Chapter 23: Impact Avoidance Measures and Mitigation

A. INTRODUCTION

The preceding chapters of this environment impact statement (EIS) discussed the potential for significant adverse impacts to occur in each of the analyzed technical areas. In keeping with the objectives of CEQR/SEQR the proposed project has been designed to minimize impacts on the environment. Thus, in many technical areas the proposed project has built into the project, measures that avoid significant impacts. These measures are described in the various chapters of the EIS and are summarized below. Where significant impacts have been identified that go beyond these measures, or where mitigation requires the approval of other agencies, such as the New York City Landmarks Preservation Commission (LPC), tidal wetlands mitigation from the New York State Department of Environmental Conservation (DEC) or traffic mitigation measures that need to be coordinated with the New York City Department of Transportation (NYCDOT), in accordance with the *CEQR Technical Manual*, these mitigation measures are presented below. Technical areas that require no impact avoidance measures or mitigation include socioeconomic conditions, community facilities, open space, shadows, air quality and noise.

As described in Chapter 1, "Project Description," the proposed Fresh Kills Park project is expected to take about three decades to complete and for much of the project detailed programmatic and design decisions have not yet been determined. The three elements of the project that are further along in design and implementation are the "Digger" signage project, North Park Phase A, and the Arthur Kill Parking Lot in South Park. The Fresh Kills Park Draft Master Plan presented the vision for the Fresh Kills Park; however, decisions about programming of capital projects will be more refined and finalized as capital projects advance thereby taking into consideration the changing needs of the community and advances in technologies. As much of the project has not yet been fully designed, the impact avoidance and mitigation measure strategies presented in this chapter would minimize, avoid, and mitigate impacts. It is expected that these strategies will be refined and implemented as individual capital projects advance.

B. IMPACT AVOIDANCE MEASURES

LANDFILL PROTECTIONS[1]

Considering that the proposed project would provide the public with the opportunity to more closely approach the surface features associated with the leachate management system, and that

[1] Appendix H also presents additional conceptual approaches to avoiding landfill impacts for the park with additional details on the more advanced North Park Phase A.

park development may induce new loading conditions on the subsurface features, the following preliminary conceptual measures would avoid impacts to public health and the environment:

- Develop park designs that do not adversely affect the leachate control systems or final cover stability;
- Demonstrate that any changes to the site meet established performance standards of the landfill infrastructure and that the requirements of the post-closure care monitoring and maintenance plan are not compromised by the proposed design;
- Provide instrumentation to monitor for any deformations in the leachate control systems and cutoff wall that would provide data to DSNY if any park elements are adversely affecting the cutoff wall;
- Install locks at leachate collection well vaults, leachate collection well valve chambers, and associated electronic control panels. These measures are intended to protect the public against entry into confined spaces, where potentially unsafe atmospheric conditions may occur, and to protect the public from potential electrical hazards.
- Install security fences, locked gates and appropriate warning signs around leachate collection well vaults, valve chambers, and associated electronic control panels. These measures are intended to act as a deterrent against public interference with leachate management system features. The design of additional fencing and locks at the leachate management system features will require that designs do not conflict with existing post-closure care maintenance and operation program procedures.
- Install locking manhole covers at manholes located along the leachate transmission forcemain route.
- Install perimeter security fence around the Fresh Kills Leachate Treatment Plant and around the Landfill Section 6/7 leachate transmission forcemain pump station. The design of fencing around these leachate management system features will require that designs do not conflict with the existing post-closure care maintenance and operation program procedures.
- Bar malicious activities or vandalism inflicted upon leachate management system infrastructure, park development will not increase the amount of leachate generated, or adversely affect the function of the electrical-mechanical systems as currently designed.
- Provide park grounds keepers and security personnel to deter malicious acts or vandalism of leachate management system features. The grounds keepers and security personnel would receive training regarding identification of landfill infrastructure and would be provided with emergency contact information for responsible landfill personnel

With respect to the landfill gas management system, the following measures would avoid impacts to public health and the environment:

- Develop park capital project designs with DSNY and DPR coordination to avoid conflicts with the landfill gas management system features. Measures could include selection of road alignments that avoid flare locations, or use of living fences (i.e., thorn bushes), or landscaping that discourages activity on or along the landfill gas interceptor venting trench. The design would take into consideration any added post-closure care maintenance and monitoring activities that occur at the various landfill gas management system features.
- Redesign and retrofit existing landfill gas extraction well heads and passive gas vents for placement within securable subsurface vaults. This measure would be used to deter park

users from interfering with landfill gas features and avoid potential hazards related to combustion of landfill gas.

- Install permeable gas venting layers (i.e., gravel layers) across interceptor venting trenches where park development features would cover the interceptor venting trenches.
- Post signage to inform the public regarding hazards associated with landfill gas.
- Maintain seals on landfill gas vents to prevent escape of landfill gas into the atmosphere. Unsealing of the gas vents would not be allowed without modification to the existing Title V **[**and Part 360 air permits, which would involve review and approval by DEC.
- Install vapor barriers beneath all park structures and the installation of methane monitoring equipment within park structures, as necessary. The installation of new methane monitoring equipment would require a change to the post-closure care maintenance and operations plan.
- Install security fencing and locking gates around landfill gas flare pads and around the landfill gas purification plant.
- Install locking manhole covers on manholes associated with the landfill gas transmission main.
- Provide DPR staff and security personnel with the authority to deter malicious acts of vandalism of landfill gas management system features. The grounds keepers and security personnel would receive training regarding identification of landfill infrastructure and would be provided with emergency contact information for responsible landfill personnel.

With respect to the stormwater management systems, the following measures would avoid impacts to public health and the environment:

- Place surcharge loads over waste prior to final cover construction to induce and accelerate settlement.
- Install monitoring equipment to measure strain in the landfill cover system geosynthetic materials.
- Develop on-mound program features that minimize the use of large loads, or designing features that use lightweight fill.
- Develop landscape features to discourage park users from entering drainage channel.
- Post signage that informs park users that the stormwater management basins are not publicly accessible (until so designed) and that entry into stormwater culverts is prohibited.
- Provide DPR personnel with the authority to deter malicious acts or vandalism of final cover and stormwater management features. The grounds keepers and security personnel would receive training regarding identification of landfill infrastructure and would be provided with emergency contact information for responsible landfill personnel.

SECURITY PROTECTIONS

In addition, since public access would be permitted onto to site, security measures would be necessary to protect important landfill infrastructure. Among the landfill structures that would need to be physically separated from landfill systems are the:

- Leachate control plant;
- Gas collection and treatment plant;
- Flare stations; and

- Above-ground transformers and pumping stations.

SOILS AND PUBLIC HEALTH

While the site is not subject to regulation under 6 NYCRR Part 375, the Soil Cleanup Objectives offer guidance. Given the diversity of existing conditions on the site, the varying hydrology of wetland landscape areas, and the wide range of uses proposed for the site, project-by-project review of soil standards would likely result in selection of various soil criteria being applied over the site based on the proposed programming and the individual capital project. This "project by project" approach is also advised by the NYCDOHMH.

LAND USE, ZONING AND COMMUNITY CHARACTER

To avoid impacts to land use and zoning, final park design and capital projects for both the 2016 and 2036 analysis years would ensure that there are adequate buffers and secure buffers between open space uses and DSNY facilities that would remain on site, such as the flare stations, leachate treatment plant, and landfill gas plant, and also the DSNY facilities in the area that would remain off site, specifically the District 2 and 3 garages and the Staten Island Waste Transfer Station to ensure that there are no conflicts between parks uses and DSNY uses (off site uses would also remain M3-1/ M2-1 and C8-1). In addition to physical separations there would also be decorative and landscaped separations to avoid any visual impacts (see the discussion below).

URBAN DESIGN AND VISUAL RESOURCES

Final park design and capital projects for both the 2016 and 2036 analysis years would ensure that there are adequate and secure buffers between open space uses and DSNY facilities that would remain on site, such as the flare stations, leachate treatment plant, and landfill gas plant, and also the DSNY facilities in the area that would remain off site, specifically the District 2 and 3 garages and the Staten Island Waste Transfer Station to ensure that there are no conflicts between parks uses and DSNY uses (off site uses would also remain M3-1/ M2-1 and C8-1). In addition to physical separations there would also be decorative and landscaped separations to avoid any visual impacts (see also the discussion below).

NATURAL RESOURCES

There are a number of elements of the project that could be proposed to avoid impacts on natural resources. These include the following.

NIGHTTIME LIGHTING

Nighttime lighting can have a significant impact on wildlife activity, including insects, birds, and mammals. To avoid these impacts, some examples of lighting strategies could include: use of a limited, non-continuous lighting schedule in areas where darkness is preferred (reducing light use during low use periods); the use of shielding devices and cutoff-type luminaries with visors or hoods; reduction of ground-reflected light and upward light emissions (which accounts for up to 20 percent of 'sky glow' or atmospheric light pollution) by assigning proper directionality and pole heights suited to the appropriate use; limiting or adjusting illumination of non-target structures (i.e., bridges, secondary roads, etc.) to minimize light trespass; and, using light sources suitable for the surface material of roadways or pathways (i.e. concrete vs. asphalt surfaces reflect light differently). In addition, with the exception of areas of Fresh Kills Park where

human activity would necessitate light while open to the public (i.e., park facilities open after dark, with associated roadways, road crossings and parking areas), most walkways or roadways traversing parklands would not require overnight lighting. For areas being illuminated through the night, minimizing glare and avoiding lights that illuminate structures would be appropriate. Careful design and planning of lighting arrays would minimize the significant adverse impacts associated with proposed project in relation to wildlife activity and nighttime lighting.

HABITAT FRAGMENTATION

Introduction

People have long had—and will continue to have—a significant presence at Fresh Kills, particularly in its history as an active landfill. Even as landfill maintenance and monitoring continues, the development of Fresh Kills Park will create and enhance vast areas of natural habitat in a previously degraded urban site. The co-existence of these functions—as landfill, park, and habitat—is a key feature of the park design, which seeks to bring a broader public to experience this unique example of urban nature, and to deepen visitors' appreciation for and relationship to their environment.

Hundreds of acres of habitat are proposed to be introduced at Fresh Kills Park, many in vast, uninterrupted stretches. Areas that today are dominated by invasive plants such as phragmites, or that contain only limited vegetation and habitat communities, are proposed to be replaced by new habitats and species selected specifically for their potential to thrive, and placed with techniques painstakingly developed to ensure their best chance for growth. At the same time, DSNY must maintain miles of access roads throughout the site for its extensive ongoing operations, while new trails and roads will give people access to new park amenities. The park design seeks to minimize any potential impacts that might arise from the proximity of people and wildlife.

One method for controlling the interaction between people and wildlife is to create a well-designed circulation network. For instance, sensitively siting roads and paths can help alleviate potential impacts. Where possible, proposed paths at Fresh Kills re-use existing Sanitation access roads. New proposed roads largely follow the perimeter of existing mounds, leaving hundreds of on-mound acres uninterrupted.

The design of specific roads and paths is also critical to minimizing impacts. For instance, trails that are properly designed, located, constructed and maintained can minimize potential impacts from humans active in and around wildlife habitats. Conversely, poorly designed trails can impact wildlife habitats by creating edge effects and barrier effects, and increasing species competition by providing additional access by invasive or non-native species. The degree of impact associated with a trail and its potential to cause habitat fragmentation is site specific and highly dependent on the location, design, construction and maintenance of the trail as well as the types of species, habitat, and corridor width in the habitats; use of the trail is a minor factor.

Consequently, design proposals at Fresh Kills Park will consider many well-established guidelines that have been demonstrated to minimize impact on wildlife communities, and apply them based on site-specific factors, including location, and habitat and wildlife types. As each specific proposal is developed, it will be submitted to DEC for review by the Natural Resources division. A summary of the guidelines to avoid or minimize impacts is presented below.

Guidelines

The following general principles can minimize the potential impact of a trail on a natural habitat:

- In areas where habitat is to be created as part of the overall park design, design trails so that they do not compromise the development and sustainability of the future functions and structures associated with the habitat;
- Develop the trail system to avoid hydrological systems; and
- Develop trails to avoid existing habitats and, where appropriate, to include a vegetated buffer between the two.

A number of specific guidelines that follow these general principles have been developed for use in and around sensitive habitat areas; these may be applied at Fresh Kills.

All trails created will be 20- to 30-inch natural surface tread, built to standards for sustainable, non-motorized, dispersed recreation for multiple users (primarily hikers and bikers, although some trails will be closed to specific user types). Design and construction will be coordinated and supervised by appropriate personnel as follows:

- Trails will be constructed to maintain and preserve any existing habitat;
- Trails will be designed to preserve natural hydrologic processes, and will be located away from riparian zones where possible;
- Trails will be designed and located to preserve or restore natural hill slope hydrologic process;
- Trails will be designed to mitigate impacts to erosive soils and unstable areas;
- Operating periods for certain trails will be limited if determined necessary;
- Downed woody material encountered during trail construction will be retained within project areas to the extent possible;
- Trails will be located from low capability to high capability land where possible. For example, areas with steep slopes and erodible soils will be avoided when possible;
- Best Management Practices (BMPs) will be used in all project areas. These can include planting vegetation to control erosion, diverting runoff from exposed surfaces, and controlling the volume and velocity of runoff;
- Weed-free practices will be followed during trail implementation, and follow-up inspections for invasive and non-native species will be completed after construction;
- Trailhead signs will include information about invasive and non-native species and their spread;
- Vegetative matter cleared during trail construction will be scattered to avoid fuel build-up; and
- Trails will be designed to minimize use conflicts (e.g. between bikers and hikers) through the use of signs.

A review of the relevant literature on the interaction between wildlife and paths for human use confirms that determining to what extent a given design might impact wildlife depends on site- and project-specific factors.

Park Roads and Habitat Fragmentation

Operation of the park roads has the potential to result in long-term adverse compromise natural resources benefits in areas where it passes through proposed landscape enhancement areas, or areas where existing plant communities would be retained. Design measures that would minimize the potential for roadways to result in significant adverse impacts to aquatic resources include:

- Collection and treatment of stormwater runoff from roadways.
- Low impact roadway management techniques including landscaped corridors and screening.
- Road-side maintenance using Integrated Pest Management Plan (IPM) strategies prepared for the park to minimize the potential for adverse effects to stormwater runoff quality.
- Maintenance of a hydrologic connection between existing wetlands and surface water bodies using viaducts where feasible; and culverts designed to facilitate movement of aquatic organisms, and to minimize impairment of flow pattern.
- Implementation of a roadway operations and maintenance plan that includes alternative strategies for de-icing and other techniques. Travel routes recommended in the "High Performance Infrastructure Guidelines: Best Practices for the Public Right-of-Way" (NY City Department of Design and Construction and Design Trust for Public Space 2005). Recommendations include prohibiting use of sodium chloride; considering the use of calcium magnesium acetate (CMA) near sensitive ecological areas and on bridges; using grit on less traveled pathways and within park areas, where de-icing salt is necessary; using good spreading techniques using a mix of de-icing salt and sand; and, pre-treating roads to help prevent bonding of ice.

Measures that would minimize the potential for roadways to result in significant adverse impacts to terrestrial wildlife include the following:

- Incorporating measures to avoid potential impairments to wildlife movement in the areas identified above by incorporating wildlife underpass features into culverts constructed under the park roads to maintain stormwater drainage and flow patterns, or separate wildlife underpass features where feasible.
- Using viaducts where feasible to minimize impairment of wildlife movement under roadways.
- Incorporating wildlife crossing warnings into roadway signage.
- Monitoring wildlife/vehicle collisions to identify the need for additional measures (e.g., speed reduction) to minimize wildlife losses and adverse effects to motorist safety due to collisions.
- Using vegetation that does not attract wildlife in roadside landscaping and keeping vegetation adjacent to the road low to provide wildlife with an unobstructed view of oncoming traffic.
- Establishing vegetative screens along roadway to reduce traffic noise in certain landscape enhancement areas.

With respect to managing water access and protecting habitats during operation of the park the following measures would be employed:

- Managing boating access to avoid impacts to natural areas (e.g., Isle of Meadows, William T. Davis Wildlife Refuge).

- "No Wake" Boating.

Another strategy to minimize potential adverse wildlife impacts due to human use while still allowing for acceptable levels of public access to the various regions of Fresh Kills Park, would be to reduce the number of trails, trail density, or intersections within certain portions of the park. In addition, modified landscape structure along trails could allow for wildlife access to nearby cover, effectively increased tolerance of wildlife to human presence.

MARINE STRUCTURES AND OVERWATER SHADING

Shading of estuarine landscapes is a concern because decreased light levels can lower productivity of primary aquatic producers and adversely affect fish and invertebrates that use these areas to provide passage for various life stages, and as important areas for feeding, refuge and spawning. Design measures that would minimize the potential for overwater structures to adversely impact aquatic resources include:

- Locating overwater structures in sufficiently deep waters to avoid intertidal and shade impacts and also minimizing the need for dredging;
- Designing overwater structures to be multi-use facilities in order to reduce the overall number of structures; and
- Minimizing reductions in ambient light transmission under piers and docks through the following techniques:
    - Maximizing the height of the structure and minimizing the width of piers and docks to decrease the shade footprint;
    - Using grated decking material or other measures to permit additional light to penetrate under the structure;
    - Using reflective paint or materials (e.g., concrete or steel) rather than material that tends to absorb light (e.g., wood) on the underside of the structure to reflect ambient light;
    - Using the fewest number of pilings necessary to support the structure and to allow light under the pier;
    - Aligning overwater structure in north-south orientation to the extent possible to allow the arc of the sun to cross perpendicular to the structure and reduce the duration of light limitation;
    - Locating floating platforms in deep water to avoid light limitation and grounding impacts to the intertidal areas and maintain at least two feet of water between the substrate and the bottom of the float;
    - Orienting night lighting such that waters surrounding the structures are not illuminated; and
    - Mitigating for unavoidable impacts to benthic landscapes (NMFS 2003).

COMMERCIAL WIND TURBINES

As described in Chapter 1, "Project Description," any commercial wind turbines at the proposed park are expected to be operated as a concession and are also expected to undergo a separate environmental review once a site specific proposal is put forward. However, it is recognized that wind turbines have the potential to result in impacts to natural resources in particular avian resources including both birds and bats given the location of the site along a known migratory flyway and the potential for breeding birds at risk of collision. Any site-specific proposed wind-

energy project should consider the requirements of recent DEC draft '*Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects*' (December 2007). These guidelines offer a protocol for both planning pre- and post-construction studies, including a thorough site and project description, designs of potential studies to detect and quantify bird and bat presence before, and actual impacts after, a proposed wind energy project is constructed. If necessary, potential impact avoidance measures could include an evaluation of alternative locations on the project site to avoid wildlife collision risk by reducing the elevation of turbines, reducing the overall height of turbine structures or rotor heights, determining whether the proposed project could cease to operate at times (daily and seasonal) when birds and bats are placed at highest collision risks, and the consideration of locating fewer turbines within Fresh Kills Park.

FLOOD HAZARD AREAS

All landscapable structures within the Fresh Kills project site (e.g., cultural centers, restaurants, etc.) that would be located within a special Flood Hazard Area, would have their first-floor flood elevations at least one-foot above the 100-year flood level (or elevation 10). This would include reconciling any future modifications to FEMA maps that may address sea level rise or other amendments to the City's flood hazard area maps.

HAZARDOUS MATERIALS

It would be a requirement of the project that vapor barriers and seals be installed to avoid impacts from methane gas leaking into structures. In addition to a vapor barrier below the proposed buildings, the proposed project may also include utility seals for all utility conduits in order to prevent gas migration, as necessary. In addition, see also "Construction" below for hazardous materials impact avoidance.

INFRASTRUCTURE

The proposed project does not require any impact avoidance measures for water supply and sanitary sewer systems, as no impacts are anticipated. However, it does include a sustainability strategy to reduce demands on water supply and sanitary wastewater treatment. These are presented in Chapter 13, "Infrastructure." Incorporating some of these measures could reduce, at certain locations, the need to extend utility connections for long distances into the site, particularly with respect to sanitary sewer connections.

Also presented in that chapter, the details of the proposed stormwater management system that would be developed as each park and road capital project moves forward and is further developed, but fitting into the overall stormwater management plan developed for this GEIS and presented in Chapter 1 "Project Description." There are a number of proposed park features that, if constructed, would convert existing pervious surfaces to impervious surfaces. These include the proposed park roads and park structures and parking. Because impervious surfaces do not allow precipitation to infiltrate to the soil, precipitation runs down a slope, infiltrates into soil, or is conveyed via a ditch or storm sewer system, to a receiving waterbody. Stormwater runoff from imperious surfaces can carry pollutants (i.e., suspended solids, nutrients, fecal coliform bacteria, petroleum hydrocarbons, metals, chlorides, insecticides and herbicides) that can affect the water quality and aquatic landscapes of the receiving waterbody.

To avoid stormwater impacts from increases in impervious surfaces and to protect receiving waters, individual stormwater best management practices (BMPs) would be used to enhance proposed park features, and provide water quality treatment and quantity management,

particularly for the road runoff. Multi-functional source control BMPs such as bioretention and pocket wetlands that not only provide water quality treatment of stormwater runoff, but also provide aesthetic and natural resource benefits would be used. The general objectives of the proposed stormwater management system are to:

- Continue to collect and handle all on-site runoff without off-site or downstream impacts.
- Maximize pervious surfaces and minimize the introduction of new impervious surfaces, reusing existing structured surfaces where feasible;
- Provide natural systems for stormwater management (e.g., created runoff swales, pocket wetlands, vegetated treatment swales, planter boxes) and minimize the use of hard infrastructure (e.g., inlets and pipes), particularly for handling runoff from roads and parking areas;
- Minimize impacts to natural stormwater management features at the site such as freshwater and tidal wetlands and minimize any potential impacts to local water quality; and
- Utilize the existing DSNY stormwater basins, to the extent feasible, without adversely impacting the DSNY stormwater management system—use of these basins and any associated modifications would be designed in accordance with DSNY and DEC specifications and approvals.

Since the proposed project is located directly along the coastal waterways of Richmond and Main Creeks, it is not expected to result in any impacts on downstream flooding. In addition, runoff is expected to be controlled on-site and would not adversely impact surrounding neighborhoods or open spaces. In sum, it is concluded that the proposed project could manage any increase in site-generated runoff while contributing positively to the local wetland systems.

The stormwater management projects proposed as part of the park would be designed to complement and enhance the aesthetic and ecological purposes of the proposed park, while also meeting the above-described stormwater management objectives with the intent of improving the current hydrologic and water quality management of the existing stormwater infrastructure. To achieve these goals, the approach would utilize a mix of traditional conveyance and storage measures (including the existing downchutes and large-scale detention basins) and smaller controls selectively located throughout each sub drainage area that would be designed to enhance hydrologic and water quality functions as well as benefitting aesthetic and landscape qualities of the park. By utilizing stormwater controls, runoff flows would also be routed through multiple levels of treatment prior to discharge off the site thereby protecting local water quality.

SOLID WASTE AND SANITATION SERVICES

The proposed project does not require any impact avoidance measures with respect to solid waste and sanitation services as no impacts are anticipated. However, it does include a sustainability strategy to reduce demands on solid waste generation and to increasing recycling and other measures such as composting. These measures are presented in Chapter 14, “Solid Waste and Sanitation Services.”

ENERGY

The proposed project does not need any impact avoidance measures with respect to energy as no impacts are anticipated. However, it does include a sustainability strategy to reduce demands on energy demands as presented in Chapter 15, “Energy.”

TRAFFIC AND PARKING

SITE-SPECIFIC CAPITAL PROJECT REVIEW

As stated above, the proposed project is a long term implementation project with multiple phases. It would have future capital projects that would require future/and or coordination with NYCDOT including curb cuts to provide access to parking facilities in North Park and South Park, as well as the proposed reconstruction of the intersections of Richmond Avenue with Forest Hill Road and Richmond Hill Road to allow for the proposed Forest Hill Road Connection (2016) and Richmond Hill Road Connection (2036). To avoid future impacts at all the locations that would provide access to the project site and to ensure proper traffic patterns and intersection designs are implemented, DPR will continue to coordinate with NYCDOT as additional capital projects move forward. In the short-term (2016) conditions, this would include site designs that would be coordinated with NYCDOT for specific park capital projects.

This would specifically include coordination with respect to improvements along Arthur Kill Road that are currently being explored by NYCDOT. This is a major corridor for access to the park and two park entrances are proposed, one to a small parking area for the Arden Heights Neighborhood Park and the other for the larger South Park Recreational Center. In addition, there is a need for sidewalks and bicycle access along the frontage of the proposed park on Arthur Kill Road as well as a need for overflow parking (in the long term) that the project had designed for parallel parking along Arthur Kill Road. In addition, the diverted traffic that would ultimately flow from the projects park road has implications for intersections off the project site. For these and other reasons, DPR would continue to coordinate with NYCDOT through the course of project implementation to ensure that impacts from the proposed project, both the proposed park elements and the park road elements, would minimize traffic impacts on local roads.

In addition, since the proposed project includes a major road improvement project that would affect circulation patterns in this area of Staten Island, DPR (the Fresh Kills Project) would also actively participate in the Staten Island Task Force which has been created to address traffic issues on Staten Island.

EVENT PLANNING

At this time DPR has not yet developed a formal events program for the park. While it is expected that by the 2016 analysis year there would be park events, there are no event facilities proposed for 2016. However, by 2036, with the completion of the Confluence and the Point there would be event facilities, including an amphitheater. While DPR has not yet developed a program for the amphitheater, it is envisioned that the events would be similar to "Summerstage" in Central Park or "Celebrate Brooklyn" in Prospect Park. In addition, the athletic fields in the Point are expected to host City-wide athletic events and competitions. Since these are longer-term (2036) components of the project, DPR would address transportation issues related to major events (e.g., traffic and transit access), with NYCDOT, NYCT, and, as necessary, NYSDOT once an events program is developed. At that time, DPR would work with these and other agencies as necessary to ensure that adequate public transit and traffic circulation is provided during events along with opportunities for other means of access, such as buses and biking (see also the discussion below under "Transit and Pedestrians).

MONITORING

Proposed Monitoring and Mitigation Planning

Given the long term nature of the Fresh Kills Park project and the conceptual level of design for much of the Park, additional traffic analysis will be necessary over the course of the project as individual areas of the park and roadway system are advanced. As the project progresses and the Park is constructed, the Department of Parks and Recreation (DPR) will continue to monitor the traffic conditions and seek ways of improving traffic flow in and around the Fresh Kills site. DPR would continue to coordinate with NYSDOT and NYCDOT through the course of project implementation to ensure that the proposed project, both the proposed park elements and the park road elements, would minimize adverse traffic impacts on local roads.

Several steps will be taken to better assess traffic conditions as the projects advance:

Ongoing Traffic Monitoring

Because the proposed project includes a major road improvement project that would affect circulation patterns in this area of Staten Island, DPR (the Fresh Kills Project) commits to actively participate in the Staten Island Task Force which has been created to address traffic issues on Staten Island. In addition to the Task Force, if needed, DPR will provide NYCDOT with the traffic analyses needed to evaluate these conditions with the new traffic patterns.

Site Specific Capital Project Review

Additional analysis and coordination with NYSDOT and NYCDOT will be required as the project advances. For instance, future capital projects will require coordination with NYCDOT for curb cuts to provide access to parking facilities in North Park and South Park, as well as the proposed reconstruction of the intersections of Richmond Avenue with Forest Hill Road and Richmond Hill Road to allow for the proposed Forest Hill Road Connection (2016) and Richmond Hill Road Connection (2036). At the proposed park entrances, DPR will submit the required drawings, analyses and signal warrants for NYCDOT review. DPR in consultation with NYCDOT will evaluate the feasibility of the proposed park entrances/exits, including the location of curb cuts for the proposed parking lots once detailed plans are submitted. The feasibility of installing a traffic signal at the intersection of Arden Avenue and West Shore Expressway (SB) service road will be determined when a signal warrant study is provided by DPR to NYCDOT. DPR will be responsible for the costs associated with the design and installation of new traffic signals, including the installation of new traffic signals/controllers at locations where the proposed signal phasing requires upgraded traffic signals.

To avoid future impacts at all the locations that would provide access to the project site and to ensure proper traffic patterns and intersection designs are implemented, DPR will continue to coordinate with NYCDOT as additional park related capital projects within the Fresh Kills site move forward. In the short-term phases of work, this would include site designs that would be coordinated with NYCDOT for specific park capital projects and a preparation of the Preliminary Design Investigation (PDI) for the proposed road projects.

DPR will coordinate with NYCDOT with respect to improvements along Arthur Kill Road that are currently being explored by NYCDOT. This is a major corridor providing access to the park via two park entrances—one to a small parking area for the Arden Heights Neighborhood Park and the other for the larger South Park Recreational Center. In addition, there is a need for sidewalks and bicycle access along the frontage of the proposed park on Arthur Kill Road. In

addition, the diverted traffic that would ultimately flow from the project's park drive has implications for intersections off the project site.

Specifically, DPR commits to providing NYCDOT all plans for projects within the Fresh Kills site. Moreover, DPR commits to providing NYCDOT and NYSDOT with all roadway plans associated with the construction of the through-traffic roads connecting Richmond Avenue with the West Shore Expressway for review. Given the nature of the GEIS and the conceptual level of the plans for the Park, it is assumed that some level of additional analysis will be required. Depending on the specific design of the projects, this additional analysis may take the form of a Supplemental Environmental Impact Statement or a Technical Memorandum. DPR in consultation with NYCDOT will determine when any additional traffic, parking, pedestrian and transit analyses will be necessary as well as the extent of the analyses. When NYCDPR determines that analyses are necessary, DPR will prepare a scope of work for NYCDOT review. Details related to the additional analyses will be determined by the scope of work, including but not limited to, the data collection program, survey of the park elements to verify the FGEIS's projected travel demand assumptions (counts at the parking lot entrances/exits for weekday and weekend in both summer and non-summer months, interviews at different land uses/park elements to determine the trip generation, modal split, vehicle occupancy, temporal and directional distributions, truck trip generation, routes employees and visitors travel to/from each land use), and types of analyses required. The findings of these analyses will be used by NYCDOT as the basis for approving and implementing mitigation measures or any subsequent improvement measures. DPR will be responsible for the costs associated with the monitoring efforts, the preliminary and final design of the proposed mitigation measures or any subsequent improvement measures, as well as the construction of the mitigation/improvement measures that require capital funding.

Special Events

As indicated in the FGEIS, at this time DPR has not yet developed a formal events program for the park. While it is expected that by the 2016 analysis year there would be park events, there are no event facilities proposed for 2016. However, by 2036, with the completion of the Confluence and the Point areas of the development, there would be event facilities, including an amphitheater. In addition, the athletic fields in the Point are expected to host City-wide athletic events and competitions. Since these are longer-term (2036) components of the project, DPR would address transportation issues related to major events (e.g., traffic, pedestrian and transit access), with NYCDOT, NYCT, NYPD, and, as necessary, NYSDOT once an events program is developed. At that time, DPR would work with these and other agencies as necessary to ensure that adequate public transit and traffic circulation is provided during events along with opportunities for other means of access, such as buses, pedestrian and biking. Also, once the events program is developed, DPR will prepare a scope of work for NYCDOT review, and should submit traffic, pedestrian and parking analyses to determine any roadway operational changes that maybe necessary. DPR will be responsible for all costs associated with these analyses, as well as the design and implementation of any subsequent recommendations.

TRANSIT AND PEDESTRIANS

INTRODUCTION

The proposed project is seeking to provide alternative modes of travel to the project site for the purpose of reducing vehicle trips (now assumed to be the predominant mode) and to reduce

traffic impacts and enhance the park experience. These alternative modes include bus, rail ferry, walk and bike, each of which is described below.

