Chapter 5: Shadows

A. INTRODUCTION

As described in Chapter 1, "Project Description," based on projections issued by the national Centers for Disease Control, Memorial Sloan Kettering Cancer Center (MSKCC) expects that new cancer cases in New York City will increase from the current rate of 40,000 annually to 60,000 annually by 2050. While this increase is a projection among all age groups, this rise is being driven by two populations: older patients, whose cases are more acute and require more complex treatment, and younger patients who are being diagnosed with prostate, colon, and breast cancer at alarming rates. To meet this increase in patient volume and the new interventions that are needed to treat the growing number of acute cases, MSKCC will need to supplement its existing capacity with a purpose-built structure with 28 operating rooms (with four dedicated to interventional radiology procedures) and up to 206 patient beds including intensive care unit (ICU) and single rooms for immunocompromised patients, as well as medical support areas.

To fulfill this need, MSKCC is requesting a series of zoning actions to establish a building envelope to facilitate the development of a new 31-story (up to 598.3 feet above curb level including mechanical bulkhead), approximately 903,065 gross square foot (gsf) inpatient hospital building (the Proposed Project), also referred to as the "MSK Pavilion." It would be located on York Avenue between East 66th and East 67th Streets and would consist of 28 operating rooms, including recovery and intensive care facilities, up to 206 single-bedded patient rooms, clinical support, a double-height lobby, and 5 mechanical floors to house intensive technologies and air exchange systems. A two-story patient bridge across East 67th Street (Patient Bridge) connecting floors 5 and 6 of the Proposed Project with floors 8 and 9 of the Memorial Hospital building would serve as the primary connector for patients in either building to access medical services in the other building.

This chapter examines the potential for the Proposed Project, which will be built within a maximum building envelope that will rise up to 598.3 ft to the top of the mechanical bulkhead to cast new shadows on sunlight- sensitive resources, which include publicly accessible parks and other open spaces, sunlight-dependent features of historic resources, and natural resources that depend on sunlight. Although the Proposed Project may not completely fill the maximum zoning envelope, this analysis assumes that it would as a Reasonable Worst Case. Following the guidelines of the 2021 *City Environmental Quality Review (CEQR) Technical Manual*, a shadow study is required if a proposed project would result in structures 50 feet or more in height, or of any height if the project site is located adjacent to, or across the street from, a sunlight-sensitive resource. Consequently, a shadow study was conducted.

PRINCIPAL CONCLUSIONS

The detailed shadows analysis presented in this chapter determined that the Proposed Project would cast incremental shadows on six publicly accessible open spaces and five sunlight-sensitive historic resources, in one or more seasons. As described in detail below, in most cases the new

shadow would be limited in extent and duration and would not substantially affect the use of the open spaces, the health of their trees and plantings, or in the case of the historic resources, the public's ability to appreciate the historic features.

However, the Proposed Project would cause significant adverse shadow impacts to one sunlight-sensitive historic resource: the stained-glass windows of St. John of Nepomucene Church. The windows on the north and east (rear) façades would receive approximately an hour to an hour and a half of new shadow during spring, summer, and fall mornings. Given the duration of the incremental shadow, and its elimination of direct sunlight on the windows above the altar in the morning (during Sunday morning services), the incremental shadow would cause a significant adverse impact to this historic resource.

B. DEFINITIONS AND METHODOLOGY

This analysis has been prepared in accordance with New York City CEQR procedures and follows the guidelines of the *CEQR Technical Manual*.

DEFINITIONS

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

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

- *Public open space* such as parks, beaches, playgrounds, plazas, schoolyards (if open to the public during non-school hours), 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.
- *Features of architectural resources that depend on sunlight for their enjoyment by the public.* Only the sunlight-sensitive features need be considered, as opposed to the entire resource. Such sunlight-sensitive features might include the following: design elements that depend on the contrast between light and dark (e.g., recessed balconies, arcades, deep window reveals); elaborate, highly carved ornamentation; stained glass windows; historic landscapes and scenic landmarks; and features for which the effect of direct sunlight is described as playing a significant role in the structure's importance as a historic landmark.
- *Natural resources* where the introduction of shadows could alter the resource's condition or microclimate. Such resources could include community gardens, surface water bodies, wetlands, and designated resources such as coastal fish and wildlife habitats.

Resources not subject to shadows analyses include the following, for the purposes of CEQR:

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

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

METHODOLOGY

The Tier 1, Tier 2 and Tier 3 Screening Assessments are conducted in accordance with the *CEQR Technical Manual.* A preliminary screening assessment must first be conducted to ascertain whether a project's shadow could reach any sunlight-sensitive resources at any time of year. The preliminary screening assessment consists of three tiers of analysis. The Tier 1 Screening Assessment determines a simple radius around the Proposed Project representing the longest shadow that could be cast. If there are sunlight-sensitive resources within this radius, the analysis proceeds to Tier 2 Screening Assessment, which reduces the area that could be affected by project shadow by accounting for the fact that shadows can never be cast between a certain range of angles south of the Development Site due to the path of the sun through the sky at the latitude of New York City.

If the Tier 2 Screening Assessment does not eliminate the possibility of new shadows on sunlight-sensitive resources, a Tier 3 Screening Assessment further refines the area that could be reached by project shadow by looking at specific representative days in each season and determining the maximum extent of shadow over the course of each representative day.

If the Tier 3 Screening Assessment does not eliminate the possibility of new shadows on sunlight-sensitive resources, a detailed shadow analysis is required to determine the extent and duration of the incremental shadow resulting from the project. Incremental shadows are determined by establishing a baseline condition in the future without the Proposed Project (the No Action condition) and comparing it to the future condition with the Proposed Project (the With Action condition), thus illustrating the baseline shadows cast by existing (or future No Action) buildings and distinguishing the additional (incremental) shadows cast by a proposed project. The detailed analysis provides the data needed to assess the shadow impacts. The effects of the new shadows on the sunlight-sensitive resources are described, and their degree of significance is considered. The results of the analysis and assessment are documented with graphics, a table of incremental shadow durations, and narrative text.

C. PRELIMINARY SCREENING ASSESSMENT

A base map was developed using Geographic Information Systems (GIS)[1] showing the location of the Development Site and the surrounding street layout and topography (see **Figure 5-1**). Mapped databases of parks and other public open spaces, City, State, and national historic resources, and natural resources were added to the map.[2] In coordination with the open space,

[1] Software: Esri ArcGIS Pro 3.1

[2] Data: City, State, and Federal agencies including New York City Parks Department; New York City Department of Information Technology and Telecommunications (DoITT), New York City Department of City Planning, New York City Landmarks Preservation Commission, New York City Department of Transportation, New York State Office of Parks, Recreation, and Historic Preservation, New York State Dept. of Environmental Conservation (NYSDEC), U.S. Fish and Wildlife Service, and others; supplemented by Nearmap hi-resolution imagery, and AKRF site visits.

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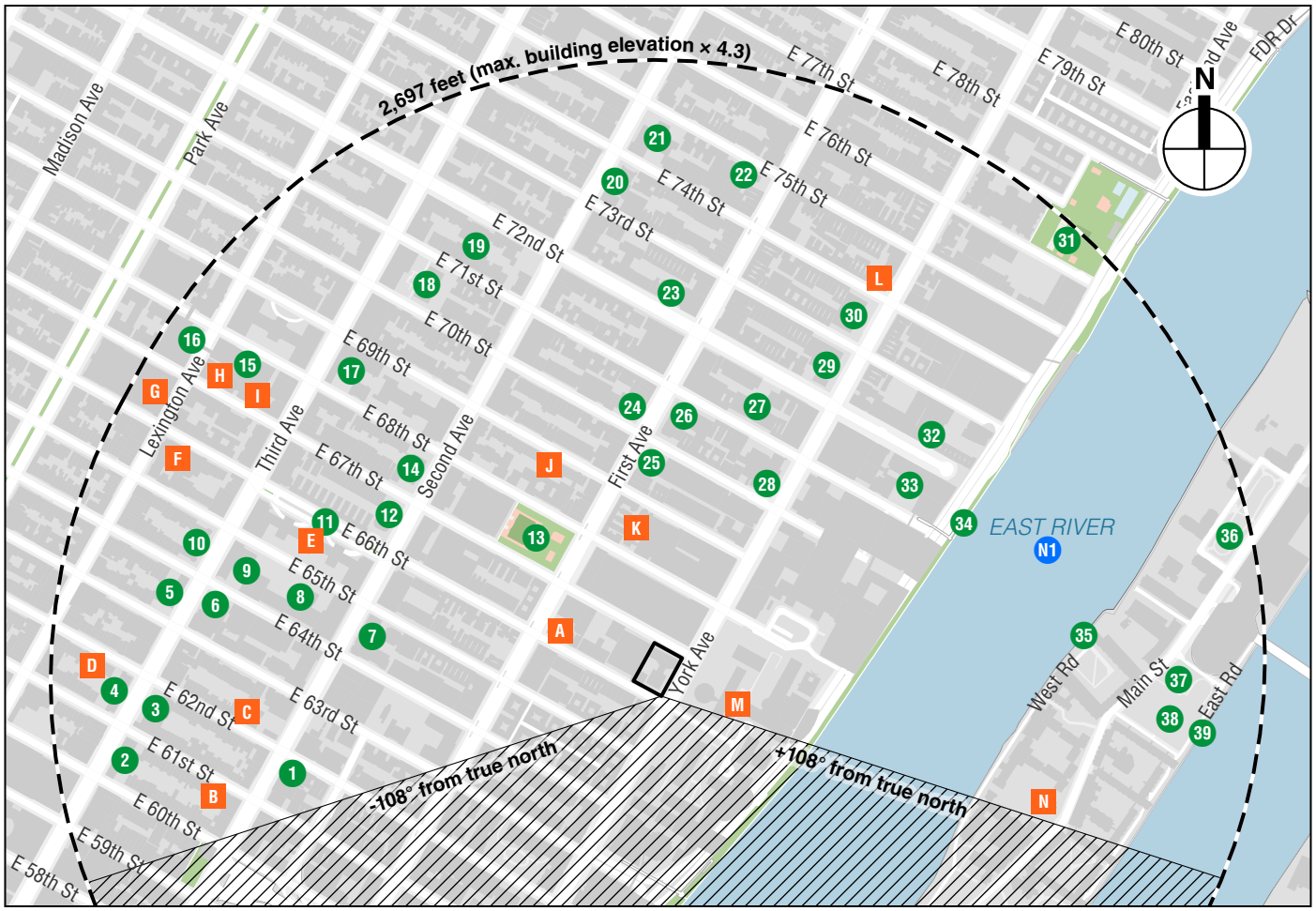

Proposed Maximum Building Envelope Footprint

Tier 1: Elevation-Based Longest Shadow Study Area Perimeter

Tier 2: Area South of Site That Could Never Be Shaded by Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Natural Resource (see Table 5-1)

Notes: Proposed maximum building envelope = 594'. Proposed maximum building envelope elevation = 627.17' (referencing North American Vertical Datum of 1988 [NAVD88]). The Tier 1 elevation-based longest shadow study area represents a highly conservative preliminary study area because it assumes the maximum elevation of the proposed building casting its longest shadow (occurring 90 minutes after sunrise on December 21) onto a surrounding flat surface at 0' NAVD88, which is approximately the mean tidal elevation of the nearby East River. Shadows falling on upland areas would be shorter. See Chapter 5, "Shadows," Section C "Tier 1 Screening Assessment" for details.

Open Space Resource	Map Key
300 East 62nd St POPS	1
200 East 61st St POPS	2
200 East 62nd St POPS	3
167 East 61st St POPS	4
188 East 64th St POPS	5
200 East 64th St POPS	6
304 East 65th St POPS	7
220 East 65th St POPS	8
200 East 65th St POPS	9
160 East 65th St POPS	10
East 66th St Greenstreets	11
265 East 66th St POPS	12
St. Catherine's Park	13
254 East 68th St POPS	14
Poses Park	15
68th St Hunter College Station	16
200 East 69th St POPS	17
211 East 70th St POPS	18
220 East 72nd St POPS	19
300 East 74th St POPS	20

Open Space Resource	Map Key
300 East 75th St POPS	21
330 East 75th St POPS	22
353 East 72nd St POPS	23
Ira S. Robbins Plaza	24
400 East 70th St POPS	25
400 East 71st St POPS	26
422 East 72nd St POPS	27
1315 York Ave	28
1365 York Ave POPS	29
1385 York Ave POPS	30
John Jay Park	31
525 East 72nd St POPS	32
524 East 72nd St POPS	33
East River Walk	34
Roosevelt Island west esplanade	35
Manhattan Park open space	36
Grandpa Al Lewis Playground	37
Capobianco Field	38
Roosevelt Island east esplanade	39

Historic Resource	Map Key
St John Nepomucene Church	A
Trinity Baptist Church (former First Swedish Baptist Church)	B
239-241 East 62nd St	C
Metropolitan Koryo United Methodist Church (former Swedish Methodist Episcopal Church)	D
Manhattan House Apts	E
Church of St Vincent Ferrer	F
Seventh Regiment Armory	G
149-151 67th St	H
Park East Synagogue	I
First Hungarian Reformed Church	J
Church of St. Catherine of Siena	K
Church of the Epiphany	L
Rockefeller University Landscape and Abbey Aldrich Rockefeller Hall building	M
Episcopal Church of the Good Shepherd	N

Natural Resource	Map Key
East River	N1

Tier 1 and Tier 2 Assessments

MSK Pavilion

Figure 5-1

historic and cultural resources, and natural resources assessments presented in other sections of this ~~DEIS~~FEIS, potential sunlight-sensitive resources were identified.

TIER 1 SCREENING ASSESSMENT

For the Tier 1 assessment, the longest shadow that the Proposed Project could cast is calculated, and, using this length as the radius, a perimeter is drawn around the Development Site. Anything outside this perimeter representing the longest possible shadow could never be affected by project generated shadow, while anything inside the perimeter needs additional assessment.

According to the *CEQR Technical Manual*, the longest shadow that a structure can cast at the latitude of New York City occurs on December 21, the winter solstice, at the start of the analysis day (90 minutes after sunrise[3]) and is equal to 4.3 times the height of the structure.

Therefore, at a maximum height of 598.3 feet above curb level, including rooftop mechanical structures, the proposed maximum building envelope could cast a shadow up to approximately 2,573 feet in length (598.3 x 4.3).

The Tier I Assessment assumes that the Development Site and the surrounding cityscape are located on a flat base plane that extends throughout the study area, whereas in reality there is substantial topographic variation. The study area generally slopes from higher elevations west of the Development Site to lower elevations near the East River waterfront. Shadows cast from a location at a higher elevation toward a location at a lower elevation (i.e., "downhill") are longer in horizontal distance than they would be on a flat plane, and vice versa. Therefore, to ensure a conservative analysis on the preliminary assessment's two-dimensional map, an elevation-based Tier 1 longest shadow study area was calculated based on the proposed maximum building envelope elevation of 627.17 feet (relative to 0' NAVD88,[4] which is approximately sea level, and roughly the mean tidal elevation of the nearby East River) rather than 598.3 feet (the proposed maximum building envelope height above ground level). The elevation at ground level at the Development Site is approximately 28.87 feet NAVD88, so 28.87 + 598.3 = 627.17 feet NAVD88. Therefore, the proposed maximum building envelope could cast a shadow up to approximately 2,697 feet in length (627.17 × 4.3) onto a hypothetical surrounding surface at elevation 0' NAVD88. This elevation-based Tier 1 study area ensures a highly conservative study area for the preliminary assessment, beyond which no shadows could reach irrespective of topography. Using 2,697 feet as the radius, a perimeter was generated around the Development Site, as shown in **Figure 5-1**.

The Tier 1 assessment showed that a number of publicly accessible open spaces and historic resources with sun-sensitive features were located in the longest shadow study area, as well as one natural resource (a portion of the East River). Therefore, the Tier 1 assessment confirms that the next tier of screening assessment is required.

TIER 2 SCREENING ASSESSMENT

Because of the path that the sun travels across the sky in the northern hemisphere, no shadow can be cast in a triangular area south of any given project site. In New York City this area lies between -108 and +108 degrees from true north. **Figure 5-1** illustrates this triangular area south of the

[3] As explained in more detail below in the "Tier 3 Screening Assessment" section, shadows occurring within 90 minutes of sunrise or sunset are not considered significant under CEQR.

[4] North American Vertical Datum of 1988

Development Site. The complementary area to the north within the longest shadow study area represents the remaining area that could potentially experience new project-generated shadow.

The Tier 2 assessment concluded that a total 39 publicly accessible open spaces are located in the remaining longest-shadow study area and require further assessment. Most of these open spaces are privately owned public spaces (POPS): plazas, courtyards, or other such spaces that are associated with residential buildings and open to the public. In addition, 14 historic sites with sunlight-dependent architectural features are located in the Tier 2 remaining longest shadow study area and require further assessment to ascertain whether they could be affected by project-generated shadow. A portion of the East River, an important natural resource, is also in the remaining longest shadow study area and requires further assessment.

The 39 open spaces, 14 historic resources, and one natural resource are shown and listed on **Figure 5-1** as well as listed in **Table 5-1** below along with the Tier 3 assessment results.

TIER 3 SCREENING ASSESSMENT

The direction and length of shadows vary throughout the course of the day and also differ depending on the season. In accordance with the *CEQR Technical Manual,* in order to determine whether project-generated shadow could fall on a sunlight-sensitive resource, the Tier 3 Screening Assessment uses three-dimensional computer modeling software[5] to calculate and display the Proposed Project's shadows on individual representative days of the year. A computer model was developed containing three-dimensional representations of the elements in the base map used in the preceding assessments, the topographic information of the study area, and a reasonable worst-case three-dimensional representation of the Proposed Project.

REPRESENTATIVE DAYS FOR ANALYSIS

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

TIMEFRAME WINDOW OF ANALYSIS

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

TIER 3 SCREENING ASSESSMENT RESULTS

Figures 5-2 to 5-5 illustrate the range of shadows that would occur, in the absence of intervening buildings, from the proposed maximum building envelope on the four representative days for analysis. As they move clockwise and generally west to east over the landscape, the shadows are

[5] Bentley MicroStation

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Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Natural Resource (see Table 5-1)

This figure illustrates the range of shadows that would occur from the Proposed Project on the analysis day representing the winter. The shadows are shown occurring approximately every 60 minutes from the start of the analysis day (90 minutes after sunrise) to the end of the analysis day (90 minutes before sunset). The Tier 3 assessment does not account for future No Action shadows, and the shadows shown in this figure do not represent incremental shadows. The Tier 3 assessment serves to illustrate the daily path or "sweep" of the proposed building's shadows across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow. Daylight Saving Time was not used, per *CEQR Technical Manual* guidelines.

Tier 3 Assessment:
December 21

MSK PAVILION

Figure 5-2

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Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Natural Resource (see Table 5-1)

This figure illustrates the range of shadows that would occur from the Proposed Project on the analysis day representing the early spring and the fall. The shadows are shown occurring approximately every 60 minutes from the start of the analysis day (90 minutes after sunrise) to the end of the analysis day (90 minutes before sunset). The Tier 3 assessment does not account for future No Action shadows, and the shadows shown in this figure do not represent incremental shadows. The Tier 3 assessment serves to illustrate the daily path or "sweep" of the proposed building's shadows across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow. Daylight Saving Time was not used, per *CEQR Technical Manual* guidelines.

Tier 3 Assessment:
March 21 / September 21

MSK PAVILION

Figure 5-3

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Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Natural Resource (see Table 5-1)

This figure illustrates the range of shadows that would occur from the Proposed Project on the analysis day representing the spring and summer growing season period. The shadows are shown occurring approximately every 60 minutes from the start of the analysis day (90 minutes after sunrise) to the end of the analysis day (90 minutes before sunset). The Tier 3 assessment does not account for future No Action shadows, and the shadows shown in this figure do not represent incremental shadows. The Tier 3 assessment serves to illustrate the daily path or "sweep" of the proposed building's shadows across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow. Daylight Saving Time was not used, per *CEQR Technical Manual* guidelines.

