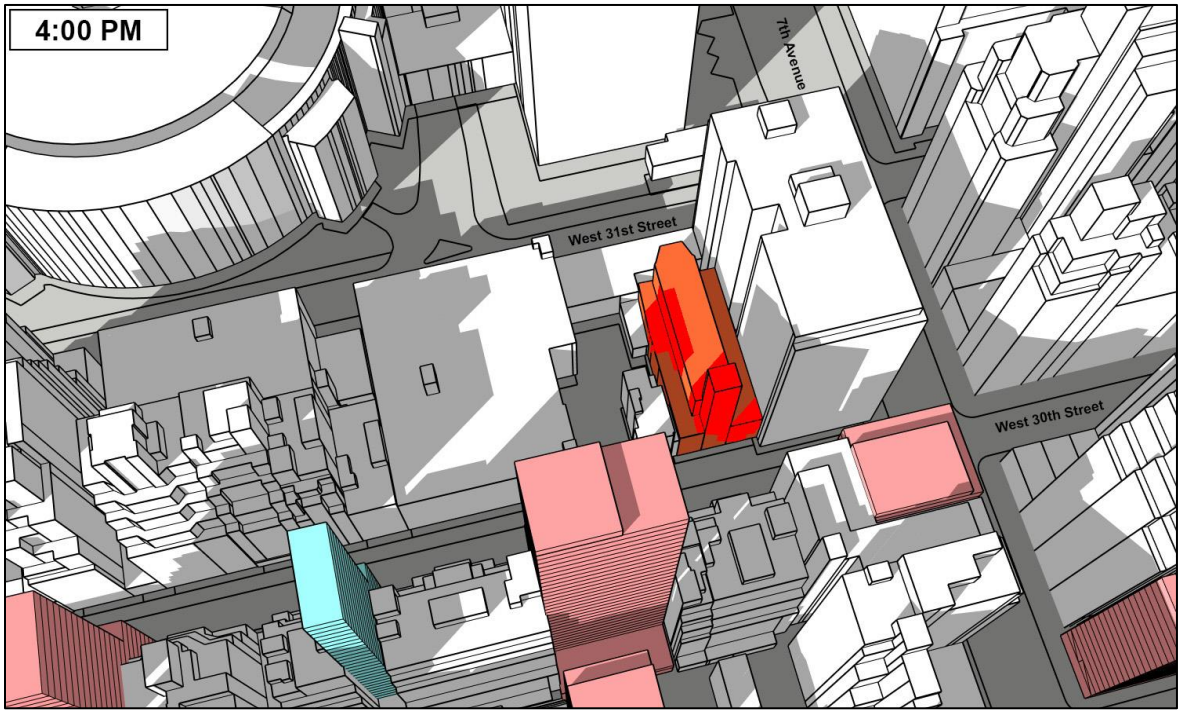




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-67 – St. John the Baptist Roman Catholic Church – May 6/August 6





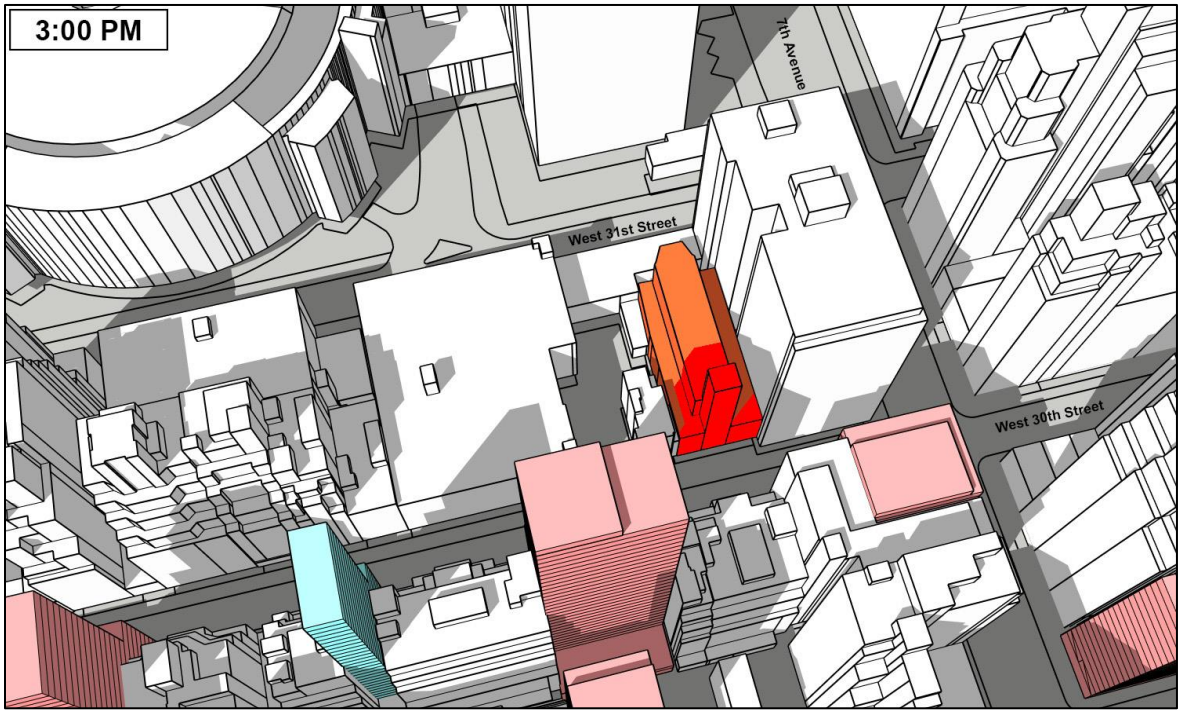
Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-68 – St. John the Baptist Roman Catholic Church – May 6/August 6



