Chapter 2: Shadows

2.0 Introduction

A shadow is defined in the *2014 CEQR Technical Manual* as the circumstance in which a building or other built structure blocks the sun from the land. An adverse shadow impact is considered to occur when the incremental shadow from a proposed action falls on a sunlight sensitive resource and substantially reduces or completely eliminates direct sunlight exposure, thereby significantly altering the public's use of the resource or threatening the viability of vegetation or other resources. Sunlight-sensitive resources include publicly accessible open spaces, historic architectural resources that contain features that depend on direct sunlight for their enjoyment by the public, and Greenstreets. In general, shadows on city streets and sidewalks or on other buildings are not considered significant under CEQR. In addition, shadows occurring within an hour and a half before sunrise or after sunset generally are also not considered significant under CEQR.

2.1 Methodology

According to the *2014 CEQR Technical Manual*, the longest shadow a structure will cast in New York City is 4.3 times its height. For actions resulting in structures less than 50 feet high, a shadows assessment is generally not necessary unless the site is adjacent to a park, historic resource, or important sunlight-dependent natural feature. The proposed actions would allow for the development of a parking garage structure with a maximum level height of approximately 128 feet (including bulkheads). Therefore, the longest shadow that would be cast by the proposed actions would be approximately 551 feet 4 inches. There are two potential sunlight-sensitive resources within the maximum potential shadow radius of the proposed project, including open space associated with the Grand Central Parkway and Greenstreets along and at the intersection of Ditmars Boulevard and 23rd Avenue. Therefore, the following provides a shadow assessment to determine whether the proposed actions would result in incremental shadows that could have significant adverse impacts.

2.2 Assessment

Because of the path that the sun travels across the sky in the northern hemisphere, no shadow can be cast in a triangle area south of any given project area. In New York City, this area lies between -108 and +108 degrees from true north. Therefore, open space, Greenstreets, and historic resources located in the area to the south of the project site (where no project shadows could fall) are excluded from further assessment.

In accordance with the *2014 CEQR Technical Manual*, a Tier 1 and Tier 2 screening assessment was first undertaken to: 1) establish a base map that illustrates the project site in relation to the location of sunlight-sensitive resources; 2) determine the longest shadow study area; and 3) locate the triangular area that cannot be shaded by the proposed project. The results of the Tier 1 and Tier 2 screening assessment are shown on Figure 2.1.

Tier 1 Shadow Screening

Greenstreets

Greenstreets, including landscaped medians along Ditmars Boulevard and 23rd Avenue and a small portion of a landscaped traffic circle, fall within the maximum shadow radius for the proposed project, comprising approximately 0.28 acre total (see Figure 2.1). Greenstreets are jointly administered/operated by the New York City Department of Parks and Recreation (DPR) and Department of Transportation (DOT), and are a "citywide system of engineered landscapes that transform unused impervious areas into vibrant and pervious green space."[1]

The Greenstreets within the maximum shadow radius were observed to function as decorative, permeable areas and not usable open space (with the exception of the landscaped traffic circle, which was observed to function as an informal open space, which constitutes approximately 0.13 acre of Greenstreets area within the maximum shadow radius).

Open Space Resources

As illustrated in Figure 2.1, approximately 4.23 acres of open area associated with the Grand Central Parkway, owned and maintained by DOT, are situated within the maximum shadow radius for the proposed project. However, per the *2014 CEQR Technical Manual*, public open spaces, which are considered sunlight-sensitive resources, are defined as "parks, beaches, playgrounds, plazas, schoolyards, greenways, landscaped medians with seating." The open area associated with the Grand Central Parkway was observed to meet none of these criteria, nor is it publicly-accessible. Thus, these landscaped areas associated with the Grand Central Parkway within the maximum shadow radius of the proposed project are not considered a sunlight-sensitive resource.

