A. INTRODUCTION

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 inspires outdoor activities, supports vegetation, and enhances architectural features, such as stained-glass windows and carved detail on historic structures. Conversely, shadows can affect the growth cycle and sustainability of natural features, and the architectural significance of built features.

The *City Environmental Quality Review (CEQR) Technical Manual* requires a shadow assessment for proposed actions that would result in new structures or additions to existing structures greater than 50 feet in height or adjacent to an existing sunlight-sensitive resource. Such resources include publicly accessible open spaces, important natural features, and historic resources with sun-sensitive features. Under CEQR, an adverse shadow impact may occur if a project's shadow adversely affects the use and/or important landscaping and vegetation of a publicly accessible open space or obscures details that make a historic resource significant. For these reasons, shadow analyses are coordinated with the open space and historic resources analyses.

Phase 1 of the Phased Redevelopment of Governors Island (the Proposed Project) would create new public open spaces both in and out of the Governors Island Historic District, but would not result in any new structures. Therefore, no further shadows assessment is necessary for Phase 1.

The Later Phases-Island Redevelopment component would include the development and construction of new buildings in the two development zones on the South Island, as well as the reuse of existing buildings on the North Island. As described in Chapter 3, "Land Use, Zoning, and Public Policy," it is assumed that the new development in the two South Island development zones would total approximately 1.65 million square feet.

No structures for the South Island development zones have been designed at this time. Therefore, the shadow study describes potential shadow effects of example buildings. It is expected that shadow impacts would have to be considered as part of the environmental review process for the land use actions necessary when future development is planned and designed.

B. PRINCIPAL CONCLUSIONS

PHASE 1

Phase 1 of the Proposed Project would not result in any new structures and, therefore, would not cause any adverse shadow impacts. However, it would improve some existing areas (such as the paved area at Soissons Landing) and create new open space areas that would become sun-sensitive open spaces.

LATER PHASES

The Later Phases-Park and Public Spaces would also not result in any tall structures but would add to the inventory of sun-sensitive open spaces.

The Later Phases-Island Redevelopment would likely result in new shadows on portions of the open spaces created or improved by the Proposed Project. Open spaces and any sun-sensitive historic resources that are near the development zones and to their east, north, and west would be more likely to experience project-generated shadows than those farther away or directly south of the development zones. If the affected open spaces were not created by the Proposed Project, it is possible that some incremental shadows from development zone structures would be considered to have significant adverse impacts. On the other hand the North Island open spaces and historic resources that are farther away from the development zones (i.e., north of Liggett Hall) would likely be only minimally affected by project-generated shadows, although this would depend on the height, location, and configuration of the structures that are eventually built in the development zones. The design and programming of the proposed Park and Public Spaces would reflect the expected sunlight and shadow conditions at each location, to address potential shadow effects. Additionally, the two development zones would be planned and developed to minimize shadow impacts on the Island's open spaces. Shadows cast by new buildings could affect utilization of these open spaces, particularly in the cooler weather months. In any case, it is expected that there would be further review of shadows when the development is actually proposed because it is very likely to require land use actions that are subject to environmental review by the City Planning Commission or the Board of Standards and Appeals.

C. DEFINITIONS AND METHODOLOGY

In the shadows assessment presented herein, methodology from the 2010 *CEQR Technical Manual* was followed wherever practicable. As already noted, however, no structures for the South Island development zones have been designed or even contemplated at this time. This assessment therefore focused on identifying and describing sensitive receptors, locating them in relation to the development zones, and assessing their potential sensitivity to shadows.

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, if the project-generated open space is included in the detailed qualitative analysis in Chapter 6, "Open Space," shadows that fall on it must be assessed and documented with the same level of detail as the other sunlight-sensitive resources.

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

In accordance with the 2010 *CEQR Technical Manual*, a preliminary assessment is first conducted to determine whether shadows from the Proposed Project could be long enough to fall on any nearby sun-sensitive resources. The length of a shadow depends on the height of the structure that casts it, as well as the time of day and the season. The heights, configurations, and locations of the proposed structures within the development zones are unknown at this time, and further, they are not limited by any specific zoning regulations, Federal Aviation Administration height restrictions, or other such factors. Therefore, the shadows assessment of the Later Phases-Island Redevelopment can only describe the sunlight-sensitive resources across the Island, provide an overview of how shadows work and how their effects are assessed, and consider the distance between the development zones and the resources of potential concern in order to provide some contextual guidelines for impact assessment and future design considerations.