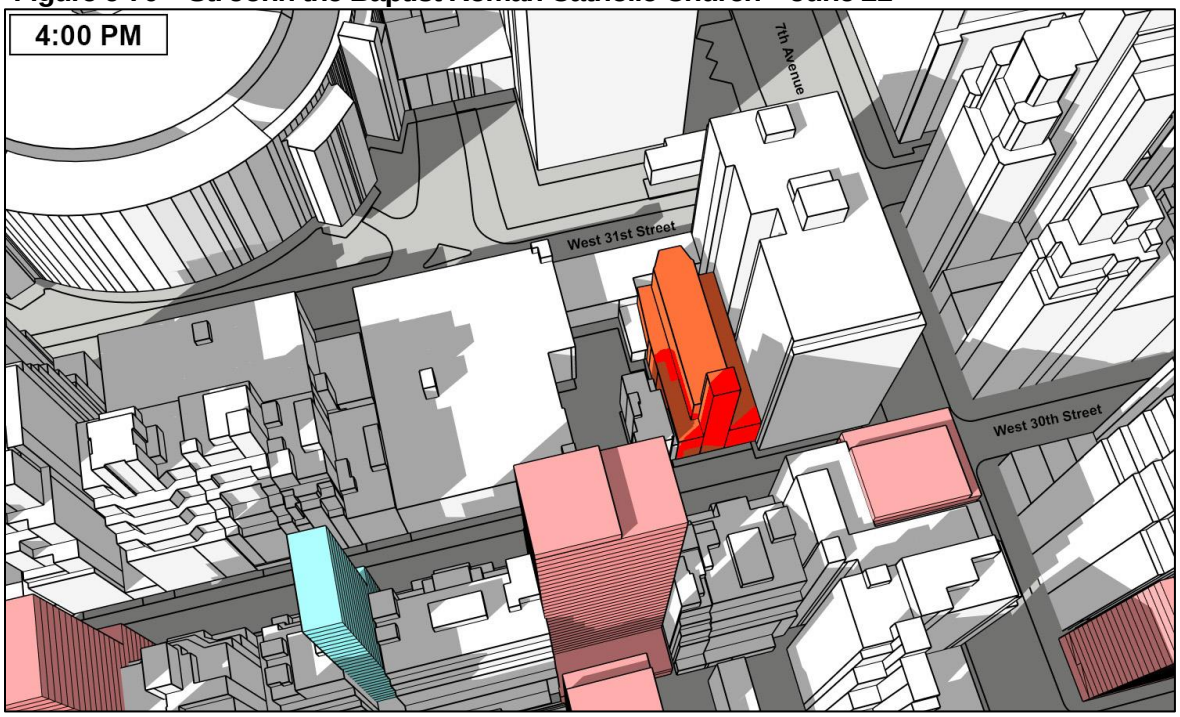
Figure 6-69 – St. John the Baptist Roman Catholic Church – June 21

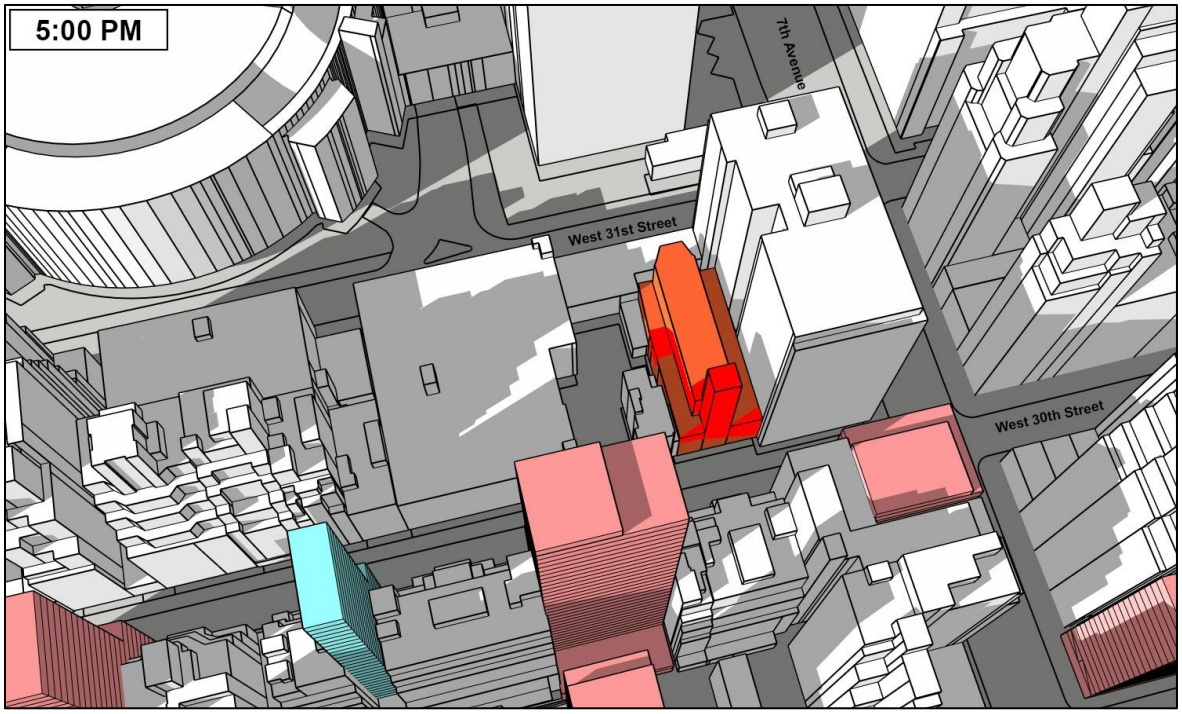




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-70 – St. John the Baptist Roman Catholic Church – June 21



