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 New York City Environmental Quality Review (CEQR)/New York State Environmental Quality Review (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 road project is expected to take about three decades to complete and for much of the project, detailed design decisions are still to be made. 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 road projects advance. For this project there are three major phases to the project and, therefore, three analysis years when each phase is expected to be complete. The three years are 2011, 2016 and 2036 for both the No Build and Build conditions. These three year analysis years reflect the endpoints for each of the following project phases:

- By 2011, completion of the modified final cover plan at Landfill Section 6/7;
- By 2016, completion of construction and operation of the Yukon Avenue Connection park road; and
- By 2036, completion of construction and operation of the Forest Hill and Richmond Hill Road Connection park roads.

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 park road 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 road 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 the New York City Department of Sanitation (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

[1] Additional impact avoidance and mitigation measures for the period during construction are presented below under “Construction.”

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

- Develop park road project designs with DSNY and the New York City Department of Parks and Recreation (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 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 New York City Department of Health and Mental Hygiene (NYCDOHMH).

NATURAL RESOURCES

Operation of the park roads has the potential to result in changes to natural resources in areas where the roads pass through the proposed landscape enhancement areas or areas where existing plant communities would be retained. 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, the proposed paths at Fresh Kills would 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.

Park Roads and Habitat Fragmentation

Operation of the park roads has the potential to result in long-term adverse impacts and 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" (New York 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 park roads 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.

INFRASTRUCTURE[1]

STORMWATER

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

[1] Impact avoidance measures with respect to landfill protections are discussed beginning on page 23-1.

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 road capital project moves forward and is further developed, but fitting into the overall stormwater management plan developed for this EIS and presented in Chapter 1 "Project Description." There are a number of proposed park road 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.

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 construction of new intersections along Richmond Avenue with Forest Hill Road, Yukon Avenue and Richmond Hill Road to allow for new park road connections into and across East Park. 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.

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, 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 East Park Road 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 construction of three new intersections along Richmond Avenue (at Forest Hill Road, Yukon Avenue and Richmond Hill Road) to allow for the proposed park roads. 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.

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 New York City Transit (NYCT)/Metropolitan Transportation Authority (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 visitors 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 Yukon Avenue 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. However, 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.

Between 2016 and 2036, all park road connections with Richmond Avenue are assumed to be completed. It is expected that in 2036, with the full build-out of the park roads (and 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 DPR/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

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.

Nuisance and Vector Management

It is recognized that grading, which is necessary to achieve the alternate design embankment elevations, will encounter waste. The associated excavations and onsite waste relocation activities have the potential to create odor nuisances and, attract vectors. However, these issues also exists as part of the work necessary to construct the final cover as described in the Final Cover Report. Consequently, specifications to establish acceptable construction procedures and mitigation techniques are also provided in the current technical specifications; specifically, Specification 02224, Solid Waste Relocation. The following list the techniques and procedures required by Specification 02224 to minimize waste exposure related impacts during construction.

- Prevent surface water from flowing into excavations.
- Dispose of collected water into the onsite leachate collection system.
- Apply odor suppressant as may be required at the end of each sift or work day.
- Apply 6-inch thick layer of general fill soil over exposed waste at the end of each shift or day when the next shift will not begin work for more than 24 hours.
- Quality Assurance Site Manager will examine areas and conditions of waste during water relocation operations; should unsatisfactory conditions be observed the work will not resume until the conditions are corrected.

In addition to these requirements listed above, the following subsections describe additional measures that will be used to manage nuisance conditions during the alternate design construction activities.

Inclement Weather

Inclement weather such as heavy rains, snow, ice conditions, high winds, or extreme temperatures may impact on the construction operations. Additional procedures to be implemented in these conditions are as follows.

- *Heavy rains.* If heavy rain occurs during waste relocation operations, the contractor personnel will check drainage channels, culverts, and erosion and sediment control features for debris that may block water flow. This debris will be removed as necessary. Stormwater sumps may be used to collect non-waste contact runoff from areas up gradient of the work area, so that stormwater does not mix with solid waste. The non-contact water will be directed to a sediment trapping device or permanent stormwater/sediments ponds.
- *Heavy snow*. Snow accumulation may be cleared from work area, as needed, by contractor personnel.
- *Ice conditions*. If adverse weather creates dangerous icing conditions, work will cease.
- *High winds.* During periods of high winds, the extent of the waste relocation excavation area will be minimized to be reduced the possibility of blowing litter. After periods of high winds, the site will be inspected by the contractor for blown litter and the observed blown litter collected.

Litter and Debris Control

During waste relocation activities litter and debris control program will include the following.

- *Blown litter and debris* will be collected by contractor on a daily basis. Collected litter waste will be placed with other relocated waste.

- *Debris Control*. Debris that falls off of waste transportation vehicles will be picked up placed with other relocate wastes.
- *Scavenging.* No waste scavenging will be allowed.

Dust Control

A dust control program will be implemented at the facility and will include the following activities:

- To the extent practical, the contractor will use existing aggregate or stabilized haul roads for transporting relocated waste from the excavation are to the spoil area to limit the generation of dust.
- Dust will be primarily controlled through the application of water to roads, and other surfaces from which dust could be generated. A truck equipped with a portable water storage tank (water wagon) will be used periodically to dampen these surfaces as conditions warrant. Dust suppressants may also be utilized to reduce dust.
- As necessary, a power broom may also be used to remove accumulated soil from paved roadways in order to minimize dust generation.

Vector Control

Vectors such as birds, rodents, and insects can be attracted to putrescible wastes exposed during the relocation activities. The primary method for control of vectors will be:

- Application of soil cover over waste to reduce the access to putrescibles;
- Implementing good housekeeping measures during waste relocation activities to eliminate conditions that could attract vectors; and
- Limiting the working area to minimize the area of exposed waste.

Should rodent and insects become a problem during waste relocation activities, control measures will be implemented in accordance with New York City and New York State Department of Health requirements.

Odor Control

Chemical odor suppressants, as described in current Technical Specification 02224 may be used to control odors. Odor control materials will be used in accordance with manufacturer recommended procedures.

Noise Control

Noise from waste relocation operations could be a nuisance under certain circumstances, such as during off-hour operations. Some routine measures can be implemented to limit noise problems including the following.

- Operations will be performed during working hours established for the current construction operations.
- During preconstruction hours, trucks will be queued on-site, not on State or city highways/streets, queues will be formed away from residential areas.

In accordance with Part 3601.14(p), noise levels resulting from equipment or operations will not exceed 67 decibels (A) beyond the property line during construction between 7 a.m and 10 p.m.

WETLAND AND WATER QUALITY 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 road viaducts and culverts 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 U.S. Army Corps of Engineers (USACE).
- Implementation of measures to stabilize the wetlands enhancement areas as necessary during planting, such as the use of 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 USACE 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.

