



4

Shadows

A shadow is defined in the *2020 CEQR Technical Manual* as the condition that results when a building or other built structure blocks the sunlight that would otherwise directly reach a certain area, space, or feature. The purpose of this section is to assess whether new structures may cast shadows on sunlight sensitive publicly accessible resources or other resources of concern such as natural resources, and to assess the significance of their impact.

Introduction

According to *the CEQR Technical Manual*, a shadows assessment is warranted for Proposed Actions that would result in new structures greater than 50 feet in height or that would be located adjacent to, or across the street from, a sunlight-sensitive resource. Such resources include publicly accessible open spaces, important sunlight-sensitive natural features, or historic resources with sun-sensitive features. 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.

In the With-Action condition, the Proposed Actions are expected to facilitate the construction of a tower, rising up to approximately 1,646 feet. Therefore, further assessment is warranted.

Principal Conclusions

A detailed shadows analysis determined that in the With-Action (2030) scenario, project-generated shadows would reach 33 sunlight sensitive resources. These incremental shadows would be limited in extent and duration and would typically only occur in one or two seasons. The limited duration of new shadow that would fall on most affected resources would not substantially reduce the quantity of direct sunlight and would not significantly alter the utilization of the resources or the variety of vegetation supported within. Resources that would receive longer shadow increments exceeding an hour on one of the analysis days include Dag Hammarskjold Plaza (O141), the UN Sculpture Garden (O120), One Vanderbilt Plaza (O172), the Stephen A. Schwarzman Building (H14), Grand Central Terminal (H40), and the East River (N1). However, it was found that these resources would continue to receive substantial sunlight throughout the affected analysis days such that the public's use and enjoyment, the viability of flora and fauna, and the physical characteristics of the resource's would not be impacted. Therefore, the Proposed Actions would not result in significant adverse shadows impacts. No publicly accessible open spaces or historic resources would experience significant adverse shadow impacts as a result of the Proposed Actions.

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. In accordance with the *CEQR Technical Manual*, a preliminary screening assessment is conducted to ascertain whether shadows resulting from a project could reach any sunlight-sensitive resource at any time of year; if the preliminary assessment indicates that, in the absence of intervening buildings, shadows from a project could reach sunlight sensitive resources on any of the representative analysis days, a detailed analysis is typically warranted.

As discussed in **Chapter 1, Project Description**, for conservative analysis purposes the EIS considers the two building program options to determine the With-Action reasonable worst case development scenario (RWCDs) for each density-based technical area: the Proposed Project with a mix of hotel, commercial office, local retail, and publicly accessible space; and the All Office Scenario, based on the same overall building square footage and building massing as the Proposed Project but comprised of approximately 2,561,770 gsf of office space, retail, and no hotel. In each chapter, where applicable, the EIS analyzes the scenario with the greater potential for impacts. ~~Since the overall building massing and design would be the same in both program options, this~~ This chapter evaluates the With-Action condition including the hotel space, as described above, because it represents the Proposed Project, and for the purposes of this analysis is not any less conservative than the All Office Scenario.

Sunlight-Sensitive Resources

The *CEQR Technical Manual* defines sunlight-sensitive resources as those resources that depend on sunlight or for which direct sunlight is necessary to maintain the resource's usability or architectural integrity. The following are considered to be sunlight sensitive resources:

- › Public open space (e.g., parks, beaches, playgrounds, plazas, schoolyards, greenways, and landscaped medians with seating). Planted areas within unused portions of

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

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

Preliminary Assessment

This preliminary screening assessment consists of three tiers of analysis:

- › **Tier 1 Screening:** The first tier determines a simple radius around the proposed building representing the longest shadow that could be cast. The longest shadow that a structure can cast at the latitude of New York City occurs on December 21, the winter solstice, at the start of the analysis day at 8:51 AM, and is equal to 4.3 times the height of the structure. If there are sunlight-sensitive resources within the radius, the analysis proceeds to the second tier;
- › **Tier 2 Screening:** The second-tier analysis 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. According to the *CEQR Technical Manual*, shadows cannot be cast within New York City within 108 degrees from True North. Topographic lines are included to demonstrate the terrain of the area;
- › **Tier 3 Screening:** 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. For the Tier 3 screening, three-dimensional modeling software with the capacity to model shadows is used, and the maximum building envelope that could be achieved as a result of the Proposed Project is modeled and geo-located within the program. Terrain, which has been included in the Tier 1 and Tier 2 screenings, is also incorporated into the model to account for how changes in elevation throughout the study area can influence shadows that could be cast by the Proposed Project. The representative days are December 21 (winter solstice), June 21 (summer solstice), March 21/September 21 (vernal/autumnal equinox), and May 6/August 6 (halfway between summer solstice and the equinoxes).

Detailed Assessment

As noted above, if the Tier 3 screening indicates that, in the absence of intervening buildings, shadows from the Proposed Project would reach a sunlight sensitive resource on any of the representative analysis days, a detailed shadow analysis would be warranted. Because existing buildings (or No-Action buildings) may already cast shadows on a sun-sensitive resource, the Proposed Project may not result in additional (incremental) shadows upon that resource. The detailed shadow analysis models a baseline condition (future No-Action) that is compared to the future condition resulting from the Proposed Project (future With-Action) to illustrate the shadows cast by the No-Action development and distinguish the additional (incremental) shadow cast by the project. The detailed shadows analysis uses a combination of Geographic Information Systems (GIS) 3D modeling and modeling in Sketchup, as well as GIS data provided publicly.

The detailed assessment considers shadows occurring between 90 minutes after sunrise and 90 minutes before sunset. At times earlier or later than this timeframe window of analysis, the sun is low on the horizon, producing shadows that are long, move fast, and generally blend with shadows from existing structures. Consequently, shadows occurring in these two 90-minute periods are not considered significant under CEQR, and their assessment is not required.

Determination of Significance

As described in the *CEQR Technical Manual*, an incremental shadow is generally not considered significant when its duration is no longer than 10 minutes at any time of year and the resource continues to receive substantial direct sunlight. A significant shadow impact generally occurs when an incremental shadow of 10 minutes or longer falls on a sunlight-sensitive resource and results in one of the following:

- › Vegetation: a substantial reduction in sunlight available to a sunlight-sensitive feature of the resource to less than the minimum time necessary for its survival (when there was sufficient sunlight in the future without the project), or a reduction in direct sunlight exposure where the sensitive feature of the resource is already subject to substandard sunlight (i.e., less than the minimum time necessary for its survival).
- › Historic and cultural resources: a substantial reduction in sunlight available for the enjoyment or appreciation of the sunlight-sensitive features of an historic or cultural resource.

- › Open space utilization: a substantial reduction in the usability of open space as a result of increased shadow, with consideration given to anticipated new users and the open space's utilization rates throughout the affected time periods as well as to the inventory of available open space resources in the study area.
- › For any sunlight-sensitive feature of a resource: complete elimination of all direct sunlight on the sunlight-sensitive feature of the resource, when the complete elimination results in substantial effects on the survival, enjoyment, or, in the case of open space or natural resources, the use of the resource.

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

Preliminary Assessment

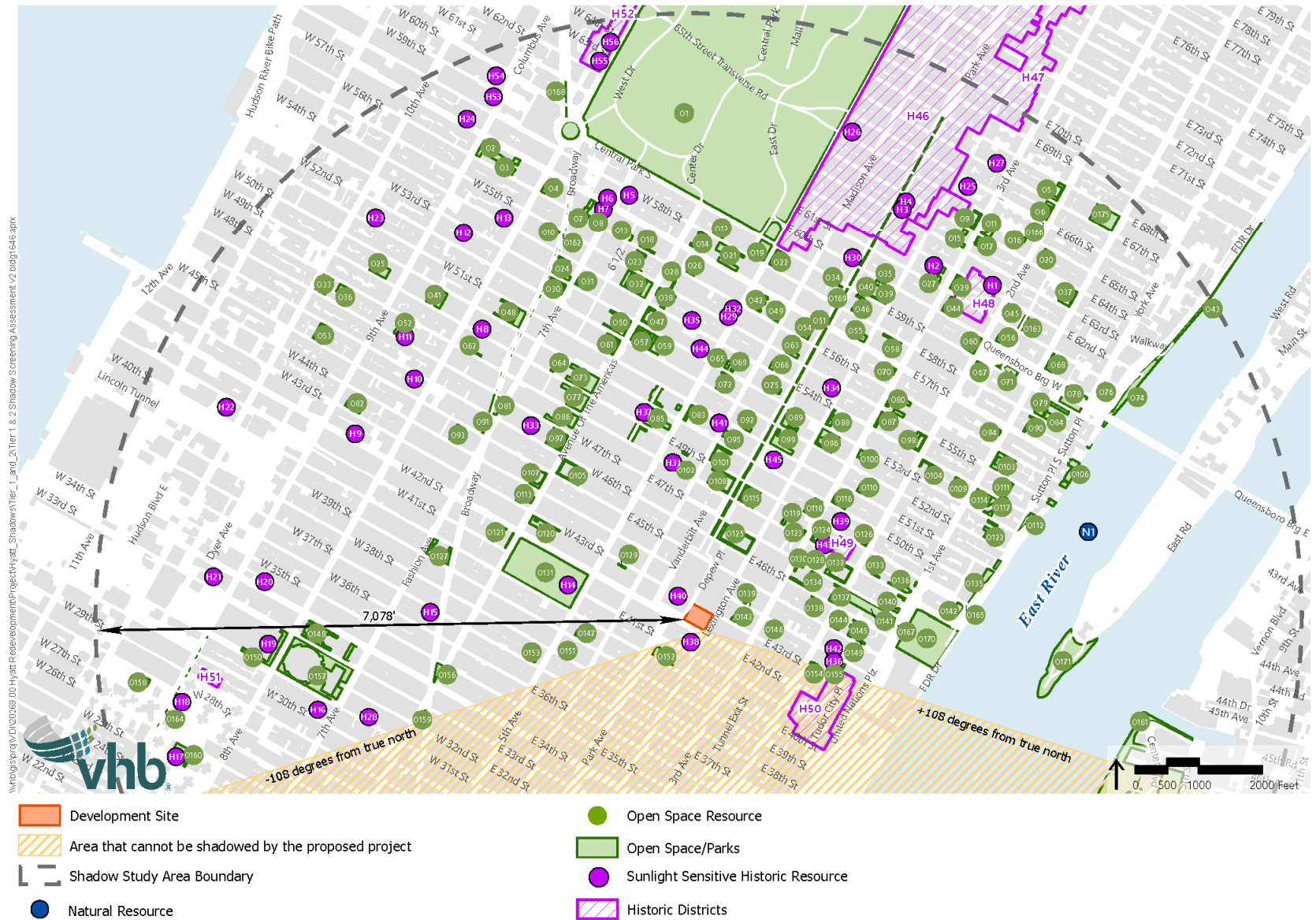
Tier 1 and 2 Screening Assessment

The Proposed Project would consist of an approximately 1,646 foot-tall building (including bulkhead) and could cast a maximum shadow up to 4.3 times as long or 7,078 feet (see **Figure 4-1**). **Figure 4-1** also identifies the location of the historic resources with sunlight-sensitive features, open spaces, and natural resources within the potential shadow sweep.

In coordination with the analysis in **Chapter 5, Historic and Cultural Resources**, historic resources within the maximum shadow radius were reviewed to evaluate whether they contain features that depend on sunlight for their enjoyment by the public; those that contain such features were included in the base map.

Figure 4-1 shows the potential sunlight-sensitive resources identified in the Tier 1 and Tier 2 Screening Assessment, accounting for the area that cannot be shadowed by the Proposed Project.

Figure 4-1 Tier 1 and Tier 2 Screening



Tier 3 Screening Assessment

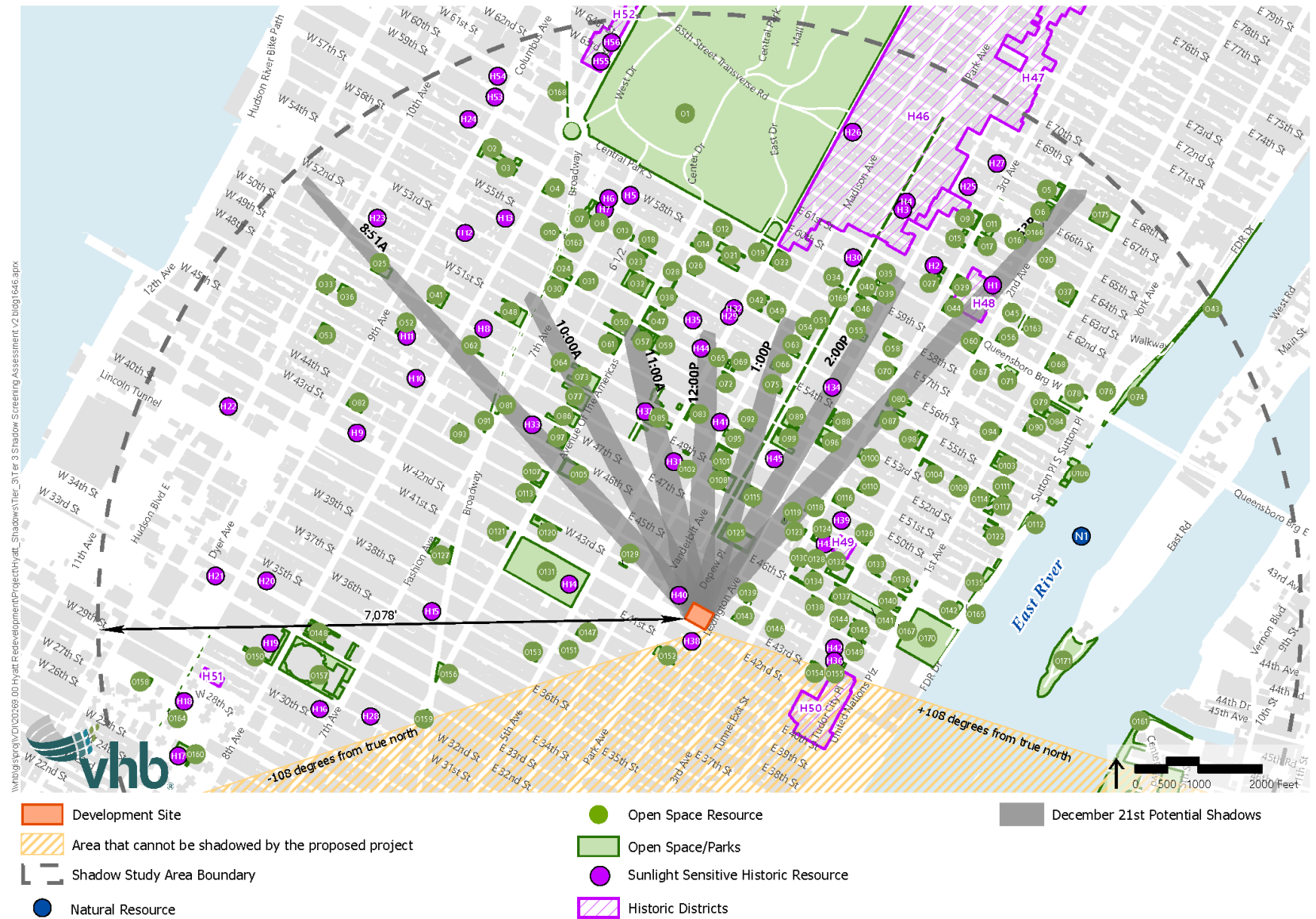
In accordance with the *CEQR Technical Manual*, a Tier 3 screening assessment was performed because the Tier 1 and Tier 2 assessments identified sunlight-sensitive resources within ± 108 degrees of True North and within the area of the longest shadow that could be cast by the Proposed Project.

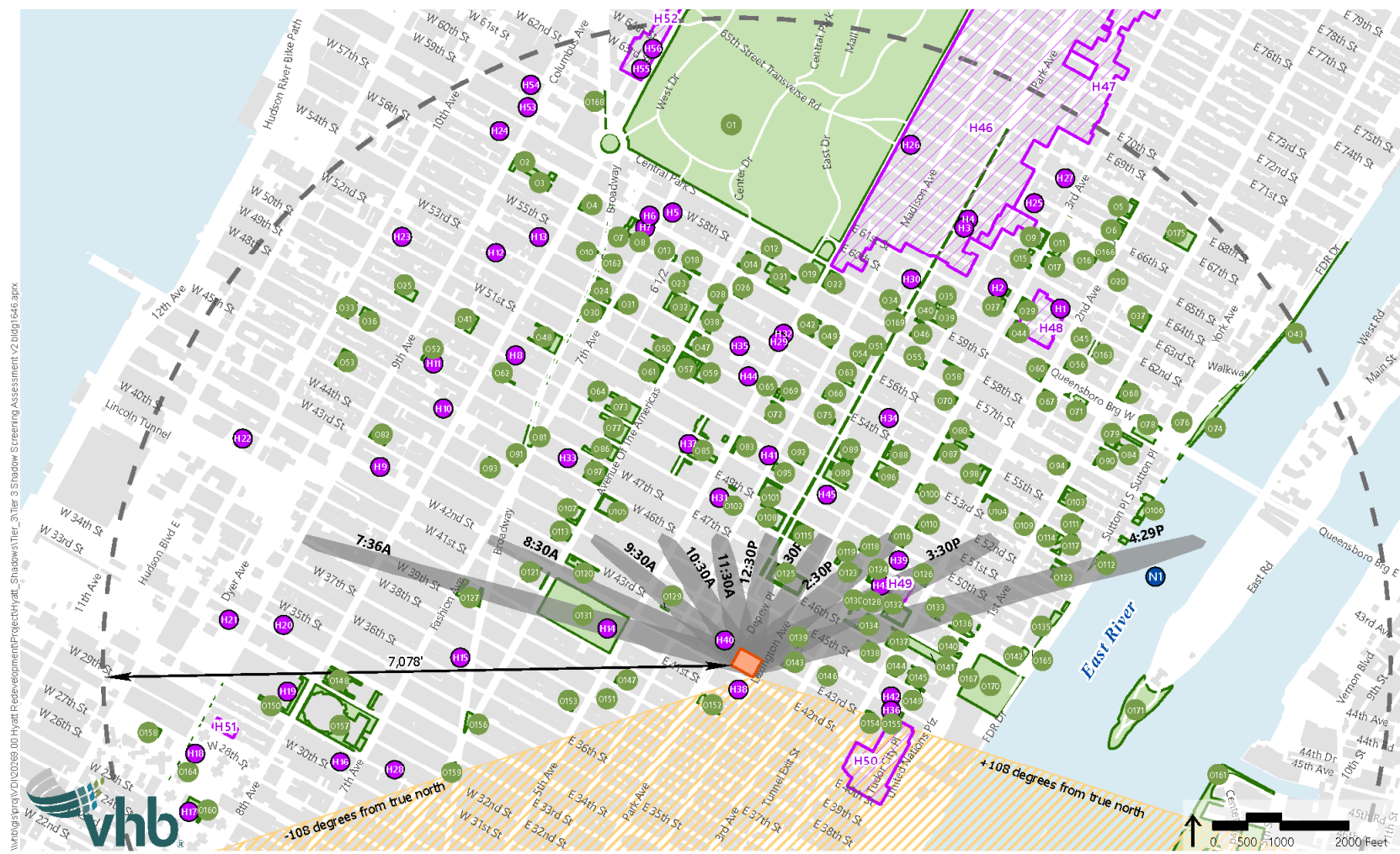
The Tier 3 screening assessment was performed for the four representative days of the year set forth in the *CEQR Technical Manual*: December 21, the winter solstice and shortest day of the year; March 21/September 21, the equinoxes; May 6/August 6, the midpoints between the summer solstice and the equinoxes; and June 21, the summer solstice and the longest day of the year.

In accordance with the *CEQR Technical Manual*, a model of the building in the With-Action condition was developed in a three-dimensional computer program. The model was geolocated, and the surrounding terrain was imported into the model to account for differences in topography. As noted above, the Tier 3 shadow screening shows the shadows that could be cast as a result of the Proposed Project but does not account for existing buildings which may already cast shadows on the identified resources. **Figure 4-2** through **Figure 4-5** below show Tier 3 screening results, which indicate that on the four analysis days, in the absence of intervening buildings:

- › Shadows cast by the Proposed Project could reach 131 sunlight-sensitive resources: 109 open spaces; 21 architectural resources; and one natural resource. These resources were then considered further in the **Detailed Analysis**.
- › A number of resources, both open spaces and architectural resources, would fall outside the area of potential shadow because of their location relative to the Development Site:
 - Of the 174 open space resources, 65 would not be affected by shadows from the Proposed Project because of their location relative to the Development Site (see **Table 4-1**).
 - Of the 49 individual historic resources that fall within the Tier 1 and Tier 2 area of potential shadow, 28 of these resources would fall outside the Tier 3 area of potential shadow (see **Table 4-2**).
 - Of the seven historic districts within the Tier 1 and Tier 2 shadow area, four would be fully outside the area of Tier 3 shadow—Upper East Side Historic District (H46) and its extension (H47); the Lemartine Place Historic District (H51), and the Upper West Side/Central Park West Historic District (H52)—and three would fall partially or wholly within the Tier 3 shadow area on different analysis periods: the Treadwell Farm Historic District (H48), the Turtle Bay Gardens Historic District (H49), and the Tudor City Historic District (H50). None of these historic districts are noted for their sunlight-sensitive resources and therefore, no further analysis is warranted for these districts. However, individual historic sunlight sensitive resources within the districts were considered and are included in the summary above.

