SHADOWS

CHAPTER 8

Within urban environments, the structures constituting a city's built fabric daily cast shadows in their immediate vicinity. As the city develops and redevelops, the extent and duration of the shadows cast are altered. As this process continues, direct sunlight exposure becomes an increasingly scarce resource for people and nature. This chapter focuses on the interaction between proposed new and altered structures and the shadows they may cast on open space, historic and cultural resources, and natural areas.

Sunlight and shadows affect people and their use of open space all day long and throughout the year, although the effects vary by season. Sunlight can entice outdoor activities, support vegetation, and enhance architectural features, such as stained-glass windows and carved detail on historic structures. Conversely, shadows can affect how open space is used, the growth cycle and sustainability of natural features, and the architectural significance of built features.

The purpose of this chapter is to assess whether new structures may cast shadows on sunlight-sensitive resources that include open space, historic and cultural resources, natural resources and Greenstreets, and to assess the significance of their impact. Potential mitigation strategies and alternatives are also presented and should be examined when significant adverse shadow impacts are identified. Because of the sunlight-sensitive nature of many open spaces, historic and cultural resources, and natural resources, this chapter is closely linked to the data and analyses from Chapter 7, "Open Space," Chapter 9, "Historic and Cultural Resources," and Chapter 11, "Natural Resources."

Many of the projects subject to CEQR do not warrant a detailed shadow analysis. Section 200 (below) describes the first tier of analysis to screen most projects for the purpose of assessing shadow impacts. As with each technical area assessed under CEQR, it is important for an applicant to work closely with the lead agency during the entire environmental review process. The lead agency may determine that it is appropriate to consult or coordinate with the City's expert technical agencies for a particular project. The New York City Department of City Planning (DCP) should be consulted for information, technical review, and recommendations relating to shadows assessments. With regard to assessment of shadows on open space, historic and cultural resources, and natural resources and potential mitigation, the New York City Department of Parks & Recreation (NYC Parks), the New York City Landmarks Preservation Commission (LPC), and the New York City Department of Environmental Protection (DEP) should also be consulted, respectively. It is recommended that these expert agencies be contacted as early as possible in the environmental review process. Section 700 (below) further outlines appropriate coordination with these expert agencies.

100. DEFINITIONS

The following terms are useful when considering the potential for impacts from Shadows.

SHADOW. A shadow is the condition that results when a building or other built structure blocks the sunlight that would otherwise directly reach a certain area, space, or feature.

INCREMENTAL SHADOW. An incremental shadow is the additional, or new, shadow that a building or other built structure resulting from a proposed project would cast on a sunlight-sensitive resource during the year.

SUNLIGHT-SENSITIVE RESOURCES OF CONCERN. Sunlight-sensitive resources of concern are those resources that depend on sunlight or for which direct sunlight is necessary to maintain the resource's usability or architectural integrity. The following are considered to be sunlight-sensitive resources:

PUBLIC OPEN SPACE. All public open space as identified in Chapter 7, "Open Space" (*e.g.*, parks, beaches, public outdoor pools, playgrounds, plazas, schoolyards, greenways, landscaped medians with seating).

ARCHITECTURAL RESOURCES. Those features of architectural resources identified in Chapter 9, "Historic and Cultural Resources," that depend on direct sunlight for their enjoyment by the public. Only the features that are sunlight-sensitive (described below) should be considered, as opposed to the entire architectural resource:

- Buildings containing design elements that are part of a recognized architectural style that depends on the contrast between light and dark design elements (*e.g.*, deep recesses or voids such as open galleries, arcades, recessed balconies, deep window reveals, and prominent rustication);
- Buildings distinguished by elaborate, highly carved ornamentation;
- Buildings with stained glass windows;
- Exterior materials and color that depend on direct sunlight for visual character (*e.g.*, multicolored features found on Victorian Gothic Revival or Art Deco facades);
- Historic landscapes, such as scenic landmarks including vegetation recognized as an historic feature of the landscape (*e.g.*, weeping beeches or pansy beds); or
- Features in structures where the effect of direct sunlight is described as playing a significant role in the structure's significance as an historic landmark. Examples include the William Lescaze House and Office, 211 E. 48 St. in Manhattan, significant as the first modern (1933) row house in New York, noted for its early use of glass block, glass bricks, and ribbon windows (LPC and S/NR listed), and LPC designated housing projects such as the Williamsburg Houses in Brooklyn and the Cherokee Apartments in Manhattan, both of which were planned to maximize light by use of site planning and architectural features, such as open stair towers and balconies.

NATURAL RESOURCES. Natural resources identified in Chapter 11, "Natural Resources," where the introduction of shadows may alter the resource's condition or microclimate including:

- Community Gardens – defined as community gardens that are City-owned and licensed through the NYC Parks GreenThumb program, or Non-City-owned community gardens that are owned by land trust organizations or other governmental entities and are currently registered with NYC Parks GreenThumb;
- Surface water bodies;
- Wetland resources;
- Upland resources; or
- Significant, sensitive, or designated resources, such as coastal fish and wildlife habitats.

OTHER RESOURCES.

- Greenstreets (planted areas within the unused portions of roadbeds that are part of the Green-streets program).

RESOURCES NOT SUBJECT TO SHADOWS ANALYSES. For the purposes of CEQR, the following are not considered to be sunlight-sensitive resources and their assessment for shadow impacts is not warranted

- City streets and sidewalks (except when improved as part of a Greenstreet);
- Buildings or structures other than those defined above;
- Private open space as defined in Chapter 7, "Open Space" (e.g., open spaces that are not publicly accessible such as front and back yards); or

- Project-generated open space. Shadows on project-generated open space are not considered significant under CEQR. However, when the condition of the project-generated open space is included as part of the qualitative open space analysis in Chapter 7, "Open Space," a discussion of how shadows would affect the new space may be warranted.

SHADOW IMPACT. In general, a significant adverse shadow impact occurs when the incremental shadow added by a proposed project falls on a Sunlight-Sensitive Resource of Concern (as defined above) and substantially reduces or completely eliminates direct sunlight exposure, thereby significantly altering the public's use and enjoyment of the resource or threatening the viability of vegetation or other resources. Each case must be considered on its own merits based on the results of the shadow assessment (Section 300) and the guidance provided in Section 400, "Assessment of Shadow Impacts."

200. DETERMINING WHETHER A SHADOW ASSESSMENT IS APPROPRIATE

The shadow assessment considers projects that result in new shadows long enough to reach a sunlight-sensitive resource. Therefore, a shadow assessment is appropriate only if the project would:

(a) result in with-action structures of 250 feet or more; or

(b) result in with-action structures of between 50 and 250 feet and be located adjacent to, within, or across the street from a sunlight-sensitive resource; and

(c) result in greater than 50 feet of incremental height change or substantial changes in bulk (i.e. a wider with-action building envelope than the no-action building).

Additions to existing structures, including rooftop mechanical equipment such as permanent HVAC equipment, bulkheads, spires, or other non-temporary structures, must be considered as part of the structure height.

Projects with less than 50 feet of incremental height difference or minimal changes to bulk likely do not require a shadows assessment as long as they are not adjacent to, within, or across the street from a sunlight sensitive resource. Where a project's incremental height increase is ten feet or less between the no-action and with-action scenario and it is located adjacent to, or across the street from, a sunlight-sensitive resource, the lead agency may determine, in consultation with partner agencies, whether a shadow assessment is appropriate.

300. SHADOW ASSESSMENT

The shadow assessment begins with a preliminary screening assessment (Section 310) to ascertain whether a project's shadow may reach any sunlight-sensitive resources at any time of the year. If the preliminary screening assessment does not eliminate this possibility, a detailed shadow analysis (Section 320) is performed in order to determine the extent and duration of the incremental shadow resulting from the project. The detailed shadow analysis provides the relevant information for the assessment of shadow impacts, which describes the effect of shadows on the sunlight-sensitive resources and their degree of significance. The results of the screening assessment and the detailed shadows analysis should be documented.

The effects of shadows on a sunlight-sensitive resource are site-specific; therefore, the preliminary screening assessment and subsequent detailed shadow analysis, if conducted, are performed for each of the sites where a new structure could be built as a result of a project (*e.g.*, for projected and potential development sites). The following discussion outlines the approach and framework of the shadow assessment. A hypothetical example is illustrated throughout this chapter to describe the analysis.

310. PRELIMINARY SCREENING ASSESSMENT

The information below describes how the preliminary shadows assessment should be conducted. While each level of assessment is described separately below, if preferred, the Tiers 1 and 2 screening assessments (described below in Sections 312 and 313) can be shown on the same map.

311. Base Map

The first step in conducting the screening assessment is to develop a base map that illustrates the proposed site location in relationship to the sunlight-sensitive resources. The base map includes the location of the proposed project, the street layout, and the locations of the sunlight-sensitive resources defined previously in Section 100. The base map should be drawn at a scale appropriate for the proposed project's size and the number and location of sunlight-sensitive resources. The map should be oriented with true north at the top of the map and display a true north arrow and a graphic scale bar. A base map for the example project is presented in Figure 8-1 (below).

