

A. INTRODUCTION

This chapter assesses the potential of the proposed project to cast new shadows on surrounding public open space or other sunlight-sensitive resources. The analysis updates changes to the proposed project and background conditions since the 2008 Final Generic Environmental Impact Statement (FGEIS) and assesses whether any changed background conditions or differences in elements between the proposed project and the development program analyzed in the 2008 FGEIS and subsequent technical memoranda would result in significant adverse shadow impacts on publicly accessible open spaces, sunlight-sensitive features of historic and cultural resources, or important natural resources that were not addressed in the 2008 FGEIS or subsequent technical memoranda.

PRINCIPAL CONCLUSIONS

The analysis concluded that the proposed parking structure in the South Lot would cast new shadows early in the mornings in all seasons onto adjacent traffic islands and a portion of an area containing trees, but that the shadows would be limited in extent and duration and would not cause significant adverse shadow impacts to these sections of Flushing Meadows-Corona Park. The Willets West development would cast new shadows of very limited extent and duration on nearby landscaped traffic islands in the winter only, and these would not cause significant adverse shadow impacts. Therefore, consistent with the conclusions of the 2008 FGEIS and subsequent technical memoranda, the proposed project would not result in any significant adverse shadows impacts.

B. SUMMARY OF FINDINGS—2008 FGEIS AND SUBSEQUENT TECHNICAL MEMORANDA

The 2008 FGEIS analyzed the potential of proposed development within the Special Willets Point District and on Lots B and D on Roosevelt Avenue to have significant adverse shadow impacts on sunlight-sensitive resources. The 2008 FGEIS concluded that development in the District could cast some incremental shadow onto Flushing Bay, the Flushing Bay Promenade, and the Flushing River in some seasons, but the extent and duration of such incremental shadow would not be large or long enough to cause a significant adverse impact on any of these resources. In addition, the 2008 FGEIS concluded that potential future development on Lots B and D would not cause a significant adverse impact on any sunlight-sensitive resources. The subsequent technical memoranda also concluded that the proposed revisions to the Willets Point Development Plan would not have significant adverse shadow impacts.

C. DEFINITIONS AND METHODOLOGY

This analysis has been prepared in accordance with New York City Environmental Quality Review (CEQR) procedures and follows the guidelines of the 2012 *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 are those resources that depend on sunlight or for which direct sunlight is necessary to maintain the resource's usability or architectural integrity. Such resources generally include:

- *Public open space* (e.g., parks, beaches, playgrounds, plazas, schoolyards, greenways, 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: 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 surface water bodies, wetlands, or designated resources such as coastal fish and wildlife habitats.

Non-sunlight-sensitive resources include, 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);
- *Project-generated open space* 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 qualitative discussion of shadows on the project-generated open space should be included in the analysis.

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.

METHODOLOGY

Following the guidelines of 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 first tier determines a simple radius around the proposed building

representing the longest shadow that could be cast. If there are sunlight-sensitive resources within this radius, the analysis proceeds to the second tier, 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 project site due to the path of the sun through the sky at the latitude of New York City.

If the second tier of analysis does not eliminate the possibility of new shadows on sunlight-sensitive resources, a third tier of screening analysis further refines the area that could be reached by 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 third tier of analysis 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. 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.

ANALYSIS FRAMEWORK

Due to its proximity to LaGuardia Airport, the Special Willets Point District is subject to height restrictions established by the Federal Aviation Administration (FAA) and the Port Authority of New York and New Jersey (PANY/NJ). Therefore, the 2008 FGEIS and subsequent technical memoranda conservatively analyzed the entire District at the maximum building envelope height allowed under these restrictions. The structures contemplated for the District in the current proposed project, including Phases 1A, 1B, and 2, fall well within the maximum building envelope height previously analyzed and approved. In addition, there have been no substantive changes to background conditions relevant to the analysis; in other words, there have been no changes to the inventory of sunlight-sensitive resources or new intervening structures. Consequently, the District does not require further analysis.

Similarly, in the 2008 FGEIS and subsequent technical memoranda the shadow screening analysis conservatively considered a maximum building envelope for the potential future development on Lot B that would be no higher than the CitiField stadium, which was approved by the FAA for 218 feet above ground level, or 232 feet above mean sea level (AMSL). This Supplemental Environmental Impact Statement (SEIS) conservatively assumes that the potential future development on Lot B would not be any taller than that which was considered for this site in the 2008 FGEIS. Therefore, no additional analysis is warranted for the Lot B structure.

The 2008 FGEIS analyzed the Lot D development as a five-story structure. As currently contemplated, the parking structure to be developed on Lot D would be 63 feet in height, similar to the parking structures on the South Lot. Therefore, this analysis conservatively included the 63-foot structure in the analysis.