Tier 3 Assessment:
May 6 / August 6

MSK PAVILION

Figure 5-4

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Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Natural Resource (see Table 5-1)

This figure illustrates the range of shadows that would occur from the Proposed Project on the analysis day representing summer. The shadows are shown occurring approximately every 60 minutes from the start of the analysis day (90 minutes after sunrise) to the end of the analysis day (90 minutes before sunset). The Tier 3 assessment does not account for future No Action shadows, and the shadows shown in this figure do not represent incremental shadows. The Tier 3 assessment serves to illustrate the daily path or "sweep" of the proposed building's shadows across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow. Daylight Saving Time was not used, per *CEQR Technical Manual* guidelines.

Tier 3 Assessment:
June 21

MSK PAVILION

Figure 5-5

shown occurring approximately every 60 minutes from the start of the analysis day (90 minutes after sunrise) to the end of the analysis day (90 minutes before sunset). **Table 5-1** summarizes which analysis day or days each resource could potentially receive project-generated shadow.

Of the 39 open spaces identified as requiring Third Tier Assessment, 17 could potentially (absent intervening buildings) be reached by project-generated shadow on one or more representative days and thus require a detailed analysis. Of those 17 open spaces, none could be affected on all four representative days, and only certain portions of the linear East River Walk could potentially be affected on three of the four days. St. Catherine's Park and Roosevelt Island's west esplanade could potentially be reached on two of the four representative days, and the remaining 14 open space resources could potentially be reached on only one of the four representative days, in most cases the winter day when shadows are longest. The other 22 open spaces resources that could not be affected on any representative day do not require any further analysis.

Of the 14 historic resources with sunlight-sensitive features identified as requiring Third Tier Assessment, seven could potentially (absent intervening buildings) be reached by project-generated shadow on one or more representative days and thus require a detailed analysis. St. John Nepomucene Church, on the western end of the block where the Development Site is located, and the Rockefeller University landscape across the street to the east, could potentially be affected on three of the four representative days. The Church of St. Catherine of Siena could potentially be affected on two of the representative days, and four other historic resources could potentially be reached on only one of the four representative days. The other seven historic resources that could not be affected on any representative day do not require any further analysis.

Portions of the East River could potentially, absent intervening buildings, be reached on three of the four representative days, and therefore requires a detailed analysis.

Table 5-1
Tier 3 Assessment

Map Key	Name	Potential Incremental Shadow			
		December 21	March 21/ September 21	May 6/ August 6	June 21
Publicly Accessible Open Spaces					
1	300 East 62nd St POPS	No	No	No	Potential
2	200 East 61st St POPS	No	No	No	No
3	200 East 62nd St POPS	No	No	No	No
4	167 East 61st St POPS	No	No	No	No
5	188 East 64th St POPS	No	No	No	No
6	200 East 64th St POPS	No	No	No	No
7	304 East 65th St POPS	No	No	No	No
8	220 East 65th St POPS	No	Potential	No	No
9	200 East 65th St POPS	No	No	No	No
10	160 East 65th St POPS	No	No	No	No
11	East 66th St Greenstreets	No	Potential	No	No
12	265 East 66th St POPS	No	Potential	No	No
13	St. Catherine's Park	Potential	Potential	No	No
14	254 East 68th St POPS	Potential	No	No	No
15	Poses Park	No	No	No	No
16	68th St Hunter College Station	No	No	No	No
17	200 East 69th St POPS	Potential	No	No	No
18	211 East 70th St POPS	No	No	No	No
19	220 East 72nd St POPS	No	No	No	No
20	300 East 74th St POPS	No	No	No	No
21	300 East 75th St POPS	No	No	No	No
22	330 East 75th St POPS	No	No	No	No
23	353 East 72nd St POPS	No	No	No	No
24	Ira S. Robbins Plaza	Potential	No	No	No
25	400 East 70th St POPS	Potential	No	No	No
26	400 East 71st St POPS	Potential	No	No	No
27	422 East 72nd St POPS	Potential	No	No	No
28	1315 York Ave	Potential	No	No	No
29	1365 York Ave POPS	Potential	No	No	No
30	1385 York Ave POPS	Potential	No	No	No
31	John Jay Park	No	No	No	No
32	525 East 72nd St POPS	No	No	No	No
33	524 East 72nd St POPS	No	No	No	No
34	East River Walk	No	Potential	Potential	Potential
35	Roosevelt Island west esplanade	No	No	Potential	Potential
36	Manhattan Park open space	No	No	No	No
37	Grandpa Al Lewis Playground	No	No	No	No
38	Capobianco Field	No	No	No	No
39	Roosevelt Island east esplanade	No	No	No	Potential
Historic Architectural Resources with Sunlight-Sensitive Features					
A	St John Nepomucene Church	No	Potential	Potential	Potential
B	Trinity Baptist Church (former First Swedish Baptist Church)	No	No	No	Potential
C	239-241 East 62nd St	No	No	No	No
D	Metropolitan Koryo United Methodist Church (former Swedish Methodist Episcopal Church)	No	No	No	No
E	Manhattan House Apts	No	Potential	No	No
F	Church of St Vincent Ferrer	No	No	No	No
G	Seventh Regiment Armory	No	No	No	No
H	149-151 67th St	No	No	No	No
I	Park East Synagogue	No	No	No	No
J	First Hungarian Reformed Church	Potential	No	No	No
K	Church of St. Catherine of Siena	Potential	Potential	No	No
L	Church of the Epiphany	No	No	No	No
M	Rockefeller University Landscape and Abby Aldrich Rockefeller Hall building	No	Potential	Potential	Potential
N	Episcopal Church of the Good Shepherd	No	No	No	Potential
Natural Resources					
N1	East River	No	Potential	Potential	Potential

See **Figures 5-2 to 5-5** for corresponding resource locations and shadow sweeps.
In the columns representing the representative analysis dates, "No" means project-generated shadow could not reach the resource, even without accounting for intervening buildings. "Potential" means project-generated shadow could potentially reach the resource on this date and requires further assessment, including the lessening or elimination of potential impact caused by intervening buildings.

D. DETAILED SHADOW ANALYSIS

A detailed analysis is warranted when the screening assessment does not rule out the possibility that project-generated shadows would reach sunlight-sensitive resources. The detailed analysis establishes a baseline condition, to distinguish the additional (incremental) shadow cast by the Proposed Project. The purpose of the detailed analysis is to determine the extent and duration of new incremental shadow that would be cast on a sunlight-sensitive resource as a result of the Proposed Project. Because existing (or future No Action) buildings may already cast shadows on a sunlight-sensitive resource, the Proposed Project may not result in additional, or incremental, shadows on that resource.

Following the analysis framework described in Chapter 1, "Project Description," a detailed analysis was performed for the analysis year of 2030, comparing the Proposed Project to the future No Action condition. In the No Action condition, the existing Sloan and Scholars buildings would remain on the Development Site. To represent future baseline conditions, three-dimensional representations of the existing buildings and future planned developments in the study area were added to the baseline 3D model using best-available spatial and imagery data from the City, Nearmap, and other sources, and information from publicly available filings with the New York City Department of Buildings.

Shadows are in constant movement. The computer simulation software utilized produces a minute-by-minute animation showing the movement of shadows over the course of each analysis period. The analysis determines the time when incremental shadow would enter each resource, and the time it would exit. Shadow analyses were performed for each of the representative days and analysis periods indicated in the Tier 3 assessment.

DETERMINATION OF IMPACT SIGNIFICANCE

The determination of significance of shadow impacts on a sunlight-sensitive resource is based on (1) the information resulting from the detailed shadow analysis describing the extent and duration of incremental shadows; and (2) an analysis of the resource's sensitivity to reduced sunlight. The goal of the detailed shadow assessment is to determine whether the effects of incremental shadows on a sunlight-sensitive resource are significant under CEQR.

A shadow impact occurs when the incremental shadow from a proposed project falls on a sunlight-sensitive resource or feature and reduces its direct sunlight exposure. Determining whether this impact is significant or not depends on the extent and duration of the incremental shadow and the specific context in which the impact occurs.

Per CEQR, 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 No Action condition). In the growing season, six to eight hours of direct sunlight is typically a minimum requirement for vegetation. Four to six hours a day of sunlight is a minimum requirement for vegetation that can tolerate partial sun, such as established tree canopies, shrubs, or perennials.

  - 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 a historic or cultural resource.
- **Open Space Utilization:**
  - A substantial reduction in the usability of open space as a result of increased shadows, accounting for anticipated new users and the open space's utilization rates throughout the affected time periods.
- **For Any Sunlight-Sensitive Feature of a Resource:**
  - Complete elimination of all direct sunlight on the sunlight-sensitive feature of the resource, when the complete elimination results in substantial effects on the survival, enjoyment, or, in the case of open space or natural resources, the use of the resource.

SUMMARY OF ANALYSIS RESULTS

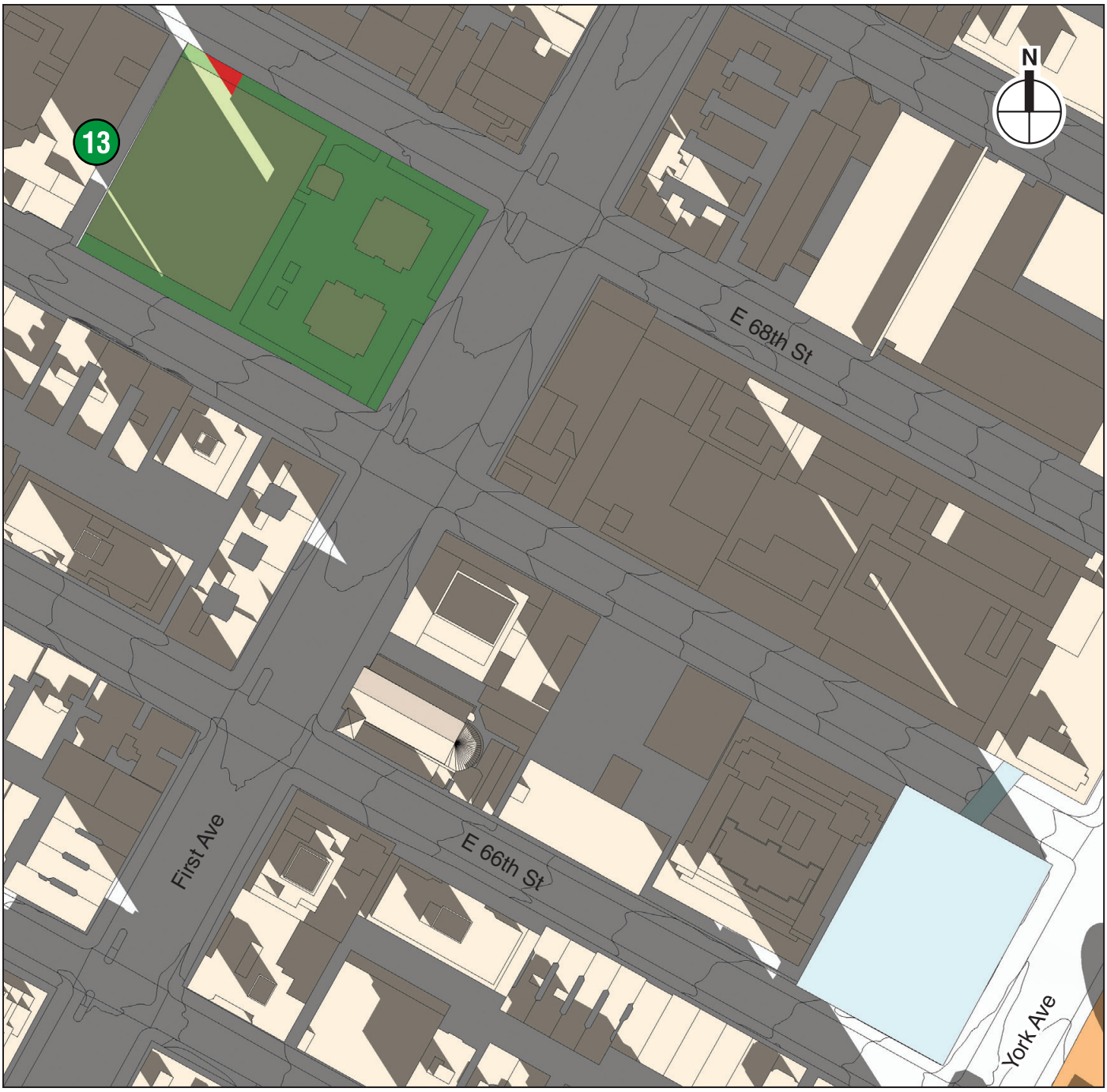
Of the 17 open space resources that were analyzed in the detailed shadow assessment, only two would receive any meaningful amount of incremental shadow: St. Catherine's Park and the Roosevelt Island west esplanade. The other four open space resources would receive 10 minutes or less of incremental shadow in one of the four seasons and none in the other seasons.

Of the seven historic resources with sunlight-sensitive features that were analyzed in the detailed shadow assessment, five would receive incremental shadow. The stained-glass windows in the north and east (rear) façades of the St John Nepomucene Catholic Church would receive between 45 minutes and approximately an hour and a half of new shadow during spring, summer, and fall mornings. Portions of the Rockefeller University campus landscape would receive approximately two hours of incremental shadow in the fall and early spring and up to four hours and 40 minutes of incremental shadow during the late spring and summer. The Abby Aldrich Rockefeller Hall's west façade and open-air area at its north end would receive approximately three and a half hours of incremental shadow in the late spring and summer. Three other historic resources would receive 25 minutes or less of incremental shadow in certain seasons and none in other seasons.

Areas of the East River would receive up to nearly two hours of incremental shadow in the late spring and summer, but negligible incremental shadow in other seasons.

Table 5-2 summarizes the entry and exit times and total duration of incremental shadows on each affected sun-sensitive resource. **Figures 5-6 to 5-35** document the results of the analysis by providing graphic representations from the computer animation of times when incremental shadow would fall on a sun-sensitive resource. The figures illustrate the extent of additional, incremental shadow at that moment in time (highlighted in red), and also show existing shadow and remaining areas of sunlight. Site plans and photographs of the sensitive resources are also provided where relevant.

10.11.23



9:40 AM

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

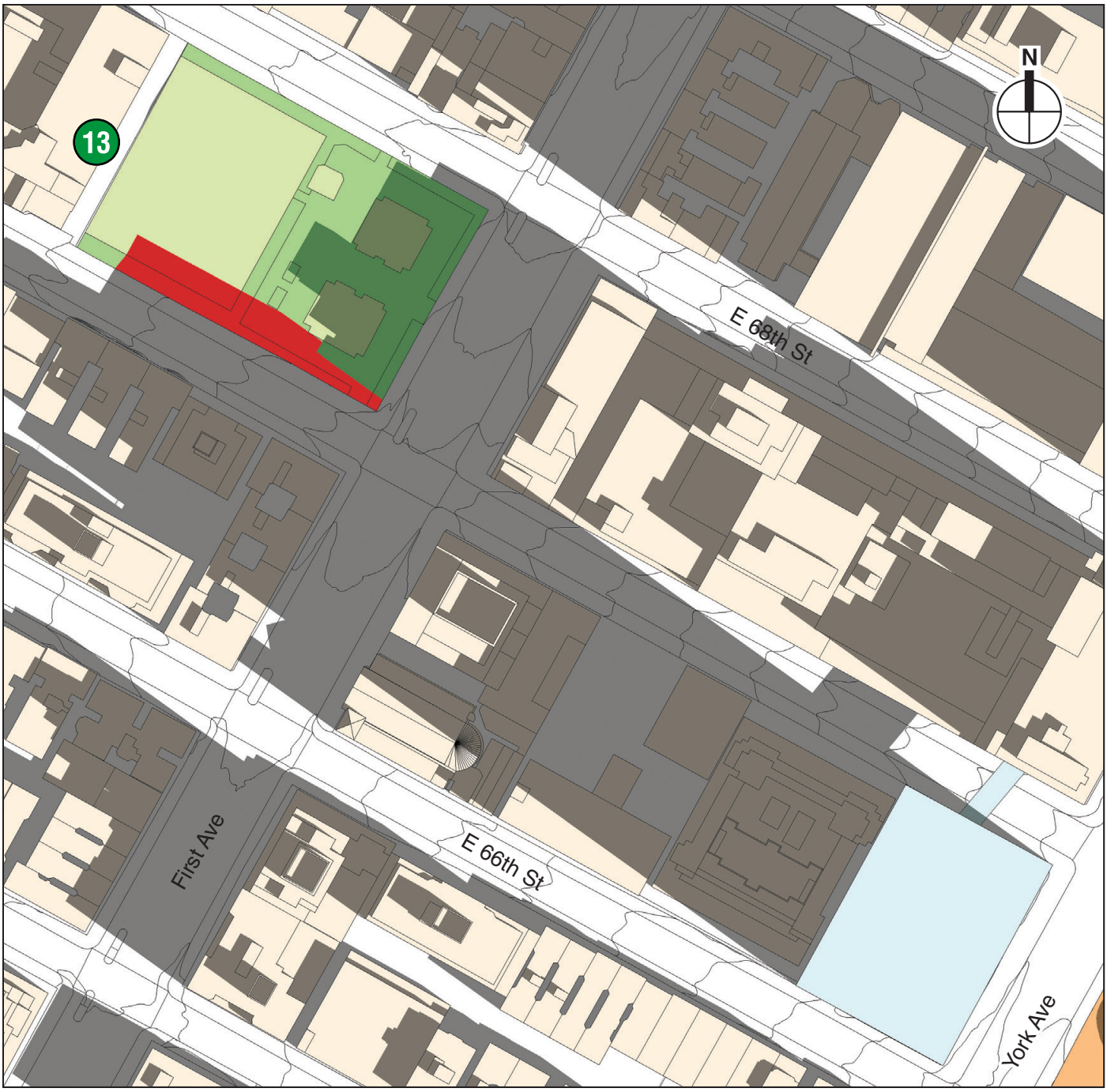
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings.