In order to consider the potential effects that future project-generated shadows could have on their surrounding environment, in comparison with the future without the Proposed Project, the following tasks were performed:

- Identify and map potentially sun-sensitive resources in the vicinity of the Proposed Project, including open spaces, historic structures, and important natural features;
- Outline the basics of how shadows work and how their effects are assessed;
- Describe the distance between the identified sun-sensitive resources and the development zones;
- Identify the potential uses and users of the sun-sensitive resources; and
- Describe the proposed vegetation and consider its potential sensitivity to increased shadows.

The open space improvements that would occur with Phase 1 of the Proposed Project would be completed before the new buildings of the Later Phases-Island Redevelopment; therefore, the

improved open spaces are included in the inventory of potentially sun-sensitive resources. However, as noted above, these improved open spaces are part of the Proposed Project and could not experience a significant adverse shadow impact from any new development because those improvements would not take place without the Proposed Project. Any discussion of potential adverse shadow impacts would therefore be in relation to resources that would continue to exist in their current form absent the Proposed Project.

It is not currently known whether the open space improvements of the Later Phases would occur prior to, or after new buildings would be constructed in the South Island development zones. This assessment conservatively assumes that all the project-generated open space would be completed before any new buildings are constructed in the development zones.

D. INVENTORY OF SUNLIGHT-SENSITIVE RESOURCES

This section describes the publicly accessible open spaces, sun-sensitive features of historic resources, and important natural features adjacent to or near the two development zones on the South Island. **Figure 7-1** shows the locations of all the resources discussed in this section. As described in Chapter 8, "Historic and Cultural Resources," the entire Island north of Division Road is in the Governors Island Historic District as listed on the State and National Registers of Historic Places and as designated by the New York City Landmarks Preservation Commission.

OPEN SPACES

THE FORT JAY GLACIS AND THE PARADE GROUND

The large, open lawn area sloping down from Fort Jay on all sides dominates the center of the North Island. This large, passive open space is currently used for picnics, passive recreational activities and the occasional concert. Phase 1 would improve this area to support both active and passive recreation. The southern end of the space would be regraded and improved to create flat sports fields.

The Glacis (defined as a slope in front of a fortification) includes what is known as the Parade Ground area, according to the *Governors Island Historic Preservation Design Manual* (2003), and is considered a sun-sensitive feature of the Governors Island National Monument and the Governors Island Historic District.

COLONELS ROW GREEN

Colonels Row Green is a triangular, passive open space southwest of the Fort Jay Glacis. It contains mature trees and grass. Phase 1 would include limited improvements to support ongoing use as festival grounds and a concert venue. It is considered a sun-sensitive landscape feature of the Governors Island Historic District.

NOLAN PARK

Nolan Park is a four-acre lawn with mature trees located east of the Fort Jay Glacis and Parade Ground. Phase 1 would enhance the space with selective plantings and reconstructing existing brick paths to improve accessibility. It is considered a sun-sensitive landscape feature of the Governors Island Historic District.

National Monument Boundary (Owned by the National Park Service)

North Island Coterminous Historic Districts

THE HILLS *Sunlight-Sensitive Open Space, Historic or Natural Resource Feature*

0 400 800 FEET

SCALE

PROPOSED PHASED REDEVELOPMENT OF
GOVERNORS ISLAND

Sunlight-Sensitive Resources
Figure 7-1

SOISSONS LANDING

Phase 1 would transform the areas around Soissons Dock, where ferries arrive, into public plazas with lawn, trees, and benches. The plazas would be new, sunlight-sensitive open space features within the Historic District boundary.

SOUTH BATTERY

The South Battery is a historic structure located south of the Parade Ground area. The asphalt surface that currently surrounds the building would be replaced in Phase 1 with lawn, trees, shrubs, and seating areas. As a result, this area would be a new, public passive open space located in the Historic District.

LIGGETT TERRACE

Phase 1 would include the replacement of the series of parking lots and lawns south of the large Liggett Hall building with a new public plaza containing flower beds, labyrinthine hedges, fountains, public art, seating areas, concession stands, and a children's play area. This new public plaza would be located within the Historic District.