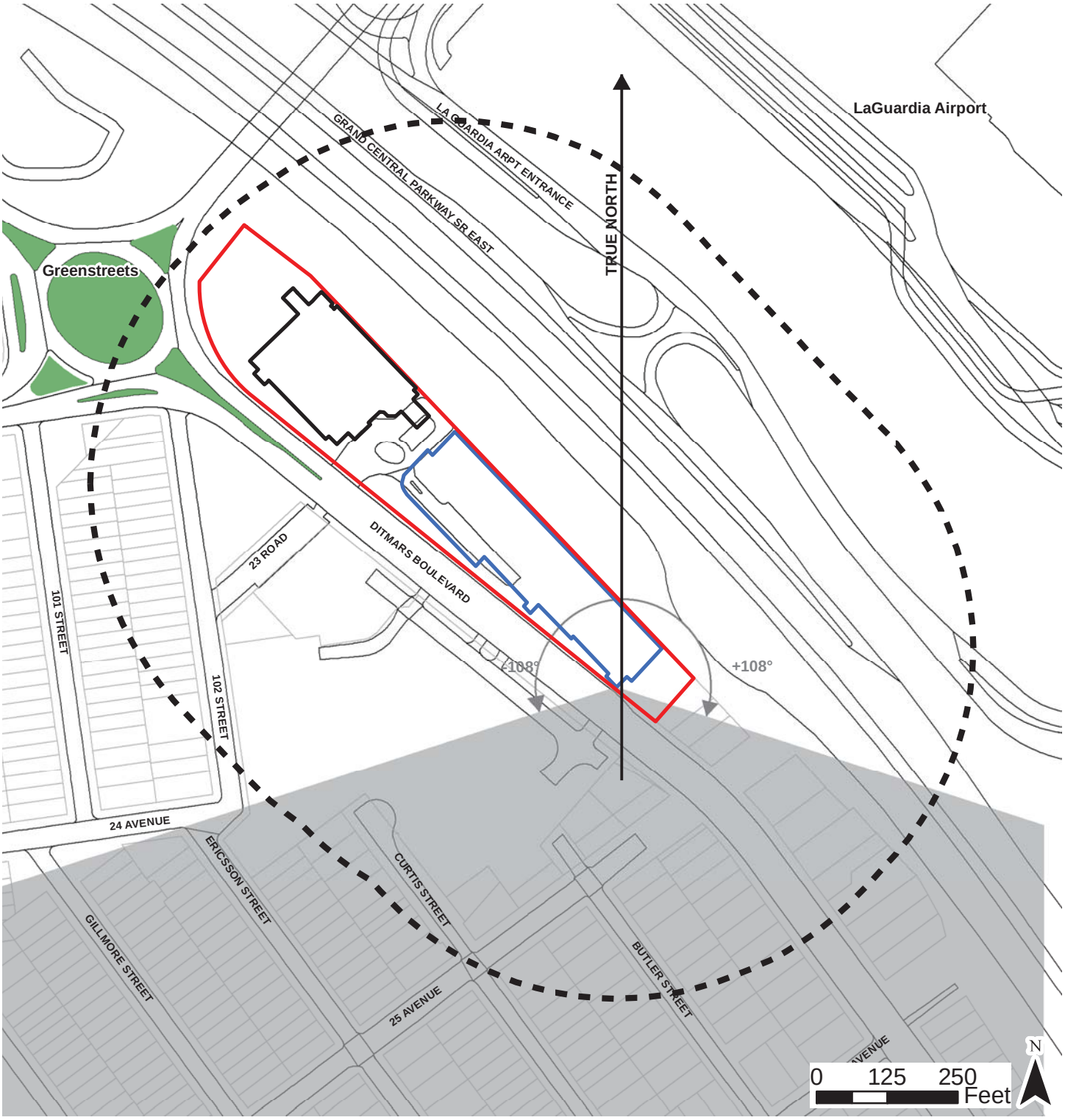
Tier 2 Shadow Screening

As illustrated in Figure 2.1, the sunlight-sensitive resources identified in the Tier 1 shadow screening assessment fall within the area of the longest shadow for the proposed project identified in the Tier 2 shadow screening assessment. Therefore, a Tier 3 shadow screening assessment is required.