Figure 4-2 Tier 3 Screening December 21 Analysis Day





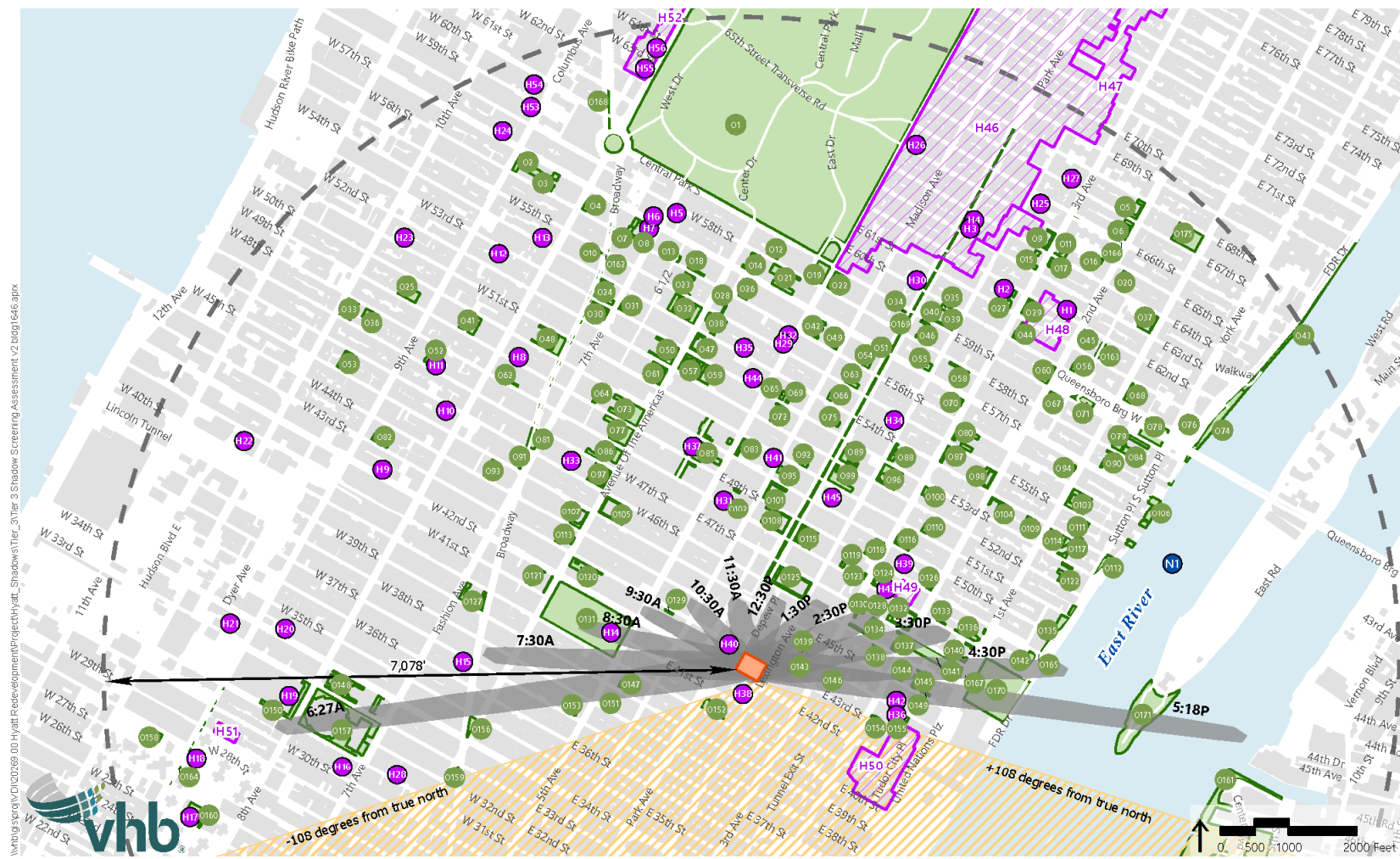


Figure 4-5 Tier 3 Screening June 21 Analysis Day

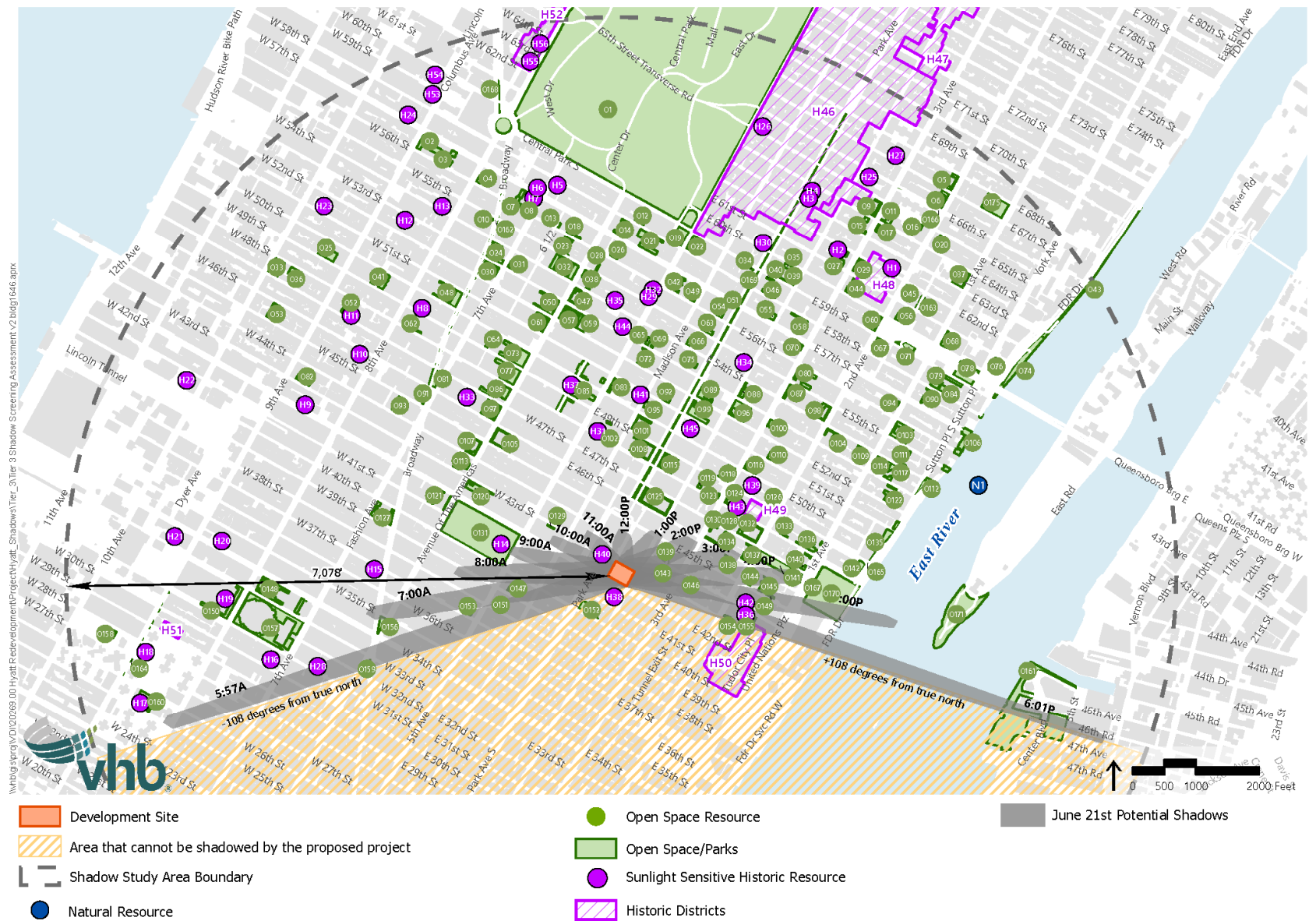


Table 4-1 Open Space Resources Screened Out at Tier 3

Map ID #	Name/Location
O1	Central Park
O2	Balsey Park
O3	Sheffield POPS, 322 West 57th Street
O4	1755 Broadway POPS
O7	211 West 56th Street POPS
O8	888 Seventh Avenue POPS
O9	160 East 65th Street POPS
O10	230 West 55th Street POPS
O11	200 East 65th Street POPS
O12	36 Central Park South POPS
O13	146 West 57th Street POPS
O14	58 West 58th Street POPS
O15	188 East 64th Street POPS
O18	118 West 57th Street POPS
O19	Grand Army Plaza
O20	304 East 65th Street POPS
O21	9 West 57th Street POPS
O22	767 Fifth Avenue POPS
O23	125 West 55th Street POPS
O24	1700 Broadway POPS
O26	40 West 57th Street POPS
O28	1370 Sixth Avenue POPS
O30	810 Seventh Avenue POPS
O31	825 Seventh Avenue POPS
O32	1345 Sixth Avenue POPS
O33	Hell's Kitchen Park
O34	500 Park Avenue POPS
O36	Clinton Community Garden
O37	340 East 64th Street POPS
O38	1350 Sixth Avenue POPS
O42	725 Fifth Avenue POPS
O43	East River Walk
O45	300 East 62nd Street POPS
O47	1330 Sixth Avenue POPS
O52	Ramon Aponte Park
O53	Matthews - Palmer Playground
O56	303 East 60th Street POPS
O57	51 West 52nd Street POPS
O58	150 East 58th Street POPS
O59	31 West 52nd Street POPS
O60	Tramway Plaza

Table 4-1 Open Space Resources Screened Out at Tier 3

Map ID #	Name/Location
O67	300 East 59th Street POPS
O68	401 East 60th Street POPS
O71	14 Honey Locusts Park
O74	Andrew Haswell Green Park
O76	Twenty-Four Sycamores Park
O78	Queensboro Oval
O79	418 East 59th Street POPS
O82	McCaffrey Playground
O84	425 East 58th Street POPS
O90	410 East 58th Street POPS
O91	1535 Broadway POPS
O93	1515 Broadway POPS
O94	360 East 57th Street POPS
O98	245 East 54th Street POPS
O103	400 East 56th Street POPS
O104	300 East 54th Street POPS
O106	Sutton Place Park
O107	1155 Sixth Avenue POPS
O109	Recreation Center 54 (indoors)
O110	217 East 51st Street POPS
O135	Perter Detmold Park
O150	James A Farley Buildings Steps
O158	Chelsea Park
O160	Penn South Playground
O162	Greenstreet
O163	Greenstreet
O164	Greenstreet
O165	Greenstreet
O166	Greenstreet
O167	Greenstreet
O168	Broadway Malls
O175	St. Catherine's Park

Source: New York City Department of Parks and Recreation open space database, NYC Capital Planning Platform POPS map

Table 4-2 Historic Resources Screened Out at Tier 3

Map ID #	Name/Location
H3	Third Church of Christ, Scientist
H4	Central Presbyterian Church
H5	Alwyn Court Apartments
H6	Osborne Apartments
H7	Rodin Studios
H9	Church of the Holy Apostle/Cross
H10	St Lukes Lutheran Church
H11	Actor's Temple
H12	St Benedict the Moor's Church
H13	St. George Tropeoforos Greek Orthodox Church
H17	St Columbia Church
H18	Church of the Holy Apostles
H19	Farley Building Collonade
H20	West Side Jewish Center
H21	St Michael's Catholic Church
H22	St Raphael's Roman Catholic Church
H24	Catholic Apostolic Church
H25	Church of St. Vincent Ferrer
H26	Bernard Museum Temple Emanu-El
H27	Park Ave Synagogue
H29	Fifth Avenue Presbyterian Church
H30	Christ Church United Methodist
H32	Former Coty Building
H35	Rockefeller Apartments
H53	William J. Syms Operation Theater
H54	St. Paul the Apostle Church
H55	Century Apartments
H56	New York Society for Ethical Culture

Source: New York Cultural Resource Information System, New York City
Landmarks Preservation Commission map

Detailed Assessment

No-Action Condition

In the future without the Proposed Actions, it is expected that the Development Site would be developed with a 1,118-foot-tall building (including the bulkhead) with a floor area ratio (FAR) of 27.

In addition, there are a number of development projects on other sites within the shadows study area that are either planned or currently under construction. These buildings were

included in the detailed shadows model using information on their proposed heights, FARs, and building footprints.

In the future without the Proposed Actions, two new sunlight-sensitive, publicly accessible open space resources would be added within the defined shadow radius by the 2030 analysis year: One Vanderbilt Plaza (O172) and 270 Park Avenue privately-owned public space (POPS) (O174).

- › The 270 Park Avenue POPS is projected as a 10,000-square-foot unenclosed space along Madison Avenue with the 270 Park Avenue building partly cantilevering over the space, covering approximately 60 percent of the space. However, specific design plans have not yet been released for this space; and to ensure a conservative analysis, the POPS was analyzed as if there were no obstruction from the 270 Park Avenue building.
- › The New York City Department of Transportation (DOT) plaza on Vanderbilt Avenue, between East 42nd and East 43rd Streets, will comprise a 60-foot-wide by 200-foot-long area along Vanderbilt Avenue that will be closed to vehicular traffic and dedicated to pedestrian use.

Other new open space resources outlined in **Chapter 3, Open Space**, were identified as part of the program for Projected Development Sites in the Greater East Midtown Rezoning FEIS (No-Action Site numbers 7, 10, and 12). Design details about these new POPS and their programming are unknown at this time, therefore they are not considered in the detailed shadows analysis.

With-Action Condition

In the future with the Proposed Actions, the Development Site would be developed with a 1,646-foot-tall building (including the bulkhead).

The detailed shadow analysis compares the future condition resulting from the Proposed Project (future With-Action) to the baseline condition (No-Action condition) to illustrate the shadows cast by existing or future buildings and distinguish the additional (incremental) shadow cast by the project. Any new shadows projected to be cast onto the identified resources from the Proposed Project are considered “incremental shadows.”

Modeling Results

As noted above, based on the Tier 3 screening results, 131 sunlight-sensitive resources, consisting of 109 open spaces, 21 historic resources, and one natural resource¹ were identified for detailed analysis.

Table 4-3 provides the modeled incremental shadow entry/exit times for these resources. The start times shown in the tables represent the time that the incremental shadows would enter any portion of the open space or sunlight-sensitive feature of the historic resource, and the end time represents the time that the incremental shadows leave that element completely.

¹ Note that Rockefeller Plaza/Center (O85/H37) is counted as an open space and a historic resource

As shown in **Table 4-3**, 80 of the 109 open spaces within the Tier 3 shadow study area would receive no incremental shadow, and there would be no significant adverse impacts for these resources.

As discussed above in Determination of Significance, the *CEQR Technical Manual* does not consider incremental shadows lasting no longer than 10 minutes at any time of the year to be significant when the resource continues to receive substantial direct sunlight. The 8 resources that would receive incremental shadow of up to 10 minutes would continue to receive substantial direct sunlight at other times during the analysis period; therefore, these resources would not experience significant adverse impacts and are not evaluated further.

For the 20 resources where an increment over 10 minutes was identified, descriptions are provided below along with **Figure 4-6**, through **Figure 4-88**, to illustrate the extent of increment shadow.

Furthermore, as shown in **Table 4-3**, of the 21 sunlight-sensitive historic resources identified for detailed analysis, four would receive incremental shadow. These are described below along with accompanying figures.

Finally, one natural resource was identified for detailed analysis and would receive incremental shadow. It is described below with an accompanying figure.

Table 4-3 Detailed Analysis Summary of Incremental Shadow Entry/Exit Times

		Analysis Day and Timeframe			
		December 21	March 21/ September 21	May 6/Aug 6	June 21
Map No.	Resource	8:51A- 02:53 PM	7:36A-4:29 PM	6:27A-5:18 PM	5:57A-6:01 PM
Open Space Resources					
O5	254 East 68th Street	-	-	-	-
O6	265 East 66th Street	-	-	-	-
O16	220 East 65th Street	-	-	-	-
O17	200 East 64th Street	-	-	-	-
O25	Gutenberg Playground	-	-	-	-
O27	167 East 61st Street	-	-	-	-
O29	200 East 62nd Street	2:24P – 2:26P 2 minutes	-	-	-
O35	118 East 60th Street	-	-	-	-
O39	750 Lexington Avenue	1:54P to 1:56P 2 minutes	-	-	-
O40	499 Park Avenue	-	-	-	-
O41	Worldwide Plaza, 350 West 50th Street	-	-	-	-
O44	200 East 61st Street	-	-	-	-
O46	110 East 59th Street	-	-	-	-
O48	1633 Broadway	-	-	-	-
O49	590 Madison Avenue	-	-	-	-

Table 4-3 Detailed Analysis Summary of Incremental Shadow Entry/Exit Times

Map No.	Resource	Analysis Day and Timeframe			
		December 21 8:51A- 02:53 PM	March 21/ September 21 7:36A-4:29 PM	May 6/Aug 6 6:27A-5:18 PM	June 21 5:57A-6:01 PM
O50	1301 Sixth Avenue	-	-	-	-
O51	450 Park Avenue	1:18P- 1:19P 1 minute	-	-	-
O54	432 Park Avenue	-	-	-	-
O55	135 East 57th Street	-	-	-	-
O61	1285 Sixth Avenue	-	-	-	-
O62	235 West 48th Street	-	-	-	-
O63	65 East 55th Street	-	-	-	-
O64	745 Seventh Avenue	-	-	-	-
O65	3 East 53rd Street	-	-	-	-
O66	535 Madison Avenue	-	-	-	-
O69	520 Madison Avenue	-	-	-	-
O70	950 Third Avenue	-	-	-	-
O72	10 East 53rd Street	-	-	-	-
O73	1251 Sixth Avenue	9:51A to 10:09A 18 minutes	-	-	-
O75	390 Park Avenue	-	-	-	-
O77	1221 Sixth Avenue	9:58A to 10:07A 9 minutes	-	-	-
O80	919 Third Avenue	-	-	-	-
O81	Father Duffy Square	-	-	-	-
O83	460 Madison Avenue	-	-	-	-
O85/H37	Rockefeller Plaza	10:51 A-11:18A 27 minutes	-	-	-
O86	1211 Sixth Avenue	-	-	-	-
O87	909 Third Avenue	-	-	-	-
O88	153 East 53rd Street	1:59P-2:06P 7 minutes	-	-	-
O89	375 Park Avenue	-	-	-	-
O92	40 East 52nd Street	-	-	-	-
O95	457 Madison Avenue	-	-	-	-
O97	1185 Sixth Avenue	-	-	-	-
O99	345 Park Avenue	-	-	-	-
O100	875 Third Avenue	-	-	-	-
O101	437 Madison Avenue	-	-	-	-
O102	12 East 49th Street	-	-	-	-

Table 4-3 Detailed Analysis Summary of Incremental Shadow Entry/Exit Times

Map No.	Resource	Analysis Day and Timeframe			
		December 21 8:51A- 02:53 PM	March 21/ September 21 7:36A-4:29 PM	May 6/Aug 6 6:27A-5:18 PM	June 21 5:57A-6:01 PM
O105	1166 Sixth Avenue	-	-	-	-
O108	280 Park Avenue	-	-	-	-
O111	415 East 54th Street	-	-	-	-
O112	<Null>	-	-	-	-
O113	1133 Sixth Avenue	-	-	-	-
O114	400 East 54th Street	-	-	-	-
O115	299 Park Avenue	-	-	-	-
O116	825 Third Avenue	-	-	-	-
O117	420 East 54th Street	-	-	-	-
O118	800 Third Avenue	-	-	-	-
O119	141 East 48th Street	-	-	--	-
O120	1114 Sixth Avenue	-	-	-	-
O121	1095 Sixth Avenue	-	-	-	-
O122	429 East 52nd Street	-	-	-	-
O123	780 Third Avenue	-	-	-	-
O124	777 Third Avenue	-	2:26P-2:59P 33 minutes	-	-
O125	245 Park Avenue	-	12:31P-1:00P 29 minutes	-	-
O126	255 East 49th Street	-	3:22P- 3:35P 13 minutes	-	-
O127	1411 Broadway	-	-	-	-
O128	767 Third Avenue	-	-	-	-
O129	6 East 43rd Street	-	-	-	-
O130	747 Third Avenue	-	-	2:05P-2:46P 41 minutes	-
O131	Bryant Park	-	7:55A to 8:31A 36 minutes	7:53A-8:28A, 8:52A-9:13A 56 minutes	8:21A to 8:54A 33 minutes
O132	885 Second Avenue	-	-	-	-
O133	309 East 48th Street	-	-	-	-
O134	212 East 47th Street	-	-	-	-
O136	100 United Nations Plaza	-	-	3:40P-4:02P 22 minutes	-
O137	240 East 47th Street	-	-	-	3:05P-3:40P 35 minutes
O138	234 East 46th Street	-	-	-	-