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 EIS, 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.
- Spill or release response will vary depending upon the volume, extent, and type of release that occurs. For small releases of known materials (e.g., gasoline container spill on soil), the contractor will implement the spill control plan that is part of the stormwater pollution prevention plan for the overall work. The spill control equipment will be used to control the release and remove and dispose of contaminated materials. Should a large release occur

(e.g., ruptured fuel storage tank) or a release of an unknown materials (e.g., unlabeled drum liquid) suspected of containing hazardous materials or petroleum products occur, the on-site personnel will contact the Director of Fresh Kills and implement the site-wide emergency response plans.

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.

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. Details of site access would be coordinated between DPR and the contractors with the assistance of the New York State Department of Transportation (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 construction of the intersection of Forest Hill Road and Richmond Avenue). During these periods of construction, major roads, such as Richmond Avenue, would have at least one lane open to traffic at all times. The temporary and limited

closure of travel lanes on these 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 NYSDOT and NYCDOT.

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

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 publicly 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.

C. MITIGATION MEASURES

INTRODUCTION

The measures below are presented as mitigation measures as they require additional approvals or are outside the jurisdiction of DPR to implement. These mitigation measures will be further developed as individual capital projects progress. Therefore, for the presentation below the mitigation is presented along with the appropriate project phases, 2011, 2016 or 2036.

EROSION AND SEDIMENTATION (2011 CONSTRUCTION PERIOD)

With the proposed modified cover plan, there are projected increases in pollutant loading that are a worst case condition in that it assumes the installation of full width road embankment material (i.e. 60 feet wide) across Landfill Section 6/7. In fact, measures could be taken reduce the width of the embankment materials and to provide appropriate sedimentation and erosion control measures, including stabilizing the corridors with vegetation. Between this DSEIS and the FSEIS, DPR and DSNY will examine potential measures to reduce this level of interim pollutant loading which is primarily due to sedimentation and erosion. These measures will be presented o the FSEIS.

ARCHAEOLOGICAL RESOURCES (2036)

No impacts to archaeological resource would occur in the 2011 or 2016 phases. To understand the potential for archaeological impacts from park road development activities, a Phase 1A study prepared for this project was performed (see FGEIS, 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 road 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—WETLAND HABITATS

INTRODUCTION

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. As described in Chapter 10 "Natural Resources," the proposed East Park Roads project would have impacts on wetlands only in the later phase with the completion of the East Park Road system. (No impacts to wetlands would occur in the 2011 or 2016 phases.) This include activities that would impact wetlands as either direct impacts (e.g., filling a portion of the wetlands for the Richmond Hill Road Connection), or indirectly (e.g., shading from Forest Hill Road connections viaduct, changes in hydrology, habitat fragmentation). However, as presented in Chapter 12 "Project Description" and Chapter 10 "Natural Resources" multiple road alignment and design options are still be considered for this long term phase of the proposed project. These options have all been evaluate in this SEIS.

Overall, the Fresh Kills Park project, and the East Park elements, are proposed to include substantial wetland and upland enhancement projects for the purposes of improving the overall ecological values of the project site. These include extensive wetland improvement projects that call for enhancement of tidal wetlands (i.e., *Spartina* and mixed marsh enhancement along tidal creeks), freshwater wetland expansion nd enhancement (i.e., palustrine scrub shrub and forested wetlands) and possible freshwater wetland creation (i.e., conversion of detention basins to sunken forest landscapes).

There are numerous wetland mitigation opportunities at Fresh Kills Park. Therefore, as design moves forward, the selected long term East Park Road options can include a number of mitigation strategies that are tailored to the impacts and mitigation opportunities specific to that option. In no case would there be any remaining unavoidable or unmitigated adverse wetland impacts from the proposed roads.

Provided below is a discussion of potential mitigation strategies and opportunities.

MITIGATION STRATEGIES

Overview

It is assumed that, after avoidance and minimization measures are undertaken, mitigation would be required for park road wetland impacts. Therefore, potential habitat restoration and enhancement alternatives have been developed below to demonstrate that feasible and implementable mitigation is possible for these impacts. These impacts are related primarily to shading or filling activities for park roads that need to cross wetlands. The proposed mitigation strategies, discussed below, seek to replace wetland functions that would be lost as a result of these impacts, and are sited in areas of the proposed project that are located near the impact zones.

Mitigation Options within East Park

The following mitigation options have been identified for East Park:

- **Living Shoreline Creation**: In areas around the East Park drainage basins, and within other areas that transition to aquatic habitats, steep slopes prevent a sustainable shoreline habitat. Thus, the potential exists to create gentler slopes that not only provide erosion control benefits, but also enhance the natural shoreline habitat and buffer areas. As roads are improved to provide better connections through the Fresh Kills Park, these shoreline areas can be enhanced to allow for natural processes to evolve through the strategic placement of plants, stone, sand fill and other structural and organic materials. Such enhancements may increase overall fill of these areas slightly, but for the purposes of improving habitat functions substantially. In addition, the replacement of the existing marginal soils with sandier soils will aid in managing invasive species (which prefer more nutrient-enriched soils). This mitigation alternative can be used to mitigate for impacts related to the placement of additional roadside fill around the site in tidal, freshwater wetland and aquatic habitats.
- **Aquatic Habitat (Stormwater Basin) Enhancement**: The six stormwater management basins in East Park provide additional opportunities for improving water quality, habitat, and aesthetics. The basins also present interesting opportunities to apply adaptive management, as the hydrologic inputs to the basins are expected to lessen significantly as on-mound revegetation becomes fully established. It is assumed that the hydrology of the DSNY basins in East Park will change as Landfill Section experiences final closure and the park roads are developed. One likely long-term result is that the basins will be drier and subject to less frequent flooding. Therefore, to enhance the remaining aquatic zones, floating islands could be placed in areas around the basins to create diversified aquatic habitat, and to provide increased riparian edge. In addition, as water levels potentially decrease within the aquatic basins, excess capacity can be converted to wetland and riparian habitat (meadow and scrub-shrub) with natural vegetation through the strategic placement of sandy soils. Interior open water areas can be created and maintained to support waterfowl and wading bird use, and in some instances can be enhanced with the establishment of freshwater submerged or floating leaved aquatic vegetation. This mitigation alternative can be used to mitigate for impacts related to the filling of the basins.
- **Stream Enhancement**: Where stream connections will continue to exist, stream channel improvements can be undertaken to mitigate for those to be impacted by the proposed road system. Stream enhancements could include the management of invasive plants species and provision of additional buffer areas planted with natural vegetation. There is also the

potential to integrate stream enhancements with larger-scale regenerative stormwater conveyance projects.

- **Freshwater Wetland Restoration and Enhancement**: In the southeastern area of the Landfill Section 6/7, adjacent to Basin R, some of the flow currently directed to Basin R could be split off to create small freshwater wetland areas and natural buffer zones. The dimensions of the freshwater area would be dependent on the ultimate proposed roadway alignment as well as the results of water budget and hydrology analysis. This freshwater wetland creation could be appropriate as mitigation for some of the freshwater impacts that may occur in other areas along the eastern edge of the site.
- **Native Grassland Meadows and Scrub-Shrub Habitat Creation:** In transition areas between new roads and wetland and aquatic habitats, the mitigation focus would be on the creation of native grassland meadows and scrub-shrub habitat through the use of sandy soils, where structurally practicable. These created habitats can provide an overall ecological context for park users, while protecting sensitive habitat from new and more-heavily used roads. Early investments in good soils, matched to the proposed plant community, can provide long term benefits. Native plant species of local origin, effective erosion and sediment controls, and matching the vegetation with the evolving site conditions will not only make for a more successful park, but will also minimize the post planting care and management.