The proposed “Willets West” development on the surface parking lot west of the CitiField stadium is a new element of the project since the 2008 FGEIS. This proposed structure would reach a maximum height of 104.67 feet and therefore requires a shadows assessment. The proposed South Lot parking facilities are also new to the project since the 2008 FGEIS. These two structures would reach a maximum height of 63 feet and consequently also require a shadows assessment.

D. PRELIMINARY SCREENING ASSESSMENT

A base map was developed using Geographic Information Systems (GIS)¹ showing the location of the proposed structures and the surrounding street and park layout (see **Figure 6-1**). In coordination with the open space, historic and cultural resources, and natural resources assessments presented in other chapters of this EIS, potential sunlight-sensitive resources were identified and shown on the map.

TIER 1 SCREENING ASSESSMENT

For the Tier 1 assessment, the longest shadow that a proposed structure could cast is calculated, and, using this length as the radius, a perimeter is drawn around the structure. 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.

Figure 6-1 shows the proposed structures for analysis with their heights. Most of the Willets West structure to be developed in Phase 1A (2018) would have a height of 73.67 feet, with lower elements in the northwest and northeast portions at 51 and 40 feet respectively, and a central element at 104.67 feet. The two parking structures in the South Lot, and the parking structure in Lot D, would each be 63 feet in height. These structures would be developed in Phases 1A (2018) and 1B (2028).

Within the CEQR analysis framework, the longest shadow a structure can cast occurs on December 21 at the start of the analysis day at 8:51 AM, and its length is equal to 4.3 times the structure's height. Diagram A on **Figure 6-1** shows the longest shadow study area for each structure, or in the case of Willets West, each structure part that has a consistent roof height. For example, the longest shadow study areas for each of the three 63-foot-high structures in the South Lot and Lot D would be a perimeter around each structure with a radius of 270.9 feet (63' x 4.3). For Willets West, the longest shadow that the tallest portion in the center of the proposed structure could cast would be 450 feet, and a perimeter with a radius of 450 feet is delineated around that portion of the structure. The portion of Willets West that is 73.67 feet high would have a longest shadow study area with a radius of 316.8 feet, and the shorter portions of Willets West would have longest shadow study areas with radii of 204 and 172 feet.