The base map should also contain topographic information, either from a site survey or from a readily available source like the USGS topographic maps. Topography is critical to determining possible shadow impacts because the height of a structure is affected by the site elevation. To illustrate, a 100-foot structure at ±0 elevation is lower in height than an identical structure on a site with an elevation of +30 feet and, therefore, its shadow effect would be less in most cases.

FIGURE 8-1 - BASE MAP

Figure 8-1 shows an example of a base map with the location of a hypothetical building site and a number of sunlight-sensitive resources (labeled 1 through 6) in proximity to the site.

312. Tier 1 Screening Assessment

After the base map is developed, the longest shadow study area is determined. The longest shadow study area encompasses the site of the proposed project and a perimeter around the site's boundary with a radius equal to the longest possible shadow that could be cast by the proposed structure (see Section 314.8), which is 4.3 times the height of the structure's maximum feasible heights, including all rooftop mechanical equipment, parapets, and any other parts of the building, and occurs on December 21, the winter solstice. To find the longest shadow length, multiply the maximum height of the structure (again, including any rooftop bulkhead and

mechanical equipment) resulting from the proposed project by the factor of 4.3. That is, if the project would result in a building 100 feet high, its longest possible shadow would be approximately 430 feet. Figure 8-2 (below) shows the longest shadow study area for the example project.

FIGURE 8-2 – LONGEST SHADOW STUDY AREA FOR SINGLE SITE PROJECTS

The example in Figure 8-2 illustrates a hypothetical proposed project that would result in a building with a total height of 303 feet including mechanical space. The longest shadow study area for this site would be a perimeter around the site with a radius of 1,303 feet (4.3 x 303).

The results of the Tier 1 screening assessment for the example confirm that two of the six sunlight-sensitive resources in proximity to the proposed project site lie outside the longest shadow study area, and, therefore, shadow from the proposed building could not reach them. No further analysis would be necessary for the sunlight-sensitive resources labeled 5 and 6.

The remaining four sunlight-sensitive resources lay within the longest shadow study area, and therefore, the next tier of screening assessment should be conducted.

For projects involving more than one site, the longest shadow study area is the combination of each individual site's study areas. This is illustrated in Figure 8-3.

FIGURE 8-3 - LONGEST SHADOW STUDY AREA FOR MULTIPLE SITE PROJECTS

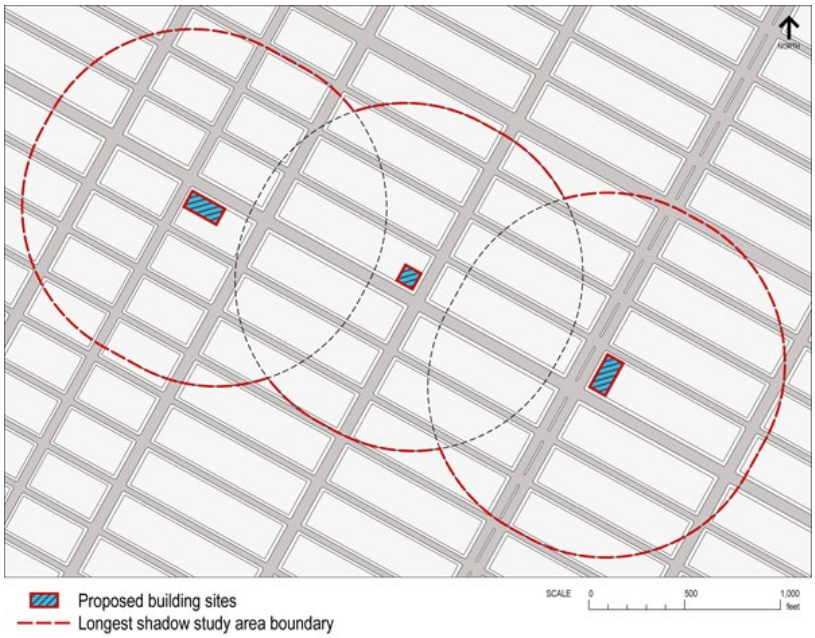


Figure 8-3 illustrates a hypothetical proposed project involving three building sites, each with a building that could rise up to 195 feet in total height, including all rooftop mechanical equipment, parapets, and any other parts of the building. The longest shadow study area for each site would be a perimeter around the site with a radius of approximately 839 feet (4.3 x 195). The combined perimeters would form the longest shadow study area.

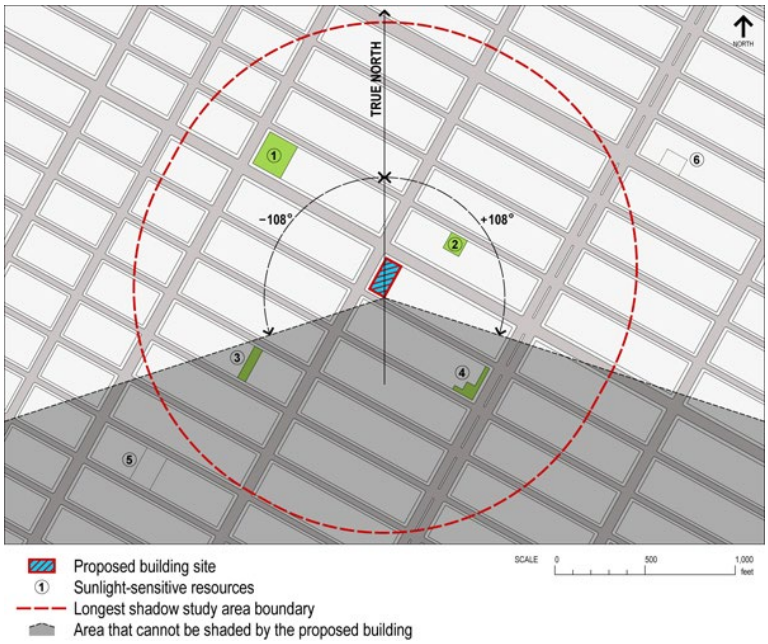
As shown in Figures 8-2 and 8-3, locate the site of the proposed project and plot its longest shadow study area. If any portion of a sunlight-sensitive resource lies within the longest shadow study area, a Tier 2 screening assessment should be performed. If none of the sunlight-sensitive resources lay within the longest shadow study area, no further assessment of shadows is warranted. Document the screening assessment with the illustrated base map.

313. Tier 2 Screening Assessment

If any portion of a sunlight-sensitive resource lies within the longest shadow study area, the following screening assessment should be performed.

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. Therefore, on the base map, locate the triangular area that cannot be shaded by the proposed project site starting from the southernmost portion of the site, covering the area between -108° degrees from true north and +108 degrees from true north, as illustrated in Figure 8-4 below for the example project. The complementing portion to the north within the longest shadow study area is the area that can be shaded by the proposed project.

FIGURE 8-4 - AREA THAT CANNOT BE SHADED BY THE PROPOSED PROJECT



The results of the Tier 2 screening assessment for the example confirm in Figure 8-4 that the sunlight-sensitive resources labeled 3 and 4 lie within the area that cannot be shaded by the proposed building, and therefore, no further analysis would be warranted for these two resources. The sunlight-sensitive resources labeled 1 and 2 lie within the area that could be shaded by the proposed building, and therefore, the next tier of screening assessment should be conducted.

It should be noted that if a sunlight-sensitive feature on an architectural resource is located on a facade that faces directly away from the proposed project site (*e.g.*, when an architectural resource is west of the proposed project site and the sun-sensitive feature is on the west facade of that structure), no further shadows assessment is warranted for that particular resource because no shadows from the proposed project could fall on that sunlight-sensitive face. For all other cases, continue the screening assessment.

If none of the sunlight-sensitive resources lay within the area that can be shaded by the proposed project, no further assessment of shadows is warranted. Provide the base map illustrating the screening assessment.

314. Tier 3 Screening Assessment

Based on the results of the Tier 2 screening assessment, a Tier 3 screening assessment should be performed if any portion of a sunlight-sensitive resource is within the area that could be shaded by the proposed project.

The Tier 3 screening assessment is used to determine whether shadows resulting from the proposed project can reach a sunlight-sensitive resource. Because the sun rises in the east and travels across the southern part of the sky in the northern hemisphere to set in the west, a project's earliest shadows would be cast almost directly westward. Throughout the day, the shadow would shift clockwise (moving northwest, then north, then northeast) until sunset, when the shadow would fall east. Therefore, a project's earliest shadow on a sunlight-sensitive resource would occur in a similar pattern, depending on the location of the resource in relation to the project site.

The screening assessment described here introduces the use of three-dimensional computer modeling software with the capacity to accurately calculate shadow patterns. This software is widely available and commonly used by architects. Some software platforms commonly used for these purposes include Google's Sketchup; Autodesk's AutoCAD and 3ds Max; AutoDesSys' FormZ and Bonzai3d; Bentley's MicroStation; and others (with some

platforms offering freeware versions). It should be noted that software is constantly upgraded and renamed, and new platforms are introduced. Therefore, consultation with the Environmental Assessment and Review Division of the Department of City Planning regarding current software is recommended. If access to this software is not available, the screening can be carried out manually through a graphic analysis without the need of a computer. The manual procedure is explained in the Appendix.