Mitigation Options Outside of East Park

In addition to mitigation opportunities within East Park there are additional mitigation opportunities within the larger Fresh Kills Park project. These options are presented for the purposes of providing the full range of wetland mitigation options that are open to the project, which are extensive.

- **South Park Tidal Wetland and Forested Habitat Community Reconnection**: A significant opportunity exists to restore or enhance the tidal inlet channel that occurs between the two landfill sections in South Park. This restoration could be used to mitigate the impacts to the forested- wetlands located in the southeast (Forest Hill Road connection) and northeast (Richmond Hill Road connection) portions of East Park. In the area between the two mounds in South Park, the drainage system was heavily altered by the landfill facility construction and associated roadway infrastructure. The channel and associated wetlands east of the existing landbridge/road are under full tidal influence, but the areas west are only minimally connected hydrologically to the tides. To improve the habitat within this area, the connection beneath the existing land bridge could be opened to allow for tidal influence in the western portion of the inlet. The opening would need to be analyzed hydrologically to ensure it is sized correctly. Once open, the site would be observed through the next year to monitor the plant community changes and water quality. It is expected that the invasives that dominate this section will be controlled by the saline water influence, and that the daily flushing will improve overall water quality. Along with these two benefits, it is assumed that the improved and protected habitat will attract a large number of wildlife, fish and birds, highly visible by visitors to the park. The inlet area and surrounding adjacent areas are known to have been filled with unregulated waste in the past. As a result, the soils in this area would need to be tested to determine whether there are contaminant levels of concern related to wildlife and human access after the area is opened to the tides. Excavation of the soils is not anticipated; however, if areas of concern are found as a result of soil

testing, excavation of two feet of existing soils and replacement by two feet of clean soils may be necessary to accomplish the tidal wetland restoration.

- **South Park Stream Enhancement**: Under this option, the existing swale that currently serves to drain areas in the southern part of South Park, both north and south of the existing service road, could be enhanced to create an improved visual experience while also improving overall water quality and stormwater management. This channel is a human-altered system influenced by ditching, road construction and historic landfill operations. The proposed approach to naturalize this swale would be to place natural materials such as rock, tree logs, root wads, and native plantings in strategic locations and allow natural channel design processes and stream geomorphology to slowly assist the channel to adapt to a more natural configuration. Minor manipulations along the stream edges to create small meanders would enhance the system. This stream enhancement could serve to mitigate the stream impacts that are proposed to occur along the east side of East Park.

TRAFFIC AND PARKING (2016 AND 2036)

INTRODUCTION

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 in the 2016 and 2036 analysis years (no traffic mitigation is necessary for the 2011 analysis year). A description of that mitigation is provided below.

2016 ANALYSIS YEAR

As discussed in Chapter 16, "Traffic and Parking," four (4) out of the five (5) analyzed intersections would be impacted under the 2016 Build Conditions. Table 23-1 summarizes the recommended mitigation measures for each impacted intersection. Provided below is a discussion of each affected intersection and its recommended mitigation. Additional details are provided below.

Richmond Hill Road and Forest Hill Road

The impacts at the westbound approach and the northbound shared through- and right-turn movement at this intersection during the weekday AM peak hour could be mitigated by developing a new signal phasing and timing plan (see Table 23-1).

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

Richmond Hill Road and Richmond Avenue

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 exclusive left-turn and the 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.

Table 23-1
Recommended Mitigation Measures
2016 Build Year

Intersection	Mitigation Measures				
	Weekday Peak Hours			Weekend Peak Hours	
	AM	Midday	PM	Midday	PM
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 / 8 / 3 / 0 Cycle length = 80 seconds	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Richmond Hill Road and Richmond Avenue	Shift 1 second of green time from the NB / SB phase to the NB left / SB left phase.	Shift 1 second of green time from the NB / SB phase to the NB left / SB left phase.	Shift 1 second of green time from the NB / SB phase to the NB left / SB left phase.	Unmitigated	Shift 1 second of green time from the NB / SB phase to the NB left / SB left phase.
Yukon Avenue and Richmond Avenue (1) *	Restrip the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane	Restrip the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane	Restrip the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane Daylight the SB approach to provide an additional moving lane	Restrip the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane	Restrip the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane
Forest Hill Road and Richmond Avenue	Shift 1 second of green time from the WB phase to the NB / SB phase.	Not impacted	Not impacted	Not impacted	Not impacted

Notes:
EB = eastbound; WB = westbound; NB = northbound; SB = southbound
(1) Intersection of Yukon Avenue and Richmond Avenue 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.

Yukon Avenue and Richmond Avenue

The impact at the westbound approach during the weekday and weekend midday peak hours could be mitigated by restriping the westbound approach to provide one 12-foot exclusive left-turn lane and one 12-foot shared through- and right-turn lane.

The impact at the southbound shared through- and right-turn movement could be mitigated by restriping the westbound approach to provide one 12-foot exclusive left-turn lane and one 12-foot shared through- and right-turn lane. Daylighting the southbound approach to provide an additional moving lane is also required.

Forest Hill Road and Richmond Avenue

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

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 23-2 to 23-6.

2036 ANALYSIS YEAR

As discussed in Chapter 16, "Traffic and Parking," recognizing that there are multiple build condition options, with the three connections proposed along Richmond Avenue, recommended mitigation measures for each roadway option are presented below.

COMPLETED EAST PARK ROAD SYSTEM

Under the 2036 Completed East Park Road Build Conditions, all five (5) analyzed intersections would be impacted under the 2036 Build Conditions. Table 23-7 summarizes the recommended mitigation measures for each impacted intersection. Provided below is a discussion of each affected intersection and its recommended mitigation.

Richmond Hill Road and Forest Hill Road

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

Richmond Hill Road and Richmond Avenue

The impacts at the westbound left-turn, northbound through and southbound shared through- and right-turn 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.