Tier 3 Shadow Screening

In accordance with the *2014 CEQR Technical Manual*, a Tier 3 screening assessment was performed because Tier 1 and Tier 2 assessments identified resources of concern within the proposed project's maximum shadow radius, including Greenstreets, in the form of landscaped medians, along Ditmars Boulevard and 23rd Avenue and a small portion of a landscaped traffic circle.

[1] http://www.nycgovparks.org/greening/green-infrastructure, Accessed 09.05.14



102-05 Ditmars Blvd. Garage
Queens, New York

Tier 1 & Tier 2
Shadows Screening Assessment

Figure
2.1

- Project Site
- Proposed Parking Garage
- 551.3-Foot Maximum Shadow Radius
- Existing Hotel Building Footprint
- Area that Cannot be Shaded by the Proposed Parking Garage
- Sunlight Sensitive Resources

Sources:

1. New York (City). Dept. of City Planning 2015. Queens MapPLUTO (Edition 15v1). New York City: NYC Department of City Planning.
2. New York (City). Dept. of City Planning 2015. LION (Edition 15B). New York City: NYC Department of City Planning.
3. New York (City). Dept. of Parks and Recreation 2015. New York City Open Spaces. New York City: NYC Department of Parks and Recreation.
4. New York (City). Department of Information Technology & Telecommunications (DoITT). Building Footprints Data. New York City: NYC DoITT.
5. New York (City). Department of Information Technology & Telecommunications (DoITT). Roadbed Data. New York City: NYC DoITT.

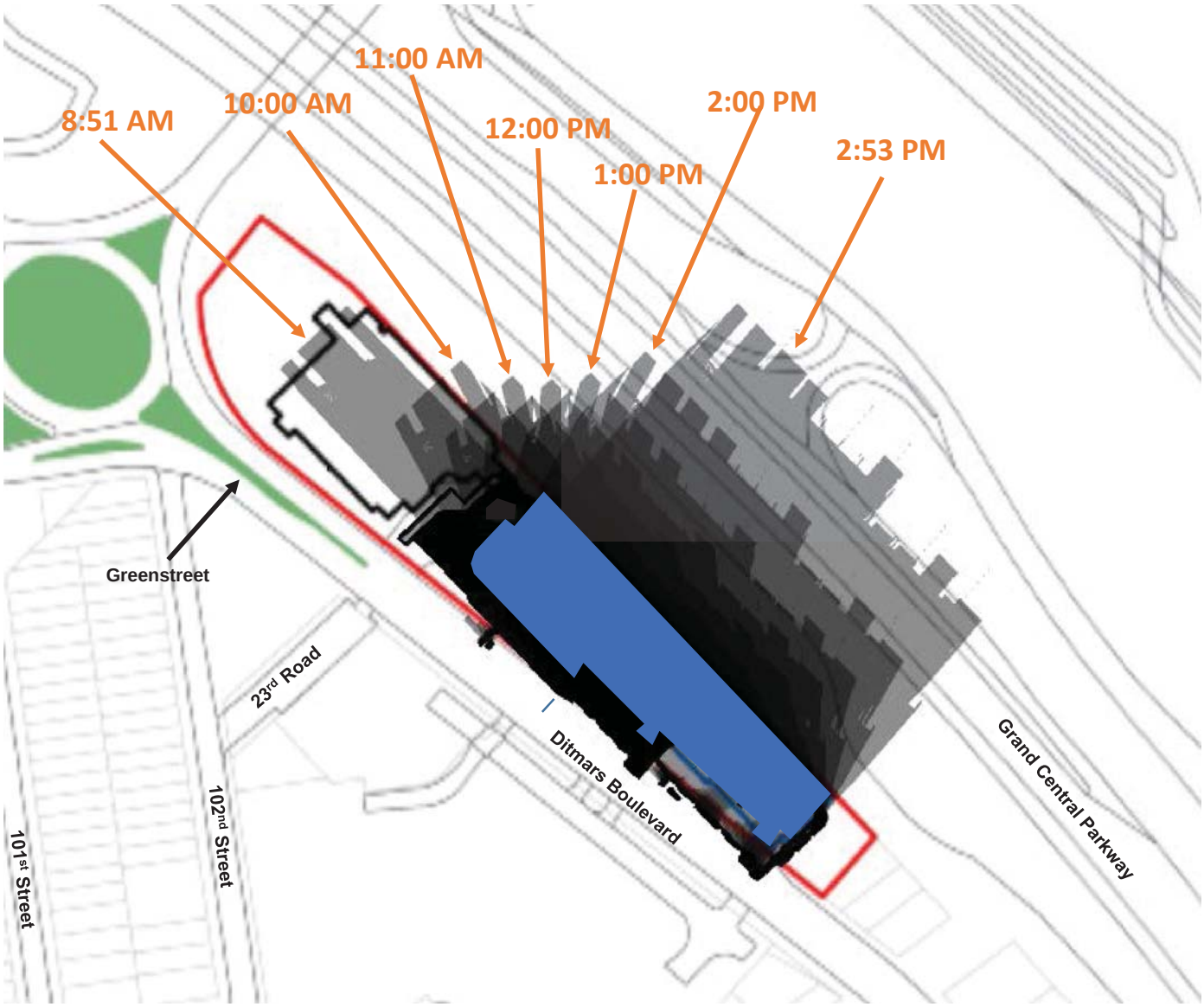
As the sun travels across the sky during the day, shadows fall in a curve on the ground opposite the sun. When the sun rises, shadows fall to the west. Because the sun rises in the east and travels across the southern part of the sky throughout the day to set in the west, a project's earliest shadows would be cast almost entirely westward. Throughout the day, shadows would shift clockwise, until sunset, when they would fall east. Midday shadows are always shorter than those at other times of the day because the sun is highest in the sky at that time. Further, because of the tilt of the earth's axis, the angle at which the sun's rays strike the earth varies throughout the year, so that during the summer, the sun is higher in the sky and shadows are shorter than during the winter. Winter shadows, although the longest, move the most quickly along their paths and do not affect the growing season of outdoor trees and plants.