GOVERNORS ISLAND NATIONAL MONUMENT AND GOVERNORS ISLAND HISTORIC DISTRICT (GENERAL)

Apart from the specific areas and landscapes listed above, the *Governors Island Historic Preservation Design Manual* (2003) describes a number of mature trees and other landscape elements adjacent to and associated with particular structures in these historic areas that should be preserved.

HAMMOCK GROVE

South of Liggett Terrace, and outside the Historic District boundary, Phase 1 open space improvements would include the creation of Hammock Grove—a 10-acre area full of trees and hammocks with meandering paths.

PLAY LAWN

Southwest of the proposed Hammock Grove, the 12-acre Play Lawn would be the largest multi-purpose open space on the Island. This area would have ball fields for active recreation as well as smaller open spaces with rolling topography.

THE HILLS

In the Later Phases-Park and Public Spaces, four hills between 32 feet and 82 feet in height would be constructed on the South Island, transforming the topography of the Island. The Hills would be planted with ground cover, shrubs, plants, and trees. In addition, there would be several pathways to explore the Hills.

This shadows assessment conservatively assumes that the Hills would be developed before the buildings in the development zones, as they would replace space that is currently not open to the public.

LIBERTY TERRACE

The Later Phases-Park and Public Spaces would also include the development of Liberty Terrace, a gathering area with covered outdoor seating, benches, moveable tables and chairs, and play areas located on the west side of the South Island.

The shadows assessment conservatively assumes that Liberty Terrace would be developed before the buildings in the development zones. Currently, this area of the South Island is not open to the public.

PICNIC POINT/SOUTH PROW

Picnic Point is currently a publicly accessible open space on the South Island. Located at the southern end of the Island, it is a primarily passive open space resource that includes picnic tables, hammocks, swings, temporary art installations, and a small farm.

In the Later Phases-Park and Public Spaces, this space would be developed into the Hills (see above) and Wetland Gardens, a three-acre area with a variety of wetland plants, an adjacent picnic area, and the South Prow Overlook, which would have benches and other seating.

THE GREAT PROMENADE

The Promenade is a 2.2-mile path around the perimeter of the Island. This open space resource provides waterfront seating areas as well as opportunities for walking, running, bicycling, and rollerblading, among other activities. Currently, the Promenade consists mostly of roadway that is car-free, except for maintenance and related functions.

In the Later Phases-Park and Public Spaces, new paving elements, lighting, way-finding, and guardrails would be added to the Promenade. The Promenade would have two levels on the western side of the Island and at the southern end. At both of these locations, the lower levels of the Promenade would allow for biking or walking near the water's edge. The upper levels would have trees and benches.

SUN-SENSITIVE FEATURES OF HISTORIC RESOURCES

GOVERNORS ISLAND NATIONAL MONUMENT AND THE GOVERNORS ISLAND HISTORIC DISTRICT

The Governors Island National Monument and the Governors Island Historic District comprise lawns, mature trees, buildings, walkways and driveways. The lawns and trees throughout the National Monument and Historic District are sun-sensitive features that must be considered in the shadow assessment. These historic landscape features are also elements of publicly accessible open spaces and are described in the preceding section, "Open Spaces."

WINDOWS OF THE CHAPEL OF ST. CORNELIUS

The Chapel of St. Cornelius is located between Nolan Park and the South Battery. It has arched leaded and stained-glass windows on all the façades. The windows are existing sun-sensitive features that are included in the assessment of project-generated shadow effects.

IMPORTANT NATURAL FEATURES

UPPER NEW YORK BAY AND BUTTERMILK CHANNEL

Governors Island is surrounded by the Upper New York Bay with the Buttermilk Channel to the southeast. These tidally influenced waters support a diverse and productive aquatic community of primary producers (phytoplankton, zooplankton, submerged aquatic vegetation (SAV) and benthic algae and invertebrates) and fish.

Sunlight penetration is an important factor in determining phytoplankton, SAV, and benthic algae productivity and biomass. Therefore, areas of the Upper New York Bay and Buttermilk Channel near the development zones are included in the shadows assessment.