Table 23-2

2016 No Build, Build, and Build with Mitigation Conditions Level of Service Analysis

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
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
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	28.9	C		T	0.96	33.0	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		36.9	D		Intersection		36.4	D
Yukon Avenue and Richmond Avenue [1]													
Eastbound					L	0.59	38.3	D		L	0.58	37.8	D
					TR	0.25	28.7	C		TR	0.25	28.7	C
Westbound	LR	0.11	26.9	C	LTR	0.24	28.5	C		L	0.02	26.0	C
										TR	0.25	28.8	C
Northbound					L	0.85	82.9	F		L	0.85	82.9	F
	T	1.03	41.7	D	T	0.90	21.7	C		T	0.90	21.7	C
Southbound	L	0.22	40.2	D	L	0.22	40.2	D		L	0.22	40.2	D
	T	0.39	4.2	A	TR	0.49	12.7	B		TR	0.49	12.7	B
	Intersection		29.7	C	Intersection		22.0	C		Intersection		22.0	C
Forest Hill Road and Richmond Avenue													
Eastbound													
Westbound	L	0.56	27.9	C	L	0.52	27.1	C		L	0.54	28.2	C
	LR	0.71	32.9	C	LR	0.66	30.9	C		LR	0.69	32.7	C
Northbound													
	T	0.86	13.9	B	T	0.79	12.0	B		T	0.78	10.9	B
	R	1.24	135.0	F	R	1.25	138.1	F	+	R	1.22	125.8	F
Southbound	L	0.09	7.9	A	L	0.09	7.9	A		L	0.09	7.4	A
	T	0.36	7.2	A	T	0.32	7.0	A		T	0.32	6.4	A
	Intersection		33.0	C	Intersection		33.8	C		Intersection		31.3	C

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

+ implies a significant adverse impact

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

Table 23-3

2016 No Build, Build, and Build with Mitigation Conditions Level of Service Analysis

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
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					
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
Yukon Avenue and Richmond Avenue													
Eastbound					L	1.43	258.9	F		L	1.26	183.4	F
					TR	0.46	34.3	C		TR	0.46	34.3	C
Westbound	LR	0.36	32.0	C	LTR	0.73	45.6	D	+	L	0.18	30.0	C
										TR	0.52	35.9	D
Northbound					L	0.67	55.8	E		L	0.67	55.8	E
	T	0.70	15.3	B	T	0.63	14.3	B		T	0.63	14.3	B
Southbound	L	0.23	38.1	D	L	0.23	38.1	D		L	0.23	38.1	D
	T	0.66	4.8	A	TR	0.86	19.4	B		TR	0.86	19.4	B
	Intersection		10.6	B	Intersection		31.9	C		Intersection		27.8	C

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.
+ implies a significant adverse impact

Table 23-4

2016 No Build, Build, and Build with Mitigation Conditions Level of Service Analysis

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
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					
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	0.59	40.5	D		L	0.59	40.5	D
	LT	0.47	36.4	D	LT	0.55	39.1	D		LT	0.55	39.1	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	0.79	25.5	C		T	0.81	27.1	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		85.9	F		Intersection		92.2	F
Yukon Avenue and Richmond Avenue													
Eastbound					L	1.36	222.3	F		L	1.24	173.8	F
					TR	0.43	31.9	C		TR	0.43	31.9	C
Westbound	LR	0.31	29.7	C	LTR	0.51	33.4	C		L	0.10	27.1	C
										TR	0.50	33.4	C
Northbound					L	0.77	70.6	E		L	0.77	70.6	E
	T	0.78	16.9	B	T	0.67	15.0	B		T	0.67	15.0	B
Southbound	L	0.21	39.9	D	L	0.21	39.9	D		L	0.21	39.9	D
	T	0.89	10.1	B	TR	1.14	85.0	F	+	TR	0.90	20.2	C
	Intersection		13.4	B	Intersection		65.4	E		Intersection		27.5	C

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.
+ implies a significant adverse impact

Table 23-5

2016 No Build, Build, and Build with Mitigation Conditions Level of Service Analysis

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
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					
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	0.72	48.1	D	+				
	LT	0.65	43.9	D	LT	0.75	50.8	D	+				
	R	1.05	76.2	E	R	0.93	45.8	D					
Northbound	L	0.00	31.3	C	L	0.00	31.3	C		Unmitigated			
	T	0.88	24.5	C	T	0.85	23.0	C					
	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					
Yukon Avenue and Richmond Avenue													
Eastbound					L	1.71	381.9	F		L	1.54	304.1	F
					TR	0.43	33.6	C		TR	0.43	33.6	C
Westbound	LR	0.60	37.8	D	LTR	1.35	214.8	F	+	L	0.37	34.1	C
										TR	0.68	41.4	D
Northbound					L	0.77	64.7	E		L	0.77	64.7	E
	T	0.91	21.8	C	T	0.81	17.6	B		T	0.81	17.6	B
Southbound	L	0.25	38.3	D	L	0.25	38.3	D		L	0.25	38.3	D
	T	0.75	5.7	A	TR	1.00	33.2	C		TR	1.00	33.2	C
	Intersection		14.7	B	Intersection		51.0	D		Intersection		38.9	D

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

+ implies a significant adverse impact

Table 23-6

2016 No Build, Build, and Build with Mitigation Conditions Level of Service Analysis

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
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					
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	0.79	21.2	C		T	0.81	22.6	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		33.3	C
Yukon Avenue and Richmond Avenue [1]													
Eastbound					L	1.21	165.9	F		L	1.05	109.3	F
					TR	0.41	33.1	C		TR	0.41	33.1	C
Westbound	LR	0.30	31.1	C	LTR	0.60	38.4	D		L	0.15	29.4	C
										TR	0.47	34.4	C
Northbound					L	0.82	71.2	E		L	0.82	71.2	E
	T	0.95	24.5	C	T	0.85	18.6	B		T	0.85	18.6	B
Southbound	L	0.14	36.9	D	L	0.14	36.9	D		L	0.14	36.9	D
	T	0.60	4.3	A	TR	0.79	17.1	B		TR	0.79	17.1	B
	Intersection		15.9	B	Intersection		26.4	C		Intersection		24.0	C

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

\+ implies a significant adverse impact

(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
Recommended Mitigation Measures
2036 Build Year

Intersection	Mitigation Measures				
	Weekday Peak Hours			Weekend Peak Hours	
	AM	Midday	PM	Midday	PM
Richmond Hill Road and Forest Hill Road	Unmitigated	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Richmond Hill Road and Richmond Avenue	Not Impacted	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Yukon Avenue and Richmond Avenue (1) *	Restripe the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane	Restripe the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane	Daylight SB approach to provide an additional moving lane. Restripe the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane	Daylight SB approach to provide an additional moving lane. Restripe the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane Shift 2 seconds of green time from the NB/SB phase to the EB/WB phase.	Restripe the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane
Forest Hill Road and Richmond Avenue	Unmitigated	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Yukon Avenue and Forest Hill Road *	Daylight the NB approach.	Daylight the NB approach.	Daylight the NB approach.	Daylight the NB approach.	Daylight the NB approach.

Notes:
EB = eastbound; WB = westbound; NB = northbound; SB = southbound
(1) Intersection of Yukon Avenue 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.

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

Yukon Avenue and Richmond Avenue

The impact at the southbound shared through- and right-turn movement at this intersection during the weekday PM peak hour could be mitigated by daylighting the southbound approach to provide an additional moving lane. Restriping the westbound approach to provide one 12-foot left-turn lane and one 12-foot shared through and right-turn lane is also required.

The impacts at the westbound approach and the southbound shared through- and right-turn movement at this intersection during the weekend midday peak hour could be mitigated by daylighting the southbound approach to provide an additional moving lane and by restriping the westbound approach to provide one 12-foot left-turn lane and one 12-foot shared through and right-turn lane. Shifting 2 second of green time from the northbound/southbound phase to the eastbound/westbound phase is also required.

