

A. INTRODUCTION

Several of the proposed buildings in the Proposed Project are taller than 50 feet, and have the potential to cast new shadows on nearby existing open spaces as well as proposed parks within the Fresh Creek Urban Renewal Area (FCURA). In accordance with CEQR criteria, a shadow analysis has been conducted to determine whether the Proposed Project could potentially cause a significant adverse impact on nearby publicly accessible open spaces, natural features, or sun-sensitive historic resources.

Under the Proposed Project, most of the proposed building envelopes would be less than 50 feet and none of them would be taller than 75 feet. The incremental shadow they would cast on adjacent sun-sensitive resources would be of limited extent and short duration throughout the year. This analysis determines that they would not cause a significant adverse impact to any sun-sensitive resources.

B. METHODOLOGY

Following the guidelines of the *CEQR Technical Manual*, this shadow study focuses on publicly accessible open spaces (uses, users, landscaping, and vegetation), significant natural features, and historic resources with significant sunlight-dependent features. Analyses are performed for four representative days of the year: March 21, which is the equivalent of September 21 (the equinoxes); May 6, the equivalent of August 6 (midpoints between the summer solstice and the equinoxes); June 21 (the summer solstice); and December 21 (the winter solstice). Since the CEQR methodology does not consider shadows and incremental increases in shadows within 1½ hours of sunrise or sunset, the analysis period on each analysis day begins 1½ hours after sunrise and ends 1½ hours before sunset.

The *CEQR Technical Manual* identifies the following situations when a proposed project may result in a significant shadow impact:

- Substantial reduction in sunlight where a sensitive use is already subject to substandard sunlight (i.e., less than the minimum time necessary for survival);
- Reduction in sunlight available to a sensitive use from more to less than the minimum time necessary for its survival;
- Substantial reduction in sunlight to a sun-sensitive use or feature; and
- Substantial reduction in the usability of the open space.

The determination of impact significance is based on an assessment of how a project's shadows specifically affect individual sun-sensitive resources; that is, the analysis considers the extent and duration of project shadows on each resource and assesses the potential impact of those shadows on

the uses and vegetation of the resource, or on the sunlight-sensitive features of an architectural resource.

The shadow diagrams and detailed analysis that follows were developed using building envelope information obtained from the applicant. Shadows were modeled using the solar rendering capabilities of MicroStation V8 software.

SCREENING

To identify sun-sensitive resources that could potentially be affected by project-generated shadow, the maximum shadow sweep of the proposed building envelopes were drawn on a map. The shadow sweep was determined by the maximum length of shadows that could fall in any direction, based on the heights of the proposed building envelopes. The full 2013 build-out of the Proposed Project was used in the screening, with building envelopes ranging in height from one story up to the 75' section of the mixed-use building on parcel 4a/b. The screening analysis determined that two sun-sensitive resources would be located within or partially within the areas that could be reached by incremental shadow from the Proposed Project as follows:

- **The Thomas Jefferson High School Athletic Fields** is an already-built Department of Education facility located on Flatlands Avenue. It contains athletic fields suitable for active recreation; and
- **The parkland within the FCURA** was created as part of the 1996 Plan. It is currently located just south of the parcels where the proposed buildings would be built under the Proposed Project. However, as part of the Proposed Action, the parkland within the FCURA would be extended north along the western side of the FCURA to Flatlands Avenue. This northern portion of the park would be located across Gateway Drive from the westernmost proposed buildings of the Proposed Project. This park includes both walking trails and open grass fields.

The screening analysis concluded that the shadows would not be long enough to reach the tidal or freshwater wetlands within and adjacent to the FCURA.

ASSESSMENT OF SHADOW IMPACTS

The sun rises in the east and casts its earliest (and longest) shadows towards the west. Later in the morning, the sun rises higher in the sky, casting shorter shadows towards the northwest. At noon, the sun is at its highest point in the sky and casts the shortest shadows of the day directly north. (During Daylight Savings Time, this occurs at 1:00 PM rather than at noon.) In the afternoon, the sun continues to move west and begins to descend, casting longer shadows toward the northeast and east. At the end of the day, just before the sun sets in the west, shadows are slightly shorter than just after sunrise.