Table 4-3 Detailed Analysis Summary of Incremental Shadow Entry/Exit Times

Map No.	Resource	Analysis Day and Timeframe			
		December 21 8:51A- 02:53 PM	March 21/ September 21 7:36A-4:29 PM	May 6/Aug 6 6:27A-5:18 PM	June 21 5:57A-6:01 PM
O139	140 East 45th Street	-	-	-	3:22P - 3:31P 9 minutes
O140	845 First Avenue	-	-	3:40P - 4:06P 26 minutes	-
O141	Dag Hammarskjold Plaza	-	-	3:17P - 4:27P 1 hour, 10 minutes	3:57P - 4:19P 22 minutes
O142	MacArthur Park	-	-	4:16P - 4:42P 26 minutes	-
O143	425 Lexington Avenue	-	-	-	2:06P - 2:28P 22 minutes
O144	301 East 45th Street	-	-	-	3:39P - 4:22P 43 minutes
O145	320 East 46th Street	-	-	-	4:12P - 4:17P, 4:23P - 4:27P 9 minutes
O146	685 Third Avenue	-	-	-	-
O147	445 Fifth Avenue	-	-	-	-
O148	1 Pennsylvania Plaza	-	-	-	-
O149	333 East 45th Street	-	-	-	-
O151	425 Fifth Avenue	-	-	-	-
O152	101 Park Avenue	-	-	-	-
O153	420 Fifth Avenue	-	-	-	-
O154	303 East 43rd Street	-	-	-	-
O155	3 United Nations Plaza	-	-	-	-
O156	Herald Square	-	-	-	-
O157	2 Pennsylvania Plaza	-	-	6:27A – 6:37A 10 minutes	-
O159	Greeley Square Park	-	-	-	-
O161	Gantry Plaza State Park	-	-	-	5:41P – 6:01P 20 minutes
O169	Park Avenue Malls	1:13P – 1:35P 22 minutes	12:10P - 12:52P 42 minutes		
O170	United Nations Sculpture Garden			4:06P - 5:20P 1 hour, 14 minutes	4:12P - 5:23P 1 hour, 11 minutes
O171	Four Freedoms State Park			4:50P - 5:18P 28 minutes	5:16P - 5:30P 14 minutes

Table 4-3 Detailed Analysis Summary of Incremental Shadow Entry/Exit Times

Map No.	Resource	Analysis Day and Timeframe			
		December 21 8:51A- 02:53 PM	March 21/ September 21 7:36A-4:29 PM	May 6/Aug 6 6:27A-5:18 PM	June 21 5:57A-6:01 PM
O172	One Vanderbilt Plaza	-	8:23A - 9:30A 7 minutes	7:41A - 7:51A, 9:07A - 10:43A 46 minutes	7:59A -11:02A 3 hours, 3 minutes
O173	Perishing Plaza West	-	-	8:43A - 8:50A 7 minutes	9:01A - 9:23A 22 minutes
O174	270 Park Avenue	-	-	-	-
Historic Resources					
H1	Church of our Lady of Peace	-	-	-	-
H2	Metropolitan Koryo United Methodist Church	-	-	-	-
H8	St. Malachy's The Actors' Church	-	-	-	-
H14	Stephen A. Schwarzman Building, New York Public Library	-	-	7:59A - 9:00A 1 hour, 1 minute	8:17A - 8:33A 16 minutes
H15	Church of the Holy Innocents	-	-	-	-
H16	St John the Baptist Church	-	-	-	-
H23	Sacred Heart of Jesus Church	-	-	-	-
H28	Church of St. Francis of Assisi	-	-	-	-
H31	Swedish Seamen's Church	-	-	-	-
H33	The Free Church of Saint Mary-The-Virgin	-	-	-	-
H34	Central Synagogue	1:53P - 1:58P 5 minutes	-	-	-
H36	Beaux-Arts Apartments, 310 East 44th Street	-	-	-	-
H37/O85	Rockefeller Center/Plaza	10:51A - 11:18A 27 minutes	-	-	-
H38	Chanin Building	-	-	-	-
H39	Amster Yard	-	-	-	-
H40	Grand Central Terminal	-	8:28A - 9:33A, 12:12P - 12:50P 1 hour, 43 minutes	8:59A - 10:12A, 11:55A - 12:19P 1 hour, 37 minutes	9:35A - 10:40A, 11:54A-12:13P 1 hour, 24 minutes

Table 4-3 Detailed Analysis Summary of Incremental Shadow Entry/Exit Times

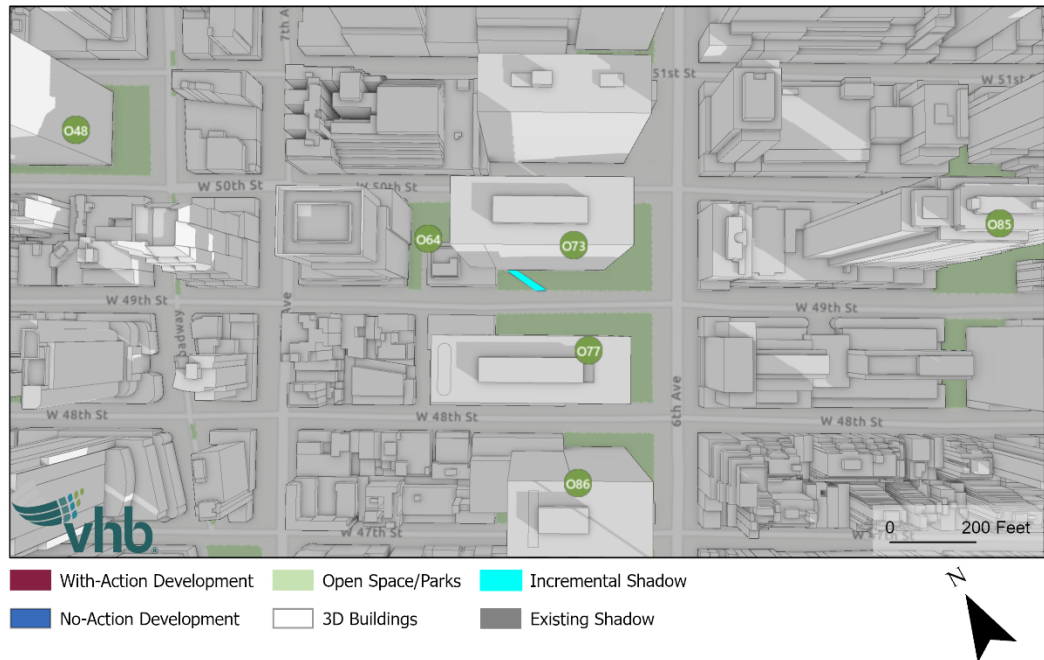
Map No.	Resource	Analysis Day and Timeframe			
		December 21 8:51A- 02:53 PM	March 21/ September 21 7:36A-4:29 PM	May 6/Aug 6 6:27A-5:18 PM	June 21 5:57A-6:01 PM
H41	St. Patrick's Cathedral	-	-	-	-
H42	Beaux-Arts Apartments, 307 East 44th Street	-	-	-	-
H43	Lescaze House	-	-	-	-
H44	St. Thomas' Church and St. Thomas' Parish House	-	-	-	-
H45	St. Bartholomew's Church and Community House	-	-	-	-
Natural Resources					
N1	East River	-	-	4:23P - 5:18P 55 minutes	4:40P - 6:01P 1 hour, 21 minutes

Notes: This table shows, for each resource, the entry and exit times and total duration of incremental shadow for each sunlight sensitive resource. A dash indicates that no incremental shadow would fall on the resource because it is already in shadow under existing or No-Action conditions in the same area and time period or because the incremental shadow does not reach it. Daylight savings time is not used, times are Eastern Standard Time per *CEQR Technical Manual* guidelines.

O73– 1251 Sixth Avenue

The 1251 Sixth Avenue is a 0.7-acre POPS that contains a fountain, ledge seating and benches, extended sidewalks, plantings, and subway access.

The detailed analysis shows that during one analysis period—the December 21st analysis period—incremental shadow would fall on this resource for an 18-minute period in the morning from 9:51 AM to 10:09 AM (see **Figure 4-6**).

Figure 4-6 O73- December 21- 10:00 AM

The portion of the plaza that would receive incremental shadow is located on the south side of the building along West 49th Street and contains some vegetation and seating. The shadow would be short in duration and small in extent, and the resource would still receive sunlight throughout the analysis day. Given the short duration of the incremental shadow and its occurrence outside of the growing season this shadow would not adversely impact the public enjoyment or viability of vegetation in this space, and no significant adverse impacts would result.

O85/H37 - Rockefeller Center/Plaza

Rockefeller Center is a complex of 19 commercial buildings covering 22 acres between West 48th and 51st Streets and is both an open space (O85) and a historic resource (H37).² Its sunlight sensitive features include its open spaces and vegetation located in a plaza space totaling two acres.

The complex's open space spans portions of three blocks and consists of several distinct components that form a cohesive network of spaces:

- › **Rockefeller Plaza.** Rockefeller Plaza, the complex's central gathering space, consists of a pedestrianized street that runs through the complex between West 48th and West 51st Streets, parallel to Fifth and Sixth Avenues. It serves predominantly as pedestrian circulation space and also contains outdoor restaurant seating and areas of temporary benches/seating during warm weather months. Programming of this space changes seasonally.

² Rockefeller Plaza, Rockefeller Center is a New York City Landmark, listed on the State and National Registers of Historic Places, and a National Historic Landmark.

- › **Lower Plaza.** The Lower Plaza is located on the block between West 48th and West 49th Streets at the center of the complex. It is located below ground level and is the site of the iconic seasonal ice-skating rink and *Prometheus* statue.
- › **Channel Gardens.** The Channel Gardens, which are located on the block between West 48th Street and West 49th Street, consist of a planted promenade that extends from Fifth Avenue and is the main entrance to Rockefeller Plaza.

The detailed analysis shows that during one analysis period—the December 21st analysis period—incremental shadow would fall on Rockefeller Plaza for a 27-minute period between 10:51 AM and 11:18 AM (see **Figure 4-7** through **Figure 4-8**). No incremental shadow would fall on the Lower Plaza or Channel Gardens. Because December is a cold-weather period and not part of the growing season, there is no potential to significantly impact vegetation and therefore only the public's use and enjoyment of the open spaces is assessed in this section.

Figure 4-7 O85/H37- December 21- 11:00 AM

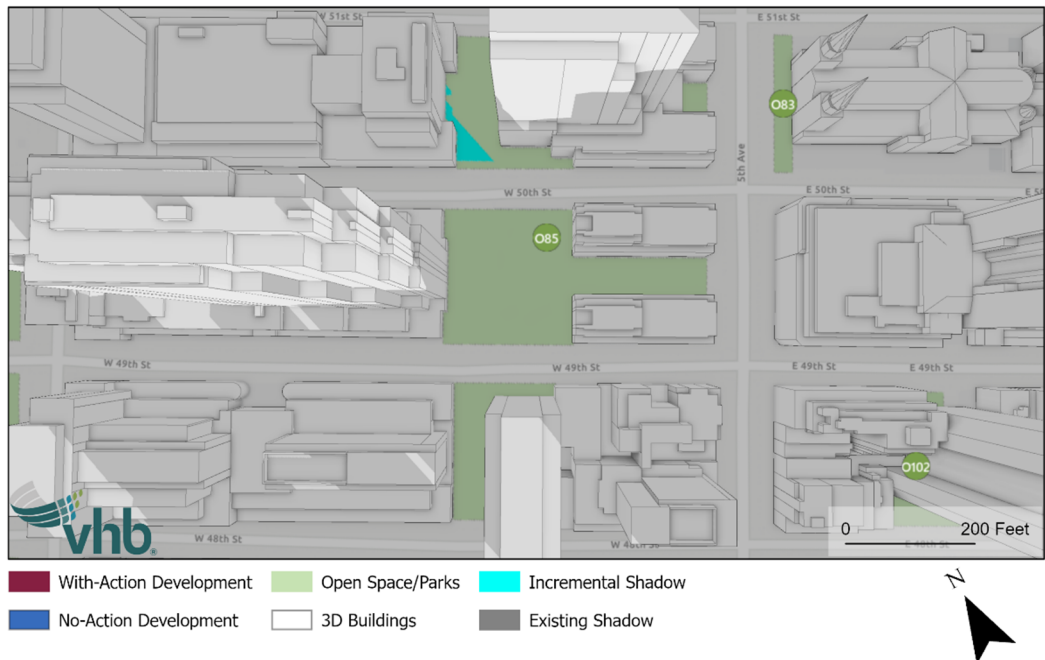
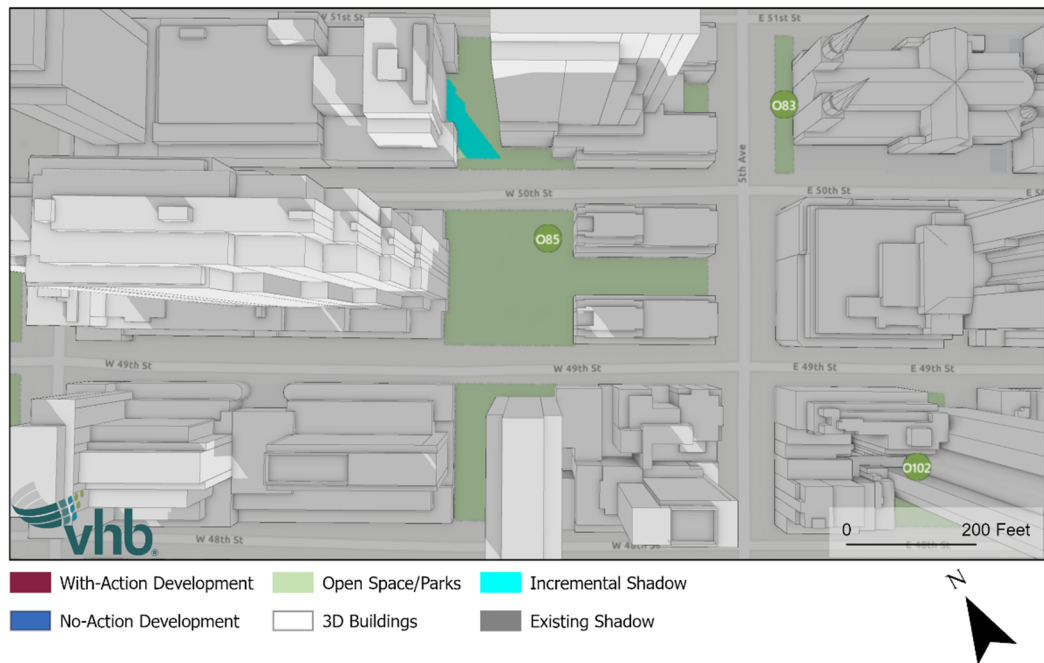


Figure 4-8 O85/H37- December 21 – 11:15 AM

Starting at 10:51 AM, the incremental shadow would fall on the section of Rockefeller Plaza that extends between West 50th and West 51st Streets, leaving with a small portion remaining in sun. Sunlight would be eliminated from the plaza from 10:56 AM to 11:15 AM (a duration of 19 minutes). At its largest extent, the incremental shadow would cover approximately 3,700 square feet or 4 percent of the overall plaza area. While the shadow increment would remove sunshine from this area of Rockefeller Plaza, the duration is limited and would occur only during one analysis period and in December. In addition, this area provides only pedestrian circulation space and does not provide seating during this season. Instead, the space is intended as a path for bringing the winter season's visitors, workers, and commuters to the Lower Plaza and does not contain sunlight sensitive features during this season. Therefore, no significant adverse impacts would result.

O124- 777 Third Avenue

The 777 Third Avenue POPS is 0.3 acres and contains a plaza and arcade, benches, seating swing, trees and planters.

The detailed analysis shows in **Figure 4-9** through **Figure 4-11** that during one analysis period—the March/September 21 analysis day—incremental shadows would fall on a portion of the plaza for a duration of 33 minutes from 2:26 PM to 2:59 PM and would eliminate sunlight from the resource for 29 minutes during this period. At its largest extent, the incremental shadow would cover 10 percent of the plaza area. The shadow would fall on the northwestern corner of the POPS where there is an expanded sidewalk, trees, and planters. There are no sunlight sensitive pedestrian amenities in this portion of the POPS. This area of the POPS currently receives approximately 3 hours of sunlight during the day and is in shadow from the building on site for much of the day. Therefore, it is expected that the planters are shade tolerant. Overall, due to the limited amenities and the shade tolerance

of the plants, this short duration of incremental shadow would not adversely impact the pedestrian usability or viability of vegetation within the space.

Figure 4-9 O124- March/September 21- 2:30 PM



Figure 4-10 O124- March/September 21- 2:45 PM

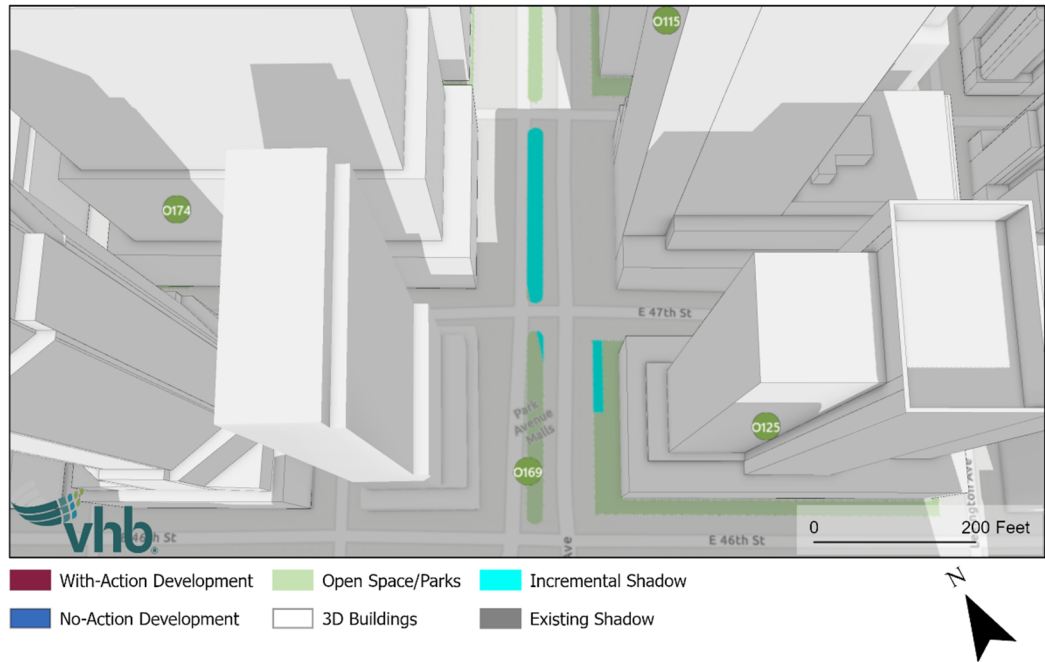


Figure 4-11 O124- March/September 21 – 2:59 PM

O125- 245 Park Avenue

The POPS at 245 Park Avenue is 0.7 acres and consists of a plaza/arcade. Much of the plaza space is covered by the building overhang, and the majority of the space does not have amenities or plantings, except for the frontage along East 46th and East 47th Streets.

The detailed analysis shows that during one analysis period—the March/September 21 analysis day—new incremental shadow would fall on the plaza from 12:31 PM to 1:00 PM (a duration of 29 minutes). The shadow would fall on the eastern side of the plaza facing Park Avenue, a portion of the plaza that does not have any amenities such as seating or planters, and is programmed solely as circulation space (see **Figure 4-12**). Therefore, this incremental shadow would result in a significant adverse impact.

Figure 4-12 O125- March/September 21- 12:45 PM

O126- 255 East 49th Street

The 255 East 49th Street POPS, also known as Sterling Plaza, is 0.1 acres and contains benches, trees, planter beds, and an arcade.

The detailed analysis showed that during one analysis period—the March/September 21 analysis day—new incremental shadow would fall on the plaza from 3:22 PM to 3:35 PM (a duration of 13 minutes). The incremental shadow would eliminate sunlight from the resource during this time, and at its greatest extent cover only 4 percent of the plaza space. The resource would not receive much sunlight after this time; however, it would still receive approximately 5 hours of sunlight throughout the analysis day. Therefore, this short shadow duration and limited extent would not adversely impact the viability of vegetation or the public's enjoyment of the resource, and no significant adverse impact would result.

O130-747 Third Avenue

The POPS at 747 Third Avenue is 0.1 acres and contains an extended sidewalk with bench seating and planters.

The detailed analysis in **Figure 4-13** through **Figure 4-15** shows that during one analysis period—the May/August 6 analysis day—new incremental shadow would fall on the portions of the plaza from 2:05 PM to 2:46 PM (a duration of 41 minutes). At its largest extent the incremental shadow would cover approximately 34 percent of the plaza area. This increment would eliminate sunlight from the resource from 2:15 PM to 2:27 PM (a duration of 12 minutes).

Figure 4-13 O130- May/August 6 - 2:05 PM



Figure 4-14 O130- May/August 6 - 2:20 PM



Figure 4-15 O130- May/August 6 – 2:45 PM

At the start of this period, the shadow would fall on the northern portion of the plaza that runs along Third Avenue, which contains some planter beds. Other portions of the plaza would still receive sunlight at this time. By 2:20, the incremental shadow would cover the northern portion of the plaza and a portion of the plaza along East 46th Street where there is limited seating. By 2:45, there would be no incremental shadow on the northern portion of the plaza, and this area would be in sun. On the East 46th Street frontage, incremental shadow would cover a very small portion of this area. The way the plaza is situated, it is already cast in shadow by the building on site for much of the day, but would still receive sunshine in various portions of the plaza for approximately 5 hours and 50 minutes from 9:00 AM to 2:20 PM and again at 2:45 PM to 3:15 PM. Given the character of the planter beds in this area, the 12 minutes of time that the Proposed Project would eliminate sunlight from the resource would not adversely impact the viability of vegetation in the POPS. Furthermore, shadow would only be cast on a few benches. Therefore, there would be no significant adverse impacts on the space due to shadows.