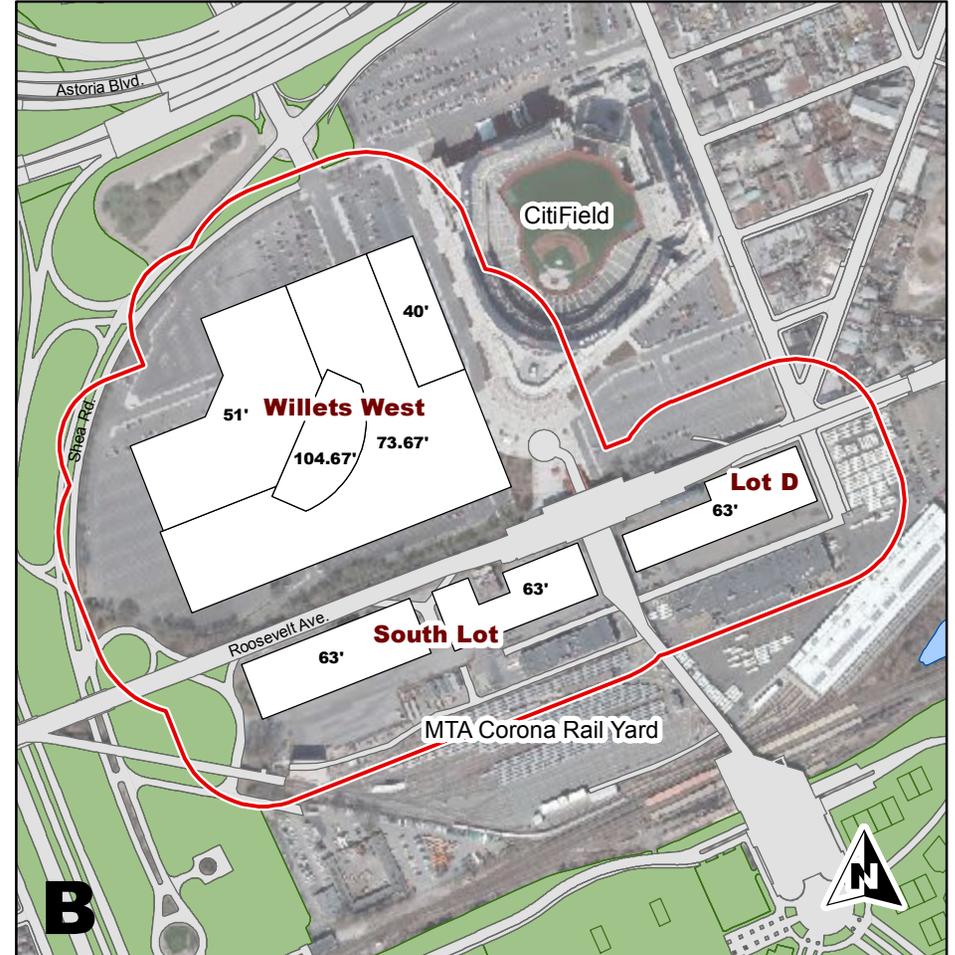
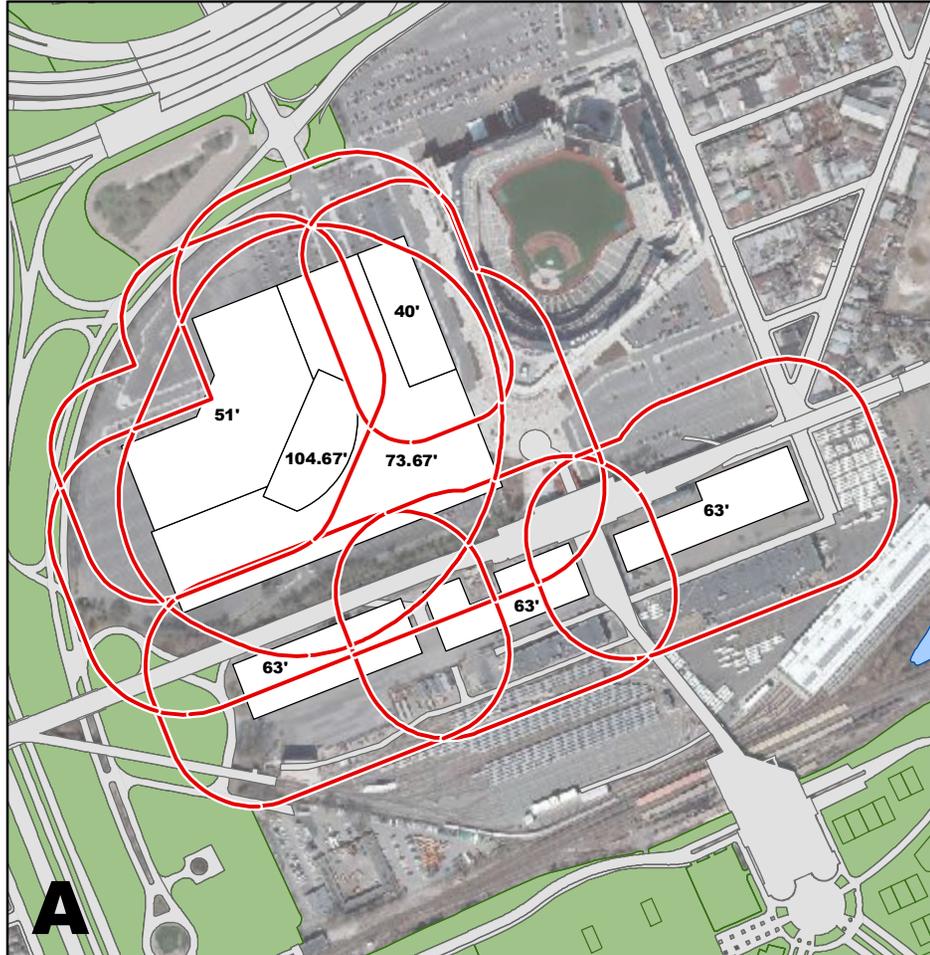
Diagram B on **Figure 6-1** shows the combined perimeters that together form the longest shadow study area for the proposed structures for analysis.

Small portions of traffic islands and an area containing trees, located between Shea Road, Roosevelt Avenue, and the access roads connecting them, are within the longest shadow study area. Therefore, the next tier of assessment was conducted.

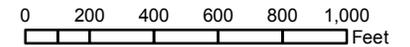
TIER 2 SCREENING ASSESSMENT

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 structure. In New York City this area lies between -108 and +108 degrees from true north. The complementing area north, east, and west of each structure within the longest shadow study area represents the remaining area that could potentially experience new project-generated shadow.

¹ Software: Esri ArcGIS 10.1; Data: New York City Department of Information Technology and Telecommunications (DoITT) and other City agencies, and AKRF site visits.



- Proposed structures for analysis (labeled with roof heights)
- Publicly-accessible open space or landscaped medians (outside project site boundary)
- Longest shadow study area boundary



Diagrams A and B, above, show the proposed structures for analysis with their heights: most of the Willets West development would have a height of 73.67 feet, with lower elements in the northwest and northeast portions at 51 and 40 feet respectively, and a central element at 104.67 feet. The two parking structures in the South Lot, and the parking structure in Lot D, would each be 63 feet in height.