314.1. Use of three-dimensional computer modeling

The model should include (i) three-dimensional representations of the elements of the base map described above; (ii) a "reasonable worst case" three-dimensional representation of the proposed project as described below; and (iii) the three-dimensional representation of the topographic information within the area being analyzed. At this stage of the assessment, the surrounding buildings should not be included in the model so that it may be determined whether shadows from the proposed project would reach a sunlight-sensitive resource. The surrounding built context is included in the next tier of analysis.

In order for the computer software to accurately represent sunlight shadows, the three-dimensional model should be set up as follows:

- All the three-dimensional objects must be at the same scale.
- The direction of true north must be correctly set up.
- The geographic location data for New York City is entered as:

  New York City, City Hall.
  Latitude: 40°42'23" north (40.706389°)
  Longitude: 74°0'29" west (74.008056°)

- The selected time zone is Eastern Standard Time. Daylight Savings Time should not be used.

314.2. Determining the "worst-case scenario" for shadows

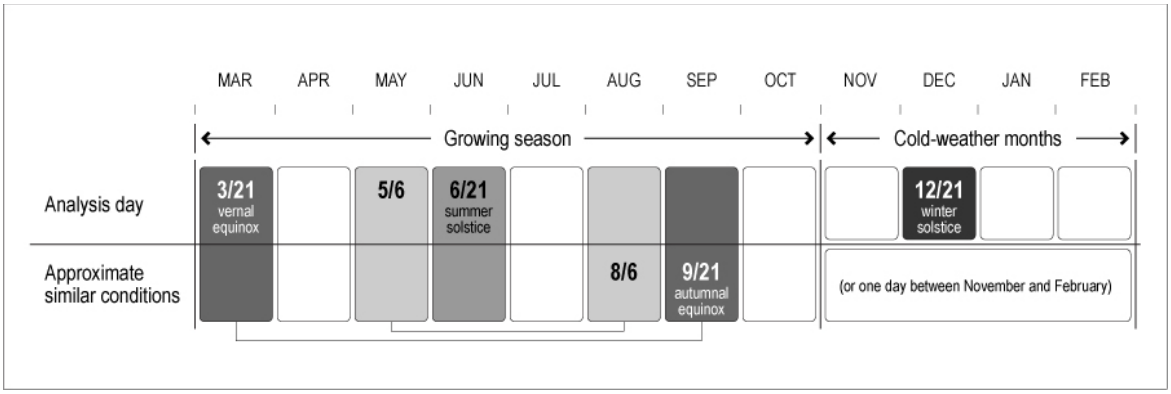
Three-dimensional models of the proposed project should depict a scenario that maximizes feasible development potential on the project site and is informed by recent development trends as well as current architectural, engineering, and construction practices. However, at the discretion of the lead agency, it may be determined that because of the degree of flexibility in the configuration of feasible development and proximity to sunlight-sensitive receptors, that maximum permitted envelopes be used for the three-dimensional models. The lead agency may consult with the Department of City Planning for technical guidance in determining the worst-case scenario for shadows analyses. If the proposed project includes special permits or similar actions that relate to the building envelope, the worst-case scenario should include such allowances or restrictions on the building form. The building envelope depicting the worst-case scenario for shadows should include the maximum feasible floor area, all rooftop mechanical equipment, parapets, and any other parts of the building. If the proposal contemplates a tower above a base, for example, then the position of the tower on the site would be critical for locating the shadow and the worst case should be illustrated. Generally, where the building is close, or adjacent, to an open space or architectural resource, a bulkier building would produce the worst-case shadows. Where the building is farther from the open space or resource, a taller tower would constitute the worst case. In the case of an expansion to an existing structure, only the effect of the proposed additional space would be considered.

314.3. Months of interest and representative days for analysis

The assessment determines whether shadows from the proposed project would fall on a sunlight-sensitive resource at any time throughout the year. Because the direction and length of shadows vary throughout the course of the day and the time of the year, the assessment of shadows is focused on representative times of the year relevant to the use and function of the identified sunlight-sensitive resources.

For the New York City area, the months of interest for an open space resource encompass the growing season (March through October) and one month between November and February (usually December) representing a cold-weather month (see Figure 8-5). Representative days for the growing season are generally the March 21 vernal equinox (or the September 21 autumnal equinox, which is approximately the same), the June 21 summer solstice, and a spring or summer day halfway between the summer solstice and equinoxes such as May 6 or August 6 (which are approximately the same). For the cold-weather months, the December 21 winter solstice is usually included to demonstrate conditions during cold-weather when people who do use open spaces rely most heavily on available sunlight for warmth. Project shadows that reach a sunlight-sensitive resource during any of these months could be of concern. These months and days are also used for assessing shadows on historic or natural sunlight-sensitive resources representing the full range of possible shadows.

FIGURE 8-5 - MONTHS OF INTEREST AND REPRESENTATIVE DAYS FOR ANALYSIS



For the representative growing season months, an analysis is not performed for those months where it is found that no shadow from the project would reach a sunlight-sensitive resource.

For the cold-weather months, if it is found that no shadow from the project would reach a sunlight-sensitive resource on the December 21 analysis day, then the assessment should be performed for a representative day in either November, January, or February in order to confirm that no shadow from the project would reach a sunlight-sensitive resource during any of these months.

314.4. Timeframe window of analysis

The shadow assessment considers those shadows occurring between 1.5 hours after sunrise and 1.5 hours before sunset. Shadows occurring earlier and later are long, move fast, and generally blend with shadows from existing structures. At times outside the timeframe window of analysis, the sun is located near the horizon, and the sun's rays reach the Earth at close to tangential angles, diminishing the amount of energy delivered by the sun's rays and producing shadows that grow in length exponentially until the sun reaches the horizon and sets. Because of these conditions, the shadows occurring between 1.5 hours before sunset and 1.5 hours after sunrise are not considered significant under CEQR, and their assessment is not warranted. For the assessment, standard, not daylight savings, time is used. Table A2 (Shadow Factors and Time of Day for Each Shadow Angle, June 21, May 6, March 21,

December 21) in the Appendix lists all times within the timeframe window of analysis for four representative days.

314.5. Conducting the shadow assessment

Once the three-dimensional computer model has been set up, shadow analyses should be performed for each of the representative days for analysis in the months of interest within the timeframe window of analysis, as described in Subsections 314.3 and 314.4, above.

A Tier 3 screening assessment for the example project (see Figures 8-1, 8-2 and 8-4), presented below in Figure 8-6 and Figures 8-6A to 8-6D, shows that, in the absence of intervening buildings, shadows from the proposed building would reach two sunlight-sensitive resources on three of the representative analysis days, and therefore, a detailed shadow analysis would be warranted for those three days. If this assessment determines that no shadows from the proposed project reach any of the sunlight-sensitive resources on any of the representative analysis days, no further assessment for those days would be warranted. Documentation to support this conclusion illustrating the screening assessment should be provided. Please note that Tier 3 screening assessment shadow diagrams should not be relied upon to make final impact determinations. If the Tier 3 Screening Assessment indicates a detailed assessment is warranted, a detailed shadow analysis (described below in Section 320) with accompanying detailed shadow diagrams should be relied upon when making impact determinations.

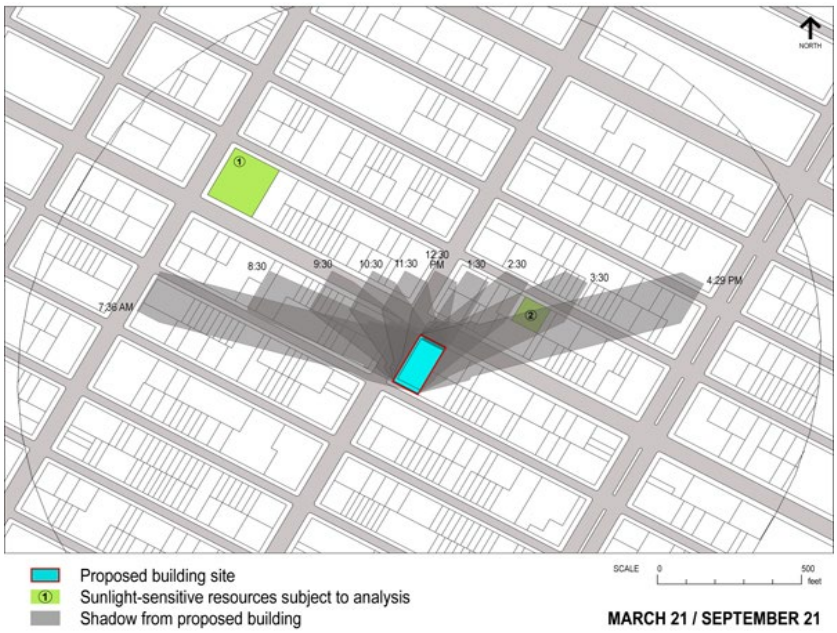
FIGURE 8-6 - THREE-DIMENSIONAL COMPUTER MODEL SET UP FOR TIER 3 SCREENING ASSESSMENT

Figures 8-6a, 8-6b, 8-6c and 8-6d illustrate the range of shadows that would occur from the proposed building in the example (303 feet tall) on four representative days for analysis. Each figure shows the shadows occurring approximately every 60 minutes from the start of the analysis day (1.5 hours after sunrise) until the end of the analysis day (1.5 hours before sunset).