Detailed Analysis
St Catherine's Park
December 21

MSK PAVILION

Figure 5-6

10.11.23



9:15 AM (10:15 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

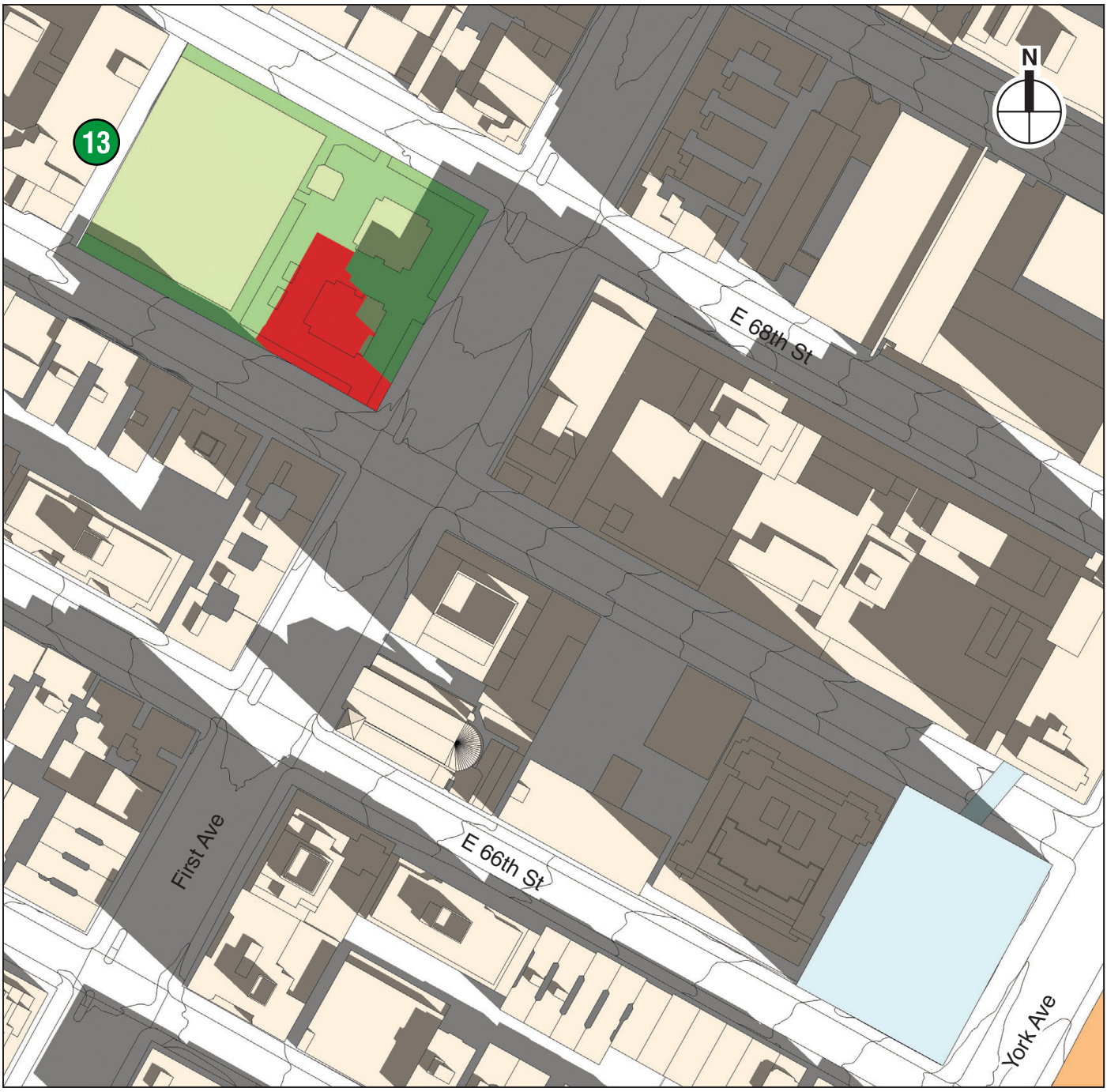
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St Catherine's Park
March 21 / September 21

MSK PAVILION

Figure 5-7

10.11.23



9:45 AM (10:45 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

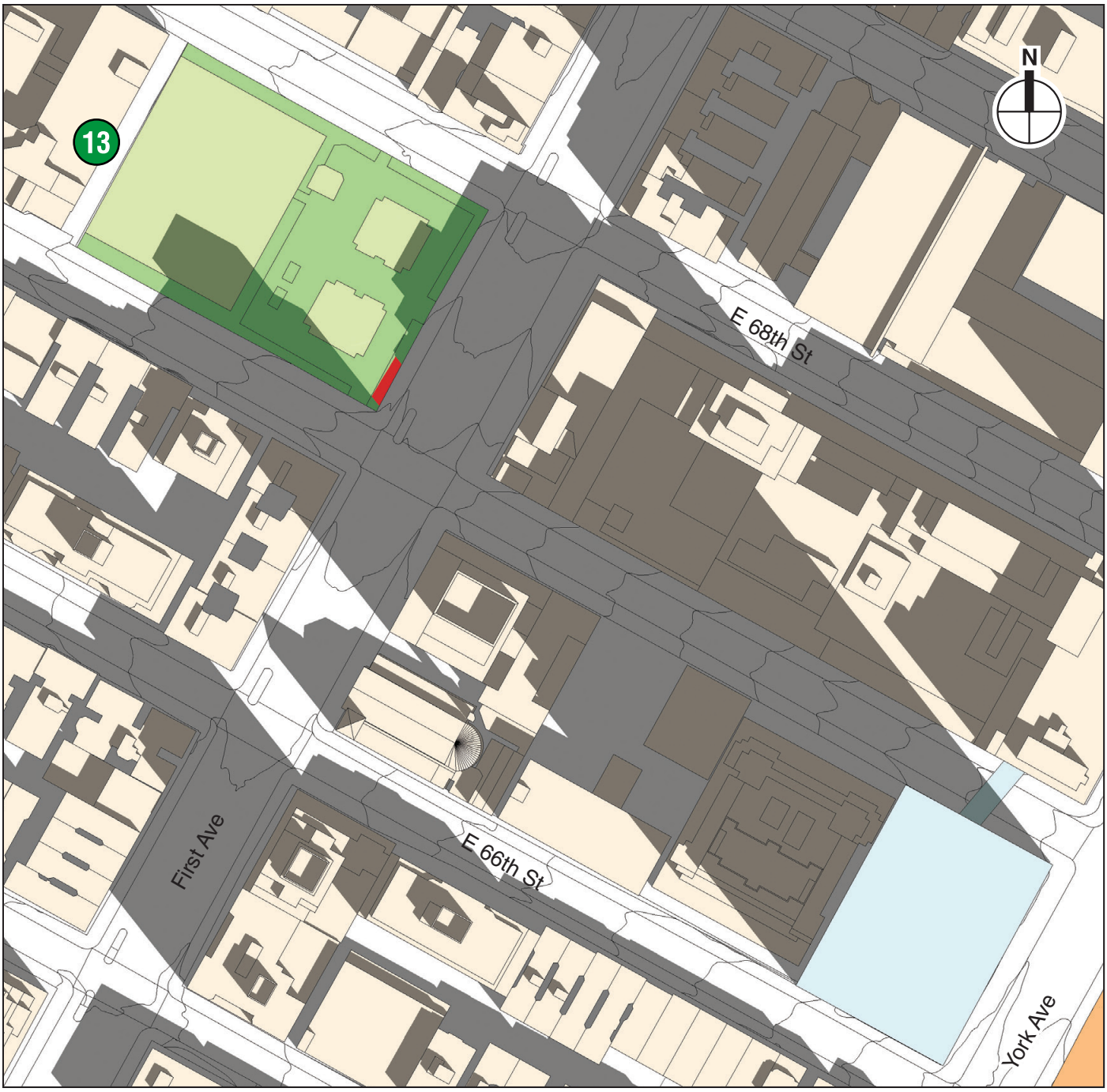
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St Catherine's Park
March 21 / September 21

MSK PAVILION

Figure 5-8

10.11.23



10:15 AM (11:15 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St Catherine's Park
March 21 / September 21

MSK PAVILION

Figure 5-9

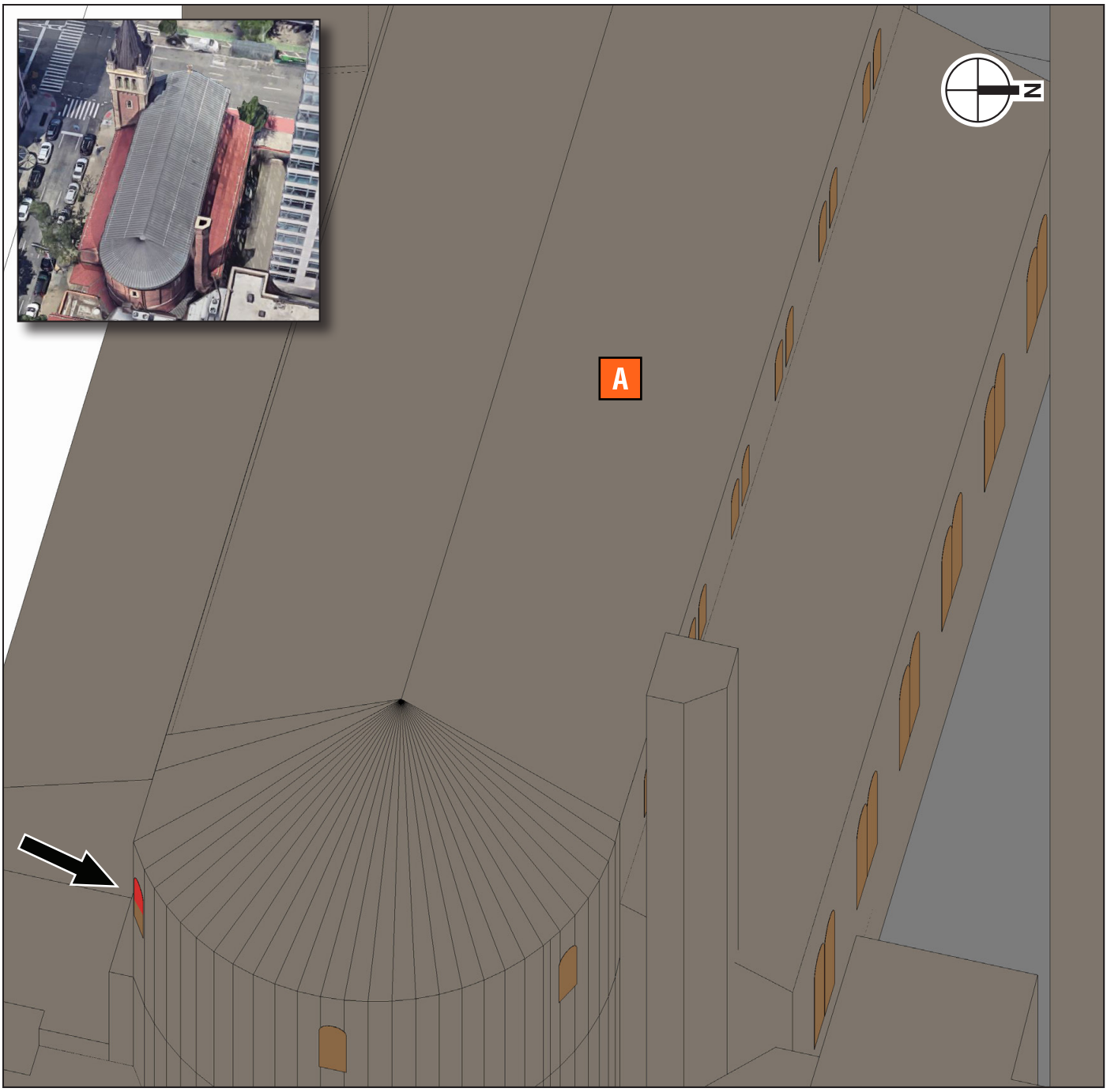






St. John of Nepomucene Church
Interior Photographs
Figure 5-10

10.11.23



8:45 AM (9:45 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

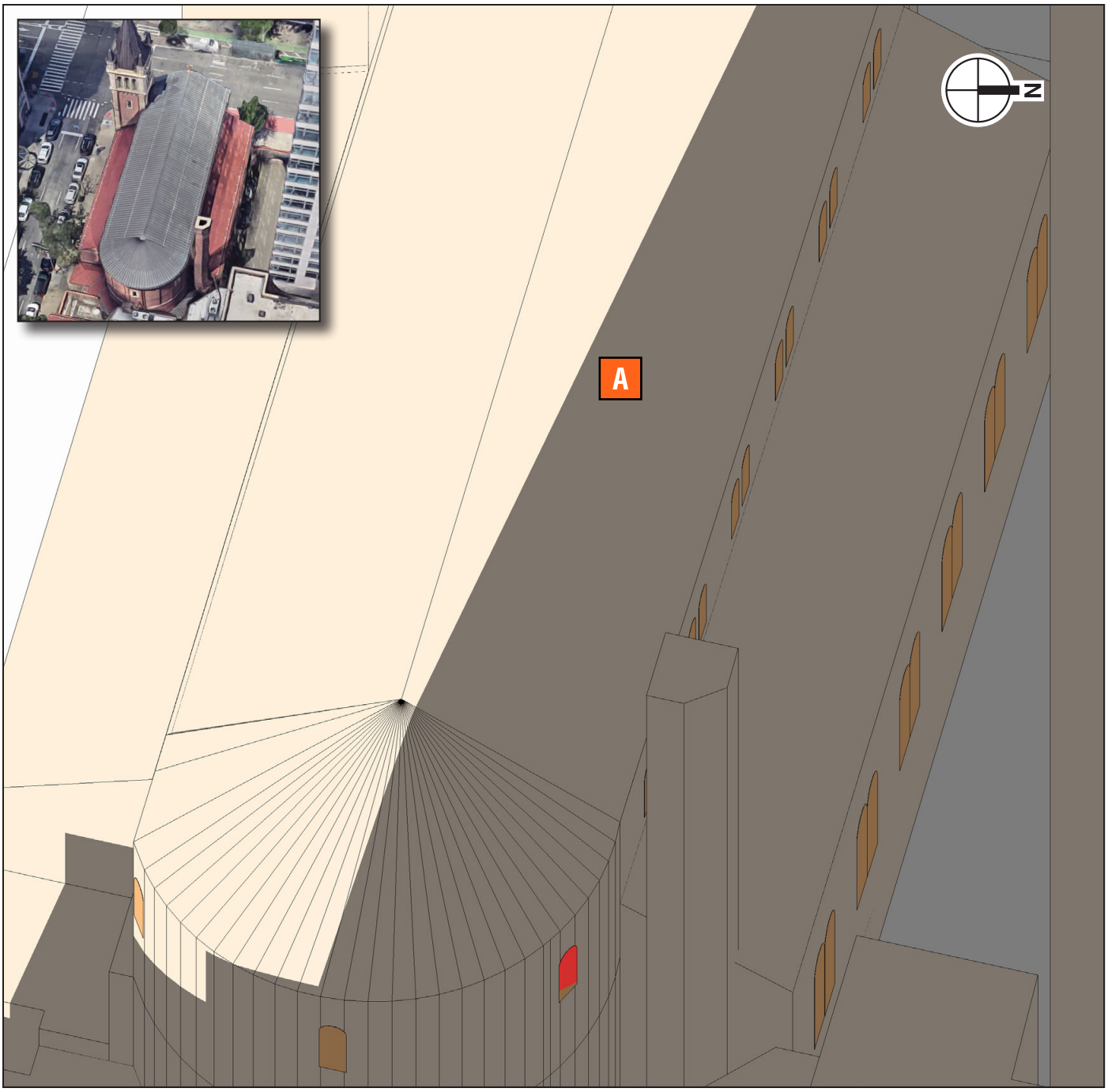
Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St. John of Nepomucene Church
March 21 / September 21

Figure 5-11

10.11.23



9:15 AM (10:15 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

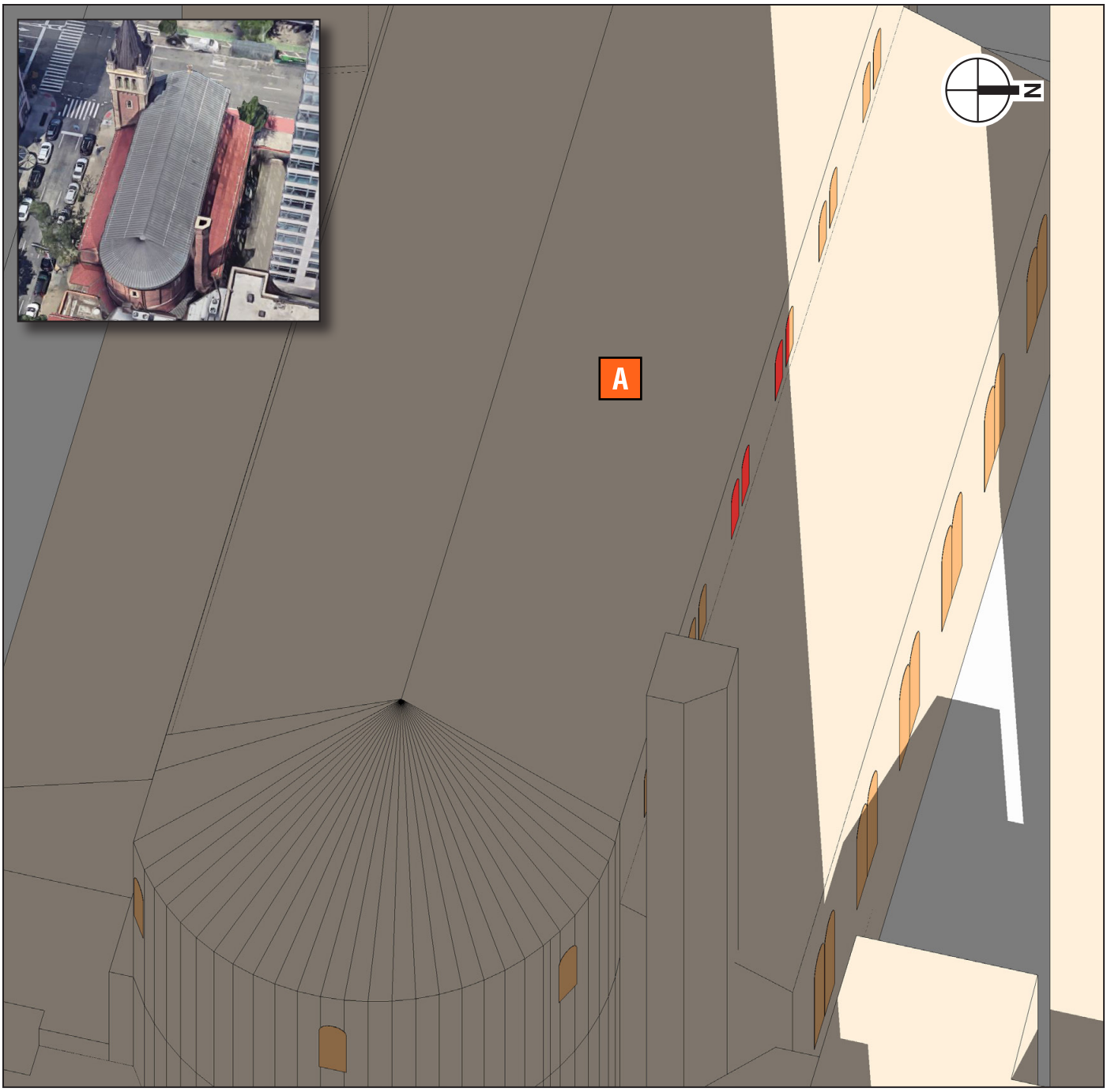
Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St. John of Nepomucene Church
March 21 / September 21