The Tier 3 screening assessment was performed for the four representative days of the year set forth in the *2014 CEQR Technical Manual*: December 21, the winter solstice and shortest day of the year; March 21/September 21, the equinoxes; May 6/August 6, the midpoints between the summer solstice and the equinoxes; and June 21, the summer solstice and the longest day of the year. The *2014 CEQR Technical Manual* defines the temporal limits of a shadow analysis period to fall from an hour and a half after sunrise to an hour and a half before sunset.

A three dimensional computer model was developed to represent the proposed project. In accordance with the *2014 CEQR Technical Manual* guidance for Tier 3 assessments, surrounding buildings are not included in the shadow assessment model. The results of the Tier 3 shadow assessment for the proposed project are illustrated in Figures 2.2a through 2.2d.

As shown in Figures 2.2a and 2.2d, shadows from the proposed project would not fall on identified Greenstreets within the maximum shadow radius during the December 21 and June 21 analysis periods. Therefore, no further analysis is warranted for these periods.

During both the March 21 and May 6 analysis periods, shadows from the proposed project would fall on Greenstreets infrastructure along Ditmars Boulevard in the morning hours (see Figures 2.2b and 2.2c). Specifically, shadows would fall on this Greenstreet at the opening of the analysis periods (i.e., 7:36 AM during the March 21 period and 6:27 AM during the May 6 period) and would transition off this Greenstreets after 26 minutes during the March 21 analysis period and after 1 hour 13 minutes during the May 6 analysis period. Shadow entry and exit times, and total shadow duration, are described below in Table 2.1.