E. DAILY AND SEASONAL VARIATIONS IN SHADOWS

The Earth spins on a tilted, not perpendicular, axis, relative to its yearly revolution around the sun (see **Figure 7-2**). During the months when the northern hemisphere is tilted away from the sun, it is winter there, and there is daylight for less than half the 24-hour day. The winter solstice occurs at the point in the annual revolution when the pole is tilted directly away from the sun. On the opposite side of the circle, when the northern hemisphere is tilted toward the sun, it is summer there, and there is daylight for more than half the 24-hour day. Summer solstice occurs when the axis is tilted most directly toward the sun. In between the winter and the summer, and again between the summer and the winter, the axis is tilted neither toward nor away from the sun, resulting in spring and fall.

Each day, the sun rises in the east, casting long shadows toward the west. Later in the morning, the sun rises higher in the sky, casting shorter shadows toward 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, shadows stretch to the east as the sun sets in the west.

In its yearly cycle, the height of the sun in the sky and the time and compass direction at which it rises and sets vary by season (see Figure 7-2). 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, it 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. In the summer, the sun rises earliest and sets latest; it also travels farther, rising from the northeast to high in the southern sky at noon and then arcing down to the northwest at dusk. Thus, the summer sun casts shadows in more directions than those seen in other seasons and the late sunset and early sunrise creates shadows earlier in the morning and later in the evening than in other seasons.

F. SHADOWS ANALYSIS FRAMEWORK

In accordance with CEQR methodology, a base map is developed showing the project site and the inventory of nearby sunlight-sensitive resources (as in Figure 7-1). In the next tier of assessment, to determine if and when project generated shadow could fall on a sunlight-sensitive resource, three-dimensional computer mapping software is typically used to calculate and

Seasons in the northern hemisphere

The Earth spins on a tilted, not perpendicular, axis, relative to the plane of its yearly trip around the sun.

During the months when the northern hemisphere is tilted away from the sun, it is winter there. The winter solstice occurs at the point in the annual revolution when the pole is tilted directly away from the sun.

On the opposite side of the circle, when the northern hemisphere is tilted toward the sun, it is summer there. Summer solstice occurs when the axis is tilted most directly toward the sun.

In between the winter and the summer, and again between the summer and the winter, the axis is tilted neither toward nor away from the sun, resulting in spring and fall.

Legend

Daily path of the sun in the sky on the solstices and equinoxes in NYC

Sun, Earth and Shadows
Figure 7-2

display the proposed project's shadows over the course of individual representative days of the year. The 2010 *CEQR Technical Manual* provides specific parameters for assessing shadows, given the daily and seasonal variations.

REPRESENTATIVE DAYS FOR ANALYSIS

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

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.

SHADOW PATTERNS IN NEW YORK CITY

Figure 7-3 shows a hypothetical building located somewhere in New York City and the shadows it would cast on the four representative analysis days. As noted in "Daily and Seasonal Variations in Shadows," above, shadows on December 21 are long, but fall in a limited arc starting to the northwest and ending to the northeast. The longest shadows are cast at the beginning and end of the analysis period when the shadow length is 4.27 times the height of the building. The shortest shadows occur at noon when the length is 2.07 times the height of the building.

On June 21, shadows are short through the middle of the day but fall farthest to the southwest and southeast early and late in the day. Again, the longest shadows are cast at the beginning and end of the analysis period when the shadow length is 4 times the height of the building. The shortest shadows occur at noon when the length is 0.31 times the height of the building.

G. THE FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the Proposed Project, it is assumed that Governors Island will continue to operate much as it does today. There are no specific plans to develop or construct any new structures. Demolition of existing buildings on the South Island, all of which are non-historic, as well as a handful of buildings on the North Island will be completed in the future without the Proposed Project.

5.27.11

December 21

March 21/Sept. 21

May 6/August 6

June 21

Note: Daylight Saving Time not used.

Daily and Seasonal Shadow Patterns in New York City
Figure 7-3

H. POTENTIAL IMPACTS OF THE PROPOSED PROJECT

PHASE 1

Phase 1 of the Proposed Project would not result in any new structures, and therefore, would not cause any adverse shadow impacts.

LATER PHASES

As described in Chapter 1, "Project Description," two future development zones totaling 33 acres has been delineated on the South Island. A 6.5-acre development zone is located on the west side of the Island facing New York Harbor (western development zone), and a 26.5-acre development zone faces Buttermilk Channel and Brooklyn (eastern development zone).