O131-Bryant Park

Bryant Park, which is both an open space (O131) and a Scenic Landmark, is a 4.58-acre, City-owned park that extends from West 40th Street to West 42nd Street, between Fifth and Sixth Avenues, and is located immediately west of the New York Public Library main branch (Stephen A. Schwarzman Building). The park is characterized by a large central lawn (300 feet long by 215 feet wide), formal pathways, stone balustrades, allées of London Plane trees, and at the west end, an oval plaza containing a black granite ornamental fountain known as the Josephine Shaw Lowell Memorial Fountain. The park is lined with many additional monuments. Amenities include two restaurant pavilions and four concession kiosks, many tables and movable chairs among plantings, game areas, food vendors, and programming for physical activity, theater and other events. The park opens at 7 AM with closing varying

from 7 PM to midnight throughout the year. The large central lawn is converted into a seasonal ice rink in the winter months (December through March).

The terraced open spaces associated with the Stephen A. Schwarzman Building, New York Public Library (H14) are also assessed in this section.

The detailed analysis shows that new incremental shadow would fall on the park on three of the four analysis days: March/September 21st, May/August 6th, and June 21st.

March/September 21st

As shown in **Figure 4-16** through **Figure 4-18**, on the March/September 21st analysis day, Bryant Park would experience new incremental shadow for 36 minutes from 7:55 AM to 8:31 AM. The incremental shadow would begin along the imaginary line of East 41st Street through the park and move north and east before exiting the park along East 42nd Street. The incremental shadow would touch portions of the central lawn, and the area on the northwestern side of the park that contains trees, planting beds, moveable seating, and walkways. At its largest it would cover approximately 19 percent of the total park area. The park would continue to have sunlit portions for the duration of the incremental shadow and would still receive approximately 6 hours of direct sunlight throughout the analysis day. For park visitors looking to enjoy these types of amenities in sunlight during that time, they could do so in other areas of the park that would be in sun. Therefore, this relatively short duration of shadow would not adversely impact the viability of vegetation or the public enjoyment of the space.

Figure 4-16 O131- March/September 21- 8:00 AM



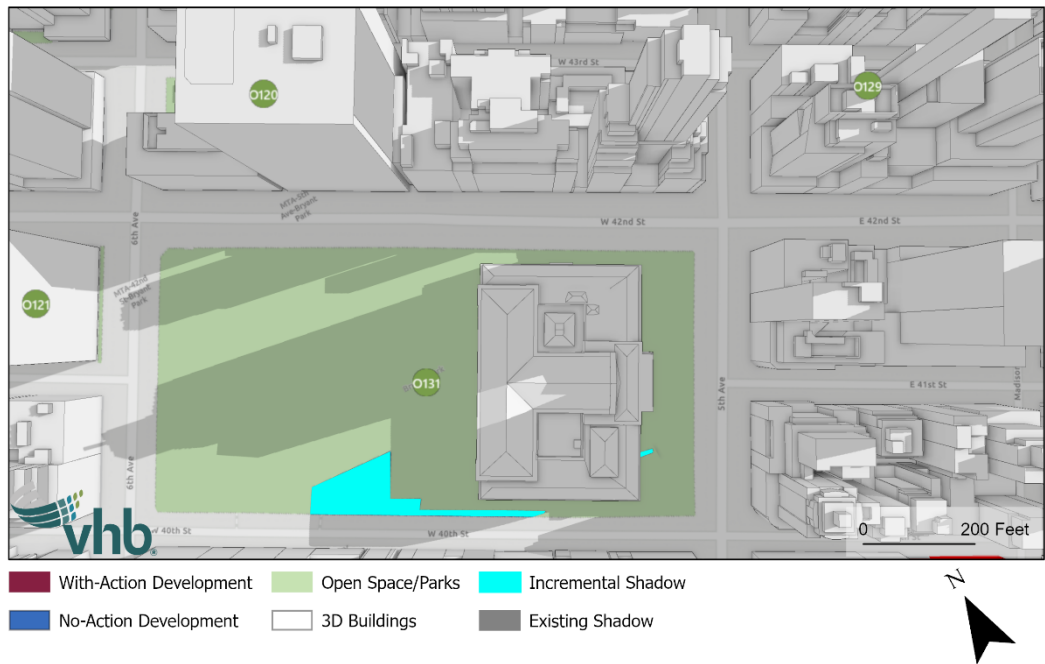
Figure 4-17 O131- March/September 21- 8:15 AM**Figure 4-18 O131- March/September 21 – 8:30 AM****May/August 6th**

As shown in **Figure 4-19** through **Figure 4-21**, on the May/August 6th analysis day, Bryant Park would experience new incremental shadow for 35 minutes from 7:53 AM to 8:28 AM and then again for 21 minutes from 8:52 AM to 9:13 AM for a total incremental shadow duration of 56 minutes. Incremental shadow would fall on areas of the park with trees, movable seating and tables, and walkways that surrounds the central lawn. At its largest extent, the incremental shadow would cover about seven percent of the total park area. At the start of the increment, shadow would enter a small portion of the park along West 40th Street at

roughly midblock; while the increment would increase in size, also along West 40th Street, other portions of the park would be in sunshine during this period of increment. There is a break where there would be no incremental shadow on the park starting at 8:28 AM. It would enter again on the east side of the Stephen A. Schwarzman building at 8:52 AM. At the end of the period, shadow would reach the northeastern corner of the park before exiting the park by 9:13 AM. The park would be largely in full sun for six hours of the day from 9:00 AM to 3:00 PM and have partial sun through the entire analysis day. During the period of incremental shadow, a park visitor could find the amenities such as seating and walking paths that would be sunlit. The area of incremental shadow at any given time on this analysis day would be relatively small, and the park would still receive direct sun for the entire period. Therefore, the incremental shadows on this analysis day would not result in a significant adverse impact.

Figure 4-19 O131- May/August 6 – 8:00 AM



Figure 4-20 O131- May/August 6 – 8:15 AM**Figure 4-21 O131- May/August 6 – 9:00 AM****June 21st**

On the June 21st analysis day, Bryant Park would experience new incremental shadow for 33 minutes from 8:21 AM to 8:54 AM (see **Figure 4-22** through **Figure 4-24**). This incremental shadow would fall on the southeast portion of the park along Fifth Avenue that contains the Stephen A. Schwarzman building plazas. This area contains seating, planting beds, and trees;

the incremental shadow would cover a small portion of the plaza, and the plaza would continue to receive sunlight in other areas throughout this period throughout the day. Therefore, this incremental shadow would not adversely impact the public’s enjoyment or viability of the vegetation in this space on this analysis day.

Figure 4-22 O131- June 21 – 8:25 AM

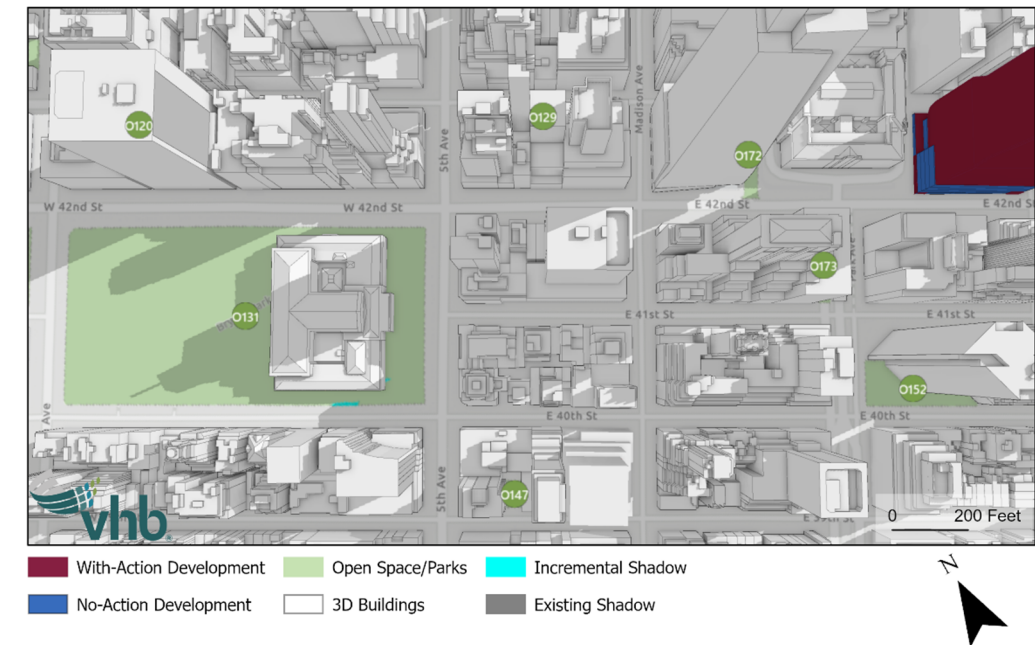


Figure 4-23 O131- June 21 – 8:40 AM

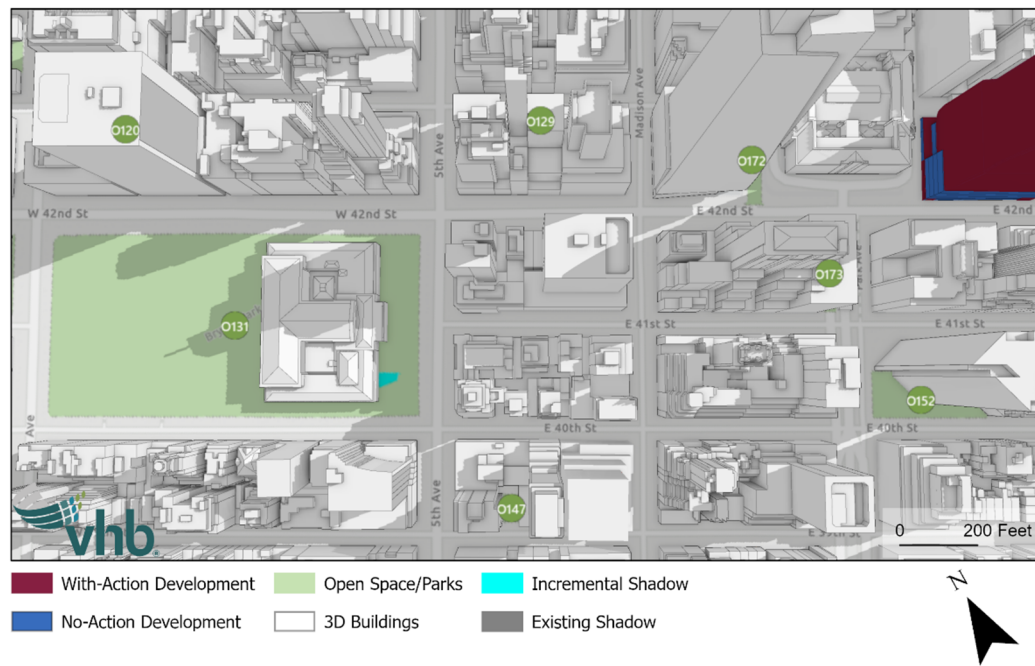
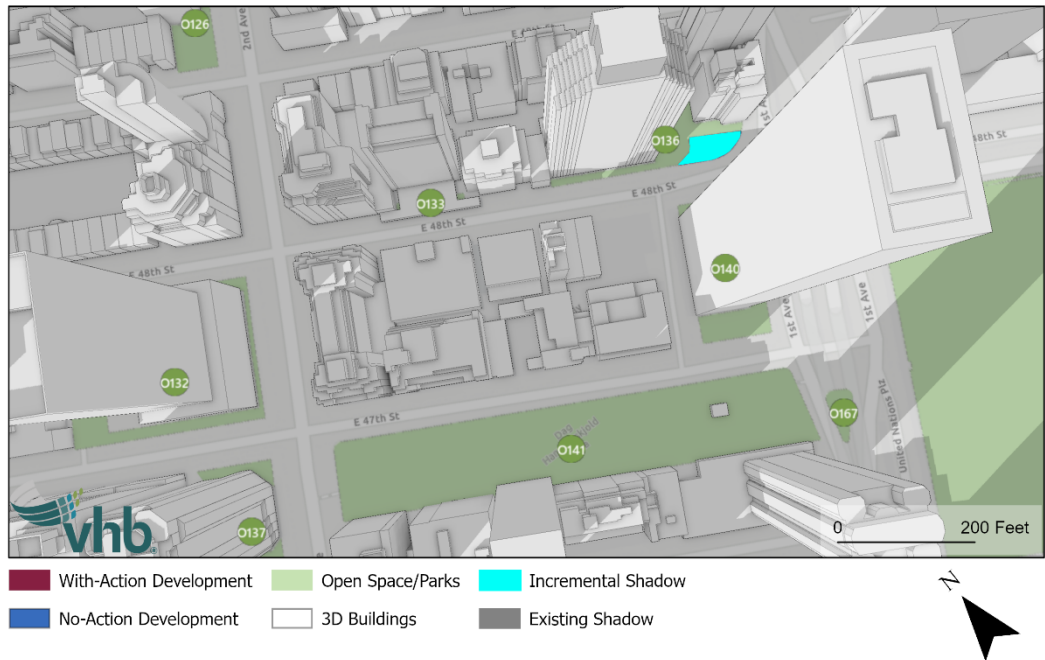


Figure 4-24 O131- June 21 – 8:54 AM

O136- 100 United Nations Plaza

100 United Nations Plaza is a plaza with trees, planters with seating ledges, a sculpture and a water feature. Part of the plaza has a covered walkway with a glass roof.

The detailed analysis shows that during one analysis period—the May/August 6 analysis day—the plaza would receive new incremental shadow for 22 minutes from 3:40 PM to 4:02 PM (see **Figure 4-25**). The plaza would remain partially in sun for the duration of new incremental shadow. Therefore, due to this and the relatively short duration of shadow, the incremental shadow would not adversely impact the public's enjoyment of the space or the viability of vegetation.

Figure 4-25 O136- May/August 6 – 3:50 PM**O137- 240 East 47th Street**

The 240 East 47th Street POPS, also known as Dag Hammarskjold Tower, contains a plaza with trees, planters with seating ledges, benches, and a water feature.

As shown in **Figure 4-26** through **Figure 4-28**, new incremental shadow would fall on the plaza on the June 21st analysis day for 35 minutes from 3:05 PM to 3:40 PM. At both the start and end of the increment, the increment would cover only a small portion of the plaza, and at all times during the increment, the plaza would still receive sunlight. Given the short duration and extent, there would not be an adverse shadow impact on the resource.

Figure 4-26 O137- June 21 - 3:06 PM



Figure 4-27 O137- June 21 - 3:20 PM



Figure 4-28 O137- June 21 – 3:35 PM

O140- 845 First Avenue

The 845 First Avenue POPS is located along the building frontage of East 47th Street and contains trees and planters surrounded by stone benches.

On the May/August 6th analysis day, the plaza would receive new incremental shadow for 26 minutes from 3:40 PM to 4:06 PM (see **Figure 4-29**). The shadow would fall on a small portion of the northern side of the plaza that contains a driveway and some planters. Due to the relatively short duration of incremental shadow, its location, and that the resource would still receive sunlight throughout the day, there would be no significant adverse impact to shadows.

Figure 4-29 O140- May/August 6 – 3:55 PM

O141- Dag Hammarskjold Plaza

Dag Hammarskjold Plaza is a 1.6-acre, City-owned, large linear plaza along East 47th Street that is paved with trees, planters, benches, and wall seating. One day of the week during the summer the paved portion of the plaza also has a Grow NYC Greenmarket. The plaza would receive incremental shadow on two analysis days: May/August 6th and June 21st.

On the May/August 6th analysis day, the plaza would experience new incremental shadow for 1 hour and 10 minutes from 3:17 PM to 4:27 PM (see **Figure 4-30** through **Figure 4-34**). The shadow would largely fall on the western portion of the plaza. Sunlight would be eliminated from the plaza from 3:50 PM to 4:01 PM (a duration of 11 minutes). At its largest extent, the incremental shadow would cover approximately 9 percent of the total plaza area and largely only touch the portion of the plaza that is paved, with a few benches. The sunlight sensitive features of the plaza are already largely in shadow from the buildings directly to the south. The plaza would receive sunlight throughout the day and after this time period. Due to the characteristics of the area that the shadow would fall on, this incremental shadow would not adversely impact the enjoyment of the space by the public or the viability of vegetation.