FIGURE 8-6A - TIER 3 SCREENING ASSESSMENT FOR THE DECEMBER 21 ANALYSIS DAY

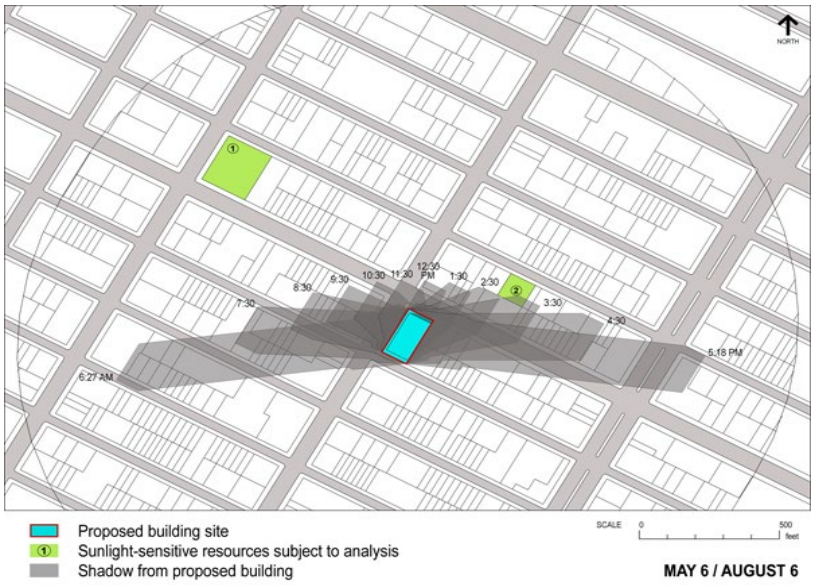
The results of the screening assessment for the December 21 analysis day show that shadows from the proposed building would be cast on the sunlight-sensitive resource labeled 1 from the start of the analysis day at 8:51 a.m. and would remain on the resource until sometime before 10:00 a.m. Shadows from the proposed building would not reach the sunlight-sensitive resource labeled 2 on the analysis day.

FIGURE 8-6B - TIER 3 SCREENING ASSESSMENT FOR THE MARCH 21/SEPTEMBER21 ANALYSIS DAY



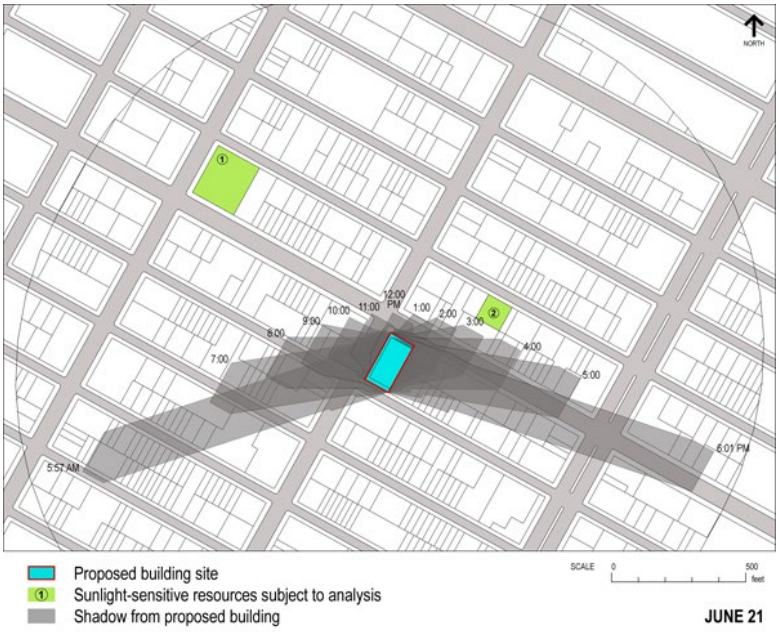
The results of the screening assessment for the March 21/September 21 analysis day show that shadows from the proposed building could reach the sunlight-sensitive resource labeled 2 sometime after 2:30 p.m. and would remain on the resource up to the end of the analysis day at 4:29 p.m. Shadows from the proposed building would not reach the sunlight-sensitive resource labeled 1 on the analysis day.

FIGURE 8-6C - TIER 3 SCREENING ASSESSMENT FOR THE MAY 6/AUGUST 6 ANALYSIS DAY



The results of the screening assessment for the May 6/August 6 analysis day show that shadows from the proposed building could reach a small portion of the sunlight-sensitive resource labeled 2 sometime between 2:30 p.m. and 4:30 p.m. Shadows from the proposed building would not reach the sunlight-sensitive resource labeled 1 on the analysis day.

FIGURE 8-6D - TIER 3 SCREENING ASSESSMENT FOR THE JUNE 21 ANALYSIS DAY



The results of the screening assessment for the June 21 analysis day show that no shadows from the proposed building could reach either of the sunlight-sensitive resources labeled 1 or 2 on the analysis day.

320. DETAILED SHADOW ANALYSIS

A detailed shadow analysis is warranted when the screening analyses described above do not rule out the possibility that project-generated shadows would reach any sunlight-sensitive resources. The detailed shadow analysis establishes a baseline condition (future No-Action) that is compared to the future condition resulting from the proposed project (future With-Action) to illustrate the shadows cast by existing or future buildings and distinguish the additional (incremental) shadow cast by the project. The baseline shadow condition and net incremental shadows from a proposed project, which are not included as part of the tiered shadow screening assessment described in Section 310 above, are necessary to make appropriate conclusions from the detailed shadows analysis regarding potential impacts from project-generated shadows. The purpose of the detailed analysis is to determine the extent and duration of new incremental shadows that fall on a sunlight-sensitive resource as a result of the proposed project. To evaluate the extent and duration of new shadow that would be cast on a sunlight-sensitive resource as a result of the proposed project, shadows that would exist in the future without the proposed project are also defined. Because existing buildings may already cast shadows on a sun-sensitive resource (or a future building could be expected to cast shadows), the proposed project may not result in additional, or incremental, shadows upon that resource (see Figure 8-7, below).

FIGURE 8-7 - EFFECTS OF EXISTING BUILDINGS

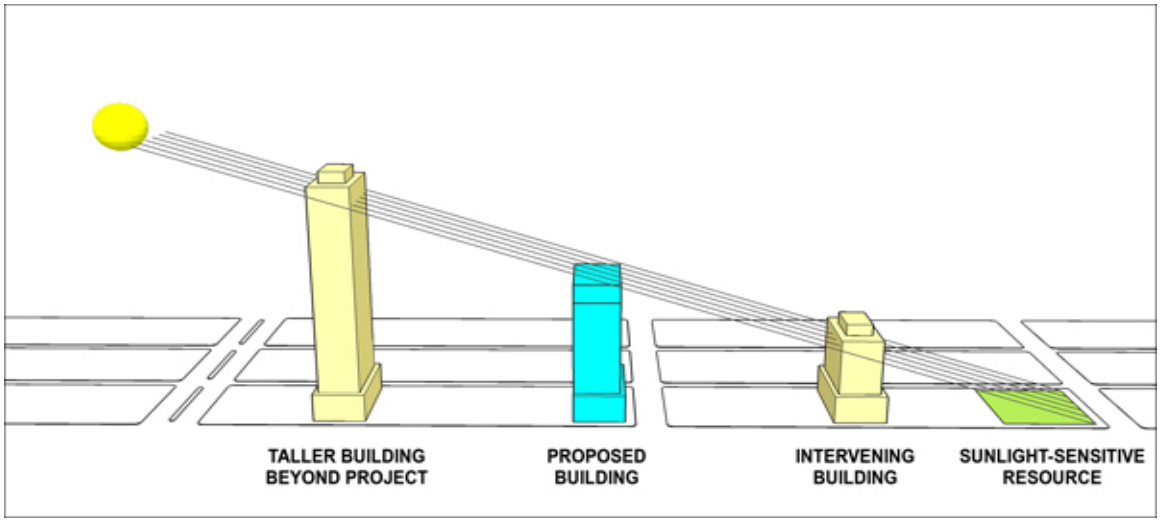


Figure 8-7 illustrates the effect of a taller existing building beyond the proposed project and a shorter existing building located between the proposed project and the sunlight-sensitive resource being analyzed. In this example, both the intervening building and the building beyond the project would cast shadows such that the proposed project does not result in incremental shadow.

321. Future No-Action conditions

The future No-Action conditions include existing buildings or structures plus any identified proposed or planned developments in the No-Action study area. This would include any planned new sunlight-sensitive resources as well.

322. Future With-Action conditions

The future With-Action conditions include the future No-Action conditions plus the new structures and open spaces (if any) created pursuant to the proposed project.

323. Use of three-dimensional computer modeling

In order to carry out the detailed shadow analysis, the three-dimensional computer model used for the previous screening assessment should be augmented by adding the existing and future buildings near the project site that could cast shadows on any of the sunlight-sensitive resources. The added buildings should be represented

as accurately as possible including their height, setbacks and any rooftop structures like water tanks or mechanical equipment. Figures 8-8 and 8-9 illustrate a three-dimensional computer model of future No-action and With-Action conditions for the example project, presented above. If no access to three-dimensional computer modeling software is available, the analysis may be carried out manually through a graphic analysis explained in Part B of the Appendix.