Within the CEQR analysis framework, the longest shadow a structure can cast occurs on December 21 at the start of the analysis day at 8:51 AM, and its length is equal to 4.3 times the structure's height. Diagram A shows the longest shadow study area for each structure, or in the case of Willets West, each structure part that has a consistent roof height. For example, the longest shadow study areas for each of the three 63' high structures in the South Lot and Lot D would be a perimeter around each structure with a radius of 270.9 feet (63 x 4.3). For Willets West, the longest shadow that the tallest portion in the center of the proposed development could cast would be 450 feet, and a perimeter with a radius of 450 feet is delineated around that portion of the structure. The portion of Willets West that is 73.67 feet high would have a longest shadow study area with a radius of 316.8 feet, and the shorter portions of Willets West would have longest shadow study areas with radii of 204 and 172 feet.

Diagram B shows the combined perimeters that together form the longest shadow study area for the proposed structures for analysis.

The Tier 2 assessment only eliminated the possibility of new shadows on a very small portion of the traffic island between the South Lot and Shea Road, south of Roosevelt Avenue. The remaining longest shadow study area still contained small portions of landscaped traffic islands adjacent to Shea Road and Roosevelt Avenue. Therefore, a Tier 3 assessment was required.

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 order to determine whether project-generated shadow could fall on a sunlight-sensitive resource, three-dimensional (3D) computer mapping software² is used in the Tier 3 assessment 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

Following the guidance of the *CEQR Technical Manual*, 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

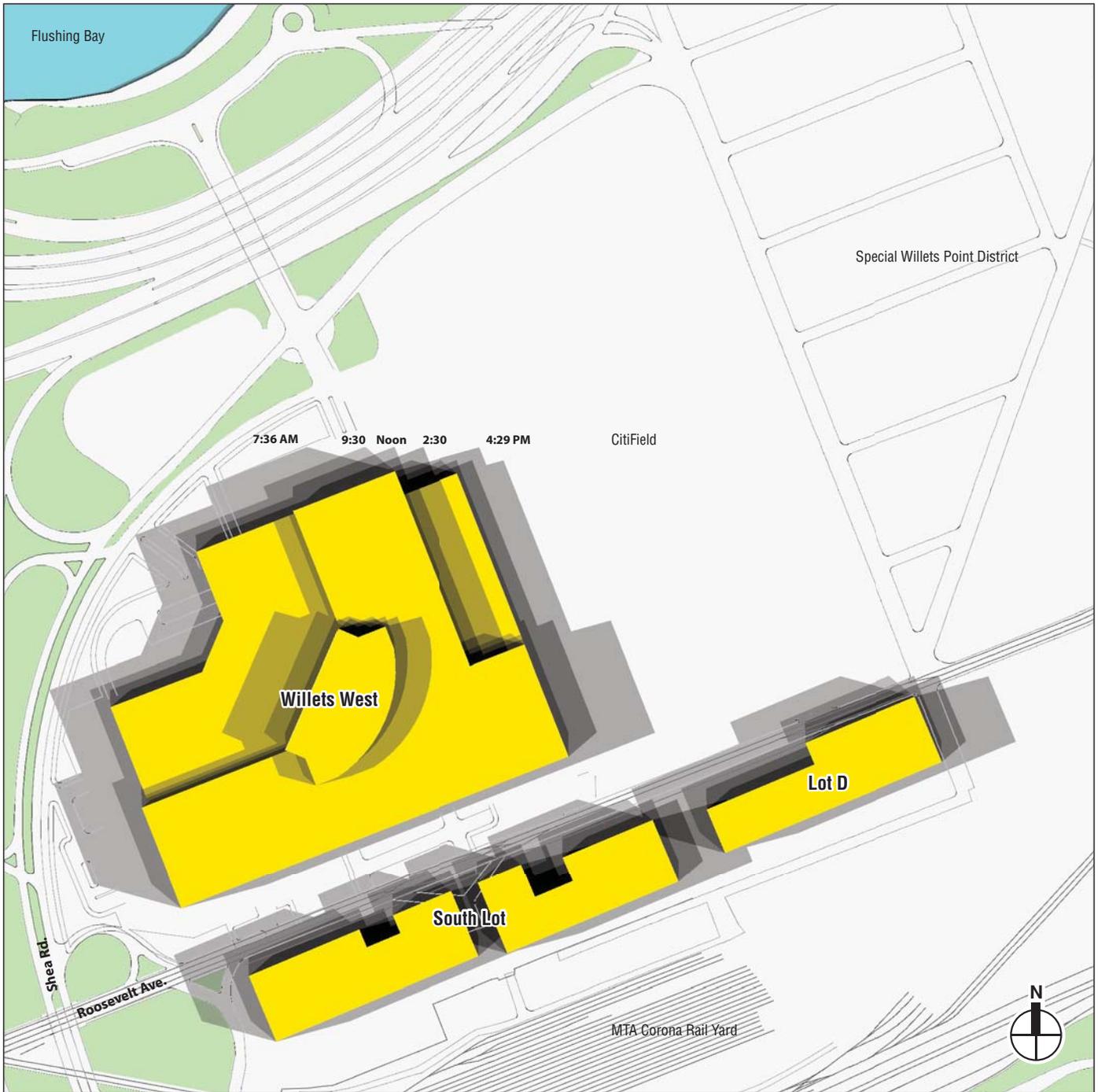
The shadow assessment considers shadows occurring between one and a half hours after sunrise and one and a half hours before sunset. At times earlier or later than this timeframe window of analysis, the sun is down near the horizon and the sun's rays reach the earth at very tangential angles, diminishing the amount of solar energy and producing shadows that are very long, move fast, and generally blend with shadows from existing structures until the sun reaches the horizon and sets. 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 6-2 through 6-5 illustrate the range of shadows that would occur, in the absence of intervening buildings, from the proposed Willets West, South Lot and Lot D structures on the four representative days for analysis. As they move east and clockwise over the landscape, the shadows are shown occurring approximately every two hours from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset).