TRANSIT SERVICE

Since bus service is an important mode of travel to the project, DPR would continue its efforts to extend bus service into the park and to provide both express and local service and connections with the Eltingville Station of Staten Island Transit. This would involve coordination with NYCT/MTA in both the design of the park to provide adequate connections and providing notification of service changes to park users. It would be the objective of these efforts to reduce reliance on private vehicular travel as the principal mode of travel for park visitiors and staff. It is noted that in order to extend bus service into the park, the proposed park roads would need to satisfy the design requirements of NYCT for bus operations. This could be accomplished by providing at least a 24-foot right-of-way that allows buses to travel in opposite directions while safely passing each other. In addition, bus stops and bus turnarounds could be provided at strategic locations along the park roads to accommodate the service requirements of NYCT. For example, it is expected that with the proposed Forest Hill Road connection operational in 2016, NYCT could modify its existing bus routes—specifically, the express bus routes that primarily operate via the West Shore Expressway—to take advantage of this direct connection into the park. In addition, to accommodate the park-generated transit demand in 2016, NYCT could amend the existing bus service and expand bus routes to include new stops within the park boundaries, extending service into the site from Richmond Avenue via the Forest Hill Road and Richmond Hill Road connections. Additional bus stops could also be provided along Arthur Kill Road, which is a corridor served by a number of Staten Island buses, in order to provide transit service to South Park facilities. In order to extend bus service into the park, the proposed park roads would need to satisfy the design requirements of NYCT for bus operations.

By the year 2036, the second park road connection with Richmond Avenue would be completed. It is expected that in 2036, with the full build-out of Fresh Kills Park, NYCT could either create new bus routes to accommodate the park-generated transit demand (especially on the weekend summer months) or could amend the existing bus routes to include new stops within the park boundaries or at the park perimeter (e.g., along Arthur Kill Road). This could potentially include service from other boroughs that could access the site via the regional highways (i.e., the West Shore Expressway), as well as augmented local service that is provided along Richmond Avenue and could be extended into the park.

PEDESTRIANS

The results of the analysis of pedestrian conditions in the future with the proposed project show that pedestrian demand from the proposed project would not require any pedestrian mitigation. However, recognizing that pedestrian and bicycle access into the park is an important design approach that would reduce vehicle trips and encourage walk and bike trips, DPR would work closely with NYCDOT (the agency with jurisdiction over the street system) to ensure that adequate sidewalk conditions are provided along the perimeter of the park (e.g. along Arthur Kill Road and Richmond Avenue where the joint NYCDPR/NYCDOT Springville Greenway project is proposed) as well as to ensure that adequate street conditions exists long the roads that lead to the park, particularly the major park entrances and those specifically located along Arthur Kill Road. It is recognized that DPR would be responsible for the design and construction at these sidewalk improvements and pedestrian/bicycle access improvements into the park that may result from the monitoring program (see the discussion above).

CONSTRUCTION

COORDINDATION WITH DSNY CLOSURE ACTIVITIES AT LANDFILL SECTIONS 6/7 AND 1/9

As stated above, the design of the proposed park has been, and will continue to be, planned to minimize disruption to the closure construction activities at Landfill Sections 6/7 and 1/9. It is expected that mobilization of construction equipment for the proposed project would begin in the third quarter of 2009 and would overlap with some of the closure construction. For example, DSNY has a closure phasing plan for Landfill Section 6/7. It is expected that this closure construction would occur in four phases and that closure construction would be completed at Landfill Section 6/7 by 2011 and at Landfill Section 1/9 by 2012. During this time, there would be considerable truck traffic delivering soils and materials to the site for the purposes of closure construction. There would be an overlap of construction activity, therefore, primarily in the early years of park construction, specifically the development of North and South Parks and initiating the park roads. To avoid impacts on DSNY activities and to minimize impacts on the project site and in the surrounding area, as specific park capital projects are designed in the early phases, it is expected that DPR and DSNY would create a "development plan" for the proposed project that would address coordination and levels of construction activity through the completion of overlapping construction activities to ensure that any conflicts between landfill closure and park construction are avoided or minimized. In addition, the plan would address long term coordination needs to avoid conflicts between construction activities and the Fresh Kills Landfill monitoring and maintenance program which DSNY must continue long past the completion of construction and at least until 2036.

PROTECTION OF DSNY INFRASTRUCTURE DURING CONSTRUCTION

As a result, project implementation must also include a plan for the systematic monitoring of construction activities to document that construction is consistent with the design, and a plan for post-construction monitoring to document the long-term integrity of the landfill environmental control systems that may be influenced by the presence of the roadway. Future final design must also include field demonstrations and measurements to verify design concepts and material parameters during the design process. Ultimately, the road design must meet requirements defined by DEC:

Construction of park roads northern extension to Richmond Avenue at Richmond Hill Road and construction of the Signature Bridge would not result in significant construction period impacts to geology, soils or groundwater. As discussed above, a construction monitoring plan would be implemented to ensure that the construction of the 2016 roadway elements would protect the existing environmental control and monitoring systems at Fresh Kills (i.e., landfill gas and leachate collection systems). This construction monitoring plan would also ensure that the integrity of the landfill cover remains and that all systems are functioning during road construction, thereby minimizing the potential for adverse impacts to the environment.

The proposed park and roads would be built on a site that was once the world's largest landfill and which contains extensive infrastructure in place to protect the landfill and the surrounding environment and public health. As a result, during construction of both the park and road elements, the protection of landfill infrastructure is essential and would be accomplished through multiple means, including training and, as necessary, use of physical barriers or protections. Among the general principles that would be part of the project plan for protecting landfill infrastructure are the following:

- Protection of landfill infrastructure from vibration impacts;

- Pre-construction contractor education and training that addresses protecting and avoiding impacts to landfill infrastructures for contractors;
- Flagging or marking of infrastructure;
- Posting of signs, such as "Buried Utility" or "Overhead Lines;"
- Review of construction procedures to identify whether alternative, less disruptive construction techniques, are applicable to a given activity;
- Protection of landfill infrastructure from vibration impacts;
- For critical landfill infrastructure, trained personnel would provide field monitoring of the construction activities and potentially affected infrastructure; and
- Record Observations of the construction activities and any monitoring results.

GENERAL CONSTRUCTION IMPACT AVOIDANCE OBJECTIVES

Overall, major construction operations would occur away from local neighborhoods. Some of the general construction principles that would be apply to the proposed project for the purposes of avoiding impacts are:

- Prepare staging plans that place construction activities internal to the project site for the larger projects thereby minimizing impacts on local neighborhoods and roads at the periphery;
- Locate heavier construction operations, such as soil making (if proposed) in an area central to the project site and away from local residential uses;
- Site individual capital project staging areas in areas that were previously disturbed or that would be disturbed as part of project development and thereby avoiding impacts to wetlands and natural features;
- Locate road construction staging areas in the proposed road corridor, clear of wetlands and landfill infrastructure;
- Use existing truck access routes for construction since these allow for direct access to and from the regional highway while internalizing truck traffic and minimizing the use of neighborhood streets around the project site;
- Evaluate the potential for the use of barging, particularly for the delivery of soils;
- Prepare a noise control plan in accordance with City regulations;
- Reuse of existing maritime infrastructure, such as bulkheads in the Plant 1 area;
- Protect wetlands and natural resources through flagging and signage to protect areas adjacent to construction activities;
- Undertake landscape enhancement during periods that would not conflict with existing wildlife and avian species use of the site;
- Perform field inspections and provide barriers to protect rare and endangered species and their landscapes or nesting areas during the construction period;
- Use best management strategies to control soil erosion and sedimentation including implementing site specific stormwater pollution preventions plans for each capital project (see the discussion below);
- Avoid excavation activities that would compromise the existing landfill cover functions;

- Incorporate enhancement measures that would minimize disturbance and removal of desirable existing native vegetation where possible;
- Invasive species management as part of construction and use of appropriate, regulated herbicide compounds suitable for use in natural areas, including herbicides approved for aquatic/wetland uses, to be applied to targeted invasive species using the lowest effective concentrations and to be used in accordance with all permits and regulations;
- Minimize the closing of existing streets by performing nighttime work along major corridors (e.g., to implement modifications at the two intersections with Richmond Avenue, at Richmond Hill and Forest Hill Roads, and the connecting ramps to the West Shore Expressway);
- Control worker access to the site by stipulating entry and exit points within each contract; and
- Provide for all necessary construction worker parking on-site.

The above descriptions are general operational objectives of the construction plan. As the project moves forward, additional site-specific construction measures would be implemented to minimize the impacts of each project and to implement the general operational objectives presented above

ARCHITECTURAL RESOURCES

One architectural resource (the NYCL Sleight Family Cemetery, a.k.a. Blazing Star Burial Ground) was identified on the project site. Four S/NR-eligible architectural resources were identified in the study area. The proposed project is not expected to result in direct or indirect adverse impacts to architectural resources in the project site or study area. No construction is currently planned within close proximity of the Sleight Family Cemetery, however, as project plans progress, if any construction activity is planned within 90 feet of this resource, a Construction Protection Plan would be prepared and implemented to ensure that the resource would not be inadvertently affected by construction-period impacts.

LANDSCAPE PROTECTIONS

Stormwater Pollution Preventions Plan (SWPPP)

The project site contains substantial freshwater and tidal wetlands comprised of creeks, ponds, and stormwater basins. It is a critical component of the projects construction practices to avoid impacts to these natural systems, not only to avoid impacts to natural resources and water quality, but also to avoid siltation impacts to the existing stormwater basins site. Therefore, the proposed project includes a "Conceptual Site-Wide Erosion and Sediment Control Plan." This plan establishes the guidelines by which each phase of project construction, through implementation of the proposed techniques, would avoid impacts to natural features and in-place stormwater management systems. The construction of Fresh Kills Park capital projects needs to meet the requirements of the DEC State Pollution Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity. The stormwater management system for the various phases of park development would complement and enhance the aesthetic and ecological purpose of the proposed park, and support the overall stormwater management objective to improve upon the current hydrologic and water quality management provided by the stormwater management infrastructure developed for the Fresh Kills Landfill. The approach would include a mix of traditional conveyance and storage measures that would

follow Low Impact Development practices throughout each subcatchment. These stormwater management approaches would both reduce runoff and pollutant loadings by managing the runoff close to its source using a set or system of small-scale practices that are linked together. They would promote the use of natural systems to achieve stormwater quality requirements and volume control through both infiltration and evapotranspiration. BMPs such as bioretention and pocket wetlands that provide multiple benefits for providing water quality treatment and wildlife landscape, aesthetic improvements and potential educational opportunities would be employed to the extent possible. Implementation of these measures would minimize the potential for significant adverse impacts to aquatic resources resulting from the discharge of stormwater from Fresh Kills Park.

Implementation of these techniques would be ensured by DPR in the contract documents as well as the SPDES General Permit requirements, since most capital projects are expected to cover at least one acre. In sum, the overall objectives of the plan are to achieve:

- No increase in turbidity that would cause a substantial visible contrast to natural conditions;
- No increase in suspended colloidal and settleable solids that would cause "deposition or impair waters for their designated "best use"; and
- No residue from oil and floating substances.

In addition to the SPDES permit, each proposed stormwater management plan would be designed to meet the requirements of Article 17 of the New York State Environmental Conservation Law and the Federal Clean Water Act. The Fresh Kills Park plan has also been designed in accordance with the standards of the *New York State Stormwater Design Manual* (DEC, 2003) and the New York State Standards and Specifications for Erosion and Sediment Control (DEC, 2005).

HABITAT PROTECTION

Overview

As summarized above and described in greater detail in Chapter 1 " Project Description," the proposed project would create a large new open space with significant cultural, recreational and environmental amenities and would simultaneously protect and enhance aquatic and terrestrial landscapes as well as the proposed park roads. The landscape enhancement elements include the following general construction activities:

- Enhancement and expansion of the existing freshwater wetlands, with possible creation of additional wetland landscapes within certain existing stormwater management basins;
- Enhancement and expansion of the existing tidal wetlands through removal of invasive species such as Phragmites and enhancement of the native intertidal and high marsh plant communities;
- Development of native grassland and meadow landscapes on the landfill sections; and
- Expansion of woodlands within the project site to provide a buffer for the site perimeter and provide an ecological connection with woodlands adjacent to the project site.

Measures to Reduce Potential Wildlife Impacts during Construction

In typical construction activities, short-term construction impacts to wildlife can include loss of landscape from staging areas for construction equipment and work sites, landscape degradation due to partial removal of landscape or necessary substrate for wildlife activity (i.e., non-

permanent removal or damage of vegetation as a result of a temporary project, such as tree trimming or temporary blocking of a drainageway to limit stormwater runoff), wildlife avoidance of construction sites due to noise, human disturbance, lighting, and other factors that cause landscape to be unsuitable. Wildlife use of a particular area would be expected to return upon completion of construction and enhancement activities. Moreover, in the long-term, the restored and enhanced landscapes proposed for Fresh Kills Park would be expected to benefit wildlife through the introduction of vegetative cover of higher quality and diversity than is currently present within much of the project site.

Strategies to limit wildlife impacts as a result of the above construction activities would depend on the duration and extent of the disturbance. The use of physical barriers at construction and staging areas, such as drift fencing, would be useful to restrict movement of ground-dwelling wildlife (i.e., small mammals, reptiles and amphibians). Direct impacts to wildlife would also be reduced by limiting the speed of construction vehicles, and avoiding nighttime construction operations. Additionally, the phasing of the park development activities over a 30 year period would limit the extent of land disturbance and area of in-water construction activities at a given time. The extended construction period would also increase the potential that suitable landscapes may be available to wildlife affected by development of a certain elements of the park and reduce the potential for significant adverse impacts.

Site-Specific Erosion and Sediment Control Plan (ESCP)

As described above, a conceptual site-wide erosion and sediment control plan has been prepared and would be implemented on a project-by-project basis through 2036. An individual SWPPP would comply with the project's conceptual plan (see the discussion above) and would meet DEC's technical standard for erosion and sediment control as presented in "New York Standards and Specifications for Erosion and Sediment Control," and DEC's technical standard for the design of post-construction stormwater control practices presented in *New York State Stormwater Management Design Manual*. The site-specific plan would include design controls and describe practices to be implemented during construction to minimize the release of pollutants in stormwater runoff, and would take into account special constraints such location of landfill environmental control systems, landfill final cover considerations, slope and proximity of sensitive natural resources. These measures would also include the following:

- Flagging and staking to define the limits of disturbance and locations to install controls—this would include identification of the tree protection zone by a certified/registered arborist for trees that are to be preserved.
- Installation of stockpile management controls.
- Stabilized construction entrances/exits and construction entrance postings,
- Appropriate inlet and outlet protection areas that have the potential to be affected by land disturbing activities—Stormwater runoff within the project site is currently managed through final grading, swales, downchutes and culverts that discharge to the existing 18 stormwater basins that moderate peak flows and allow suspended sediments to settle out of suspension within the basins prior to discharge to the receiving surface waters. It is anticipated that during construction, site drainage will remain similar to the existing configuration of directing stormwater to the stormwater basins. Basin outlet structures would be equipped with appropriate outlet protection devices and maintained as specified in the SWPPP. Specific details for inlet and outlet protection devices will be included in the site-specific ESCPS but would likely include sediment barriers such as drop inlet protection and inlet filter berms.

- Perimeter controls in areas to be disturbed during grading activities (i.e., sediment barriers such as compost socks, gravel bag/sand bag berms).
- Stormwater conveyances (i.e., channels, swales, diversion berms, etc) to direct runoff to one of the existing stormwater basins, as is appropriate for the site-specific ESCP.
- Fugitive dust control measures (e.g., seeding or wet suppression), including minimizing the amount of exposed soil at any given time.
- Stabilization of disturbed areas with temporary seeding or permanent cover—seeding should be consistent with landscaping plan and enhancement plans developed for the portion of the park under construction.
- Removal of temporary BMPs following final stabilization.

Natural Resources Protection Plan

In addition to the above, a natural resources protection plan would be prepared for each construction project. This plan would have a pre-construction walkover identify sensitive landscapes, trees, sensitive plant communities such as wetlands, and any other communities that have been identified for preservation and protection under the proposed project and would establish the necessary protection zones around these resources to minimize the potential for adverse direct or indirect impacts to these resources. These protection zones would be identified on design drawings, flagged and staked in the field by a professional (i.e., certified/registered arborist for trees, and by a horticulturist or botantist for wetlands and other sensitive plant communities), and identified on all construction drawings along with notes indicating activities allowed and prohibited within each protection zone.

Clearing of staging areas for roadway construction, as well as construction of other park elements, would also conducted in a manner consistent with minimizing impacts to large trees (e.g., trees greater than 12-inches in diameter at breast height) that are outside of adjacent to areas proposed for construction disturbance. Maintaining existing mature trees provides benefits in temperature reduction (via shading, evapotranspiration potential, air quality improvements) and aesthetic value to park visitors that could take decades to restore through reforestation programs.

Construction Monitoring Program

A construction monitoring program would be implemented during construction to document that construction is consistent with the design and intent of the projects construction management plan including protection of the environmental monitoring control systems at Fresh Kills Landfill (i.e., landfill final cover gas and leachate collection systems) and to ensure that those systems remain intact and functioning during and after construction activities.

In-Water Construction

The installation of the piles, boat ramps, outfall structures, or bulkhead, can have temporary impacts during construction. Potential impacts to natural resources during construction activities could be minimized through implementation of the following:.

- Measures to minimize increases in turbidity and suspended sediment in the water column, and to capture floating debris during sediment removal and grading activities, and installation of in-water structures Examples of measures to be considered include silt curtains and coffer dams. Measures would be selected on the basis of on-site conditions and consultation with DEC and the USACOE.

- Implementation of measures to stabilize the wetlands enhancement areas as necessary during planting, such as the use of a biodegradable/geosynthetic erosion control mats or revegetation mats.
- If necessary, implementation of measures that may restrict or limit the construction activities in waters or sensitive areas during certain seasons. To the extent that any construction period may need to be restricted to avoid impacts to fish spawning or avian nesting, it is expected that these restrictions would be contained with the permits that are necessary for the proposed projects (see discussion following).

In addition, it is recognized that all construction activities within open water or other wetlands are subject to the review and approval of the DEC and the USACOE and federal natural resources agencies through the permitting process that would further identify and implement these and other necessary protection measures that may be identified during the permit process as necessary to protect water quality and landscapes.

Groundwater and Surface Water

Construction of the certain park elements proposed for the Point, where the more intensive construction program is proposed, may require activities into the groundwater. In this event the proposed project would secure all the regulatory approvals from DEC and NYCDEP and take all the steps for environmental control and protection in order to ensure that local waterways are not adversely impacted by dewatering activities.

Protections for Rare Threatened and Endangered Species

The Northern diamondback terrapin, which is a New York State game species and watch list species on NYNHP's 2007 Rare Animal Status List, has been captured and observed in Main Creek in the vicinity of William T. Davis Refuge in 1995, and again in 2005. Low shoreline areas adjacent to open sand or other unvegetated soils could potentially support nesting diamondback terrapins, as well as areas of foraging adults. Construction of North Park could impact terrapin nesting or foraging activity. To avoid this impact, prior to any construction activity in potential terrapin nesting landscape, a field inspection would be performed and barriers would be constructed to prevent nest building within proposed work sites. Also, a site walk-through to identify and rescue adults or emerging hatchlings (as necessary) prior to construction activity would be undertaken. These activities would be conducted by an experienced biologist, and any permits required for handling terrapins would be secured prior to this activity.

In addition, to avoid impacts to barn owls any bridge structures known to support nesting barn owls (i.e., bridges, abandoned structures) would be fully searched by an experienced ornithologist or biologist for the presence of roosting or nesting owls prior to construction. If any nests are present, a consultation with DEC would be performed to assess any potential construction-related impacts of the project, and determine an appropriate course of action (e.g., alternative construction phasing until young birds have fledged, removal of an inactive nest, etc.). In addition, pre-construction measures could include netting or other techniques that would prohibit or discourage barn owl nesting prior to construction. Signage could also be used to alert contractors to barn owl nesting in these areas to avoid indirect impacts.

HAZARDOUS MATERIALS

Clearing and Grading

Certain capital projects are expected to require excavation for the purposes of installing new utilities such as electricity, water and sewer connections as well as foundations for the proposed structures. These excavation areas, however, in the context of the overall project, are limited and the majority of the proposed project activities would occur at or above the existing grade (i.e., on the added cover soil). It is also not expected that most site specific capital projects would require activities or structures what would extend into either shallow or deep groundwater at most locations. However, in the events such activities do occurred during construction, a permit would be obtained from NYCDEP or the DEC as necessary.

The hazardous materials analysis concluded that the majority of the project site has the potential to have been impacted by hazardous materials as defined under CEQR. Therefore, for site-specific capital project areas where soil and/or groundwater disturbance is proposed, individual project-specific subsurface investigations and, if necessary, remediation, would be undertaken in accordance with additional site research (e.g.. aerial photos, database searches) that may be necessary at the time of construction in order to supplement the conclusions presented in this GEIS, along with the necessary individual project site investigations and testing programs. Any impacts due to hazardous materials would be avoided through techniques that would include covering the affected area with the appropriate soils for park uses, capping the affected area with structures such as parking and structured athletic surfaces, and removal of any soils that are contaminated to the extent that removal must be performed.

This site specific assessment would be performed, as follows:

- Review of documentation related to the individual project site and with respect to completed or underway landfill closure construction; monitoring, maintenance, and requirements for continued landfill environmental management; the nature and location of past and current uses; and nature of planned future uses, including final cover types (e.g., natural or synthetic turf, drainage structures, and pavement utility connections).
- Based on the plans for each capital project, determine potential hazardous materials impacts based on grading plans and areas of soil disturbance (both horizontal and vertical disturbance from grading and filling) and the need for fill material under the proposed project's "Soil Management Plan" (see Chapter 1, "Project Description") This would also include an assessment of potential need for any dewatering or vapor protection for structures.
- Prior to any soil disturbance, perform Phase I and II site investigations (as necessary) with subsurface testing and remediation, where appropriate. Site testing would disclose the need for any project-specific remediation, incorporate the objectives of the project's "Soil Management Plan" and include a Construction Health and Safety Plan, as appropriate. All of the above would be prepared for implementation prior to undertaking any invasive site construction work in order to ensure proper handling of excavated material and protection of worker and community health and safety.
- Remediate any potential impacts to existing landfill infrastructure. In areas where existing landfill infrastructure may be impacted with such materials as paving, synthetic field, lawn, and planting, it would need to be avoided or replaced in order to avoid any potential exposure impacts or residual contamination issues for future users of the park.

Construction Health and Safety Plan

Extensive testing has been performed at the site to determine if the proposed project has the potential to result in any impacts on public health. Based on the results of that testing, a Construction Health and Safety Plan would be implemented during construction and the proposed project includes a final cover and soil management plan that would avoid exposure of open space users to any soils that could potentially contain contaminants. The construction health and safety plan would be comprehensive for each individual site and may include elements such as community monitoring. With these protection measures included as part of the proposed project, no impacts on public health would occur due to hazardous materials.

The above measures are based on the work that was performed at the Owl Hollow Park project which is an area of concern recognized as the Arden Avenue landfill (see the discussion above). Similar conditions are expected in the early phases of North Park (Phase A) which has been identified as in the area of the former Travis landfill. In addition, these measures would apply to other areas of the proposed park given the potential for most areas of the project site to have hazardous materials. With these measures in place, which DPR would incorporate into the project design, potential impacts from hazardous materials are avoided for the future Fresh Kills Park projects.

Building Demolition and Reuse

In addition to site development, prior to renovation or demolition of any existing building, a comprehensive environmental survey including an assessment for asbestos should be performed in each building to confirm the presence or absence of asbestos, lead-based paint, or other hazardous materials. If the investigation finds that a structure contains asbestos, it would need to be properly removed and disposed of in accordance with all City, State and Federal regulations by a licensed asbestos abatement contractor.

In addition, any renovation or demolition activities with the potential to disturb lead-based paint must be performed in accordance with the applicable Occupational Safety and Health Administration regulation (OSHA 29 CFR 1926.62—Lead Exposure in Construction). If disposal of suspect mercury-containing or suspect PCB-containing lighting or electrical fixtures is required, unless there is labeling or test data that indicates that these fixtures are not mercury- and/or PCB-containing, it would be performed in accordance with applicable federal, state, and local regulations and guidelines.

SOLID WASTE

The proposed project would require demolition as well as new construction. It is not expected that significant solid waste would be generated from construction activities. To minimize solid waste during construction, there would be the recycling of cut trees and vegetation for use as park mulch. In addition the City has an active program to reduce solid waste generated by construction sites that would be implemented.

TRAFFIC

To minimize traffic impacts on local neighborhood during construction, it is proposed to maximize the use of the regional highway access provided by the West Shore Expressway as well as to use the existing landfill service roads that are internal to the site for the purposes of delivering soils and construction equipment. Construction workers are expected to access the site primarily from the West Shore Expressway although some may reach the site by local roads.

Arriving and departing autos would primarily reach and exit the site via the West Shore Expressway connections to the project site and then use landfill service roads within the site. However, it is noted that for the 2016 program, other than the park projects at the site periphery, the site would not be accessible to vehicles from the local roads (i.e., there would not be any access from Richmond Avenue). Details of site access would be coordinated between DPR and the contractors with the assistance of NYSDOT and NYCDOT. Barging of soils may also be considered.

With the proposed construction program, access to the project site would be gate-controlled and some streets may be temporarily closed or have lane closures at the periphery of the site for the construction of new intersections (e.g., the re-construction of the intersection of Forest Hill Road and Richmond Avenue with the Forest Hill Road connection) as well as the installation of utility connections (e.g., water, sewer, gas, electric) at the periphery of the site. During these limited periods of construction impact, major roads, such as Arthur Kill Road, would have at least one lane open to traffic at all times. The temporary and limited closure of travel lanes on side streets is an unavoidable temporary impact on the local traffic network.

Nighttime construction may be considered at high traffic locations along Richmond Avenue as well as along the West Shore Expressway in order to minimize disruptions to traffic. This would be a consideration at final design and proposed (if appropriate) as part of the final construction approval with NYCDOT and NYSDOT.

In addition, all construction worker parking would be provided on site.

AIR QUALITY

Potential measures that could be implemented to reduce short-term impacts of the proposed project include the following:

DIESEL EQUIPMENT REDUCTION

Individual capital projects could minimize the use of diesel engines and use electric engines by operating from grid power instead, to the extent possible. This would allow the use of electric engines where practicable and could potentially eliminate some generators that would normally be needed for construction equipment.

CLEAN FUEL.

Ultra Low Sulfur Diesel would be used exclusively for all diesel engines throughout the project duration in accordance with local laws.

USE OF NEWER EQUIPMENT

The use of newer engine models with cleaner emissions standards would reduce air emissions particularly with respect to particular matter. Requiring the use of new equipment as well as the anticipated turnover and technological advances in construction equipment through the life of the project would reduce emissions for future projects. Use of cleaner small engines and gasoline engines would further reduce emissions.

POINT SOURCE CITING

In addition, in order to reduce the resulting concentration increments at sensitive receptors, large emissions sources and activities, such as concrete trucks and pumps, would be located away from residential buildings, schools, and playgrounds.

Dust Control/Soil Erosion and Sediment Control Practices

Because fugitive dust is a common impact of construction, it is also regulated under New York City's code. During construction, all appropriate fugitive dust control measures—including watering exposed areas and using dust covers for trucks—must be used to satisfy Section 1402.2-9.11 of the New York City Air Pollution Code. To prevent fugitive dust from becoming airborne, those measures include:

- Use of water to control dust in the construction operations and during the clearing and grading of land;
- Application of water to dirt paths, materials, stockpiles, and other surfaces that can generate airborne dust over extended periods;
- Construction of temporary roads would be built with properly sized stone or concrete equivalent over filtering material;
- Covering of open-body trucks transporting materials likely to generate airborne dust at all times when in motion;
- Paving and management of access roads to control dust; and
- Prompt removal of earth or other material from paved streets where earth or other material has been deposited by trucking or earth-moving equipment, erosion by water, or other means.

Each contractor should be required to implement a dust control plan that includes strict fugitive dust control plans as part of contract specifications. For example, stabilized truck exit areas would be established for washing off the wheels of all trucks that exit the project site. In addition, truck access points would be either watered as needed or, in cases where such routes would remain in the same place for an extended duration, the routes would be stabilized, covered with gravel, or temporarily paved to minimize dust. All trucks hauling loose material could also be equipped with tight fitting tailgates and covered prior to leaving the site. In addition to regular cleaning by the City, area roads adjacent to the sites should be cleaned as frequently as needed. Water sprays could be used for all excavation, demolition, and transfer of soils to ensure that materials are dampened as necessary to avoid the suspension of dust into the air. Loose materials could be watered, stabilized with a biodegradable suppressing agent, or covered. By implementing the above, an aggressive fugitive emissions reduction program could reduce fugitive dust emissions by at least 50 percent. In addition, the soil erosion and sediment control practices presented above would have the dual benefit of providing dust suppression.

CONSTRUCTION VEHICLE SPEEDS AND IDLING

Limiting on-site travel speeds to 5 miles per hour would control particulate emissions. In addition, idling of trucks or other equipment would not be permitted during periods when they are being unloaded or are not in use.

NOISE

The City has recently updated its Noise Control Code (effective July 1, 2007). Thus, the construction associated with the proposed project would be subject to the requirements of the new City Noise Control Code. Outlined below is a list of source controls noise reduction measures that may be proposed to meet those requirements, path controls that would occur with construction, and clarifications where the benefits of such reductions were included in the analyses.

As described above, all construction equipment and vehicles must also meet the City, State, and Federal regulatory requirements regarding noise emissions, and construction activities would be limited to weekdays between the hours of 7:00 AM and 6:00 PM.

In terms of source controls (e.g., reducing noise levels at the source or during most sensitive time periods), the following types of measures could be implemented as part of a noise control plan in order to avoid noise impacts during construction:

- NYCDEP, in its review of the noise control plan, would require all contractors and subcontractors to properly maintain their equipment.
- DPR could require all contractors and subcontractors to properly maintain their equipment and have quality mufflers installed;
- Noisy equipment, such as generators, cranes, concrete pumps, concrete trucks, and dump trucks, should be located away from and shielded (as necessary) from local neighborhoods (the only existing sensitive receptors immediately adjacent to the construction site) and used to the least extent possible; and
- Noise curtains and equipment enclosures could be utilized to provide shielding to sensitive receptor locations as necessary.

With the above measures in place, it is concluded that construction period noise emissions would be limited to the extent practicable and performed in accordance with all local, State and Federal laws and practices. The proposed project would also make use of the project site to avoid impacts on the surrounding neighborhoods and sensitive receptors.

PUBLIC HEALTH PROTECTIONS

VAPOR INFILTRATION

In light of the potential for leachate and/or groundwater to contain to contain NMOCs or volatile organic constituents from landfill and/or off-site industrial and commercial activities, appropriate sub-slab venting systems and/or vapor barriers is expected to be needed in the design of all buildings and structures at the project site.

EXPANDED MONITORING AND MAINTENANCE

In addition, as the details of the public access plan are developed, it is expected that the modifications for the post closure monitoring and maintenance plan or an additional monitoring plan developed by DPR, may be necessary. This plan may include:

- More intensive surface sampling for landfill gas in areas of the site that become publically accessible; and

- Coordination on exchange of monitoring between DSNY and DPR, including data on surface water quality and sediment sampling performed at Fresh Kills that would be shared with DPR and park managers and ecologists;
- Additional monitoring in areas not currently monitored in areas where dermal contact could occur under the proposed park project. This includes streams that would be restored, and stormwater basins, particularly in places where eco-classrooms and public access is being proposed.

SIGNAGE

Increased signage would also be an important component of the park's public health protection program which would include:

- Warnings about landfill infrastructure and systems;
- Only catch and release and the state health advisories on consumption;
- No swimming or water access unless accompanied by DPR personnel;
- Security signs on fencing provided around DSNY infrastructure and at limits of public access;[1] and
- Signage regarding rabies and other concerns that may arise over time.