Some resources are more likely to be in the path of project-generated shadows than others. These are the resources located adjacent to or very close to the two development zones, to the north, east or west. Resources that are further away are less likely to be affected and those that are directly to the south of any new buildings would not receive new shadows.

In addition, the particular uses of a resource—its vegetation and other characteristics—establish its sensitivity to shadows. Passive recreation uses and elements such as benches and lawns are considered more sensitive than active uses such as bikeways or soccer fields. Similarly, some types of vegetation or natural habitat may more sensitive to sunlight than others. Flower beds, wetland areas, or certain types of tree species may require more hours of sunlight than other types of vegetation, for example.

RESOURCES WITHIN 100 FEET OF THE DEVELOPMENT ZONES

The following sun-sensitive resources are located adjacent to, or within approximately 100 feet of, at least one of the two development zones:

- Portions of the Upper New York Bay
- Picnic Point South Prow
- Portions of the Great Promenade
- The Hills
- Liberty Terrace
- Play Lawn
- Hammock Grove
- Liggett Terrace
- Yankee Landing
- Buttermilk Channel

Liberty Terrace is southwest of the western development zone and not closer than 800 feet to the eastern development zone, so it would be less likely than the others to experience shadow effects from the development zones.

Resources within this distance from the development zones and located to the north, east or west are likely to receive additional shadow from any building on the edge of the development zone.

RESOURCES BETWEEN 400 AND 800 FEET FROM THE DEVELOPMENT ZONES

The following resources are between approximately 400 feet and 800 feet to the north, east or west from at least one of the development zones:

- Colonels Row Green
- Portion of the Parade Ground
- South Battery

A small portion of the western edge of the National Monument area also lies within about 800 feet of the western development zone. However, this area contains a building and a parking lot area that are not sunlight-sensitive resources.

A building located on the northern edge of either development zone would have to be approximately 130 feet or taller to cast a shadow long enough to reach beyond the existing shadows of Liggett Hall and buildings adjacent to it and onto Colonels Row Green at the end of the December 21 analysis day when shadows are longest. The same hypothetical building at the northern edge of either development zone would have to be approximately 160 feet or taller to cast a shadow that would reach beyond existing shadows and fall on Colonels Row Green at the end of the March 21/September 21 analysis day.

A building located at the eastern development zone's northern edge could be as tall as approximately 100 feet without casting new shadow on the South Battery area at the end of the December 21 analysis day, or perhaps 130 feet, depending on how intervening shadows from the Yankee Landing area would fall at that time. Such a building could be about 125 feet (or 160 feet depending on existing intervening shadows) before it would cast shadow on South Battery at the end of the March 21/September 21 analysis day.

A building at the northern edge of the eastern development zone would have to be at least 130 feet in height before its shadow could reach the southern edges of the Parade Ground area on December 21; it would have to be nearly 200 feet or higher to reach that space at the end of the March 21/September 21 analysis day.

RESOURCES FARTHER THAN 800 FEET FROM THE DEVELOPMENT ZONES

The windows of the Chapel of St. Cornelius are between 800 and 900 feet from the northern edge of the eastern development zone. There are windows on all façades, including those that face the development zones. Shadow cast by a building located at the northern edge of the eastern development zone would not fall far enough to the east on December 21 to reach the Chapel. The same building would have to be taller than about 280 feet to cast a shadow long enough to reach the Chapel at the end of the March 21/September 21 analysis day, though the intervening building at South Battery might cast existing shadow on the Chapel at that time.

The southern edge of Nolan Park is about 1,100 feet northeast of the nearest development zone boundary. A building located at that development zone boundary would have to be approximately 440 feet or taller to reach Nolan Park.

Much of the Fort Jay Glacis on the west side is between about 800 and 1,200 feet from the nearest boundary of the western development zone, and the southern portion of the Glacis is a similar distance from the nearest eastern development zone boundary. A building at the northern edge of the western development zone would have to be a minimum height of 280 feet to cast a shadow long enough to reach the Fort Jay Glacis; this would occur at the end of the March

21/September 21 analysis day (on December 21, any shadow from the western development zone would not fall far enough east to fall on the Fort Jay Glacis). A building 220 feet or taller located at the northern edge of the eastern development zone would cast a shadow on December 21 that could reach the Fort Jay Glacis.