FIGURE 8-8 - THREE-DIMENSIONAL COMPUTER MODEL OF FUTURE NO-ACTION CONDITIONS

Figure 8-8 provides an example of shadows that would exist without the project under the future No-Action scenario.

FIGURE 8-9 - THREE-DIMENSIONAL COMPUTER MODEL OF FUTURE WITH-ACTION CONDITIONS

Figure 8-9 provides an example of the shadows produced by the proposed project in addition to those cast by existing structures, thus illustrating future With-Action conditions.

324. Performing the detailed analysis

Once the three-dimensional computer model has been set up, shadow analyses should be performed within the timeframe window of analysis only for each of the representative days in the months of interest, where the Tier 3 screening assessment could not rule out the possibility of shadows reaching a sunlight-sensitive resource.

The shadow attributable to the project is the increment beyond shadows that would be cast in the existing or future No-Action condition. The objective of the detailed analysis is to identify incremental shadows and document the time at which incremental shadows enter and exit the sunlight-sensitive resource in order to determine the total time that incremental shadows are cast on the resource.

325. Documenting the extent and duration of incremental shadows

The results of the detailed shadow analysis should be documented in graphic form and accompanied by a table summarizing the extent and duration of incremental shadows.

Graphic material documenting the conditions on each of the sunlight-sensitive resources at which an incremental shadow occurs should be submitted. The graphic material should include:

- The base map illustrating the proposed project site location in relation to the sunlight-sensitive resources. Graphic representations (examples provided in Figures 8-10 to 8-21 below) at an appropriate scale to illustrate incremental shadows on the resources in question during the representative analysis days and times that include:
  - Shadows resulting from the future No-Action conditions;
  - Shadows resulting from the future With-Action conditions; and
  - The incremental shadow on the sunlight-sensitive resource highlighted in a contrasting tone (*e.g.,* red) with its outline delineated.
  - Additionally, in the case of incremental shadows on sunlight-sensitive features of historic resources it may be useful to provide axonometric drawings documenting conditions on those features (such as windows) that cannot be assessed from a site plan.

The graphics should include a graphic scale bar and identify the direction of true north as well as the representative analysis day and time being illustrated.

The summary table should include the following information for each of the sunlight-sensitive resources on which an incremental shadow occurs:

- Name of the sunlight-sensitive resource;
- Representative analysis days;
- Timeframe window of analysis (1.5 hours after sunrise and 1.5 hours before sunset) for the day analyzed;
- Time of incremental shadow entering the sunlight-sensitive resource (enter time);
- Time of incremental shadow exiting the sunlight-sensitive resource (exit time);
- Total duration of incremental shadow in hours and minutes; and
- A note confirming that daylight savings time has not been used.

Table 8-1
Analysis Summary for Example Project

Analysis day	December 21	March 21/ September 21	May 6 / August 6	June 21
Timeframe window	8:51 a.m. - 2:53 p.m.	7:36 a.m. - 4:29 p.m.	6:27 a.m. - 5:18 p.m.	5:57 a.m. - 6:01 p.m.
①				
Shadow enter - exit times	8:51 a.m. - 9:41 a.m.	-	-	-
Incremental shadow duration	50 minutes	-	-	-
②				
Shadow enter - exit times	-	2:39 - 4:29 p.m.	3:17 p.m. - 3:48 p.m.	-
Incremental shadow duration	-	1 hour 50 minutes	31 minutes	-
Note: Daylight Savings Time not used.				

The results of the Tier 3 screening assessment for the example showed that on the June 21 analysis day no shadows from the proposed building could reach any of the sunlight-sensitive resources. The Tier 3 screening assessment showed that shadows from the proposed building could reach the sunlight-sensitive resources on the December 21, March 21, and May 6 analysis days. Accordingly, the detailed shadow analysis for the example focuses only on these months; its results are summarized in Table 8-1 above and illustrated in Figures 8-10 through 8-21 below.

FIGURE 8-10 - DECEMBER 21 - 8:51A.M.

On the December 21 analysis day, the shadow from the proposed building enters the sunlight-sensitive resource labeled 1 at 8:51 a.m. (the start of the analysis day, 1.5 hours after sunrise). Shadows from existing buildings cover large portions of the sunlight-sensitive resource, and only a small portion receives direct sunlight at this time.

FIGURE 8-11 - DECEMBER 21 - 9:08 A.M.

By 9:08 a.m., the extent of the incremental shadow on the sunlight-sensitive resource covers a larger area because the shadows from existing buildings have become shorter.

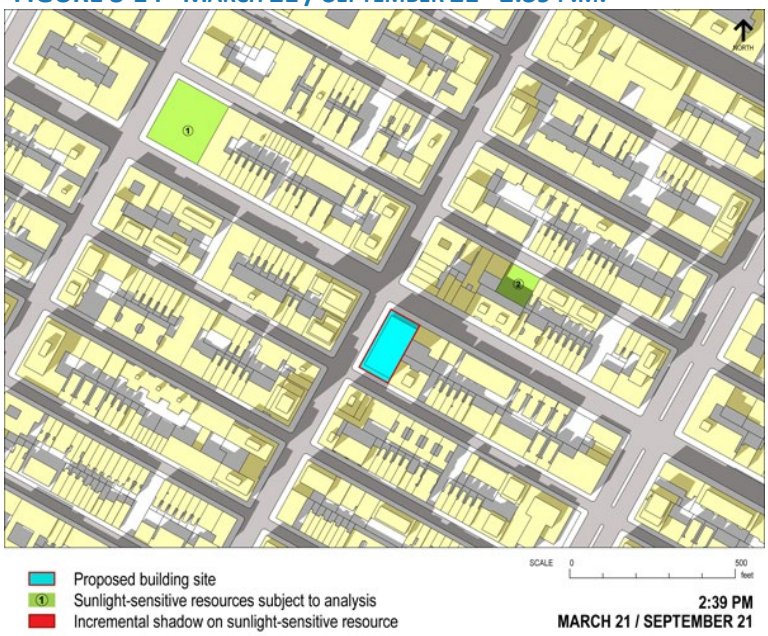
FIGURE 8-12 - DECEMBER 21 - 9:24 A.M.

By 9:24 a.m., as the sun travels towards the west and rises higher in the sky, the incremental shadow on the sunlight-sensitive resource has shifted to the northern portion of the resource.

FIGURE 8-13 - DECEMBER 21 - 9:41A.M.

By 9:41a.m., the shadow from the proposed building exits the sunlight-sensitive resource labeled 1. Shadows from the proposed building do not reach the sunlight-sensitive resource labeled 2 on this analysis day.

FIGURE 8-14 - MARCH 21 / SEPTEMBER 21 - 2:39 P.M.

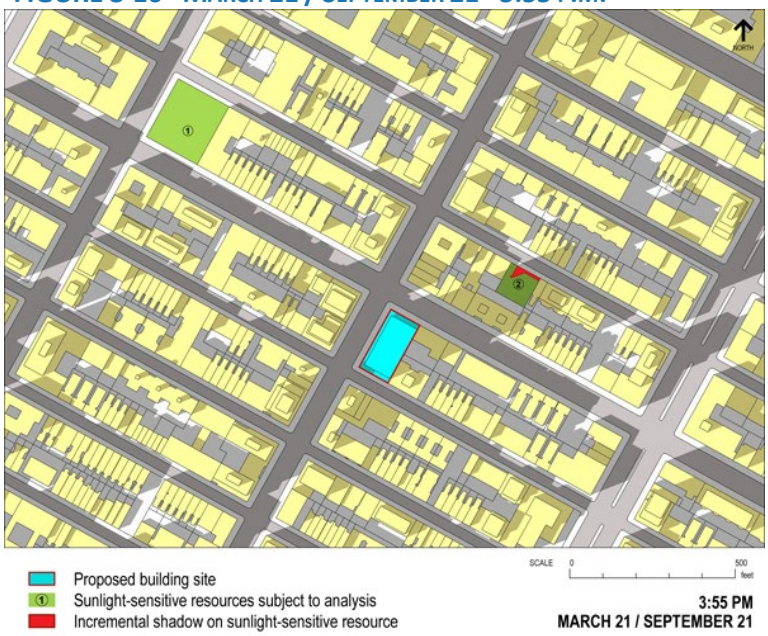


On the March 21/September 21 analysis day, the shadow from the proposed building enters the sunlight-sensitive resource labeled 2 at 2:39 p.m. Shadows from existing buildings cover the southern half portion of the resource at this time.

FIGURE 8-15 - MARCH 21 / SEPTEMBER 21 - 3:15 P.M.

By 3:15 p.m., the incremental shadow from the proposed building covers the northern portion of the sunlight-sensitive resource effectively eliminating all direct sunlight that the resource would otherwise receive in the absence of the proposed building.

FIGURE 8-16 - MARCH 21 / SEPTEMBER 21 - 3:55 P.M.



By 3:55 p.m., the extent of the incremental shadow from the proposed building has become smaller but continues to eliminate all direct sunlight that the resource would otherwise receive in the absence of the proposed building.

FIGURE 8-17 - MARCH 21 / SEPTEMBER 21 - 4:29 P.M.