Figure 4-30 O141- May/August 6 – 3:20 PM

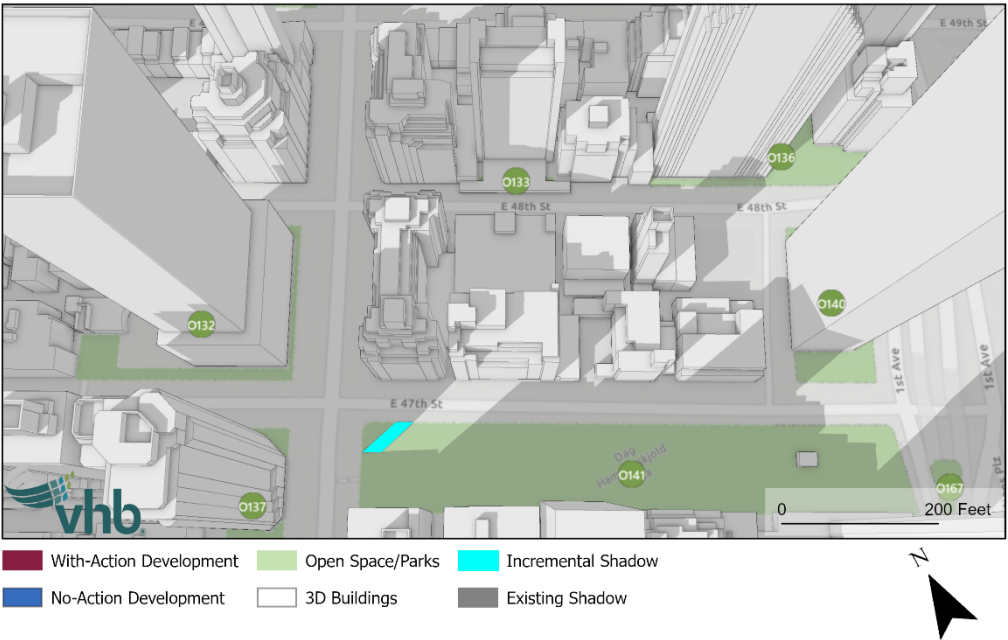


Figure 4-31 O141- May/August 6 – 3:35 PM

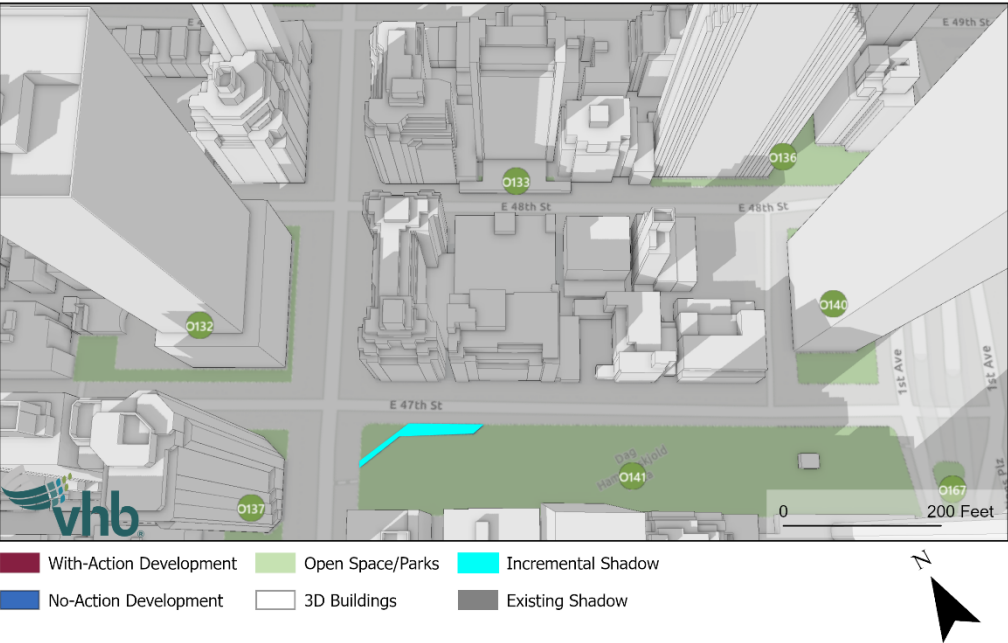


Figure 4-32 O141 May/August 6 – 3:50 PM



Figure 4-33 O141- May/August 6 – 4:05 PM

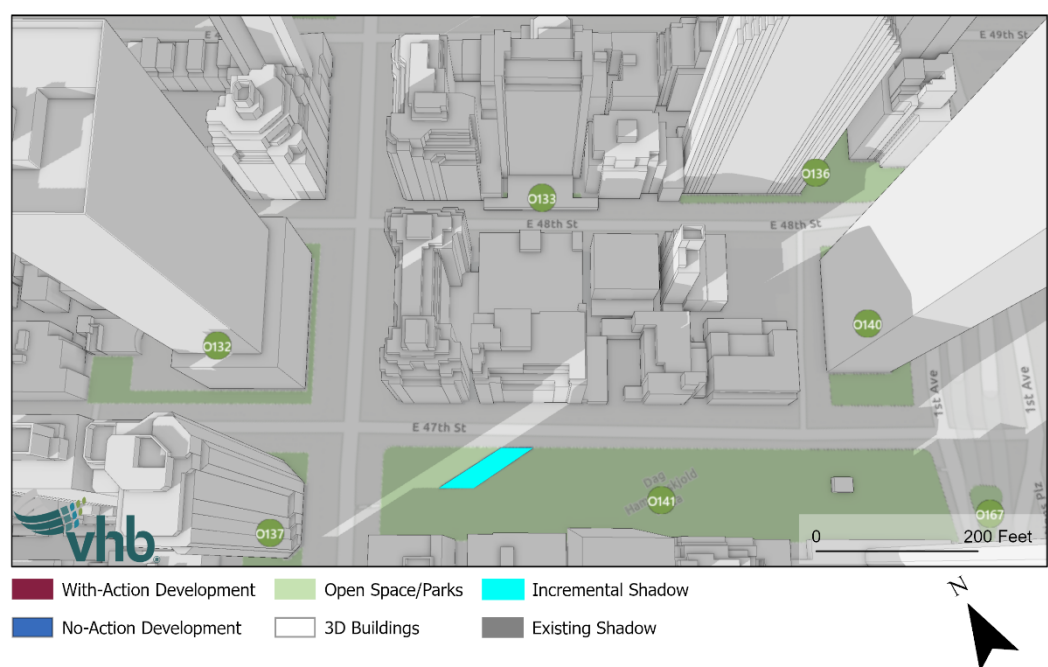
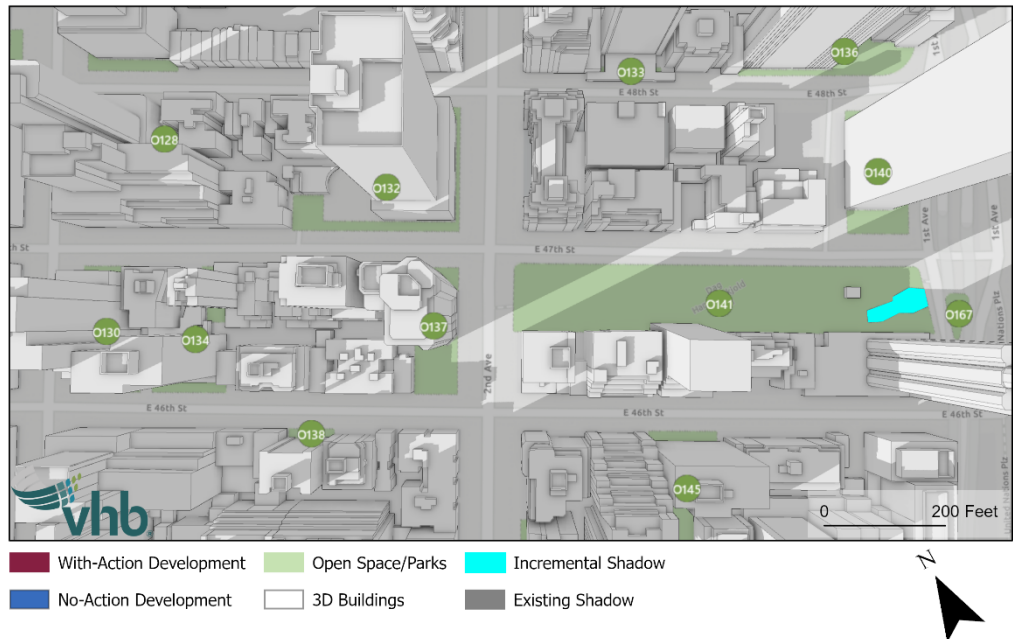


Figure 4-34 O141- May/August 6 – 4:20 PM

On the June 21st analysis day, the plaza would experience new incremental shadow for 22 minutes from 3:57 PM to 4:19 PM (see **Figure 4-35**). The shadow would fall on the western portion of the plaza, which would remain partially in sun throughout the period of incremental shadow. Therefore, this incremental shadow would not adversely impact the enjoyment of the space by the public or the viability of vegetation.

Figure 4-35 O141- June 21 – 4:10 PM

O142- MacArthur Park

MacArthur Park, a 0.3-acre playground located along the FDR Drive from East 48th Street to East 49th Street, contains playground facilities, chairs, benches, tables, and landscaping.

As shown in **Figure 4-36**, it would receive a small area of incremental shadow on the May/August 6th analysis day from 4:16 PM to 4:42 PM (a duration of 26 minutes). Given the relatively short duration of shadow, that the Park would receive full sun throughout the rest of the analysis day, and that the Park would receive partial sun throughout the period of incremental shadow, there would be no significant adverse impact due to shadows.

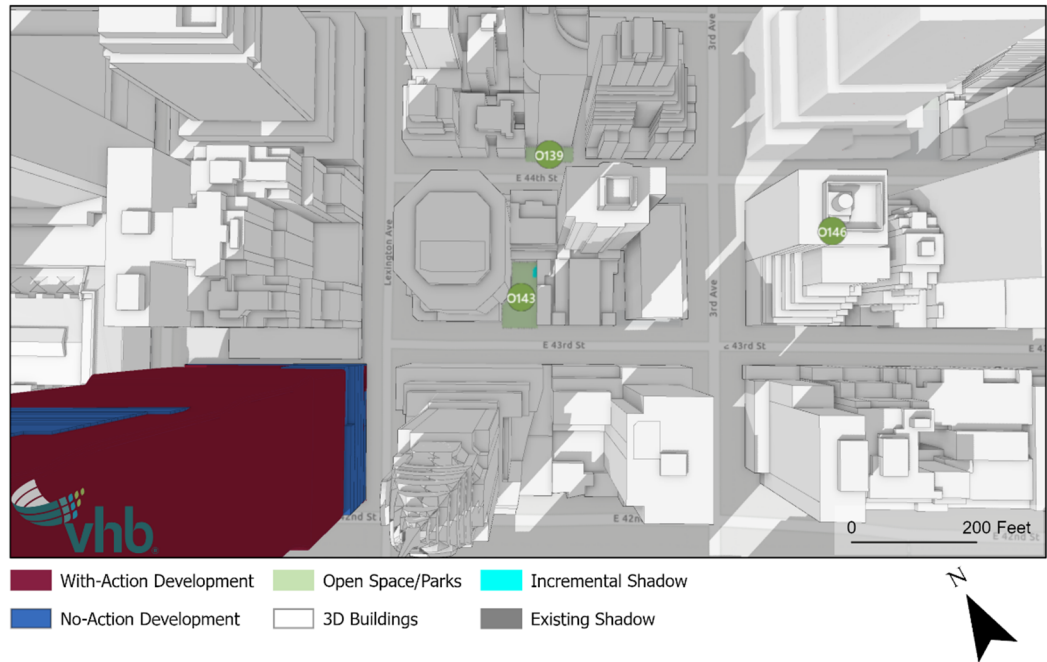
Figure 4-36 O142- May/August 6 – 4:35 PM



O143- 425 Lexington Avenue

The 425 Lexington Avenue POPS contains a plaza, movable tables and chairs and planters with seating ledges, and trees.

As shown in **Figure 4-37**, it would receive new incremental shadow on the June 21st analysis day for 22 minutes from 2:06 PM to 2:28 PM. The incremental shadow would remove the last sunlight from the space for 16 minutes during this period. At its largest extent the shadow would cover approximately 210 square feet or five percent of the total plaza area and would be limited to the back corner of the plaza where amenities are more limited. Because of the plaza's midblock location and relationship to neighboring buildings, the resource is already cast in No-Action and existing shadow by the surrounding buildings. However, it would still receive sunlight for 3 ½ hours throughout the analysis day and would continue to receive sunlight on the other analysis days. Therefore, given the short duration of the shadow, and that the resource would still receive sunlight at other times during the day, there would be no significant adverse impact due to shadows.

Figure 4-37 O143- June 21 - 2:20 PM**O144- 301 East 45th Street**

301 East 45th Street is an expanded sidewalk, with several planters located in the building's recessed area. This space contains no seating amenities.

As shown in **Figure 4-38** through **Figure 4-41** it would receive incremental shadow on the June 21st analysis day for 43 minutes from 3:39 PM to 4:22 PM. Because this space is functionally a sidewalk area, this incremental shadow would not adversely impact the public's use and enjoyment of this space, and no significant adverse shadows impacts would result.

Figure 4-38 O144- June 21 – 3:41 PM



Figure 4-39 O144- June 21 – 3:55 PM



Figure 4-40 O144- June 21 – 4:10 PM



Figure 4-41 O144- June 21 – 4:21 PM



O161- Gantry Plaza State Park

Gantry Plaza State Park is located across the East River in Queens. The portion of the waterfront park that could potentially be shadowed contains landscaping, trees, grassy fields,

boardwalks and walkways, a ferry terminal, the Queens West Sports Field, the Pepsi Cola sign, and various seating areas.

As shown in **Figure 4-42** and **Figure 4-43** incremental shadows would fall on a portion of Gantry Plaza State Park for 20 minutes from 5:41 PM to 6:01 PM on the June 21st analysis day. The shadow would first enter the park on the waterfront below 46th Avenue, and then move south and across Center Boulevard into the Queens West Sports Field. At this time of day and this distance from the Development Site, the shadow would move rapidly across the resource. Given the short time period, the rapid movement of the incremental shadow, and that the rest of the resource would remain in sunlight throughout this time, there would be no significant adverse impact due to shadows.

Figure 4-42 O161- June 21 – 5:45 PM



Figure 4-43 O161- June 21 – 6:00 PM

O169- Park Avenue Malls

The Park Avenue malls consist of a median along Park Avenue that extends for 56 blocks; they do not contain seating but are filled with planting beds that contain trees, shrubs and flowers and the occasional sculpture. The detailed analysis examined the malls between East 46th Street and East 51st Street as this is the area that falls within the Tier 3 shadow area.

Incremental shadows would fall on the resource on two analysis days: December 21st and March/September 21st.

As shown in **Figure 4-44**, on December 21st shadows would fall from 1:13 PM to 1:35 PM (a duration of 22 minutes) on the section of the malls that spans from East 54th Street to just north of East 56th Street. The shadow would cover a relatively small linear area across these three mall segments. Given the relatively short extent and duration of shadow outside of the growing season, there would be no significant adverse impact due to shadows on this analysis day.

Figure 4-44 O169- December 21 – 1:25 PM

As shown in **Figure 4-12**, on the March/September 21st analysis day shadows would fall on the resource from 12:10 PM to 12:52 PM (a duration of 42 minutes). It would fall on the portion of the malls that stretch from East 46th Street to East 48th Street and would almost entirely cover the mall from East 47th to East 48th Street at its largest extent (or approximately two percent of the total mall area). This portion of the mall would still receive some sunlight throughout the day. Given that the Park Avenue Malls remain largely shaded for much of the day under existing conditions, the existing vegetation has proven to be shade tolerant. As a result, the incremental shadows would not result in a significant adverse impact to the malls.

O170- United Nations Sculpture Garden

The United Nations (UN) Sculpture Garden is a 6-acre UN-owned garden located outside of the United Nations Visitor Centre is an open space with sculptures, trees, and landscaping that is open only to official building tours and visitors from 10 AM to 5 PM from May through September.

The detailed analysis shows that incremental shadows would reach this resource on two analysis days: May/August 6th and June 21st.

As shown in **Figure 4-45** through **Figure 4-48**, on the May/August 6th analysis day, new shadows would fall on this resource from 4:06 PM – 5:20 PM. Taking daylight savings into account, these shadows would occur wholly after the garden is closed to visitors, and therefore would not affect the public's enjoyment of the resource. Furthermore, the garden benefits from its location next to the river and receives full sun exposure for 7 ½ hours, and additional partial sun throughout the analysis day, so the viability of the vegetation would not be impacted.

Figure 4-45 O170- May/August 6 – 4:10 PM

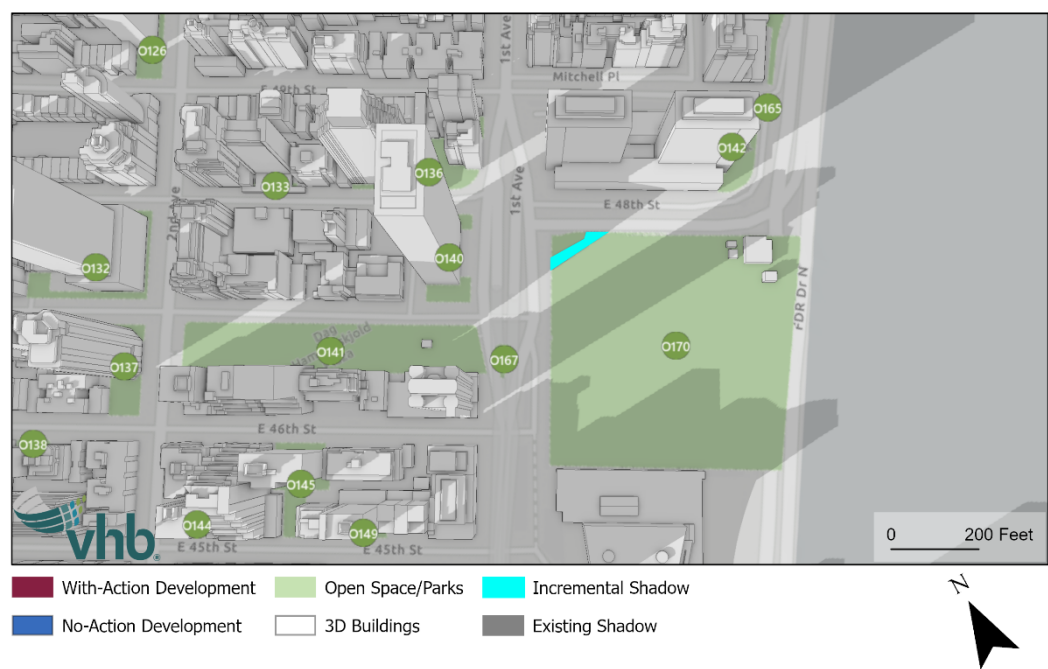


Figure 4-46 O170- May/August 6 – 4:20 PM

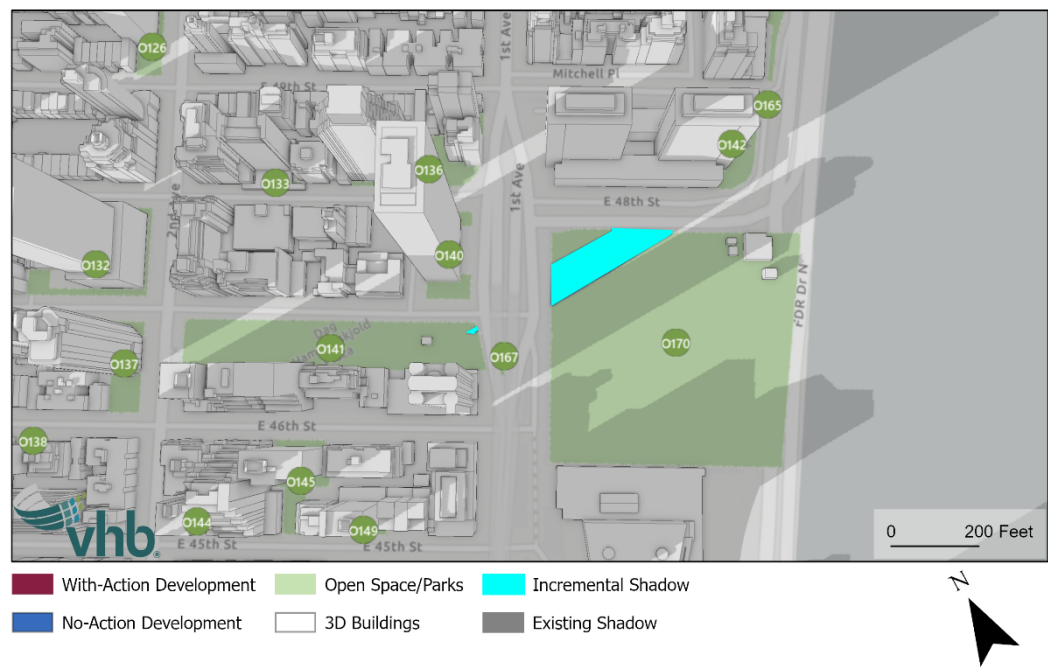


Figure 4-47 O170- May/August 6 – 4:40 PM**Figure 4-48 O170- May/August 6 – 5:05 PM**

As shown in **Figure 4-49** through **Figure 4-53**, on the June 21st analysis day, new project-generated shadows would fall on the resource from 4:12 PM to 5:23 PM (a duration of 1 hour and 11 minutes). Throughout the day, the garden would be in full sun for eight hours before having any shadow intrusion from existing buildings starting at 2:00 PM. As described above, these shadows would occur at a time of day after the garden is closed to visitors and would therefore not affect the public's enjoyment of this resource. The garden would

continue to be fully in sunshine through the morning and early afternoon, and therefore viability of the vegetation would not be affected.

Figure 4-49 O170- June 21 – 4:15 PM

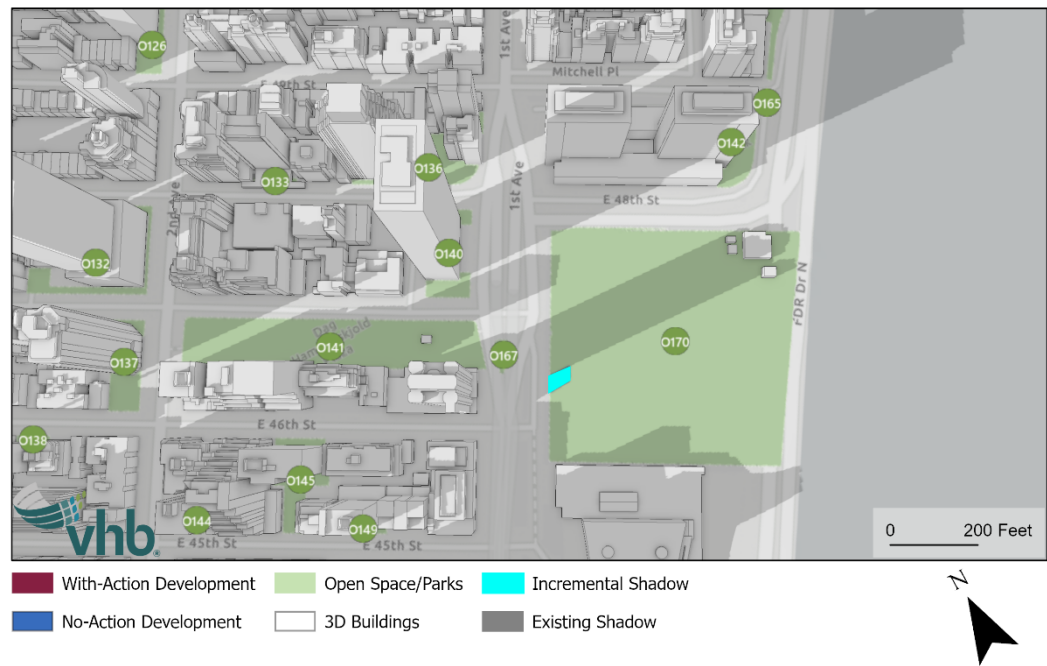


Figure 4-50 O170- June 21 – 4:30 PM

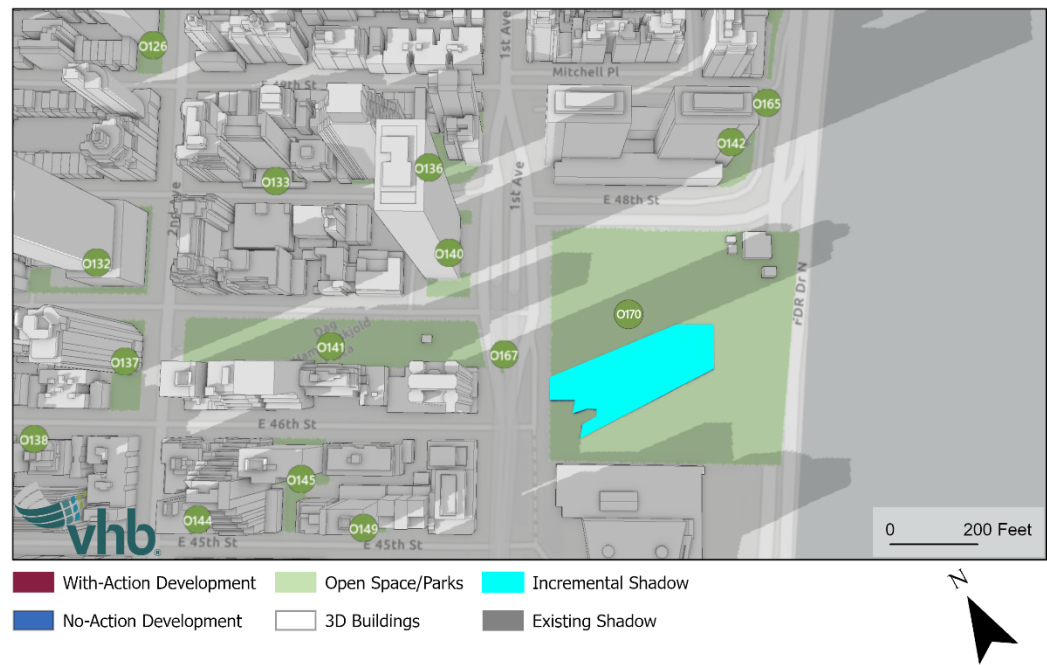


Figure 4-51 O170- June 21 – 4:45 PM



Figure 4-52 O170- June 21 – 5:00 PM



Figure 4-53 O170- June 21 – 5:15 PM

For these reasons, the project-generated shadows would not result in a significant adverse impact to the garden on either analysis day.