Soissons Landing is about 1,600 feet from the nearest development zone boundary. A building at the northern edge of the western development zone boundary would have to be more than 500 feet tall to cast a shadow that would reach Soissons Landing.

EXAMPLE BUILDINGS

In order to better visualize and understand potential shadow effects of the Later Phases-Island Redevelopment component of the Proposed Project, example buildings were analyzed at five locations in the development zones. Three buildings were hypothetically placed in the larger eastern development zone, and two buildings were hypothetically placed in the western development zone. The five example buildings were assigned heights of 131 feet, which is the height of Building 877, the tallest existing building on the South Island (including mechanical penthouse). The example buildings were modeled with footprints of approximately 85 feet by 95 feet, and sited approximately midway between the center and the periphery of the development zones.

Shadows were modeled using the representative days and timeframe windows of analysis described in Section F, "Shadows Analysis Framework," above. **Figures 7-4 through 7-7** show the shadow patterns and range for the five example buildings on December 21, March 21/September 21, May 6/August 6, and June 21 analysis days, respectively.

Governors Island is generally flat, and as a conservative assumption, it was modeled as if it were flat in the future with the completion of the Proposed Project. However, the proposed Hills open space and the existing Fort Jay Glacis would have variable elevation, making any shadows that fall on these areas from the development zones shorter than they appear in Figures 7-4 through 7-7.

It is noted that virtually all the buildings on the North Island would continue to exist and would continue to cast the same shadows they cast today. Therefore, Liggett Hall and the buildings adjacent to it would continue to cast shadow onto Colonels Row Green, the Parade Ground area, and other adjacent areas. In places where existing shadows fall, no additional shadow from the Proposed Project could occur.

In the example, on the December 21 analysis day (see Figure 7-4), shadows from the western development zone would fall on the Promenade and the waters of the Upper New York Bay in the morning, and possibly on portions of the trees or landscaping to the northeast of the development zone in the afternoon, although existing shadows would likely already fall there. Shadows from the eastern development zone would fall primarily across portions of Picnic Point/South Prow, the Hills, the Play Lawn, and Hammock Grove in the morning, and portions of the Hills and the Play Lawn in the afternoon. Shadow might also reach as far as the southern end of Colonels Row, but existing shadow from Liggett Hall would also likely fall there.

On March 21 and September 21 (see Figure 7-5), shadows from the western development zone would fall on the Promenade and the waters of the Upper New York Bay in the morning. Late in the afternoon, shadows could fall on a small portion of Hammock Grove, and possibly on a small area of Liggett Terrace, although existing shadows would likely already be falling there at that time. Shadows from the eastern development zone would fall primarily across a portion of

National Monument Boundary (Owned by the National Park Service)

North Island Coterminous Historic Districts

0 400 800 Feet

Range of Shadows Cast by Example 131'-High Buildings
December 21
Figure 7-4

National Monument Boundary (Owned by the National Park Service)

North Island Coterminous Historic Districts

0 400 800 Feet

Range of Shadows Cast by Example 131'-High Buildings
March 21 / Sept. 21
Figure 7-5

National Monument Boundary (Owned by the National Park Service)

North Island Coterminous Historic Districts

0 400 800 Feet

Range of Shadows Cast by Example 131'-High Buildings
May 6 / August 6
Figure 7-6

National Monument Boundary (Owned by the National Park Service)

North Island Coterminous Historic Districts

0 400 800 Feet

Range of Shadows Cast by Example 131'-High Buildings
June 21
Figure 7-7

Picnic Point/the South Prow and the Hills in the morning and a small area of trees and landscaping between Liggett Hall and Yankee Landing in the late afternoon, though existing shadow would likely already be falling there.

On May 6 and August 6 (see Figure 7-6), shadows are shorter than in the fall, winter, and early spring. Shadows from the western zone would fall on the Promenade and the waters of the Upper New York Bay early but would exit these resources by mid-morning. Late in the afternoon, shadow could fall across portions of Hammock Grove and Liggett Terrace. Shadows from the eastern development zone would fall on part of Picnic Point/the South Prow until mid-morning, very small areas of the Hills and the Play Lawn in the morning, and a small portion of the Great Promenade at the end of the analysis day.