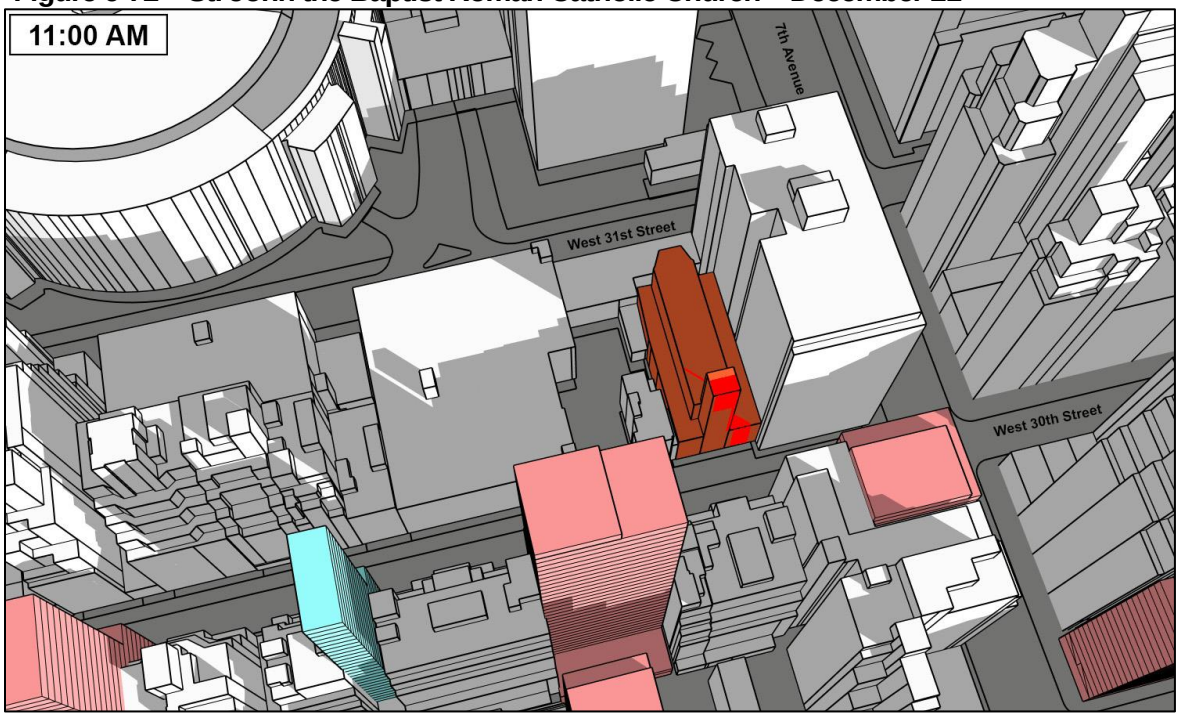


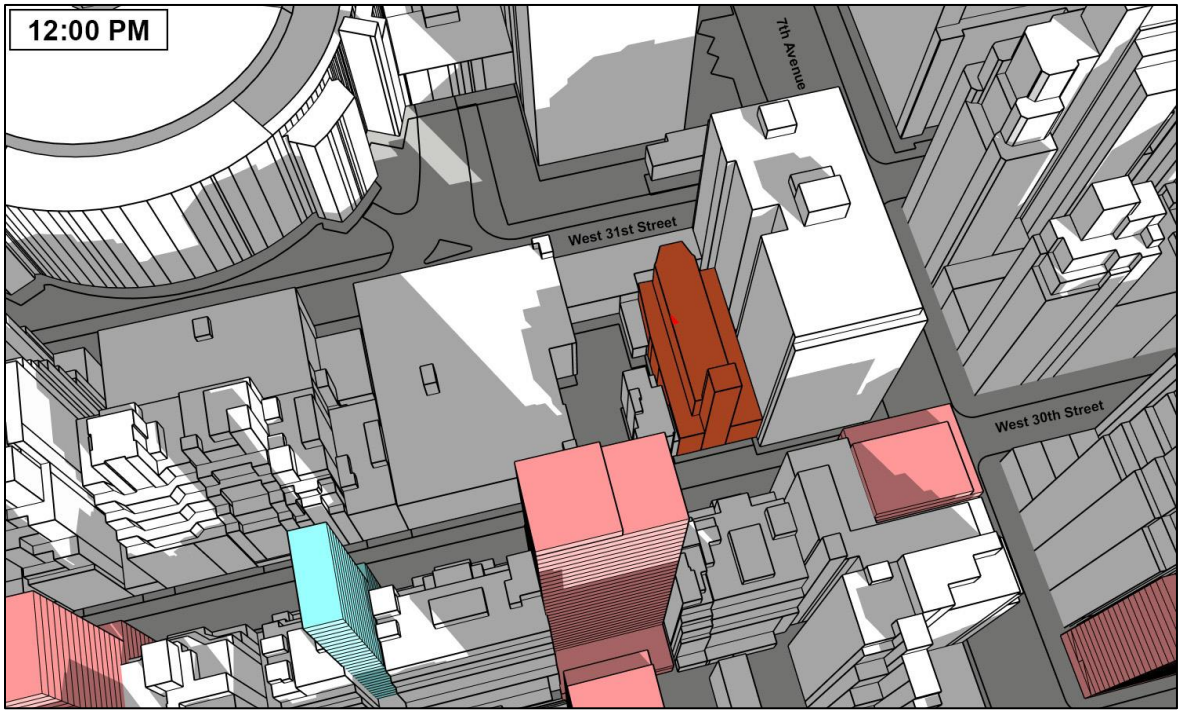
Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-71 – St. John the Baptist Roman Catholic Church – June 21



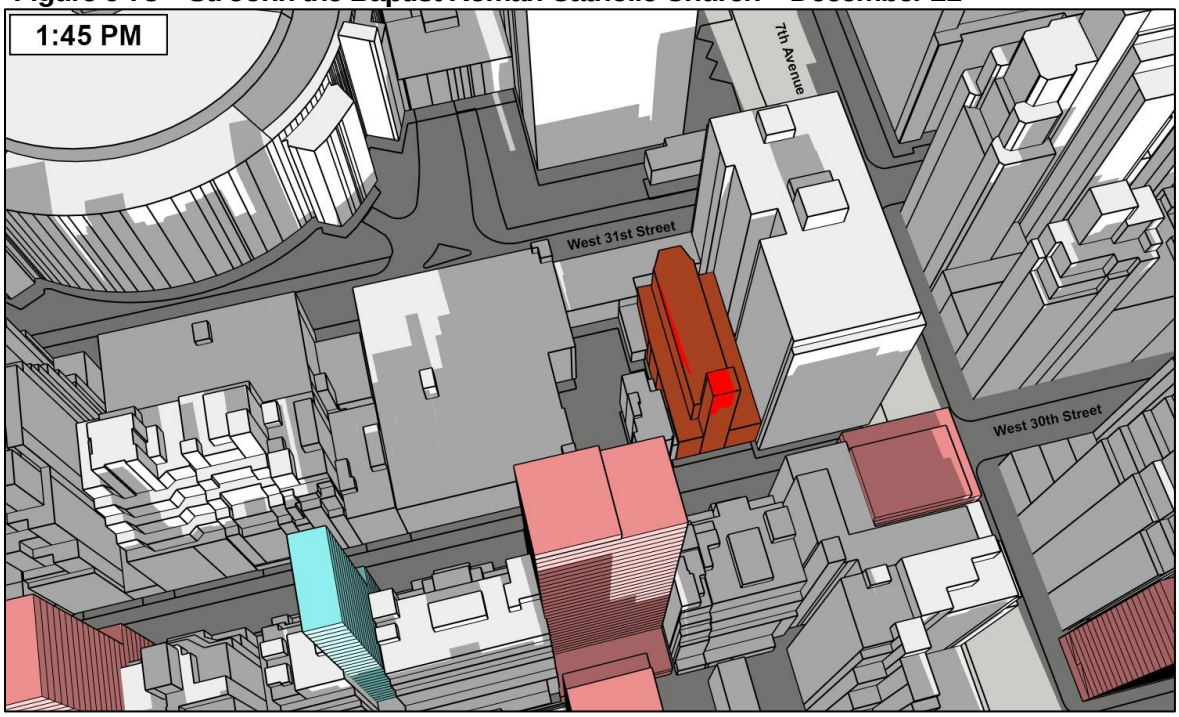
Figure 6-72 – St. John the Baptist Roman Catholic Church – December 21





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-73 – St. John the Baptist Roman Catholic Church – December 21