Figure 5-12

10.11.23



8:15 AM (9:15 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

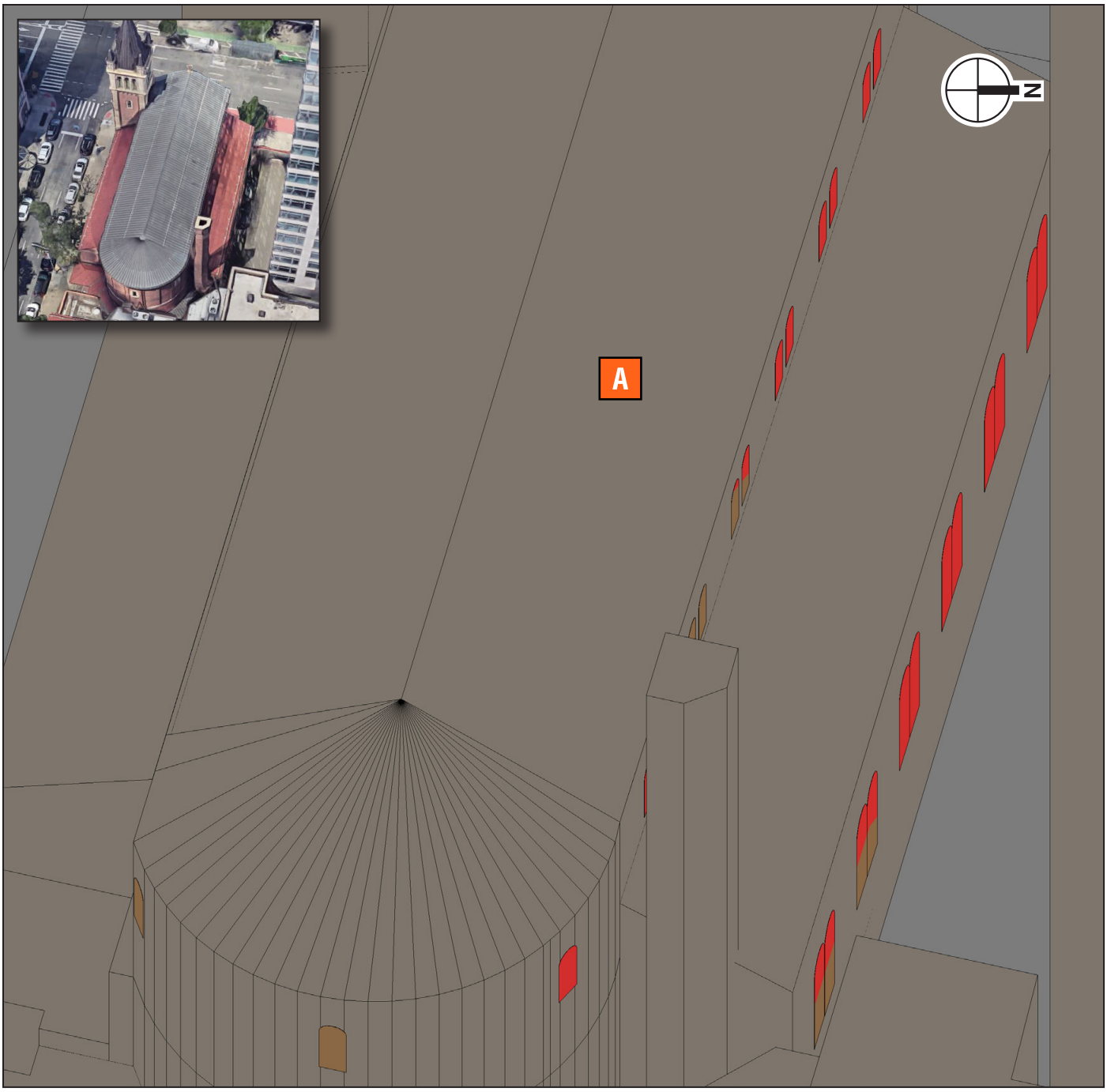
Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St. John of Nepomucene Church
May 6 / August 6

Figure 5-13

10.11.23



8:45 AM (9:45 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

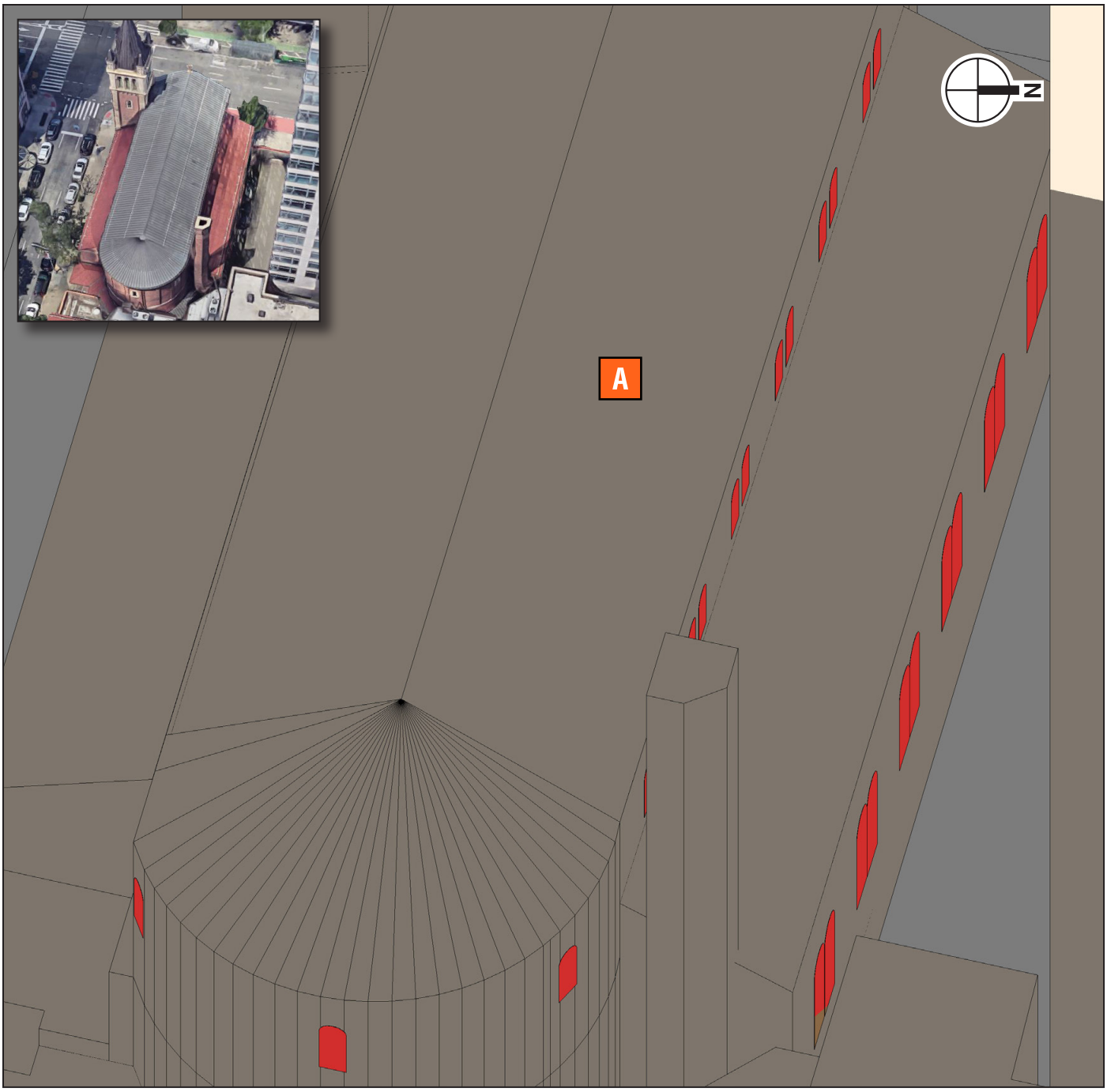
Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St. John of Nepomucene Church
May 6 / August 6

Figure 5-14

10.11.23



9:15 AM (10:15 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

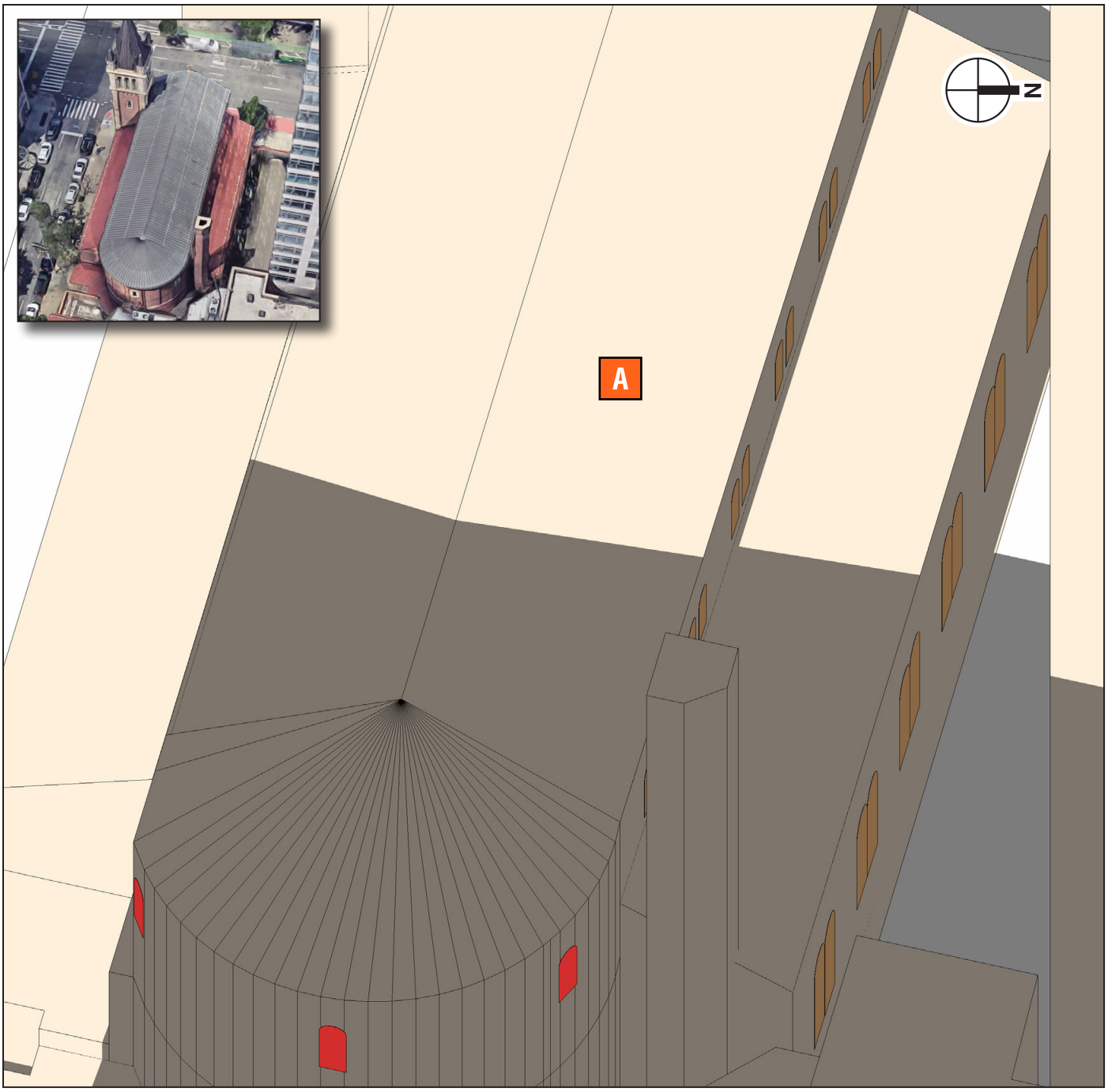
Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St. John of Nepomucene Church
May 6 / August 6

Figure 5-15

10.11.23



9:45 AM (10:45 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

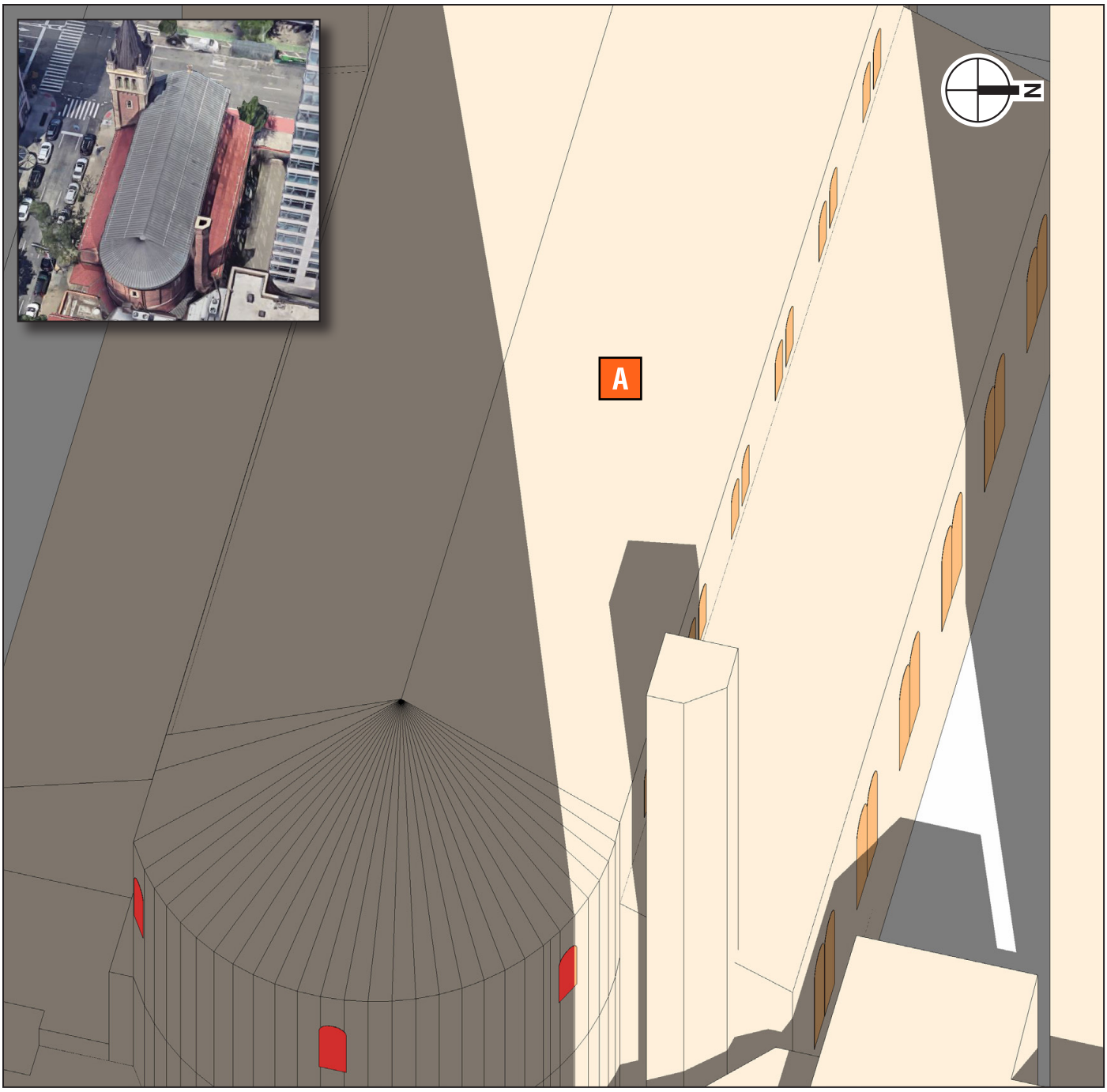
Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St. John of Nepomucene Church
May 6 / August 6

Figure 5-16

10.11.23



8:40 AM (9:40 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St. John of Nepomucene Church
June 21

Figure 5-17

MSK PAVILION

10.11.23



9:10 AM (10:10 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

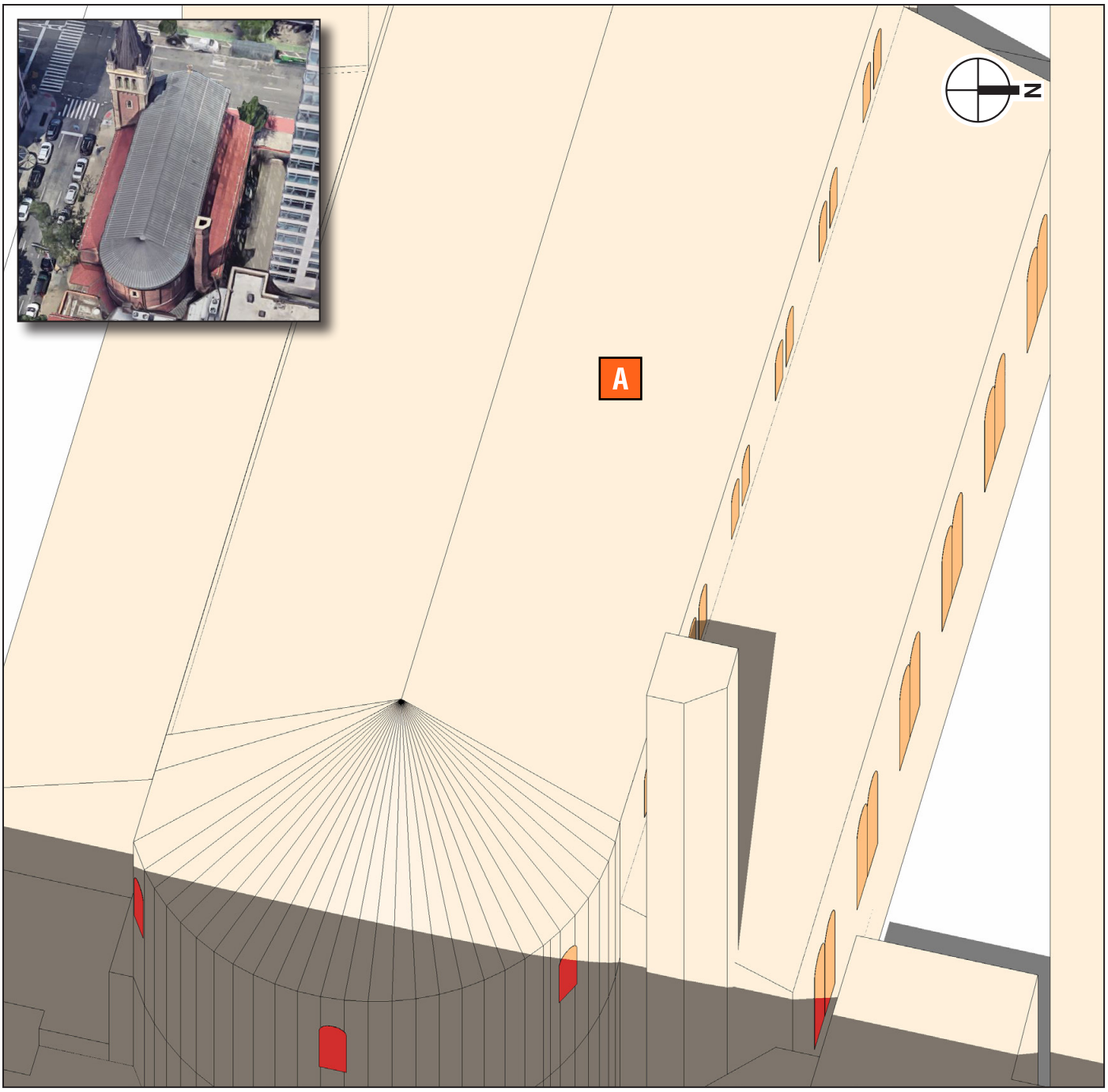
Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St. John of Nepomucene Church
June 21