Forest Hill Road and Richmond Avenue

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

The impacts at the westbound left-turn, northbound through and right-turn and southbound shared through- and right-turn movement at this intersection during the weekday midday, weekday PM, and weekend PM peak hours 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 five analyzed peak hours could be mitigated by daylighting the northbound approach.

With the above mitigation measures in place, majority of the impacted locations would operate at the same or better service levels than the 2036 No Build conditions as presented in Tables 23-8 to 23-12.

YUKON AVENUE CONNECTION OPTION

Under the 2036 Yukon Avenue Connection Option Build Conditions, four (4) out of the five (5) analyzed intersections would be impacted. Table 23-13 summarizes the recommended mitigation measures for each impacted intersection. Provided below is a discussion of each affected intersection and its recommended mitigation.

Richmond Hill Road and Forest Hill Road

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

Table 23-8

2036 No Build, Build, and Build with Mitigation Conditions Level of Service Analysis

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
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					
Yukon Avenue and Richmond Avenue[1]													
Eastbound					L	0.12	27.2	C		L	0.12	27.2	C
					TR	0.13	27.2	C		TR	0.13	27.2	C
Westbound	LR	0.13	27.1	C	LTR	0.15	27.3	C		L	0.02	26.0	C
										TR	0.15	27.4	C
Northbound					L	0.56	53.6	D		L	0.56	53.6	D
	T	1.23	123.8	F	T	1.08	61.7	E		T	1.08	61.7	E
Southbound	L	0.27	40.9	D	L	0.27	40.9	D		L	0.27	40.9	D
	T	0.46	4.6	A	TR	0.53	13.2	B		TR	0.53	13.2	B
	Intersection		84.2	F	Intersection		45.4	D		Intersection		45.4	D
Forest Hill Road and Richmond Avenue													
Eastbound					L	0.10	21.8	C					
					T	0.07	21.4	C					
					R	0.09	21.7	C					
Westbound	L	0.66	30.8	C	L	1.81	405.5	F	+				
	LR	0.84	42.1	D	TR	0.10	21.7	C		Unmitigated			
Northbound					L	0.85	82.9	F					
	T	1.03	37.6	D	T	1.31	165.1	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	0.52	19.1	B					
	Intersection		62.7	E	Intersection		222.6	F					
Yukon Avenue and Forest Hill Road													
Eastbound	L	0.07	20.0+	C	L	0.14	20.8	C		L	0.14	20.8	C
Northbound	LT	1.08	75.0	E	LT	1.13	92.3	F	+	LT	0.98	45.9	D
Southbound	T	0.57	15.9	B	T	0.57	16.0	B		T	0.57	16.0	B
	R	0.11	10.2	B	R	0.12	10.3	B		R	0.12	10.3	B
	Intersection		48.7	D	Intersection		58.0	E		Intersection		32.4	C

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

\+ implies a significant adverse impact

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

Table 23-9

2036 No Build, Build, and Build with Mitigation Conditions Level of Service Analysis

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
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					
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	L	0.49	28.1	C					
					T	0.19	22.1	C					
					R	0.03	8.6	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	0.04	30.9	C					
	T	0.86	23.4	C	T	1.08	74.9	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	142.7	F	+				
	Intersection		51.0	D	Intersection		102.9	F					
Yukon Avenue and Richmond Avenue [1]													
Eastbound					L	0.30	32.7	C		L	0.26	31.4	C
					TR	0.26	30.5	C		TR	0.26	30.5	C
Westbound	LR	0.43	33.4	C	LTR	0.53	36.1	D		L	0.16	29.5	C
										TR	0.43	33.7	C
Northbound					L	0.71	59.1	E		L	0.71	59.1	E
	T	0.84	18.5	B	T	0.76	16.4	B		T	0.76	16.4	B
Southbound	L	0.28	38.8	D	L	0.28	38.8	D		L	0.28	38.8	D
	T	0.80	6.4	A	TR	0.96	26.5	C		TR	0.96	26.5	C
	Intersection		12.8	B	Intersection		23.9	C		Intersection		23.7	C
Forest Hill Road and Richmond Avenue													
Eastbound					L	0.10	17.9	B					
					T	0.07	17.5	B					
					R	0.39	21.9	C					
Westbound	L	0.79	37.1	D	L	1.75	374.4	F	+				
	LR	1.01	74.6	E	TR	0.13	18.2	B		Unmitigated			
Northbound					L	1.19	173.4	F					
	T	0.76	11.1	B	T	1.20	125.6	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	1.32	174.1	F	+				
	Intersection		18.8	B	Intersection		173.4	F					
Yukon Avenue and Forest Hill Road													
Eastbound	L	0.26	22.3	C	L	0.40	24.3	C		L	0.40	24.3	C
Northbound	LT	1.19	122.7	F	LT	1.27	152.9	F	+	LT	1.11	87.4	F
Southbound	T	0.77	21.9	C	T	0.78	22.0	C		T	0.78	22.0	C
	R	0.19	10.9	B	R	0.23	11.3	B		R	0.23	11.3	B
	Intersection		81.9	E	Intersection		73.5	E		Intersection		47.3	D

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

+ implies a significant adverse impact

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

Table 23-10

2036 No Build, Build, and Build with Mitigation Conditions Level of Service Analysis

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
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.74	30.8	C	L	0.76	32.7	C		Unmitigated			
	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					
	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					
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	L	0.38	24.9	C		Unmitigated			
					T	0.21	21.6	C					
					R	0.03	9.1	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					
Northbound	L	0.00	27.2	C	L	0.05	32.7	C					
	T	0.96	36.5	D	T	0.96	41.6	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	411.6	F	+				
	Intersection		161.7	F	Intersection		265.0	F					
Yukon Avenue and Richmond Avenue													
Eastbound					L	0.32	31.6	C		L	0.29	30.6	C
					TR	0.24	28.6	C		TR	0.24	28.6	C
Westbound	LR	0.38	30.8	C	LTR	0.49	33.0	C		L	0.09	26.9	C
										TR	0.47	32.8	C
Northbound					L	0.71	64.9	E		L	0.71	64.9	E
	T	0.93	23.4	C	T	0.81	17.7	B		T	0.81	17.7	B
Southbound	L	0.26	40.5	D	L	0.26	40.5	D		L	0.26	40.5	D
	T	1.06	43.4	D	TR	1.27	143.6	F	+	TR	1.00	33.4	C
	Intersection		35.5	D	Intersection		91.3	F		Intersection		28.4	C
Forest Hill Road and Richmond Avenue													
Eastbound					L	0.13	19.6	B		Unmitigated			
					T	0.09	18.9	B					
					R	0.28	21.5	C					
Westbound	L	0.90	48.8	D	L	2.14	547.8	F	+				
	LR	1.16	124.0	F	TR	0.17	19.8	B					
Northbound					L	2.48	726.5	F					
	T	1.00	27.1	C	T	1.45	230.8	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	1.79	386.3	F	+				
	Intersection		85.2	F	Intersection		363.6	F					
Yukon Avenue and Forest Hill Road													
Eastbound	L	0.22	21.8	C	L	0.36	23.8	C		L	0.36	23.8	C
Northbound	LT	1.37	198.2	F	LT	1.46	234.8	F	+	LT	1.28	155.4	F
Southbound	T	0.79	22.8	C	T	0.80	22.9	C		T	0.80	22.9	C
	R	0.16	10.6	B	R	0.22	11.2	B		R	0.22	11.2	B
	Intersection		100.3	F	Intersection		114.0	F		Intersection		79.5	E