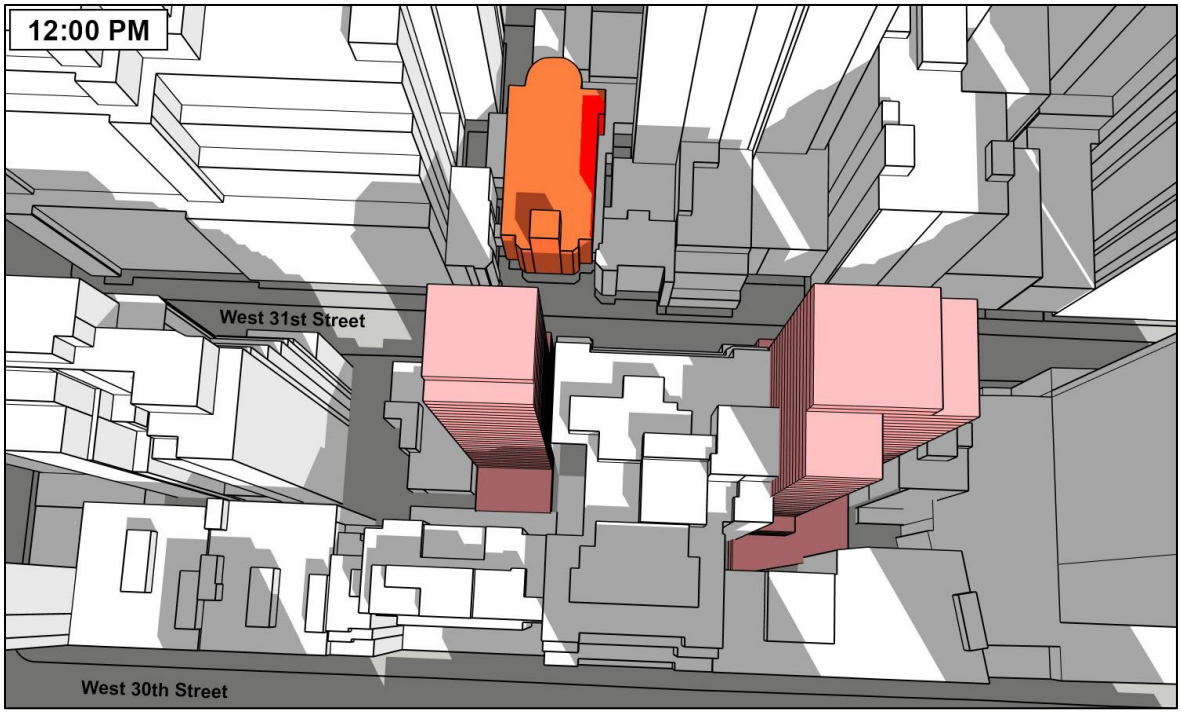




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

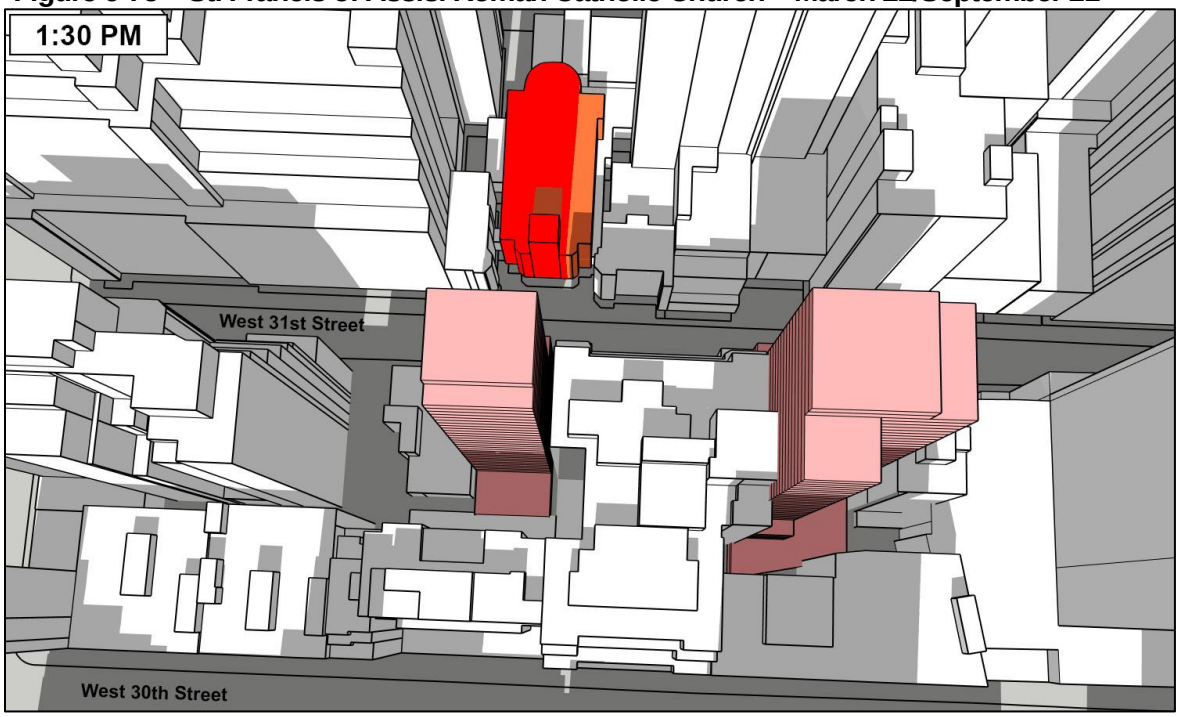
Figure 6-74 – St. Francis of Assisi Roman Catholic Church – March 21/September 21





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-75 – St. Francis of Assisi Roman Catholic Church – March 21/September 21



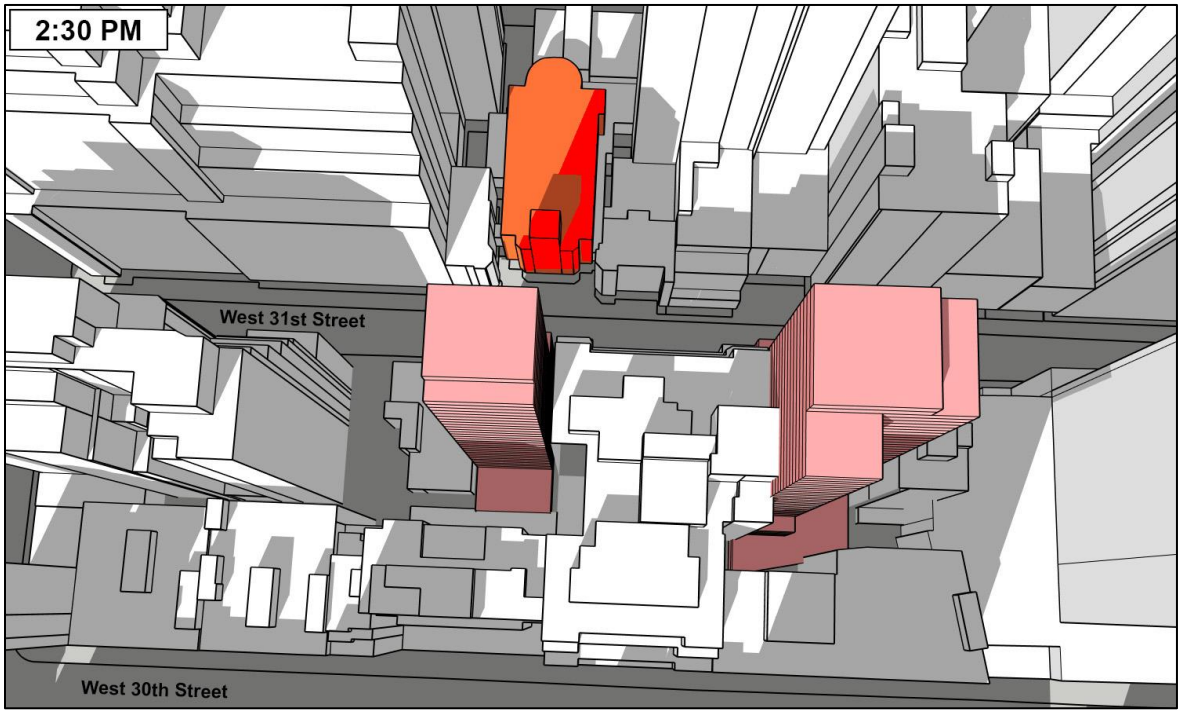




Figure 6-76 – St. Francis of Assisi Roman Catholic Church – March 21/September 21