Figure 5-18

10.11.23



9:40 AM (10:40 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

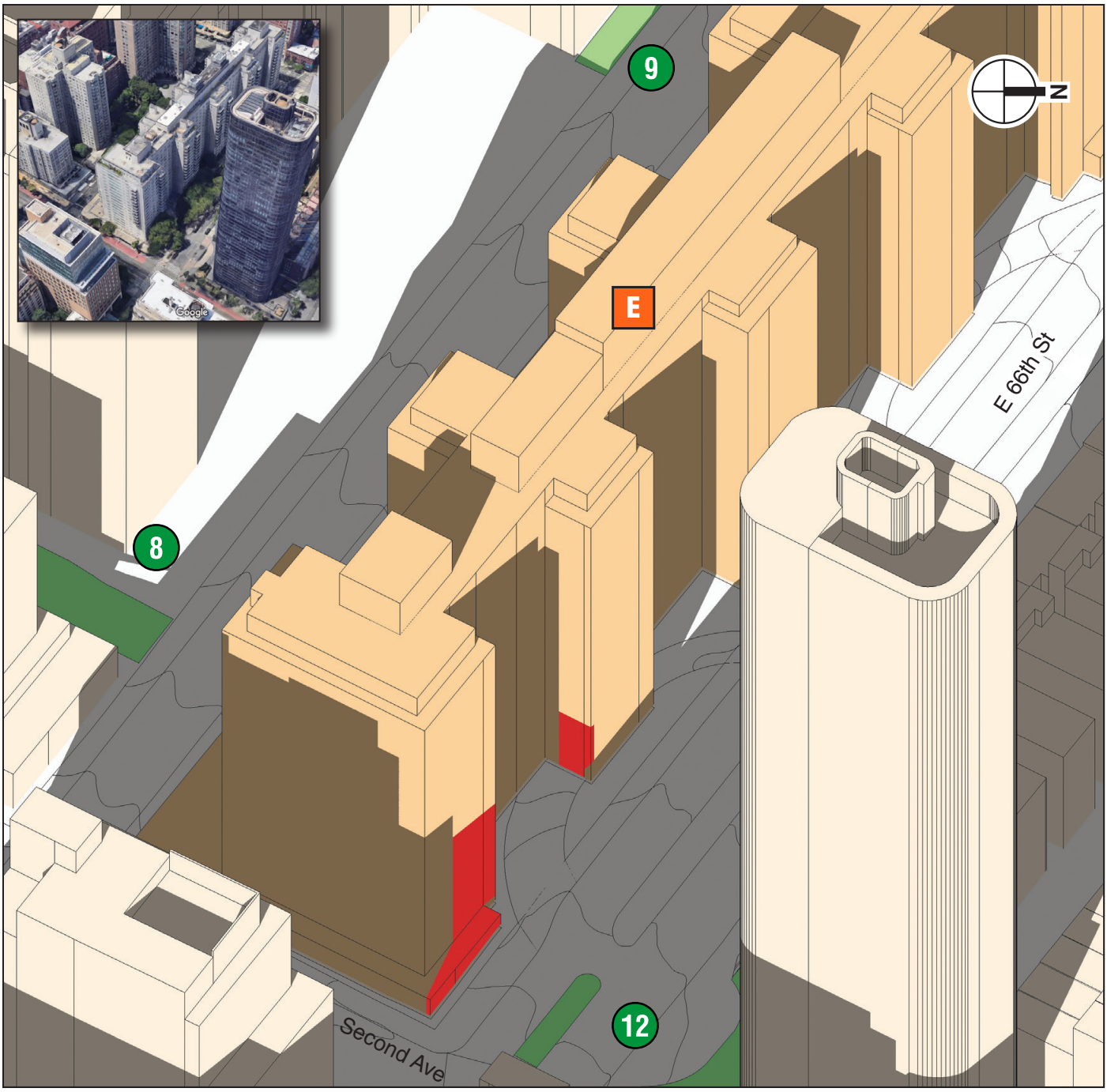
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
St. John of Nepomucene Church
June 21

MSK PAVILION

Figure 5-19

10.11.23



7:45 AM (8:45 AM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

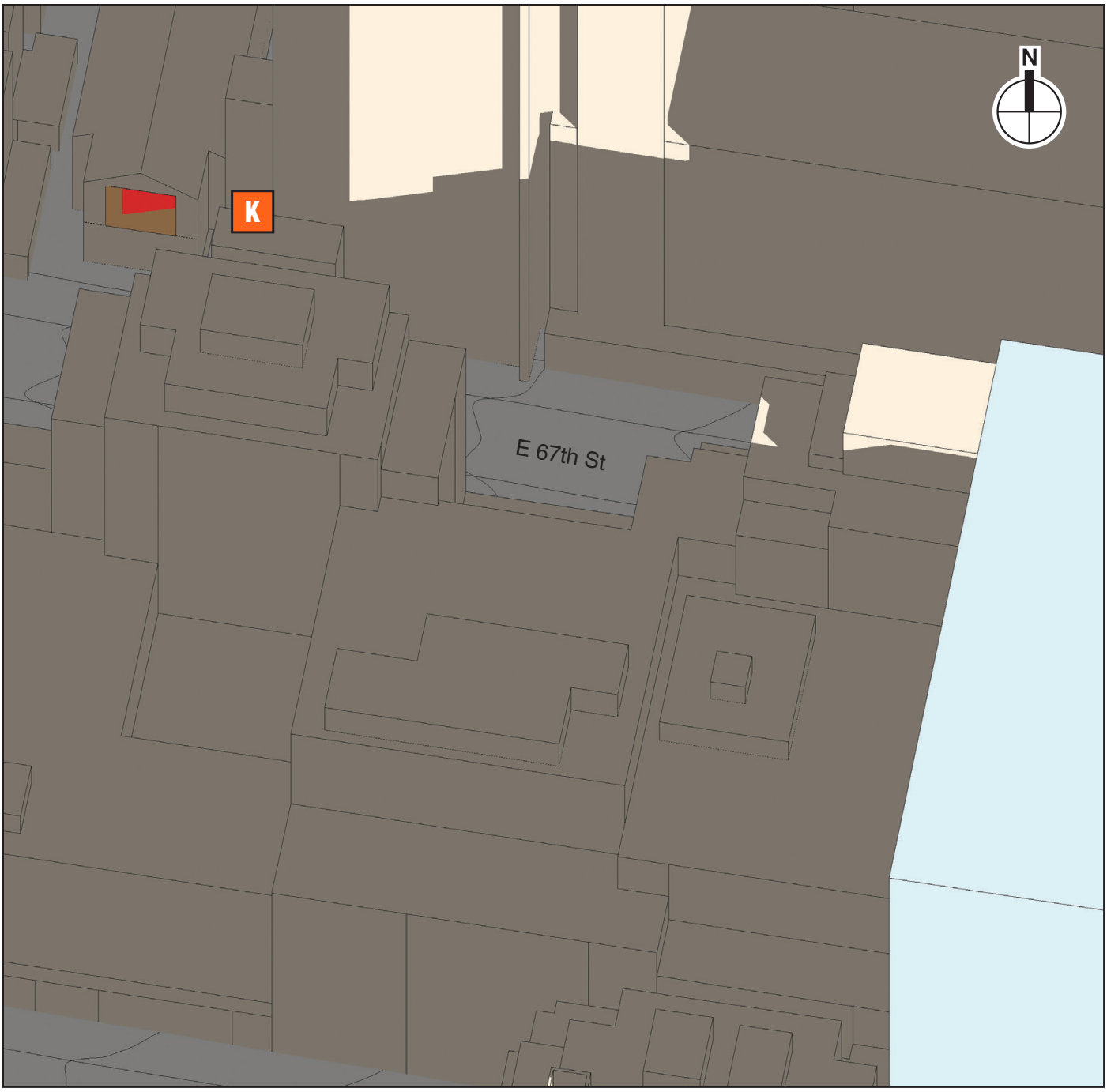
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Manhattan House Apartments
March 21 / September 21

MSK PAVILION

Figure 5-20

10.11.23



10:20 AM

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

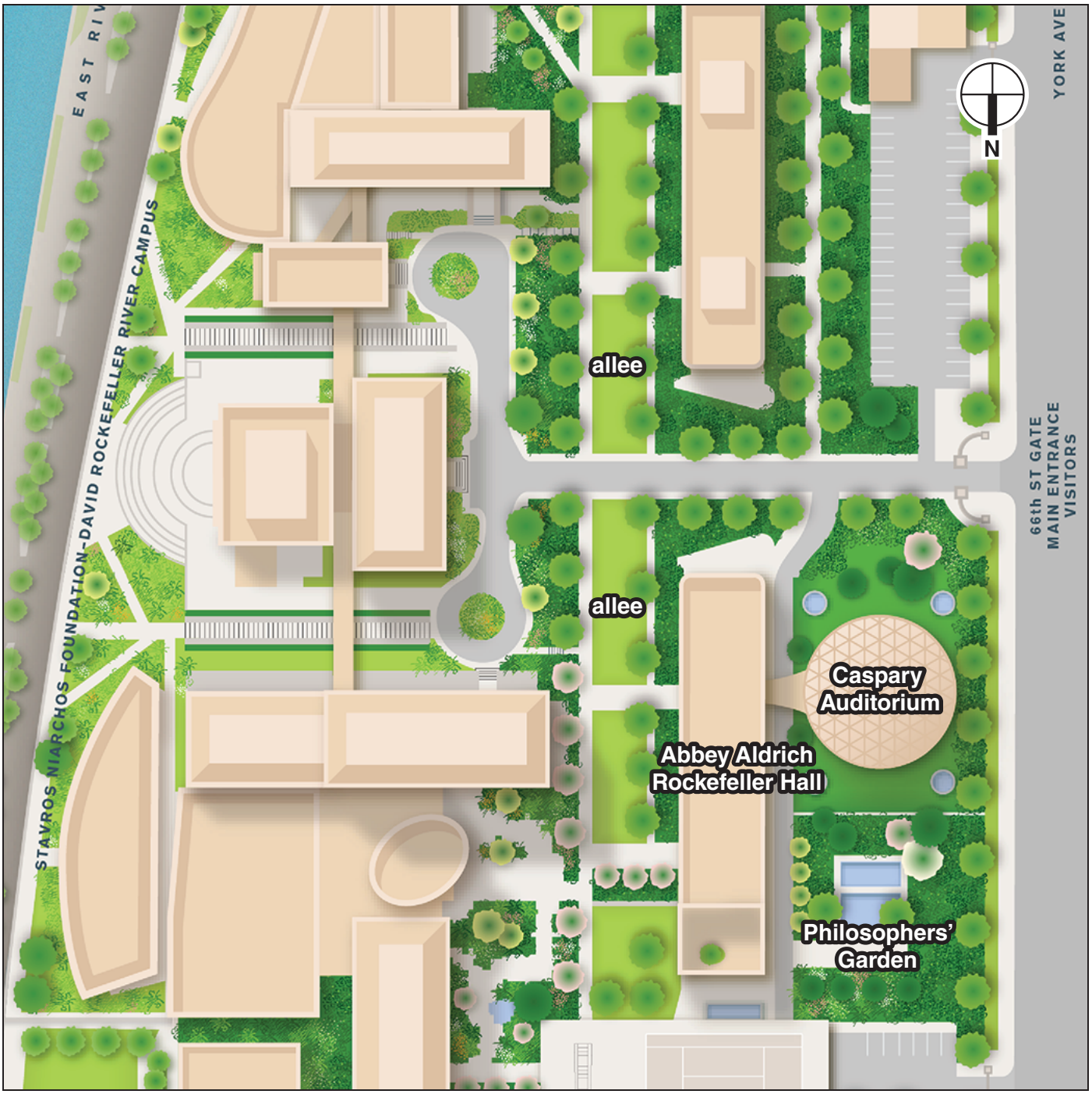
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings.

Detailed Analysis
St Catherine of Siena Church
December 21

MSK PAVILION

Figure 5-21

10.11.23



Source: https://www2.rockefeller.edu/campusmap/

Rockefeller University landscape plan

MSK PAVILION

Figure 5-22

10.11.23



2:30 PM (3:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

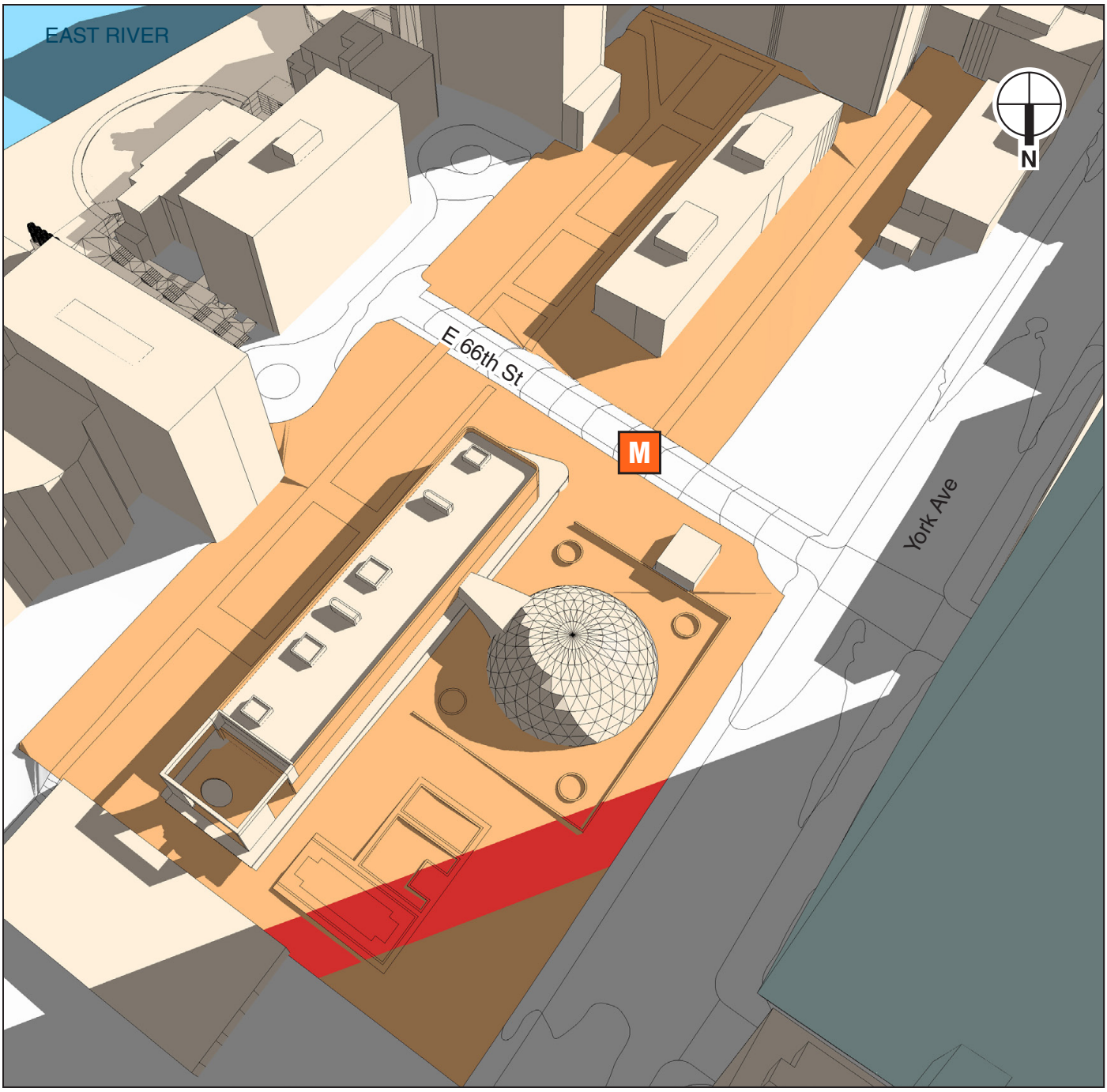
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
March 21 / September 21

MSK PAVILION

Figure 5-23

10.11.23



3:30 PM (4:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

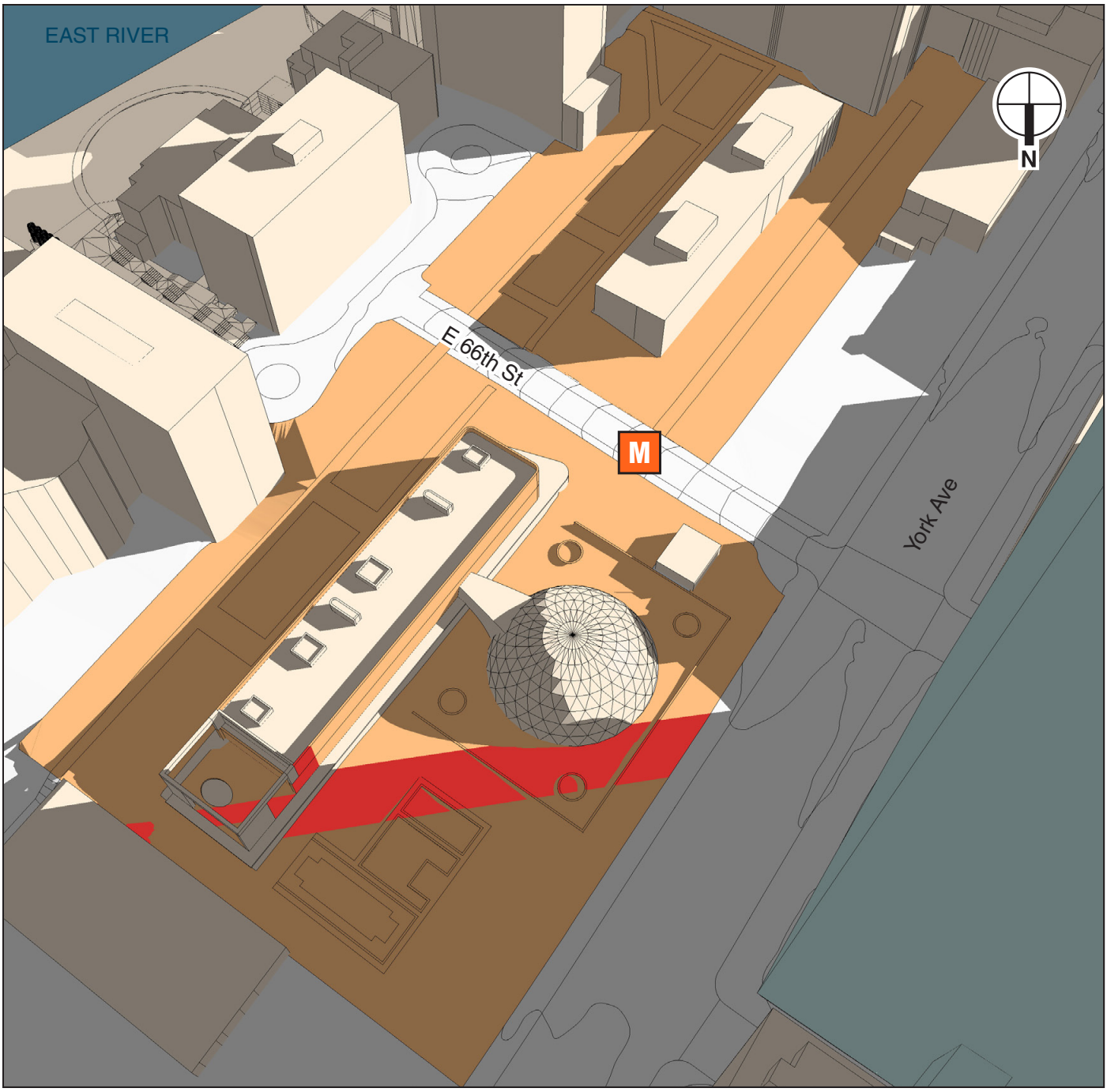
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
March 21 / September 21