O171- Four Freedoms State Park

Four Freedoms State Park, located on the southern tip of Roosevelt Island, contains fields and trees, pathways for walking, and the Franklin D. Roosevelt memorial. It is located just south of the Smallpox Memorial Hospital and Strecker Memorial Laboratory. The park is open to the public from 9 AM to 5 PM 6 days of the week.

The park would receive project generated shadows from 4:50 PM to 5:18 PM (a duration of 28 minutes) on the May/August 6th analysis day (see **Figure 4-54** and **Figure 4-55**). These shadows would occur at the end of the day when shadows move very quickly across the resource, so any one area would not be shaded for long. Furthermore, the park, located in the East River, is free of shadows for the majority of the day. Therefore, due to this short duration of shadow, there would not be a significant adverse impact to the public's enjoyment of the resource or the viability of vegetation and further analysis is not required.

The park would receive project generated shadows from 5:16 PM to 5:30 PM (a duration of 14 minutes) on the June 21st analysis day (see **Figure 4-53** and **Figure 4-54** through **Figure 4-56**). These shadows would occur after the park is closed to the public, and therefore would not affect the public's enjoyment of the resource. Furthermore, the park, located in the East River, is free of shadows for the majority of the day. Therefore, this short duration of shadow would not constitute a significant adverse impact and further analysis is not required.

Figure 4-54 O171- May/August 6 – 4:55 PM



Figure 4-55 O171- May/August 6 – 5:10 PM**Figure 4-56 O171- June 21 – 5:15 PM**

O172- One Vanderbilt Plaza

As described above, under the No-Action condition, the new DOT plaza on Vanderbilt Avenue, between East 42nd and East 43rd Streets, will comprise a 60-foot-wide by 200-foot-long area along Vanderbilt Avenue that will be closed to vehicular traffic and dedicated to pedestrian use.

The detailed analysis shows that the new plaza would receive incremental shadow lasting longer than 10 minutes on two analysis days: May/August 6th and June 21st.

As shown in **Figure 4-57** through **Figure 4-63**, on the May/August 6th analysis day, the plaza would receive incremental shadow from 7:41 AM to 7:51 AM and then again from 9:07 AM to 10:43 AM, for a total duration of 46 minutes. The shadow would eliminate remaining sunlight from the resource from 7:41 AM to 7:51 AM and again from 9:07 AM to 9:30 AM. This plaza is conceived as a pedestrian circulation space and is expected to have few or no sunlight sensitive features. Due to the fact that the area is characterized by large high-rise buildings, any plantings that are located in the area would likely be shade tolerant. Therefore, given the relatively short duration of shadow, the lack of sunlight sensitive features, and that the resource would still receive sunlight for four hours, there would be no significant adverse impact.

Figure 4-57 O172-May/August 6 – 7:45 AM



Figure 4-58 O172-May/August 6 – 9:15 AM



Figure 4-59 O172- May/August 6 – 9:30 AM



Figure 4-60 O172 May/August 6 – 9:45 AM

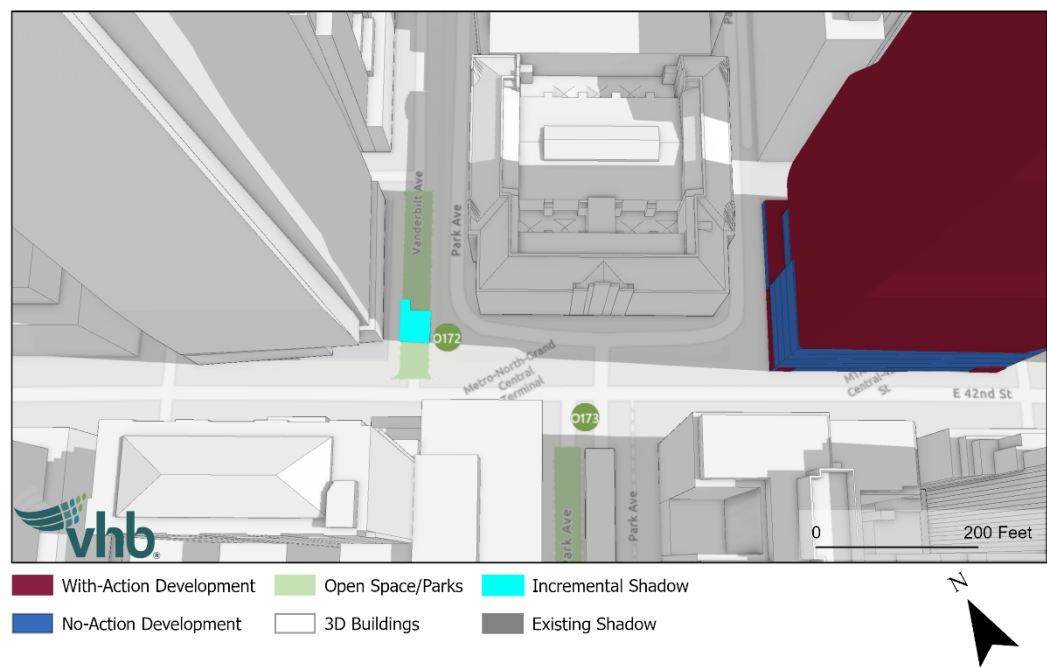


Figure 4-61 O172- May/August 6 – 10:00 AM

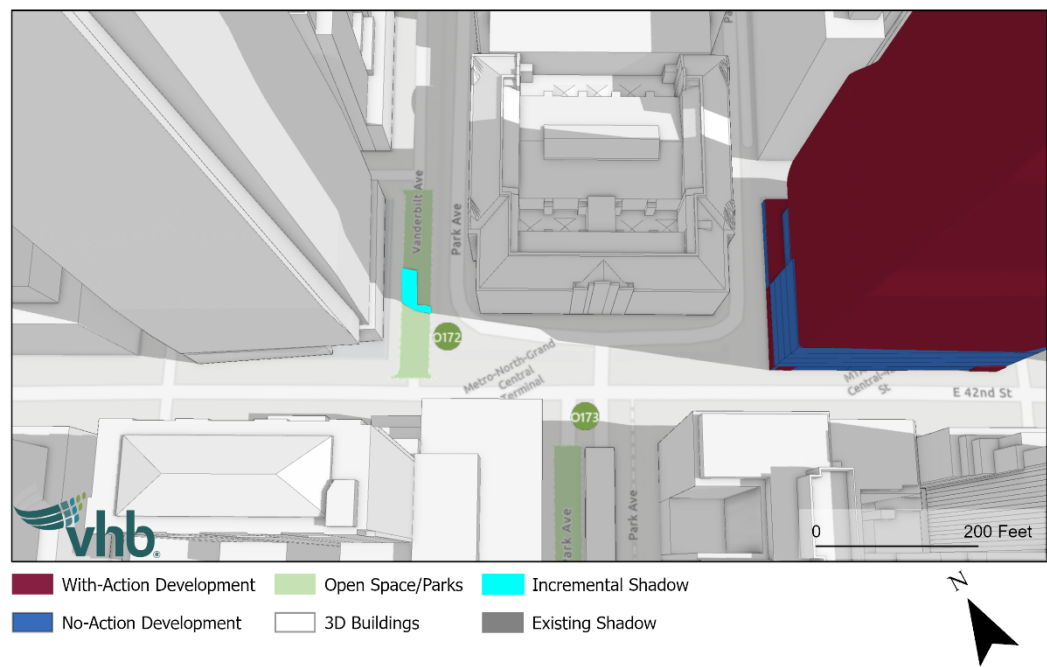
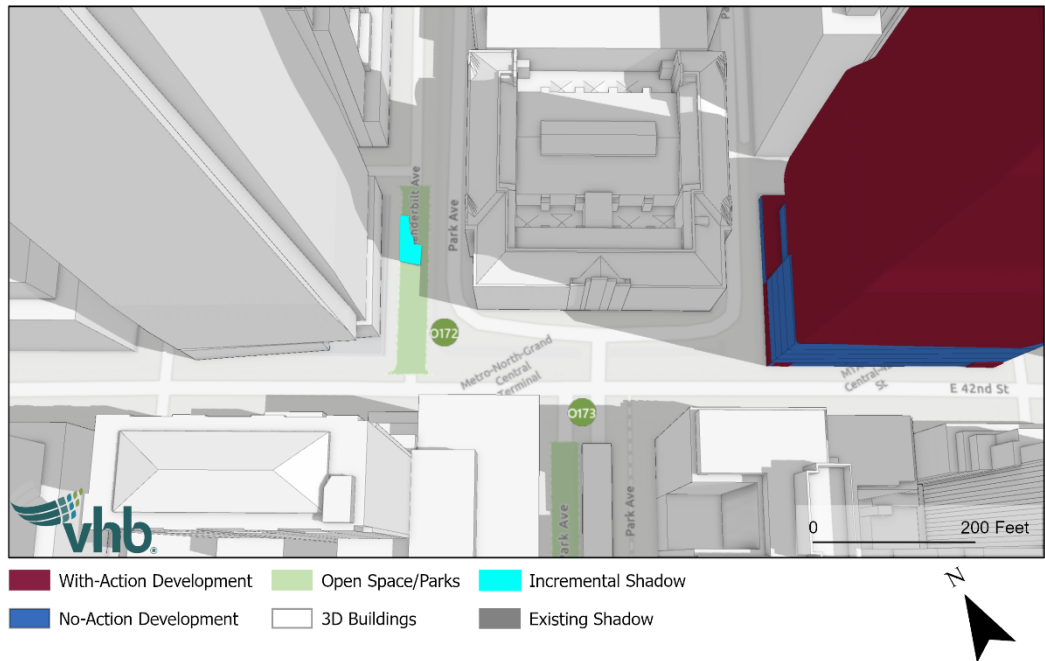
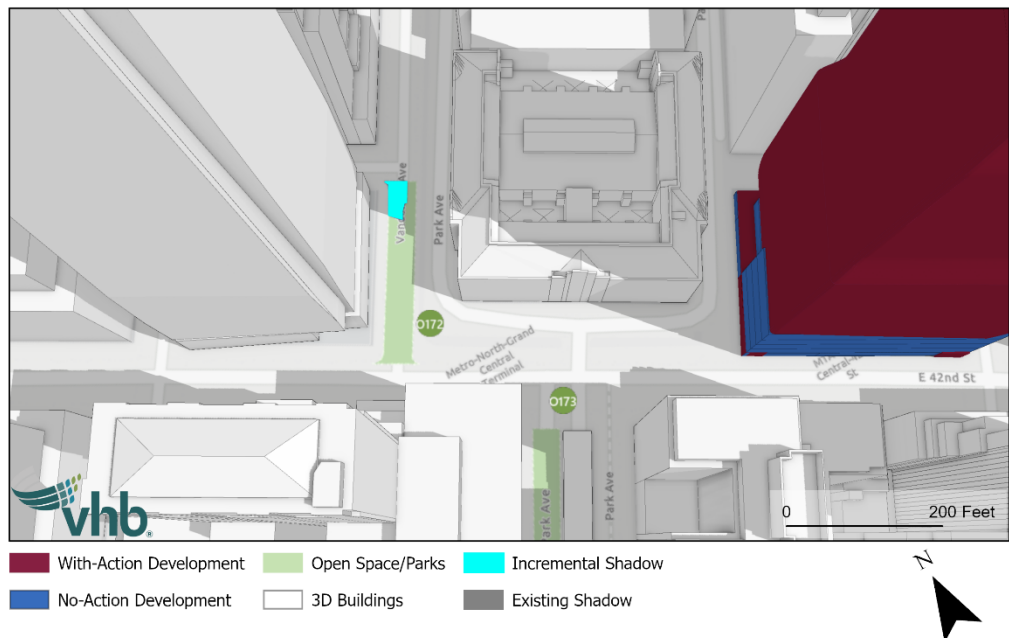


Figure 4-62 O172 May/August 6 – 10:15 AM**Figure 4-63 O172- May/August 6 – 10:30 AM**

On the June 21st analysis day (see **Figure 4-64** through **Figure 4-69**), the plaza would receive incremental shadow for 3 hours and 3 minutes, from 7:59 AM to 11:02 AM. Areas of the plaza would remain in sunlight throughout this period of shadow, and the plaza would continue to receive sunlight in the midafternoon. As stated above, it is also expected that the amenities and plantings will be shade tolerant. Therefore, this shadow would not adversely impact the future vegetation and public enjoyment of the plaza on this analysis day.

Figure 4-64 O172- June 21 – 8:30 AM

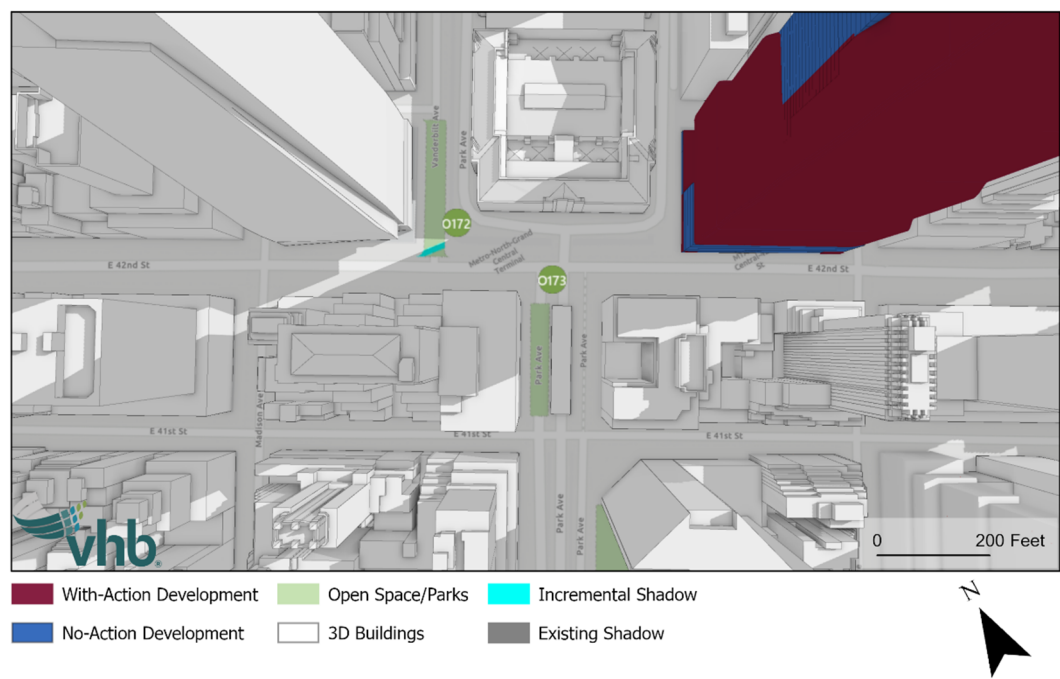


Figure 4-65 O172-June 21 – 9:05 AM



Figure 4-66 O172- June 21 – 9:30 AM



Figure 4-67 O172- June 21 – 10:00 AM

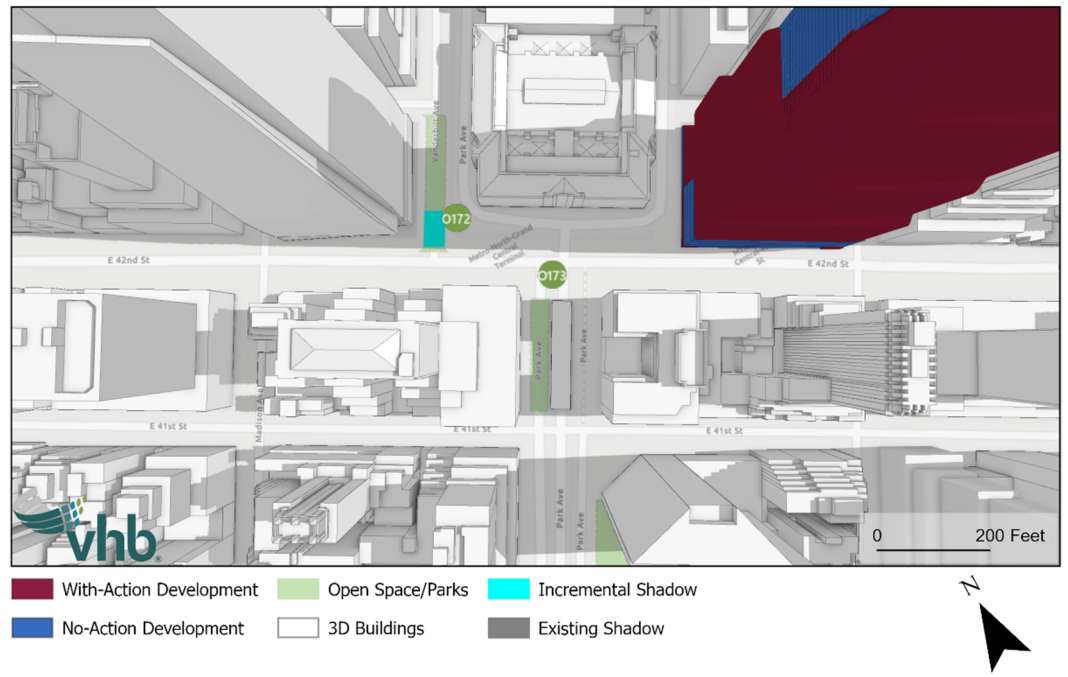
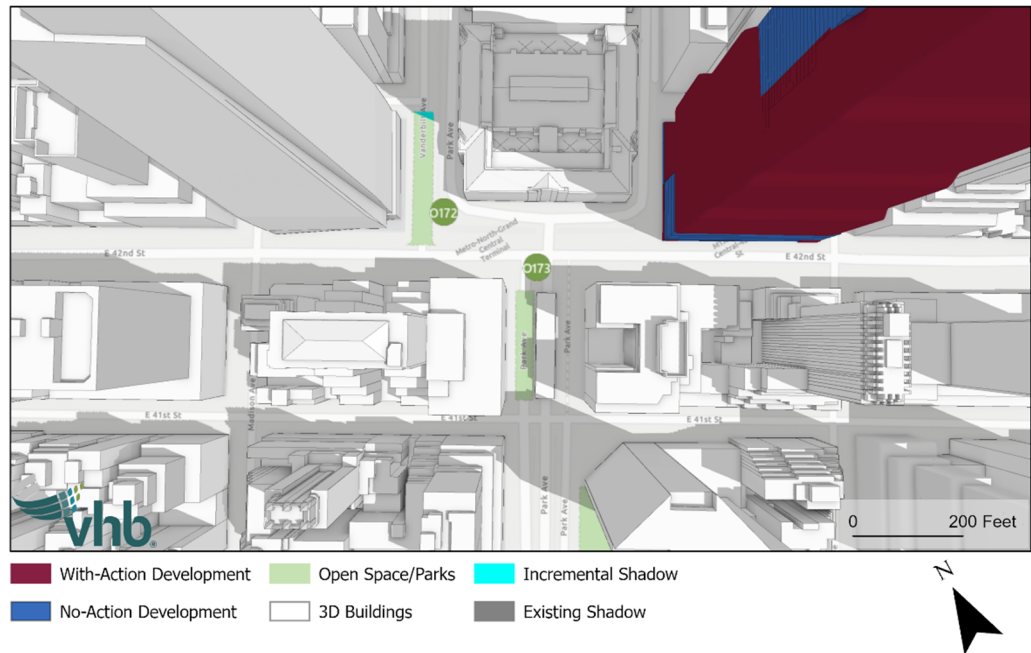


Figure 4-68 O172- June 21 – 10:30 AM**Figure 4-69 O172- June 21 – 11:00 AM**

O173- Pershing Plaza West

Pershing Plaza West, a plaza located along the Park Avenue Viaduct just south of 42nd Street, contains movable seating, benches and trees. The detailed analysis shows that on one analysis day—June 21st—this resource would experience a 22-minute duration of incremental shadow between 9:01 AM and 9:23 AM. As shown in **Figure 4-70**, the shadow would fall on a small portion of the space closest to 42nd Street. The plaza would receive

sunlight throughout the remainder of day; therefore, given the small area of extent and the short duration of shadow, there would be no significant adverse impact on the plaza.