Figure 6-77 – St. Francis of Assisi Roman Catholic Church – May 6/August 6







Figure 6-78 – St. Francis of Assisi Roman Catholic Church – May 6/August 6



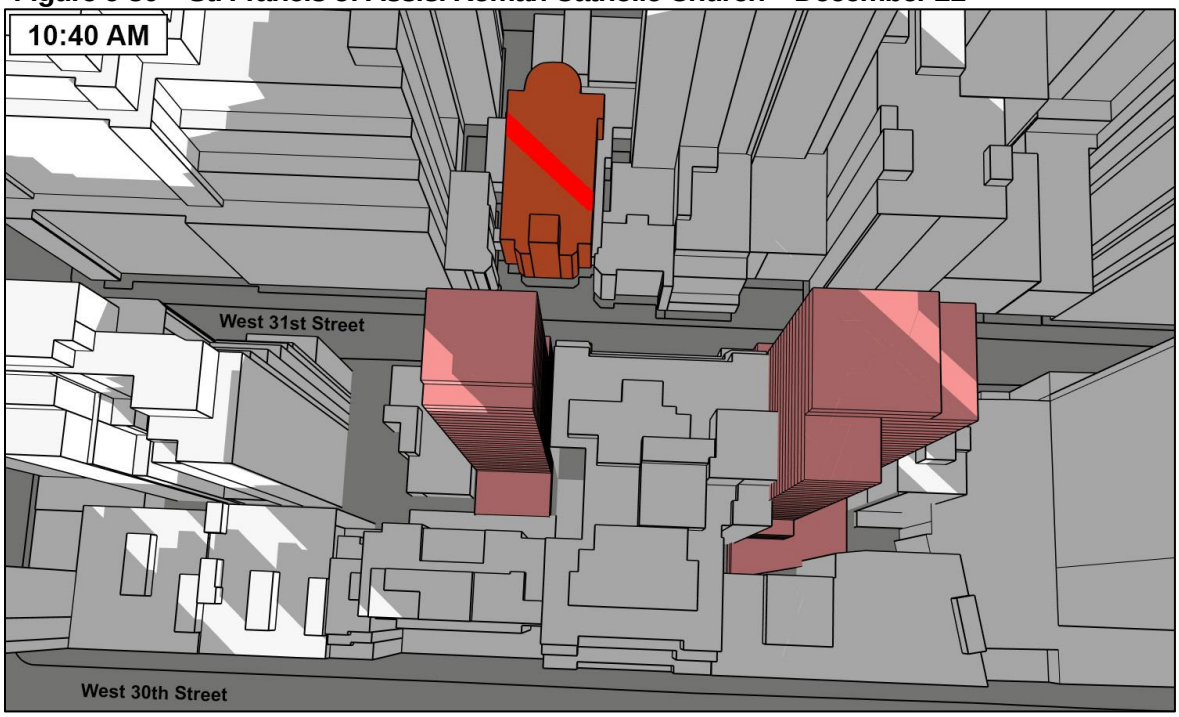
Figure 6-79 – St. Francis of Assisi Roman Catholic Church – June 21