MSK PAVILION

Figure 5-24

10.11.23



4:29 PM (5:29 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

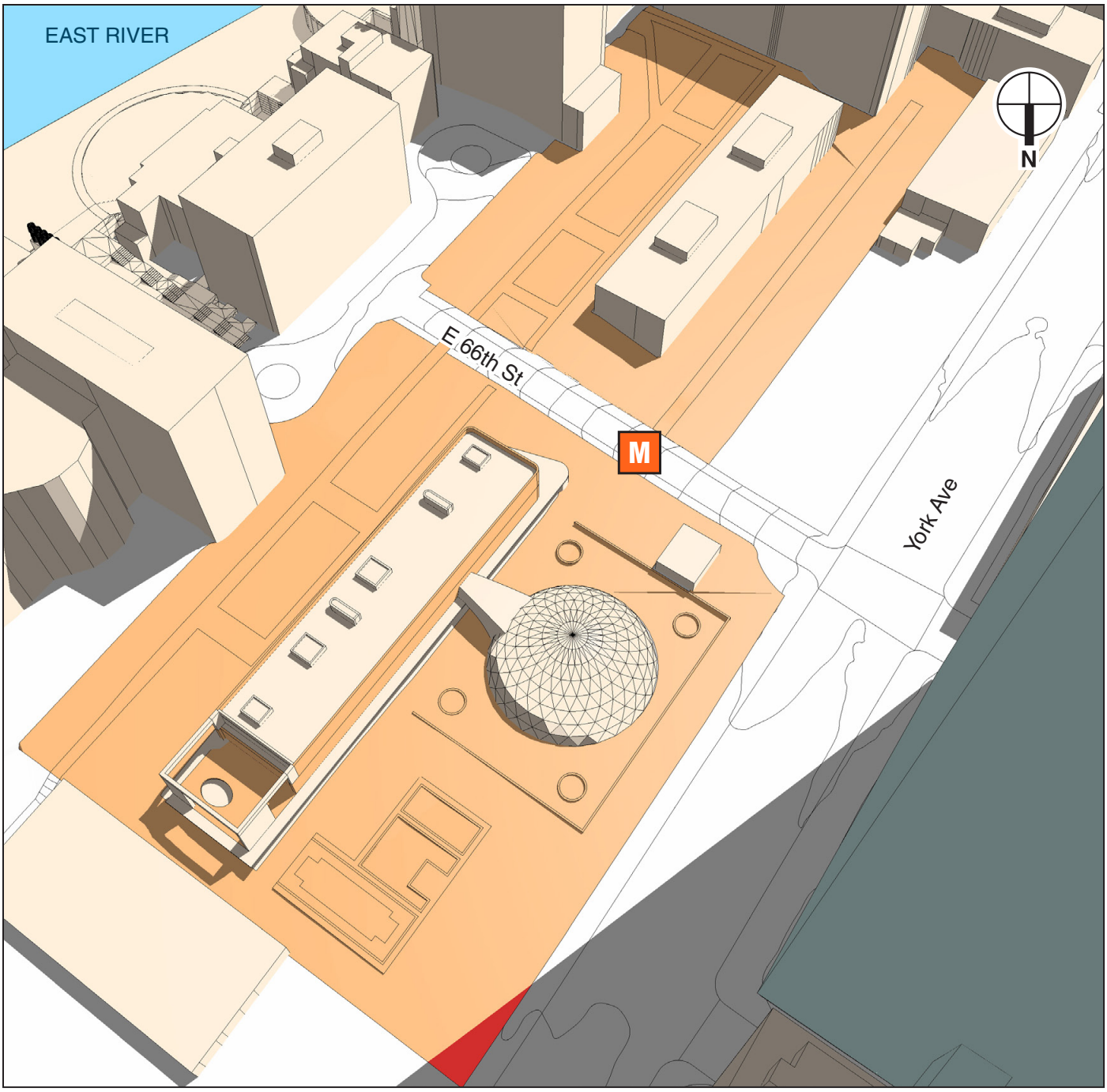
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
March 21 / September 21

MSK PAVILION

Figure 5-25

10.11.23



1:30 PM (2:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

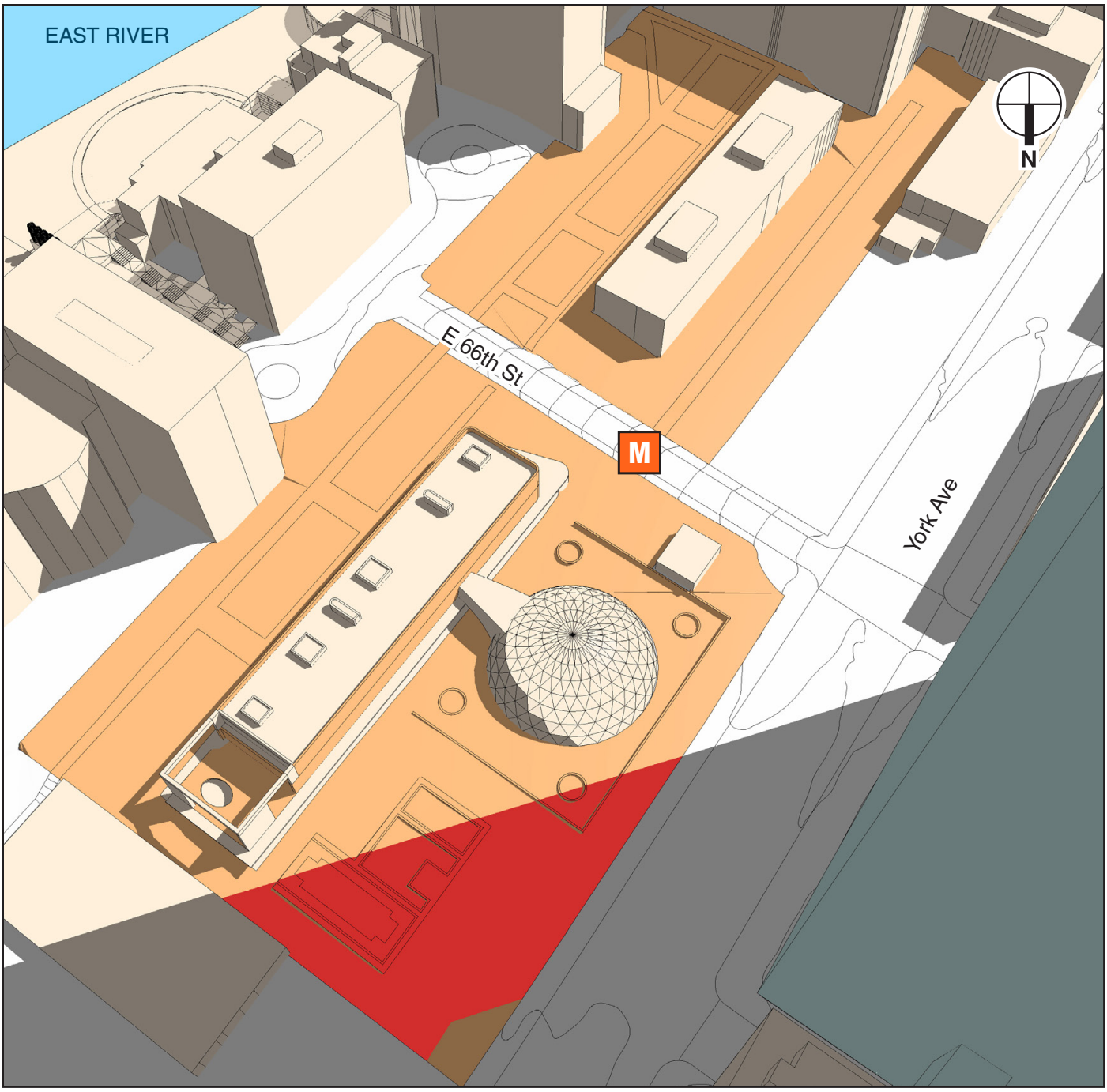
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
May 6 / August 6

MSK PAVILION

Figure 5-26

10.11.23



2:30 PM (3:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
May 6 / August 6

MSK PAVILION

Figure 5-27

10.11.23



3:30 PM (4:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

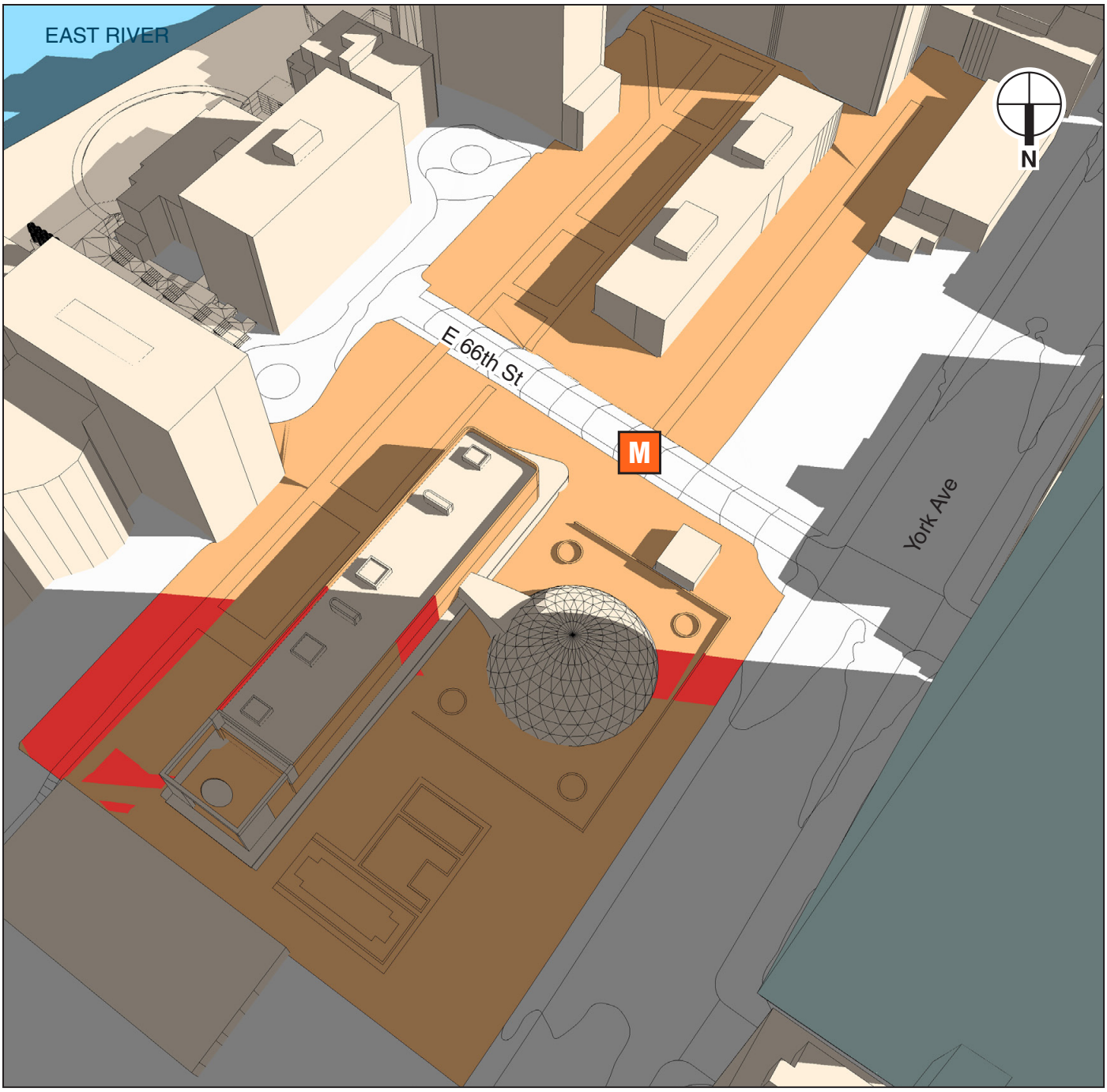
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
May 6 / August 6

MSK PAVILION

Figure 5-28

10.11.23



4:30 PM (5:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

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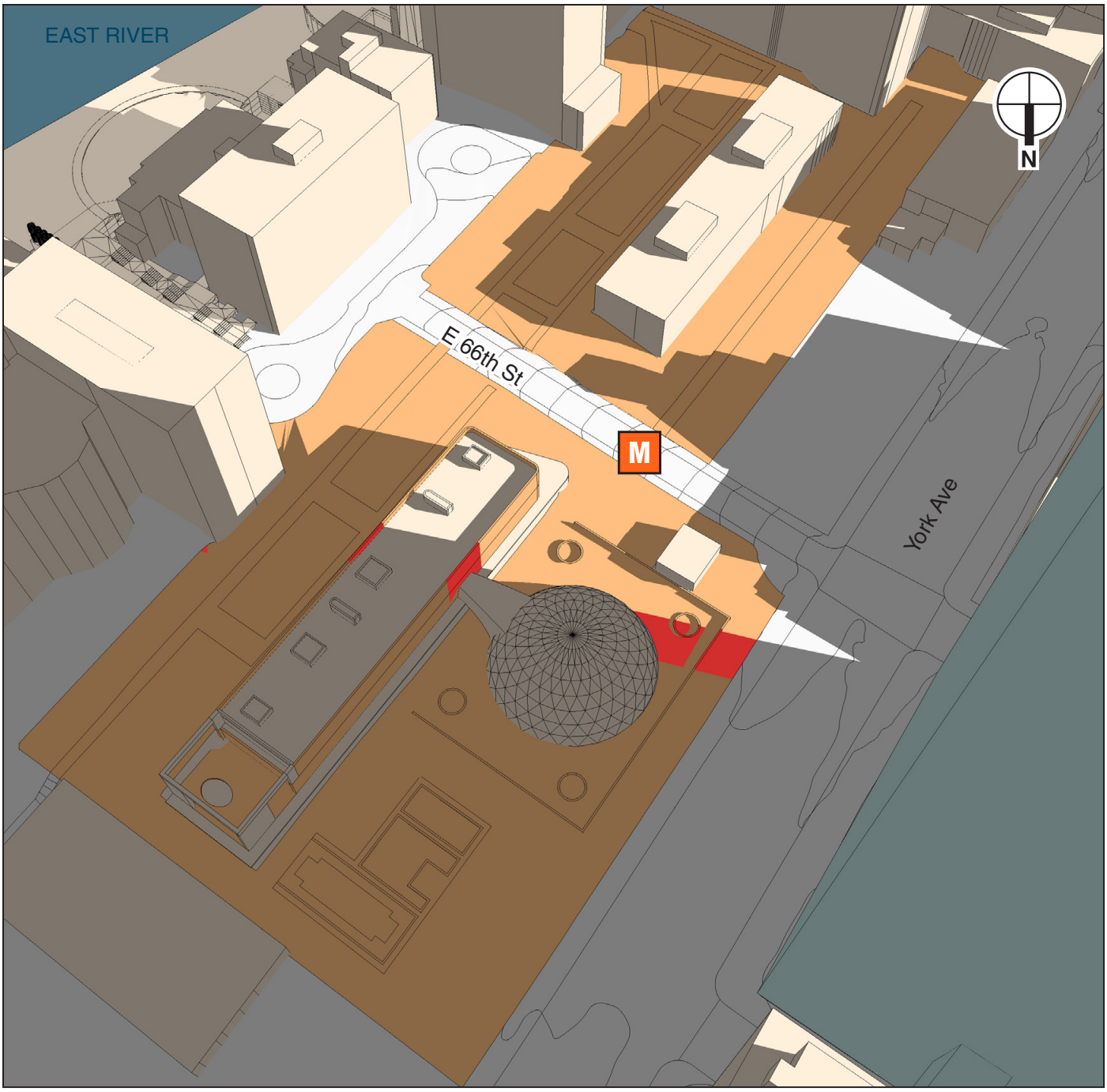
Detailed Analysis
Rockefeller University Historic District
May 6 / August 6

MSK PAVILION

Figure 5-29

10.11.23



5:18 PM (6:18 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

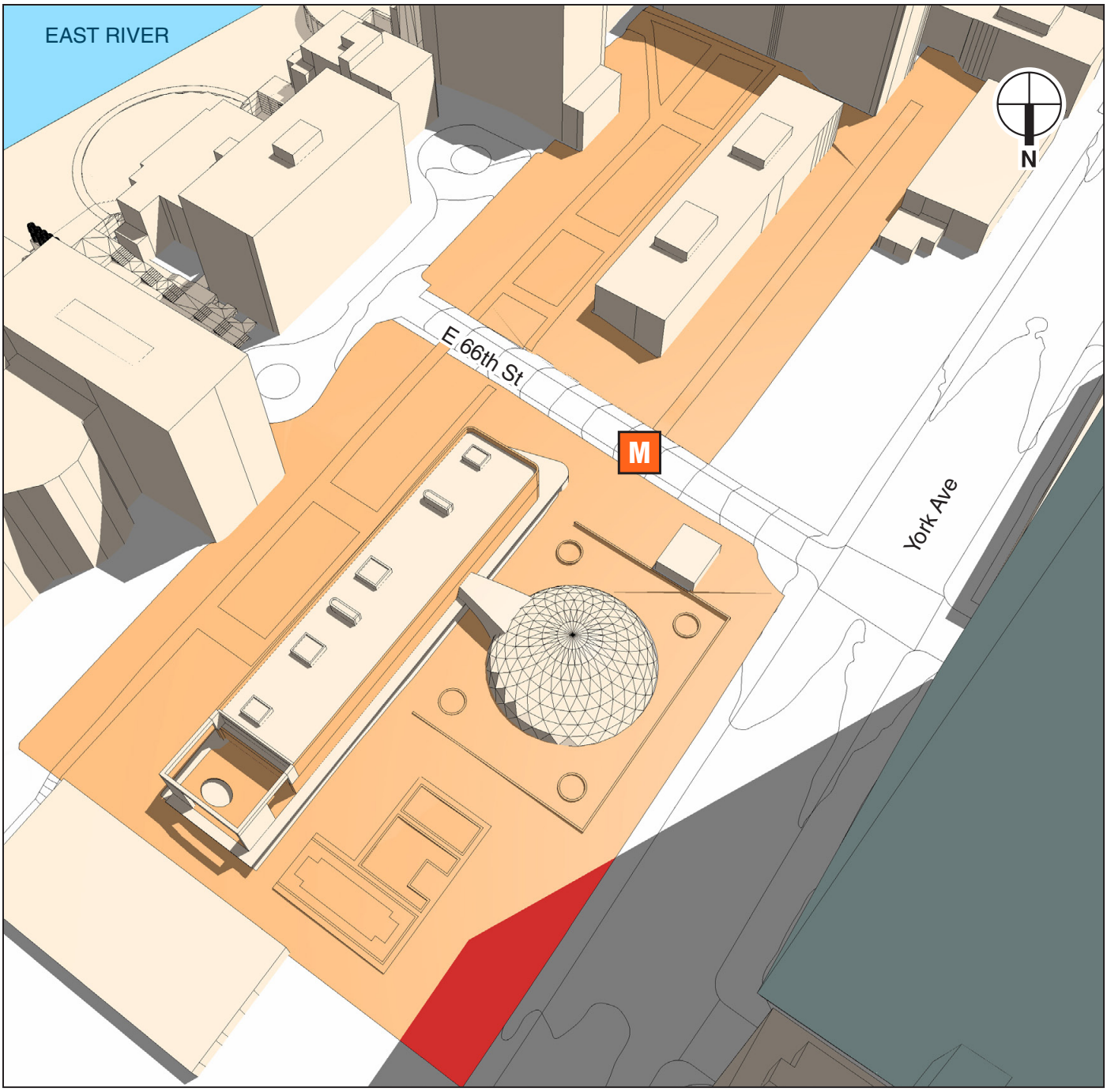
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
May 6 / August 6