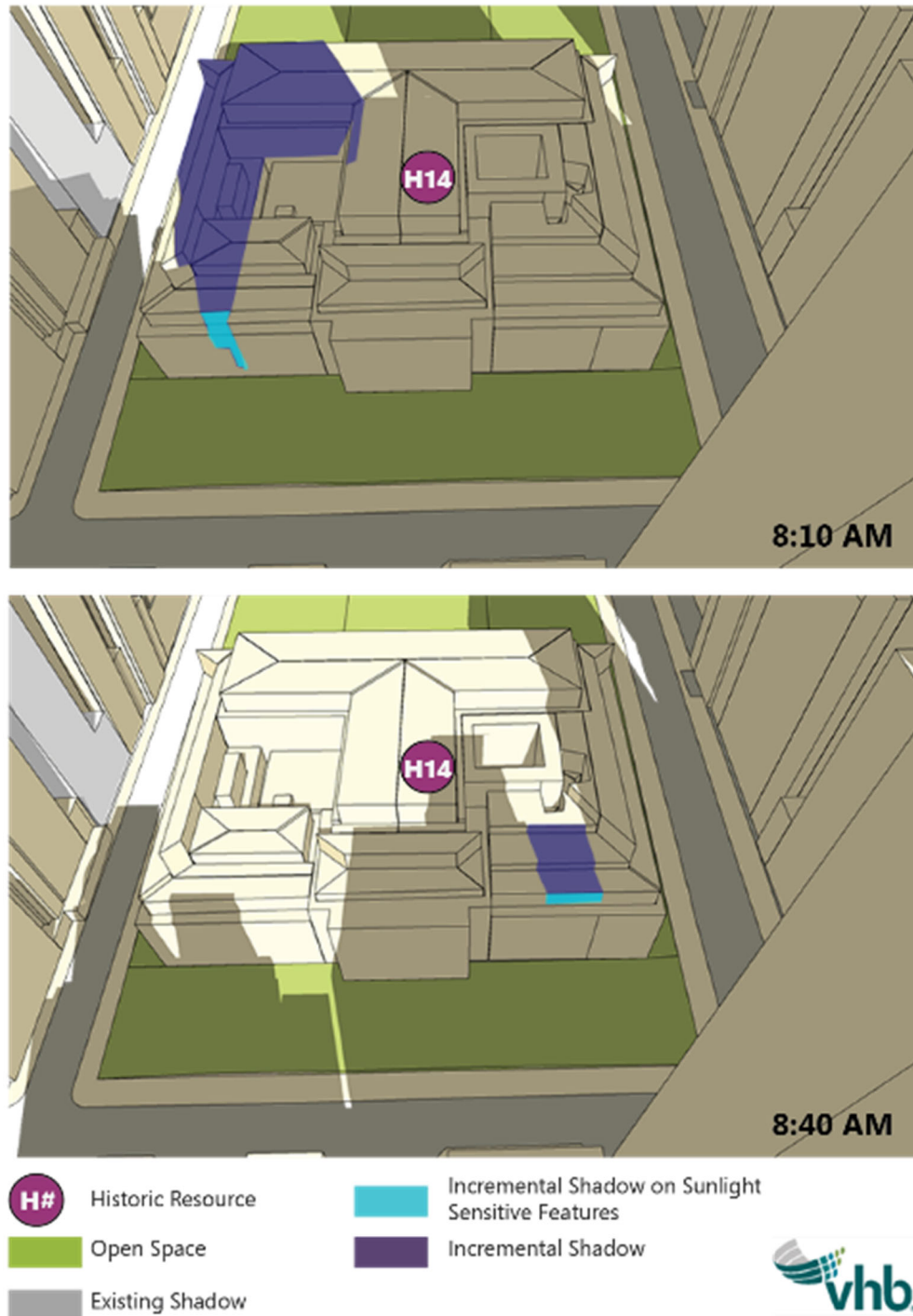
Figure 4-70 O173-June 21 – 9:10 AM



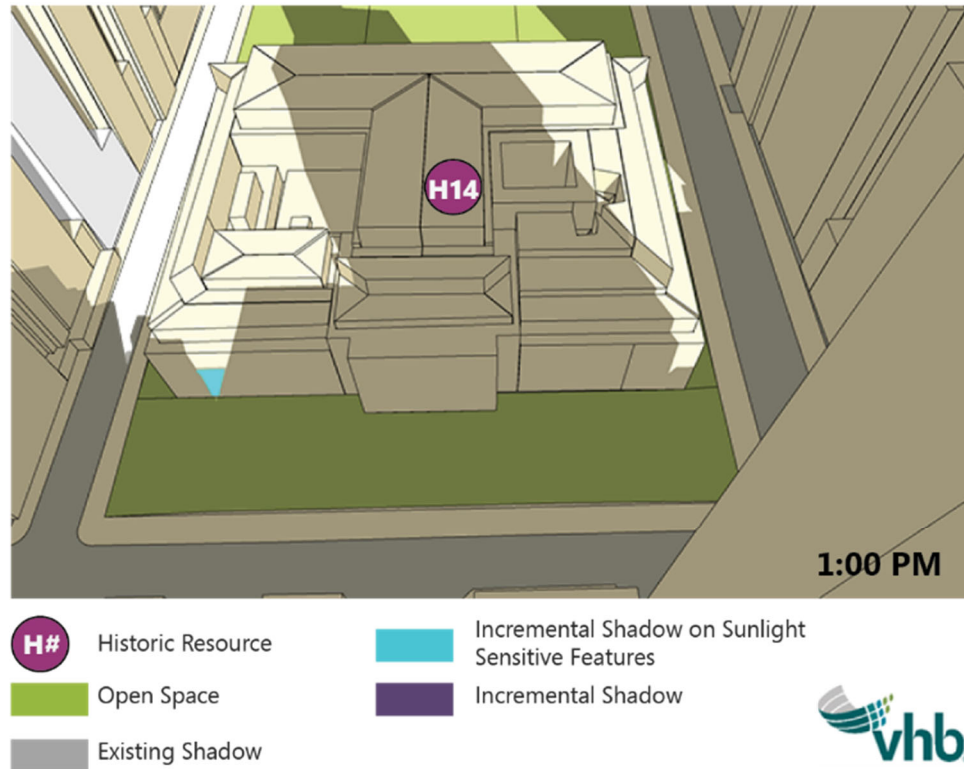
H14- Stephen A. Schwarzman Building, New York Public Library

The Stephen A. Schwarzman Building, which houses the New York Public Library Main Branch, is a New York City and National Landmark. The terrace surrounding the building is technically part of Bryant Park, and was evaluated as such above. The façade that faces Fifth Avenue features a columned entrance porch in the center portion and sculptural detail, which are considered sunlight sensitive. The Fifth Avenue façade would receive incremental shadow on two analysis days: May/August 6th and June 21st.

On the May/August 6th analysis day, the sunlight sensitive features of the resource would receive incremental shadow from 7:59 AM to 9:00 AM (a duration 1 hour and 1 minute). As shown in **Figure 4-71**, the incremental shadow would shade a small strip of the southern side of the façade, which at this time is largely already shaded from existing buildings. The new shadow increment would cast the Fifth Avenue façade completely in shadow from 7:59 AM to 8:11 AM, a duration of 12 minutes, after which, this area would again begin to receive direct sunlight. At 8:22 AM, the incremental shadow would reach the northern side of the façade on the opposite side of the main entrance and cover a relatively small area. The façade would continue to receive direct sunlight from 8:11 AM onwards. Given that the Proposed Project would eliminate direct sunlight from the resource for a relatively small period of time, this increment would not affect the public's enjoyment of the resource. Furthermore, the resource would continue to receive substantial sun throughout the analysis day. Therefore, there would be no significant adverse impact to the library on this analysis day.

Figure 4-71 H14-May/August 6

On the June 21st analysis day, the library would have new project-generated shadows cast on the Fifth Avenue façade from 8:17 AM to 8:33 AM (a 16-minute duration). These shadows would shade a relatively small area of the southern portion of the façade (see [Figure 4-72](#)). The façade would continue to receive direct sunlight throughout this period and throughout the analysis day. Therefore, the new incremental shadow would not have a significant adverse impact on the public's enjoyment of the library.

Figure 4-72 H14-June 21

H34- Central Synagogue

The Central Synagogue is located at the southwest corner of Lexington Avenue and East 55th Street. It has stained glass windows along its Lexington Avenue façade.

The detailed analysis shows that on the December 21st analysis day, the top-most windows located on the Synagogue's turrets would experience new incremental shadow from 1:53 PM to 1:58 PM (a 5-minute duration). The resource would continue to receive direct sunlight throughout the day; therefore, this very short period of incremental shadow would not significantly change the shadow condition at the resource, and as such, the public's use and enjoyment of the resource would not be significantly adversely affected by project shadow.

H40 – Grand Central Terminal

Grand Central Terminal, a New York City Landmark, a S/NR-listed property, and a National Historic Landmark, is described in detail in **Chapter 5, Historic and Cultural Resources**.

This analysis considers how the Proposed Project would affect a pedestrian's experience of light within the Terminal's main concourse. A variety of windows contribute light to the main concourse and are taken into consideration in the following analysis.

The *CEQR Technical Manual* provides guidance and methodology for analysis of how a project may result in the elimination of direct sunlight on a resource, however, in the case of the Terminal, the experience of light within the main concourse is a function of a combination of direct sunlight, reflected sunlight, and ambient daylight, as well as the interior artificial lighting. This analysis therefore considers both direct sunlight, as guided by

the *CEQR Technical Manual*, as well as the conditions of reflected sunlight and ambient daylight within the main concourse of the Terminal.

Main Concourse—Sources of Illumination

On the Terminal's west and east façades, there is a series of three large, arched windows that illuminate the main concourse; these windows consist of two separated panes of glass with metal and glass walkways traversing the interstitial spaces (see **Photo 4-1** and **Photo 4-2**). The walkways connect the Terminal's office spaces on the north and south. The east and west façades also include additional windows that are smaller and rectangular on the northernmost and southern ends of the façade; however, these rectangular windows face interior offices, entryways, or stairways and do not illuminate the main concourse.

The main concourse also receives light from north- and south-facing large, clerestory windows at an upper elevation where the roof begins to arch in addition to skylight windows located on the ceilings over the ramp to the dining concourse and track entrances on the north and south sides of the main concourse respectively (see **Photo 4-4** and **Photo 4-5**).

While not greatly influencing lighting within the main concourse, indirect light also filters through a series of interior windows that are located between the main concourse and Vanderbilt Hall (see **Photo 4-3**). Vanderbilt Hall, a former waiting room now occupied by the Great Northern Food Hall and event space, has a series of large and arched windows facing 42nd Street on the southern façade of the Terminal.

In addition to the sources of natural light, a variety of artificial lighting sources are used within the Terminal to supplement the natural light and highlight important architectural features, and they are key contributors to the experience of light within the Terminal.

Photo 4-1 GCT Eastern Façade Facing Lexington Avenue



Photo 4-2 GCT Western Façade facing Vanderbilt Avenue

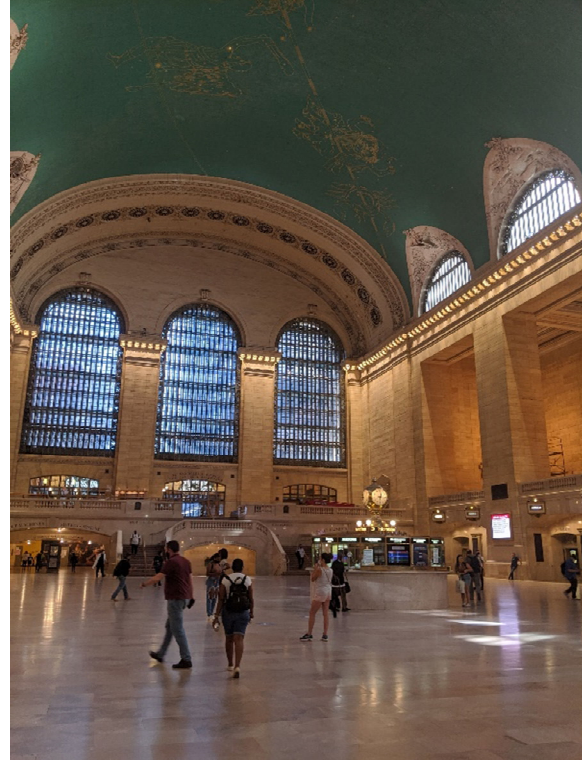


Photo 4-3 GCT Southern Façade Windows viewed from Main Concourse



Photo 4-4 South Facing Clerestory Windows and Vanderbilt Hall Interior Windows



Photo 4-5 GCT North Facing Clerestory Windows

Main Concourse—Experience of Light

As discussed above, there are a number of different windows that illuminate the main concourse: the main arched windows on the west and east facades, the clerestory windows near the roof on the north and south sides, the skylight windows, and the windows that separate the main concourse from Vanderbilt Hall, with the hall's southern façade's windows beyond that. Depending on season, time of day, and weather, the experience of light within the main concourse is based on a combination of direct, reflected and/or ambient daylight³ through the various windows, and, because of the variety of windows and window design, the distinction between these types of light is not readily apparent. For example, the window design of the east and west façade windows makes direct sunlight, reflected sunlight, and ambient daylight through these windows appear similar within the concourse⁴. At the time **Photo 4-6** and **Photo 4-7** were taken, there was no direct light on the eastern façade windows, but instead reflected light from the Grand Hyatt façade and ambient daylight. The corresponding interior photo shows that the windows look illuminated at that time. Similarly, at the time **Photo 4-8** and **Photo 4-9** were taken, the western façade windows are in partial direct sunlight and partial shadow, but the windows appear illuminated from the interior. In all instances, there is no discernable difference between direct sunlight, ambient daylight, and reflected sunlight. **Photo 4-10** through **Photo 4-13** show the conditions looking toward the southern facing windows in the main concourse at the same time as the exterior photos were taken of the southern façade.

³ Reflected daylight as described here is sunlight that bounces off of surrounding surfaces such as glass building facades or windows. Ambient daylight, as opposed to direct sunlight, is natural or indirect light.

⁴ Similar conditions were also documented in the Chapter 5, *One Vanderbilt FEIS*, CEQR #14DCP188M.

Photo 4-6 GCT Eastern Façade in Reflected Sunlight



Photo captured 8/20/20 at 3:15 PM. The sunlight hitting the façade is being reflected off of the Grand Hyatt façade. The three arched windows illuminate the main concourse, while the rectangular windows on the far left and the right do not.

Photo 4-7 GCT Eastern Façade facing Lexington Avenue

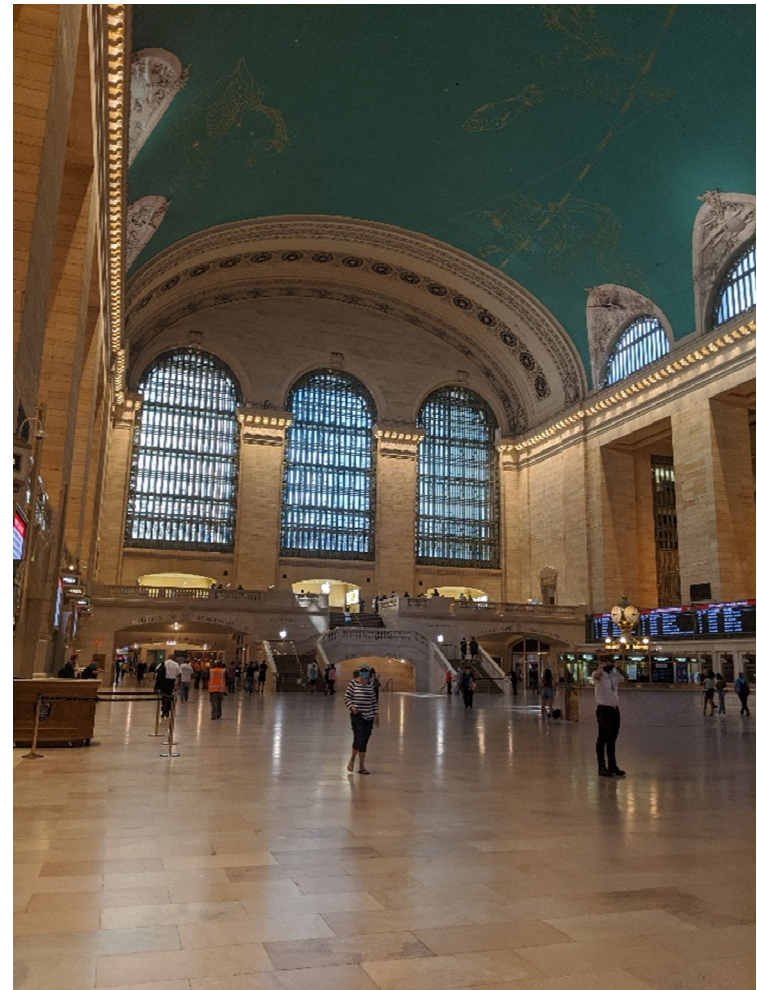


Photo captured 8/20/20 at 3:03 PM. Note that there is no discernable difference in the illumination of these windows versus the western windows in the figure below, which are partially in shadow and partially in direct sunlight.

Photo 4-8 GCT Western Façade Windows in Partial Direct Sunlight and Ambient Daylight



Photo captured 8/20/20 at 3:09 PM. The three arched windows illuminate the main concourse, while the windows on the far left and the right do not. At this time, some of the windows are receiving direct sunlight while others are in shadow.

Photo 4-9 GCT Western Façade facing Vanderbilt Avenue



Photo captured 8/20/20 at 3:02 PM. Note that there is no discernable difference between the portions of the windows in direct sunlight and those in ambient daylight

Photo 4-10 GCT Southern Façade Windows in Direct Sunlight and Shadow



Photo captured 8/20/20 at 3:14 PM. The windows shown in this photo directly illuminate Vanderbilt Hall

Photo 4-11 GCT Southern Façade Windows viewed from Main Concourse



Photo captured 8/20/20 at 3:04 PM. Skylights are shown on the ceiling above the American Flag in this photo.

Photo 4-12 GCT Southern Facing Clerestory Windows and Vanderbilt Hall interior Windows



Photo captured 8/20/20 at 3:03 PM. At this time, the eastern (windows on the left) clerestory windows were in direct sunlight, while the western windows (the two on the right) were in shade and are therefore exhibiting ambient daylight conditions. There is no discernable difference between those in shadow and those in direct sunlight, or between these windows and the northern facing windows shown in the subsequent picture. The skylights above the dining concourse ramps can also be seen here. From this vantage point, no light can be seen coming from the skylights.

Photo 4-13 GCT Northern Facing Clerestory Windows



Photo captured 8/20/20 at 3:02 PM. At this time, the clerestory windows were in ambient daylight/reflected sunlight from the MetLife building. There is no discernable difference in the southern facing and northern facing clerestory windows at this time despite these conditions. The skylights above the track entrances can also be seen from this vantage point.

Analysis Results

The detailed analysis showed that the project would result in new incremental shadows during three analysis periods: March 21st/September 21st, May 6th/ August 6th, and June 21st analysis periods.

The *CEQR Technical Manual* provides guidance and methodology for analysis of how a project may result in the elimination of direct sunlight on a resource. An incremental shadow is not considered significant when its duration is shorter than 10 minutes at any time of year and the resource continues to receive substantial direct sunlight. A significant shadow impact for a sunlight-sensitive feature of a resource generally occurs when an incremental shadow of 10 minutes or longer falls on a sunlight sensitive resource and results in the complete elimination of all direct sunlight on the sunlight-sensitive feature of the resource, when the complete elimination results in substantial effects on enjoyment or use of the resource. However, in the case of the Terminal, the experience of light within the main concourse is a function of a combination of direct sunlight, reflected sunlight, and ambient daylight, as well as the interior artificial lighting. This analysis therefore considers both direct sunlight as guided by the *CEQR Technical Manual* as well as the conditions of reflected sunlight and ambient daylight within the main concourse of the Terminal.

March/September 21st

On the March/September 21st analysis day, incremental shadow would move from west to east across the Terminal and would be limited to small portions of the windows on the eastern façades (see **Figure 4-73** and **Figure 4-74**). These windows would experience incremental shadows in two separate periods, from 8:28 AM to 9:33 AM and again from 12:12 PM to 12:50 PM (a total duration of 1 hour and 43 minutes).