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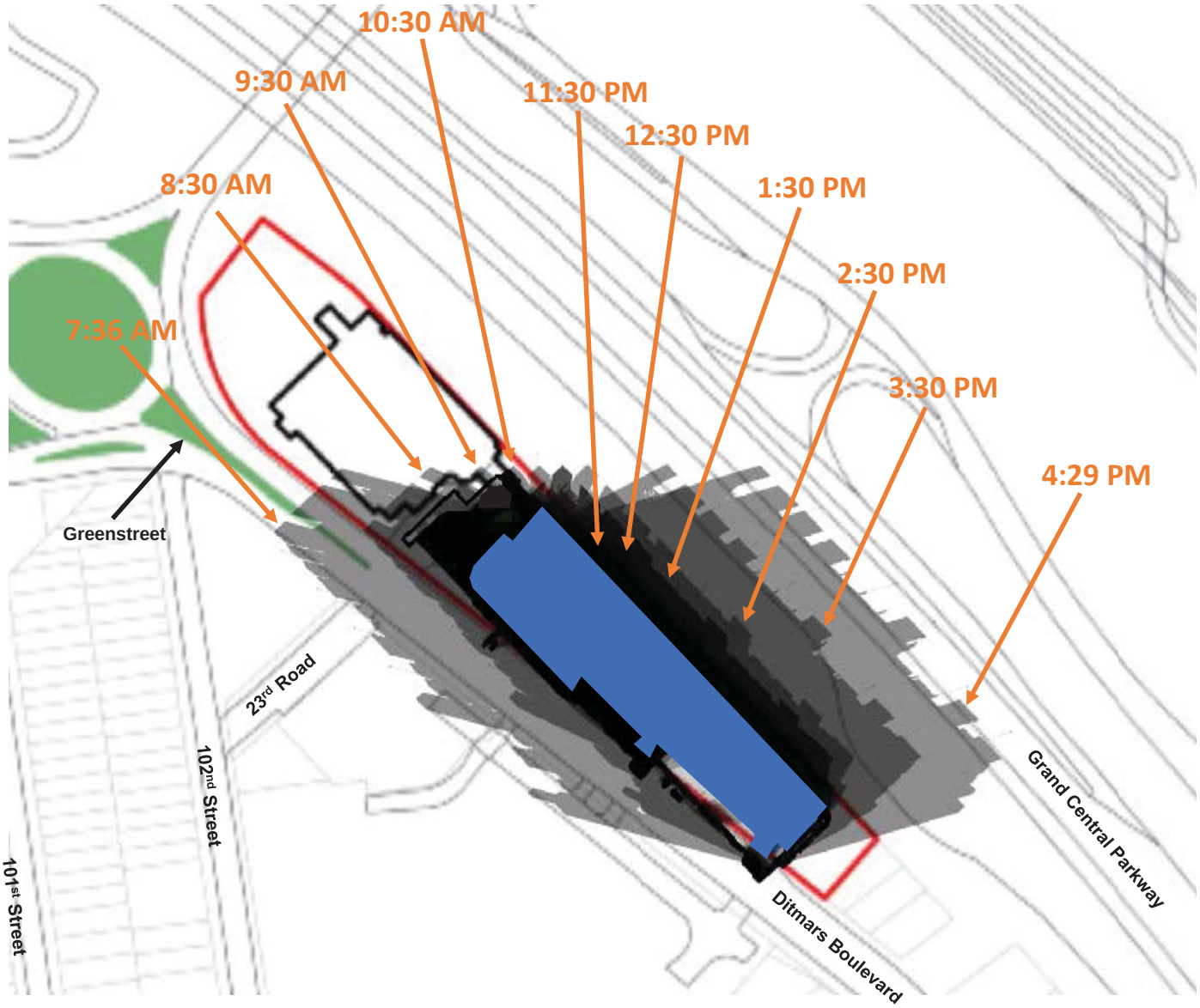
102-05 Ditmars Blvd. Garage
Queens, New York

Tier 3 Shadow Screening Assessment
December 21

Figure 2.2a

- Project Site
- Proposed Parking Garage
- Existing Hotel Building Footprint
- Projected Shadow
- Sunlight Sensitive Resource

Sources:
1. New York (City). Dept. of City Planning 2014. Queens MapPLUTO (Edition 15v1). New York City: NYC Department of City Planning.
2. New York (City). Dept. of Parks and Recreation 2012. New York City Open Space. New York City: NYC Department of Parks and Recreation.
3. New York (City). Department of Information Technology & Telecommunications (DoITT). Building Footprints Data. New York City: NYC DoITT.