MSK PAVILION

Figure 5-30

10.11.23



1:30 PM (2:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

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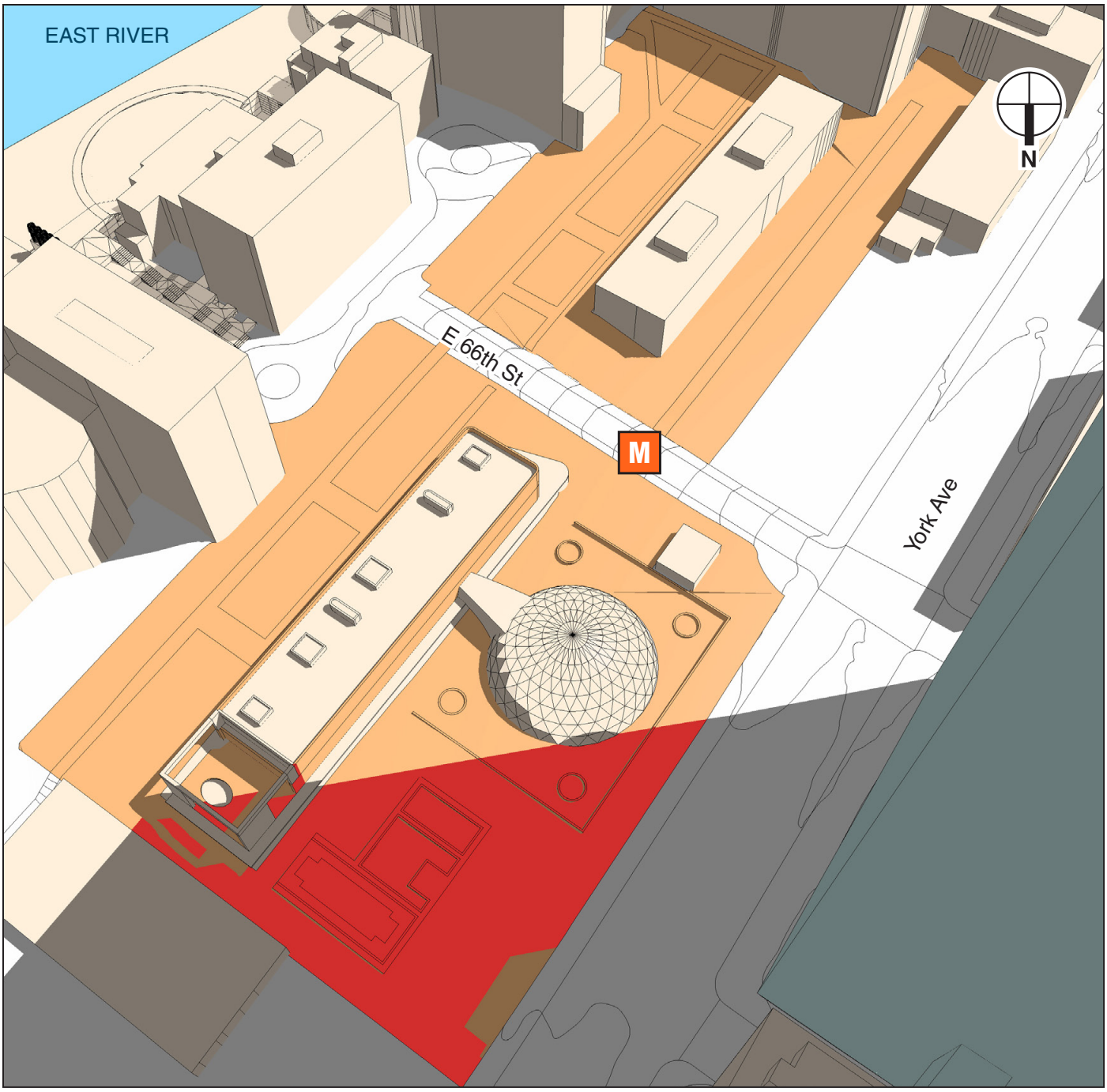
Detailed Analysis
Rockefeller University Historic District
June 21

MSK PAVILION

Figure 5-31

10.11.23



2:30 PM (3:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

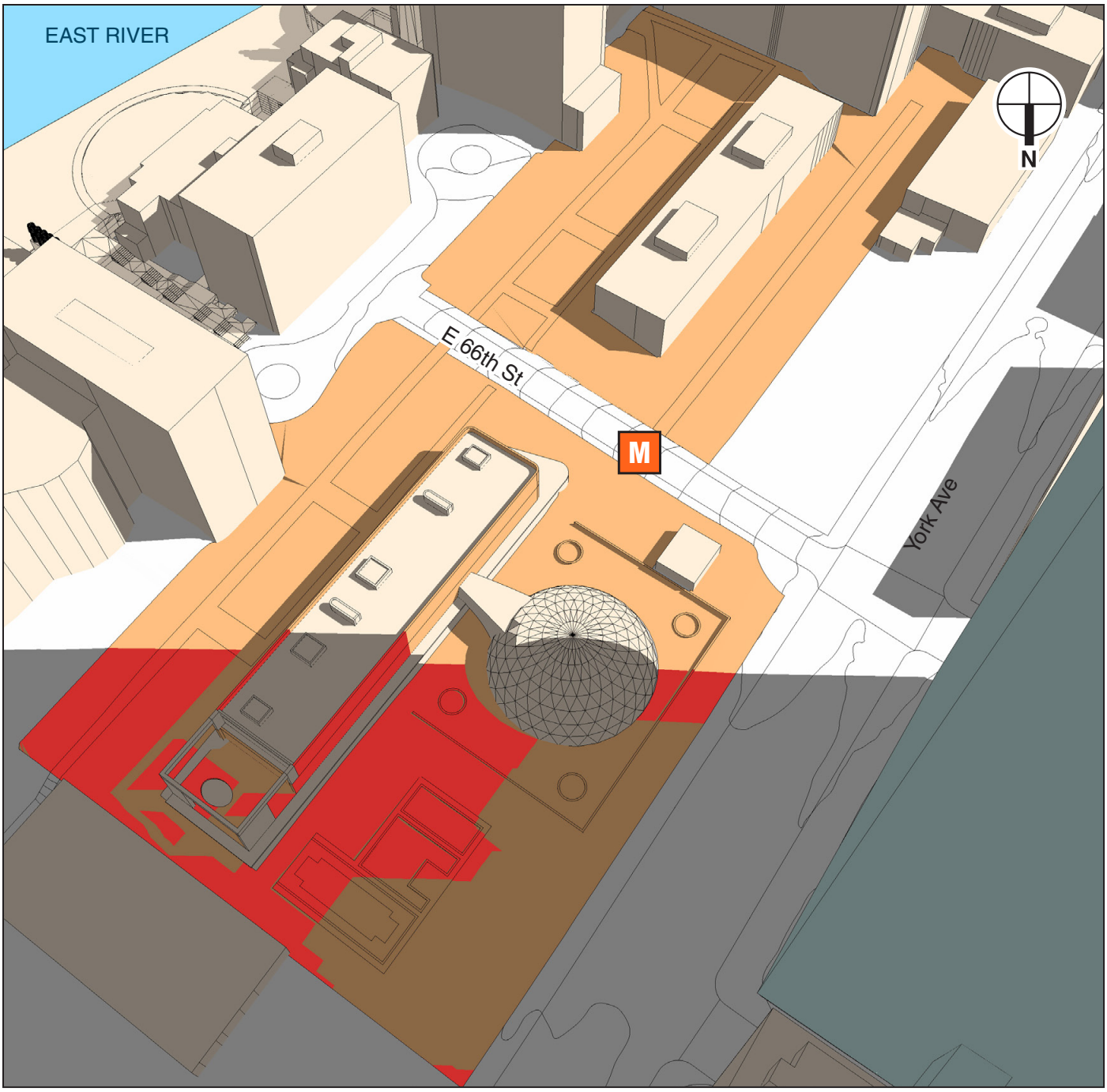
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
June 21

MSK PAVILION

Figure 5-32

10.11.23



3:30 PM (4:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

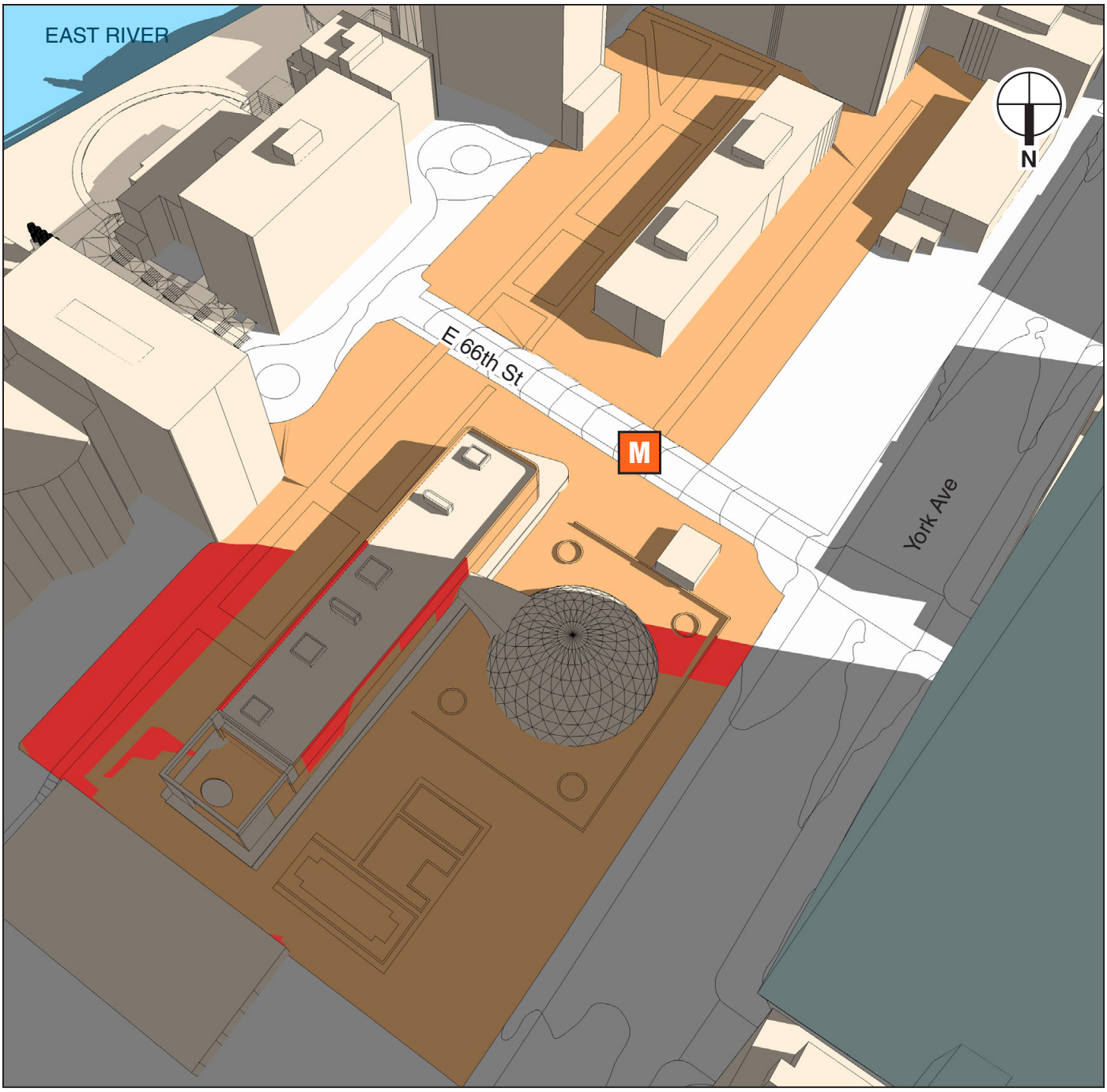
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
June 21

MSK PAVILION

Figure 5-33

10.11.23



4:30 PM (5:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

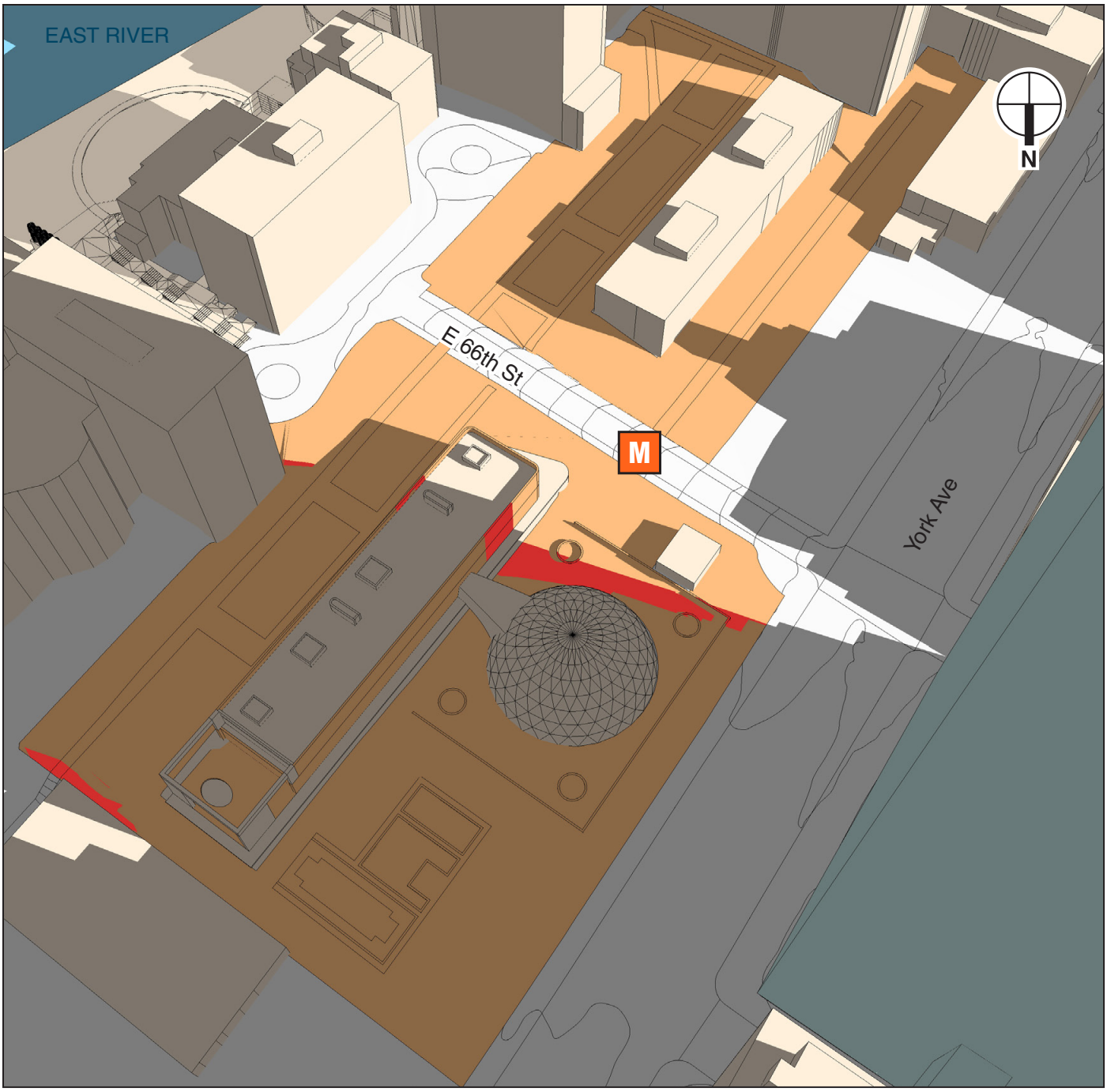
NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
June 21

MSK PAVILION

Figure 5-34

10.11.23



5:30 PM (6:30 PM EDT)

Proposed Project

Publicly Accessible Open Space (see Table 5-1)

Historic Resource with Sunlight-Sensitive Features (see Table 5-1)

Incremental Shadow

NOTES: Only the areas of shadow highlighted in red represent incremental shadow resulting from the Proposed Project. All other shadow is future No Action shadow, i.e. baseline shadow from existing and future No Action buildings. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine the actual clock time.

Detailed Analysis
Rockefeller University Historic District
June 21

MSK PAVILION

Figure 5-35

Table 5-2
Incremental Shadow Durations

Map Reference	Name	Dec. 21	Mar. 21 / Sept. 21	May 6 / Aug. 6	Jun. 21
Publicly Accessible Open Spaces					
8	220 East 65th St POPS	—	7:36am to 7:46am Total 10 min	—	—
11	East 66th St Greenstreets	—	8:05am to 8:06am Total 1 min	—	—
13	St. Catherine's Park	9:30am to 9:50am Total 20 min	9:05am to 10:15am Total 1 hr 10 min	—	—
29	1365 York Ave POPS	1:50pm to 2:00pm Total 10 min	—	—	—
30	1385 York Ave POPS	1:58pm to 2:00pm Total 2 min	—	—	—
35	Roosevelt Island west esplanade	—	—	5:05pm to 5:18pm Total 13 min	5:25pm to 6:01pm Total 36 min
Historic Resources with Sunlight-Sensitive Features					
A	St John Nepomucene Church – north windows	—	—	8:15am to 9:35am Total 1 hr 20 min	8:55am to 9:40am Total 45 min
	St John Nepomucene Church – east (rear) windows	—	8:35am to 9:25am Total 50 min	8:35am to 10:05am Total 1 hr 30 min	8:10am to 9:45am Total 1 hr 35 min
E	Manhattan House Apts	—	7:36am to 8:00am Total 24 min	—	—
K	Church of St. Catherine of Siena	10:10am to 10:35am Total 25 min	11:15am to 11:25am Total 10 min	—	—
M	RUHD* Landscape	—	2:20pm to 4:29pm Total 2 hr 9 min	1:25pm to 5:18pm Total 3 hr 53 min	1:20pm to 6:01pm Total 4 hr 41 min
	RUHD* Abby Aldrich Rockefeller Hall	—	4:15pm to 4:29pm Total 14 min	2:55pm to 5:18pm Total 2 hr 9 min	2:25pm to 6:01pm Total 3 hr 36 min
N	Episcopal Church of the Good Shepherd	—	—	—	5:45pm to 6:01pm Total 16 min
Natural Resources					
N1	East River	—	4:20pm to 4:29pm Total 9 min	4:00pm to 5:18pm Total 1 hr 18 min	4:10pm to 6:01pm Total 1 hr 51 min

Notes:
Table indicates entry and exit times and total duration of incremental shadow for each sunlight-sensitive resource.
Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add one hour to the given times to determine actual clock time.
* RUHD = Rockefeller University Historic District

ASSESSMENT OF SHADOW IMPACTS BY RESOURCE

The following section briefly describes each affected resource that would receive more than 10 minutes of incremental shadow;[6] its sunlight sensitivity; and the extent, duration, and potential

[6] Per *CEQR Technical Manual* guidelines, incremental shadow is not considered significant when its duration is no more than 10 minutes, and the resource otherwise continues to receive substantial sunlight. *CEQR Technical Manual*, 2020 edition, page 8-27.

effects of incremental shadow. Descriptions of resource condition and utilization rates were taken from Chapter 4, "Open Space." Map reference numbers are included with the name, for convenience.

Times are given in Eastern Standard Time (EST) in all seasons, as mandated by the *CEQR Technical Manual*, but Eastern Daylight Time (EDT) is in effect for all representative analysis days except for December 21, and times are also provided parenthetically in EDT when relevant, for informational purposes.

OPEN SPACE RESOURCES

St. Catherine's Park (Map #13)

St. Catherine's Park occupies the eastern half of the block bounded by East 67th and 68th Streets and First and Second Avenues. On the west side of the park there are basketball and handball courts, tennis walls, a running track, and a workout station. The east side of the park contains several playground features. Closer to East 67th Street there is a playground for younger children, a fenced in swing area, and spray showers. On the north side closer to 68th Street, there is a larger playground for older children. There are benches, shade trees, and planted areas throughout the park. All of these features are surrounded by large shade trees along the perimeter of the entire park. Generally speaking, the active uses accommodated in the western half of the park would be less sensitive to shadows, while the seating areas, water feature and other children's play areas, planting beds, and denser tree canopy in the eastern half of the park would be more sensitive to shadows.

On the December 21 analysis day representing winter, much of the park would be in existing shadows in the morning hours, and the Proposed Project would add a small area of new shadow on the western, active-recreational half of the park for 20 minutes, 9:30 AM to 9:50 AM (see **Figure 5-6**). Given the small size and brief duration of the incremental shadow, and the likely lower levels of usage at this time of year compared to warmer months, the impact of the incremental shadow would be minimal.