By the end of the analysis day, at 4:29 p.m. (1.5 hours before sunset), the shadow from the proposed building exits the sunlight-sensitive resource. Shadows from existing buildings cover the majority of the resource at this time. Shadows from the proposed building do not reach the sunlight-sensitive resource labeled 1 on this analysis day.

FIGURE 8-18 - MAY 6 / AUGUST 6 - 3:17 P.M.

On the May 6/August 6 analysis day, the shadow from the proposed building enters the sunlight-sensitive resource labeled 2 at 3:17 p.m. Shadows from existing buildings cover a sliver of the resource at this time and the incremental shadow from the proposed building is virtually imperceptible.

FIGURE 8-19 - MAY 6 / AUGUST 6 - 3:27 P.M.

By 3:27 p.m., the incremental shadow from the proposed building covers a small sliver of the sunlight-sensitive resource.

FIGURE 8-20 - MAY 6 / AUGUST 6 - 3:38 P.M.

By 3:38 p.m., the extent of the incremental shadow from the proposed building has become smaller and shifted towards the east.

FIGURE 8-21 - MAY 6 / AUGUST 6 - 3:48 P.M.

By 3:48 p.m., the shadow from the proposed building exits the sunlight-sensitive resource labeled 2. Shadows from the proposed building do not reach the sunlight-sensitive resource labeled 1 on this analysis day.

The graphic material shown in Figures 8-10 to 8-21 depicts shadow conditions during instants in time. Because shadows are in constant movement, there may be cases when the graphic material is not sufficient to clearly illustrate how incremental shadows occur on a sunlight-sensitive resource. In order to assess conditions at several times or throughout a certain period, the assessment of shadows for certain complex projects may benefit

from assembling a computer animation showing how shadows occur throughout a certain period of time (Subsection 314 includes a list of different software platforms with this capacity). The use of such computer animation might be requested by the lead agency responsible for reviewing the shadow analysis. For guidance on appropriate software to use, the lead agency should consult with DCP.

FIGURE 8-22 - ANIMATION OF SHADOW SWEEP OVER A PERIOD OF TIME (PLEASE CLICK HERE FOR ANIMATION)

400. DETERMINING IMPACT SIGNIFICANCE

The determination of significance of shadow impacts on a sunlight-sensitive resource is based on (i) the information resulting from the detailed shadow analysis describing the extent and duration of incremental shadows and (ii) an analysis of the resource's sensitivity to reduced sunlight. The goal of the 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.

410. OPEN SPACE AND NATURAL RESOURCES

The uses and features of open space or a natural resource indicate its sensitivity to shadows. Shadows occurring during the cold-weather months of interest generally do not affect the growing season of outdoor vegetation; however, shadow effects on other uses and activities should be assessed. Therefore, shadow sensitivity is typically assessed for both (i) warm-weather-dependent features like pools, wading pools and sand boxes, or vegetation that could be affected by a loss of sunlight during the growing season; and (ii) features, such as benches, that could be affected by a loss of winter sunlight. While in most cases it can be assumed that vegetation would not be affected by shadows during the cold-weather months, there may be instances where it is recommended that the assessment take into consideration the presence of vegetation that may be affected by shadows cast even during the colder months of the year. For example, if an area potentially affected by shadows has evergreen trees present, it may be warranted to assess the potential for shadow impacts during all seasons as evergreen trees photosynthesize when the environment allows, including during the winter months.

Uses that rely on sunlight include passive uses, such as sitting or sunning, and active uses, such as activities on playfields or paved courts, gardening, pools, or playing in children's wading pools and sprinklers. Vegetation requiring direct sunlight includes tree canopies, flowering plants, and plots–particularly plots for food production–in

Community Gardens. Where lawns are actively used, the turf may require extensive direct sunlight. Consequently, the assessment of an open space's sensitivity to increased shadows focuses on identifying the existing conditions of its facilities, plantings, and uses, and the sunlight requirements for each.

When reviewing the potential for impacts to vegetation and plantings present in sunlight-sensitive resources of concern, the assessment should determine the amount of sunlight that will be available in the Future With-Action condition. The amount of sunlight typically considered to be the minimum that plantings and vegetation would need is six to eight hours of direct sunlight. Examples of such areas include grass lawns, planted annuals or areas used for a relatively substantial amount of food production (e.g., a garden primarily growing fruit and vegetables). However, the assessment can take into account that some plantings and vegetation can tolerate partial sun, with a reduced minimum requirement of four to six hours of direct sunlight. Examples of areas that can tolerate partial sun are established tree canopies, shrubs or perennials. Direct sunlight does not need to be continuous–a portion of the direct sun could be in the morning and the balance in the afternoon–but the periods of sunlight do need to be full and unobscured. Reviewing Figure 8-23 below, an example of a site plan of a sunlight-sensitive resource of concern, the Central lawn is an area that should receive a minimum of six to eight hours of full, direct sun. In contrast, the mature trees, shrubs and other plantings shown on Figure 8-23 in the area surrounding the Central lawn likely could tolerate partial sun, or four to six hours of direct sunlight a day. Further guidance on how to assess the potential for impacts from project-generated shadows on plantings and vegetation in a sunlight-sensitive resource of concern is provided in Section 411 below.

When determining impact significance, it is important to consider the context of the study area and the characteristics of the resources present. The minimum sunlight requirements described above are for sunlight-sensitive open space resources, such as parks, playgrounds and gardens typically found in neighborhoods throughout the City. It may be possible that a study area includes a unique sunlight-sensitive resource, for example a resource such as a botanical garden or an urban farm, which cultivates a diverse collection of species, perhaps representing different climates, for the purpose of public display, education, propagation, food production, and/or research. Under such a discrete circumstance, a more thorough and detailed assessment, specific to the sunlight needs of varied species present, may be warranted by the proposed action.

For open space resources within the jurisdiction of NYC Parks, including GreenThumb gardens under the jurisdiction of NYC Parks, or gardens that are owned by other governmental entities or land trust organizations and are registered with the GreenThumb program, NYC Parks can be consulted in order to verify existing sun-sensitive areas and obtain information on current recreational and passive activities in sunlit areas of the park, as well as planned capital projects that may result in a change to existing sunlight-sensitive features.

Although shadows on project-generated open space are not considered significant under CEQR, the assessment of shadows on project-generated open space should be conducted and documented with the same level of detail as other sunlight-sensitive open space resources when such project-generated open space is included qualitatively as part of a detailed analysis as described in Chapter 7, “Open Space.”

411. Assessment

A site plan and inventory of the features that constitute the open space or natural resource as well as an inventory detailing existing conditions, quality, and levels of use of the open space are needed to determine the significance of the shadow cast in the future With-Action. The majority of this information may be already available through the analysis in Chapter 7, “Open Space,” and Chapter 11, “Natural Resources,” respectively, and should be used as part of the assessment.

The site plan should show the boundary and layout of the open space or natural resource, the location of sunlight-sensitive features, such as vegetation, benches, pools, and sprinklers and sitting areas, its built structures, and other features of the open space, including paved areas. The site plan should identify the direction of true north, include a graphic scale bar, and may be complemented by photographs of the open space features. If a site plan for the project site is not available, an aerial image of the project site may be used that outlines and

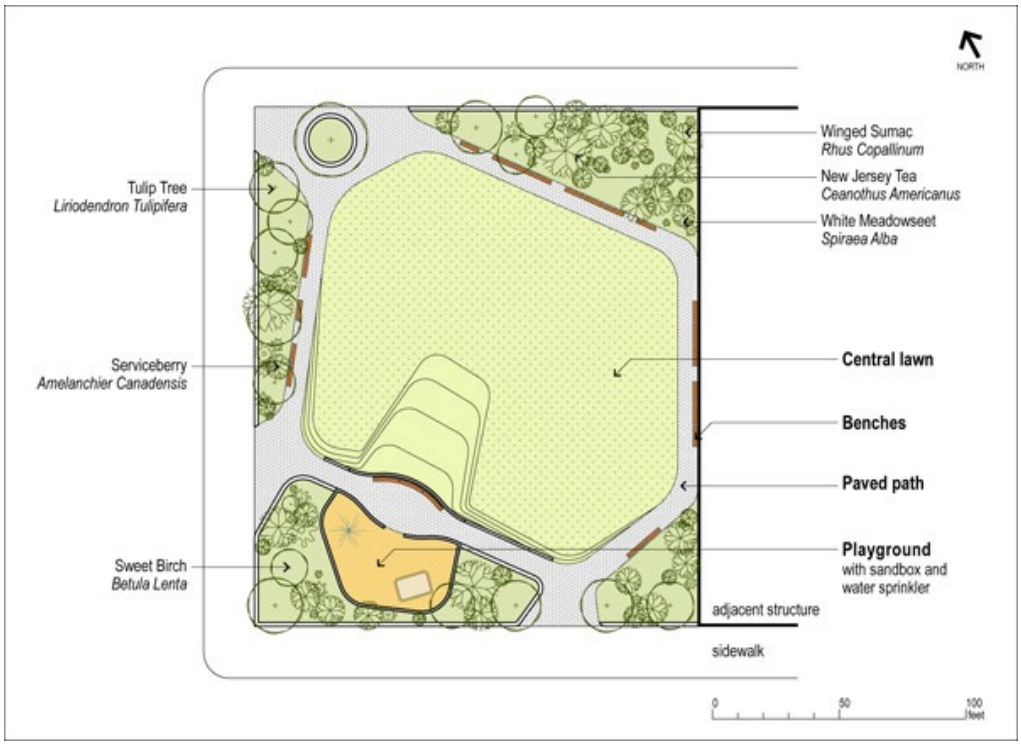
identifies all the features (as described above) of the open space or natural resource. Figure 8-23 below provides an example of an open space site plan.