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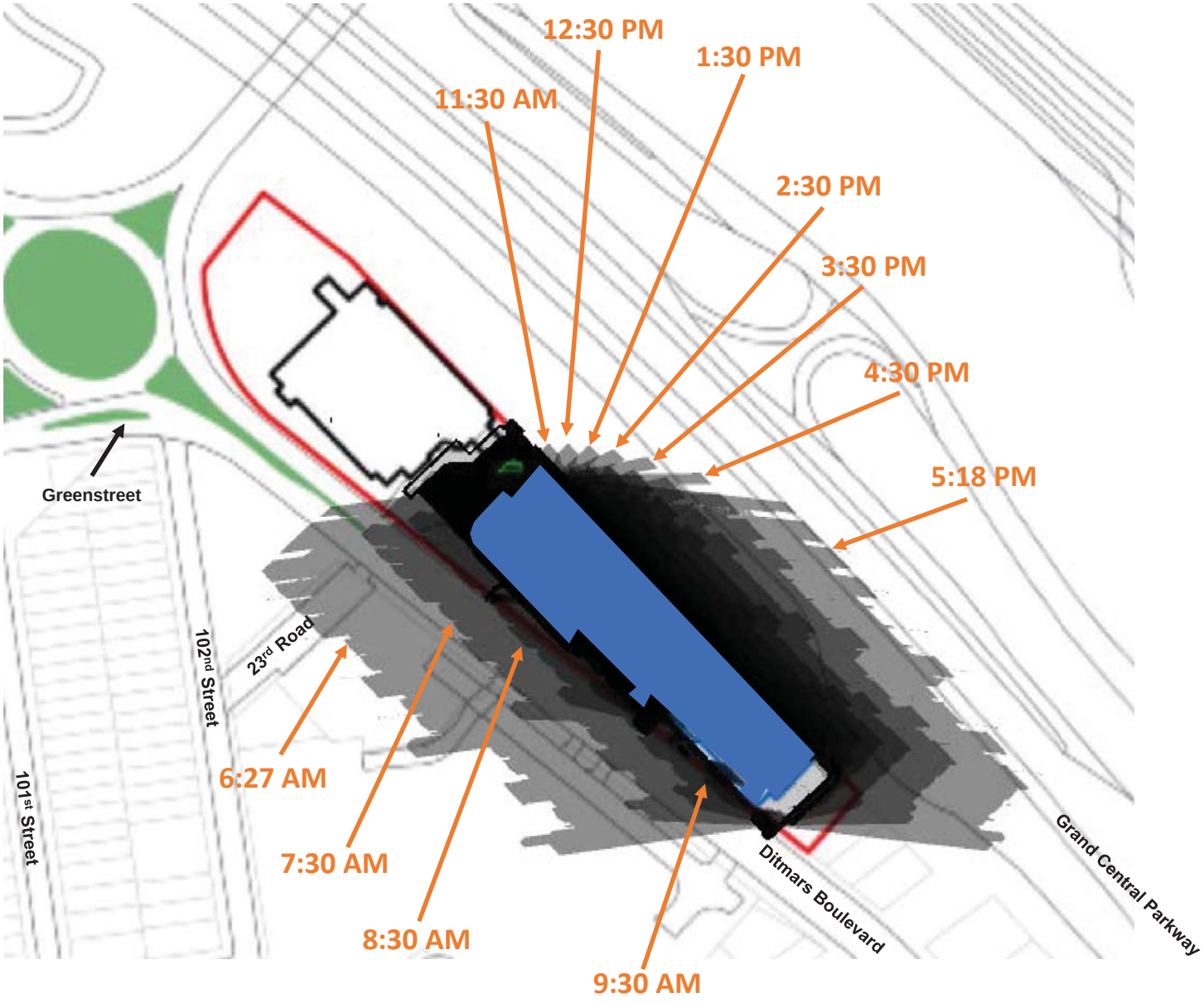
102-05 Ditmars Blvd. Garage
Queens, New York