The Tier 3 assessment showed that shadows from the Willets West structure would not fall on any sunlight-sensitive areas on the three analysis days of the growing season. On the December 21 analysis day, small incremental shadows would fall on portions of the adjacent landscaped

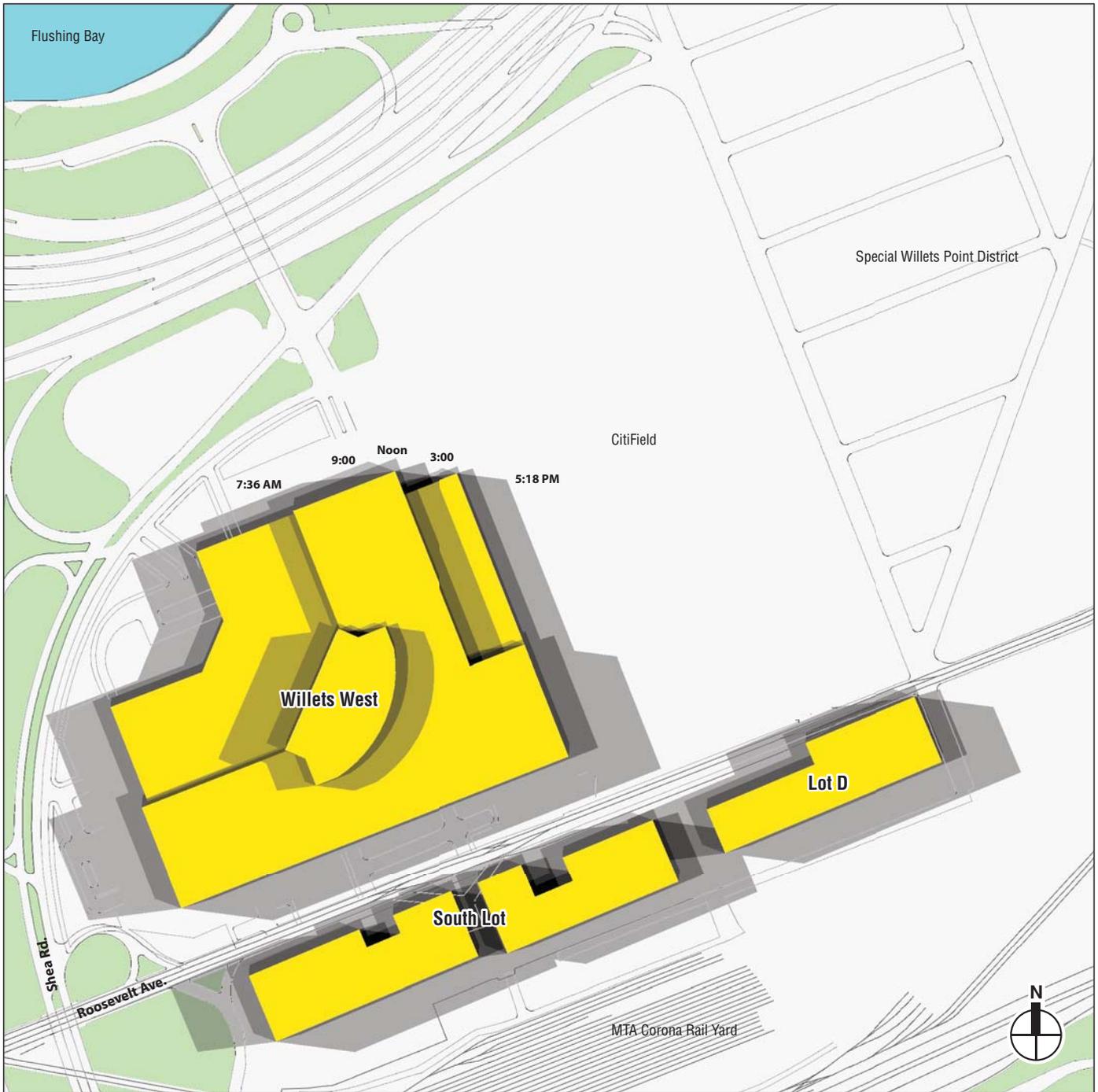
² MicroStation V8i (SELECTSeries 3).