On the March 21/September 21 analysis day representing the early spring and the fall, incremental shadow from the top of the proposed building would move across portions of the southern part of the park over the course of an hour and 10 minutes, from 9:05 AM to 10:15 AM (10:05 AM to 11:15 AM EDT). Even during this relatively brief affected period, the incremental shadow would move, falling on different features and seating areas at different times (see **Figures 5-7 to 5-9**). Substantial areas of sun would remain in the playground and seating areas on the east side of the park as well as the active areas on the west side throughout the affected period for users seeking sun, as well as afterwards for much of the remaining day, and consequently the incremental shadow would not significantly impact the use or users of the park on this analysis day.

No incremental shadow would reach the park on the late spring or summer representative days.

With regard to the park's trees and plantings, no incremental shadow would reach them on the May 6/August 6 or June 21 analysis days representing the heart of New York city's growing season. On the March 21 and September 21 dates representing the "shoulders" of the growing season, a limited number of trees and plantings in the south and southeast area of the park would receive anywhere between 5 minutes up to nearly an hour (in the southeast corner) of new shadow. Given the limited number of the park's trees and plants affected by incremental shadow, the limited duration of incremental shadow, and the fact that they would remain unaffected through

the May to August heart of the growing season, the Proposed Project would not significantly impact the health of the park's vegetation.

Roosevelt Island west esplanade (Map #35)

There is an esplanade along the perimeter of Roosevelt Island where the public can walk and enjoy the Manhattan skyline views, jog, bike, or sit in certain locations where there are benches or steps.

Incremental shadow from the top of the proposed building would reach a section of the esplanade at the end of the late spring and summer analysis days when shadows extend far to the east. The incremental shadow would fall for the final 13 minutes of the May 6/August 6 analysis day and for the final 36 minutes of the June 21 analysis day. During these brief affected periods, plenty of sunlit areas would remain available to the immediate north and south along this linear esplanade for users seeking sun. Therefore, the incremental shadow would not significantly affect the use of the esplanade, or its vegetation, which would receive many hours of sun on these dates, particularly in the mid-day and afternoon due to the lack of structures to the south and west.

HISTORIC RESOURCES

St. John Nepomucene Church (Map #A)

This building, eligible for listing on the New York State and National Registers of Historic Places (S/NR-eligible) as well as eligible for designation as a New York City Landmark (NYCL-eligible), is located at 1224 First Avenue at the northeast corner of East 66th Street. It is oriented east-west with its primary façade and primary entrance on First Avenue facing away from the Development Site. The altar is situated at the rear, or east end, of the church's sanctuary and high above the altar at the upper level are three small stained-glass windows; these windows face toward the Development Site. The church's south façade, fronting on East 66th Street, and its north façade contain paired stained-glass windows set in round arch openings at the first floor and paired stained glass arched windows at the upper level. The north and south façades are oriented roughly at 90-degree angles to the Development Site. At the time of this writing, the church typically holds Sunday services at 9:00 AM, 10:30 AM, 12:00 PM, and 6:00 PM, and on other days of the week at 12:15 PM. See **Figure 5-10** showing interior photos of the sanctuary and the sunlit stained-glass windows along the north (side) façade and east/rear façade (above the altar) during Sunday services on May 7, 2023.

No incremental shadow would affect the church on the winter analysis day.

On the March 21/September 21 analysis day incremental shadow would fall on one or at times two of the three upper-level rear windows between 8:35 and 9:25 AM (9:35 to 10:25 AM EDT), potentially eliminating the remaining direct sunlight on the rear façade for the first 25 minutes but only some of the direct sunlight for the later 25 minutes (see **Figures 5-11 and 5-12**). Given the brevity of the period during which all the direct sunlight would be eliminated (25 minutes) as well as the overall period of incremental shadow (50 minutes), as well as the fact that after this period, from 10:30 EDT into the afternoon, the rear (and south façade) windows would be in sun, the new shadow would not cause a significant adverse impact to this resource.

On the analysis day representing May 6 and August 6, sunlight and shadows fall on Manhattan's north façades (which are actually 29 degrees to the northeast rather than due north), albeit at increasingly oblique angles, from sunrise until approximately 9:35 AM (10:35 AM EDT), after which the sun has moved far enough south that its rays begin to fall on south façades and no longer

on north façades. The sun's rays (and shadows) also fall on east façades throughout this period until early afternoon.

Incremental shadow would begin to fall on the church's north façade windows at 8:15 AM (9:15 AM EDT) and by 8:30 AM (9:30 AM EDT) would eliminate all the direct sun on the upper and lower-level stained glass windows, covering most of the windows (with the others in existing shadows from the adjacent building) for about 50 minutes until 9:20 AM (10:20 AM EDT), as shown in **Figures 5-13 to 5-15**. By this point the sun's rays would be hitting north façades very obliquely, and 15 minutes later no more incremental shadow or existing shadow or sun) would affect the north façade windows as the sun would move too far south, as shown in **Figure 5-16** showing 9:45 AM (10:45 AM EDT).

At the same time, incremental shadow would move onto the upper-level rear windows above the alter at 8:35 AM (9:35 AM EDT), eliminating the sun for about an hour and 10 minutes until 9:45 AM (10:45 AM EDT), as shown in **Figures 5-14 to 5-16**. The incremental shadow would then begin to move off the windows, first one, then two, then all three, over the course of 20 minutes, exiting entirely at 10:05 AM (11:05 AM EDT).

Given the coverage and duration of the incremental shadow and its diminution and, at times, elimination of direct sunlight particularly from the upper rear windows, which otherwise would get direct (not oblique) sunlight and given the time at which this diminution occurs (during Sunday services), the incremental shadow would cause a significant adverse impact to this historic resource. It should be noted that ambient daylight, if not direct sunlight, would continue to provide some illumination to all the windows, even those facing away from the sun at this time of day.

On the June 21 analysis date, sun and shadow angles follow similar patterns to the May 6/August 6 date, and in the morning incremental shadow would fall on the north façade of the church, but rather obliquely, until late morning, and the east façade more directly. Incremental shadow would also move onto the rear windows above the altar beginning at 8:10 AM (9:10 AM EDT) covering first one, then two 15 minutes later, then all three by 8:45 AM (9:45 AM EDT), eliminating all the direct sunlight from then until 9:35 AM (10:35 AM EDT), then existing completely 10 minutes after that (see **Figures 5-17 to 5-19**). Incremental shadow would also fall on portions of the upper and lower north façade windows between approximately 9:00 AM to 9:40 AM (10:00 AM to 10:40 AM EDT) but the perceived impact would be minor because half or more of both rows of windows would remain in sun and because the sun's rays are quite oblique and consequently weaker during this time (see **Figures 5-18 and 5-19**).

Given the nearly one hour of elimination of direct sunlight on the rear windows, the time during which this occurs (during Sunday services), and the significant impacts earlier and later in the year as described above, the incremental shadow would cause a significant adverse impact to this historic resource. As noted above, ambient daylight, if not direct sunlight, would continue to provide some illumination to all the windows, even those facing away from the sun at this time of day.

Manhattan House Apartments (Map #E)

This apartment and retail complex, completed in 1951 and designated as a landmark by New York City Landmarks Preservation Commission (LPC) in 2007, occupies the full block bounded by East 65th and 66th Streets and Second and Third Avenues. It has deep projecting balconies that create light and shadow on the façades, as noted in the designation report, and a block-long garden in the rear (East 65th Street side), which is not publicly accessible, but which nevertheless is integral to the building's architectural significance. Therefore, the façades and rear garden were included in

the analysis as sunlight-sensitive features. The analysis showed that the rear garden would never receive incremental shadow, but portions of the north façade would, as described below.

Incremental shadow would not reach this building on the winter date nor the late spring and summer dates.

Beginning at the start of the March 21/September 21 date, incremental shadow would fall very briefly (about 4 minutes) on a small area on the east/Second Avenue façade, and then for about 20 minutes on a portion of the north façade, on the lower half near Second Avenue, for a cumulative total of 24 minutes (7:36 AM to 8:00 AM, or 8:36 AM to 9:00 AM EDT). Even at the incremental shadow's largest extent around 7:45 AM (8:45 AM EDT) large areas of the block-long north façade would remain in sun, for passers-by to appreciate (see **Figure 5-20**), and the new shadow would be gone 15 minutes later. Therefore, the Proposed Project would not significantly impact the public's ability to appreciate this historic resource.

Church of St. Catherine of Siena (Map #K)

This church is located at 405-409 East 68th Street, on the north side of the block. It is a through-block building and its primary (south) façade and entrance on East 68th Street faces the Development Site. The upper portion of the façade contains three-pointed arch window openings with stained glass.

Incremental shadow would reach the church for 25 minutes on the December 21 analysis day representing winter, from 10:10 AM to 10:35 AM, eliminating the small remaining area of direct sunlight on the front façade and windows, with the rest of the façade in existing shadows (see **Figure 5-21**). Other than this period, the façade and windows would be entirely in existing shadow throughout the morning and into early afternoon. Given the brief duration and small coverage area, and the fact that the façade and windows would generally be entirely in shadows for much of the day in any case, the incremental shadow would not significantly alter the look and feel of this façade and stained-glass windows on this analysis day. Incremental shadow would also fall on the façade on the March 21/September 21 analysis day for 10 minutes, which is not deemed a significant amount of time. No incremental shadow would occur on the late spring and summer analysis dates.

Rockefeller University Historic District (Map #M)

The Rockefeller University Historic District (S/NR-eligible and NYCL-eligible), whose architectural and historical significance is described in detail in Chapter 6, "Cultural and Historic Resources," includes two specific elements within the Tier 3 shadow sweeps that have been identified as sunlight-sensitive: the campus landscape designed by landscape architect Dan Kiley, and the Abby Aldrich Rockefeller Hall building, specifically the windows on the west façade facing the Development Site and the open-air porch element at the building's north end.

It is important to note that neither the Dan Kiley-designed landscape nor the Abby Aldrich Rockefeller Hall building are publicly accessible, and therefore any potential effects to users appreciating these resources would be extremely limited in scope. Potential shadow impacts to the landscape's tree canopy and other plantings were evaluated similarly to any open space vegetation per the methodology described in the Methodology sections above.

No incremental shadow would reach any sunlight-sensitive features in the Historic District on the December 21 analysis day.

Landscape

As described below, incremental shadow would fall on portions of the northern part of the Kiley-designed landscape, i.e., north of the east-west drive that bisects the landscape, extending east from the main entrance gate at East 66th Street and York Avenue to Founder's Hall. The northern part of the Kiley-designed landscape contains several areas (see **Figure 5-22**) including the Philosophers' Garden area and the area surrounding the windowless domed blue-clad Caspary Hall, both of which contain some benches/seating areas as well as lush plantings, and, east of the Abby Aldrich Rockefeller Building, a landscaped allee (paths, lawn, rows of leafy mature trees). Above the entire landscape, a high, dense canopy of trees keeps the spaces mostly shady with some dappled sunlight throughout the leaf-on growing season.

On all the spring, summer, and fall representative analysis days, incremental shadow would move onto the northwest corner of the landscape (the northwest corner of the Philosophers' Garden area) in mid-afternoon and gradually move east and south, covering the largest area around 3:30 PM EDT, then becoming smaller as existing shadows lengthen, until only small areas of incremental shadow remain at the end of the analysis day.

On the March 21/September 21 analysis day, a limited band of incremental shadow would move across primarily the Philosophers' Garden area from approximately 2:20 PM to 4:29 PM (3:20 PM to 5:29 PM EDT). Areas of sun would remain on the garden and in other areas of the landscape throughout this period (see **Figures 5-23 to 5-25**).

On the May 6/August 6 analysis day, incremental shadow would enter the northwest corner at 1:25 PM (2:25 PM EDT) and would be largest from 2:30 PM to 2:45 PM (3:30 PM to 3:45 PM EDT), falling on a portion of the Philosophers' Garden; however, plenty of sunlit benches and landscaped areas would remain (see **Figures 5-26 and 5-27**). By 3:30 PM (4:30 PM EDT) half of the Philosophers' Garden area would be in shadow from existing buildings while most of the rest of the Philosophers' Garden would be in incremental shadow, with a small area of sunlight, but large areas would remain in sunlight in other parts of the landscape (see **Figure 5-28**). After 4:00 PM (5:00 PM EDT) incremental shadow would be limited to small areas due to more extensive existing shadows (see **Figures 5-29 and 5-30**).

On the June 21 analysis day, incremental shadow would enter the northwest corner at 1:20 PM (2:20 PM EDT), as shown in **Figure 5-31**. At 2:00 PM (3:00 PM EDT) half of the Philosophers' Garden area would be in incremental shadow while the other half would remain in sun, and from 2:15 PM to 3:00 PM (3:15 PM to 4:00 PM EDT) much of the Philosophers' Garden area would be in incremental shadow, while other areas east and south of Caspary Hall as well as the allees farther east would remain in sun (see **Figure 5-32**). At 3:30 PM (4:30 PM EDT), half of the Philosophers' Garden area would be in existing shadow while incremental shadow would eliminate the other half and fall on areas adjacent to Caspary Hall and on a portion of the allee east of Abby Aldrich Rockefeller Hall; however, other areas of landscape would remain in sun (see **Figure 5-33**). After 4:00 PM (5:00 PM EDT) incremental shadows would be more limited due to extensive existing shadows, and after 5:00 PM (6:00 PM EDT) would be limited to small areas (see **Figures 5-34 and 5-35**).

Total incremental shadow durations in the mid- to late-afternoon falling on some portion of the northern part of the Kiley-designed landscape would range from about two hours in the fall and early spring to more than four hours in the summer. However, the shadow increment would move during the course of that overall time period, affecting different areas of the landscape at different times. Individual trees, plants, benches, or other features would receive no more than an hour and 15 minutes of incremental shadow, and many of these features would receive less than that. Large

areas of sun would continue to reach the landscape throughout the affected period, especially the landscape areas adjacent to Caspary Hall, the allees, and the southern part of Kiley-designed landscape. Furthermore, as noted above, the landscape is not publicly accessible and so the incremental shadow would affect a very limited number of people. Finally, the Kiley-designed landscape, and the Philosophers' Garden in particular, was designed as, and continues to be, a leafy, shady retreat and contemplative space, under a dense mature tree canopy, and the limited extent and duration of new shadow would not significantly alter their look and feel. Therefore, given these factors, the incremental shadow would not cause significant impacts to the use and appreciation of this historic landscape.

With regard to the mature tree canopy and the plantings and landscaping underneath, a solar exposure analysis was conducted to quantify the duration of direct sunlight that would reach the affected areas of the Historic District with and without the Proposed Project.[7] The analysis showed that each individual tree or plant would receive a maximum of an hour and 15 minutes of new shadow from the Proposed Project—many trees and plants would receive less new shadow—as the shadow would pass across the landscape. Further, virtually all areas of the landscape affected by incremental shadow would continue to receive more than seven hours of sunlight throughout the mornings, mid-day, and early afternoons in the spring, summer, and fall, due to the lack of tall buildings to the east and southeast (where the river is located) and the immediate south and southwest (the southern half of the landscape and York Avenue). Therefore, the vegetation would not be significantly affected by the project-generated incremental shadow.

Abby Aldrich Rockefeller Hall

This building has an open-air porch -like feature at its northern end, and its west façade facing the project is covered in windows. These have been identified as sunlight-sensitive features from the perspective of users in the building or the open-air feature.

The open-air feature would be in incremental shadow for about 15 minutes at the end of the March 21/September 21 analysis day, and for one and a half to two hours in the late afternoon of the late spring and summer analysis days (see **Figures 5-25, 5-28,** and **5-32 to 5-33**). The new shadow would eliminate all the sunlight reaching this feature for most of these periods.

Incremental shadow durations on the building's west façade windows would begin at similar times of day to those on the open-air feature but would continue until the end of each analysis day. They would fall on just one or two at first and increase in coverage over the course of the duration, but never eliminating sun from all the windows of the façade.

As noted above, this building is not publicly accessible and so the incremental shadow would affect a very limited number of people, and therefore, along with the fact that the feature would be in sun for virtually the entire rest of the day before the incremental shadow would occur, the new shadow would not significantly affect the public's appreciation of these features.

[7] For the solar exposure analysis, the entire study area (the Kiley-designed landscape) was divided into one-meter by one-meter grid cells, and for each cell, the modeling software calculated the total amount of sunlight received (in time as well as kilowatts of solar energy), on each of the three analysis days in the growing season, with and without the project. Using this data, the analysis evaluated whether the trees, plantings and other vegetation would receive substandard direct sunlight as a result of the Proposed Project.

Episcopal Church of the Good Shepherd (Map #N)

This historic church has stained-glass windows on all façades including the west and south façades that face toward the project. Incremental shadow from the top of the proposed building would reach the church at the end of the midsummer (June 21) analysis day, 5:45 PM to 6:01 PM (6:45 PM to 7:01 PM EDT), eliminating the direct sunlight from the west and south façades for that final 16-minute period. However, the duration would be brief, and the façades would be entirely in sun for the whole afternoon up until that point. Further, incremental shadow would not reach the church at any other time of year. Given these factors, the incremental shadow would not significantly impact this historic resource.

NATURAL RESOURCES

East River (Map #N1)

The East River is a tidally influenced water body supporting a diverse and productive aquatic community of primary producers (phytoplankton, zooplankton, submerged aquatic vegetation (SAV) and benthic algae and invertebrates) and fish. Sunlight penetration is an important factor in determining phytoplankton, SAV, and benthic algae productivity and biomass.

An area of incremental shadow would fall on a portion of the East River for nine minutes at the end of the March 21/September 21 analysis day, for an hour and 18 minutes at the end of the May 6/August 6 analysis day, and for an hour and 51 minutes at the end of the June 21 analysis day, generally on areas of the river between the nearby Manhattan waterfront and Roosevelt Island. The affected areas of the river would receive direct sun for most of the day before the period of incremental shadow, on all three analysis days.

The current flows swiftly in this area of the East River, and it would move phytoplankton and other natural elements quickly through the shaded areas. Therefore, project-generated shadows would not be expected to affect primary productivity. Incremental shadows would therefore not be likely to significantly affect aquatic resources (plankton or fish) in these areas of the river. Consequently, project-generated shadows would not cause significant adverse impacts to the East River.

E. CONCLUSIONS

The Proposed Project would cast incremental shadows on six sunlight-sensitive open spaces, but four of these six would only receive 10 minutes or less of incremental shadow; the other two, St. Catherine's Park and Roosevelt Island's west esplanade, would receive varying durations of new shadow depending on the season but the analysis concluded that in neither case would the new shadows significantly affect the use of these resources or their trees and plantings.

The stained-glass windows in the north and east (rear) façades of the St John Nepomucene Church would receive between 90 and 45 minutes of new shadow during spring, summer, and fall mornings, diminishing and, at times, eliminating the direct sunlight from the windows, particularly on the May 6/August 6 and June 21 analysis days. While ambient daylight would continue to illuminate the windows, given the duration and reduction or elimination of direct sunlight, and the time of day that they would occur (during services), these incremental shadows would cause a significant adverse impact to this resource. See Chapter 18, "Mitigation," for potential mitigation measures that ~~are being~~have been explored by the Applicant ~~in consultation with DCP and LPC~~.

Four other historic resources would receive incremental shadow. Portions of the Rockefeller University Historic District landscape, which is not open to the public, would receive

approximately two hours of incremental shadow in the fall and early spring and up to four hours and 40 minutes of incremental shadow during the late spring and summer. The Abby Aldrich Rockefeller Hall's west façade and open-air feature at its north end would receive up to three and a half hours of incremental shadow in the late spring and summer. Three other historic resources would receive 25 minutes or less of incremental shadow in certain seasons and none in other seasons. In these four cases, the analysis concluded that the effects of the incremental shadow would not be significant, for reasons described in detail above.

Areas of the East River would receive up to nearly two hours of incremental shadow in the late spring and summer, but negligible incremental shadow in other seasons and the analysis concluded that the impacts of these new shadows on the aquatic environment would not be significant. ✷