To carry out the assessment, the composite shadows obtained from the detailed shadows analysis are overlaid on the open space site plan in order to determine the areas and sunlight-sensitive features of the open space that would be cast in the project's incremental shadow. The assessment is performed for all the months of interest when incremental shadows are predicted to be cast on the open space or natural resource.

Under certain circumstances, for example if a natural area is a sunlight-sensitive area of concern or if it is uncertain, it may be useful to inventory vegetation, noting species, caliper, height, and age. Such inventory may be presented in the site plan, and it may be advisable to use the services of a recreation planner, landscape architect, or horticulturist to inventory, survey, and assess the sensitivity of the open space to shadows. Care should be taken when reviewing potential shadow impacts on Community Gardens to understand what is planted at the site (at the time of the analysis). While some Community Gardens focus on vegetation grown for landscaping or ornamental purposes, other Community Gardens also grow food crops in raised beds for consumption. When sunlight-sensitive resources are under the jurisdiction of NYC Parks, for example GreenThumb Community Gardens, it may be appropriate, depending on the abundance and variety of species present, to consult with NYC Parks to help determine the relative shade tolerance of existing plantings and vegetation. Other relevant agencies should also be consulted if the open space under review is under state or federal jurisdiction.

If the open space or natural resource supports activities that rely on sunlight and would be cast in project shadow, it is also appropriate to survey its use. This should be done on a sunny day in the spring, summer, or fall, preferably on the weekend or at the time of peak use. Based on this work, the activities, plants, or other facilities in the open space that need sunlight and may be affected by project shadows should be identified and may be noted in the site plan and documented in the analyses or assessment. To the extent possible, the acceptable and minimum amounts of daily sunlight required for the plants or activities should be reviewed as part of the assessment.

FIGURE 8-23 – ILLUSTRATED SITE PLAN FOR THE SUNLIGHT-SENSITIVE RESOURCE LABELED 1



412. Estimating the Relative Loss of Sunlight from Incremental Shadows

Where the incremental shadows from the project fall on sunlight-sensitive features or uses, additional analysis is conducted to assess the loss of sunlight relative to sunlight that would be available without the project. It is appropriate to estimate shadow patterns on the affected area of the open space or resource throughout the day in order to assess how shadows, both incremental shadows from the project and shadows cast by existing structures, affect the sensitive features. It should also be assessed whether these sensitive features are already subject to substandard sunlight conditions in the absence of additional incremental shadows from the project. The assessment should consider all shadows on the portion of the sunlight-sensitive features or uses affected by the project's incremental shadow throughout the day. The analysis should be undertaken for each of the months of interest where the effects of incremental shadows from the project could be significant.

It should be noted that the shade created by trees and other natural features is not considered to be shadow of concern for the impact analysis; however, incremental shadow on a tree-shaded environment may create a significant impact as the incremental shadow is not redundant with tree shade, and the tree canopy may be considered a sunlight-sensitive resource.

Consideration of the inventory of available open space resources within the Open Space study area outlined in Chapter 7, "Open Space," may be helpful in assessing the significance of the loss of sunlight for active or passive recreational uses. For example, if many of the parks in the study area already have shadows on similar sun sensitive features, the additional loss of sunlight in parks may be more critical.

Some open spaces contain facilities that are not sensitive to sunlight. These are usually paved; do not contain sitting areas, vegetation, or unusual or historic plantings that necessitate sunlight; and do not accommodate active uses. Incremental shadows on these portions of an open space resource should be documented and disclosed but are not generally considered significant under CEQR.

The significance of shadows cast on an open space should be closely examined in relation to the open space's utilization rates, as discussed in Chapter 7, "Open Space," in order to determine the potential for the shadows

to affect the times of day the space is commonly used. This is particularly important when shadows are cast on open spaces that fall within an area without similar sunlit resources. Estimating the loss of sunlight on paved or hardscape open spaces that accommodate active uses–such as basketball and tennis courts–may be determined based on how the active area is used by the community and the utilization rate of such spaces as described and assessed in Chapter 7, "Open Space." While this loss of sunlight is generally not considered significant, the lead agency should consider how the area is used by the community and the utilization rate of such spaces as described and assessed in Chapter 7, "Open Space," in order to determine the significance of the incremental shadow.

420. HISTORIC RESOURCES

The shadow sensitivity of the sunlight-sensitive features of an historic structure depends on its design and setting. If any of the characteristics or elements that make the resource historically significant depend on sunlight, it is appropriate to inventory those features to determine their sensitivity to a reduction in sunlight. The assessment should consider the specific context in which the incremental shadow occurs and provide an analysis of how other shadows from existing structures affect the sunlight-sensitive features of the historic resource throughout the day.

Additional guidance regarding the identification of sunlight-sensitive features and assessment of stained glass windows can be found in the National Park Service (NPS) Preservation Brief 17, "Architectural Character: Identifying the Visual Aspects of Historic Buildings as an Aid to Preserving Their Character," and NPS Preservation Brief 33: "The Preservation and Repair of Historic Stained and Leaded Glass."

421. Assessment

The assessment of shadows on an historic resource focuses only on those features or portions of the historic resource that are sunlight-sensitive and can be enjoyed by the public. Only the incremental shadow duration on the sunlight-sensitive features of the historic resource is of concern under CEQR. The assessment of shadows on an historic resource requires a site plan and inventory of the sunlight-sensitive features. The inventory discusses the historic significance of the affected features and how the features are enjoyed by the public, including views from streets and other publicly accessible places. The sunlight-sensitive features should be described in detail and illustrated as appropriate with drawings and/or photographs, including axonometric drawings when the affected features cannot be assessed on a site plan. The majority of this information may be already available in Chapter 9, "Historic and Cultural Resources," and should be used as part of the assessment.

The inventory of sunlight-sensitive features may also be determined by checking the LPC designation report for LPC designated properties, scenic landmarks, and (publicly accessible) interiors, or the State/National Register nomination form for State/National Register listed properties. The State/National Register listings comprise the entirety of the building and/or structure and do not distinguish between publicly and privately accessible interiors. Building interiors that are State/National Register listed or eligible, or LPC designated, are included in the types of resources that may receive potential shadow impacts. All other interiors are not considered under this type of analysis. Consult with the staff of the LPC to confirm presence or absence of sunlight-sensitive features on LPC and S/NR eligible properties.

430. DETERMINING IMPACT SIGNIFICANCE

The scenarios illustrated below provide general guidelines for determining impact significance and supplement the considerations described in Sections 410 and 420. As with every technical area, each project must be considered on its own merits, taking into account its unique circumstances. For instance, the precise location of the incremental shadow within the sunlight-sensitive resource (or the presence of well-lit resources in close proximity to the affected resource) may be highly relevant because the incremental shadow may affect specific features that are key to the character, use, survival, or enjoyment of the sunlight-sensitive resource. For the purposes of CEQR, the determination of impact significance in ambiguous cases should be done in a conservative manner. In all cases, the

rationale for the determination of impact significance should be clearly presented in the resulting environmental review document.

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

VEGETATION

- A substantial reduction in sunlight duration available to a sunlight-sensitive feature of the resource to less than the time of its minimum sunlight needs, as determined in Section 410 above (when there was sufficient sunlight in the future without the project).
- A reduction in direct sunlight exposure where the sensitive feature of the resource is already subject to substandard sunlight (i.e., less than the minimum sunlight needs, as determined in Section 410 above).

HISTORIC AND CULTURAL RESOURCES

- A substantial reduction in sunlight available for the enjoyment or appreciation of the sunlight-sensitive features of an historic or cultural resource.

OPEN SPACE UTILIZATION

- A substantial reduction in the usability of open space as a result of increased shadows (cross reference with information provided in Chapter 7, "Open Space," regarding 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.

In determining impact significance, it is appropriate to consult with the government agency under which jurisdiction of the affected sunlight-sensitive resource falls, including NYC Parks, LPC, or other agencies, as warranted. Below is a non-exclusive list of examples of significant impacts caused by incremental shadows.

EXAMPLES

A chapel attached to a 19th century cathedral that is designated as a New York City Landmark, listed in the State and National Register of Historic Places, and a designated National Historic Landmark would receive incremental shadows on some of its stained-glass windows from a proposed building. The review finds that the interiors of such religious structures are important to their character and that the qualities that the stained-glass windows impart to the interior are a major part of the overall architectural intent in this church and part of the Gothic Revival style. After assessing the extent and duration of the incremental shadow, it is determined that the darkening would occur for a substantial part of the day on the stained-glass windows and would constitute a significant impact. In addition, the impact would occur regardless of whether the cathedral holds services when the incremental shadow is cast.