Note: Daylight Saving Time not used.

- Proposed Buildings for Analysis
- Publicly-Accessible Open Space or Landscaped Traffic Islands
- Shadow

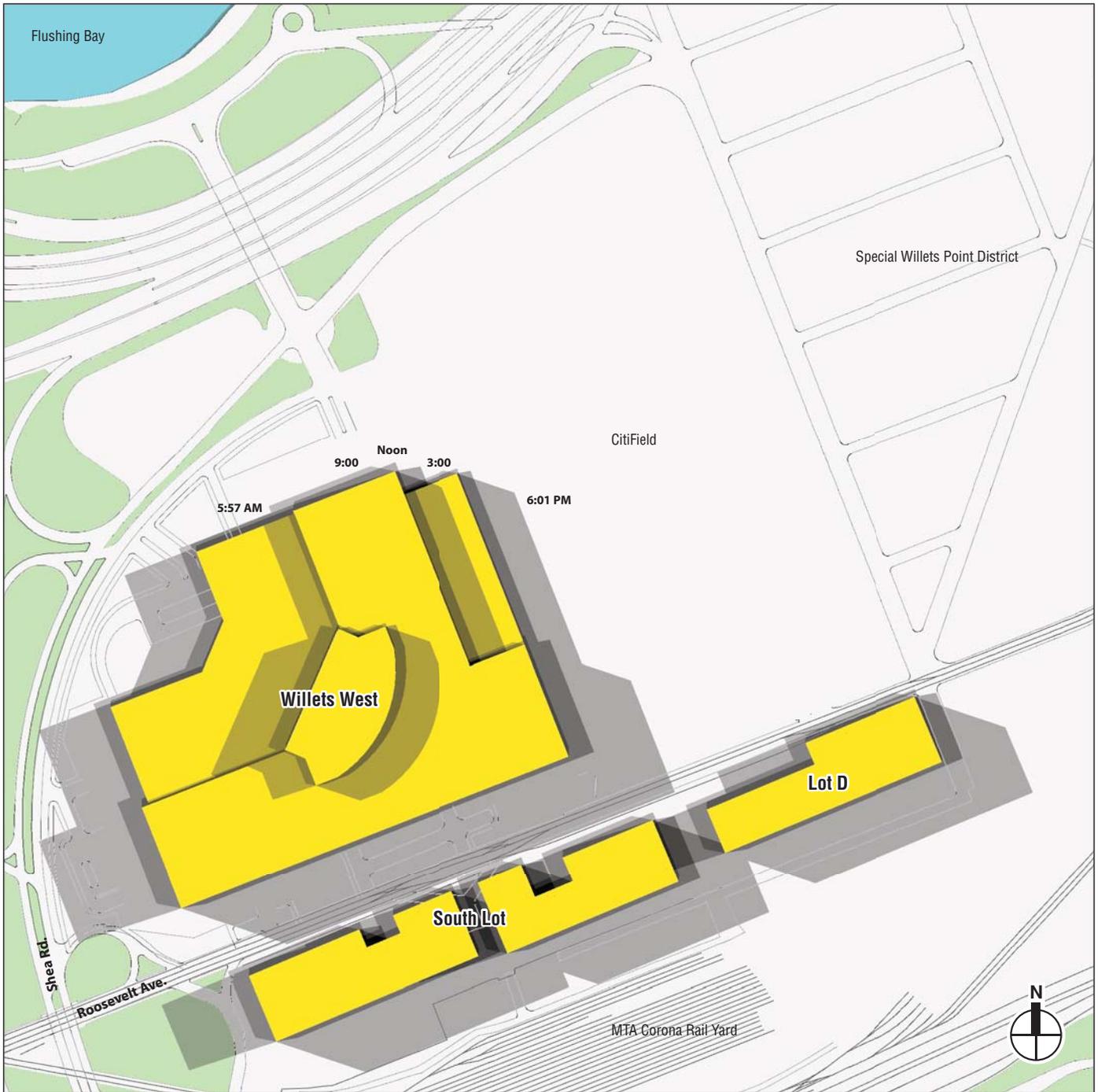
This figure illustrates the range of shadows that would occur, absent intervening structures, from the proposed building on this representative day. The shadows are shown occurring approximately every two to three hours from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset). The Tier 3 assessment serves to illustrate the daily path or "sweep" of the proposed building's shadow across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow.