In its yearly cycle, the height of the sun in the sky and the time and compass direction at which it rises and sets varies by season. In the winter, the sun travels in a low arc across the southern sky, rising late in the southeast and setting early in the southwest. Because it is so low in the sky, the sun casts longer shadows. In the spring and fall, the sun arcs through the sky at a somewhat higher angle, rises earlier in the east, and sets later in the west. In these seasons, shadows are of moderate length. In the summer, the sun arcs through the sky at its highest angle, rising almost directly overhead at noon. For this reason, summer shadows are shortest. However, in the summer the sun rises at its earliest and sets at its latest, and it also travels farther from the northeast to the northwest. Therefore, the summer sun casts shadows in more directions than

those seen in other seasons, and its late sunset and early sunrise creates shadows earlier in the morning and later in the evening than in other seasons.

C. EXISTING CONDITIONS

Presently, the area of the FCURA to be developed under the Proposed Project is vacant. Therefore, there are limited areas of shadow on the Thomas Jefferson Athletic Fields and the wetlands along Hendrix Creek.

D. 2011 THE FUTURE WITHOUT THE PROPOSED ACTION

Absent the Proposed Action, the FCURA will be developed in accordance with the 1996 Plan. New housing that will be constructed adjacent to the Thomas Jefferson High School Athletic Fields will cast shadows on that open space during certain time periods. New shadows cast by the proposed buildings of the 1996 Plan will be very small in extent and short in duration, and will not occur at all on one of the four analysis days. In December, when the duration of new shadows will be greatest, the area that will be covered by the new shadow will still be small. Additionally, the fields are active recreation facilities that are less sensitive to increases in shadow than such facilities as seating areas or children's water sprinklers.

E. 2011 PROBABLE IMPACTS OF THE PROPOSED ACTION

This section and Table 6-1 describe the extent and duration of incremental shadow on the sun-sensitive resources identified above.

Table 6-1
2011 Incremental Shadow Durations

Sun-sensitive resource	March 21 8:36 AM-5:29 PM EDT	May 6 7:27 AM-6:18 PM EDT	June 21 6:57 AM-7:01 PM EDT	December 21 8:51 AM-2:53 PM EST
Thomas Jefferson High School Athletic Fields	8:36 AM – 8:40 AM 4:15 PM – 5:29 PM Total: 1h 18m	5:15 PM – 6:18 PM Total: 1h 3m	—	8:51 AM – 11:30 AM 1:15 PM – 2:53 PM Total: 4h 17m
The parkland within the FCURA (Undeveloped)	—	—	—	—
Notes: EST—Eastern Standard Time; EDT—Eastern Daylight Time March 21 is the equivalent of September 21; May 6 is the equivalent of August 6				

The proposed two- and three-story residential buildings on the adjacent block to the west of the fields would be completed by 2011, and would cast very small areas of shadow at the end of the March 21/September 21, May 6/August 6, and December 21 analysis days. Incremental shadow durations would range from about an hour in the late spring to approximately an hour and a half in the winter. Shadows from these buildings would be too short to reach the fields on the June 21 analysis day.

The proposed two- and three-story residential buildings on the adjacent block to the south of the fields would also be completed in 2011, and would cast small areas of shadow for several minutes at the start of the March 21/September 21 analysis day, and for about two hours and 40 minutes at the start of the December 21 analysis day. These buildings would not cast shadow on the fields on the May 6/August 6 and June 21 analysis days.

Overall, in the 2011 Build year the Proposed Action would not result in a significant adverse shadow impact to the Thomas Jefferson High School Athletic Fields. Incremental shadow cast by the proposed buildings would be very small in extent and short in duration, and would not occur at all on one of the four analysis days. In December, when incremental shadow duration would be greatest, the area that would be covered by the new shadow would still be small. Additionally, the fields are active recreation facilities that are less sensitive to increases in shadow than such facilities as seating areas or children's water sprinklers.

The parkland within the FCURA would not be extended northward by 2011, but existing grassland and natural habitat would remain on this undeveloped portion of land. However, new buildings associated with the Proposed Project would not cast shadows on this land.