OTHER PUBLIC HEALTH CONCERNS

In addition to the expanded protection of landfill infrastructure, monitoring and maintenance described above, the following additional measures are under consideration as techniques for the protection of public health.

To the extent necessary the proposed project could incorporate signage to alert park users with respect to avoid wildlife contact (the potential for rabies being just one of the concerns) and DPR personnel could be trained in protection and avoidance methods as well.

Fresh Kills Park would also use an integrated pest management approach that would take into consideration park usage (turf, landscape, trees, and structural/rodent) and consider least-toxic methods to controlling pests. Given that the proposed Fresh Kills Park would have wetland components, this would influence what the specific rodent control programs should/can be conducted. Baiting procedures (if any, for certain areas of the park), and bait formulation, rodent inspections, for example, would likely need to be customized for the wetlands area park (and perhaps beyond). An emerging issue that DPR is confronting is protection of raptors and birds of prey from rodenticide exposure. It is expected that the Fresh Kills Park program would encourage emphasis on non-chemical control of any of the commensal species of rats (e.g., Norway rat) near any of the wetlands.

In addition, the DOHMH prepares an annual mosquito control plan and provides mosquito management in City Parks. In order to avoid impacts from the West Nile Virus, DPR would begin coordination efforts with DOHMH relative to the control of mosquitoes in accordance

[1] As stated in Chapter 1, "Project Description," the project would be phased in over a long periods of time. Fencing and access control would be provided at the secure limits of each capital project to ensure that the public does not have uncontrolled access to portions of the site that may still be undergoing closure construction, or have not been properly prepared yet for public access.

with that plan at sites with the proposed Fresh Kills Park. The aggressiveness or intensity of the project would be comprehensive, as necessary, to protect the public from any potential health impacts due to West Nile Virus.

C. MITIGATION MEASURES

The measures below are presented as mitigation measures as they require additional regulatory approvals or are outside the jurisdiction of DPR to implement. Specific mitigation measures will be developed as individual capital projects progress.

ARCHAEOLOGICAL RESOURCES

To understand the potential for archaeological impacts from park development activitie, a Phase 1A study prepared for this project was performed (see Appendix B). It was the conclusion of that analysis that portions of the project site are sensitive for precontact and historic period archaeological resources. As the design for individual capital projects progresses, in order to avoid or to mitigate these impacts, it is recommended that individual construction projects be reviewed by an archaeologist to determine if the project could impact any archaeologically sensitive areas identified in the Phase 1A archaeological documentary study. If it is determined that impacts are possible, further investigation such as Phase 1B archaeological testing would be necessary to identify the presence or absence of archaeological resources. The Phase 1B would be designed in consultation with LPC and procedures for evaluating and reporting the field results would be approved by LPC. If Stage 1B testing indicates the presence of archaeological resources, further mitigation involving avoidance of artifacts and/or data recovery would be undertaken to mitigate any adverse impacts to the maximum extent practicable.

NATURAL RESOURCES

As described in Chapter 1 "Project Description," the proposed project would include substantial wetland and upland enhancement projects for the purposes of improving the overall ecological value of the project site. The project would also include activities in wetlands such as park roads, viaducts and bridges that would directly impact wetland as either direct impacts (e.g., filling a portion of the Fresh Kills to widen the roadway under the West Shore Expressway), or indirectly (e.g., shading of Main Creek beneath the proposed pedestrian bridges).

The proposed project includes an extensive wetland enhancement projects that call for enhancement of tidal wetlands (i.e., *Spartina* and mixed marsh enhancement along tidal creeks), freshwater wetland enhancement and enhancement (i.e., palustrine scrub shrub and forested wetlands) and possible freshwater wetland creation (i.e., conversion of detention basins to sunken forest landscapes). The Fresh Kills Park Plan intends to protect and enhance the condition and value of the wetland systems currently present and proposed future conditions, while offsetting the adverse impacts to wetlands resulting from construction of park roads and bridges. Table 23-1 below, identifies the area of wetland and aquatic landscapes that would be permanently and adversely impacted as a result of the construction of the proposed park roads and bridges for the 2016 and 2036 build years, and the areas of proposed wetland enhancement as part of the offsets for these unavoidable adverse impacts. A detailed discussion of these potential adverse impacts to wetlands and aquatic landscapes is presented in Chapter 10 "Natural Resources."

Table 23-1
Potential Wetland Impacts, Mitigation, and Habitat Enhancement for the 2016 and 2036 Analysis Years

Project Element	Area of Wetlands Filled (Acres)		Area of Wetlands or Aquatic Landscape Shaded (Acres)		Proposed Area of Wetlands Enhancement	
	Freshwater[1]	Tidal[2]	Freshwater[1]	Tidal[2]	Freshwater[1]	Tidal[2]
2016 Analysis Year						
Forest Hill Road Extension of Southern Park Road			1.10		*North Park*— 9.5 acres *South Park*—14 acres *Confluence, The Marsh*—4 acres *Confluence, The Terrace*—1 acre *Confluence, Creek Landing*—1 acre	*North Park*— 40 acres *South Park*— *4 acres* *Confluence, The Marsh*—0 acres *Confluence, The Terrace*— *0 acres* *Confluence, Creek Landing*— 1 acre
Loop Park Road, North Segment of West Shore Expressway underpass		0.3				
Loop Park Road, South Segment of West Shore Expressway Underpass		0.4				
Northbound West Shore Expressway Service Road— Loop Park Road to Wild Avenue	0.02					
Northbound West Shore Expressway Service Road— Arden Avenue to Loop Park Road			0.02			
Main Creek Pedestrian/Bicycle Bridge				0.3		
Richmond Creek Pedestrian/Bicycle Bridge				0.4		
Marine Infrastructure	0.0	0.0	0.0	0.2		
Subtotal (Acres)	-0.02	-0.7	-1.3	-0.9	±29.5	±45
2036 Analysis Year						
Park Road North—Richmond Road Connection	4.3				*East Park*— 24.5 acres *Confluence, The Point*—2 acres	*East Park*— 28 Acres *Confluence, The Point*— 3 acres
Signature Bridge		0.03		1.7		
Marine Infrastructure				0.4		
Subtotal (Acres)	-4.32	-0.73		-2.1	+26.5	+31
TOTAL	-4.52	-0.7	-1.1	-3.0	+56	+76

Notes:
[1] Freshwater wetlands are regulated by ACOE. There are no DEC-regulated wetlands on the project site.
[2] Tidal wetlands are regulated by both DEC and ACOE.
[3] See Figure 23-1 for Areas of Potential Wetland Mitigation.
Source: Biohabitats Incorporated, February, 2007; AKRF, March 2007.

The proposed project wetland activities include enhancement of degraded wetlands, enhancement of significantly altered wetlands, and creation of new wetland landscapes. Measures to minimize temporary adverse impacts to wetlands due to construction are described above. Wetland enhancements would include:

- Tidal—Tidal wetland enhancement would include enhancement and expansion of the existing tidal wetlands. Methods would include removal of invasive species (primarily Phragmites) and enhancement of the native intertidal and high marsh plant communities. Tidal enhancement would include mudflats, low salt marsh, and high salt marsh.
- Freshwater—enhancement and expansion of the existing freshwater wetlands present within the project site would occur, with possible creation of additional wetland landscapes within existing stormwater management basins, primarily forested wetlands, where compatible with the stormwater management plan developed for the park.
- Wetland enhancement—Enhancing vegetation and other conditions of existing functioning, but degraded wetlands.

Locations for those potential wetland mitigation projects are presented in Figure 23-1.

Tidal wetland enhancement at Fresh Kills Park would also require the treatment and management of invasive *Phragmites* that currently dominates much of the project area. These measures may include repeated herbicide application, cutting and removal (some grubbing, very little excavation) with intensive native vegetation plantings, and modification of sediment surface elevations to create water depth/inundation conditions that do not support Phragmites.

In terms of the tidal wetland enhancement approaches, there are a large number of instances where the landfill cover and associate slopes, perimeter protection and leachate collection systems, and other landfill infrastructure limit grading of upland areas to establish the elevations suitable for enhancement of tidal wetlands. In many of the landfill perimeter areas along the tidal waterways, tidal wetland enhancement techniques may include using softer techniques and less intrusive processes that do not involve significant upland excavation or tidal waterway dredging. These techniques include tidal wetland fringe enhancement that can include minor water-ward fill with clean sandy material, along with marsh toe stabilization (rocks, logs, coir fiber rolls, etc), improving hydrologic inundation periods, and native marsh plantings that are encompassed in a 'living shoreline' stabilization and enhancement approach. Further development of tidal wetland enhancement measures will involve determining tidal flows, tidal elevations, and sedimentation patterns.

Some elements of existing wetland conditions may be enhanced through very minor surface elevation changes, debris removal, targeted invasive species management, in-fill native plantings or channel modifications. Enhancement designs will be patterned after local native wetland systems in form, function and biological diversity.

TRAFFIC AND PARKING

As discussed in Chapter 16, "Traffic and Parking," a number of intersections in the study area would experience significant traffic impacts as a result of vehicular traffic generated by the proposed project.

The analysis results show that in the 2016 Build Conditions, the weekday PM and weekend midday peak hours would have the highest number of impacted intersections with seventeen (17) and sixteen (16), respectively. The weekend PM and weekday midday would have fourteen (14) and thirteen (13) impacted intersections, respectively. The weekday AM peak hour would have the fewest number of impacted intersections under the 2016 Build conditions with eleven (11).

By comparison, in the 2016 Build Conditions presented in the DGEIS, the weekend midday peak hour would have the highest number of impacted intersections with eighteen (18), followed by weekday PM and weekday midday peak hours with fifteen (15) and thirteen (13) impacted intersections, respectively. The Saturday PM peak hour would have twelve (12) impacted intersections. The weekday AM peak hour would have the fewest number of impacted intersections under the 2016 Build conditions with eleven (11).

The analysis results also show that in the 2036 Build conditions, the weekday PM peak hour would have the highest number of impacted intersections with twenty five (25), followed by the weekend midday peak hour with twenty four (24) impacted intersections. The weekend PM peak hour would have twenty one (21) impacted intersections. The weekday AM and weekday midday peak hours would have the fewest number of impacted intersections under the Build 2036 conditions with twenty (20).

By comparison, in the 2036 Build Conditions presented in the DGEIS, the weekday PM and weekend midday peak hours would have the highest number of impacted intersections with

twenty-four (24), followed by the weekend PM peak hour with twenty-two (22) impacted intersections. The weekday AM and weekday midday peak hours would have the fewest number of impacted intersections under the Build 2036 conditions with twenty (20) each.

RECOMMENDED MITIGATION MEASURES

2016 BUILD CONDITIONS

With the proposed mitigation measures in place, majority of the impacted approaches/lane groups would be mitigated back to the same or better service conditions than the 2016 No Build conditions; however, some intersections would remain unmitigated as summarized in Table 23-2. Compared to the DGEIS, the total number of unmitigated intersections would remain unchanged for all five peak hours analyzed.

Table 23-2
Summary of Mitigated and Unmitigated Interesctions—2016

Peak Period	Impacted Intersections	Mitigated	Unmitigated
Weekday AM	11	9	2
Weekday Midday	13	11	2
Weekday PM	17	14	3
Weekend Midday	16	11	5
Weekend PM	14	11	3

Table 23-3 summarizes all of the measures contained in the mitigation plan for the 2016 Build conditions, during the weekday AM, midday and PM, and weekend midday and PM peak hours, respectively. Provided below is a discussion of each affected intersection and its required mitigation.

Victory Boulevard and West Shore Expressway (SB) Ramps

The impact at the westbound left-turn movement at this intersection during all peak hours could be mitigated by shifting 1 second of green time from the southbound phase to the eastbound/westbound phase.

Victory Boulevard and Travis Avenue

The impact at the northbound left-turn movement at this intersection during the weekday PM, and weekend midday and PM peak hours could be mitigated by shifting 1 second of green time from the eastbound/westbound phase to the northbound/southbound phase.

Richmond Avenue and Signs Road

The impact at the northbound left-turn movement at this intersection during the weekday AM peak hour could be mitigated by shifting 1 second of green time from the northbound/southbound phase to the northbound phase.

The impacts at the eastbound right-turn movement and southbound through-right movement at this intersection during the weekday PM and weekend midday peak hours could be mitigated by daylighting the southbound and eastbound approaches.

The impact at the southbound through-right movement at this intersection during the weekend PM peak hour could be mitigated by daylighting the southbound approach.

Richmond Avenue and Draper Place

The impact at the northbound left-turn movement during the AM peak hour could be mitigated by shifting 1 second of green time from northbound/southbound phase to the northbound phase.

The impacts at the northbound left-turn movement and southbound through-right movement during the weekday midday, PM, weekend midday, and weekend PM peak hours could be mitigated by shifting 1 second of green time from northbound/southbound phase to the northbound only phase and by daylighting the southbound approach to provide an additional moving lane.

Richmond Avenue and Richmond Hill Road

The impact at the southbound left-turn movement at this intersection during the weekday AM, weekday midday, weekday PM, and weekend PM could be mitigated by shifting 1 second of green time from the northbound/southbound phase to the northbound/southbound protected left-turn phase.

The impacts at the westbound shared left-turn and through movement and the southbound left-turn movement at this intersection during the weekend midday peak hour could not be mitigated by standard traffic engineering measures.

Richmond Avenue and Forest Hill Road

The impacts at this intersection could not be mitigated by standard traffic engineering measures during any peak hour.

Richmond Avenue and Arthur Kill Road

The impact at the westbound through movement at this intersection during the weekday AM peak hour could be mitigated by shifting 1 second of green time from the northbound/southbound protected left-turn phase to the eastbound/westbound phase.

The impacts at the westbound through movement and southbound left-turn movement at this intersection during the weekday midday peak hour could be mitigated by shifting 1 second of green time from the northbound/southbound phase to the eastbound/westbound phase and by shifting 1 second of green time from the northbound/southbound phase to the northbound/southbound protected left-turn phase.

The impacts at the westbound through movement, the northbound through-right movement and southbound left-turn movement at this intersection during the weekday PM and weekend midday peak hours could not be mitigated by standard traffic engineering measures.

The impacts at the westbound through movement and the southbound left-turn movement at this intersection during the weekend PM peak hour could not be mitigated by standard traffic engineering measures.

Arthur Kill Road and Woodrow Road

The impact at the westbound left-through movement at this intersection during the weekend PM peak hour could be mitigated by shifting 3 seconds of green time from the northbound phase to the eastbound/westbound phase.

Table 23-3
2016 Recommended Mitigation Measures

Intersection	Mitigation Measures				
	Weekday Peak Hours			Weekend Peak Hours	
	AM	Midday	PM	Midday	PM
Primary Study Area					
Victory Boulevard and West Shore Expressway (SB) Ramps	Shift 1 second of green time from SB phase to EB/WB phase	Shift 1 second of green time from SB phase to EB/WB phase	Shift 1 seconds of green time from SB phase to EB/WB phase	Shift 1 seconds of green time from SB phase to EB/WB phase	Shift 1 seconds of green time from SB phase to EB/WB phase
Victory Boulevard and Travis Avenue	Not impacted	Not impacted	Shift 1 second of green time from the EB/WB phase to the NB/SB phase	Shift 1 second of green time from the EB/WB phase to the NB/SB phase	Shift 1 second of green time from the EB/WB phase to the NB/SB phase
Signs Road and Richmond Avenue *	Shift 1 second of green time from NB/SB phase to NB only phase	Not impacted	Daylight SB approach Daylight EB approach	Daylight SB approach Daylight EB approach	Daylight SB approach
Draper Place and Richmond Avenue *	Shift 1 second of green time from NB/SB phase to NB only phase	Daylight SB approach to provide an additional moving lane Shift 1 second of green time from NB/SB phase to NB only phase	Daylight SB approach to provide an additional moving lane Shift 1 second of green time from NB/SB phase to NB only phase	Daylight SB approach to provide an additional moving lane Shift 1 second of green time from NB/SB phase to NB only phase	Daylight SB approach to provide an additional moving lane Shift 1 second of green time from NB/SB phase to NB only phase
Richmond Hill Road and Richmond Avenue	Shift 1 second of green time from NB/SB phase to NB left / SB left phase	Shift 1 second of green time from NB/SB phase to NB left / SB left phase	Shift 1 second of green time from NB/SB phase to NB left / SB left phase	Unmitigated	Shift 1 second of green time from NB/SB phase to NB left / SB left phase
Forest Hill Road and Richmond Avenue	Unmitigated	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Arthur Kill Road and Richmond Avenue	Shift 1 second of green time from NB left / SB left phase to EB/WB phase	Shift 1 second of green time from NB/SB phase to EB/WB phase Shift 1 second of green time from NB/SB phase to NB left / SB left phase	Unmitigated	Unmitigated	Unmitigated
Arthur Kill Road and Woodrow Road	Not impacted	Not impacted	Not impacted	Not impacted	Shift 3 seconds of green time from NB to EB/WB
Arden Avenue and Arthur Kill Road	Shift 3 seconds of green time from the WB protected phase to the EB/WB phase	Shift 3 seconds of green time from the WB protected phase to the EB/WB phase	Shift 3 seconds of green time from the WB protected phase to the EB/WB phase	Shift 2 seconds of green time from the WB protected phase to EB/WB phase	Shift 1 second of green time from the WB protected phase to EB/WB phase
Drumgoole Road and Richmond Avenue (1)	Restripe NB approach as three 10-feet wide lanes	Restripe NB approach as three 10-feet wide lanes	Restripe NB approach as three 10-feet wide lanes	Restripe NB approach as three 10-feet wide lanes	Restripe NB approach as three 10-feet wide lanes
Arthur Kill Road and Drumgoole Road	Restripe the EB approach to provide a 16-foot shared through and right-turn lane	Shift 1 seconds of green time from protected EB/WB left turn phase to EB/WB phase Restripe the EB approach to provide a 16-foot shared through and right-turn lane	Shift 6 seconds of green time from the EB/WB exclusive left-turn phase to the NB/SB phase Restripe the EB approach to provide a 16-foot shared through and right-turn lane	Restripe the EB approach to provide a 16-foot shared through and right-turn lane	Shift 1 seconds of green time from EBL/WBL to EB/WB Shift 1 second of green time from the EB left / WB left phase to the NB/SB phase Restripe the EB approach to provide a 16-foot shared through and right-turn lane
Arthur Kill Road and West Shore Expressway (NB) Service Road	Unmitigated	Not impacted	Not impacted	Unmitigated	Not impacted
Arthur Kill Road and West Shore Expressway (SB) Service Road	Not impacted	Shift 1 second of green time from the EB/WB to the SB phase	Shift 1 seconds of green time from the EB /WB phase to the SB phase	Not impacted	Not impacted
Muldoon Avenue and West Shore Expressway (SB) Service Road (2)	Re-stripe SB approach by shifting moving lane on service road to east curb	Re-stripe SB approach by shifting moving lane on service road to east curb	Re-stripe SB approach by shifting moving lane on service road to east curb	Re-stripe SB approach by shifting moving lane on service road to east curb	Re-stripe SB approach by shifting moving lane on service road to east curb
Arden Avenue and West Shore Expressway (SB) Service Road *	Daylight the WB approach Create signalized intersection with the following signal timing/phasing plan: Phase / Green / Amber / Red WB / 30 / 3 / 2 SB / 50 / 3 / 2 Cycle length = 90 seconds	Daylight the WB approach Create signalized intersection with the following signal timing/phasing plan: Phase / Green / Amber / Red WB / 22 / 3 / 2 SB / 58 / 3 / 2 Cycle length = 90 seconds	Daylight the WB approach Create signalized intersection with the following signal timing/phasing plan: Phase / Green / Amber / Red WB / 18 / 3 / 2 SB / 62 / 3 / 2 Cycle length = 90 seconds	Daylight the WB approach Create signalized intersection with the following signal timing/phasing plan: Phase / Green / Amber / Red WB / 25 / 3 / 2 SB / 55 / 3 / 2 Cycle length = 90 seconds	Daylight the WB approach Create signalized intersection with the following signal timing/phasing plan: Phase / Green / Amber / Red WB / 25 / 3 / 2 SB / 55 / 3 / 2 Cycle length = 90 seconds
Secondary Study Area					
Travis Avenue and Forest Hill Road	Not impacted	Shift 2 second of green time from EB phase to NB/SB phase	Shift 3 seconds of green time from the EB phase to the NB/SB phase	Shift 3 seconds of green time from the EB phase to the NB/SB phase	Shift 3 seconds of green time from the EB phase to the NB/SB phase
Richmond Hill Road and Forest Hill Road	Develop a new signal timing/phasing plan: Phase / Green / Amber / Red EB/WB / 36 / 3 / 2 NB/SB / 35 / 3 / 2 EB / 6 / 3 / 0 Cycle length = 90 seconds	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Woodrow Road and Bloomingdale Road	Not impacted	Not impacted	Shift 1 second of green time from WB phase to NB/SB phase	Not impacted	Not impacted
Amboy Road and Arden Avenue	Not impacted	Not impacted	Not impacted	Shift 1 second of green time from EB/WB to NB/SB	Not impacted
Amboy Road and Richmond Avenue (3) *	Restripe SB approach to 12-feet left-turn lane	Restripe SB approach to 12-feet left-turn lane	Restripe SB approach to 12-feet left-turn lane Daylight SB approach.	Restripe SB approach to 12-feet left-turn lane	Restripe SB approach to 12-feet left-turn lane
Yukon Avenue and Forest Hill Road *	Not impacted	Daylight the NB approach	Daylight the NB approach. Shift 1 second of green time from the EB phase to the NB/SB phase	Not impacted	Not impacted

Notes:
(1) Intersection of Drumgoole Road and Richmond Avenue was not impacted during the weekday AM and midday peak hours and was analyzed under mitigation conditions for verification purposes only.
(2) Intersection of Muldoon Avenue and West Shore Expressway (SB) Service Road was not impacted during the weekday AM and PM, and weekend PM peak hours and was analyzed under mitigation conditions for verification purposes only.
(3) Intersection of Amboy Road and Richmond Avenue was not impacted during the weekday AM, midday and weekend PM peak hours and was analyzed under mitigation conditions for verification purposes only.
* Daylight at intersection approaches implies that curbside parking is prohibited for approximately 100-feet.

Arden Avenue and Arthur Kill Road

The impact at the eastbound through movement at this intersection during the weekday AM and midday peak hours could be mitigated by shifting 3 seconds of green time from the westbound protected phase to the eastbound/westbound phase.

The impact at the eastbound left-turn movement and eastbound through movement at this intersection during the weekday PM peak hour could be mitigated by shifting 3 seconds of green time from the westbound protected phase to the eastbound/westbound phase.

The impact at the eastbound through-movement during the weekend midday peak hour could be mitigated by shifting 2 seconds of green time from the westbound protected phase to the eastbound/westbound phase.

The impacts at the eastbound left-turn movement and through-movement during the weekend PM peak hour could be mitigated by shifting 1 second of green time from the westbound protected phase to the eastbound/westbound phase.

Richmond Avenue and Drumgoole Road

The impact at the northbound through movement at this intersection during the weekday PM and weekend midday and PM peak hours could be mitigated by restriping the northbound approach to provide three 10-foot-wide lanes.

Arthur Kill Road and Drumgoole Road

The impact at the eastbound through-right movement at this intersection during the weekday AM and weekend midday peak hours could be mitigated by restriping the eastbound approach to provide a 16-foot shared through and right-turn lane.

The impact at the eastbound through-right movement at this intersection during the weekday midday could be mitigated by shifting 1 second of green time from the eastbound/westbound protected left-turn phase to the eastbound/westbound phase. In addition, restriping the eastbound approach to provide a 16-foot shared through and right-turn lane is also required.

The impacts at the eastbound through-right movement and northbound approach at this intersection during the weekday PM peak hour could be mitigated by shifting 6 seconds of green time from eastbound/westbound protected left-turn phase to the northbound/southbound phase. In addition, restriping the eastbound approach to provide a 16-foot shared through and right-turn lane is also required.

The impacts at the eastbound through-right movement and northbound through-right movement at this intersection during the weekend PM peak hour could be mitigated by shifting 1 second of green time from the eastbound/westbound protected left-turn phase to the eastbound/westbound phase and by shifting 1 second of green time from the eastbound/westbound protected left-turn phase to the northbound/southbound phase. In addition, restriping the eastbound approach to provide a 16-foot shared through and right-turn lane is also required.

Arthur Kill Road and West Shore Expressway (NB) Service Road

The impact at the eastbound left-turn movement at this intersection during the weekday AM and weekend midday peak hours could not be mitigated by standard traffic engineering measures.

Arthur Kill Road and West Shore Expressway (SB) Service Road

The impact at the southbound approach at this intersection during the weekday midday and PM peak hours could be mitigated by shifting 1 second of green time from the eastbound/westbound phase to the southbound phase.

Muldoon Avenue and West Shore Expressway (SB) Service Road

The impact at the eastbound right-turn movement at this intersection during the weekday midday peak hour could be mitigated by restriping the southbound approach to shift the moving lane on the service road to the east curb.

Arden Avenue and West Shore Expressway (SB) Service Road

The impact at the westbound left-turn movement at this intersection during all peak hours could be mitigated by installing a new two-phase traffic signal operating with a 90-second cycle length and by daylighting the westbound approach (see Table 23-3). The feasibility of this signal including a signal warrant analysis would be reviewed by NYCDOT as part of the intersection design.

Travis Avenue and Forest Hill Road

The impact at the northbound left-through movement at this intersection during the weekday midday peak hour could be mitigated by shifting 2 second of green time from the eastbound phase to the northbound/southbound phase.

The impacts at the northbound left-through movement and southbound through-right movement at this intersection during the weekday PM peak hour could be mitigated by shifting 3 seconds of green time from the eastbound phase to the northbound/southbound phase.

The impact at the northbound left-through movement at this intersection during the weekend midday and PM peak hours could be mitigated by shifting 3 seconds of green time from the eastbound phase to the northbound/southbound phase.

Richmond Hill Road and Forest Hill Road

The impacts at the westbound approach and northbound through-right movement at this intersection during the weekday AM peak hour could be mitigated by developing a new signal phasing and timing plan (see Table 23-3).

The impacts at the westbound approach, northbound through-right movement and southbound through-right movement during the weekday midday, weekday PM and weekend midday and PM peak hours could not be mitigated by standard traffic engineering measures.

Woodrow Road and Bloomingdale Road

The impacts at the northbound and southbound approaches at this intersection during the weekday PM peak hour could be mitigated by shifting 1 second of green time from the westbound phase to the northbound/southbound phase.

Arden Avenue and Amboy Road

The impact at the southbound left-turn movement at this intersection during the weekend midday peak hour could be mitigated by shifting 1 second of green time from the eastbound/westbound phase to the northbound/southbound phase.

Table 23-4

2016 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday AM Peak Hour

Intersection	2016 No Build				2016 Build					2016 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Primary Study Area - Signalized Intersections														
Victory Boulevard and West Shore Expressway (SB) Ramps														
Eastbound	TR	0.49	20.5	C	TR	0.49	20.8	C		TR	0.48	19.8	B	
Westbound	L	1.46	248.4	F	L	1.48	255.3	F	+	L	1.42	231.2	F	
	T	0.26	16.4	B	T	0.26	16.4	B		T	0.25	15.8	B	
Southbound	LTR	0.28	16.0	B	LTR	0.29	16.1	B		LTR	0.30	16.7	B	
	Intersection		103.8	F	Intersection		106.2	F		Intersection		97.1	F	
Signs Road and Richmond Avenue														
Eastbound	L	0.53	34.6	C	L	0.55	35.0+	D		L	0.55	35.0+	D	
	R	1.06	110.7	F	R	1.06	113.3	F		R	1.06	113.3	F	
Northbound	L	1.45	231.1	F	L	1.47	238.6	F	+	L	1.42	217.3	F	
	TR	0.88	7.3	A	TR	0.81	5.3	A		TR	0.81	5.3	A	
Southbound	TR	0.52	9.8	A	TR	0.52	9.8	A		TR	0.54	10.6	B	
	Intersection		35.8	D	Intersection		37.0	D		Intersection		35.1	D	
Draper Place and Richmond Avenue														
Eastbound	LT	1.24	166.9	F	LT	1.24	166.9	F		LT	1.24	166.9	F	
Westbound	LTR	0.04	26.9	C	LTR	0.04	26.9	C		LTR	0.04	26.9	C	
Northbound	L	1.26	164.3	F	L	1.27	169.6	F	+	L	1.22	147.9	F	
	TR	0.67	5.0	A	TR	0.61	4.5	A		TR	0.61	4.5	A	
Southbound	TR	0.64	27.7	C	TR	0.64	27.8	C		TR	0.67	29.2	C	
	Intersection		43.3	D	Intersection		45.8	D		Intersection		43.4	D	
Richmond Hill Road and Richmond Avenue														
Eastbound	LTR	0.01	25.8	C	LTR	0.01	25.8	C		LTR	0.01	25.8	C	
Westbound	L	0.20	28.6	C	L	0.27	29.8	C		L	0.27	29.8	C	
	LT	0.20	28.5	C	LT	0.26	29.6	C		LT	0.26	29.6	C	
	R	0.89	40.2	D	R	0.80	32.0	C		R	0.78	29.9	C	
Northbound	L	0.00	32.9	C	L	0.00	32.9	C		L	0.00	32.1	C	
	T	1.01	41.2	D	T	0.94	29.3	C		T	0.97	33.6	C	
	R	0.16	13.9	B	R	0.16	13.9	B		R	0.17	14.7	B	
Southbound	L	1.29	195.0	F	L	1.29	198.4	F	+	L	1.20	158.6	F	
	TR	0.50	16.6	B	TR	0.47	16.2	B		TR	0.48	17.1	B	
	Intersection		43.4	D	Intersection		37.0	D		Intersection		36.7	D	
Forest Hill Road and Richmond Avenue														
Eastbound					L	0.47	27.1	C						
					T	0.13	20.7	C						
					R	0.04	19.7	B						
Westbound	L	0.56	27.9	C	L	1.41	229.8	F	+					
	LR	0.71	32.9	C	TR	0.16	21.0	C						
Northbound					L	0.83	79.7	E		Unmitigated				
	T	0.86	13.9	B	T	1.13	92.1	F	+					
	R	1.24	135.0	F	R	1.95	462.1	F	+					
Southbound	L	0.09	7.9	A	L	0.06	38.4	D						
	T	0.36	7.2	A	TR	0.52	20.8	C						
	Intersection		33.0	C	Intersection		142.9	F						
Arthur Kill Road and Richmond Avenue														
Eastbound	L	0.19	25.8	C	L	0.19	25.8	C		L	0.19	25.1	C	
	TR	0.82	33.6	C	TR	0.83	34.3	C		TR	0.81	32.2	C	
Westbound	L	0.27	29.2	C	L	0.29	30.3	C		L	0.26	27.7	C	
	T	1.23	147.0	F	T	1.24	150.8	F	+	T	1.20	133.4	F	
	R	0.68	18.1	B	R	0.69	18.2	B		R	0.69	18.2	B	
Northbound	L	0.62	40.7	D	L	0.63	41.0	D		L	0.67	43.7	D	
	TR	1.19	124.5	F	TR	1.19	125.2	F		TR	1.19	125.2	F	
Southbound	L	0.50	37.7	D	L	0.51	37.8	D		L	0.54	39.6	D	
	TR	0.56	26.7	C	TR	0.47	25.2	C		TR	0.47	25.2	C	
	Intersection		75.9	E	Intersection		77.6	E		Intersection		74.4	E	
Arden Avenue and Arthur Kill Road														
Eastbound	L	0.49	29.0	C	L	0.66	37.7	D		L	0.60	31.9	C	
	T	0.92	51.8	D	T	1.03	75.2	E	+	T	0.93	51.0	D	
	R	0.18	22.2	C	R	0.18	22.2	C		R	0.17	19.9	B	
Westbound	L	1.23	148.4	F	L	0.46	20.1	C		L	0.51	21.4	C	
	TR	0.23	11.3	B	TR	0.52	15.2	B		TR	0.52	15.2	B	
Northbound	LTR	1.59	308.0	F	LTR	1.16	126.0	F		LTR	1.16	126.0	F	
Southbound	L	0.67	49.9	D	L	0.41	28.3	C		L	0.41	28.3	C	
	TR	0.75	34.5	C	TR	0.86	43.6	D		TR	0.86	43.6	D	
	Intersection		125.7	F	Intersection		57.2	E		Intersection		51.1	D	
Drumgoole Road and Richmond Avenue [1]														
Eastbound	L	1.25	148.1	F	L	1.13	97.1	F		L	1.13	97.1	F	
	LR	1.26	150.4	F	LR	1.14	100.0	F		LR	1.14	100.0	F	
Northbound	T	1.17	109.4	F	T	1.18	111.3	F		T	0.88	28.6	C	
Southbound	T	0.52	19.4	B	T	0.46	18.5	B		T	0.46	18.5	B	
	Intersection		113.8	F	Intersection		91.3	F		Intersection		59.0	E	
Arthur Kill Road and Drumgoole Road														
Eastbound	L	1.28	165.1	F	L	0.89	42.6	D		L	0.89	42.6	D	
	TR	1.24	157.9	F	TR	1.28	172.2	F	+	TR	1.20	140.5	F	
Westbound	L	0.61	20.2	C	L	0.61	20.2	C		L	0.61	20.2	C	
	TR	0.55	32.2	C	TR	0.56	32.4	C		TR	0.56	32.4	C	
Northbound	L	0.22	18.9	B	L	0.24	18.8	B		L	0.24	18.8	B	
	TR	1.25	141.4	F	TR	1.25	142.2	F		TR	1.25	142.2	F	
Southbound	LTR	0.80	27.4	C	LTR	0.75	25.4	C		LTR	0.75	25.4	C	
	Intersection		101.4	F	Intersection		88.8	F		Intersection		84.4	F	
Arthur Kill Road and West Shore Expressway (NB) Service Road														
Eastbound	L	1.31	183.7	F	L	2.03	496.4	F	+					
	T	0.31	7.5	A	T	0.23	6.9	A						
Westbound	TR	0.75	13.2	B	TR	0.51	9.3	A		Unmitigated				
Northbound	LTR	0.78	51.4	D	LTR	0.77	49.3	D						
	Intersection		33.2	C	Intersection		111.9	F						