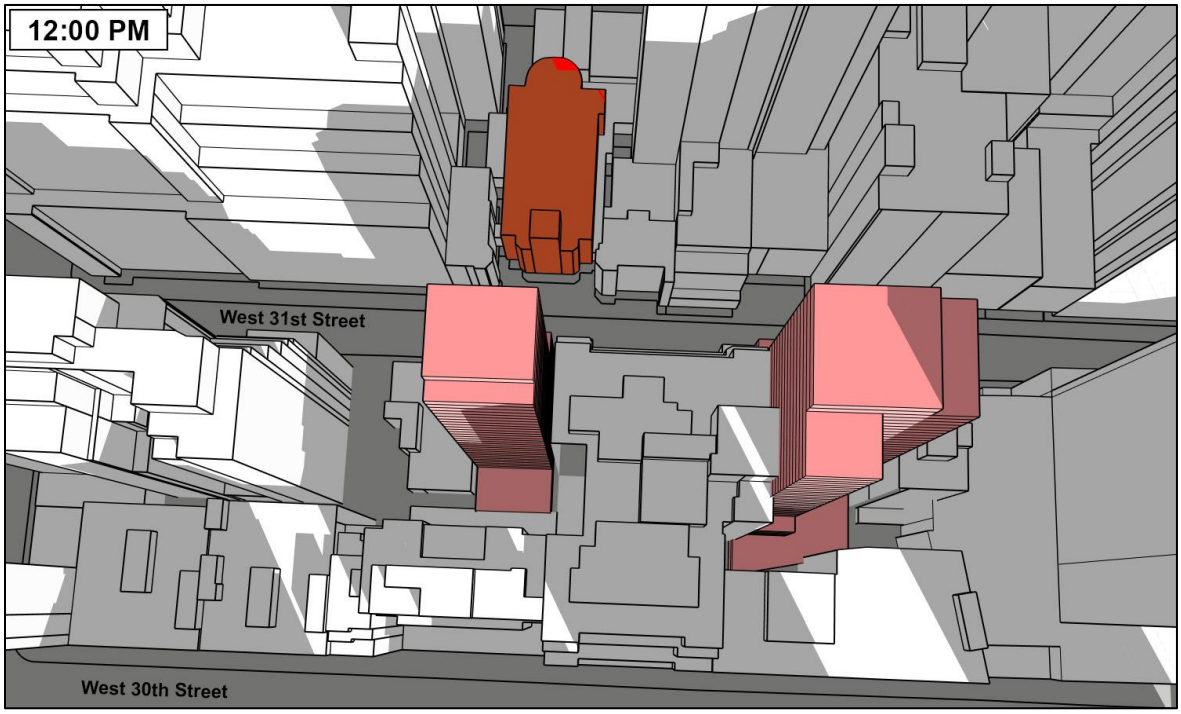






Figure 6-80 – St. Francis of Assisi Roman Catholic Church – December 21

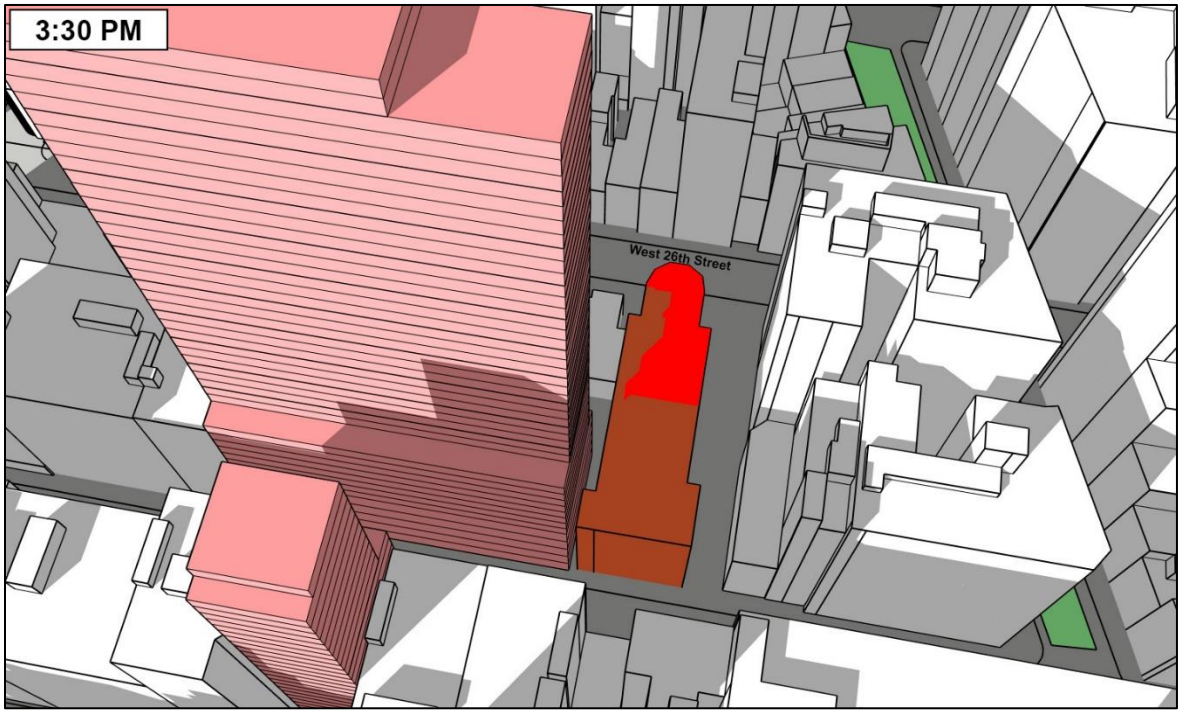




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-81 – Trinity Chapel – March 21/September 21





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-82 – Trinity Chapel – March 21/September 21

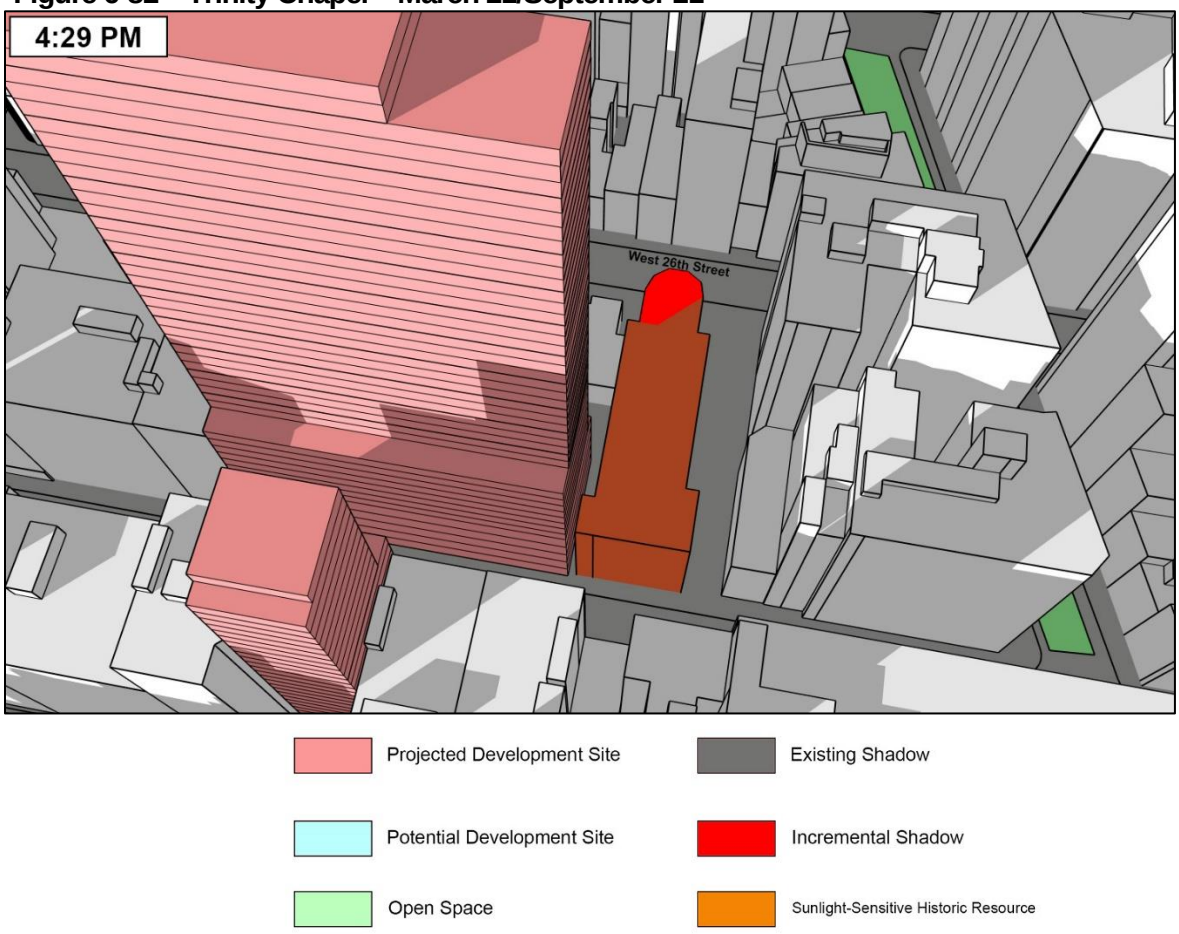
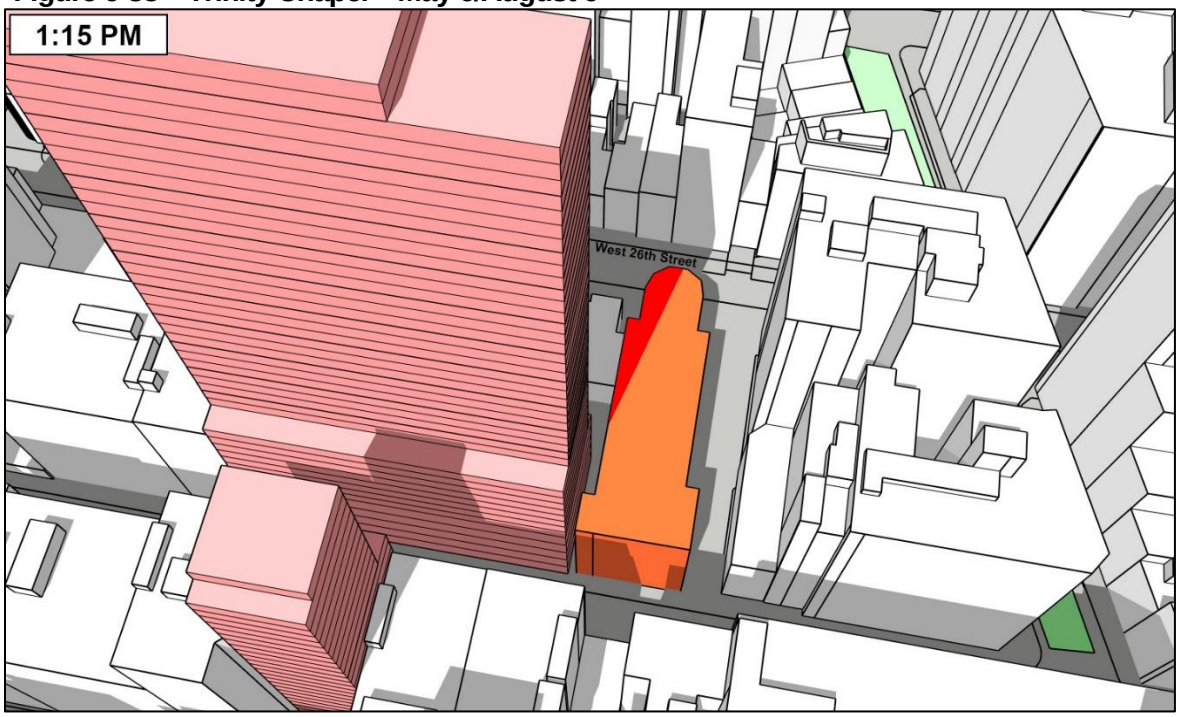