Tier 3 Shadow Screening Assessment
March 21

Figure 2.2b

- Project Site
- Proposed Parking Garage
- Existing Hotel Building Footprint
- Projected Shadow
- Sunlight Sensitive Resource

Sources:
1. New York (City). Dept. of City Planning 2014. Queens MapPLUTO (Edition 15v1). New York City: NYC Department of City Planning.
2. New York (City). Dept. of Parks and Recreation 2015. New York City Open Space. New York City: NYC Department of Parks and Recreation.
3. New York (City). Department of Information Technology & Telecommunications (DoITT). Building Footprints Data. New York City: NYC DoITT.



Note: 10:30 AM projected shadows are masked by other projected illustrated shadows during this analysis day and are therefore not visible

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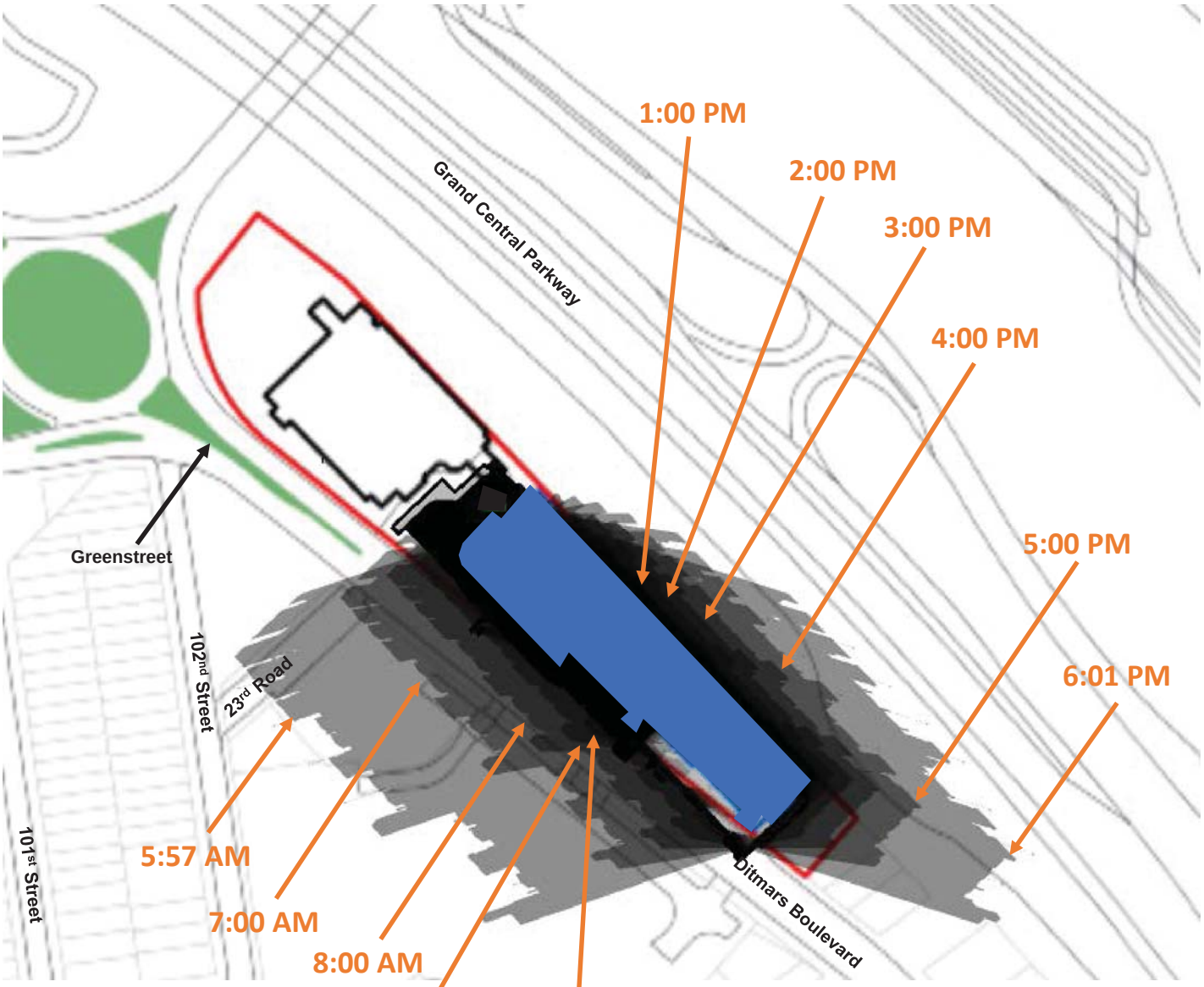
102-05 Ditmars Blvd. Garage Queens, New York	Tier 3 Shadow Screening Assessment May 6	Figure 2.2c