Table 23-4

2016 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday AM Peak Hour

Intersection	2016 No Build				2016 Build					2016 Build with Mitigation			
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS
Primary Study Area - Unsignalized Intersections													
Muldoon Avenue and West Shore Expressway (SB) Service Road [1]													
Eastbound	R	0.24	16.1	C	R	0.30	19.5	C		Free-flow operation			
Arden Avenue and West Shore Expressway (SB) Service Road										Signalized			
Westbound	L	2.78	919.9	F	L	9.54	*	F	+	L	0.55	25.5	C
Southbound	L	0.46	9.1	A	L	0.46	9.1	A		L	0.76	20.7	C
										T	0.57	15.2	B
										Intersection		19.6	B
Secondary Study Area - Signalized Intersections													
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.33	16.9	B	L	0.32	16.9	B		L	0.40	20.3	C
	TR	0.57	16.2	B	TR	0.57	16.3	B		TR	0.62	20.0	B
Westbound	LTR	1.09	88.6	F	LTR	1.12	101.6	F	+	LTR	1.07	80.5	F
Northbound	L	0.27	27.0	C	L	0.28	27.3	C		L	0.19	20.7	C
	TR	1.13	108.1	F	TR	1.26	161.6	F	+	TR	1.12	100.1	F
Southbound	L	1.52	302.7	F	L	1.52	302.7	F		L	1.52	300.7	F
	TR	0.86	42.2	D	TR	0.86	42.7	D		TR	0.76	32.0	C
	Intersection		81.0	F	Intersection		99.6	F		Intersection		76.2	E
Amboy Road and Richmond Avenue [1]													
Eastbound	L	0.39	27.7	C	L	0.39	27.7	C		L	0.39	27.7	C
	T	0.96	57.0	E	T	0.96	57.0	E		T	0.96	57.0	E
	R	0.27	22.6	C	R	0.27	22.6	C		R	0.27	22.6	C
Westbound	L	0.69	64.1	E	L	0.69	64.1	E		L	0.69	64.1	E
	T	0.65	30.6	C	T	0.65	30.6	C		T	0.65	30.6	C
	R	0.33	14.7	B	R	0.33	14.7	B		R	0.33	14.7	B
Northbound	L	0.18	19.5	B	L	0.18	19.6	B		L	0.18	19.6	B
	T	0.63	26.8	C	T	0.64	27.0	C		T	0.64	27.0	C
	R	0.16	18.5	B	R	0.16	18.5	B		R	0.16	18.5	B
Southbound	L	0.64	21.2	C	L	0.65	21.5	C		L	0.60	19.6	B
	TR	0.69	19.4	B	TR	0.70	19.7	B		TR	0.75	21.8	C
	Intersection		30.6	C	Intersection		30.7	C		Intersection		31.0	C

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.

\+ implies a significant adverse impact

* implies that delays are in excess of 1000 seconds

(1) Intersection not impacted but analysis was conducted to incorporate permanent geometric/signal phasing changes proposed as mitigation measures in other peak hours.

Table 23-5
2016 No Build, Build, and Build with Mitigation Level of Service Analyses
Weekday Midday Peak Hour

Intersection	2016 No Build				2016 Build					2016 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Primary Study Area - Signalized Intersections														
Victory Boulevard and West Shore Expressway (SB) Ramps														
Eastbound	TR	0.60	23.2	C	TR	0.62	23.9	C		TR	0.60	22.7	C	
Westbound	L	1.48	261.0	F	L	1.52	277.3	F	+	L	1.46	249.0	F	
	T	0.22	16.0	B	T	0.22	16.0	B		T	0.21	15.4	B	
Southbound	LTR	0.32	16.3	B	LTR	0.33	16.4	B		LTR	0.34	17.1	B	
	Intersection		92.1	F	Intersection		97.0	F		Intersection		88.3	F	
Draper Place and Richmond Avenue														
Eastbound	LT	1.24	165.2	F	LT	1.24	165.2	F		LT	1.24	165.2	F	
Westbound	LTR	0.15	28.3	C	LTR	0.15	28.3	C		LTR	0.15	28.3	C	
Northbound	L	1.24	159.7	F	L	1.27	171.1	F	+	L	1.22	150.2	F	
	TR	0.5	3.8	A	TR	0.48	3.7	A		TR	0.48	3.7	A	
Southbound	TR	1.03	58.7	E	TR	1.04	63.3	E	+	TR	0.84	32.7	C	
	Intersection		56.5	E	Intersection		60.4	E		Intersection		45.9	D	
Richmond Hill Road and Richmond Avenue														
Eastbound	LTR	0.01	27.3	C	LTR	0.01	27.3	C		LTR	0.01	27.3	C	
Westbound	L	0.56	39.3	D	L	0.64	43.3	D		L	0.64	43.3	D	
	LT	0.59	40.6	D	LT	0.68	45.2	D		LT	0.68	45.2	D	
	R	0.90	42.3	D	R	0.79	31.4	C		R	0.77	29.4	C	
Northbound	L	0.00	31.3	C	L	0.00	31.3	C		L	0.00	30.4	C	
	T	0.72	19.6	B	T	0.72	19.7	B		T	0.74	20.9	C	
	R	0.30	15.6	B	R	0.31	15.6	B		R	0.32	16.5	B	
Southbound	L	1.26	174.8	F	L	1.26	177.2	F	+	L	1.18	143.8	F	
	TR	0.75	20.2	C	TR	0.69	19.1	B		TR	0.71	20.3	C	
	Intersection		35.0+	D	Intersection		34.5	C		Intersection		32.6	C	
Forest Hill Road and Richmond Avenue														
Eastbound					L	0.65	31.9	C						
					T	0.18	20.6	C						
					R	0.11	19.9	B						
Westbound	L	0.66	30.7	C	L	1.64	328.1	F	+					
	LR	0.85	42.7	D	TR	0.22	21.1	C						
Northbound					L	0.84	80.7	F		Unmitigated				
	T	0.63	9.4	A	T	0.96	40.8	D						
	R	0.63	12.8	B	R	1.14	118.2	F	+					
Southbound	L	0.17	10.8	B	L	0.10	39.0	D						
	T	0.73	10.7	B	TR	1.21	129.8	F	+					
	Intersection		13.7	B	Intersection		111.4	F						
Arthur Kill Road and Richmond Avenue														
Eastbound	L	0.17	26.0	C	L	0.17	26.0	C		L	0.17	25.3	C	
	TR	0.59	27.1	C	TR	0.61	27.5	C		TR	0.59	26.4	C	
Westbound	L	0.24	25.3	C	L	0.25	25.8	C		L	0.24	24.5	C	
	T	1.12	105.3	F	T	1.14	110.3	F	+	T	1.10	95.8	F	
	R	0.49	14.3	B	R	0.51	14.6	B		R	0.49	13.1	B	
Northbound	L	0.47	37.0	D	L	0.49	37.3	D		L	0.46	35.8	D	
	TR	0.87	35.4	D	TR	0.87	35.9	D		TR	0.94	44.7	D	
Southbound	L	1.24	158.8	F	L	1.26	167.3	F	+	L	1.18	133.2	F	
	TR	0.80	31.8	C	TR	0.64	27.1	C		TR	0.68	30.0	C	
	Intersection		61.8	E	Intersection		64.6	E		Intersection		58.7	E	
Arden Avenue and Arthur Kill Road														
Eastbound	L	0.53	29.4	C	L	0.69	37.6	D		L	0.63	31.7	C	
	T	1.16	121.7	F	T	1.26	161.4	F	+	T	1.15	112.5	F	
	R	0.22	22.6	C	R	0.22	22.6	C		R	0.20	20.3	C	
Westbound	L	1.00	76.3	E	L	0.35	18.7	B		L	0.42	21.6	C	
	TR	0.13	10.4	B	TR	0.35	12.6	B		TR	0.35	12.6	B	
Northbound	LTR	0.63	29.0	C	LTR	0.46	25.4	C		LTR	0.46	25.4	C	
Southbound	L	0.41	28.4	C	L	0.31	24.4	C		L	0.31	24.4	C	
	TR	0.59	28.5	C	TR	0.72	33.6	C		TR	0.72	33.6	C	
	Intersection		61.9	E	Intersection		69.6	E		Intersection		53.2	D	
Drumgoole Road and Richmond Avenue [1]														
Eastbound	L	1.00	58.6	E	L	0.92	42.0	D		L	0.92	42.0	D	
	LR	0.96	49.3	D	LR	0.89	37.7	D		LR	0.89	37.7	D	
Northbound	T	0.92	34.4	C	T	0.94	36.3	D		T	0.70	22.3	C	
Southbound	T	1.12	89.9	F	T	1.01	51.2	D		T	1.01	51.2	D	
	Intersection		61.3	E	Intersection		42.7	D		Intersection		38.0	D	
Arthur Kill Road and Drumgoole Road														
Eastbound	L	0.95	58.0	E	L	0.71	25.0	C		L	0.72	25.5	C	
	TR	1.01	79.7	E	TR	1.08	102.7	F	+	TR	0.97	68.9	E	
Westbound	L	0.54	21.2	C	L	0.50	19.8	B		L	0.53	20.8	C	
	TR	0.44	31.9	C	TR	0.46	32.2	C		TR	0.44	31.1	C	
Northbound	L	0.36	30.0	C	L	0.49	38.6	D		L	0.49	38.6	D	
	TR	0.88	31.9	C	TR	0.89	32.6	C		TR	0.89	32.6	C	
Southbound	LTR	1.25	146.1	F	LTR	1.17	109.7	F		LTR	1.17	109.7	F	
	Intersection		77.3	E	Intersection		63.4	E		Intersection		60.0	E	
Arthur Kill Road and West Shore Expressway (SB) Service Road														
Eastbound	TR	0.51	16.4	B	TR	0.52	16.5	B		TR	0.55	17.6	B	
Westbound	L	0.89	55.6	E	L	0.52	23.3	C		L	0.55	26.1	C	
	T	0.17	13.2	B	T	0.18	13.2	B		T	0.19	13.9	B	
Southbound	LTR	1.12	88.7	F	LTR	1.13	92.0	F	+	LTR	1.09	76.7	E	
	Intersection		51.3	D	Intersection		50.3	D		Intersection		44.1	D	

Table 23-5

2016 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday Midday Peak Hour

Intersection	2016 No Build				2016 Build					2016 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Primary Study Area - Unsignalized Intersections														
Muldoon Avenue and West Shore Expressway (SB) Service Road														
Eastbound	R	0.71	38.3	E	R	0.97	94.3	F	+	Free-flow operation				
Arden Avenue and West Shore Expressway (SB) Service Road										Signalized				
Westbound	L	1.49	501.2	F	L	11.62	*	F	+	L	0.32	28.2	C	
Southbound	L	0.64	11.4	B	L	0.65	11.6	B		L	1.00	43.0	D	
										T	0.85	20.6	C	
										Intersection		32.0	C	
Secondary Study Area - Signalized Intersections														
Travis Avenue and Forest Hill Road														
Eastbound	LR	0.29	21.8	C	LR	0.29	21.8	C		LR	0.31	23.3	C	
Northbound	LT	0.92	34.2	C	LT	1.05	62.8	E	+	LT	0.98	44.6	D	
Southbound	TR	1.08	72.2	E	TR	1.09	75.5	E		TR	1.05	59.4	E	
	Intersection		53.7	D	Intersection		66.4	E		Intersection		50.6	D	
Richmond Hill Road and Forest Hill Road														
Eastbound	L	0.60	22.1	C	L	0.60	21.9	C						
	TR	0.59	16.4	B	TR	0.59	16.5	B						
Westbound	LTR	1.11	98.1	F	LTR	1.14	108.8	F	+					
Northbound	L	0.41	37.5	D	L	0.41	37.5	D		Unmitigated				
	TR	1.20	136.5	F	TR	1.39	216.5	F	+					
Southbound	L	1.25	187.5	F	L	1.25	187.5	F						
	TR	1.27	165.7	F	TR	1.29	170.9	F	+					
	Intersection		108.0	F	Intersection		132.7	F						
Amboy Road and Richmond Avenue [1]														
Eastbound	L	1.06	149.7	F	L	1.06	149.7	F		L	1.06	149.7	F	
	T	1.05	82.3	F	T	1.05	82.3	F		T	1.05	82.3	F	
	R	0.17	23.3	C	R	0.17	23.3	C		R	0.17	23.3	C	
Westbound	L	0.68	64.3	E	L	0.68	64.3	E		L	0.68	64.3	E	
	T	1.01	72.3	E	T	1.01	72.3	E		T	1.01	72.3	E	
	R	0.56	20.5	C	R	0.56	20.5	C		R	0.56	20.5	C	
Northbound	L	0.24	18.7	B	L	0.25	19.1	B		L	0.25	19.1	B	
	T	0.71	27.0	C	T	0.73	28.1	C		T	0.73	28.1	C	
	R	0.14	16.5	B	R	0.14	16.5	B		R	0.14	16.5	B	
Southbound	L	0.79	29.5	C	L	0.82	33.2	C		L	0.77	27.5	C	
	TR	0.72	18.5	B	TR	0.74	19.4	B		TR	0.79	22.3	C	
	Intersection		44.9	D	Intersection		45.3	D		Intersection		45.4	D	
Yukon Avenue and Forest Hill Road														
Eastbound	L	0.22	21.7	C	L	0.22	21.7	C		L	0.22	21.7	C	
Northbound	LT	0.86	30.2	C	LT	1.02	60.2	E	+	LT	0.90	32.5	C	
Southbound	T	0.65	17.7	B	T	0.69	18.8	B		T	0.69	18.8	B	
	R	0.16	10.6	B	R	0.16	10.6	B		R	0.16	10.6	B	
	Intersection		22.5	C	Intersection		36.4	D		Intersection		24.3	C	

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.

\+ implies a significant adverse impact

* implies that delays are in excess of 1000 seconds

(1) Intersection not impacted but analysis was conducted to incorporate permanent geometric/signal phasing changes proposed as mitigation measures in other peak hours.

Table 23-6

2016 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday PM Peak Hour

Intersection	2016 No Build				2016 Build					2016 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Primary Study Area - Signalized Intersections														
Victory Boulevard and West Shore Expressway (SB) Ramps														
Eastbound	TR	0.42	19.1	B	TR	0.44	19.3	B		TR	0.43	18.5	B	
Westbound	L	1.43	231.6	F	L	1.46	244.8	F	+	L	1.40	220.6	F	
	T	0.14	15.1	B	T	0.14	15.1	B		T	0.14	14.5	B	
Southbound	LTR	0.28	15.9	B	LTR	0.28	16.0	B		LTR	0.29	16.7	B	
	Intersection		107.3	F	Intersection		112.4	F		Intersection		102.3	F	
Victory Boulevard and Travis Avenue														
Eastbound	L	0.34	21.1	C	L	0.36	21.9	C		L	0.38	23.8	C	
	T	0.53	20.7	C	T	0.55	21.1	C		T	0.56	22.1	C	
	R	0.36	18.0	B	R	0.17	15.5	B		R	0.17	16.2	B	
Westbound	L	0.21	17.0	B	L	0.22	17.2	B		L	0.23	18.1	B	
	T	0.74	27.1	C	T	0.76	27.8	C		T	0.78	29.5	C	
	R	0.28	16.9	B	R	0.28	16.9	B		R	0.29	17.6	B	
Northbound	L	1.28	201.1	F	L	1.31	210.5	F	+	L	1.28	197.1	F	
	TR	0.50	20.2	C	TR	0.50	20.2	C		TR	0.49	19.3	B	
Southbound	L	0.55	25.1	C	L	0.55	25.1	C		L	0.53	23.5	C	
	TR	1.11	91.2	F	TR	1.11	91.2	F		TR	1.08	80.3	F	
	Intersection		51.1	D	Intersection		53.0	D		Intersection		49.4	D	
Signs Road and Richmond Avenue														
Eastbound	L	0.50	34.0	C	L	0.53	34.5	C		L	0.53	34.5	C	
	R	1.24	170.0	F	R	1.25	172.7	F	+	R	1.06	100.7	F	
Northbound	L	0.91	58.9	E	L	0.92	60.4	E		L	0.92	60.4	E	
	TR	0.62	3.2	A	TR	0.58	3.0	A		TR	0.58	3.0	A	
Southbound	TR	1.27	143.1	F	TR	1.28	147.9	F	+	TR	1.21	119.8	F	
	Intersection		87.3	F	Intersection		92.2	F		Intersection		73.2	E	
Draper Place and Richmond Avenue														
Eastbound	LT	1.23	160.2	F	LT	1.23	160.2	F		LT	1.23	160.2	F	
Westbound	LTR	0.21	29.9	C	LTR	0.21	29.9	C		LTR	0.21	29.9	C	
Northbound	L	1.31	189.2	F	L	1.33	198.7	F	+	L	1.27	172.3	F	
	TR	0.47	3.2	A	TR	0.44	3.1	A		TR	0.44	3.1	A	
Southbound	TR	1.15	99.6	F	TR	1.16	103.3	F	+	TR	0.93	32.7	C	
	Intersection		79.0	E	Intersection		83.7	F		Intersection		46.7	D	
Richmond Hill Road and Richmond Avenue														
Eastbound	LTR	0.01	27.3	C	LTR	0.01	27.3	C		LTR	0.01	27.3	C	
Westbound	L	0.51	37.5	D	L	0.58	40.1	D		L	0.58	40.1	D	
	LT	0.47	36.4	D	LT	0.56	39.5	D		LT	0.56	39.5	D	
	R	0.76	25.6	C	R	0.67	21.9	C		R	0.65	20.7	C	
Northbound	L	0.00	27.2	C	L	0.00	27.2	C		L	0.00	26.5	C	
	T	0.80	26.0	C	T	0.78	25.3	C		T	0.80	26.9	C	
	R	0.39	21.0	C	R	0.40	21.1	C		R	0.41	22.2	C	
Southbound	L	1.26	169.1	F	L	1.27	171.9	F	+	L	1.21	146.4	F	
	TR	1.25	142.6	F	TR	1.21	124.2	F		TR	1.25	141.1	F	
	Intersection		94.8	F	Intersection		86.1	F		Intersection		92.3	F	
Forest Hill Road and Richmond Avenue														
Eastbound					L	0.70	32.0	C						
					T	0.19	18.7	B						
					R	0.08	17.6	B						
Westbound	L	0.75	34.8	C	L	1.72	357.4	F	+					
	LR	0.97	63.6	E	TR	0.22	19.2	B						
Northbound					L	0.93	96.8	F		Unmitigated				
	T	0.83	12.8	B	T	1.25	146.1	F	+					
	R	1.06	64.3	E	R	1.92	450.3	F	+					
Southbound	L	0.50	28.3	C	L	0.28	43.0	D						
	T	1.02	34.2	C	TR	1.74	362.6	F	+					
	Intersection		31.2	C	Intersection		274.8	F						
Arthur Kill Road and Richmond Avenue														
Eastbound	L	0.25	27.9	C	L	0.25	27.9	C						
	TR	0.65	26.8	C	TR	0.66	27.2	C						
Westbound	L	0.23	24.6	C	L	0.25	25.2	C						
	T	1.23	147.5	F	T	1.25	152.6	F	+					
	R	0.63	16.1	B	R	0.64	16.3	B		Unmitigated				
Northbound	L	0.70	43.1	D	L	0.71	43.8	D						
	TR	1.23	140.4	F	TR	1.23	143.4	F	+					
Southbound	L	1.24	158.8	F	L	1.25	164.1	F	+					
	TR	1.26	154.7	F	TR	1.15	109.2	F						
	Intersection		114.0	F	Intersection		105.5	F						
Arden Avenue and Arthur Kill Road														
Eastbound	L	0.63	32.9	C	L	0.80	46.1	D	+	L	0.73	37.2	D	
	T	1.20	135.6	F	T	1.30	175.5	F	+	T	1.18	123.6	F	
	R	0.27	23.2	C	R	0.27	23.2	C		R	0.24	20.8	C	
Westbound	L	0.93	59.3	E	L	0.28	17.6	B		L	0.33	19.9	B	
	TR	0.17	10.7	B	TR	0.39	13.0	B		TR	0.39	13.0	B	
Northbound	LTR	0.86	41.0	D	LTR	0.57	27.9	C		LTR	0.57	27.9	C	
Southbound	L	1.32	210.9	F	L	0.80	49.6	D		L	0.80	49.6	D	
	TR	0.72	32.4	C	TR	0.83	41.2	D		TR	0.83	41.2	D	
	Intersection		75.4	E	Intersection		74.4	E		Intersection		58.2	E	
Drumgoole Road and Richmond Avenue														
Eastbound	L	1.25	146.3	F	L	1.13	98.0	F		L	1.13	98.0	F	
	LR	1.25	148.5	F	LR	1.13	99.8	F		LR	1.13	99.8	F	
Northbound	T	1.17	110.3	F	T	1.18	114.3	F	+	T	0.89	28.9	C	
Southbound	T	1.26	146.2	F	T	1.19	117.9	F		T	1.19	117.9	F	
	Intersection		135.9	F	Intersection		110.4	F		Intersection		83.4	F	

Table 23-6

2016 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday PM Peak Hour

Intersection	2016 No Build				2016 Build					2016 Build with Mitigation			
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS
Arthur Kill Road and Drumgoole Road													
Eastbound	L	1.40	223.3	F	L	0.96	52.2	D		L	1.33	201.5	F
	TR	1.20	143.3	F	TR	1.26	169.2	F	+	TR	1.18	137.8	F
Westbound	L	0.65	23.5	C	L	0.65	23.5	C		L	0.80	31.9	C
	TR	0.62	35.2	D	TR	0.64	35.6	D		TR	0.64	35.6	D
Northbound	L	0.49	37.4	D	L	0.60	48.0	D	+	L	0.60	44.6	D
	TR	1.22	129.3	F	TR	1.22	131.3	F	+	TR	1.06	62.6	E
Southbound	LTR	1.25	141.2	F	LTR	1.14	93.4	F		LTR	0.99	38.4	D
	Intersection		124.9	F	Intersection		95.0	F		Intersection		64.9	E
Arthur Kill Road and West Shore Expressway (SB) Service Road													
Eastbound	TR	0.53	16.7	B	TR	0.54	16.7	B		TR	0.56	17.8	B
Westbound	L	1.15	126.3	F	L	0.63	28.9	C		L	0.68	33.6	C
	T	0.29	14.1	B	T	0.29	14.1	B		T	0.31	14.9	B
Southbound	LTR	1.27	149.2	F	LTR	1.28	151.3	F	+	LTR	1.24	131.6	F
	Intersection		89.5	F	Intersection		82.2	F		Intersection		73.4	E
Primary Study Area - Unsignalized Intersections													
Muldoon Avenue and West Shore Expressway (SB) Service Road [1]													
Eastbound	R	0.08	20.1	C	R	0.12	29.8	D		Free-flow operation			
Arden Avenue and West Shore Expressway (SB) Service Road										Signalized			
Westbound	L	2.44	905.7	F	L	25.88	*	F	+	L	0.53	33.6	C
Southbound	L	0.68	12.0	B	L	0.69	12.2	B		L	0.95	30.1	C
										T	1.01	43.1	D
										Intersection		36.8	D
Secondary Study Area - Signalized Intersections													
Travis Avenue and Forest Hill Road													
Eastbound	LR	0.36	22.4	C	LR	0.36	22.4	C		LR	0.40	24.9	C
Northbound	LT	1.05	64.7	E	LT	1.20	121.2	F	+	LT	1.05	63.0	E
Southbound	TR	1.24	138.1	F	TR	1.25	140.9	F	+	TR	1.18	108.6	F
	Intersection		101.0	F	Intersection		123.5	F		Intersection		83.5	F
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.57	21.8	C	L	0.57	21.6	C					
	TR	0.65	18.0	B	TR	0.65	18.0	B					
Westbound	LTR	1.22	138.3	F	LTR	1.25	151.4	F	+				
Northbound	L	0.63	56.2	E	L	0.63	56.2	E		Unmitigated			
	TR	1.28	168.4	F	TR	1.50	261.4	F	+				
Southbound	L	1.24	191.4	F	L	1.24	191.4	F					
	TR	1.30	175.2	F	TR	1.31	179.3	F	+				
	Intersection		125.7	F	Intersection		155.2	F					
Woodrow Road and Bloomingdale Road													
Eastbound	LTR	0.18	43.2	D	LTR	0.22	44.1	D		LTR	0.22	44.1	D
Westbound	LT	0.70	42.0	D	LT	0.72	43.2	D		LT	0.76	46.7	D
	R	0.29	31.2	C	R	0.30	31.4	C		R	0.32	32.5	C
Northbound	LTR	0.99	54.1	D	LTR	1.01	59.3	E	+	LTR	0.98	50.8	D
Southbound	LTR	2.01	481.8	F	LTR	2.09	516.5	F	+	LTR	2.00	475.5	F
	Intersection		220.2	F	Intersection		235.9	F		Intersection		216.4	F
Amboy Road and Richmond Avenue													
Eastbound	L	1.27	219.7	F	L	1.27	219.7	F		L	1.27	219.7	F
	T	0.93	49.5	D	T	0.93	49.5	D		T	0.93	49.5	D
	R	0.19	20.2	C	R	0.19	20.2	C		R	0.19	20.2	C
Westbound	L	0.81	83.6	F	L	0.81	83.6	F		L	0.81	83.6	F
	T	0.98	59.6	E	T	0.98	59.6	E		T	0.98	59.6	E
	R	0.47	15.0	B	R	0.47	15.0	B		R	0.47	15.0	B
Northbound	L	0.51	34.5	C	L	0.55	37.8	D		L	0.55	37.8	D
	T	0.92	49.2	D	T	0.95	53.4	D		T	0.95	53.4	D
	R	0.17	20.6	C	R	0.17	20.6	C		R	0.17	20.6	C
Southbound	L	1.23	154.9	F	L	1.27	172.0	F	+	L	1.20	142.1	F
	TR	0.92	36.1	D	TR	0.94	39.2	D		TR	0.85	28.2	C
	Intersection		58.0	E	Intersection		60.7	E		Intersection		55.7	E
Yukon Avenue and Forest Hill Road													
Eastbound	L	0.19	21.4	C	L	0.19	21.4	C		L	0.19	22.1	C
Northbound	LT	0.99	51.8	D	LT	1.17	112.0	F	+	LT	0.99	46.6	D
Southbound	T	0.67	18.1	B	T	0.70	19.0	B		T	0.69	18.0	B
	R	0.13	10.4	B	R	0.13	10.4	B		R	0.13	9.9	A
	Intersection		32.9	C	Intersection		63.2	E		Intersection		31.4	C

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.

\+ implies a significant adverse impact

* implies that delays are in excess of 1000 seconds

(1) Intersection not impacted but analysis was conducted to incorporate permanent geometric/signal phasing changes proposed as mitigation measures in other peak hours.