Note: Daylight Saving Time not used.

- Proposed Buildings for Analysis
- Publicly-Accessible Open Space or Landscaped Traffic Islands
- Shadow

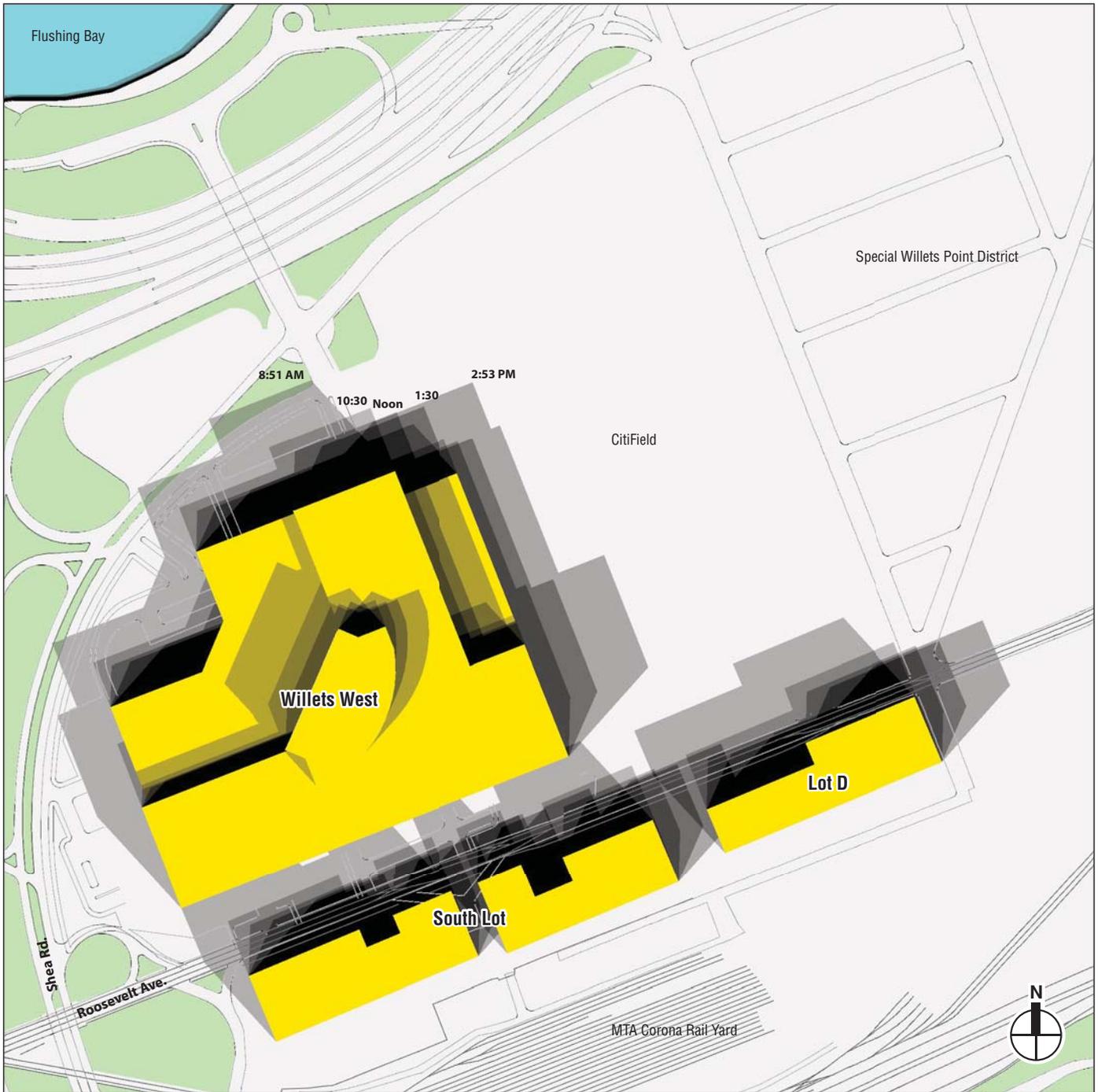
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Willetts Point Development

traffic islands at the start of the analysis day. However, per CEQR guidelines, these landscaped features would be only minimally sensitive to sun and shadows in the winter.