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.
+ implies a significant adverse impact

Table 23-11

2036 No Build, Build, and Build with Mitigation Conditions Level of Service Analysis

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
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					
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	L	0.43	26.0	C					
					T	0.19	21.4	C					
					R	0.03	9.6	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	0.06	33.7	C					
	T	1.05	54.6	D	T	1.19	121.2	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	343.0	F	+				
	Intersection		106.7	F	Intersection		216.8	F					
Yukon Avenue and Richmond Avenue													
Eastbound					L	0.41	37.9	D		L	0.32	32.1	C
					TR	0.24	30.3	C		TR	0.22	28.4	C
Westbound	LR	0.72	42.9	D	LTR	1.08	108.4	F	+	L	0.33	30.7	C
										TR	0.62	37.2	D
Northbound					L	0.82	71.2	E		L	0.82	71.2	E
	T	1.09	64.4	E	T	0.97	27.9	C		T	1.02	40.0	D
Southbound	L	0.30	39.0	D	L	0.30	39.0	D		L	0.30	39.0	D
	T	0.90	9.1	A	TR	1.10	88.1	E	+	TR	0.91	22.4	C
	Intersection		35.7	D	Intersection		52.1	D		Intersection		31.9	C
Forest Hill Road and Richmond Avenue													
Eastbound					L	0.11	20.0+	C					
					T	0.08	19.5	B					
					R	0.33	22.8	C					
Westbound	L	0.95	58.4	E	L	2.08	522.0	F	+				
	LR	1.20	141.1	F	TR	0.24	21.4	C					
Northbound					L	2.77	657.3	F		Unmitigated			
	T	1.05	43.6	D	T	1.51	257.9	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	0.98	40.9	D					
	Intersection		46.8	D	Intersection		259.7	F					
Yukon Avenue and Forest Hill Road													
Eastbound	L	0.31	23.0	C	L	0.44	25.1	C		L	0.44	25.1	C
Northbound	LT	1.06	70.1	E	LT	1.13	94.6	F	+	LT	0.99	48.7	D
Southbound	T	0.77	21.8	C	T	0.78	21.9	C		T	0.78	21.9	C
	R	0.22	11.2	B	R	0.29	11.9	B		R	0.29	11.9	B
	Intersection		39.6	D	Intersection		48.6	D		Intersection		31.2	C

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.
+ implies a significant adverse impact

Table 23-12

2036 No Build, Build, and Build with Mitigation Conditions Level of Service Analysis

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
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					
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	L	0.45	28.9	C					
					T	0.19	23.5	C					
					R	0.03	9.5	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	0.05	31.0	C					
	T	0.99	36.3	D	T	1.13	92.5	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	225.2	F	+				
	Intersection		64.5	E	Intersection		143.3	F					
Yukon Avenue and Richmond Avenue [1]													
Eastbound					L	0.29	32.6	C		L	0.25	31.3	C
					TR	0.23	30.0	C		TR	0.23	30.0	C
Westbound	LR	0.36	32.0	C	LTR	0.53	35.8	D		L	0.15	29.2	C
										TR	0.45	34.0	C
Northbound					L	0.85	75.0	E		L	0.85	75.0	E
	T	1.13	81.9	F	T	1.02	39.3	D		T	1.02	39.3	D
Southbound	L	0.17	37.2	D	L	0.17	37.2	D		L	0.17	37.2	D
	T	0.71	5.3	A	TR	0.87	19.4	B		TR	0.87	19.4	B
	Intersection		46.8	D	Intersection		31.6	C		Intersection		31.5	C
Forest Hill Road and Richmond Avenue													
Eastbound					L	0.11	19.3	B					
					T	0.07	18.8	B					
					R	0.34	22.4	C					
Westbound	L	0.81	38.9	D	L	1.86	426.3	F	+				
	LR	1.02	76.0	E	TR	0.18	20.1	C		Unmitigated			
Northbound					L	2.65	803.8	F					
	T	0.86	13.5	B	T	1.26	147.8	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	1.23	133.8	F	+				
	Intersection		28.1	C	Intersection		229.8	F					
Yukon Avenue and Forest Hill Road													
Eastbound	L	0.22	21.7	C	L	0.33	23.3	C		L	0.33	23.3	C
Northbound	LT	0.91	34.9	C	LT	0.97	45.2	D	+	LT	0.85	27.3	C
Southbound	T	0.75	20.8	C	T	0.75	20.9	C		T	0.75	20.9	C
	R	0.15	10.5	B	R	0.22	11.2	B		R	0.22	11.2	B
	Intersection		25.7	C	Intersection		29.8	C		Intersection		22.6	C

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

\+ implies a significant adverse impact

(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
Yukon Avenue Connection Option Recommended Mitigation Measures
2036 Build Year

Intersection	Mitigation Measures				
	Weekday Peak Hours			Weekend Peak Hours	
	AM	Midday	PM	Midday	PM
Richmond Hill Road and Forest Hill Road	Unmitigated	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Richmond Hill Road and Richmond Avenue	Shift 1 second of green time from the NB/SB phase to the NB left / SB left phase.	Unmitigated	Unmitigated	Unmitigated	Unmitigated
Yukon Avenue and Richmond Avenue (1) *	Restripe the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane	Restripe the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane Daylight SB approach to provide an additional moving lane.	Unmitigated	Unmitigated	Restripe the WB approach to provide one 12-ft left-turn lane and one 12-ft shared through and right-turn lane Daylight SB approach.
Forest Hill Road and Richmond Avenue	Shift 1 second of green time from the WB phase to the NB/SB phase.	Not impacted	Shift 1 second of green time from the WB phase to the NB/SB phase.	Unmitigated	Not impacted

Notes:
EB = eastbound; WB = westbound; NB = northbound; SB = southbound
(1) Intersection of Yukon Avenue and Richmond Avenue was not impacted during the weekday AM peak hour and was analyzed under mitigation conditions for verification purposes only.
* Daylight at intersection approaches implies that curbside parking is prohibited for approximately 100-feet.

Richmond Hill Road and Richmond Avenue

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

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

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

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

Yukon Avenue and Richmond Avenue

The impacts at the westbound approach and the southbound shared through- and right-turn movement during the weekday midday peak hour could be mitigated by restriping the westbound approach to provide one 12-foot left-turn lane and one 12-foot shared through- and right-turn lane. In addition, daylighting the southbound approach to provide an additional moving lane is also required.

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

The impacts at the westbound approach and the southbound shared through- and right-turn movement during the weekend PM peak hour could be mitigated by restriping the westbound approach to provide one 12-foot left-turn lane and one 12-foot shared through- and right-turn lane. In addition, daylighting the southbound approach is also required.