Figure 6-83 – Trinity Chapel – May 6/August 6

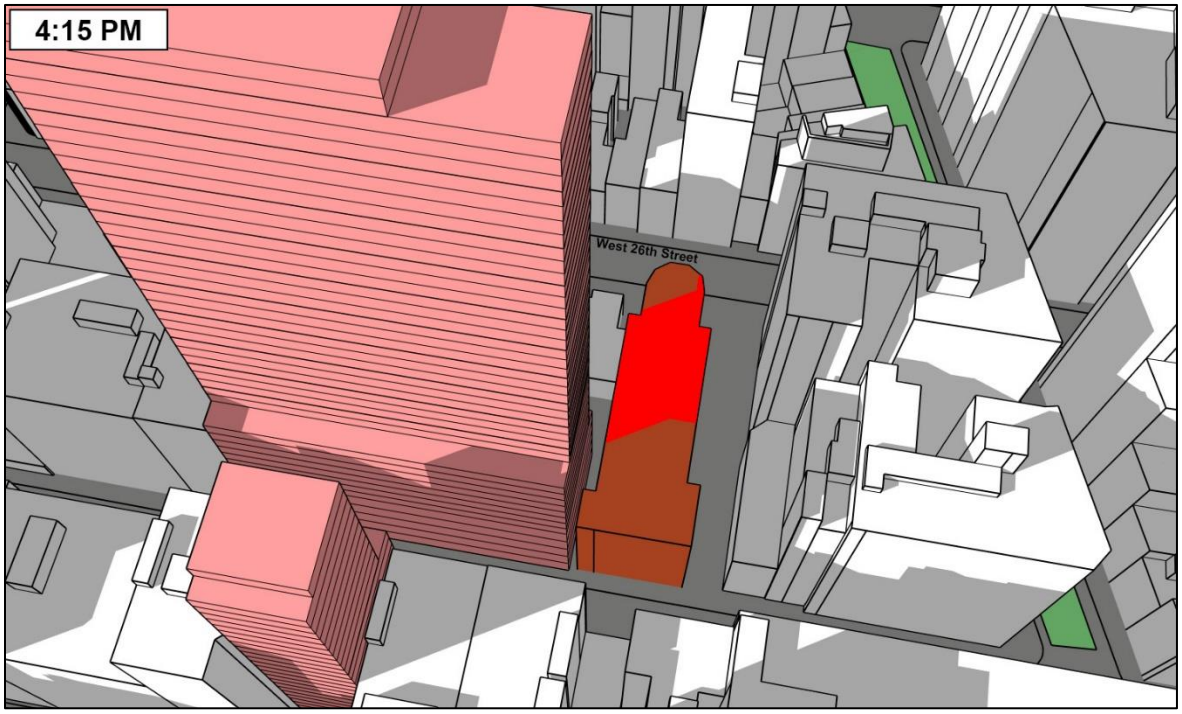




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-84 – Trinity Chapel – May 6/August 6





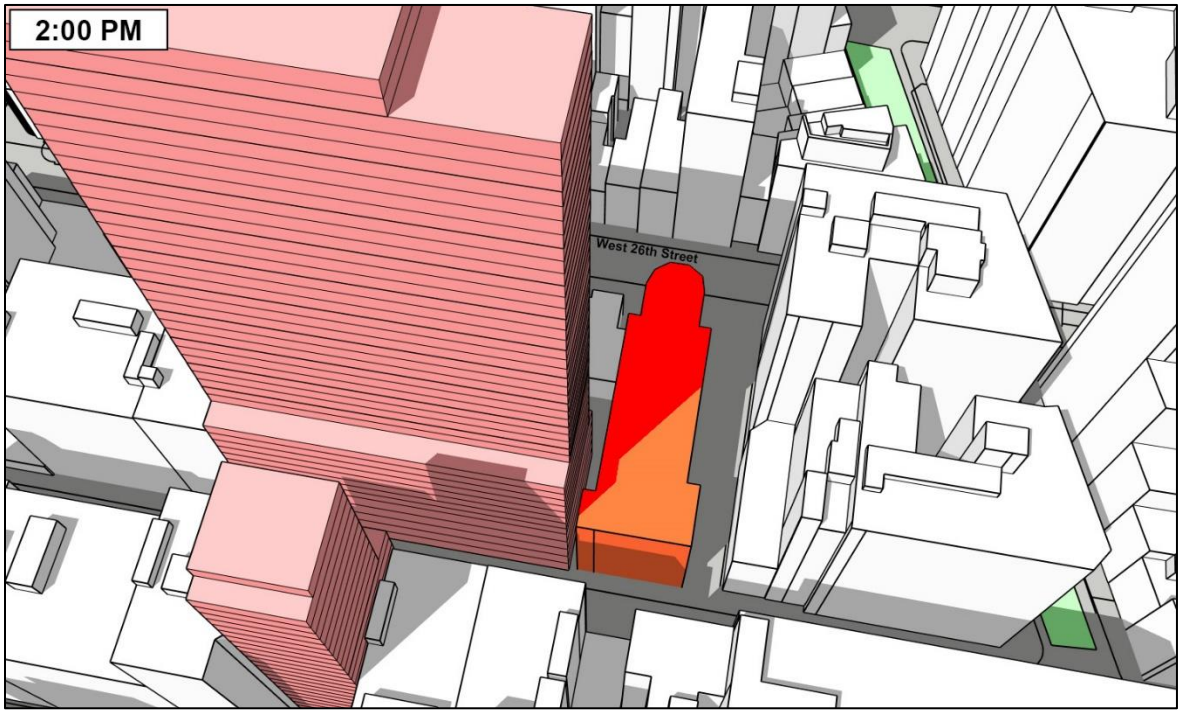
Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-85– Trinity Chapel – May 6/August 6