Table 23-7

2016 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekend Midday Peak Hour

Intersection	2016 No Build				2016 Build					2016 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Primary Study Area - Signalized Intersections														
Victory Boulevard and West Shore Expressway (SB) Ramps														
Eastbound	TR	0.35	17.9	B	TR	0.36	18.1	B		TR	0.35	17.3	B	
Westbound	L	1.46	245.2	F	L	1.49	258.8	F	+	L	1.44	236.7	F	
	T	0.11	14.8	B	T	0.11	14.8	B		T	0.11	14.3	B	
Southbound	LTR	0.26	15.8	B	LTR	0.27	15.9	B		LTR	0.28	16.5	B	
	Intersection		119.0	F	Intersection		124.4	F		Intersection		114.6	F	
Victory Boulevard and Travis Avenue														
Eastbound	L	0.25	18.3	B	L	0.26	19.0	B		L	0.28	20.2	C	
	T	0.57	21.6	C	T	0.60	22.3	C		T	0.61	23.3	C	
	R	0.35	17.9	B	R	0.14	15.3	B		R	0.15	15.9	B	
Westbound	L	0.26	18.0	B	L	0.28	18.4	B		L	0.29	19.5	B	
	T	0.68	24.7	C	T	0.71	25.6	C		T	0.73	27.0	C	
	R	0.29	17.0	B	R	0.29	17.0	B		R	0.30	17.7	B	
Northbound	L	1.16	145.4	F	L	1.19	154.2	F	+	L	1.10	120.9	F	
	TR	0.61	22.5	C	TR	0.61	22.5	C		TR	0.59	21.4	C	
Southbound	L	0.59	28.0	C	L	0.59	28.0	C		L	0.56	25.9	C	
	TR	0.78	28.9	C	TR	0.78	28.9	C		TR	0.76	27.2	C	
	Intersection		31.2	C	Intersection		32.7	C		Intersection		30.4	C	
Signs Road and Richmond Avenue														
Eastbound	L	0.54	34.8	C	L	0.58	35.8	D		L	0.58	35.8	D	
	R	1.24	171.2	F	R	1.25	177.1	F	+	R	1.06	104.7	F	
Northbound	L	1.01	80.7	F	L	1.02	83.0	F		L	1.02	83.0	F	
	TR	0.77	4.7	A	TR	0.71	3.9	A		TR	0.71	3.9	A	
Southbound	TR	1.20	113.8	F	TR	1.21	120.6	F	+	TR	1.15	94.1	F	
	Intersection		67.5	E	Intersection		73.4	E		Intersection		57.0	E	
Draper Place and Richmond Avenue														
Eastbound	LT	1.24	163.3	F	LT	1.24	163.3	F		LT	1.24	163.3	F	
Westbound	LTR	0.14	28.1	C	LTR	0.14	28.1	C		LTR	0.14	28.1	C	
Northbound	L	1.32	193.2	F	L	1.35	205.8	F	+	L	1.30	182.1	F	
	TR	0.60	4.4	A	TR	0.55	4.1	A		TR	0.55	4.1	A	
Southbound	TR	1.24	140.8	F	TR	1.25	145.7	F	+	TR	1.03	57.0	E	
	Intersection		91.6	F	Intersection		98.3	F		Intersection		58.0	E	
Richmond Hill Road and Richmond Avenue														
Eastbound	LTR	0.01	27.3	C	LTR	0.01	27.3	C						
Westbound	L	0.62	42.3	D	L	0.70	47.0	D						
	LT	0.65	43.9	D	LT	0.77	52.2	D	+					
	R	1.05	76.2	E	R	0.93	46.0	D						
Northbound	L	0.00	31.3	C	L	0.00	31.3	C						
	T	0.88	24.5	C	T	0.84	22.7	C				Unmitigated		
	R	0.39	16.8	B	R	0.39	16.9	B						
Southbound	L	1.27	180.0	F	L	1.29	185.7	F	+					
	TR	1.02	44.0	D	TR	0.98	34.2	C						
	Intersection		48.2	D	Intersection		41.9	D						
Forest Hill Road and Richmond Avenue														
Eastbound					L	0.65	31.2	C						
					T	0.17	19.8	B						
					R	0.08	18.9	B						
Westbound	L	0.80	37.8	D	L	1.72	362.7	F	+					
	LR	1.01	74.3	E	TR	0.30	21.5	C				Unmitigated		
Northbound					L	1.05	127.4	F						
	T	0.88	14.3	B	T	1.25	143.8	F	+					
	R	0.98	38.6	D	R	1.56	288.5	F	+					
Southbound	L	0.41	22.1	C	L	0.23	41.7	D						
	T	0.62	9.3	A	TR	1.00	44.9	D						
	Intersection		21.0	C	Intersection		141.3	F						
Arthur Kill Road and Richmond Avenue														
Eastbound	L	0.19	26.5	C	L	0.19	26.5	C						
	TR	0.71	29.9	C	TR	0.74	30.6	C						
Westbound	L	0.48	38.7	D	L	0.51	42.2	D						
	T	1.23	148.9	F	T	1.25	156.3	F	+					
	R	0.65	17.7	B	R	0.67	18.1	B				Unmitigated		
Northbound	L	0.80	48.4	D	L	0.82	49.8	D						
	TR	1.28	158.5	F	TR	1.28	160.9	F	+					
Southbound	L	1.25	163.0	F	L	1.27	170.9	F	+					
	TR	0.72	29.2	C	TR	0.61	26.4	C						
	Intersection		99.1	F	Intersection		103.1	F						
Arden Avenue and Arthur Kill Road														
Eastbound	L	0.57	31.0	C	L	0.76	44.1	D		L	0.71	38.4	D	
	T	0.85	42.3	D	T	0.95	54.9	D	+	T	0.89	44.0	D	
	R	0.11	21.1	C	R	0.11	21.1	C		R	0.10	19.7	B	
Westbound	L	1.04	80.3	F	L	0.35	17.8	B		L	0.39	18.4	B	
	TR	0.25	11.4	B	TR	0.50	14.7	B		TR	0.50	14.7	B	
Northbound	LTR	0.78	35.9	D	LTR	0.51	26.6	C		LTR	0.51	26.6	C	
Southbound	L	0.72	47.8	D	L	0.46	28.2	C		L	0.46	28.2	C	
	TR	0.74	33.8	C	TR	0.88	44.9	D		TR	0.88	44.9	D	
	Intersection		41.2	D	Intersection		36.0	D		Intersection		32.8	C	
Drumgoole Road and Richmond Avenue														
Eastbound	L	1.25	149.1	F	L	1.14	101.8	F		L	1.14	101.8	F	
	LR	1.25	146.7	F	LR	1.13	100.4	F		LR	1.13	100.4	F	
Northbound	T	1.27	151.8	F	T	1.28	156.8	F	+	T	0.96	35.6	D	
Southbound	T	1.01	49.3	D	T	0.93	34.4	C		T	0.93	34.4	C	
	Intersection		123.3	F	Intersection		106.6	F		Intersection		57.4	E	

Table 23-7

2016 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekend Midday Peak Hour

Intersection	2016 No Build				2016 Build					2016 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Arthur Kill Road and Drumgoole Road														
Eastbound	L	1.27	166.3	F	L	0.88	38.1	D		L	0.88	38.1	D	
	TR	1.25	163.2	F	TR	1.33	196.2	F	+	TR	1.25	162.0	F	
Westbound	L	0.71	21.1	C	L	0.71	21.1	C		L	0.71	21.1	C	
	TR	0.48	32.6	C	TR	0.51	33.0	C		TR	0.51	33.0	C	
Northbound	L	0.17	20.9	C	L	0.31	27.2	C		L	0.31	27.2	C	
	TR	1.19	119.1	F	TR	1.20	122.0	F		TR	1.20	122.0	F	
Southbound	LTR	1.34	186.9	F	LTR	1.27	156.0	F		LTR	1.27	156.0	F	
	Intersection		127.1	F	Intersection		111.2	F		Intersection		107.1	F	
Arthur Kill Road and West Shore Expressway (NB) Service Road														
Eastbound	L	1.42	238.0	F	L	2.21	582.3	F	+	Unmitigated				
	T	0.48	12.2	B	T	0.41	11.4	B						
Westbound	TR	0.90	22.8	C	TR	0.58	13.1	B						
Northbound	LTR	0.59	21.5	C	LTR	0.58	20.9	C						
	Intersection		37.4	D	Intersection		103.3	F						
Primary Study Area - Unsignalized Intersections														
Muldoon Avenue and West Shore Expressway (SB) Service Road														
Eastbound	R	0.38	18.4	C	R	0.50	26.6	D		Free-flow operation				
Arden Avenue and West Shore Expressway (SB) Service Road										Signalized				
Westbound	L	1.55	397.1	F	L	11.36	*	F	+	L	0.45	27.5	C	
Southbound	L	0.48	9.4	A	L	0.49	9.4	A		L	0.76	18.0	B	
										T	0.67	14.7	B	
										Intersection		17.9	B	
Secondary Study Area - Signalized Intersections														
Travis Avenue and Forest Hill Road														
Eastbound	LR	0.22	21.1	C	LR	0.22	21.1	C		LR	0.24	23.3	C	
Northbound	LT	1.13	93.4	F	LT	1.27	150.5	F	+	LT	1.11	82.3	F	
Southbound	TR	1.05	63.6	E	TR	1.07	67.3	E		TR	1.00	46.7	D	
	Intersection		73.7	E	Intersection		102.2	F		Intersection		61.5	E	
Richmond Hill Road and Forest Hill Road														
Eastbound	L	0.64	22.9	C	L	0.63	22.7	C						
	TR	0.64	17.7	B	TR	0.65	17.8	B						
Westbound	LTR	1.29	171.9	F	LTR	1.32	183.9	F	+					
Northbound	L	0.15	24.3	C	L	0.15	24.3	C		Unmitigated				
	TR	1.20	133.6	F	TR	1.38	212.1	F	+					
Southbound	L	1.32	233.0	F	L	1.32	233.0	F						
	TR	1.33	191.1	F	TR	1.35	196.9	F	+					
	Intersection		128.8	F	Intersection		151.9	F						
Amboy Road and Arden Avenue														
Eastbound	L	0.21	17.6	B	L	0.21	17.6	B		L	0.23	18.5	B	
	TR	0.65	23.7	C	TR	0.65	23.7	C		TR	0.67	24.9	C	
Westbound	LTR	0.85	33.1	C	LTR	0.85	33.1	C		LTR	0.89	38.2	D	
Northbound	L	0.47	23.4	C	L	0.47	23.6	C		L	0.45	22.0	C	
	TR	0.62	22.8	C	TR	0.63	23.0	C		TR	0.61	21.9	C	
Southbound	L	1.35	206.4	F	L	1.37	213.6	F	+	L	1.30	183.4	F	
	TR	0.59	22.0	C	TR	0.59	22.1	C		TR	0.58	21.1	C	
	Intersection		48.3	D	Intersection		49.2	D		Intersection		46.5	D	
Amboy Road and Richmond Avenue														
Eastbound	L	1.24	200.5	F	L	1.24	200.5	F		L	1.24	200.5	F	
	T	1.16	123.2	F	T	1.16	123.2	F		T	1.16	123.2	F	
	R	0.20	23.7	C	R	0.20	23.7	C		R	0.20	23.7	C	
Westbound	L	0.64	59.6	E	L	0.64	59.6	E		L	0.64	59.6	E	
	T	1.21	143.2	F	T	1.21	143.2	F		T	1.21	143.2	F	
	R	0.61	22.0	C	R	0.61	22.0	C		R	0.61	22.0	C	
Northbound	L	0.29	19.9	B	L	0.30	20.4	C		L	0.30	20.4	C	
	T	0.81	32.3	C	T	0.84	34.0	C		T	0.84	34.0	C	
	R	0.19	17.0	B	R	0.19	17.0	B		R	0.19	17.0	B	
Southbound	L	1.18	124.0	F	L	1.22	144.4	F	+	L	1.14	111.3	F	
	TR	0.76	20.1	C	TR	0.78	21.2	C		TR	0.83	24.9	C	
	Intersection		76.5	E	Intersection		78.4	E		Intersection		75.9	E	

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.

\+ implies a significant adverse impact

* implies that delays are in excess of 1000 seconds

Table 23-8

2016 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekend PM Peak Hour

Intersection	2016 No Build				2016 Build					2016 Build with Mitigation			
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS
Primary Study Area - Signalized Intersections													
Victory Boulevard and West Shore Expressway (SB) Ramps													
Eastbound	TR	0.32	17.5	B	TR	0.33	17.6	B		TR	0.32	16.9	B
Westbound	L	1.05	83.9	F	L	1.08	92.4	F	+	L	1.04	80.7	F
	T	0.10	14.8	B	T	0.10	14.8	B		T	0.10	14.2	B
Southbound	LTR	0.21	15.4	B	LTR	0.22	15.5	B		LTR	0.23	16.1	B
	Intersection		44.2	D	Intersection		47.6	D		Intersection		42.7	D
Victory Boulevard and Travis Avenue													
Eastbound	L	0.11	15.4	B	L	0.11	15.5	B		L	0.12	16.3	B
	T	0.53	20.7	C	T	0.56	21.3	C		T	0.57	22.2	C
	R	0.26	16.6	B	R	0.07	14.5	B		R	0.07	15.1	B
Westbound	L	0.20	16.8	B	L	0.22	17.1	B		L	0.23	18.0	B
	T	0.60	22.3	C	T	0.63	23.0	C		T	0.64	24.1	C
	R	0.22	16.2	B	R	0.22	16.2	B		R	0.23	16.8	B
Northbound	L	1.52	298.2	F	L	1.56	312.5	F	+	L	1.39	239.6	F
	TR	0.51	20.3	C	TR	0.51	20.3	C		TR	0.50	19.5	B
Southbound	L	0.38	20.2	C	L	0.38	20.2	C		L	0.37	19.2	B
	TR	0.86	34.4	C	TR	0.86	34.4	C		TR	0.84	31.8	C
	Intersection		42.0	D	Intersection		44.5	D		Intersection		39.0	D
Signs Road and Richmond Avenue													
Eastbound	L	0.37	32.6	C	L	0.41	33.0	C		L	0.41	33.0	C
	R	0.94	78.5	E	R	0.95	81.8	F		R	0.95	81.8	F
Northbound	L	0.81	33.6	C	L	0.82	44.8	D		L	0.82	44.8	D
	TR	0.74	4.2	A	TR	0.69	3.7	A		TR	0.69	3.7	A
Southbound	TR	1.06	58.1	E	TR	1.08	63.5	E	+	TR	1.02	44.4	D
	Intersection		33.0	C	Intersection		37.1	D		Intersection		28.4	C
Draper Place and Richmond Avenue													
Eastbound	LT	1.11	121.5	F	LT	1.11	121.5	F		LT	1.11	121.5	F
Westbound	LTR	0.19	28.7	C	LTR	0.19	28.7	C		LTR	0.19	28.7	C
Northbound	L	1.29	181.1	F	L	1.32	193.6	F	+	L	1.27	170.5	F
	TR	0.58	4.2	A	TR	0.54	4.0	A		TR	0.54	4.0	A
Southbound	TR	1.1	85.2	F	TR	1.12	89.8	F	+	TR	0.90	35.3	D
	Intersection		61.3	E	Intersection		66.6	E		Intersection		41.7	D
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	LTR	0.01	27.3	C		LTR	0.01	27.3	C
Westbound	L	0.45	35.7	D	L	0.53	38.4	D		L	0.53	38.4	D
	LT	0.38	34.0	C	LT	0.48	36.6	D		LT	0.48	36.6	D
	R	1.02	65.8	E	R	0.91	43.5	D		R	0.89	39.5	D
Northbound	L	0.00	31.3	C	L	0.00	31.3	C		L	0.00	30.4	C
	T	0.83	22.3	C	T	0.80	21.4	C		T	0.82	22.9	C
	R	0.36	16.4	B	R	0.37	16.4	B		R	0.38	17.4	B
Southbound	L	1.28	188.5	F	L	1.30	195.8	F	+	L	1.21	160.5	F
	TR	0.86	23.3	C	TR	0.82	22.0	C		TR	0.84	23.6	C
	Intersection		36.9	D	Intersection		34.7	C		Intersection		33.4	C
Forest Hill Road and Richmond Avenue													
Eastbound					L	0.61	29.9	C					
					T	0.16	19.7	B					
					R	0.09	19.0	B					
Westbound	L	0.68	31.5	C	L	1.58	299.2	F	+				
	LR	0.85	43.3	D	TR	0.24	20.8	C					
Northbound					L	0.90	91.4	F					
	T	0.72	10.5	B	T	1.01	48.1	D	+				
	R	0.98	40.8	D	R	1.66	334.1	F	+				
Southbound	L	0.56	33.6	C	L	0.31	43.7	D					
	T	0.72	10.5	B	TR	1.14	96.9	F	+				
	Intersection		17.0	B	Intersection		118.3	F					
Arthur Kill Road and Richmond Avenue													
Eastbound	L	0.07	22.2	C	L	0.07	22.2	C					
	TR	0.58	26.8	C	TR	0.60	27.2	C					
Westbound	L	0.21	24.6	C	L	0.22	25.2	C					
	T	1.20	134.5	F	T	1.22	141.7	F	+				
	R	0.53	14.8	B	R	0.54	15.1	B					
Northbound	L	0.68	42.3	D	L	0.70	43.0	D					
	TR	1.02	59.0	E	TR	1.03	60.8	E					
Southbound	L	1.23	156.3	F	L	1.25	163.6	F	+				
	TR	0.75	30.0	C	TR	0.65	27.2	C					
	Intersection		68.3	E	Intersection		71.4	E					
Arthur Kill Road and Woodrow Road													
Eastbound	TR	0.72	19.2	B	TR	0.58	16.0	B		TR	0.55	13.6	B
Westbound	LT	1.29	165.1	F	LT	1.37	199.2	F	+	LT	1.29	163.0	F
Northbound	L	0.20	21.6	C	L	0.21	21.6	C		L	0.23	24.0	C
	R	0.55	28.4	C	R	0.55	28.6	C		R	0.61	32.9	C
	Intersection		75.9	E	Intersection		96.3	F		Intersection		80.8	F
Arden Avenue and Arthur Kill Road													
Eastbound	L	0.62	32.8	C	L	0.80	46.1	D	+	L	0.77	42.8	D
	T	0.82	39.1	D	T	0.91	48.4	D	+	T	0.88	43.8	D
	R	0.07	20.7	C	R	0.07	20.7	C		R	0.07	20.0+	C
Westbound	L	0.75	28.9	C	L	0.22	15.5	B		L	0.22	15.5	B
	TR	0.20	10.9	B	TR	0.40	13.2	B		TR	0.40	13.2	B
Northbound	LTR	0.65	29.7	C	LTR	0.40	24.2	C		LTR	0.40	24.2	C
Southbound	L	0.60	37.0	D	L	0.39	25.9	C		L	0.39	25.9	C
	TR	0.60	28.6	C	TR	0.72	33.4	C		TR	0.72	33.4	C
	Intersection		30.6	C	Intersection		32.7	C		Intersection		31.1	C
Drumgoole Road and Richmond Avenue													
Eastbound	L	1.25	148.4	F	L	1.14	101.5	F		L	1.14	101.5	F
	LR	1.26	150.5	F	LR	1.14	103.7	F		LR	1.14	103.7	F
Northbound	T	1.09	76.7	E	T	1.1	81.5	F	+	T	0.83	25.9	C
Southbound	T	1.04	59.7	E	T	0.97	40.8	D		T	0.97	40.8	D
	Intersection		99.6	F	Intersection		77.4	E		Intersection		58.6	E

Unmitigated

Unmitigated

Table 23-8

2016 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekend PM Peak Hour

Intersection	2016 No Build				2016 Build					2016 Build with Mitigation			
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS
Arthur Kill Road and Drumgoole Road													
Eastbound	L	0.96	58.4	E	L	0.59	21.0	C		L	0.62	22.6	C
	TR	1.02	82.6	F	TR	1.10	108.8	F	+	TR	0.99	72.2	E
Westbound	L	0.72	24.5	C	L	0.67	22.6	C		L	0.72	22.9	C
	TR	0.44	31.9	C	TR	0.46	32.3	C		TR	0.44	31.2	C
Northbound	L	0.26	24.7	C	L	0.40	32.3	C		L	0.40	31.7	C
	TR	1.24	142.1	F	TR	1.25	145.0	F	+	TR	1.22	130.3	F
Southbound	LTR	1.27	151.9	F	LTR	1.18	113.6	F		LTR	1.15	99.6	F
	Intersection		109.9	F	Intersection		99.5	F		Intersection		87.1	F
Primary Study Area - Unsignalized Intersections													
Muldoon Avenue and West Shore Expressway (SB) Service Road [1]													
Eastbound	R	0.02	14.4	B	R	0.03	18.2	C		Free-flow operation			
Arden Avenue and West Shore Expressway (SB) Service Road										Signalized			
Westbound	L	1.38	338.3	F	L	9.28	*	F	+	L	0.42	27.1	C
Southbound	L	0.49	9.5	A	L	0.49	9.6	A		L	0.78	19.3	B
										T	0.70	15.7	B
										Intersection		18.8	B
Secondary Study Area - Signalized Intersections													
Travis Avenue and Forest Hill Road													
Eastbound	LR	0.34	22.3	C	LR	0.34	22.3	C		LR	0.38	24.7	C
Northbound	LT	1.15	101.3	F	LT	1.28	155.9	F	+	LT	1.12	88.0	F
Southbound	TR	0.96	39.4	D	TR	0.97	41.3	D		TR	0.92	29.9	C
	Intersection		64.1	E	Intersection		91.2	F		Intersection		55.6	E
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.62	22.2	C	L	0.61	22.1	C					
	TR	0.65	17.9	B	TR	0.66	18.1	B					
Westbound	LTR	1.28	164.4	F	LTR	1.30	176.3	F	+				
Northbound	L	0.54	47.2	D	L	0.54	47.2	D		Unmitigated			
	TR	1.17	123.2	F	TR	1.34	194.5	F	+				
Southbound	L	1.51	312.7	F	L	1.51	312.7	F					
	TR	1.12	102.3	F	TR	1.13	107.7	F	+				
	Intersection		105.9	F	Intersection		127.4	F					
Amboy Road and Richmond Avenue [1]													
Eastbound	L	1.19	190.7	F	L	1.19	190.7	F		L	1.19	190.7	F
	T	1.15	118.9	F	T	1.15	118.9	F		T	1.15	118.9	F
	R	0.13	22.8	C	R	0.13	22.8	C		R	0.13	22.8	C
Westbound	L	0.70	67.7	E	L	0.70	67.7	E		L	0.70	67.7	E
	T	1.03	78.7	E	T	1.03	78.7	E		T	1.03	78.7	E
	R	0.45	18.4	B	R	0.45	18.4	B		R	0.45	18.4	B
Northbound	L	0.16	17.2	B	L	0.16	17.4	B		L	0.16	17.4	B
	T	0.74	28.3	C	T	0.76	29.4	C		T	0.76	29.4	C
	R	0.13	16.3	B	R	0.13	16.3	B		R	0.13	16.3	B
Southbound	L	0.85	36.4	D	L	0.88	41.7	D		L	0.82	33.2	C
	TR	0.69	17.4	B	TR	0.71	18.1	B		TR	0.76	20.4	C
	Intersection		56.7	E	Intersection		57.1	E		Intersection		56.8	E

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.

\+ implies a significant adverse impact

* implies that delays are in excess of 1000 seconds

(1) Intersection not impacted but analysis was conducted to incorporate permanent geometric/signal phasing changes proposed as mitigation measures in other peak hours.

Richmond Avenue and Amboy Road

The impacts at the southbound left-turn movement at this intersection during the weekday PM, and weekend midday could be mitigated by restriping the southbound approach to provide a 12-foot left-turn lane. In addition, daylighting the southbound approach is required during the weekday PM peak hour.

Yukon Avenue and Forest Hill Road

The impact at the northbound approach at this intersection during the weekday midday and PM peak hours could be mitigated by daylighting the northbound approach. In addition, shifting 1 second of green time from the eastbound phase to the northbound/southbound phase is required during the weekday PM peak hour.

With the above mitigation measures in place, majority of the impacted locations would operate at the same or better service levels than the 2016 No Build conditions as presented in Tables 23-4 through 23-8.

RECOMMENDED MITIGATION MEASURES

2036 BUILD CONDITIONS

With the proposed mitigation measures in place, most of the impacted approaches/lane groups would be mitigated back to the same or better service conditions than the 2036 No Build conditions; however, some of the intersections would remain unmitigated as summarized in Table 23-9. Compared to the DGEIS, the total number of unmitigated intersections would remain unchanged for two of the five peak hours analyzed. The exceptions would be the weekday AM, midday and weekend midday peak hours. For the weekday AM and midday peak hours, there would be two less unmitigated intersections, respectively. For the weekend midday peak hour, there would be an additional unmitigated intersection.

Table 23-9
Summary of Mitigated and Unmitigated Interesctions—2036

Peak Period	Impacted Intersections	Mitigated	Unmitigated
Weekday AM	20	14	6
Weekday Midday	20	15	5
Weekday PM	25	15	10
Weekend Midday	24	15	9
Weekend PM	21	16	5

Table 23-10 summarizes all of the measures contained in the mitigation plan for the 2036 Build conditions, during the weekday AM, midday and PM, and weekend midday and PM peak hours, respectively. Provided below is a discussion of each affected intersection and its required mitigation.

Victory Boulevard and West Shore Expressway (SB) Ramps

The impact at the westbound left-turn movement at this intersection during the weekday AM peak hour could be mitigated by shifting 1 second of green time from the southbound phase to the eastbound/westbound phase.

The impact at the westbound left-turn movement at this intersection during the weekday midday and PM and weekend midday peak hours could be mitigated by shifting 2 seconds of green time from the southbound phase to the eastbound/westbound phase.

The impact at the westbound left-turn movement at this intersection during the weekend PM peak hour could be mitigated by shifting 3 seconds of green time from the southbound phase to the eastbound/westbound phase.

Victory Boulevard and West Shore Expressway (NB) Ramps

The impact at the eastbound left-turn movement at this intersection during the weekday PM peak hour could be mitigated by shifting 2 seconds of green time from the northbound phase to the eastbound/westbound phase.

Victory Boulevard and Wild Avenue

The impact at the westbound approach at this intersection during the weekday PM peak hour could be mitigated by shifting 2 seconds of green time from the southbound phase to the eastbound/westbound phase.

Victory Boulevard and Travis Avenue

The impact at the eastbound through movement at this intersection during the weekday AM peak hour could be mitigated by restriping the eastbound approach to provide one 11-foot-wide left-turn lane, one 12-foot-wide through lane, and one 10-foot-wide right-turn lane.

The impact at the northbound left-turn movement at this intersection during the weekday midday peak hour could be mitigated by restriping the eastbound approach to provide one 11-foot-wide left-turn lane, one 12-foot-wide through lane, and one 10-foot-wide right-turn lane. In addition, shifting 1 second of green time from the eastbound/westbound phase to the northbound/southbound phase would be required.

The impacts at the eastbound left-turn movement, westbound through movement, and northbound left-turn movement at this intersection during the weekday PM peak hour could not be mitigated by standard traffic engineering measures.

The impact at the northbound left-turn movement at this intersection during the weekend midday peak hour could not be mitigated by standard traffic engineering measures.

The impact at the northbound left-turn movement at this intersection during the weekend PM peak hour could be mitigated by restriping the eastbound approach to provide one 11-foot-wide left-turn lane, one 12-foot-wide through lane, and one 10-foot-wide right-turn lane. In addition, shifting 5 seconds of green time from the eastbound/westbound phase to the northbound/southbound phase would be required.

Richmond Avenue and Signs Road

The impacts at the eastbound right-turn movement and northbound left-turn movement at this intersection during the weekday AM peak hour could be mitigated by shifting 1 second of green time from the northbound/southbound phase to the northbound phase and by daylighting the eastbound approach.

The impacts at the eastbound right-turn movement, northbound left-turn movement and southbound through-right movement during the weekday midday, weekday PM, weekend midday and weekend PM peak hours could be mitigated by daylighting the southbound approach

Table 23-10
2036 Recommended Mitigation Measures

Intersection	Mitigation Measures				
	Weekday Peak Hours			Weekend Peak Hours	
	AM	Midday	PM	Midday	PM
Primary Study Area					
Victory Boulevard and West Shore Expressway (SB) Ramps	Shift 1 second of green time from SB phase to EB/WB phase	Shift 2 seconds of green time from SB phase to EB/WB phase	Shift 2 seconds of green time from SB phase to EB/WB phase	Shift 2 seconds of green time from SB phase to EB/WB phase	Shift 3 seconds of green time from SB phase to EB/WB phase
Victory Boulevard and West Shore Expressway (NB) Ramps	Not impacted	Not impacted	Shift 2 seconds of green time from NB phase to EB/WB phase	Not impacted	Not impacted
Victory Boulevard and Wild Avenue	Not impacted	Not impacted	Shift 2 seconds of green time from SB phase to EB/WB phase	Not impacted	Not impacted
Victory Boulevard and Travis Avenue	Restripe EB approach to create 11-feet left-turn, 12-feet through, and 10-feet right-turn lanes	Restripe EB approach to create 11-feet left-turn, 12-feet through, and 10-feet right-turn lanes Shift 1 second of green time from EB/WB phase to NB/SB phase	Unmitigated	Unmitigated	Restripe EB approach to create 11-feet left-turn, 12-feet through, and 10-feet right-turn lanes Shift 5 seconds of green time from EB/WB phase to NB/SB phase
Signs Road and Richmond Avenue *	Daylight the EB approach Shift 1 second of green time from NB/SB phase to NB only phase	Daylight the SB approach to provide an additional 11-feet moving lane Daylight the EB approach Shift 1 second of green time from NB/SB phase to NB only phase	Daylight the SB approach to provide an additional 11-feet moving lane Daylight the EB approach Shift 1 second of green time from NB/SB phase to NB only phase	Daylight the SB approach to provide an additional 11-feet moving lane Daylight the EB approach Shift 1 second of green time from NB/SB phase to NB only phase	Daylight the SB approach to provide an additional 11-feet moving lane Daylight the EB approach Shift 1 second of green time from NB/SB phase to NB only phase
Draper Place and Richmond Avenue *	Shift 1 second of green time from NB/SB phase to NB only phase	Daylight the SB approach to provide an additional moving lane Shift 2 seconds of green time from NB/SB phase to NB only phase	Daylight the SB approach to provide an additional moving lane Shift 1 second of green time from NB/SB phase to NB only phase	Daylight the SB approach to provide an additional moving lane Shift 2 seconds of green time from NB/SB phase to NB only phase	Daylight the SB approach to provide an additional moving lane Shift 2 seconds of green time from NB/SB phase to NB only phase
Richmond Hill Road and Richmond Avenue	Not impacted	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Forest Hill Road and Richmond Avenue	Unmitigated	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Arthur Kill Road and Richmond Avenue	Unmitigated	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Arthur Kill Road and Woodrow Road	Not impacted	Not impacted	Not impacted	Shift 2 seconds of green time from the EB/WB phase to the NB phase.	Shift 4 seconds of green time from NB to EB/WB Daylight the NB approach
Arden Avenue and Woodrow Road (1)	Restripe the SB approach to provide 11-feet wide shared left-through and an exclusive right-turn lanes	Restripe the SB approach to provide 11-feet wide shared left-through and an exclusive right-turn lanes	Restripe the SB approach to provide 11-feet wide shared left-through and an exclusive right-turn lanes Shift 1 seconds of green time from NB/SB phase to EB/WB	Restripe the SB approach to provide 11-feet wide shared left-through and an exclusive right-turn lanes Daylight the WB approach	Restripe the SB approach to provide 11-feet wide shared left-through and an exclusive right-turn lanes Daylight the WB approach
Arden Avenue and Arthur Kill Road	Unmitigated	Restripe EB approach with a 10-feet wide left-turn, 12-feet wide through, and 10-feet wide right-turn lanes Restripe SB approach to create 10-feet left and 12-feet through/right lanes Shift 2 seconds of green time from WB phase to EB/WB phase Shift 1 second of green time from NB/SB to EB/WB phase	Unmitigated	Unmitigated	Restripe EB approach with a 10-feet wide left-turn, 12-feet wide through, and 10-feet wide right-turn lanes Restripe SB approach to create 10-feet left and 12-feet through/right lanes Shift 7 seconds of green time from WB to EB/WB Shift 1 second of green time from the NB/SB phase to the EB/WB phase
Drumgoole Road and Richmond Avenue	Restripe NB approach as three 10-feet wide lanes	Restripe NB approach as three 10-feet wide lanes	Restripe NB approach as three 10-feet wide lanes	Restripe NB approach as three 10-feet wide lanes	Restripe NB approach as three 10-feet wide lanes
Arthur Kill Road and Drumgoole Road	Restripe the EB approach to provide a 16-foot shared through and right-turn lane Shift 1 second of green time from the EBL/WBL to NB/SB.	Restripe the EB approach to provide a 16-foot shared through and right-turn lane Shift 1 second of green time from the EBL/WBL to EB/WB. Shift 5 seconds of green time from the EBL/WBL to NB/SB.	Unmitigated	Restripe the EB approach to provide a 16-foot shared through and right-turn lane Shift 1 second of green time from EBL/WBL to EB/WB Shift 3 seconds of green time from EBL/WBL to NB/SB	Restripe the EB approach to provide a 16-foot shared through and right-turn lane Shift 1 second of green time from EBL/WBL to EB/WB Shift 3 seconds of green time from EBL/WBL to NB/SB
Arthur Kill Road and West Shore Expressway (NB) Service Road	Unmitigated	Not impacted	Not impacted	Unmitigated	Not impacted
Arthur Kill Road and West Shore Expressway (SB) Service Road	Shift 1 second of green time from EB/WB phase to the SB phase	Shift 1 seconds of green time from EB/WB phase to the SB phase	Shift 1 seconds of green time from EB/WB phase to the SB phase	Shift 1 seconds of green time from EB/WB to SB	Shift 1 seconds of green time from EB/WB to SB
Muldoon Avenue and West Shore Expressway (SB) Service Road (2)	Re-stripe SB approach by shifting moving lane on service road to east curb	Re-stripe SB approach by shifting moving lane on service road to east curb	Re-stripe SB approach by shifting moving lane on service road to east curb	Re-stripe SB approach by shifting moving lane on service road to east curb	Re-stripe SB approach by shifting moving lane on service road to east curb
Arden Avenue and West Shore Expressway (SB) Service Road *	Daylight the WB approach Create signalized intersection with the following signal timing/phasing plan: Phase / Green / Amber / Red WB / 30 / 3 / 2 SB / 50 / 3 / 2 Cycle length = 90 seconds	Daylight the WB approach Create signalized intersection with the following signal timing/phasing plan: Phase / Green / Amber / Red WB / 12 / 3 / 2 SB / 68 / 3 / 2 Cycle length = 90 seconds	Unmitigated	Daylight the WB approach Create signalized intersection with the following signal timing/phasing plan: Phase / Green / Amber / Red WB / 20 / 3 / 2 SB / 60 / 3 / 2 Cycle length = 90 seconds	Daylight the WB approach Create signalized intersection with the following signal timing/phasing plan: Phase / Green / Amber / Red WB / 25 / 3 / 2 SB / 55 / 3 / 2 Cycle length = 90 seconds
Secondary Study Area					
Travis Avenue and Forest Hill Road *	Daylight the EB approach Shift 4 seconds of green time from EB phase to the NB/SB phase	Shift 3 seconds of green time from EB phase to NB/SB phase	Shift 3 seconds of green time from EB phase to NB/SB phase	Shift 3 seconds of green time from EB phase to NB/SB phase	Shift 3 seconds of green time from EB phase to NB/SB phase
Richmond Hill Road and Forest Hill Road	Unmitigated	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Arthur Kill Road and Bloomingdale Road	Not impacted	Not impacted	Shift 2 seconds of green time from NB phase to EB/WB phase	Not impacted	Not impacted
Woodrow Road and Foster Road *	Daylight the WB approach	Daylight the WB approach	Daylight the WB approach	Daylight the WB approach	Not impacted
Woodrow Road and Huguenot Avenue	Not impacted	Shift 1 second of green time from EB/WB phase to NB/SB phase	Shift 1 second of green time from EB/WB phase to NB/SB phase	Shift 1 second of green time from EB/WB phase to NB/SB phase	Shift 1 second of green time from EB/WB phase to NB/SB phase
Amboy Road and Huguenot Avenue	Unmitigated	Not impacted	Unmitigated	Unmitigated	Shift 1 second of green time from EB/WB phase to NB/SB phase
Amboy Road and Arden Avenue	Restripe the WB approach with an 11-feet wide left-and-through lane and an exclusive 10-feet wide right-turn lane Shift 1 second of green time from EB/WB phase to NB/SB phase	Restripe the WB approach with an 11-feet wide left-and-through lane and an exclusive 10-feet wide right-turn lane Shift 1 second of green time from EB/WB phase to NB/SB phase	Restripe the WB approach with an 11-feet wide left-and-through lane and an exclusive 10-feet wide right-turn lane Shift 1 second of green time from EB/WB phase to NB/SB phase	Restripe the WB approach with an 11-feet wide left-and-through lane and an exclusive 10-feet wide right-turn lane Shift 1 second of green time from EB/WB phase to NB/SB phase	Restripe the WB approach with an 11-feet wide left-and-through lane and an exclusive 10-feet wide right-turn lane Shift 1 second of green time from EB/WB phase to NB/SB phase
Amboy Road and Richmond Avenue	Restripe SB approach to create 12-feet wide left-turn lane	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Yukon Avenue and Forest Hill Road *	Daylight the NB approach.	Daylight the NB approach. Shift 1 second of green time from the EB phase to the NB/SB phase.	Daylight the NB approach. Shift 1 second of green time from the EB phase to the NB/SB phase.	Daylight the NB approach. Shift 2 seconds of green time from the EB phase to the NB/SB phase.	Daylight the NB approach.