F. 2013 THE FUTURE WITHOUT THE PROPOSED ACTION

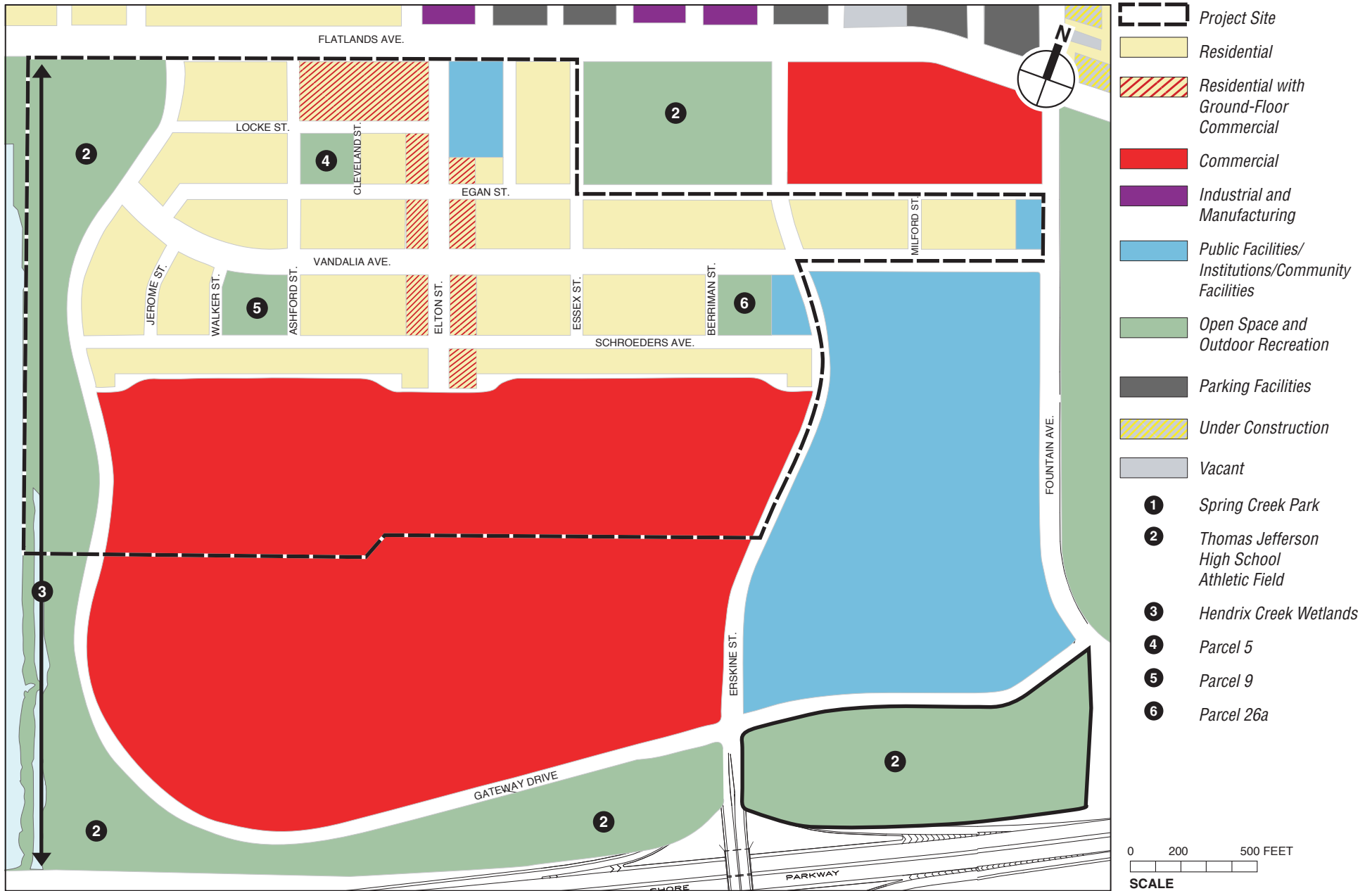
Absent the Proposed Action, the FCURA would be developed in accordance with the 1996 Plan. The 1996 Plan includes low- and mid-rise residential and community facility buildings as well as three interior parks and the completion of the parkland within the FCURA. New buildings will cast shadows on the open space resources that are part of the 1996 Plan. The buildings in closest proximity to these open spaces would range in height from two to three stories (approximately 20 to 30 feet). The tallest buildings would be 10 stories (approximately 100 feet) but would be further from the open spaces and their shadows would be intercepted by intervening buildings. Therefore, given the height and arrangement of the proposed buildings, shadows will not be extensive and will not adversely affect new open space resources within the FCURA.