- Project Site
- Proposed Parking Garage
- Existing Hotel Building Footprint
- Projected Shadow
- Sunlight Sensitive Resource

Sources:
1. New York (City). Dept. of City Planning 2014. Queens MapPLUTO (Edition 15v1). New York City: NYC Department of City Planning.
2. New York (City). Dept. of Parks and Recreation 2012. New York City Open Space. New York City: NYC Department of Parks and Recreation.
3. New York (City). Department of Information Technology & Telecommunications (DoITT). Building Footprints Data. New York City: NYC DoITT.



Note: 11:00 AM and 12:00 PM projected shadows are masked by other projected illustrated shadows during this analysis day and are therefore not visible

102-05 Ditmars Blvd. Garage Queens, New York	**Tier 3 Shadow Screening Assessment** June 21	**Figure 2.2d**

- Project Site
- Proposed Parking Garage
- Existing Hotel Building Footprint
- Projected Shadow
- Sunlight Sensitive Resource

Sources:
1. New York (City). Dept. of City Planning 2014. Queens MapPLUTO (Edition 15v1). New York City: NYC Department of City Planning.
2. New York (City). Dept. of Parks and Recreation 2012. New York City Open Space. New York City: NYC Department of Parks and Recreation.
3. New York (City). Department of Information Technology & Telecommunications (DoITT). Building Footprints Data. New York City: NYC DoITT.

Table 2.1: Incremental Shadow Duration from Proposed Project

Analysis Day	December 21	March 21 / September 21	May 6 / August 6	June 21
Analysis Timeframe Window	8:51 AM – 2:53 PM	7:36 AM – 4:29 PM	6:27 AM – 5:18 PM	5:57 AM – 6:01 PM
Greenstreets along Ditmars Boulevard				
Shadow Enter – Exit Times	No incremental shadow	7:36 AM – 8:02 AM	6:27 AM – 7:40 AM	No incremental shadow
Shadow Duration	-	26 minutes	1 Hour 13 Minutes	
Notes: (1) Daylight savings time not used, times shown are eastern standard time (EST) (2) All times are approximate				

However, observations of this Greenstreets during field visits indicated that this Greenstreets, in the vicinity of these anticipated shadows, is primarily pavement, with no vegetative features and is therefore not sunlight-dependent (see Figure 2.3 for photographs depicting this Greenstreets infrastructure). As such, shadows from the proposed project during these analysis periods would not adversely affect this Greenstreets area and no further analysis is warranted.

Figure 2.3 – Photograph of Greenstreets along Ditmars Boulevard in the Vicinity of the Proposed Project

2.3 Conclusion

The projected shadows that would be cast on identified resources of concern within the proposed project's maximum shadow radius would fall on portions of those resources that are not sunlight-dependent (i.e., areas that are strictly pavement). Therefore, the proposed project would not result in significant adverse shadow impacts to any sunlight-sensitive resources and no further analysis is required.