Notes:
(1) Intersection of Arden Avenue and Woodrow Road was not impacted during the weekday midday peak hour and was analyzed under mitigation conditions for verification purposes only.
(2) Intersection of Muldoon Avenue and West Shore Expressway (SB) Service Road was not impacted during the weekday AM and weekend PM peak hours and was analyzed under mitigation conditions for verification purposes only.
* Daylight at intersection approaches implies that curbside parking is prohibited for approximately 100-feet.

to provide an additional 11-foot-wide moving lane for approximately 100 feet. Additionally, it is required to shift 1 second of green time from the northbound/southbound phase to the exclusive northbound phase and by daylighting the eastbound approach.

Richmond Avenue and Draper Place

The impact at the northbound left-turn movement at this intersection during the weekday AM peak hour could be mitigated by shifting 1 second of green time from northbound/southbound phase to the northbound phase.

The impacts at the northbound left-turn movement and southbound through-right movement at this intersection during the weekday midday, weekend midday and weekend PM peak hours could be mitigated by daylighting the southbound approach to provide an additional moving lane and by shifting 2 seconds of green time from northbound/southbound phase to the northbound phase.

The impacts at the northbound left-turn movement and southbound through-right movements during the weekday PM peak hour could be mitigated by daylighting the southbound approach to provide an additional moving lane and shifting 1 second of green time from northbound/southbound phase to northbound phase.

Richmond Avenue and Richmond Hill Road

The impacts at the westbound left-turn, northbound through and southbound through-right movements at this intersection during the weekday midday peak hour could not be mitigated by standard traffic engineering measures.

The impacts at the southbound approach at this intersection during the weekday PM peak hour could not be mitigated by standard traffic engineering measures.

The impacts at the westbound left-turn, northbound through and southbound approach at this intersection during the weekend midday peak hour could not be mitigated by standard traffic engineering measures.

The impacts at the northbound through movement and the southbound through-right movement at this intersection during the weekend PM peak hour could not be mitigated by standard traffic engineering measures.

Richmond Avenue and Forest Hill Road

The impacts at the westbound left-turn and northbound through and right-turn movements at this intersection during the weekday AM peak hour could not be mitigated by standard traffic engineering measures.

The impacts at the westbound left-turn, northbound through and right-turn and southbound through-right movement at this intersection during the weekday midday, weekday PM, weekend midday, and weekend PM peak hours could not be mitigated by standard traffic engineering measures.

Richmond Avenue and Arthur Kill Road

The impacts at the westbound through movement and northbound through-right movement at this intersection during the weekday AM peak hour could not be mitigated by standard traffic engineering measures.

The impacts at the westbound through movement, northbound through-right and southbound left-turn movements at this intersection during the weekday midday and PM, and weekend PM peak hours could not be mitigated by standard traffic engineering measures.

The impacts at the westbound through movement, northbound approach and southbound left-turn movements at this intersection during the weekend midday peak hour could not be mitigated by standard traffic engineering measures.

Arthur Kill Road and Woodrow Road

The impact at the northbound right-turn movement at this intersection during the weekend midday peak hour could be mitigated by shifting 2 seconds of green time from the eastbound/westbound phase to the northbound phase.

The impact at the westbound left-through movement at this intersection during the weekend PM peak hour could be mitigated by shifting 4 seconds of green time from the northbound phase to the eastbound/westbound phase. In addition, daylighting of the northbound approach is also required.

Arden Avenue and Woodrow Road

The impact at the southbound approach at this intersection during the weekday AM peak hour could be mitigated by restriping the southbound approach to provide an 11-foot-wide left-through lane and an 11-foot-wide exclusive right-turn lane.

The impact at the eastbound and westbound approaches at this intersection during the weekday PM peak hour could be mitigated by restriping the southbound approach to provide an 11-foot-wide left-through lane and an 11-foot-wide exclusive right-turn lane, and by shifting 1 seconds of green time form the northbound/southbound phase to the eastbound/westbound phase.

The impact at the southbound and westbound approaches at this intersection during the weekend midday peak hour could be mitigated by restriping the southbound approach to provide an 11-foot-wide left-through lane and an 11-foot-wide exclusive right-turn lane and by daylighting the westbound approach.

The impact at the westbound approach at this intersection during the Saturday PM peak hour by restriping the southbound approach to provide an 11-foot-wide left-through lane and an 11-foot-wide exclusive right-turn lane and by daylighting the westbound approach.

Arden Avenue and Arthur Kill Road

The impacts at the eastbound left-turn movement, eastbound through movement and southbound through-right turn movement at this intersection during the weekday AM, PM, and weekend midday peak hours could not be mitigated by standard traffic engineering measures.

The impacts at the eastbound left-turn movement and eastbound through movement during the weekday midday peak hour could be mitigated by shifting 2 seconds of green time from the exclusive westbound phase to the eastbound/westbound phase and by shifting 1 second of green time from the northbound/southbound phase to the eastbound/westbound phase. In addition, it is required to restripe the eastbound approach to provide a 10-foot-wide left-turn lane, a 12-foot-wide through lane and a 10-foot-wide right-turn lane; and restripe the southbound approach to provide a 10-foot-wide left turn lane and a 12-foot-wide through/right lane.

The impact at the eastbound left-turn movement and eastbound through movement during the weekend PM peak hour could be mitigated by restriping the eastbound approach to provide a 10-foot-wide left-turn lane, a 12-foot-wide through lane and a 10-foot-wide right-turn lane; and restripe the southbound approach to provide a 10-foot-wide left turn lane and a 12-foot-wide through/right lane. In addition, it is required to shift 7 seconds of green time from the exclusive westbound phase to the eastbound/westbound phase and by shifting 1 second of green time from the northbound/southbound phase to the eastbound/westbound phase.

Richmond Avenue and Drumgoole Road

The impact at the northbound through movement at this intersection during all the peak hours could be mitigated by restriping the northbound approach to provide three 10-foot-wide through lanes.

Arthur Kill Road and Drumgoole Road

The impacts at the eastbound and northbound through-right movements at this intersection during the weekday AM peak hour could be mitigated by restriping the eastbound approach to provide a 16-foot shared through and right-turn lane. In addition, shifting 1 second of green time from the eastbound/westbound protected left-turn phase to the northbound/southbound phase is also required.

The impacts at the eastbound through-right movement and northbound approach at this intersection during the weekday midday peak hour could be mitigated by restriping the eastbound approach to provide a 16-foot shared through and right-turn lane and by shifting 1 second of green time from the eastbound/westbound protected left-turn phase to the eastbound/westbound phase. In addition, shifting 5 seconds of green time from the eastbound/westbound protected left-turn phase to the northbound/southbound phase is also required.

The impacts at the eastbound through-right movement and the northbound approach at this intersection during the weekday PM peak hour could not be mitigated by standard traffic engineering measures.

The impacts at the eastbound and northbound through-right movements at this intersection during the weekend midday and PM peak hours could be mitigated by restriping the eastbound approach to provide a 16-foot shared through and right-turn lane, by shifting 1 second of green time from the eastbound/westbound protected left-turn phase to the eastbound/westbound phase, and by shifting 3 seconds of green time from the eastbound/westbound protected left-turn phase to the northbound/southbound phase.

Arthur Kill Road and West Shore Expressway (NB) Service Road

The impact at the eastbound left-turn movement at this intersection during the weekday AM and weekend midday peak hours could not be mitigated by standard traffic engineering measures.

Arthur Kill Road and West Shore Expressway (SB) Service Road

The impact at the southbound approach at this intersection during all five (5) analyzed peak hours could be mitigated by shifting 1 second of green time from the eastbound/westbound phase to the southbound phase.

Muldoon Avenue and West Shore Expressway (SB) Service Road

The impact at the eastbound right-turn movement at this intersection during the weekday midday, PM, and weekend midday could be mitigated by restriping the southbound approach to shift the moving lane on the service road to the east curb.

Arden Avenue and West Shore Expressway (SB) Service Road

The impact at the westbound left-turn movement at this intersection during all the peak hours, except for the weekday PM peak hour could be mitigated by installing a new two-phase traffic signal operating with a 90-second cycle length and by daylighting the westbound approach (see Table 23-10).

The impact at the westbound left-turn movement at this intersection during the weekday PM peak hour could not be mitigated by standard traffic engineering measures.

Travis Avenue and Forest Hill Road

The impact at the northbound left-through movement at this intersection during the weekday AM peak hour could be mitigated by shifting 4 seconds of green time from the eastbound phase to the northbound/southbound phase and by daylighting the eastbound approach.

The impacts at the northbound left-through movement and southbound through-right movement at this intersection during the weekday midday and PM, and weekend midday and PM peak hours could be mitigated by shifting 3 seconds of green time from the eastbound phase to the northbound/southbound phase.

Richmond Hill Road and Forest Hill Road

The impacts at the westbound approach, northbound through-right movement, and southbound through-right movement at this intersection during all peak hours could not be mitigated by standard traffic engineering measures.

Arthur Kill Road and Bloomingdale Road

The impacts at the eastbound through-right movement at this intersection during the weekday PM peak hour at this intersection could be mitigated by shifting 2 seconds of green time from the northbound phase to the eastbound/westbound phase.

Woodrow Road and Foster Road

The impact at westbound left-through movement at this intersection during the weekday AM, midday, PM and weekend midday peak hours could be mitigated by daylighting the westbound approach.

Woodrow Road and Huguenot Avenue

The impact at the northbound approach at this intersection during the weekday midday, weekday PM, weekend midday and weekend PM peak hours could be mitigated by shifting 1 second of green time from the eastbound/westbound phase to the northbound/southbound phase.

Amboy Road and Huguenot Avenue

The impact at the southbound left-turn movement at this intersection during the weekday AM, weekday PM, and weekend midday peak hours could not be mitigated by standard traffic engineering measures.

The impact at the southbound left-turn movement at this intersection during the weekend PM peak hour could be mitigated by shifting 1 second of green time from the eastbound/westbound phase to the northbound/southbound phase.

Arden Avenue and Amboy Road

The impact at the southbound left-turn movement at this intersection during the weekday AM and midday, and weekend midday and PM peak hours could be mitigated by shifting 1 second of green time from the eastbound/westbound phase to the northbound/southbound phase, and by restriping the westbound approach with a 10-foot-wide exclusive right-turn and 11-foot-wide left-through lanes.

The impact at northbound left-turn movement and southbound left-turn movement at this intersection during the weekday PM peak hour could be mitigated by shifting 1 second of green time from the eastbound/westbound phase to the northbound/southbound phase, and by restriping the westbound approach with a 10-foot-wide exclusive right-turn and 11-foot-wide left-through lanes.

Richmond Avenue and Amboy Road

The impact at the southbound left-turn movement at this intersection during the weekday AM peak hour could be mitigated by restriping the southbound approach to create a 12-foot-wide left-turn lane.

The impacts at the southbound left-turn movement at this intersection during the weekday midday peak hour could not be mitigated by standard traffic engineering measures.

The impact at the northbound through movement and the southbound approach at this intersection during the weekday PM peak hour could not be mitigated by standard traffic engineering measures.

The impact at the northbound through movement at this intersection during the weekend midday peak hour could not be mitigated by standard traffic engineering measures.

The impacts at the northbound through and the southbound left-turn movements at this intersection during the weekend PM peak hour could not be mitigated by standard traffic engineering measures.

Yukon Avenue and Forest Hill Road

The impact at the northbound approach at this intersection during the weekday AM and weekend PM peak hours could be mitigated by daylighting the northbound approach.

The impact at the northbound approach at this intersection during the weekday midday and PM peak hours could be mitigated by daylighting the northbound approach. In addition, shifting 1 second of green time from the eastbound phase to the northbound/southbound phase is also required.

The impact at the northbound approach at this intersection during the weekend midday peak hour could be mitigated by daylighting the northbound approach. In addition, shifting 2 seconds of green time from the eastbound phase to the northbound/southbound phase is also required.

With the above mitigation measures in place, most of the impacted locations would operate at the same or better service levels than the 2036 No Build conditions as presented in Tables 23-11 through 23-15.

As identified in Chapter 16, "Traffic and Parking," certain segments of the West Shore Expressway corridor could experience congested traffic conditions in the 2016 and 2036 Build conditions. DPR will continue to coordinate with NYSDOT to explore highway access design alternatives that would maximize traffic operating conditions along the West Shore Expressway corridor with the proposed project in place, while minimizing congestion.

AIR QUALITY

Chapter 18, "Air Quality," presents the maximum of the predicted 8-hour carbon monoxide (CO) concentrations for the proposed project, and concludes that the proposed project would not result in any significant adverse air quality impacts. Therefore, no air quality mitigation is required. However, this section considers the effects on air quality of the proposed project with the implementation of the traffic mitigation measures discussed above. ✷

Table 23-11

2036 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday AM Peak Hour

Intersection	2036 No Build				2036 Build					2036 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Primary Study Area - Signalized Intersections														
Victory Boulevard and West Shore Expressway (SB) Ramps														
Eastbound	TR	0.58	22.9	C	TR	0.59	23.2	C		TR	0.58	22.1	C	
Westbound	L	1.93	456.2	F	L	1.96	469.1	F	+	L	1.88	433.1	F	
	T	0.31	17.1	B	T	0.31	17.1	B		T	0.30	16.4	B	
Southbound	LTR	0.34	16.5	B	LTR	0.36	16.8	B		LTR	0.37	17.4	B	
	Intersection		181.1	F	Intersection		183.5	F		Intersection		170.2	F	
Victory Boulevard and Travis Avenue														
Eastbound	L	0.16	16.4	B	L	0.17	16.7	B		L	0.17	16.7	B	
	T	1.01	60.9	E	T	1.03	65.4	E	+	T	0.99	55.9	E	
	R	0.28	17.0	B	R	0.09	14.7	B		R	0.09	14.8	B	
Westbound	L	0.43	32.8	C	L	0.43	32.8	C		L	0.43	32.8	C	
	T	0.65	23.9	C	T	0.67	24.7	C		T	0.67	24.7	C	
	R	0.41	19.0	B	R	0.41	19.0	B		R	0.41	19.0	B	
Northbound	L	0.65	30.7	C	L	0.66	31.6	C		L	0.66	31.6	C	
	TR	0.92	41.8	D	TR	0.92	41.8	D		TR	0.92	41.8	D	
Southbound	L	1.44	270.8	F	L	1.44	270.8	F		L	1.44	270.8	F	
	TR	0.64	23.9	C	TR	0.64	23.9	C		TR	0.64	23.9	C	
	Intersection		46.9	D	Intersection		49.2	D		Intersection		46.9	D	
Signs Road and Richmond Avenue														
Eastbound	L	0.62	37.3	D	L	0.64	37.9	D		L	0.64	37.9	D	
	R	1.27	186.9	F	R	1.29	193.7	F	+	R	1.09	117.0	F	
Northbound	L	2.07	510.0	F	L	2.12	534.7	F	+	L	2.02	492.7	F	
	TR	1.05	38.0	D	TR	0.94	10.6	B		TR	0.94	10.6	B	
Southbound	TR	0.62	10.9	B	TR	0.64	11.2	B		TR	0.65	12.0	B	
	Intersection		84.4	F	Intersection		75.8	E		Intersection		67.5	E	
Draper Place and Richmond Avenue														
Eastbound	LT	1.49	271.3	F	LT	1.49	271.3	F		LT	1.49	271.3	F	
Westbound	LTR	0.05	27.0	C	LTR	0.05	27.0	C		LTR	0.05	27.0	C	
Northbound	L	1.50	270.0	F	L	1.52	278.4	F	+	L	1.46	251.2	F	
	TR	0.81	6.6	A	TR	0.71	5.3	A		TR	0.71	5.3	A	
Southbound	TR	0.76	30.4	C	TR	0.78	30.9	C		TR	0.81	32.8	C	
	Intersection		66.2	E	Intersection		71.0	E		Intersection		67.9	E	
Forest Hill Road and Richmond Avenue														
Eastbound					L	0.20	23.3	C						
					T	0.15	22.2	C						
					R	0.09	21.7	C						
Westbound	L	0.66	30.8	C	L	1.81	407.8	F	+					
	LR	0.84	42.1	D	TR	0.15	22.3	C						
Northbound					L	0.92	95.4	F		Unmitigated				
	T	1.03	37.6	D	T	1.30	163.1	F	+					
	R	1.48	243.5	F	R	2.18	565.1	F	+					
Southbound	L	0.10	8.3	A	L	0.06	38.5	D						
	T	0.43	7.7	A	TR	0.53	19.3	B						
	Intersection		62.7	E	Intersection		216.8	F						
Arthur Kill Road and Richmond Avenue														
Eastbound	L	0.22	27.4	C	L	0.22	27.4	C						
	TR	0.98	51.7	D	TR	0.99	54.7	D						
Westbound	L	0.35	33.6	C	L	0.35	33.6	C						
	T	1.48	253.1	F	T	1.49	259.7	F	+					
	R	0.82	24.1	C	R	0.84	25.4	C		Unmitigated				
Northbound	L	0.74	45.6	D	L	0.76	46.4	D						
	TR	1.42	225.2	F	TR	1.44	231.6	F	+					
Southbound	L	0.60	40.1	D	L	0.62	40.6	D						
	TR	0.66	29.0	C	TR	0.55	26.5	C						
	Intersection		126.7	F	Intersection		132.0	F						
Arden Avenue and Woodrow Road														
Eastbound	LTR	0.81	19.2	B	LTR	0.82	19.6	B		LTR	0.82	19.6	B	
Westbound	LTR	1.23	129.9	F	LTR	1.23	130.6	F		LTR	1.23	130.6	F	
Northbound	LTR	0.80	26.0	C	LTR	0.81	26.5	C		LTR	0.92	40.2	D	
Southbound	LTR	1.45	238.8	F	LTR	1.46	247.0	F	+	LT	1.01	73.6	E	
										R	0.32	16.7	B	
	Intersection		94.2	F	Intersection		96.0	F		Intersection		63.7	E	
Arden Avenue and Arthur Kill Road														
Eastbound	L	0.61	33.4	C	L	0.86	58.7	E	+					
	T	1.11	100.8	F	T	1.21	141.5	F	+					
	R	0.22	22.7	C	R	0.22	22.7	C						
Westbound	L	1.56	295.6	F	L	0.55	22.6	C						
	TR	0.28	11.8	B	TR	0.62	17.4	B		Unmitigated				
Northbound	LTR	2.47	701.9	F	LTR	1.80	403.4	F						
Southbound	L	1.04	130.2	F	L	0.55	34.8	C						
	TR	0.89	45.5	D	TR	1.02	73.0	E	+					
	Intersection		267.0	F	Intersection		129.0	F						
Drumgoole Road and Richmond Avenue														
Eastbound	L	1.50	257.1	F	L	1.36	191.7	F		L	1.36	191.7	F	
	LR	1.51	259.4	F	LR	1.36	194.6	F		LR	1.36	194.6	F	
Northbound	T	1.40	209.5	F	T	1.42	219.0	F	+	T	1.07	64.9	E	
Southbound	T	0.62	21.1	C	T	0.55	19.9	B		T	0.55	19.9	B	
	Intersection		202.6	F	Intersection		177.3	F		Intersection		116.5	F	
Arthur Kill Road and Drumgoole Road														
Eastbound	L	1.52	270.9	F	L	1.04	73.4	E		L	1.09	89.3	F	
	TR	1.49	264.7	F	TR	1.53	283.1	F	+	TR	1.44	243.1	F	
Westbound	L	0.74	24.1	C	L	0.74	24.1	C		L	0.76	25.9	C	
	TR	0.66	34.6	C	TR	0.68	35.0+	D		TR	0.68	35.0+	D	
Northbound	L	0.41	29.2	C	L	0.39	25.7	C		L	0.37	23.7	C	
	TR	1.49	251.3	F	TR	1.51	256.5	F	+	TR	1.47	239.4	F	
Southbound	LTR	0.96	42.6	D	LTR	0.88	32.2	C		LTR	0.86	29.7	C	
	Intersection		170.6	F	Intersection		150.7	F		Intersection		140.4	F	

Table 23-11

2036 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday AM Peak Hour

Intersection	2036 No Build				2036 Build					2036 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Arthur Kill Road and West Shore Expressway (NB) Service Road														
Eastbound	L	1.56	289.3	F	L	2.52	712.5	F	+					
	T	0.37	8.0	A	T	0.26	7.2	A						
Westbound	TR	0.89	19.2	B	TR	0.61	10.6	B		Unmitigated				
Northbound	LTR	0.92	69.4	E	LTR	0.90	64.8	E						
	Intersection		49.5	D	Intersection		163.2	F						
Arthur Kill Road and West Shore Expressway (SB) Service Road														
Eastbound	TR	0.64	18.4	B	TR	0.65	18.6	B		TR	0.68	20.0-	B	
Westbound	L	1.78	391.5	F	L	0.96	80.2	F		L	1.05	106.3	F	
	T	0.37	14.8	B	T	0.37	14.8	B		T	0.39	15.7	B	
Southbound	LTR	1.23	131.8	F	LTR	1.23	134.4	F	+	LTR	1.19	115.8	F	
	Intersection		106.1	F	Intersection		66.2	E		Intersection		61.7	E	
Primary Study Area - Unsignalized Intersections														
Muldoon Avenue and West Shore Expressway (SB) Service Road[1]														
Eastbound	R	0.35	20.6	C	R	0.46	29.2	D		Free-flow operation				
Arden Avenue and West Shore Expressway (SB) Service Road										Signalized				
Westbound	L	7.94	*	F	L	26.73	*	F	+	L	0.66	28.2	C	
Southbound	L	0.55	9.9	A	L	0.56	9.9	A		L	0.91	31.6	C	
										T	0.70	18.2	B	
										Intersection		26.0	C	
Secondary Study Area - Signalized Intersections														
Travis Avenue and Forest Hill Road														
Eastbound	LR	0.72	30.2	C	LR	0.72	30.2	C		LR	0.72	32.8	C	
Northbound	LT	0.97	43.2	D	LT	1.06	68.0	E	+	LT	0.98	42.3	D	
Southbound	TR	0.85	26.2	C	TR	0.87	27.0	C		TR	0.80	20.3	C	
	Intersection		33.9	C	Intersection		45.2	D		Intersection		31.9	C	
Richmond Hill Road and Forest Hill Road														
Eastbound	L	0.42	20.1	C	L	0.43	20.3	C						
	TR	0.68	19.2	B	TR	0.78	22.8	C						
Westbound	LTR	1.34	192.0	F	LTR	1.37	206.5	F	+					
Northbound	L	0.49	43.0	D	L	0.49	43.0	D		Unmitigated				
	TR	1.34	195.6	F	TR	1.48	255.5	F	+					
Southbound	L	1.83	435.7	F	L	1.83	435.7	F						
	TR	1.01	68.9	E	TR	1.03	74.8	E	+					
	Intersection		144.5	F	Intersection		163.3	F						
Woodrow Road and Foster Road														
Eastbound	TR	0.85	21.7	C	TR	0.86	22.0	C		TR	0.86	22.0	C	
Westbound	LT	1.52	262.9	F	LT	1.53	266.8	F	+	LT	1.38	198.9	F	
Northbound	LR	0.91	44.4	D	LR	0.91	44.4	D		LR	0.91	44.4	D	
	Intersection		104.8	F	Intersection		106.2	F		Intersection		84.2	F	
Amboy Road and Huguenot Avenue														
Eastbound	L	1.23	162.6	F	L	1.23	162.6	F						
	TR	0.59	18.8	B	TR	0.59	18.8	B						
Westbound	L	0.6	25.0	C	L	0.6	25.0	C						
	TR	0.81	27.5	C	TR	0.81	27.5	C						
Northbound	L	0.22	24.8	C	L	0.22	24.8	C		Unmitigated				
	TR	0.88	40.9	D	TR	0.88	41.1	D						
Southbound	L	1.31	214.9	F	L	1.33	219.3	F	+					
	TR	1.13	103.4	F	TR	1.13	104.0	F						
	Intersection		66.4	E	Intersection		66.8	E						
Amboy Road and Arden Avenue														
Eastbound	L	0.23	17.6	B	L	0.23	17.6	B		L	0.21	17.7	B	
	TR	0.89	37.1	D	TR	0.89	37.1	D		TR	0.91	40.7	D	
Westbound	LTR	0.79	29.4	C	LTR	0.79	29.4	C		LT	0.87	40.6	D	
										R	0.25	17.1	B	
Northbound	L	0.85	64.9	E	L	0.85	64.9	E		L	0.79	52.2	D	
	TR	0.65	23.7	C	TR	0.65	23.8	C		TR	0.64	22.6	C	
Southbound	L	1.41	233.3	F	L	1.42	236.1	F	+	L	1.34	202.1	F	
	TR	0.80	30.0	C	TR	0.80	30.0	C		TR	0.78	28.3	C	
	Intersection		53.6	D	Intersection		53.9	D		Intersection		51.0	D	
Amboy Road and Richmond Avenue														
Eastbound	L	0.63	42.0	D	L	0.63	42.0	D		L	0.63	42.0	D	
	T	1.15	115.9	F	T	1.15	115.9	F		T	1.15	115.9	F	
	R	0.32	23.4	C	R	0.32	23.4	C		R	0.32	23.4	C	
Westbound	L	0.84	89.7	F	L	0.84	89.7	F		L	0.84	89.7	F	
	T	0.78	36.6	D	T	0.78	36.6	D		T	0.78	36.6	D	
	R	0.40	15.7	B	R	0.40	15.7	B		R	0.40	15.7	B	
Northbound	L	0.29	22.6	C	L	0.31	23.1	C		L	0.31	23.1	C	
	T	0.75	31.4	C	T	0.79	33.2	C		T	0.79	33.2	C	
	R	0.19	18.8	B	R	0.19	18.8	B		R	0.19	18.8	B	
Southbound	L	0.90	54.2	D	L	0.95	64.8	E	+	L	0.89	42.7	D	
	TR	0.82	25.3	C	TR	0.84	26.4	C		TR	0.89	32.3	C	
	Intersection		49.3	D	Intersection		50.5	D		Intersection		49.8	D	
Yukon Avenue and Forest Hill Road														
Eastbound	L	0.07	20.0+	C	L	0.07	20.0+	C		L	0.07	20.0+	C	
Northbound	LT	1.08	75.0	E	LT	1.18	114.2	F	±	LT	1.03	58.6	E	
Southbound	T	0.57	15.9	B	T	0.58	16.2	B		T	0.58	16.2	B	
	R	0.11	10.2	B	R	0.11	10.2	B		R	0.11	10.2	B	
	Intersection		48.7	D	Intersection		72.6	E		Intersection		40.4	D	

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service

\+ implies a significant adverse impact

* implies that delays are in excess of 1000 seconds

(1) Intersection not impacted but analysis was conducted to incorporate permanent geometric/signal phasing changes proposed as mitigation measures in other peak hours.