Forest Hill Road and Richmond Avenue

The impact at the northbound right-turn movement during the weekday AM and PM peak hours could be mitigated by shifting 1 second of green time from the westbound phase to the northbound/southbound phase.

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

With the above mitigation measures in place, majority of the impacted locations would operate at the same or better service levels than the 2036 No Build conditions as presented in Tables 23-14 to 23-18.

Table 23-14

2036 No Build, Yukon Avenue Connection Option Build and Build with Mitigation Conditions Level of Service Analysis

Weekday AM Peak Hour

Intersection	2036 No Build				Yukon Avenue Option Build					Yukon Option 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
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.42	20.1	C	L	0.42	19.9	B					
	TR	0.68	19.2	B	TR	0.69	19.4	B					
Westbound	LTR	1.34	192.0	F	LTR	1.40	216.3	F	+				
Northbound	L	0.49	43.0	D	L	0.49	43.0	D		Unmitigated			
	TR	1.34	195.6	F	TR	1.51	269.5	F	+				
Southbound	L	1.83	435.7	F	L	1.83	435.7	F					
	TR	1.01	68.9	E	TR	1.03	73.8	E	+				
	Intersection		144.5	F	Intersection		172.6	F					
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	0.29	30.2	C	L	0.37	31.9	C		L	0.37	31.9	C
	LT	0.19	28.3	C	LT	0.27	29.8	C		LT	0.27	29.8	C
	R	1.06	79.3	E	R	0.96	51.2	D		R	0.93	46.0	D
Northbound	L	0.00	32.9	C	L	0.00	32.9	C		L	0.00	32.1	C
	T	1.21	118.1	F	T	1.12	83.1	F		T	1.15	96.4	F
	R	0.19	14.2	B	R	0.20	14.3	B		R	0.20	15.1	B
Southbound	L	1.53	296.9	F	L	1.54	302.3	F	+	L	1.43	251.7	F
	TR	0.60	17.8	B	TR	0.57	17.4	B		TR	0.59	18.4	B
	Intersection		95.0	F	Intersection		74.1	E		Intersection		77.5	E
Yukon Avenue and Richmond Avenue (1)													
Eastbound					L	0.85	58.7	E		L	0.80	52.2	D
					TR	0.35	30.4	C		TR	0.35	30.4	C
Westbound	LR	0.13	27.1	C	LTR	0.30	29.4	C		L	0.03	26.0	C
										TR	0.32	29.9	C
Northbound					L	1.29	213.5	F		L	1.29	213.5	F
	T	1.23	123.8	F	T	1.07	58.9	E		T	1.07	58.9	E
Southbound	L	0.27	40.9	D	L	0.27	40.9	D		L	0.27	40.9	D
	T	0.46	4.6	A	TR	0.59	13.8	B		TR	0.59	13.8	B
	Intersection		84.2	F	Intersection		49.2	D		Intersection		48.9	D
Forest Hill Road and Richmond Avenue													
Westbound	L	0.66	30.8	C	L	0.61	29.3	C		L	0.64	30.8	C
	LR	0.84	42.1	D	LR	0.79	37.2	D		LR	0.82	40.5	D
Northbound	T	1.03	37.6	D	T	0.96	20.8	C		T	0.94	17.8	B
	R	1.48	243.5	F	R	1.49	247.6	F	+	R	1.46	232.4	F
Southbound	L	0.10	8.3	A	L	0.10	8.3	A		L	0.10	7.8	A
	T	0.43	7.7	A	T	0.39	7.4	A		T	0.38	6.8	A
	Intersection		62.7	E	Intersection		56.8	E		Intersection		52.9	D

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

\+ implies a significant adverse impact

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

Table 23-15

2036 No Build, Yukon Avenue Connection Option Build and Build with Mitigation Conditions Level of Service Analysis

Weekday Midday Peak Hour

Intersection	2036 No Build				Yukon Avenue Option Build					Yukon Option 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
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.78	33.1	C	L	0.78	32.9	C					
	TR	0.70	19.6	B	TR	0.72	20.1	C					
Westbound	LTR	1.39	213.2	F	LTR	1.46	243.7	F	+				
Northbound	L	0.49	43.0	D	L	0.49	43.0	D		Unmitigated			
	TR	1.43	232.1	F	TR	1.69	347.9	F	+				
Southbound	L	1.51	289.7	F	L	1.51	289.7	F					
	TR	1.51	267.4	F	TR	1.56	291.9	F	+				
	Intersection		186.6	F	Intersection		230.1	F					
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	LTR	0.01	27.3	C					
Westbound	L	0.66	43.9	D	L	0.77	52.3	D	+				
	LT	0.72	47.9	D	LT	0.85	60.8	E	+				
	R	1.08	85.2	F	R	0.95	49.5	D					
Northbound	L	0.00	31.3	C	L	0.00	31.3	C		Unmitigated			
	T	0.86	23.4	C	T	0.89	25.2	C					
	R	0.37	16.4	B	R	0.39	16.8	B					
Southbound	L	1.50	279.4	F	L	1.52	284.5	F	+				
	TR	0.90	25.3	C	TR	0.87	23.8	C					
	Intersection		51.0	D	Intersection		48.5	D					
Yukon Avenue and Richmond Avenue													
Eastbound					L	2.94	925.4	F		L	2.64	792.4	F
					TR	1.03	89.5	F		TR	1.03	89.5	F
Westbound	LR	0.43	33.4	C	LTR	2.51	739.0	F	+	L	0.59	58.4	E
										TR	0.68	41.6	D
										WB Approach		44.2	D
Northbound					L	1.59	330.8	F		L	1.59	330.8	F
	T	0.84	18.5	B	T	0.75	16.2	B		T	0.75	16.2	B
Southbound	L	0.28	38.8	D	L	0.28	38.8	D		L	0.28	38.8	D
	T	0.80	6.4	A	TR	1.07	58.0	E	+	TR	0.85	18.2	B
	Intersection		12.8	B	Intersection		138.8	F		Intersection		82.2	F

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service; WB = Westbound.
+ implies a significant adverse impact