G. 2013 PROBABLE IMPACTS OF THE PROPOSED ACTION

In the 2013 Build year, all the proposed buildings would be complete (see Figure 6-1). The parkland within the FCURA would also be extended northward to Flatlands Avenue, and three new interior parks (Parcels 5, 9, and 26b) would be constructed. Incremental shadow extent and duration on the Thomas Jefferson High School Athletic Fields would be the same as in the 2011 Build year, and the parkland within the FCURA and the three new interior open spaces would receive small areas of incremental shadow for generally short durations at the beginning and/or the end of each of the four analysis days (see Table 6-2).

Table 6-2
2013 Incremental Shadow Durations

Sun-sensitive Resource	March 21 8:36 AM-5:29 PM EDT	May 6 7:27 AM-6:18 PM EDT	June 21 6:57 AM-7:01 PM EDT	December 21 8:51 AM-2:53 PM EST
Thomas Jefferson High School Athletic Fields	8:36 AM – 8:40 AM 4:15 PM – 5:29 PM Total: 1h 18m	5:15 PM – 6:18 PM Total: 1h 3m	—	8:51 AM – 11:30 AM 1:15 PM – 2:53 PM Total: 4h 17m
The parkland within the FCURA (northern portion)	8:36 AM – 10:00 AM Total: 1h 24m	7:27 AM – 9:00 AM Total: 1h 33m	6:57 AM – 8:45 AM Total: 1h 48m	8:51 AM – 9:45 AM Total: 54m
Parcel 5	8:36 AM – 8:45 AM 4:15 PM – 5:29 PM Total: 1h 23m	7:27 AM – 8:15 AM 5:15 PM – 6:18 PM Total: 1h 51m	6:57 AM – 8:15 AM 6:00 PM – 7:01 PM Total: 2h 19m	8:51 AM – 11:30 AM 1:15 PM – 2:53 PM Total: 4h 17m
Parcel 9	8:36 AM – 9:15 AM 4:15 PM – 5:29 PM Total: 1h 53m	7:27 AM – 8:15 AM 5:15 PM – 6:18 PM Total: 1h 51m	6:57 AM – 8:15 AM 6:00 PM – 7:01 PM Total: 2h 19m	8:51 AM – 12:00 PM 1:15 PM – 2:53 PM Total: 4h 47m
Parcel 26b	8:36 AM – 9:15 AM 4:15 PM – 5:29 PM Total: 1h 53m	5:15 PM – 6:18 PM Total: 1h 3m	6:00 PM – 7:01 PM Total: 1h 1m	8:51 AM – 11:30 AM 1:15 PM – 2:53 PM Total: 4h 17m
Notes: EST—Eastern Standard Time; EDT—Eastern Daylight Time March 21 is the equivalent of September 21; May 6 is the equivalent of August 6				



MARCH 21/SEPTEMBER 21 ANALYSIS DAY – 8:36 AM TO 5:29 PM

Small areas of incremental shadow would be cast on the Thomas Jefferson High School Athletic Fields, the parkland within the FCURA, and the three interior parks at the start of the analysis day at 8:36 AM, but shadows move quickly early in the morning and the incremental shadow would exit the Thomas Jefferson High School Athletic Fields and the three proposed parks on Parcels 5, 9, and 26b at or before 9:15 AM (see Figures 6-2 and 6-3). The incremental shadow would exit the parkland within the FCURA at 10:00 AM. The open spaces would be in full sun until 4:15 PM, when incremental shadow would enter the three proposed parks on Parcels 5, 9, and 26b and also the Thomas Jefferson High School Athletic Fields, and would remain until the end of the analysis day at 5:29 PM (see Figure 6-4). The parkland within the FCURA would not experience incremental shadow at the end of this analysis day. New shadows cast by the Proposed Project's buildings would not extend to the wetlands along Hendrix Creek.

Given the very small extent and short durations of incremental shadow, and the lack of existing shadow throughout the day, the Proposed Project would not result in a significant adverse shadow impact on March 21/September 21.

MAY 6/AUGUST 6 ANALYSIS DAY – 7:27 AM TO 6:18 PM




At the start of the analysis day at 7:27 AM, small areas of new shadow would be cast on the parkland within the FCURA and the new parks on Parcels 5 and 9. The incremental shadow would shrink quickly eastward (see Figure 6-5) and exit Parcels 5 and 9 at 8:15 AM, and the parkland within the FCURA at 9:00 AM. The proposed park on Parcel 26b and the Thomas Jefferson High School Athletic Fields would not receive any incremental shadow at this time. All five open spaces would be in sun for the rest of the morning and afternoon, until 5:15 PM, when incremental shadow would enter the three proposed parks on Parcels 5, 9, and 26b; and the Thomas Jefferson High School Athletic Fields. The extent of incremental shadow on these open spaces would stay small for the remaining hour and three minutes of the analysis day (see Figure 6-6). The parkland within the FCURA would not experience incremental shadow at the end of the day. New shadows cast by the Proposed Project's buildings would not extend to the wetlands along Hendrix Creek.