Table 23-12

2036 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday Midday Peak Hour

Intersection	2036 No Build				2036 Build					2036 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Primary Study Area - Signalized Intersections														
Victory Boulevard and West Shore Expressway (SB) Ramps														
Eastbound	TR	0.72	27.6	C	TR	0.74	28.8	C		TR	0.71	25.7	C	
Westbound	L	2.04	506.0	F	L	2.15	554.0	F	+	L	1.96	468.8	F	
	T	0.26	16.5	B	T	0.26	16.5	B		T	0.25	15.2	B	
Southbound	LTR	0.37	16.8	B	LTR	0.45	17.6	B		LTR	0.47	19.0	B	
	Intersection		167.6	F	Intersection		177.4	F		Intersection		152.0	F	
Victory Boulevard and Travis Avenue														
Eastbound	L	0.24	18.0	B	L	0.27	19.0	B		L	0.29	20.3	C	
	T	0.57	21.6	C	T	0.61	22.8	C		T	0.61	23.2	C	
	R	0.43	19.3	B	R	0.09	14.7	B		R	0.09	15.3	B	
Westbound	L	0.18	16.5	B	L	0.20	17.0	B		L	0.21	17.8	B	
	T	0.66	24.2	C	T	0.71	25.7	C		T	0.73	27.2	C	
	R	0.32	17.4	B	R	0.32	17.4	B		R	0.32	18.2	B	
Northbound	L	1.17	149.6	F	L	1.20	158.3	F	+	L	1.11	124.9	F	
	TR	0.76	28.1	C	TR	0.76	28.1	C		TR	0.74	26.5	C	
Southbound	L	0.83	53.9	D	L	0.83	53.9	D		L	0.78	45.6	D	
	TR	0.80	30.4	C	TR	0.80	30.4	C		TR	0.78	28.6	C	
	Intersection		34.2	C	Intersection		36.3	D		Intersection		33.3	C	
Signs Road and Richmond Avenue														
Eastbound	L	0.45	33.3	C	L	0.48	33.7	C		L	0.48	33.7	C	
	R	1.03	102.1	F	R	1.09	120.0	F	+	R	0.92	69.7	E	
Northbound	L	1.20	144.6	F	L	1.24	159.4	F	+	L	1.18	133.3	F	
	TR	0.76	4.5	A	TR	0.72	4.0	A		TR	0.72	4.0	A	
Southbound	TR	1.18	103.5	F	TR	1.22	124.1	F	+	TR	0.92	25.4	C	
	Intersection		63.1	E	Intersection		76.5	E		Intersection		27.0	C	
Draper Place and Richmond Avenue														
Eastbound	LT	1.48	266.3	F	LT	1.48	266.3	F		LT	1.48	266.3	F	
Westbound	LTR	0.18	28.7	C	LTR	0.18	28.7	C		LTR	0.18	28.7	C	
Northbound	L	1.48	259.3	F	L	1.57	298.9	F	+	L	1.45	246.5	F	
	TR	0.60	4.3	A	TR	0.57	4.2	A		TR	0.57	4.2	A	
Southbound	TR	1.23	140.3	F	TR	1.29	164.6	F	+	TR	1.08	74.5	E	
	Intersection		108.3	F	Intersection		126.1	F		Intersection		83.3	F	
Richmond Hill Road and Richmond Avenue														
Eastbound	LTR	0.01	27.3	C	L	0.51	28.7	C						
					T	0.19	22.1	C						
					R	0.06	8.9	A						
Westbound	L	0.66	43.9	D	L	0.98	71.3	E	+					
	LT	0.72	47.9	D	T	0.11	21.1	C						
	R	1.08	85.2	F	R	0.78	22.6	C		Unmitigated				
Northbound	L	0.00	31.3	C	L	0.22	33.5	C						
	T	0.86	23.4	C	T	1.07	72.6	E	+					
	R	0.37	16.4	B	R	0.54	30.0	C						
Southbound	L	1.50	279.4	F	L	1.42	241.5	F						
	TR	0.90	25.3	C	TR	1.24	143.0	F	+					
	Intersection		51.0	D	Intersection		101.4	F						
Forest Hill Road and Richmond Avenue														
Eastbound					L	0.22	19.5	B						
					T	0.19	18.8	B						
					R	0.38	21.7	C						
Westbound	L	0.79	37.1	D	L	1.81	402.5	F	+					
	LR	1.01	74.6	E	TR	0.22	19.1	B		Unmitigated				
Northbound					L	1.69	380.0	F						
	T	0.76	11.1	B	T	1.17	110.0	F	+					
	R	0.75	16.5	B	R	1.35	201.1	F	+					
Southbound	L	0.21	12.2	B	L	0.12	39.4	D						
	T	0.88	14.3	B	TR	1.36	193.8	F	+					
	Intersection		18.8	B	Intersection		181.9	F						
Arthur Kill Road and Richmond Avenue														
Eastbound	L	0.21	27.5	C	L	0.21	27.5	C						
	TR	0.70	29.8	C	TR	0.73	30.5	C						
Westbound	L	0.41	33.7	C	L	0.43	35.8	D						
	T	1.35	196.3	F	T	1.36	204.2	F	+					
	R	0.59	16.2	B	R	0.66	18.2	B		Unmitigated				
Northbound	L	0.56	39.0	D	L	0.58	39.5	D						
	TR	1.03	62.8	E	TR	1.08	77.7	E	+					
Southbound	L	1.49	265.2	F	L	1.59	308.9	F	+					
	TR	0.95	44.8	D	TR	0.80	32.1	C						
	Intersection		101.3	F	Intersection		113.7	F						
Arden Avenue and Woodrow Road[1]														
Eastbound	LTR	0.84	20.5	C	LTR	0.87	22.7	C		LTR	0.87	22.7	C	
Westbound	LTR	0.96	40.2	D	LTR	0.98	43.9	D		LTR	0.98	43.9	D	
Northbound	LTR	0.57	18.8	B	LTR	0.59	19.2	B		LTR	0.64	20.4	C	
Southbound	LTR	0.79	28.8	C	LTR	0.84	33.7	C		LT	0.62	20.9	C	
										R	0.23	16.0	B	
	Intersection		27.0	C	Intersection		29.7	C		Intersection		27.7	C	
Arden Avenue and Arthur Kill Road														
Eastbound	L	0.65	34.1	C	L	0.88	58.1	E	+	L	0.80	44.2	D	
	T	1.40	218.6	F	T	1.51	268.1	F	+	T	1.33	185.2	F	
	R	0.26	23.2	C	R	0.26	23.2	C		R	0.24	20.9	C	
Westbound	L	1.20	142.2	F	L	0.42	20.0-	B		L	0.47	22.1	C	
	TR	0.16	10.6	B	TR	0.43	13.7	B		TR	0.42	13.0	B	
Northbound	LTR	0.87	43.6	D	LTR	0.62	30.1	C		LTR	0.67	33.0	C	
Southbound	L	0.59	38.1	D	L	0.41	27.0	C		L	0.43	28.5	C	
	TR	0.71	32.4	C	TR	0.85	42.4	D		TR	0.85	43.0	D	
	Intersection		104.0	F	Intersection		108.5	F		Intersection		80.8	F	
Drumgoole Road and Richmond Avenue														
Eastbound	L	1.20	128.6	F	L	1.14	101.8	F		L	1.14	101.8	F	
	LR	1.15	109.2	F	LR	1.09	84.8	F		LR	1.09	84.8	F	
Northbound	T	1.10	81.2	F	T	1.18	112.7	F	+	T	0.88	28.8	C	
Southbound	T	1.34	184.3	F	T	1.27	152.9	F		T	1.27	152.9	F	
	Intersection		131.6	F	Intersection		121.1	F		Intersection		93.0	F	
Arthur Kill Road and Drumgoole Road														
Eastbound	L	1.21	144.6	F	L	0.89	39.8	D		L	1.14	122.5	F	
	TR	1.21	148.9	F	TR	1.30	187.5	F	+	TR	1.17	131.1	F	
Westbound	L	0.60	21.3	C	L	0.60	21.3	C		L	0.72	26.0	C	
	TR	0.52	33.3	C	TR	0.55	33.8	C		TR	0.52	32.5	C	
Northbound	L	0.44	34.9	C	L	0.59	47.8	D	+	L	0.59	44.9	D	
	TR	1.05	65.7	E	TR	1.10	81.0	F	+	TR	0.97	39.2	D	
Southbound	LTR	1.62	307.5	F	LTR	1.61	302.7	F		LTR	1.26	146.4	F	
	Intersection		157.3	F	Intersection		151.8	F		Intersection		88.7	F	

Table 23-12

2036 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday Midday Peak Hour

Intersection	2036 No Build				2036 Build					2036 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Arthur Kill Road and West Shore Expressway (SB) Service Road														
Eastbound	TR	0.61	17.8	B	TR	0.63	18.2	B		TR	0.66	19.6	B	
Westbound	L	1.33	201.4	F	L	0.80	48.4	D		L	0.86	61.5	E	
	T	0.20	13.4	B	T	0.21	13.5	B		T	0.22	14.2	B	
Southbound	LTR	1.34	177.0	F	LTR	1.38	195.0	F	+	LTR	1.33	173.4	F	
	Intersection		106.4	F	Intersection		99.1	F		Intersection		90.9	F	
Primary Study Area - Unsignalized Intersections														
Muldoon Avenue and West Shore Expressway (SB) Service Road														
Eastbound	R	1.08	122.3	F	R	1.96	507.4	F	+	Free-flow operation				
Arden Avenue and West Shore Expressway (SB) Service Road										Signalized				
Westbound	L	4.50	*	F	L	60.33	*	F	+	L	0.70	45.4	D	
Southbound	L	0.77	14.7	B	L	0.79	15.3	C		L	1.02	43.5	D	
										T	0.97	28.9	C	
										Intersection		36.7	D	
Secondary Study Area - Signalized Intersections														
Travis Avenue and Forest Hill Road														
Eastbound	LR	0.35	22.3	C	LR	0.35	22.3	C		LR	0.38	24.7	C	
Northbound	LT	1.25	143.5	F	LT	1.44	226.0	F	+	LT	1.24	135.0	F	
Southbound	TR	1.29	159.0	F	TR	1.32	173.0	F	+	TR	1.25	138.0	F	
	Intersection		142.7	F	Intersection		184.1	F		Intersection		128.8	F	
Richmond Hill Road and Forest Hill Road														
Eastbound	L	0.78	33.1	C	L	0.80	34.9	C						
	TR	0.70	19.6	B	TR	0.82	25.1	C						
Westbound	LTR	1.39	213.2	F	LTR	1.57	292.6	F	+					
Northbound	L	0.49	43.0	D	L	0.49	43.0	D		Unmitigated				
	TR	1.43	232.1	F	TR	1.65	329.9	F	+					
Southbound	L	1.51	289.7	F	L	1.51	289.7	F						
	TR	1.51	267.4	F	TR	1.57	295.0	F	+					
	Intersection		186.6	F	Intersection		232.0	F						
Woodrow Road and Foster Road														
Eastbound	TR	0.72	15.8	B	TR	0.73	16.0	B		TR	0.73	16.0	B	
Westbound	LT	1.16	104.6	F	LT	1.18	112.7	F	+	LT	1.06	68.4	F	
Northbound	LR	1.12	99.5	F	LR	1.12	99.5	F		LR	1.12	99.5	F	
	Intersection		69.0	E	Intersection		71.8	E		Intersection		56.6	E	
Woodrow Road and Huguenot Avenue														
Eastbound	L	0.50	17.7	B	L	0.51	17.9	B		L	0.54	19.6	B	
	TR	0.73	21.4	C	TR	0.74	21.8	C		TR	0.77	24.1	C	
Westbound	L	0.27	14.4	B	L	0.30	15.2	B		L	0.32	16.7	B	
	T	0.38	13.6	B	T	0.39	13.8	B		T	0.41	14.6	B	
	R	0.12	11.2	B	R	0.12	11.2	B		R	0.13	11.9	B	
Northbound	LTR	1.38	202.9	F	LTR	1.39	207.0	F	+	LTR	1.32	173.7	F	
Southbound	LTR	0.77	23.6	C	LTR	0.78	23.7	C		LTR	0.74	21.3	C	
	Intersection		72.3	E	Intersection		73.5	E		Intersection		64.2	E	
Amboy Road and Arden Avenue														
Eastbound	L	0.36	21.9	C	L	0.36	21.9	C		L	0.35	22.0	C	
	TR	0.69	25.1	C	TR	0.69	25.1	C		TR	0.71	26.4	C	
Westbound	LTR	1.04	67.7	E	LTR	1.04	67.7	E		LT	0.91	43.6	D	
										R	0.36	18.8	B	
Northbound	L	0.55	27.9	C	L	0.57	29.1	C		L	0.54	26.4	C	
	TR	0.67	24.4	C	TR	0.69	24.8	C		TR	0.67	23.6	C	
Southbound	L	1.43	243.3	F	L	1.49	267.4	F	+	L	1.40	228.8	F	
	TR	0.67	24.2	C	TR	0.68	24.6	C		TR	0.66	23.4	C	
	Intersection		59.8	E	Intersection		62.3	E		Intersection		49.4	D	
Amboy Road and Richmond Avenue														
Eastbound	L	1.27	222.2	F	L	1.27	222.2	F						
	T	1.26	160.0	F	T	1.26	160.0	F						
	R	0.20	23.7	C	R	0.20	23.7	C						
Westbound	L	0.81	86.4	F	L	0.81	86.4	F						
	T	1.21	141.3	F	T	1.21	141.3	F						
	R	0.67	23.7	C	R	0.67	23.7	C		Unmitigated				
Northbound	L	0.41	24.4	C	L	0.54	32.6	C						
	T	0.84	34.3	C	T	0.93	44.1	D						
	R	0.17	16.8	B	R	0.17	16.8	B						
Southbound	L	1.17	123.5	F	L	1.36	210.8	F	+					
	TR	0.86	26.2	C	TR	0.93	34.5	C						
	Intersection		83.0	F	Intersection		92.2	F						
Yukon Avenue and Forest Hill Road														
Eastbound	L	0.26	22.3	C	L	0.26	22.3	C		L	0.27	23.1	C	
Northbound	LT	1.19	122.7	F	LT	1.41	212.7	F	+	LT	1.18	113.0	F	
Southbound	T	0.77	21.9	C	T	0.81	23.5	C		T	0.79	22.0	C	
	R	0.19	10.9	B	R	0.19	10.9	B		R	0.19	10.4	B	
	Intersection		61.9	E	Intersection		105.6	F		Intersection		61.1	E	

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.

+ implies a significant adverse impact

* implies that delays are in excess of 1000 seconds

(1) Intersection not impacted but analysis was conducted to incorporate permanent geometric/signal phasing changes proposed as mitigation measures in other peak hours.

Table 23-13

2036 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday PM Peak Hour

Intersection	2036 No Build				2036 Build					2036 Build with Mitigation			
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS
Primary Study Area - Signalized Intersections													
Victory Boulevard and West Shore Expressway (SB) Ramps													
Eastbound	TR	0.51	20.7	C	TR	0.53	21.1	C		TR	0.50	19.3	B
Westbound	L	1.89	437.0	F	L	2.02	493.9	F	+	L	1.87	423.6	F
	T	0.17	15.4	B	T	0.17	15.4	B		T	0.16	14.2	B
Southbound	LTR	0.32	16.4	B	LTR	0.45	17.6	B		LTR	0.47	19.1	B
	Intersection		194.0	F	Intersection		204.9	F		Intersection		177.3	F
Victory Boulevard and West Shore Expressway (NB) Ramps													
Eastbound	L	0.72	42.8	D	L	0.82	59.3	E	+	L	0.71	41.2	D
	T	0.33	17.3	B	T	0.17	15.4	B		T	0.16	14.2	B
Westbound	T	0.77	28.3	C	T	0.81	30.9	C		T	0.77	27.2	C
	R	0.12	15.0	B	R	0.12	15.1	B		R	0.12	13.9	B
Northbound	L	0.31	16.4	B	L	0.32	16.5	B		L	0.34	17.8	B
	T	0.20	15.4	B	T	0.54	19.1	B		T	0.57	20.9	C
	R	0.77	26.3	C	R	0.82	29.6	C		R	0.86	35.2	D
	Intersection		24.1	C	Intersection		26.7	C		Intersection		26.4	C
Victory Boulevard and Wild Avenue													
Eastbound	LTR	0.79	23.2	C	LTR	0.67	18.5	B		LTR	0.64	16.6	B
Westbound	LTR	0.96	40.2	D	LTR	1.02	55.1	E	+	LTR	0.96	40.3	D
Southbound	LTR	0.05	19.7	B	LTR	0.05	19.7	B		LTR	0.05	21.1	C
	Intersection		32.2	C	Intersection		40.1	D		Intersection		30.6	C
Victory Boulevard and Travis Avenue													
Eastbound	L	0.68	47.6	D	L	0.98	118.4	F	+				
	T	0.63	23.0	C	T	0.67	24.3	C					
	R	0.42	18.9	B	R	0.20	15.9	B					
Westbound	L	0.32	19.7	B	L	0.36	21.1	C					
	T	0.88	36.7	D	T	0.95	45.9	D	+				
	R	0.33	17.7	B	R	0.33	17.7	B		Unmitigated			
Northbound	L	1.50	289.3	F	L	1.54	302.9	F	+				
	TR	0.60	22.3	C	TR	0.60	22.3	C					
Southbound	L	0.80	42.7	D	L	0.80	42.7	D					
	TR	1.33	180.7	F	TR	1.33	180.7	F					
	Intersection		85.9	F	Intersection		91.5	F					
Signs Road and Richmond Avenue													
Eastbound	L	0.59	36.2	D	L	0.63	37.7	D		L	0.63	37.7	D
	R	1.48	272.1	F	R	1.56	306.5	F	+	R	1.33	202.0	F
Northbound	L	1.10	106.2	F	L	1.12	115.1	F	+	L	1.07	96.2	F
	TR	0.74	4.3	A	TR	0.67	3.5	A		TR	0.67	3.5	A
Southbound	TR	1.51	253.5	F	TR	1.59	289.2	F	+	TR	1.20	114.6	F
	Intersection		151.8	F	Intersection		181.3	F		Intersection		81.6	F
Draper Place and Richmond Avenue													
Eastbound	LT	1.46	257.8	F	LT	1.46	257.8	F		LT	1.46	257.8	F
Westbound	LTR	0.25	30.4	C	LTR	0.25	30.4	C		LTR	0.25	30.4	C
Northbound	L	1.55	295.8	F	L	1.62	324.4	F	+	L	1.55	291.1	F
	TR	0.56	3.6	A	TR	0.50	3.3	A		TR	0.50	3.3	A
Southbound	TR	1.38	199.7	F	TR	1.46	234.6	F	+	TR	1.16	105.1	F
	Intersection		144.3	F	Intersection		171.7	F		Intersection		103.0	F
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	L	0.41	25.5	C					
					T	0.21	21.6	C					
					R	0.06	9.3	A					
Westbound	L	0.57	39.9	D	L	0.82	44.7	D					
	LT	0.60	41.3	D	T	0.11	20.5	C					
	R	0.90	37.9	D	R	0.75	21.8	C		Unmitigated			
Northbound	L	0.00	27.2	C	L	0.28	36.3	D					
	T	0.96	36.5	D	T	0.96	41.1	D					
	R	0.47	22.5	C	R	0.57	30.1	C					
Southbound	L	1.51	275.4	F	L	2.17	576.4	F	+				
	TR	1.50	253.2	F	TR	1.84	411.2	F	+				
	Intersection		161.7	F	Intersection		262.2	F					
Forest Hill Road and Richmond Avenue													
Eastbound					L	0.29	22.1	C					
					T	0.21	20.3	C					
					R	0.27	21.4	C					
Westbound	L	0.90	48.8	D	L	2.21	579.5	F	+				
	LR	1.16	124.0	F	TR	0.30	21.5	C		Unmitigated			
Northbound					L	2.74	842.5	F					
	T	1.00	27.1	C	T	1.43	222.6	F	+				
	R	1.26	142.1	F	R	2.12	538.6	F	+				
Southbound	L	0.60	37.4	D	L	0.33	44.6	D					
	T	1.23	118.1	F	TR	1.84	406.9	F	+				
	Intersection		85.2	F	Intersection		371.3	F					
Arthur Kill Road and Richmond Avenue													
Eastbound	L	0.30	30.3	C	L	0.30	30.3	C					
	TR	0.77	30.5	C	TR	0.79	31.3	C					
Westbound	L	0.46	39.8	D	L	0.46	40.4	D					
	T	1.48	253.9	F	T	1.50	262.0	F	+				
	R	0.76	20.3	C	R	0.88	28.6	C		Unmitigated			
Northbound	L	0.83	51.2	D	L	0.85	52.8	D					
	TR	1.46	243.7	F	TR	1.55	282.1	F	+				
Southbound	L	1.49	264.5	F	L	1.55	291.7	F	+				
	TR	1.51	264.5	F	TR	1.41	218.7	F					
	Intersection		191.0	F	Intersection		192.9	F					
Arden Avenue and Woodrow Road													
Eastbound	LTR	1.00	42.9	D	LTR	1.04	54.8	D	+	LTR	1.01	44.1	D
Westbound	LTR	1.36	186.9	F	LTR	1.38	197.2	F	+	LTR	1.32	170.0	F
Northbound	LTR	0.65	20.2	C	LTR	0.69	21.3	C		LTR	0.79	26.3	C
Southbound	LTR	0.87	36.7	D	LTR	0.92	44.9	D		LT	0.66	22.9	C
										R	0.33	17.4	B
	Intersection		80.4	F	Intersection		88.6	F		Intersection		74.1	E
Arden Avenue and Arthur Kill Road													
Eastbound	L	0.77	41.2	D	L	1.04	93.4	F	+				
	T	1.44	236.5	F	T	1.54	282.3	F	+				
	R	0.32	24.0	C	R	0.32	24.0	C					
Westbound	L	1.11	107.5	F	L	0.33	18.4	B		Unmitigated			
	TR	0.20	11.0	B	TR	0.48	14.3	B					
Northbound	LTR	1.18	129.1	F	LTR	0.77	37.0	D					
Southbound	L	2.02	516.5	F	L	1.05	103.5	F					
	TR	0.86	42.1	D	TR	1.00	68.1	E	+				
	Intersection		149.3	F	Intersection		120.2	F					
Drumgoole Road and Richmond Avenue													
Eastbound	L	1.50	253.9	F	L	1.41	217.6	F		L	1.41	217.6	F
	LR	1.50	256.3	F	LR	1.42	219.8	F		LR	1.42	219.8	F
Northbound	T	1.40	209.6	F	T	1.53	267.8	F	+	T	1.15	97.4	F
Southbound	T	1.51	256.6	F	T	1.46	236.7	F		T	1.46	236.7	F
	Intersection		242.0	F	Intersection		240.9	F		Intersection		185.2	F

Table 23-13

2036 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekday PM Peak Hour

Intersection	2036 No Build				2036 Build					2036 Build with Mitigation			
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS
Arthur Kill Road and Drumgoole Road													
Eastbound	L	1.82	398.7	F	L	1.26	158.8	F					
	TR	1.43	242.0	F	TR	1.51	278.2	F	+				
Westbound	L	0.78	25.5	C	L	0.78	25.5	C					
	TR	0.74	38.6	D	TR	0.76	39.8	D		Unmitigated			
Northbound	L	0.59	46.7	D	L	0.73	64.3	E	+				
	TR	1.46	236.2	F	TR	1.53	267.4	F	+				
Southbound	LTR	1.50	251.4	F	LTR	1.37	193.8	F					
	Intersection		219.3	F	Intersection		188.1	F					
Arthur Kill Road and West Shore Expressway (SB) Service Road													
Eastbound	TR	0.63	18.2	B	TR	0.67	18.9	B		TR	0.70	20.4	C
Westbound	L	1.69	351.6	F	L	1.02	96.5	F		L	1.10	125.7	F
	T	0.34	14.6	B	T	0.34	14.6	B		T	0.36	15.4	B
Southbound	LTR	1.52	257.7	F	LTR	1.55	267.6	F	+	LTR	1.49	243.9	F
	Intersection		165.4	F	Intersection		142.9	F		Intersection		133.8	F
Primary Study Area - Unsignalized Intersections													
Muldoon Avenue and West Shore Expressway (SB) Service Road													
Eastbound	R	0.13	26.4	D	R	0.24	53.3	F	+	Free-flow operation			
Arden Avenue and West Shore Expressway (SB) Service Road													
Westbound	L	8.25	*	F	L	122.50	*	F	+	Unmitigated			
Southbound	L	0.82	16.5	C	L	0.83	17.3	C					
Secondary Study Area - Signalized Intersections													
Travis Avenue and Forest Hill Road													
Eastbound	LR	0.42	23.1	C	LR	0.42	23.1	C		LR	0.47	25.7	C
Northbound	LT	1.46	235.2	F	LT	1.69	337.6	F	+	LT	1.43	218.1	F
Southbound	TR	1.49	247.3	F	TR	1.55	271.8	F	+	TR	1.46	229.8	F
	Intersection		224.0	F	Intersection		278.0	F		Intersection		209.2	F
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.74	30.8	C	L	0.76	32.7	C					
	TR	0.78	22.6	C	TR	0.91	33.4	C					
Westbound	LTR	1.58	298.0	F	LTR	1.83	410.1	F	+				
Northbound	L	0.75	73.5	E	L	0.75	73.5	E		Unmitigated			
	TR	1.52	271.7	F	TR	1.75	374.8	F	+				
Southbound	L	1.49	288.0	F	L	1.49	288.0	F					
	TR	1.54	279.5	F	TR	1.63	322.7	F	+				
	Intersection		216.4	F	Intersection		275.1	F					
Arthur Kill Road and Bloomingdale Road													
Eastbound	TR	1.07	71.6	E	TR	1.11	87.4	F	+	TR	1.06	68.9	E
Westbound	LT	0.64	22.7	C	LT	0.7	25.3	C		LT	0.63	20.7	C
Northbound	LR	0.73	32.2	C	LR	0.73	32.2	C		LR	0.77	36.6	D
	Intersection		53.8	D	Intersection		63.8	E		Intersection		52.8	D
Woodrow Road and Foster Road													
Eastbound	TR	0.80	18.2	B	TR	0.81	18.9	B		TR	0.81	18.9	B
Westbound	LT	1.39	201.2	F	LT	1.42	214.5	F	+	LT	1.28	152.0	F
Northbound	LR	1.04	73.5	E	LR	1.04	73.5	E		LR	1.04	73.5	E
	Intersection		96.9	F	Intersection		101.7	F		Intersection		79.3	E
Woodrow Road and Huguenot Avenue													
Eastbound	L	0.37	15.0	B	L	0.37	15.2	B		L	0.39	16.4	B
	TR	0.81	25.5	C	TR	0.83	26.7	C		TR	0.87	30.6	C
Westbound	L	0.47	21.8	C	L	0.53	25.3	C		L	0.60	31.7	C
	T	0.45	14.5	B	T	0.46	14.6	B		T	0.48	15.6	B
	R	0.22	12.1	B	R	0.22	12.1	B		R	0.23	12.9	B
Northbound	LTR	1.76	368.4	F	LTR	1.77	375.3	F	+	LTR	1.67	329.0	F
Southbound	LTR	1.00	53.6	D	LTR	1.01	54.5	D		LTR	0.96	43.5	D
	Intersection		126.4	F	Intersection		129.1	F		Intersection		114.6	F
Amboy Road and Huguenot Avenue													
Eastbound	L	0.94	76.3	E	L	0.94	76.3	E					
	TR	0.42	15.7	B	TR	0.42	15.7	B					
Westbound	L	0.14	12.9	B	L	0.14	12.9	B					
	TR	0.85	30.7	C	TR	0.85	30.7	C					
Northbound	L	0.31	29.0	C	L	0.31	29.0	C		Unmitigated			
	TR	0.85	38.1	D	TR	0.87	39.8	D					
Southbound	L	1.55	309.7	F	L	1.67	361.2	F	+				
	TR	1.17	119.0	F	TR	1.17	121.3	F					
	Intersection		75.5	E	Intersection		80.1	F					
Amboy Road and Arden Avenue													
Eastbound	L	0.24	19.4	B	L	0.24	19.4	B		L	0.27	21.2	C
	TR	0.69	25.2	C	TR	0.69	25.2	C		TR	0.71	26.5	C
Westbound	LTR	1.25	148.5	F	LTR	1.25	148.5	F		LT	1.06	79.4	E
										R	0.46	20.5	C
Northbound	L	0.94	83.4	F	L	0.96	89.0	F	+	L	0.88	69.0	E
	TR	0.80	29.9	C	TR	0.82	30.9	C		TR	0.80	28.9	C
Southbound	L	2.40	673.9	F	L	2.54	737.7	F	+	L	2.32	637.0	F
	TR	0.80	29.9	C	TR	0.81	30.3	C		TR	0.79	28.4	C
	Intersection		133.3	F	Intersection		140.0	F		Intersection		103.0	F
Amboy Road and Richmond Avenue													
Eastbound	L	1.54	323.2	F	L	1.54	323.2	F					
	T	1.12	100.7	F	T	1.12	100.7	F					
	R	0.23	20.7	C	R	0.23	20.7	C					
Westbound	L	0.98	122.0	F	L	0.98	122.0	F					
	T	1.17	123.1	F	T	1.17	123.1	F					
	R	0.56	16.9	B	R	0.56	16.9	B		Unmitigated			
Northbound	L	1.14	171.6	F	L	1.14	171.6	F					
	T	1.09	92.3	F	T	1.27	161.0	F	+				
	R	0.20	21.0	C	R	0.20	21.0	C					
Southbound	L	1.52	273.0	F	L	1.52	279.1	F	+				
	TR	1.09	81.1	F	TR	1.15	102.0	F	+				
	Intersection		110.2	F	Intersection		126.2	F					
Yukon Avenue and Forest Hill Road													
Eastbound	L	0.22	21.8	C	L	0.22	21.8	C		L	0.23	22.6	C
Northbound	LT	1.37	198.2	F	LT	1.63	309.6	F	+	LT	1.36	190.2	F
Southbound	T	0.79	22.8	C	T	0.85	26.2	C		T	0.83	24.4	C
	R	0.16	10.6	B	R	0.16	10.6	B		R	0.16	10.1	B
	Intersection		100.3	F	Intersection		158.6	F		Intersection		101.6	F

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.