On June 21 (see Figure 7-7), shadows from the western zone would fall on the Promenade and the Upper New York Bay early in the morning, and portions of the Play Lawn, Hammock Grove, and Liggett Terrace late in the afternoon. Shadows from the eastern zone would reach small areas of the Upper New York Bay and the Great Promenade very early and very late in the analysis day, as well as small areas of Picnic Point/the South Prow and the Hills briefly in the mid-morning.

In general the shadow analysis shows that buildings taller than 131 feet or closer to open spaces could cast larger shadows on sun-sensitive resources for longer periods. On the other hand shadows from shorter structures or structures of a similar height but located farther away would not reach so far into the open spaces.

The example using 131-foot-tall buildings at five locations demonstrates that portions of the South Island open spaces are likely to experience shadow from buildings in the development zones in all seasons. On the North Island, including the Historic District and National Monument, there would be only minimal shadows from any future new buildings, with the exception of the proposed Liggett Terrace open space, which is very close to the northern edges of both development zones.

Due to its location in Upper New York Bay, there are no structures to the south, east, or west of Governors Island that cast shadows on the South Island spaces. Therefore, the spaces on the east side of the Island would experience sun throughout the mornings in all seasons, while the spaces on the west side would experience sun throughout the afternoons in the spring, summer, and fall. Due to its location between the two development zones, Hammock Grove, similar to Liggett Terrace, could receive shadow from the buildings in the development zones both in the morning from the east and in the afternoon from the west.

The sunlight and shadow conditions on the new open spaces that would be expected to occur with the Later Phases-Island Redevelopment would inform the selection of plant materials and the design of the Park and Public Spaces. In areas that would be likely to experience more shade, such as areas adjacent to and north of a development zone, elements and materials more tolerant of shade conditions would be selected. In areas where long durations of sunlight would be expected, like much of Picnic Point/the South Prow, materials less sensitive to shadow and more tolerant of direct sunlight may be used.

POTENTIAL SHADOWS FROM THE HILLS

The four hills that would be constructed on the South Island as part of the proposed Later Phases-Park and Public Spaces would range between 32 feet and 82 feet in height, and could potentially cast shadows on the adjacent open space areas as well as Upper New York Bay.

Considering the maximum height of 82 feet, the longest shadow that the hills could cast during the analysis period would be 350 feet (82 feet x 4.27). Using the location and configuration of the hills as shown in Figure 7-1, shadows from the hills could reach a section of the Great Promenade, portions of Liberty Terrace and the Play Lawn, and a small area of Upper New York Bay in all seasons. The extent and duration of the shadows on these resources would vary by season, as shown in Figure 7-3, and based on the specific height, shape, and location of each hill. A small area in the northern portion of Picnic Point/the South Prow could also be reached in the late spring and summer analysis periods.

CONCLUSION

As noted earlier, the height, configuration, and location of buildings that would be built in the development zones in the Later Phases have not been determined at this time.

However, certain general conclusions can be reached from the shadows assessment presented above. The development zones and the four hills that would be constructed on the South Island are surrounded by publicly accessible open spaces, the waters of the Upper New York Bay, and the Governors Island Historic District, all of which are or contain sun-sensitive features. Therefore, any buildings developed in the Later Phases that would be located on the periphery of the development zones would likely be adjacent to a sun-sensitive resource. If multiple buildings are developed next to or near each other, a wider extent and longer duration of shadow would be generated on adjacent open space or surface water.

Open spaces and any sun-sensitive historic resources that are near the development zones and to their east, north, and west would be more likely to experience project-generated shadows than those farther away or directly south of the development zones. If the affected open spaces were not created by the Proposed Project, it is possible that some incremental shadows from development zone structures would be considered to have significant adverse impacts. The design and programming of the proposed Park and Public Spaces would reflect the expected sunlight and shadow conditions at each location, to address potential shadow effects. Additionally, the two development zones would be planned and developed to minimize shadow impacts on the Island's open spaces. Shadows cast by new buildings could affect utilization of these open spaces, particularly in the cooler weather months. It is expected that there would be further review of shadows when the development is actually proposed and designed. ✷