Given the small extent and short durations of incremental shadow, and the lack of existing shadow throughout the day, the Proposed Project would not result in a significant adverse shadow impact on May 6/August 6.

JUNE 21 ANALYSIS DAY – 6:57 AM TO 7:01 PM




Incremental shadow would reach the parkland within the FCURA and the proposed parks on Parcels 5 and 9 from the start of the analysis day at 6:57 AM. The shadow would move off the two proposed parks at 8:15 AM and off the parkland within the FCURA at 8:45 AM. The areas of incremental shadow would be small. No shadow from the Proposed Project would reach the proposed park on Parcel 26b and the Thomas Jefferson High School Athletic Fields in this early morning period (see Figure 6-7). No further incremental shadow would occur until 6:00 PM, when shadow from the proposed buildings would enter the three proposed parks on Parcels 5, 9, and 26b. The incremental shadow would stay for the remaining one hour and one minute of the analysis day (see Figure 6-8). The parkland within the FCURA and the Thomas Jefferson High School Athletic Fields would not experience incremental shadow at the end of the June analysis day. New shadows cast by the Proposed Project's buildings would not extend to the wetlands along Hendrix Creek.



-  Shadow
-  Open Space
-  Incremental Shadow on Open Space




0 200 400 FEET
SCALE



-  Shadow
-  Open Space
-  Incremental Shadow on Open Space




0 200 400 FEET
SCALE



-  Shadow
-  Open Space
-  Incremental Shadow on Open Space




0 200 400 FEET
SCALE



-  Shadow
-  Open Space
-  Incremental Shadow on Open Space




0 200 400 FEET
SCALE



-  Shadow
-  Open Space
-  Incremental Shadow on Open Space




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SCALE



-  Shadow
-  Open Space
-  Incremental Shadow on Open Space

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SCALE



-  Shadow
-  Open Space
-  Incremental Shadow on Open Space

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SCALE

Given the small extent and short durations of incremental shadow, and the lack of existing shadow throughout the day, the Proposed Project would not result in a significant adverse shadow impact on June 21.

DECEMBER 21 ANALYSIS DAY – 8:51 AM TO 2:53 PM

On December 21, when shadows are longest, the proposed buildings would cast shadow on the Thomas Jefferson High School Athletic Fields, the parkland within the FCURA, and the proposed interior parks at the start of the analysis day. In the cases of the parkland within the FCURA and the Thomas Jefferson High School Athletic Fields, the extent of incremental shadow on these spaces would be quite small relative to the overall size of the space. The incremental shadow would exit the parkland within the FCURA at 9:45 AM and the athletic fields at 11:30 AM.

The size of the shadow on Parcels 5, 9, and 26b at the start of the analysis day would be greater than at other times of the year, though never large enough to cover more than half of their area (see Figure 6-9). The shadows move quickly on the short December day, and would shrink eastward and exit Parcels 5 and 26b at 11:30 AM, and Parcel 9 at 12:00 PM (see Figure 6-10).

At 1:15 PM incremental shadow would move onto the three proposed parks on Parcels 5, 9, and 26b and the Thomas Jefferson High School Athletic Fields, and remain until 2:53 PM (see Figures 6-11 and 6-12). The parkland within the FCURA would not receive new shadow during this afternoon period. However, as with the morning shadows, the afternoon shadows would cover only a small portion of these open space resources.




While the extent and duration of incremental shadow is greater in December than at other times of the year, the majority of the parks, and the athletic field, would remain mostly in sun during this analysis day and would not experience a significant adverse impact. *



- Shadow
- Open Space
- Incremental Shadow on Open Space




0 200 400 FEET
SCALE



-  Shadow
-  Open Space
-  Incremental Shadow on Open Space




0 200 400 FEET
SCALE



-  Shadow
-  Open Space
-  Incremental Shadow on Open Space

0 200 400 FEET
SCALE



-  Shadow
-  Open Space
-  Incremental Shadow on Open Space

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