\+ implies a significant adverse impact

* implies that delays are in excess of 1000 seconds

Table 23-14
2036 No Build, Build, and Build with Mitigation Level of Service Analyses
Weekend Midday Peak Hour

Intersection	2036 No Build				2036 Build					2036 Build with Mitigation				
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS	
Primary Study Area - Signalized Intersections														
Victory Boulevard and West Shore Expressway (SB) Ramps														
Eastbound	TR	0.42	19.0	B	TR	0.44	19.3	B		TR	0.41	17.7	B	
Westbound	L	1.88	433.0	F	L	2.03	499.1	F	+	L	1.89	432.6	F	
	T	0.13	15.0	B	T	0.13	15.0	B		T	0.12	13.9	B	
Southbound	LTR	0.29	16.1	B	LTR	0.45	17.6	B		LTR	0.47	19.0	C	
	Intersection		204.0	F	Intersection		214.1	F		Intersection		187.1	F	
Victory Boulevard and Travis Avenue														
Eastbound	L	0.43	26.1	C	L	0.62	44.7	D						
	T	0.68	24.4	C	T	0.73	26.6	C						
	R	0.41	18.8	B	R	0.15	15.4	B						
Westbound	L	0.40	22.2	C	L	0.47	25.8	C						
	T	0.81	30.4	C	T	0.89	37.4	D		Unmitigated				
	R	0.35	17.8	B	R	0.35	17.8	B						
Northbound	L	2.75	846.4	F	L	2.86	896.4	F	+					
	TR	0.72	26.2	C	TR	0.72	26.2	C						
Southbound	L	0.94	73.4	E	L	0.94	73.4	E						
	TR	0.93	43.2	D	TR	0.93	43.2	D						
	Intersection		82.4	F	Intersection		91.1	F						
Signs Road and Richmond Avenue														
Eastbound	L	0.62	37.3	D	L	0.68	39.9	D		L	0.68	39.9	D	
	R	1.49	274.5	F	R	1.59	319.4	F	+	R	1.35	213.6	F	
Northbound	L	1.21	149.1	F	L	1.24	161.7	F	+	L	1.18	136.4	F	
	TR	0.93	9.5	A	TR	0.83	5.7	A		TR	0.83	5.7	A	
Southbound	TR	1.43	216.6	F	TR	1.53	259.9	F	+	TR	1.15	94.2	F	
	Intersection		124.8	F	Intersection		155.5	F		Intersection		69.1	E	
Draper Place and Richmond Avenue														
Eastbound	LT	1.50	271.9	F	LT	1.50	271.9	F		LT	1.50	271.9	F	
Westbound	LTR	0.17	28.4	C	LTR	0.17	28.4	C		LTR	0.17	28.4	C	
Northbound	L	1.57	299.6	F	L	1.65	336.7	F	+	L	1.53	279.3	F	
	TR	0.72	5.4	A	TR	0.65	4.7	A		TR	0.65	4.7	A	
Southbound	TR	1.48	249.2	F	TR	1.59	297.3	F	+	TR	1.36	196.8	F	
	Intersection		155.5	F	Intersection		189.9	F		Intersection		139.5	F	
Richmond Hill Road and Richmond Avenue														
Eastbound	LTR	0.01	27.3	C	L	0.45	26.5	C						
					T	0.19	21.4	C						
					R	0.06	9.8	A						
Westbound	L	0.77	52.6	D	L	1.02	81.8	F	+					
	LT	0.75	50.5	D	T	0.14	20.8	C						
	R	1.26	154.9	F	R	0.94	40.6	D		Unmitigated				
Northbound	L	0.00	31.3	C	L	0.37	39.2	D						
	T	1.05	54.6	D	T	1.18	117.2	F	+					
	R	0.46	18.1	B	R	0.65	32.1	C						
Southbound	L	1.52	284.6	F	L	1.78	401.1	F	+					
	TR	1.22	124.8	F	TR	1.69	343.5	F	+					
	Intersection		106.7	F	Intersection		213.8	F						
Forest Hill Road and Richmond Avenue														
Eastbound					L	0.29	22.9	C						
					T	0.20	20.9	C						
					R	0.32	22.6	C						
Westbound	L	0.95	58.4	E	L	2.16	556.7	F	+					
	LR	1.20	141.1	F	TR	0.39	23.6	C		Unmitigated				
Northbound					L	3.27	*	F						
	T	1.05	43.6	D	T	1.48	243.8	F	+					
	R	1.16	98.0	F	R	1.80	391.8	F	+					
Southbound	L	0.50	28.3	C	L	0.28	43.0	D						
	T	0.75	10.9	B	TR	1.04	57.8	E	+					
	Intersection		46.8	D	Intersection		269.2	F						
Arthur Kill Road and Richmond Avenue														
Eastbound	L	0.22	28.0	C	L	0.22	28.0	C						
	TR	0.85	35.8	D	TR	0.88	38.1	D						
Westbound	L	0.74	72.1	E	L	0.74	72.1	E						
	T	1.48	254.5	F	T	1.50	265.1	F	+					
	R	0.78	22.6	C	R	0.93	36.2	D		Unmitigated				
Northbound	L	0.96	67.8	E	L	0.98	73.3	E	+					
	TR	1.52	267.7	F	TR	1.61	305.6	F	+					
Southbound	L	1.50	269.6	F	L	1.59	310.1	F	+					
	TR	0.86	35.4	D	TR	0.74	29.8	C						
	Intersection		161.5	F	Intersection		182.6	F						
Arthur Kill Road and Woodrow Road														
Eastbound	TR	0.90	29.9	C	TR	0.72	19.4	B		TR	0.75	21.8	C	
Westbound	LT	1.83	402.9	F	LT	1.62	307.9	F		LT	1.80	389.4	F	
Northbound	L	0.27	22.4	C	L	0.28	22.6	C		L	0.26	21.0	C	
	R	0.84	44.0	D	R	0.90	50.9	D	+	R	0.84	42.2	D	
	Intersection		158.9	F	Intersection		136.8	F		Intersection		167.4	F	
Arden Avenue and Woodrow Road														
Eastbound	LTR	0.82	19.7	B	LTR	0.88	24.5	C		LTR	0.88	24.5	C	
Westbound	LTR	1.11	83.6	F	LTR	1.14	93.5	F	+	LTR	0.97	38.5	D	
Northbound	LTR	0.69	21.3	C	LTR	0.74	22.9	C		LTR	0.77	24.7	C	
Southbound	LTR	0.96	53.9	D	LTR	1.04	74.8	E	+	LT	0.63	21.0	C	
										R	0.37	17.0	B	
	Intersection		46.0	D	Intersection		54.2	D		Intersection		28.0	C	
Arden Avenue and Arthur Kill Road														
Eastbound	L	0.71	37.6	D	L	1.01	89.3	F	+					
	T	1.02	72.8	E	T	1.13	107.4	F	+					
	R	0.13	21.4	C	R	0.13	21.4	C						
Westbound	L	1.32	190.8	F	L	0.42	19.9	B						
	TR	0.29	11.9	B	TR	0.62	17.0	B		Unmitigated				
Northbound	LTR	1.11	104.0	F	LTR	0.71	34.4	C						
Southbound	L	1.07	124.7	F	L	0.59	33.9	C						
	TR	0.88	44.7	D	TR	1.05	80.3	F	+					
	Intersection		84.8	F	Intersection		61.9	E						
Drumgoole Road and Richmond Avenue														
Eastbound	L	1.50	257.7	F	L	1.44	231.0	F		L	1.44	231.0	F	
	LR	1.49	253.8	F	LR	1.43	227.9	F		LR	1.43	227.9	F	
Northbound	T	1.52	261.5	F	T	1.66	324.7	F	+	T	1.24	138.2	F	
Southbound	T	1.20	121.8	F	T	1.15	98.5	F		T	1.15	98.5	F	
	Intersection		222.5	F	Intersection		236.1	F		Intersection		159.0	F	

Table 23-14

2036 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekend Midday Peak Hour

Intersection	2036 No Build				2036 Build					2036 Build with Mitigation			
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS
Arthur Kill Road and Drumgoole Road													
Eastbound	L	1.62	318.3	F	L	1.14	119.1	F		L	1.33	197.7	F
	TR	1.50	269.4	F	TR	1.60	315.8	F	+	TR	1.44	241.4	F
Westbound	L	0.85	27.4	C	L	0.85	27.4	C		L	0.98	40.5	D
	TR	0.57	34.2	C	TR	0.61	34.9	C		TR	0.58	33.5	C
Northbound	L	0.21	22.5	C	L	0.40	32.3	C		L	0.40	30.6	C
	TR	1.43	222.9	F	TR	1.52	264.0	F	+	TR	1.41	212.8	F
Southbound	LTR	1.61	304.8	F	LTR	1.48	245.8	F		LTR	1.36	192.6	F
	Intersection		218.9	F	Intersection		201.1	F		Intersection		170.1	F
Arthur Kill Road and West Shore Expressway (NB) Service Road													
Eastbound	L	1.67	344.3	F	L	3.03	945.4	F	+				
	T	0.58	13.4	B	T	0.48	12.1	B					
Westbound	TR	1.07	61.0	E	TR	0.69	15.0	B			Unmitigated		
Northbound	LTR	0.69	25.3	C	LTR	0.68	24.3	C					
	Intersection		67.8	E	Intersection		180.2	F					
Arthur Kill Road and West Shore Expressway (SB) Service Road													
Eastbound	TR	0.69	19.5	B	TR	0.74	20.7	C		TR	0.78	22.6	C
Westbound	L	2.20	581.6	F	L	1.39	235.3	F		L	1.46	265.7	F
	T	0.26	13.8	B	T	0.26	13.9	B		T	0.28	14.7	B
Southbound	LTR	1.18	110.4	F	LTR	1.21	122.6	F	+	LTR	1.17	105.5	F
	Intersection		131.4	F	Intersection		75.1	E		Intersection		72.1	E
Primary Study Area - Unsignalized Intersections													
Muldoon Avenue and West Shore Expressway (SB) Service Road													
Eastbound	R	0.56	27.1	D	R	1.02	119.9	F	+		Free-flow operation		
Arden Avenue and West Shore Expressway (SB) Service Road											Signalized		
Westbound	L	3.53	*	F	L	27.36	*	F	+	L	0.68	36.4	D
Southbound	L	0.58	10.3	B	L	0.60	10.5	B		L	0.84	19.1	B
										T	0.89	22.5	C
										Intersection		22.9	C
Secondary Study Area - Signalized Intersections													
Travis Avenue and Forest Hill Road													
Eastbound	LR	0.26	21.5	C	LR	0.26	21.5	C		LR	0.28	23.7	C
Northbound	LT	1.58	288.9	F	LT	1.83	400.9	F	+	LT	1.56	275.4	F
Southbound	TR	1.26	145.3	F	TR	1.33	173.7	F	+	TR	1.25	138.6	F
	Intersection		198.7	F	Intersection		265.3	F		Intersection		192.5	F
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.79	30.8	C	L	0.82	33.3	C					
	TR	0.77	22.1	C	TR	0.89	30.6	C					
Westbound	LTR	1.73	362.0	F	LTR	2.02	493.2	F	+				
Northbound	L	0.17	25.3	C	L	0.17	25.3	C			Unmitigated		
	TR	1.42	229.2	F	TR	1.64	323.9	F	+				
Southbound	L	1.59	340.5	F	L	1.59	340.5	F					
	TR	1.58	299.0	F	TR	1.70	352.8	F	+				
	Intersection		225.0	F	Intersection		286.8	F					
Woodrow Road and Foster Road													
Eastbound	TR	0.84	20.6	C	TR	0.85	21.4	C		TR	0.85	21.4	C
Westbound	LT	1.18	114.4	F	LT	1.21	123.9	F	+	LT	1.09	76.8	E
Northbound	LR	0.86	37.2	D	LR	0.86	37.2	D		LR	0.86	37.2	D
	Intersection		56.6	E	Intersection		60.2	E		Intersection		43.8	D
Woodrow Road and Huguenot Avenue													
Eastbound	L	0.41	15.9	B	L	0.42	16.1	B		L	0.44	17.5	B
	TR	0.79	24.3	C	TR	0.81	25.4	C		TR	0.85	28.8	C
Westbound	L	0.47	21.5	C	L	0.53	24.6	C		L	0.60	30.3	C
	T	0.45	14.5	B	T	0.46	14.6	B		T	0.47	15.6	B
	R	0.11	11.0	B	R	0.11	11.0	B		R	0.11	11.7	B
Northbound	LTR	1.38	202.1	F	LTR	1.40	211.2	F	+	LTR	1.33	179.2	F
Southbound	LTR	0.89	33.8	C	LTR	0.89	34.2	C		LTR	0.86	29.0	C
	Intersection		71.4	E	Intersection		74.6	E		Intersection		66.1	E
Amboy Road and Huguenot Avenue													
Eastbound	L	1.92	460.3	F	L	1.92	460.3	F					
	TR	0.51	17.2	B	TR	0.51	17.2	B					
Westbound	L	0.11	12.5	B	L	0.11	12.5	B					
	TR	0.88	33.2	C	TR	0.88	33.2	C			Unmitigated		
Northbound	L	0.34	28.4	C	L	0.35	29.2	C					
	TR	0.78	32.6	C	TR	0.80	33.9	C					
Southbound	L	0.78	54.1	D	L	0.83	63.1	E	+				
	TR	0.97	55.4	E	TR	0.97	56.7	E					
	Intersection		80.3	F	Intersection		80.9	F					
Amboy Road and Arden Avenue													
Eastbound	L	0.32	20.9	C	L	0.32	20.9	C		L	0.29	20.5	C
	TR	0.78	28.7	C	TR	0.78	28.7	C		TR	0.80	30.6	C
Westbound	LTR	1.17	115.5	F	LTR	1.17	115.5	F		LT	1.05	79.0	E
										R	0.43	19.9	B
Northbound	L	0.74	41.9	D	L	0.76	44.3	D		L	0.71	38.1	D
	TR	0.75	27.1	C	TR	0.76	27.9	C		TR	0.75	26.3	C
Southbound	L	2.26	608.6	F	L	2.39	670.5	F	+	L	2.22	590.9	F
	TR	0.70	25.4	C	TR	0.71	25.7	C		TR	0.69	24.4	C
	Intersection		123.1	F	Intersection		130.4	F		Intersection		105.6	F
Amboy Road and Richmond Avenue													
Eastbound	L	1.49	298.3	F	L	1.49	298.3	F					
	T	1.39	219.3	F	T	1.39	219.3	F					
	R	0.24	24.3	C	R	0.24	24.3	C					
Westbound	L	0.75	75.3	E	L	0.75	75.3	E					
	T	1.45	245.5	F	T	1.45	245.5	F					
	R	0.74	26.4	C	R	0.74	26.4	C			Unmitigated		
Northbound	L	0.51	29.8	C	L	0.67	44.5	D					
	T	0.96	49.6	D	T	1.14	103.5	F	+				
	R	0.22	17.4	B	R	0.22	17.4	B					
Southbound	L	1.80	399.6	F	L	1.80	400.5	F					
	TR	0.90	30.4	C	TR	0.97	40.3	D					
	Intersection		145.4	F	Intersection		153.0	F					
Yukon Avenue and Forest Hill Road													
Eastbound	L	0.31	23.0	C	L	0.31	23.0	C		L	0.33	24.7	C
Northbound	LT	1.06	70.1	E	LT	1.27	155.2	F	+	LT	1.02	55.7	E
Southbound	T	0.77	21.8	C	T	0.84	25.5	C		T	0.81	22.1	C
	R	0.22	11.2	B	R	0.22	11.2	B		R	0.21	10.1	B
	Intersection		39.6	D	Intersection		77.7	E		Intersection		35.2	D

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.

\+ implies a significant adverse impact

* implies that delays are in excess of 1000 seconds

Table 23-15

2036 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekend PM Peak Hour

Intersection	2036 No Build				2036 Build					2036 Build with Mitigation			
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS
Primary Study Area - Signalized Intersections													
Victory Boulevard and West Shore Expressway (SB) Ramps													
Eastbound	TR	0.38	18.4	B	TR	0.39	18.6	B		TR	0.37	16.4	B
Westbound	L	1.33	192.9	F	L	1.48	253.2	F	+	L	1.33	188.4	F
	T	0.12	15.0	B	T	0.12	15.0	B		T	0.11	13.2	B
Southbound	LTR	0.24	15.6	B	LTR	0.39	16.9	B		LTR	0.42	19.0	B
	Intersection		89.6	F	Intersection		105.3	F		Intersection		81.3	F
Victory Boulevard and Travis Avenue													
Eastbound	L	0.17	16.8	B	L	0.21	18.4	B		L	0.37	30.3	C
	T	0.63	23.0	C	T	0.68	24.7	C		T	0.75	30.9	C
	R	0.30	17.2	B	R	0.07	14.5	B		R	0.08	17.6	B
Westbound	L	0.30	19.2	B	L	0.34	20.9	C		L	0.50	32.7	C
	T	0.71	25.8	C	T	0.79	29.6	C		T	0.91	43.8	D
	R	0.27	16.7	B	R	0.27	16.7	B		R	0.30	20.4	C
Northbound	L	2.59	776.2	F	L	2.69	820.0	F	+	L	2.40	682.8	F
	TR	0.61	22.6	C	TR	0.61	22.6	C		TR	0.54	17.8	B
Southbound	L	0.57	27.3	C	L	0.57	27.3	C		L	0.45	18.9	B
	TR	1.03	64.6	E	TR	1.03	64.6	E		TR	0.91	36.0	D
	Intersection		82.6	F	Intersection		89.7	F		Intersection		76.3	E
Signs Road and Richmond Avenue													
Eastbound	L	0.43	33.2	C	L	0.49	33.8	C		L	0.49	33.8	C
	R	1.13	134.2	F	R	1.24	175.1	F	+	R	1.05	104.6	F
Northbound	L	0.97	70.9	E	L	1.00	78.0	E	+	L	0.95	59.6	E
	TR	0.88	7.1	A	TR	0.80	5.1	A		TR	0.80	5.1	A
Southbound	TR	1.27	144.9	F	TR	1.36	185.9	F	+	TR	1.03	44.9	D
	Intersection		76.6	E	Intersection		102.3	F		Intersection		31.9	C
Draper Place and Richmond Avenue													
Eastbound	LT	1.33	204.2	F	LT	1.33	204.2	F		LT	1.33	204.2	F
Westbound	LTR	0.22	29.3	C	LTR	0.22	29.3	C		LTR	0.22	29.3	C
Northbound	L	1.54	286.2	F	L	1.62	323.3	F	+	L	1.50	268.3	F
	TR	0.69	5.0	A	TR	0.63	4.6	A		TR	0.63	4.6	A
Southbound	TR	1.32	179.1	F	TR	1.43	227.0	F	+	TR	1.19	123.5	F
	Intersection		114.2	F	Intersection		145.7	F		Intersection		95.3	F
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	L	0.48	29.6	C					
					T	0.19	23.5	C					
					R	0.06	9.8	A					
Westbound	L	0.50	37.5	D	L	0.74	41.3	D					
	LT	0.49	37.0	D	T	0.14	22.8	C					
	R	1.22	137.8	F	R	0.93	37.5	D		Unmitigated			
Northbound	L	0.00	31.3	C	L	0.28	34.4	C					
	T	0.99	36.3	D	T	1.13	92.9	F	+				
	R	0.43	17.5	B	R	0.61	30.3	C					
Southbound	L	1.53	292.4	F	L	1.46	261.5	F					
	TR	1.03	45.8	D	TR	1.43	225.8	F	+				
	Intersection		64.5	E	Intersection		142.2	F					
Forest Hill Road and Richmond Avenue													
Eastbound					L	0.25	21.4	C					
					T	0.18	20.0-	B					
					R	0.33	22.3	C					
Westbound	L	0.81	38.9	D	L	1.91	447.0	F	+				
	LR	1.02	76.0	E	TR	0.32	21.9	C					
Northbound					L	3.14	*	F		Unmitigated			
	T	0.86	13.5	B	T	1.23	134.0	F	+				
	R	1.16	100.1	F	R	1.97	472.1	F	+				
Southbound	L	0.66	44.5	D	L	0.36	45.3	D					
	T	0.87	13.6	B	TR	1.27	152.3	F	+				
	Intersection		28.1	C	Intersection		244.5	F					
Arthur Kill Road and Richmond Avenue													
Eastbound	L	0.09	22.6	C	L	0.09	22.6	C					
	TR	0.69	29.3	C	TR	0.72	30.1	C					
Westbound	L	0.36	32.2	C	L	0.40	35.2	D					
	T	1.44	237.1	F	T	1.46	247.5	F	+				
	R	0.63	17.1	B	R	0.78	22.4	C		Unmitigated			
Northbound	L	0.82	49.3	D	L	0.84	51.3	D					
	TR	1.21	132.7	F	TR	1.31	172.5	F	+				
Southbound	L	1.47	260.4	F	L	1.57	301.0	F	+				
	TR	0.89	37.8	D	TR	0.79	31.4	C					
	Intersection		117.9	F	Intersection		135.6	F					
Arthur Kill Road and Woodrow Road													
Eastbound	TR	0.87	26.9	C	TR	0.70	18.7	B		TR	0.64	15.0	B
Westbound	LT	1.54	272.9	F	LT	1.66	324.2	F	+	LT	1.53	266.2	F
Northbound	L	0.25	22.1	C	L	0.25	22.2	C		L	0.29	25.6	C
	R	0.65	32.0	C	R	0.71	34.5	C		R	0.71	37.1	D
	Intersection		120.0	F	Intersection		151.0	F		Intersection		125.7	F
Arden Avenue and Woodrow Road													
Eastbound	LTR	0.79	18.0	B	LTR	0.85	21.3	C		LTR	0.85	21.3	C
Westbound	LTR	1.12	87.7	F	LTR	1.15	98.0	F	+	LTR	0.98	41.2	D
Northbound	LTR	0.49	17.8	B	LTR	0.54	18.3	B		LTR	0.56	18.7	B
Southbound	LTR	0.57	19.2	B	LTR	0.62	20.3	C		LT	0.45	17.7	B
										R	0.25	16.2	B
	Intersection		41.2	D	Intersection		45.6	D		Intersection		26.7	C
Arden Avenue and Arthur Kill Road													
Eastbound	L	0.77	41.4	D	L	1.05	95.9	F	+	L	0.82	42.0	D
	T	0.98	61.7	E	T	1.08	90.9	F	+	T	0.83	32.7	C
	R	0.08	20.9	C	R	0.08	20.9	C		R	0.07	15.7	B
Westbound	L	0.99	73.1	E	L	0.26	17.2	B		L	0.37	19.5	B
	TR	0.23	11.3	B	TR	0.50	14.7	B		TR	0.49	13.9	B
Northbound	LTR	0.87	42.8	D	LTR	0.53	27.1	C		LTR	0.57	29.1	C
Southbound	L	0.86	68.4	E	L	0.49	29.0	C		L	0.51	30.8	C
	TR	0.71	32.5	C	TR	0.86	43.2	D		TR	0.86	43.7	D
	Intersection		47.5	D	Intersection		52.5	D		Intersection		31.0	C
Drumgoole Road and Richmond Avenue													
Eastbound	L	1.50	256.3	F	L	1.44	230.5	F		L	1.44	230.5	F
	LR	1.50	258.4	F	LR	1.45	232.9	F		LR	1.45	232.9	F
Northbound	T	1.30	164.8	F	T	1.46	236.5	F	+	T	1.09	76.0	E
Southbound	T	1.24	140.5	F	T	1.20	119.9	F		T	1.20	119.9	F
	Intersection		193.3	F	Intersection		201.8	F		Intersection		145.4	F

Table 23-15

2036 No Build, Build, and Build with Mitigation Level of Service Analyses

Weekend PM Peak Hour

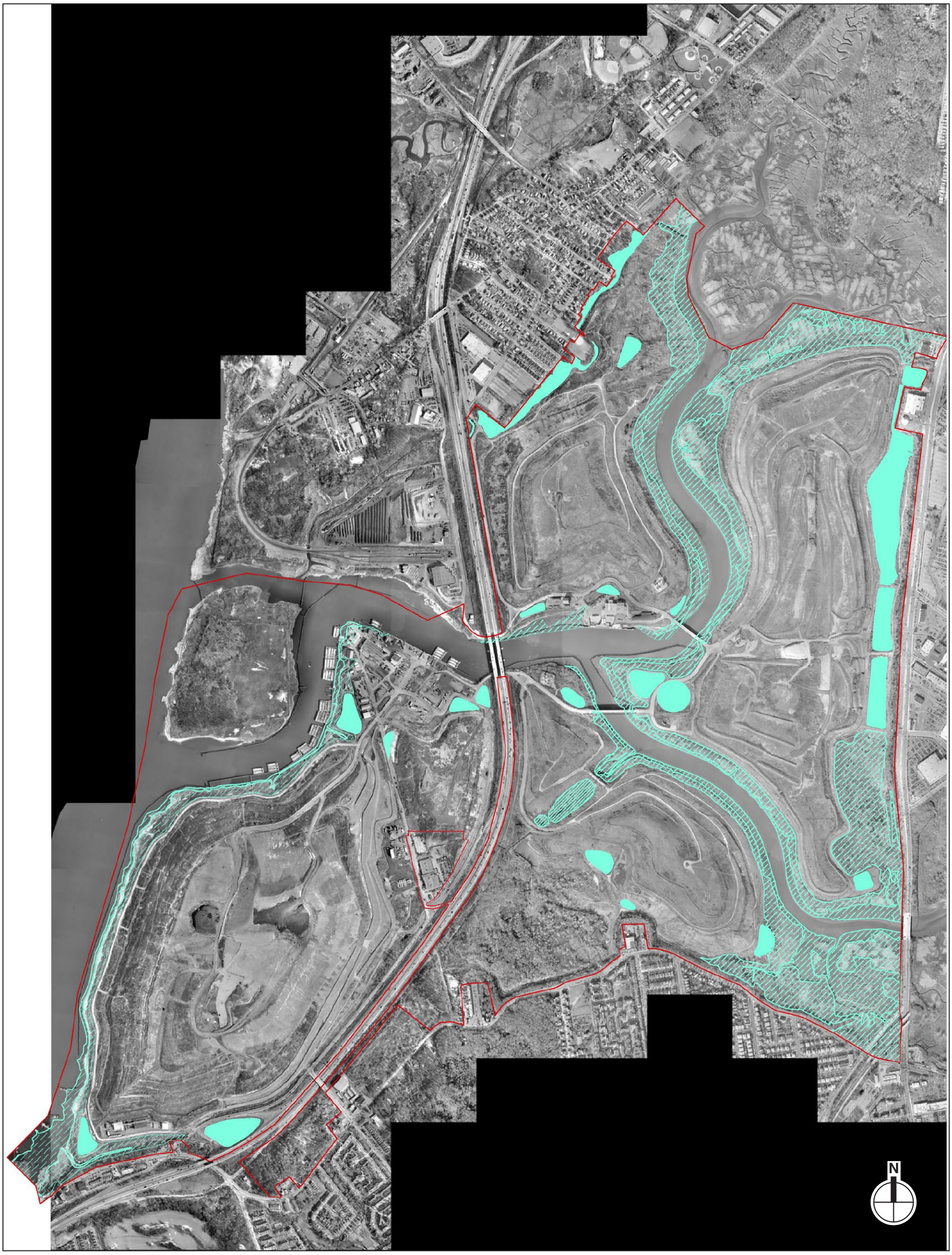
Intersection	2036 No Build				2036 Build					2036 Build with Mitigation			
	Lane Group	v/c Ratio	Delay (sec)	LOS	Lane Group	v/c Ratio	Delay (sec)	LOS		Lane Group	v/c Ratio	Delay (sec)	LOS
Arthur Kill Road and Drumgoole Road													
Eastbound	L	1.21	144.1	F	L	0.76	28.1	C		L	0.88	49.7	D
	TR	1.22	151.6	F	TR	1.33	199.9	F	+	TR	1.20	141.6	F
Westbound	L	0.80	24.8	C	L	0.80	24.8	C		L	0.90	33.8	C
	TR	0.52	33.2	C	TR	0.56	33.9	C		TR	0.53	32.6	C
Northbound	L	0.32	27.9	C	L	0.50	39.7	D		L	0.50	37.9	D
	TR	1.49	251.4	F	TR	1.58	290.9	F	+	TR	1.47	237.6	F
Southbound	LTR	1.52	262.0	F	LTR	1.41	215.7	F		LTR	1.30	164.8	F
	Intersection		192.3	F	Intersection		189.9	F		Intersection		153.5	F
Arthur Kill Road and West Shore Expressway (SB) Service Road													
Eastbound	TR	0.49	16.1	B	TR	0.54	16.7	B		TR	0.56	17.8	B
Westbound	L	1.35	201.8	F	L	0.83	47.8	D		L	0.89	59.6	E
	T	0.28	14.0	B	T	0.29	14.1	B		T	0.30	14.9	B
Southbound	LTR	1.10	80.7	F	LTR	1.13	91.8	F	+	LTR	1.09	77.0	E
	Intersection		70.6	E	Intersection		49.0	D		Intersection		44.7	D
Primary Study Area - Unsignalized Intersections													
Muldoon Avenue and West Shore Expressway (SB) Service Road[1]													
Eastbound	R	0.03	16.8	C	R	0.06	26.4	D		Free-flow operation			
Arden Avenue and West Shore Expressway (SB) Service Road										Signalized			
Westbound	L	3.13	*	F	L	31.00	*	F	+	L	0.50	28.0	C
Southbound	L	0.59	10.5	B	L	0.60	10.7	B		L	0.95	34.8	C
										T	0.95	33.1	C
										Intersection		33.2	C
Secondary Study Area - Signalized Intersections													
Travis Avenue and Forest Hill Road													
Eastbound	LR	0.41	23.0	C	LR	0.41	23.0	C		LR	0.45	25.5	C
Northbound	LT	1.61	301.6	F	LT	1.86	411.2	F	+	LT	1.58	288.3	F
Southbound	TR	1.15	98.4	F	TR	1.21	125.5	F	+	TR	1.14	94.6	F
	Intersection		177.5	F	Intersection		242.2	F		Intersection		173.7	F
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.77	30.5	C	L	0.80	33.0	C					
	TR	0.78	22.5	C	TR	0.89	30.6	C					
Westbound	LTR	1.71	354.8	F	LTR	1.97	472.1	F	+				
Northbound	L	0.64	57.7	E	L	0.64	57.7	E		Unmitigated			
	TR	1.39	214.3	F	TR	1.59	302.5	F	+				
Southbound	L	1.82	440.8	F	L	1.82	440.8	F					
	TR	1.32	184.3	F	TR	1.44	236.6	F	+				
	Intersection		195.1	F	Intersection		251.2	F					
Woodrow Road and Huguenot Avenue													
Eastbound	L	0.37	14.8	B	L	0.37	14.9	B		L	0.39	16.1	B
	TR	0.67	19.1	B	TR	0.69	19.6	B		TR	0.71	21.3	C
Westbound	L	0.22	13.3	B	L	0.25	13.9	B		L	0.27	15.2	B
	T	0.39	13.7	B	T	0.40	13.8	B		T	0.42	14.7	B
	R	0.11	11.1	B	R	0.11	11.1	B		R	0.12	11.7	B
Northbound	LTR	1.35	187.1	F	LTR	1.37	197.2	F	+	LTR	1.30	165.8	F
Southbound	LTR	0.71	20.8	C	LTR	0.71	20.9	C		LTR	0.68	19.1	B
	Intersection		68.2	E	Intersection		71.6	E		Intersection		62.4	E
Amboy Road and Huguenot Avenue													
Eastbound	L	0.74	36.8	D	L	0.74	36.8	D		L	0.78	43.0	D
	TR	0.44	15.9	B	TR	0.44	15.9	B		TR	0.45	16.7	B
Westbound	L	0.11	12.5	B	L	0.11	12.5	B		L	0.12	13.1	B
	TR	0.74	23.8	C	TR	0.74	23.8	C		TR	0.76	25.2	C
Northbound	L	0.12	18.9	B	L	0.12	18.9	B		L	0.11	18.1	B
	TR	0.74	30.7	C	TR	0.76	31.7	C		TR	0.74	29.9	C
Southbound	L	0.82	56.7	E	L	0.87	65.8	E	+	L	0.81	53.9	D
	TR	0.74	30.8	C	TR	0.74	31.1	C		TR	0.72	29.4	C
	Intersection		28.1	C	Intersection		29.0	C		Intersection		28.4	C
Amboy Road and Arden Avenue													
Eastbound	L	0.29	19.3	B	L	0.29	19.3	B		L	0.28	19.6	B
	TR	0.72	26.2	C	TR	0.72	26.2	C		TR	0.74	27.6	C
Westbound	LTR	1.19	124.9	F	LTR	1.19	124.9	F		LT	1.11	101.7	F
										R	0.34	18.3	B
Northbound	L	0.48	24.8	C	L	0.49	25.5	C		L	0.46	23.5	C
	TR	0.69	24.9	C	TR	0.71	25.5	C		TR	0.69	24.2	C
Southbound	L	1.47	261.5	F	L	1.55	298.3	F	+	L	1.46	254.7	F
	TR	0.67	24.1	C	TR	0.68	24.4	C		TR	0.66	23.2	C
	Intersection		75.4	E	Intersection		79.0	E		Intersection		62.0	E
Amboy Road and Richmond Avenue													
Eastbound	L	1.42	280.2	F	L	1.42	280.2	F					
	T	1.38	214.3	F	T	1.38	214.3	F					
	R	0.15	23.1	C	R	0.15	23.1	C					
Westbound	L	0.85	94.0	F	L	0.85	94.0	F					
	T	1.24	152.5	F	T	1.24	152.5	F					
	R	0.54	20.2	C	R	0.54	20.2	C		Unmitigated			
Northbound	L	0.25	19.7	B	L	0.31	21.8	C					
	T	0.87	37.2	D	T	1.05	72.1	E	+				
	R	0.15	16.5	B	R	0.15	16.5	B					
Southbound	L	1.27	167.2	F	L	1.45	247.0	F	+				
	TR	0.82	23.1	C	TR	0.88	27.8	C					
	Intersection		105.2	F	Intersection		116.2	F					
Yukon Avenue and Forest Hill Road													
Eastbound	L	0.22	21.7	C	L	0.22	21.7	C		L	0.22	21.7	C
Northbound	LT	0.91	34.9	C	LT	1.09	81.8	F	+	LT	0.96	41.4	D
Southbound	T	0.75	20.8	C	T	0.82	23.9	C		T	0.82	23.9	C
	R	0.15	10.5	B	R	0.15	10.5	B		R	0.15	10.5	B
	Intersection		25.7	C	Intersection		47.4	D		Intersection		30.3	C

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service

\+ implies a significant adverse impact

* implies that delays are in excess of 1000 seconds

(1) Intersection not impacted but analysis was conducted to incorporate permanent geometric/signal phasing changes proposed as mitigation measures in other peak hours.



Fresh Kills Project Site Boundary

Stormwater Basins and Freshwater Wetlands

Tidal Wetlands

Stormwater Basins and Degraded Wetlands for Potential Improvement

Figure 23-1