The western of the two proposed parking structures on the South Lot would cast new shadow on the adjacent areas of the park to its immediate west in the morning on all four analysis days.

The proposed parking structure on Lot D would not cast shadows on any sunlight-sensitive resources at any time of year.

A detailed analysis was consequently warranted to determine the duration and extent of new shadows from the South Lot parking structure on the four analysis days, and from the Willetts West structure on December 21.

E. DETAILED SHADOW ANALYSIS

The purpose of the detailed analysis is to determine the extent and duration of new incremental shadows that fall on sunlight-sensitive resources as a result of the project, and to assess their effects. A baseline or future No Action condition is established, containing existing buildings and sunlight-sensitive resources and any future developments planned in the area, to illustrate the baseline shadows from buildings and other structures in the study area defined in the preliminary assessment. The future condition with the proposed project and its shadows can then be compared to the shadows from the No Action condition, to determine the incremental shadows that would result with the proposed project.

Three-dimensional representations of the existing buildings in the study area were developed and added to the three-dimensional model used in the Tier 3 assessment.

Shadows are in constant movement. The computer simulation software produces an 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.

Table 6-1 summarizes the entry and exit times and total duration of incremental shadows on each affected sunlight-sensitive resource. The extent and duration of incremental shadows are described for each analysis day below. Because there are no intervening structures between the Willetts West and South Lot developments and the landscaped traffic islands onto which they would cast new shadow, **Figures 6-2 to 6-5** serve to show the extent and movement of incremental shadows that would occur.

**Table 6-1
Incremental Shadow Durations**

Analysis Day and Timeframe Window	March 21 / Sept. 21 7:36 AM-4:29 PM	May 6 / August 6 6:27 AM-5:18 PM	June 21 5:57 AM-6:01 PM	December 21 8:51 AM-2:53 PM
Traffic islands and parkland west of South Lot	7:36 AM-8:50 AM Total: 1 hr 14 min	6:27 AM-8:25 AM Total: 1 hr 58 min	5:57 AM-8:15 AM Total: 2 hr 17 min	8:51 AM-9:00 AM Total: 9 min
Landscaped traffic islands adjacent to Shea Road north of Roosevelt Avenue	—	—	—	8:51 AM-9:10 AM Total: 19 min
Notes: Table indicates entry and exit times and total duration of incremental shadow for each sunlight-sensitive resource. Per <i>CEQR Technical Manual</i> guidelines, daylight saving time is not used; times are Eastern Standard Time. 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.				

MARCH 21/SEPTEMBER 21

At the start of the March 21/September 21 analysis day at 7:36 AM, incremental shadow from the South Lot structure would fall to the west on a small area of parkland containing grass and trees. The incremental shadow would move east, exiting the larger section of parkland, located a bit further west and south, 34 minutes later at 8:10 AM and the smaller traffic island at 8:50 AM (see **Figure 6-2**).

MAY 6/AUGUST 6

At the start of the May 6/August 6 analysis day at 6:27 AM, incremental shadow from the South Lot structure would fall to the west on the same two areas of the park, the small traffic island to the northwest and the larger area of grass and trees to the west. The incremental shadow would move east, exiting the larger area at 7:25 AM and the small traffic island at 8:25 AM (see **Figure 6-3**).

JUNE 21

At the start of the June 21 analysis day at 5:57 AM, incremental shadow from the South Lot structure would fall to the west on the same two portions of adjacent parkland. The incremental shadow would move east, exiting the larger area at 7:15 AM and the small traffic island at 8:15 AM (see **Figure 6-4**).

DECEMBER 21

Shadow from the Willets West structure would fall on small portions of the landscaped traffic islands along Shea Road to the northwest for the first nine minutes of the analysis day.

Shadow from the South Lot structure would fall on a small portion of a landscaped traffic island for the first 19 minutes of the analysis day.

F. CONCLUSIONS

The areas of parkland west and northwest of the South Lot parking structure would receive new shadows during the months of the growing season, ranging between an hour and a quarter in early spring and early fall, to two and a quarter hours on June 21. The new shadows would be small in extent, and would move, affecting different plants at different times during the affected period. These areas of parkland would continue to get more than seven hours of direct sun even in March and September, because there are no structures to their south and west. Consequently, the new shadows from the proposed project would not cause significant adverse shadow impacts to these areas of Flushing Meadows-Corona Park. The nine minutes of new shadow in the winter that would be cast by the Willets West structure would not cause a significant adverse impact to the traffic islands along Shea Road north of Roosevelt Avenue. Therefore, consistent with the conclusions of the 2008 FGEIS and subsequent technical memoranda, the proposed project would not result in any significant adverse shadows impacts. *