A 19th century scenic landmark that is designated as a New York City Landmark, listed in the State and National Register of Historic Places, and a designated National Historic Landmark would receive incremental shadow from a proposed building. After taking into account the time of the year, shadow duration during the day, and the number of days a years of the incremental shadow, the review finds (i) that the park is sensitive to the incremental shadow because it detracts from the experience of a seemingly naturalistic environment that was part of the design intent of the park; (ii) that the addition of incremental shadow would endanger the rare and exotic plant species that were part of its original horticultural design; and (iii) that the incremental shadows could therefore constitute a significant impact.

A 20th century office building that is designated a New York City Landmark that also has a publicly accessible interior garden atrium that is designated as a New York City interior landmark would receive incremental shadow from a proposed structure. The full height atrium is considered an outstanding and unique example of an "urban greenhouse." After taking into account the extent and duration of the incremental shadow, the review finds that the incremental shadow that would be cast on the atrium would detract from the public's appreciation and enjoyment of the space and could therefore result in a significant shadow impact.

DETERMINING IMPACT SIGNIFICANCE FOR THE EXAMPLE

The results of the example's detailed shadow analysis document the extent and duration of the incremental shadows that the proposed project would cast on two sunlight-sensitive resources, summarized in Table 8-1 and illustrated in Figures 8-10 through 8-21.

SUNLIGHT-SENSITIVE RESOURCE EXAMPLE 1:

Incremental shadows from the proposed building would reach the sunlight-sensitive resource labeled 1 only on the December 21 analysis day. No incremental shadows from the proposed building would reach the resource on other analysis days.

On the December 21 analysis day, incremental shadows from the proposed building would enter the sunlight-sensitive resource at 8:51 a.m. (the start of the analysis day) and would exit the resource at 9:41 a.m., remaining in the resource for a total of 50 minutes.

At the start of the analysis day at 8:51 a.m. (Figure 8-10) the resource is almost covered in shadows from both the proposed building and from existing buildings. By 9:08 a.m. (Figure 8-11), both shadows have shifted north allowing sunlight to reach the southwest corner of the resource where the playground is located (see site plan in Figure 8-22). By 9:24 (Figure 8-12), both shadows have shifted further north and to the east allowing sunlight to reach approximately half of the resource, including a large portion of the central lawn area. By 9:41 a.m. (Figure 8-13), the incremental shadow exits the resource and, although the existing building to the east casts some shadow on it, sunlight reaches the majority of the resource.

In conclusion, the overall duration of the incremental shadows cast on the sunlight-sensitive resource would be short and occur during a small portion of the day. Upon examination of the site plan in Figure 8-23, the incremental shadows would not affect areas of the resource with sensitive uses such as the playground, nor would affect the vegetation as December is typically not part of the growing season (although the specific sunlight needs of species present at the site should be verified). Therefore, the proposed building would not result in a significant shadow impact on the sunlight-sensitive resource labeled 1.

SUNLIGHT-SENSITIVE RESOURCE EXAMPLE 2:

Incremental shadows from the proposed building would reach the sunlight-sensitive resource labeled 2 only on the March 21/September 21 and May 6/August 6 analysis days (see Figures 8-16 through 8-20). No incremental shadows from the proposed building would reach the resource on other analysis days.

Even though a site plan for this resource is not available, it is known that the resource contains non-shade-tolerant vegetation and sunlight-sensitive uses such as benches.

On the May 6/August 6 analysis day, incremental shadows from the proposed building would enter the sunlight-sensitive resource at 3:17 p.m. and would exit the resource at 3:48 p.m., remaining in the resource for a total of 31 minutes. As discussed, and illustrated in Figures 8-18 to 8-21, the incremental shadow from the proposed building would cover only a small portion of the resource and the majority of the resource would continue to receive direct sunlight during this period of

time. Given the marginal extent and relatively short duration of the incremental shadow on this analysis day, the incremental shadow is not considered significant.

On the March 21/September 21 analysis day, incremental shadows from the proposed building would enter the sunlight-sensitive resource at 2:39 p.m. and would exit the resource at 4:29 p.m., remaining in the resource for a total of 1 hour and 50 minutes.

As discussed, and illustrated in Figures 8-14 to 8-17, the incremental shadow from the proposed building would substantially reduce and eventually eliminate the sunlight that would reach the resource during a relatively long period of time. The shadow would affect the resource's vegetation as March is part of the growing season and would affect sunlight-sensitive uses in the resource. Therefore, the proposed building would result in a significant shadow impact on the sunlight-sensitive resource labeled 2.

500. MITIGATION

Where a significant impact is identified, potential mitigation strategies must be assessed to reduce or eliminate, to the greatest extent practicable, the effects caused by incremental shadows.

In all cases, additional mitigation strategies that involve modifications to the height, shape, size, or orientation of the proposed building may be explored and include:

- The reorientation of building bulk to avoid incremental shadow on sunlight-sensitive features of the open space, natural or historic resource.
- The reduction of the overall height of the project.
- The use of alternative technologies that may reduce the height of the project and reduce shadow impacts (*e.g.*, the use of dry cooling towers vs. wet cooling towers).
- The relocation of the project to a different site, when appropriate.

For open space resources, the types of mitigation that may be appropriate include relocating sunlight-sensitive features within an open space to avoid sunlight loss; relocating, replacing or monitoring vegetation for a set period of time; undertaking additional maintenance to reduce the likelihood of species loss; or providing for replacement facilities on another nearby site. Other potential mitigation strategies include the redesign or reorientation of the open space site plan to provide for replacement facilities, vegetation, or other features. Where the affected open space is a city park, it is appropriate for the lead agency to coordinate mitigation options with NYC Parks. The lead agency may also wish to coordinate with NYC Parks as an expert agency on open spaces that are not city parks.

For historic resources, potential mitigation strategies include the use of artificial lighting to simulate the effect of sunlight on features such as stained-glass windows. Where the affected historic resource is a New York City landmark, an LPC-calendared or eligible property, or a National Register listed or eligible structure or property, it is appropriate for the lead agency to coordinate mitigation options with LPC. The lead agency may also wish to coordinate with LPC as an expert agency on historic resources that are not NYC landmarks.

Potential mitigation strategies to reduce or eliminate a significant shadow impact on natural resources may be coordinated with the Department of Environmental Protection (DEP).

These mitigation strategies can become alternatives to be analyzed in accordance with the project's goals and objectives.

600. ALTERNATIVES

Where a significant shadow impact is identified, potential alternatives to reduce or eliminate significant impacts should be explored, including:

- The reorientation of building bulk to avoid incremental shadow on sunlight-sensitive features of the open space, natural, or historic resource.
- The reduction of the overall height of the project.
- The use of alternative technologies where substituting one technology for another may reduce the height of the project and reduce shadow impacts (*e.g.*, the use of dry cooling towers vs. wet cooling towers).
- The relocation of the project to a different site, when appropriate.

700. REGULATIONS AND COORDINATION

710. REGULATIONS AND STANDARDS

There are no specific city, state, or federal statutory regulations or standards governing the analysis and assessment of shadows.

720. APPLICABLE COORDINATION

Coordination with DCP is appropriate when it is an involved agency and the project includes an action subject to approval by the City Planning Commission. The lead agency should coordinate with those agencies that identify, operate, or have jurisdiction over the sunlight-sensitive resources identified in this chapter. The assessment of shadow impacts on a sunlight-sensitive resource and the development of mitigation strategies should be coordinated with the appropriate agency with jurisdiction over the resource. Mitigation would typically require the approval or commitment of such agency. Agencies typically consulted include the Department of Parks & Recreation for sunlight-sensitive open space resources, the Landmarks Preservation Commission for historic and cultural sunlight-sensitive resources, and the Department of Environmental Protection for sunlight-sensitive natural resources.

730. LOCATION OF INFORMATION

- The Department of City Planning maintains copies of the Sanborn maps, Fire Insurance Underwriters maps, and tax maps for the entire city. These sources are also available online (except Sanborn maps) and in local public libraries. City Maps are available for viewing in the Borough President's office in each borough and at the Department of City Planning. Additionally, the Department of City Planning provides a zoning and land use map (ZoLa) of New York City available online. This map provides helpful zoning and land use information such as zoning districts, historic districts and landmarks, and parkland.

  DCP data, including: LION Single Line Street Base Map; MapPLUTO; and Privately Owned Public Spaces (POPS) are available on datasets found online at the DCP website. CEQR Data Hub Datasets is a repository of data publicly available for CEQR review purposes.

  New York City Department of City Planning
  120 Broadway, 31st Floor
  New York, NY 10271
  www.nyc.gov/planning

- The Department of Parks & Recreation maintains a database of the City's public open spaces available online. For additional information, see Section 730 (Location of Information) of Chapter 7, "Open Space," for a

detailed list of informational resources regarding open space. Data on NYC Parks resources are also available on the NYC Open Data platform: NYC Open Data.

New York City Department of Parks & Recreation
The Arsenal
830 Fifth Avenue
New York, NY 10065
www.nyc.gov/parks

- The Landmarks Preservation Commission maintains a database of the City's historic and cultural landmarks with a variety of information available online including historic district maps and designation reports.

  New York City Landmarks Preservation Commission
  253 Broadway
  11th Floor
  New York, NY 10007
  www.nyc.gov/landmarks

- New York City Department of Environmental Protection

  59-17 Junction Boulevard, 13th Floor
  Flushing, NY 11373
  www.nyc.gov/dep