Figure 4-73 H40-March/September 21

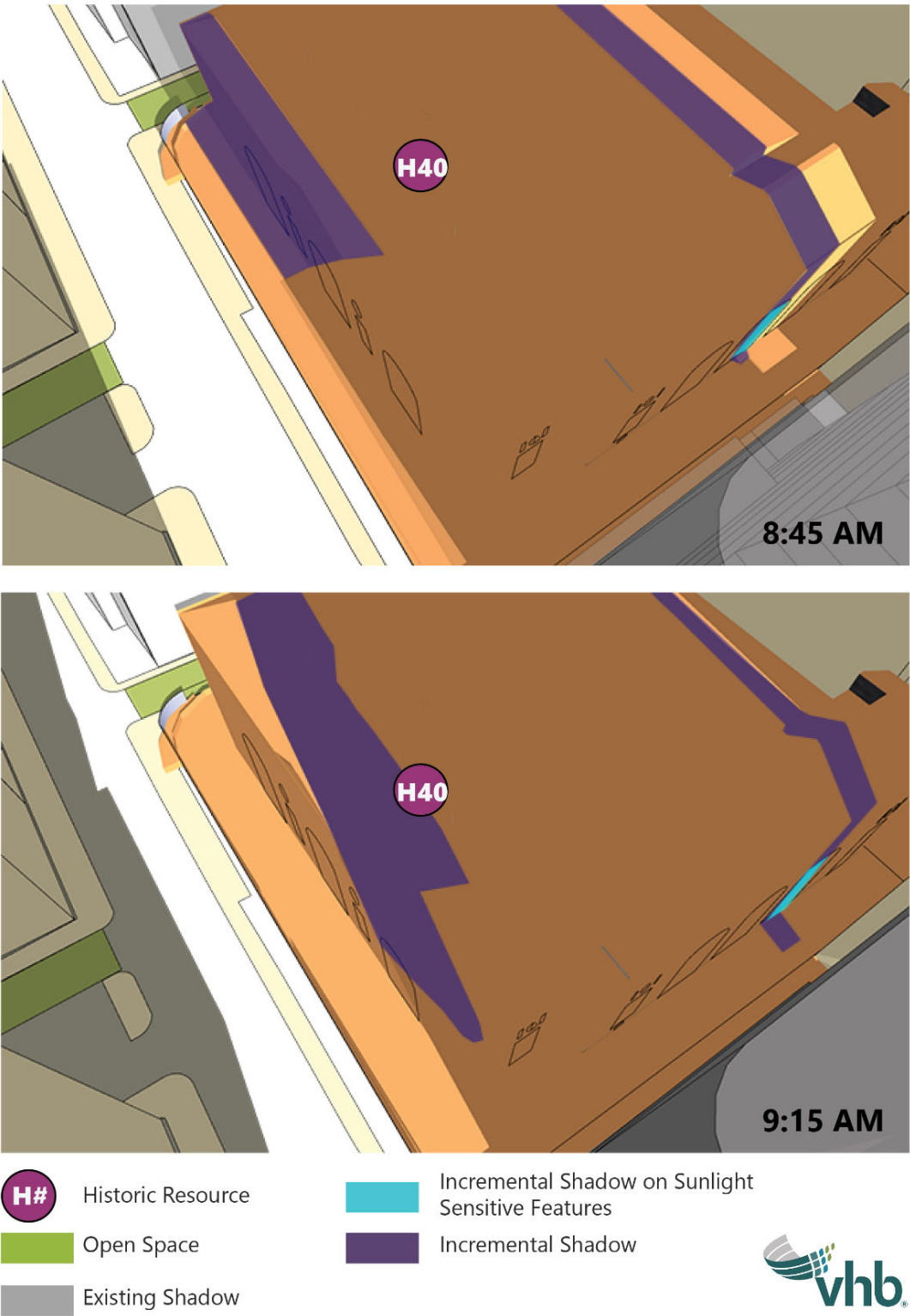
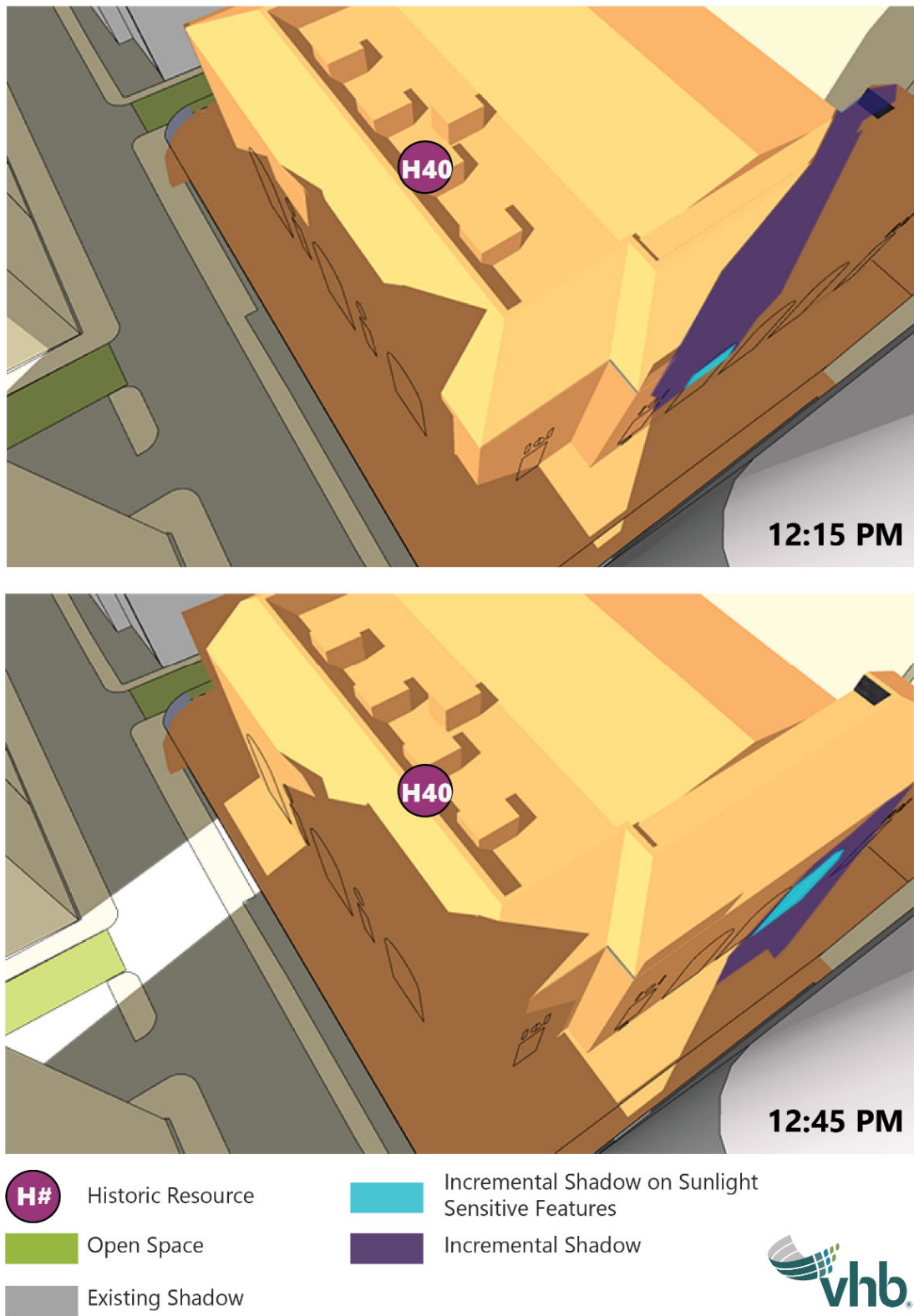


Figure 4-74 H40-March/September 21



In the first period, the main concourse's eastern façade windows would receive incremental shadow from 8:28 AM to 9:33 AM (a 1 hour and 5-minute duration), with direct sunlight eliminated from these windows between 9:08 and 9:33 AM (a duration of 25 minutes). During this 25-minute period, the western windows are naturally in shade at this time from the position of the sun, however some of the clerestory windows would receive direct sunlight and some indirect sunlight would also come through the Vanderbilt Hall windows.

In the second period, incremental shadow would cover portions of the main concourse's eastern façade windows between 12:12 and 12:50 PM (a 38-minute duration). Direct sunlight would still reach portions of these windows throughout this time period, with the exception of 13 minutes between 12:12 PM and 12:25 PM when direct sunlight would be completely eliminated. During this 13-minute period, portions of the southern windows and all of the clerestory and skylight windows would receive direct sunlight. The western windows are naturally in shade from the position of the sun.

May/August 6th

During the May 6th / August 6th analysis period, incremental shadows would be cast on Grand Central Terminal for two periods and move generally from south to north across the building (see **Figure 4-75** through **Figure 4-76**). Incremental shadow would be cast on the main concourse's eastern façade windows for a total of 1 hour and 37 minutes over the analysis day.

During the first period, the main concourse's eastern façade windows would experience incremental shadow from 8:59 AM to 10:12 AM, a duration of 1 hour and 13 minutes. Direct sunlight would be eliminated from these windows from 10:00 AM to 10:12 AM (a duration of 12 minutes). During the entirety of this 12-minute period, direct sunlight would enter portions of the southern windows, and at times both the clerestory windows and skylights. The western windows are naturally in shade from the position of the sun.

The main concourse's eastern façade windows would experience incremental shadow again from 11:55 AM to 12:19 PM, a duration of 24 minutes. During this second period of shadow increment, direct sunlight would never be entirely eliminated from the windows. Direct sunlight would reach the southern façade windows at times, the clerestory windows, and the skylights. The western windows are naturally in shade from the position of the sun.

Figure 4-75 H40-May/August 6

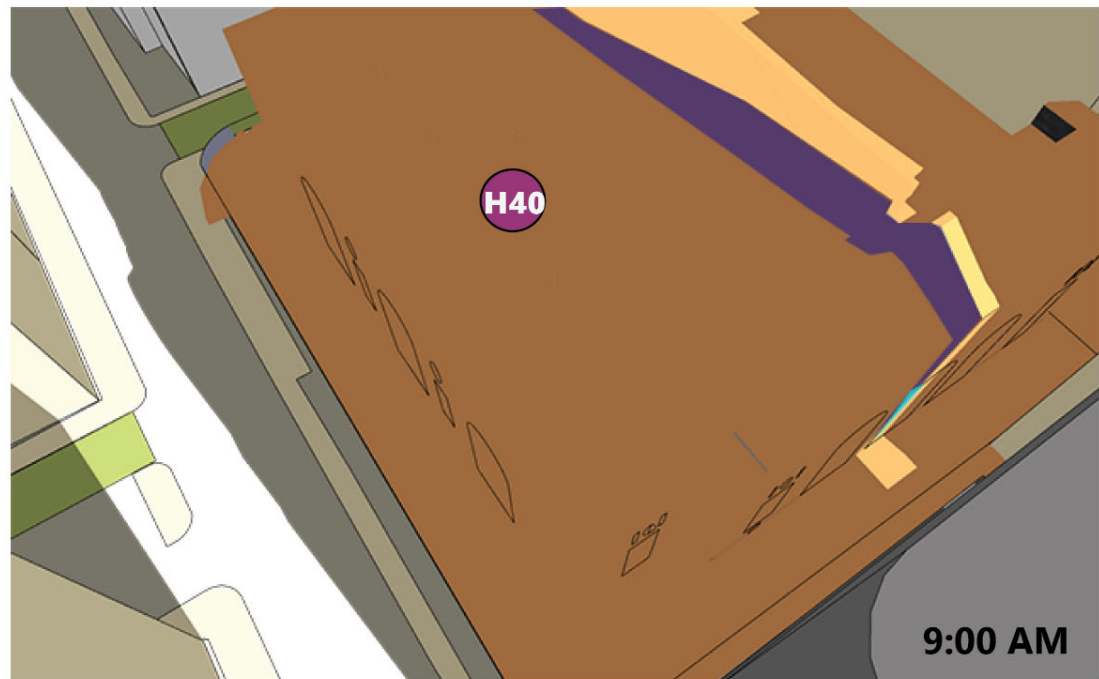


Figure 4-76 H40-May/August 6

Historic Resource



Open Space



Existing Shadow

Incremental Shadow on Sunlight
Sensitive Features

Incremental Shadow

**June 21st**

During the June 21st analysis period, new incremental shadow would fall on the Terminal. The shadows would move across the roof starting from the western edge of the roof and ending on the eastern façade. As shown in **Figure 4-77** through **Figure 4-78**, the eastern

windows would receive incremental shadow from 9:35 AM to 10:40 AM and then again from 11:54 AM to 12:13 PM (a total duration of 1 hour and 24 minutes).

Figure 4-77 H40-June 21

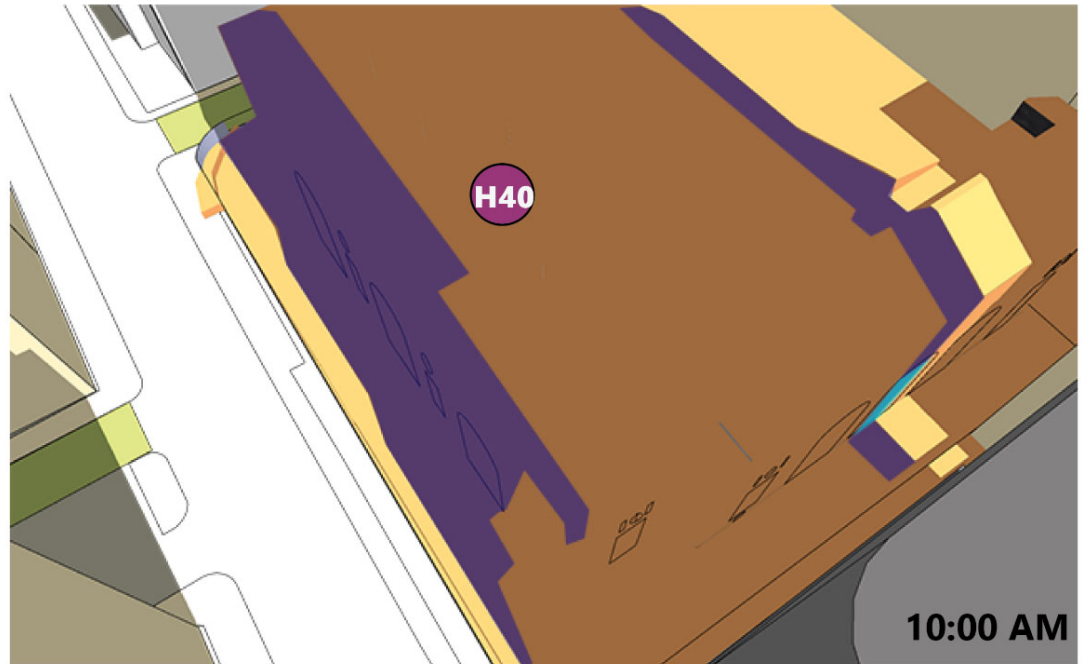
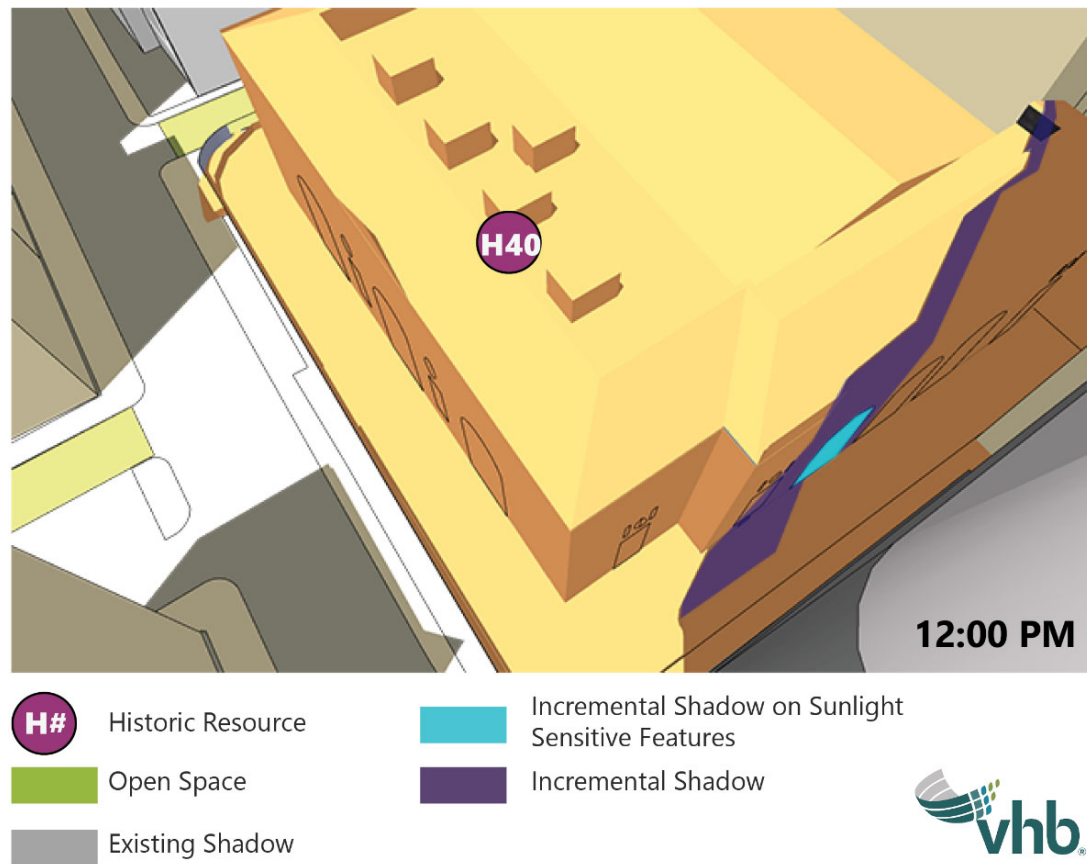


Figure 4-78 H40-June 21

The main concourse's eastern façade windows would receive incremental shadow for the entire 1 hour and 24 minutes.

At the beginning of the first period (9:35 AM to 10:40 AM), the increment would consist of a small area of shadow limited to a portion of one window. Shadow would then move over the two northernmost main concourse eastern façade windows. Direct sunlight would be eliminated from these windows from 10:36 AM to 10:40 AM (a duration of 4 minutes). During this 4-minute period, all of the southern façade windows, clerestory, and skylight windows would be in direct sun. The western windows are naturally in shade from the position of the sun.

There would again be incremental shadow on the main concourse's eastern façade windows starting between 11:54 AM and 12:13 PM. At the very beginning of this period, direct sunlight would be eliminated from these windows for one minute. Direct sunlight would reach all of the southern windows, the clerestory windows, and the skylights during the period of elimination. The western windows are naturally in shade from the position of the sun.

Conclusion

According to the *CEQR Technical Manual*, an incremental shadow is not considered significant when its duration is shorter than 10 minutes at any time of year and the resource continues to receive substantial direct sunlight. A significant shadow impact for a sunlight-sensitive feature of a resource generally occurs when an incremental shadow of 10 minutes

or longer falls on a sunlight sensitive resource and results in the complete elimination of all direct sunlight on the sunlight-sensitive feature of the resource, when the complete elimination results in substantial effects on enjoyment or use of the resource. In the case of the Terminal, however, the experience of light within the main concourse is a function of a combination of direct sunlight, reflected sunlight, and ambient daylight.

While there would be periods of incremental shadow on three of the four analysis days, as described above, these shadows are often limited in duration and extent and in no case would eliminate light from the Terminal as a whole. Incremental shadow would be cast on the main concourse's eastern façade windows on the March/September 21st, May/August 6th, and June 21st analysis days, for periods of 1 hour and 43 minutes, 1 hour and 37 minutes, and 1 hour and 24 minutes respectively (a total of 4 hours and 44 minutes across the three analysis days). Direct sunlight would be eliminated from the main concourse's eastern façade windows on the March/September 21st, May/August 6th, and June 21st analysis days, for periods of 38 minutes, 12 minutes, and 5 minutes respectively. During these periods, the main concourse's eastern façade windows would provide ambient and reflected light to the interior of the Terminal, and direct sun would continue to reach the main concourse through a variety of the Terminal's other windows (i.e., the clerestory windows and skylight windows). In addition, indirect light would reach the main concourse through Vanderbilt Hall as portions of, or all of (depending on the day), the southern windows would continue to experience direct sun.

As discussed above, the experience of light within the main concourse depends on a combination of direct sunlight, reflected sunlight, and ambient daylight. In addition, the experience of direct sunlight through the east windows in contrast to reflected and ambient light is not always apparent due to the window design (see **Photo 4-6** through **Photo 4-13** above), with the separated planes of glass with metal and glass walkways traversing the interstitial spaces making direct sunlight and diffuse daylight appear similar to someone within the concourse.

Therefore, the Proposed Project would not result in significant adverse shadows impacts on Grand Central Terminal.

N1 – East River

The East River, a salt water tidal strait that connects New York Harbor with the western end of Long Island Sound is a sunlight sensitive natural resource. The waterway is navigable for its entire length of sixteen miles. The hydrodynamic and estuarine character of this water body coupled with the numerous municipal and industrial discharges that have occurred in the river over many years, make this water body a physically harsh environment. For this reason, many of the species using the area must be tolerant of highly variable conditions.

The river would receive incremental shadow on the May/August 6th and June 21st analysis days. Shadow would fall on the East River for 55 minutes at the end of the day from 4:23 PM to 5:18 PM (a duration of 55 minutes) on the May/August 6th analysis day (see **Figure 4-79** through **Figure 4-82**) and from 4:40 PM – 6:01 PM (a duration of 1 hour and 21 minutes) on the June 21st analysis day (see **Figure 4-83** through **Figure 4-88**). The river currents move phytoplankton and other natural elements through shaded area, and fish move through different areas of the river. The relatively small area of new shadows on these two analysis days would not adversely affect the health of the aquatic habitat, and there would be no significant adverse impact to the river due to shadows.

Figure 4-79 N1-May/August 6 – 4:25 PM



Figure 4-80 N1-May/August 6 – 4:40 PM



Figure 4-81 N1-May/August 6 – 4:55 PM



Figure 4-82 N1-May/August 6 – 5:10 PM



Figure 4-83 N1-June 21 – 4:45 PM



Figure 4-84 N1-June 21 – 5:00 PM



Figure 4-85 N1-June 21 – 5:15 PM



Figure 4-86 N1-June 21 – 5:30 PM



Figure 4-87 N1-June 21 – 5:45 PM



Figure 4-88 N1-June 21 – 6:00 PM