Table 23-16

2036 No Build, Yukon Avenue Connection Option Build and Build with Mitigation Conditions Level of Service Analysis

Weekday PM Peak Hour

Intersection	2036 No Build				Yukon Avenue Option Build					Yukon Option 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
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.74	30.8	C	L	0.74	30.8	C					
	TR	0.78	22.6	C	TR	0.79	23.1	C					
Westbound	LTR	1.58	298.0	F	LTR	1.67	338.3	F	+				
Northbound	L	0.75	73.5	E	L	0.75	73.5	E		Unmitigated			
	TR	1.52	271.7	F	TR	1.80	395.0	F	+				
Southbound	L	1.49	288.0	F	L	1.49	288.0	F					
	TR	1.54	279.5	F	TR	1.63	321.5	F	+				
	Intersection		216.4	F	Intersection		269.7	F					
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	LTR	0.01	27.3	C					
Westbound	L	0.57	39.9	D	L	0.70	46.7	D	+				
	LT	0.60	41.3	D	LT	0.74	49.4	D	+				
	R	0.90	37.9	D	R	0.80	27.8	C		Unmitigated			
Northbound	L	0.00	27.2	C	L	0.00	27.2	C					
	T	0.96	36.5	D	T	0.96	36.1	D					
	R	0.47	22.5	C	R	0.48	22.9	C					
Southbound	L	1.51	275.4	F	L	1.52	280.3	F	+				
	TR	1.50	253.2	F	TR	1.53	267.6	F	+				
	Intersection		161.7	F	Intersection		169.8	F					
Yukon Avenue and Richmond Avenue													
Eastbound					L	2.62	783.0	F					
					TR	0.78	45.5	D					
Westbound	LR	0.38	30.8	C	LTR	1.05	100.0	F	+				
Northbound					L	2.97	946.7	F		Unmitigated			
	T	0.93	23.4	C	T	0.80	17.4	B					
Southbound	L	0.26	40.5	D	L	0.26	40.5	D					
	T	1.06	43.4	D	TR	1.45	221.7	F	+				
	Intersection		35.5	D	Intersection		217.6	F					
Forest Hill Road and Richmond Avenue													
Westbound	L	0.90	48.8	D	L	0.83	40.7	D		L	0.86	45.3	D
	LR	1.16	124.0	F	LR	1.08	96.5	F		LR	1.13	112.7	F
Northbound	T	1.00	27.1	C	T	1.01	31.6	C		T	0.99	25.8	C
	R	1.26	142.1	F	R	1.27	145.3	F	+	R	1.24	133.1	F
Southbound	L	0.60	37.4	D	L	0.60	37.4	D		L	0.60	36.7	D
	T	1.23	118.1	F	T	1.17	91.8	F		T	1.15	81.3	F
	Intersection		85.2	F	Intersection		72.6	E		Intersection		65.8	E

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

+ implies a significant adverse impact

Table 23-17

2036 No Build, Yukon Avenue Connection Option Build and Build with Mitigation Conditions Level of Service Analysis

Weekend Midday Peak Hour

Intersection	2036 No Build				Yukon Avenue Option Build					Yukon Option 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
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.79	30.8	C	L	0.80	31.2	C					
	TR	0.77	22.1	C	TR	0.78	22.8	C					
Westbound	LTR	1.73	362.0	F	LTR	1.82	405.2	F	+				
Northbound	L	0.17	25.3	C	L	0.17	25.3	C		Unmitigated			
	TR	1.42	229.2	F	TR	1.68	341.4	F	+				
Southbound	L	1.59	340.5	F	L	1.59	340.5	F					
	TR	1.58	299.0	F	TR	1.69	348.9	F	+				
	Intersection		225.0	F	Intersection		275.3	F					
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	LTR	0.01	27.3	C					
Westbound	L	0.77	52.6	D	L	0.92	73.4	E	+				
	LT	0.75	50.5	D	LT	0.93	74.2	E	+				
	R	1.26	154.9	F	R	1.12	97.3	F					
Northbound	L	0.00	31.3	C	L	0.00	31.3	C		Unmitigated			
	T	1.05	54.6	D	T	1.04	49.6	D					
	R	0.46	18.1	B	R	0.48	18.5	B					
Southbound	L	1.52	284.6	F	L	1.54	295.6	F	+				
	TR	1.22	124.8	F	TR	1.26	140.6	F	+				
	Intersection		106.7	F	Intersection		108.5	F					
Yukon Avenue and Richmond Avenue													
Eastbound					L	3.87	*	F					
					TR	0.91	62.5	E					
Westbound	LR	0.72	42.9	D	LTR	4.66	*	F	+				
Northbound					L	2.91	915.9	F		Unmitigated			
	T	1.09	64.4	E	T	0.96	26.8	C					
Southbound	L	0.30	39.0	D	L	0.30	39.0	D					
	T	0.90	9.1	A	TR	1.29	150.3	F	+				
	Intersection		35.7	D	Intersection		288.2	F					
Forest Hill Road and Richmond Avenue													
Westbound	L	0.95	58.4	E	L	0.88	46.7	D					
	LR	1.20	141.1	F	LR	1.13	114.2	F					
Northbound	T	1.05	43.6	D	T	1.09	59.9	E	+	Unmitigated			
	R	1.16	98.0	F	R	1.16	99.0	F					
Southbound	L	0.50	28.3	C	L	0.50	28.3	C					
	T	0.75	10.9	B	T	0.69	10.1	B					
	Intersection		46.8	D	Intersection		52.1	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 23-18

2036 No Build, Yukon Avenue Connection Option Build and Build with Mitigation Conditions Level of Service Analysis

Weekend PM Peak Hour

Intersection	2036 No Build				Yukon Avenue Option Build					Yukon Option 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
Richmond Hill Road and Forest Hill Road													
Eastbound	L	0.77	30.5	C	L	0.79	30.8	C					
	TR	0.78	22.5	C	TR	0.79	23.2	C					
Westbound	LTR	1.71	354.8	F	LTR	1.81	399.4	F	+				
Northbound	L	0.64	57.7	E	L	0.64	57.7	E		Unmitigated			
	TR	1.39	214.3	F	TR	1.63	318.9	F	+				
Southbound	L	1.82	440.8	F	L	1.82	440.8	F					
	TR	1.32	184.3	F	TR	1.43	233.8	F	+				
	Intersection		195.1	F	Intersection		242.0	F					
Richmond Hill Road and Richmond Avenue													
Eastbound	LTR	0.01	27.3	C	LTR	0.01	27.3	C					
Westbound	L	0.50	37.5	D	L	0.67	44.9	D					
	LT	0.49	37.0	D	LT	0.62	42.5	D					
	R	1.22	137.8	F	R	1.10	90.9	F					
Northbound	L	0.00	31.3	C	L	0.00	31.3	C		Unmitigated			
	T	0.99	36.3	D	T	0.97	32.4	C					
	R	0.43	17.5	B	R	0.45	17.8	B					
Southbound	L	1.53	292.4	F	L	1.56	306.6	F	+				
	TR	1.03	45.8	D	TR	1.07	59.7	E	+				
	Intersection		64.5	E	Intersection		64.7	E					
Yukon Avenue and Richmond Avenue													
Eastbound					L	2.71	824.7	F		L	2.46	711.6	F
					TR	0.87	57.1	E		TR	0.87	57.1	E
Westbound	LR	0.36	32.0	C	LTR	1.74	388.2	F	+	L	0.40	40.0	D
										TR	0.70	42.3	D
Northbound					L	2.96	935.1	F		L	2.96	935.1	F
	T	1.13	81.9	F	T	1.01	35.8	D		T	1.01	35.8	D
Southbound	L	0.17	37.2	D	L	0.17	37.2	D		L	0.17	37.2	D
	T	0.71	5.3	A	TR	1.04	46.1	D	+	TR	1.01	36.0	D
	Intersection		46.8	D	Intersection		151.4	F		Intersection		128.9	F

Notes: L = Left Turn, T = Through, R = Right Turn, DefL = Defacto Left Turn; LOS = Level of Service.
+ implies a significant adverse impact