Figure 6-86 – Trinity Chapel – June 21





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

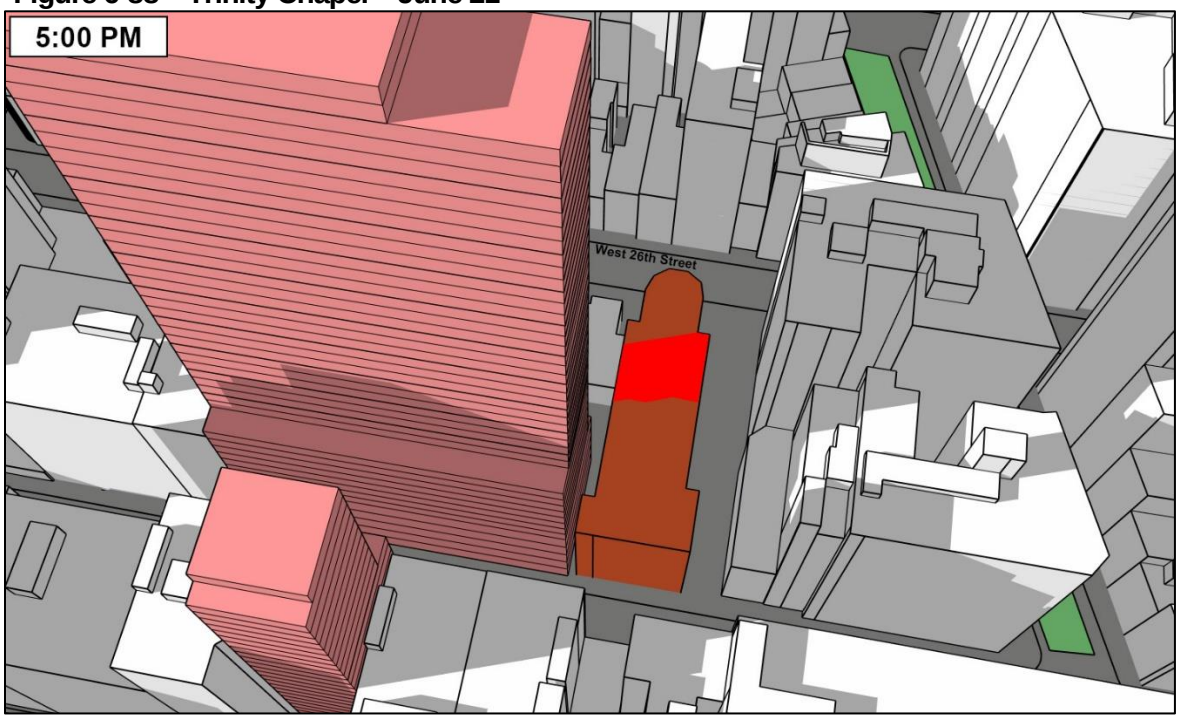
Figure 6-87 – Trinity Chapel – June 21

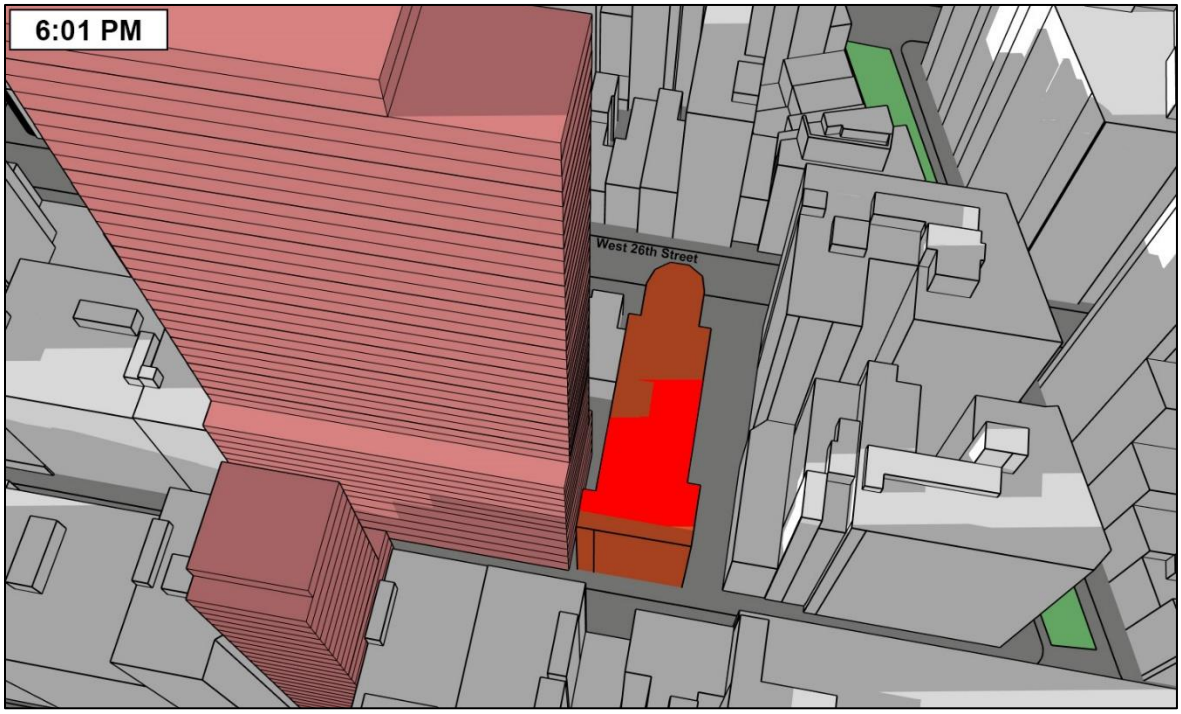




Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource

Figure 6-88 – Trinity Chapel – June 21





Projected Development Site
Existing Shadow
Potential Development Site
Incremental Shadow
Open Space
Sunlight-Sensitive Historic Resource